WATER MASTER PLAN

for the

CITY OF
Saint Peter
WHERE HISTORY & PROGRESS MEET

BMI Project No. M21.36454 / M21.38992

October 2007

Prepared by

BOLTON & MENK, INC.
Consulting Engineers & Surveyors

DESIGNING FOR A BETTER TOMORROW

WATER MASTER PLAN
CITY OF SAINT PETER, MINNESOTA

OCTOBER 2007

M21.36454 / M21.38992

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Signature: ______________________ Typed or Printed Name: Herman Dharmarajah

Date 10/29/07 Reg. No. 18256

BOLTON & MENK, INC.
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SECTION 1 - INTRODUCTION

A. PURPOSE

The purpose of this report is to confirm the status of City's wells, treatment and distribution system and to provide the City of Saint Peter with necessary information regarding the City's water system so that the City can establish priorities, plan, fund, and implement required future water system improvements. This report should be reviewed and updated periodically to ensure that the necessary water system improvements are being planned, funded and implemented.

B. REPORT ORGANIZATION

To adequately address the major areas which were evaluated, the report is organized in seven sections. The projected water use demands, based on anticipated population and commercial/industrial trends, are presented in Section 2. Section 3 presents a summary of drinking water quality issues, including Federal and State Drinking Water regulations and existing water quality data. Section 4 presents a summary of existing facilities. Section 5 presents a summary of recommendations for water system improvements.

SECTION 2 - WATER USE PROJECTIONS

A. PURPOSE

Planning for water systems is normally based on an approximate 20-year planning period. However, in this case, a development area (west side area) has been identified which has a longer planning period; therefore, evaluation of the water system capacity will include the development area. Planning for water treatment and supply will be developed for approximately a 20-year period, with a design year of 2027. For evaluation of distribution system improvements and water tower siting, the planning area will be expanded to include the development area and a planning period of 33 years, to the year 2040. This matches the planning period utilized in the City's Comprehensive Plan.

In order to determine water use projections, the following data will need to be evaluated:

- Service area and land use;
- Population densities;
- Population projections;
- Historical water use;
- Conservation history.

Based on this data, water demand projections can be determined for the planning period.

B. SERVICE AREA

The City of Saint Peter is located in east central Nicollet County along the Minnesota River. Saint Peter is approximately 80 miles southwest of Minneapolis/St. Paul metropolitan area and approximately 10 miles north of Mankato, a regional business and retail area. Highway 169 provides a major four-lane highway link from the Minneapolis/St. Paul metropolitan area to the Mankato/North Mankato area. This transportation network promotes further manufacturing and industrial growth.

The economic base of the Saint Peter area has shown considerable growth during the past 10 years. It is anticipated that this economic growth will continue and equal if not exceed that of the previous 10 years.

The two major employers in the Saint Peter area are the Saint Peter Regional Treatment Center/Security Hospital and Gustavus Adolphus College. These two institutions will continue to be major employers in the Saint Peter Area and offer a solid core of employment opportunities within the community. The City of Saint Peter had estimated the water used by the Regional Treatment Center (RTC) based on the measured amount of wastewater and past water use from one RTC well. A water meter was installed in November 2004, and a few months of water meter data suggests that the estimates were unreliable for comparisons.

The location of Saint Peter offers a unique setting for growth. In addition to the expansion and the improvements to the transportation system, the City's proximity to the Mankato area and to the Twin Cities area, the college, schools and the up-to-date infrastructure will foster residential, commercial and industrial growth.

Current and planned future service areas are shown in Figure 2-1. The present water system services areas within the City limits of Saint Peter. Plans for the northeast area within the city limits are to expand commercial developments. Plans for the west side growth area call for providing water service as the current city limits are expanded. Most of the area to the west is planned for residential development, while areas to the north are a mixture of residential and industrial.

C. POPULATION PROJECTIONS

Since 1930, the City of Saint Peter has experienced slow but steady population growth. This population growth rate is anticipated to continue for the next two decades. The City of Saint Peter has prepared demographic information which was used in projecting future population growth. Projecting the population growth is difficult due to the proximity to the Mankato and Twin Cities areas. The growth rate will be greatly affected by decisions of the State and the City Council concerning Highway 169 improvements. The abundant water supply of Saint Peter and the State of Minnesota will attract people from other parts of the country. The past and future populations for the City of Saint Peter, the Regional Treatment Center, and the service planning area are presented in Table 2.1. The service area population projections are the net population of the City of Saint Peter less the Regional Treatment Center Population. Figure 2-2 Shows City of Saint Peter population projections from 1950-2050. Projection methods are described following the figures.

Table 2.1 POPULATION PROJECTIONS							
					Projected Population		
Year	**Total Saint Peter**	**Regional Treatment Center**	**Saint Peter Service Population**	**Nicollet County Population**	**1996 WW Facility Plan**	**City/County Ratio**	**Anticipated 70 New Homes/Yr**
1960	8,655	2,365	6,290				
1970	8,339	885	7,454				
1980	9,056	559	8,497	26,924			
1990	9,421	557	8,864	28,076			
2000	10,000	500	9,500	29,771	9,759		
2005	10,682	510	10,682	30,880	10,800	10,345	10,875
2010	10,887	1,100	10,887	31,870	12,000	10,676	11,750
2015				32,640	12,900	10,934	12,625
2020				33,180	13,800	11,115	13,500
2030				34,010	15,800	11,393	15,250
2040					16,600		17,000

Various methods have been used to estimate the future population. St. Peter Public School District estimates that the population would grow by 6 percent from year 2000 to 2020. This estimate appears to be too conservative as it does include Nicollet County Townships, LeSueur County Townships and the City of Kasota. The Wastewater Treatment Facility Plan prepared in 1996 estimated the total population growth to be 70 percent from year 2000 to 2040.

Another approach would be to use the average number of new residential units anticipated to be constructed each year. The City of Saint Peter has issued 289 permits during the last four years. Population was also projected using 70 new housing units per year with a population of 2.5 persons per housing unit. The State Demographers Office published the projected population for Nicollet County through year 2030. The City of Saint Peter population has been 33.5 percent of Nicollet County's population from 1980 to 2000. However, the ratio of City population to County population will continue to change as the City grows and the rural areas of the County lose population.

Past comprehensive studies for the City of Saint Peter water system deducted the population of the Regional Treatment Center (RTC) from the total population of the City to get the population serviced by the City. This is no longer necessary as the RTC has become a water service customer effective in year 2003.

A further breakdown of population has been estimated for the upper and lower system. As described in more detail in later sections, the City of Saint Peter operates two separate water pressure zones. Development of population estimates for each pressure zone is necessary to assist in planning water services to each zone. The majority of future population growth will occur in the upper zone. The service area expansion in the lower system can occur only in the 110-acre area shown in Figure 2-1. Some growth in the water usage of the lower system may also occur due to redevelopment. The ultimate population growth in the lower system is expected to be between 550 and 650 people. Table 2.2 shows the projected service population allocation by zone. The lower system population was assumed to increase by 150 people every 10 years. In November 2004, the City started serving the Regional Treatment Center from the upper system and this resulted in shifting the population from one system to the other.

Table 2.2
POPULATION PROJECTIONS BY PRESSURE ZONE

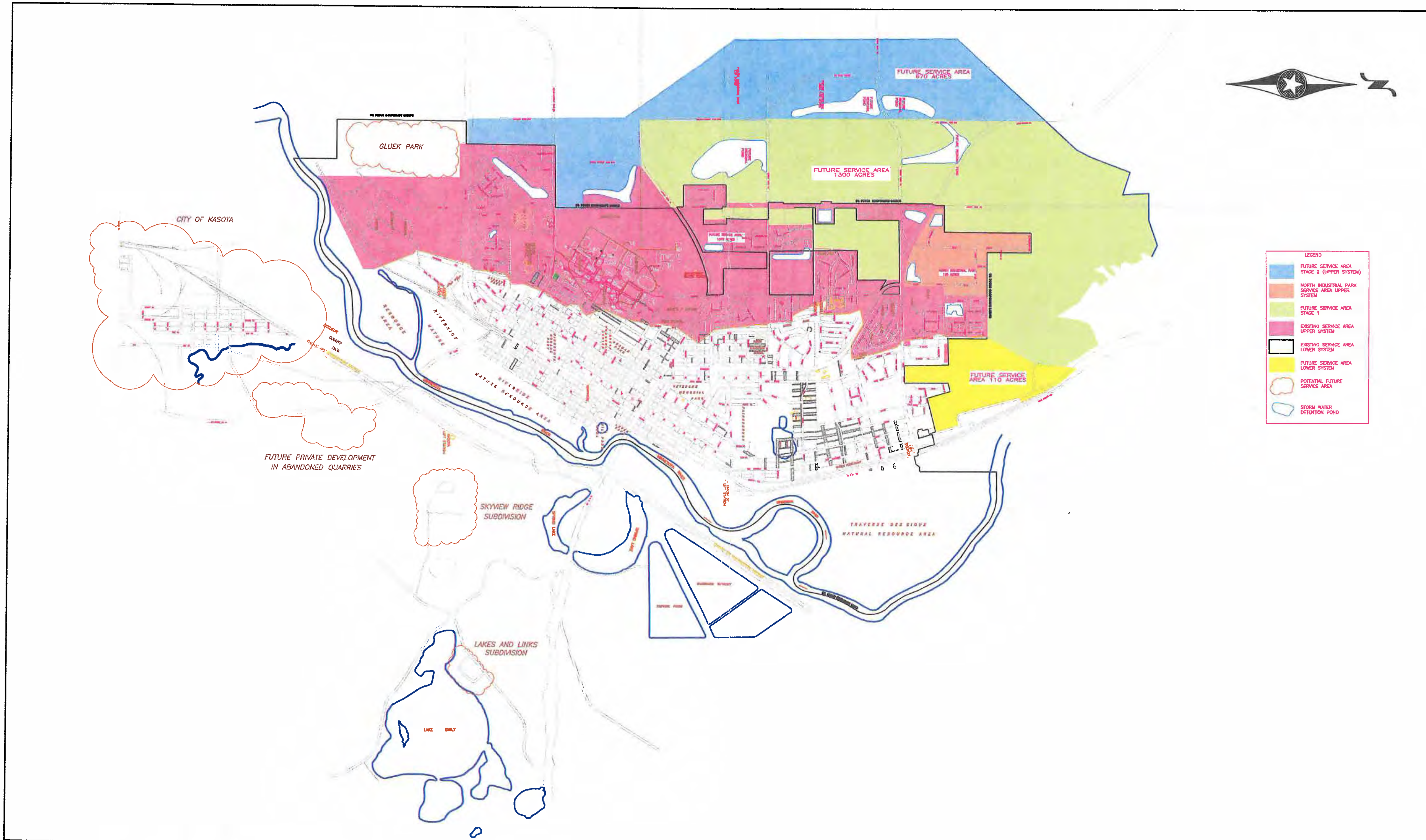
Year	Lower System	Upper System	Total
2003	7,426	2,784	10,210
2005	7,117	3,284	10,401
2010	7,576	4,174	11,750
2020	7,726	5,774	13,500
2030	7,876	7,374	15,250
2040	8,026	8,974	17,000

D. HISTORICAL WATER USE

Average day water use is evaluated and utilized to project future water system demands. In addition, maximum day to average day water use ratios are determined in order to project the future maximum day water usage.

The City of Saint Peter has limited data available to evaluate commercial and industrial water use separately from residential water use. The two largest individual water users are a private customer (57 million gallons per year), and the Regional Treatment Center (37 million gallons per year). The private customer is currently constructing new facilities that will slightly increase its water demand.

Historical monthly pumping data from 1995 to 2006 is presented in Table 2.3 and the per capita usage for years 1980, 1990 and 2000 are shown in Table 2.4.



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SCALE FEET

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MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN WILLMAR, MN
BURNSVILLE, MN CHASKA, MN AMES, IA LIBERTY, MO

CITY OF SAINT PETER
CURRENT AND FUTURE SERVICE AREAS

JUNE, 2005

FIGURE NO. 2-1

Figure 2-2
City of St. Peter Population Projection

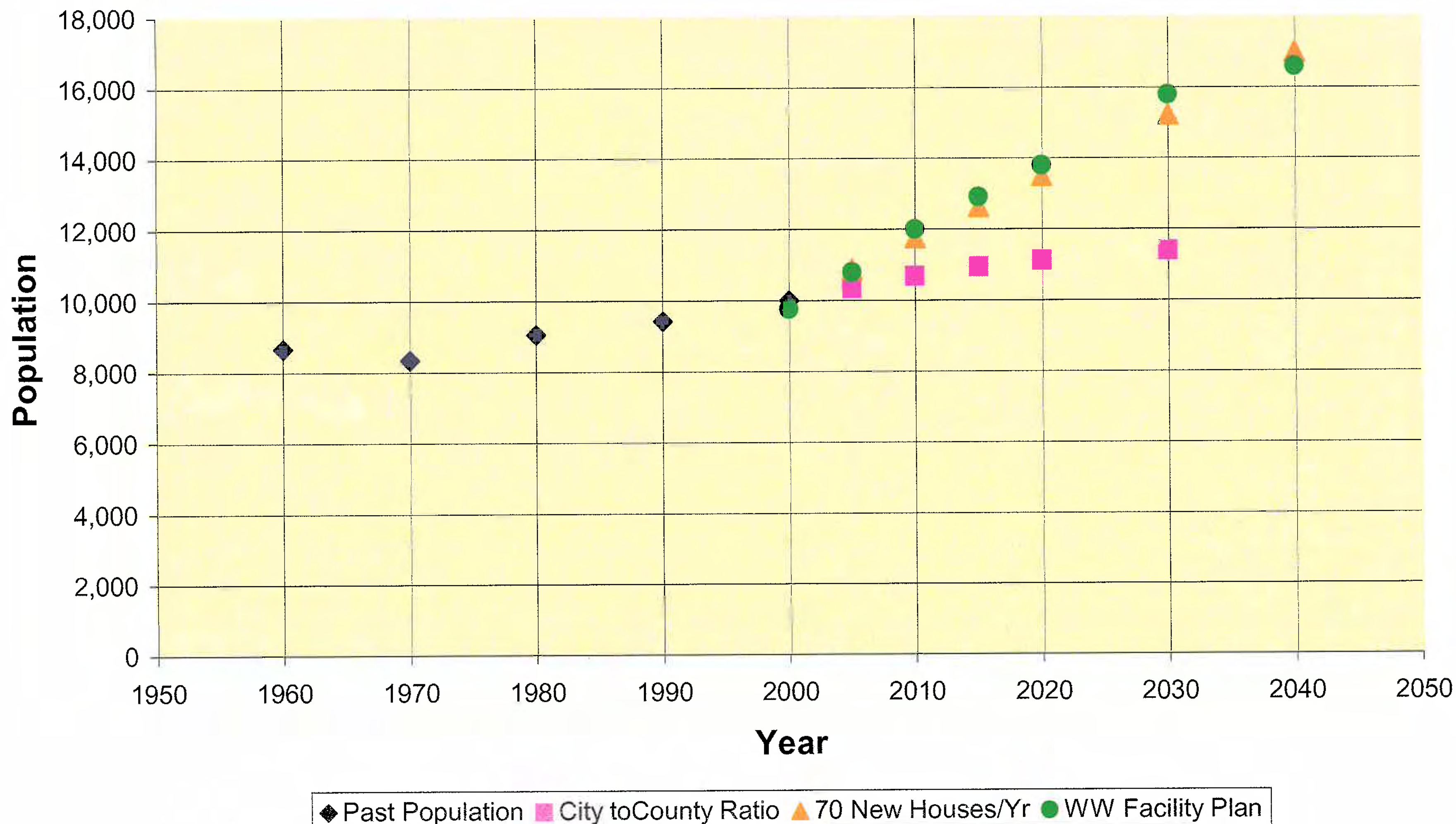


Table 2.3
HISTORICAL MONTHLY PUMPING DATA (MILLION GALLONS)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
January	25.952	26.208	26.152	22.234	22.567	27.017	27.556	27.740	31.665	32.685	34.541	32.958
February	22.852	25.174	24.082	39.249	20.608	26.137	26.314	24.932	30.171	34.556	31.993	30.719
March	25.236	30.079	27.202	23.485	23.404	27.758	28.816	29.194	34.560	37.570	35.580	32.838
April	26.725	28.690	27.346	42.824	23.146	32.046	28.695	30.558	38.733	41.042	38.385	36.259
May	27.967	33.515	29.720	31.173	27.675	36.393	31.536	33.312	40.016	44.756	34.000	36.655
June	30.435	32.692	35.249	28.177	28.656	30.065	33.895	32.016	41.008	45.057	38.411	44.661
July	29.377	36.511	23.944	34.009	37.487	36.925	50.112	46.097	47.592	50.238	58.789	55.930
August	27.374	30.367	25.814	53.294	36.618	40.105	41.870	35.493	55.884	47.144	42.814	37.796
September	29.631	25.838	26.100	34.953	36.160	42.572	32.316	35.252	48.858	43.765	35.098	32.631
October	28.930	28.203	27.175	43.929	31.464	40.600	30.414	31.223	44.799	39.890	34.349	33.479
November	26.335	25.831	22.012	44.126	25.818	28.871	27.257	27.860	35.752	33.363	27.788	26.309
December	25.932	26.140	43.638	42.468	25.496	27.080	27.117	28.011	34.824	35.241	30.792	25.727
Total	326.746	349.248	338.434	439.921	339.099	395.569	385.898	381.688	483.862	485.307	442.540	425.962
Monthly Average	27.23	29.10	28.20	36.66	28.26	32.96	32.16	31.81	40.32	40.44	36.88	35.50
Daily Average	0.895	0.957	0.927	1.205	0.929	1.084	1.057	1.046	1.326	1.330	1.212	1.167

Table 2.4 PER CAPITA WATER USE FOR THE CITY OF SAINT PETER						
Year	**Water Use (gallons)**	**3-yr Ave. (gallons)**	**Total Population**	**Resident Regional Center Population**	**Net Water Using Population**	**Per Capita Use (gpcd)**
1979 1980 1981	319,451,200 324,042,300 293,131,800	312,208,433	9,056	600	8,456	101.2
1989 1990 1991	383,417,400 339,614,230 371,772,540	364,934,723	9,421	575	8,846	113.0
1999 2000 2001	339,100,000 395,569,000 386,291,000	373,653,300	9,747	---	9,747	105.0

From Table 2.4 it is seen that the per capita use in year 2000 has dropped compared to the value for year 1990.

Average daily water use will be calculated based on a daily per capita water use of 110 gpcd. This value is considerably lower than the 125 gpcd utilized in 1992 Water Master Plan update, and reflects the City's reduced water losses as well as reduce water usage by customers due to more efficient plumbing fixtures. See Appendix F for more information on water demand reduction due to conservation.

In addition to average daily water use, projections of maximum daily water usage must be made. This is typically done by reviewing historical data and determining the maximum day to average day ratios. This ratio is used as a multiplier of the average day usage to determine the maximum day projections. Table 2.5 presents the peak day pumping rates for years 1996 to 2006. Table 2.6 shows the average day and peak day demands and the ratio of peak day to average day demand from 1996 to 2006. In Saint Peter, the peak day to average day ratio has ranged from 1.51 (1998) to 2.51 (1996). The very high peak day demand in 1996 is due to filling of Greenhill reservoir after painting. Average peak day to average day water demand ratio is 1.98 (1996 is excluded from the calculation). For purposes of making future projections, a ratio of 2.0 will be utilized. This ratio is the same ratio used in previous studies, and is typical for cities the size of Saint Peter.

Table 2.5 PEAK DAY PUMPING DATA		
Year	**Date**	**Gallons**
1996	6-10	2,400,500*
1997	6-10	1,911,600
1998	7-13	1,818,800
1999	8-5	2,280,800
2000	5-2	1,853,200
2001	7-18	1,791,000
2002	7-22	1,976,600
2003	8-17	2,617,400
2004	6-29	2,317,400
2005	7-15	2,479,000
2006	7-5	2,505,800
* Greenhill tower refilling		

Table 2.6 AVERAGE AND PEAK DAY WATER USAGE DATA			
Year	**Annual Avg. Day Demand (MGD)**	**Peak Day Demand (MGD)**	**Peak Day/Avg. Day Ratio**
1996	0.956	2.400	2.51
1997	0.927	1.911	2.06
1998	1.205	1.819	1.51
1999	0.929	2.281	2.45
2000	1.084	1.853	1.71
2001	1.058	2.430	2.29
2002	1.045	1.966	1.88
2003	1.326	2.617	1.97
2004	1.330	2.317	1.74
2005	1.212	2.479	2.04
2006	1.167	2.506	2.15

Metered water usage from 1995 to 2006 is presented in Table 2.7. Table 2.8 presents the number of connections.

Table 2.7 METERED WATER USAGE (Million Gallons per Year)							
Year	**Residential**	**Commercial, Industrial & Institutional**	**City Use Metered & Estimated**	**Total Metered & Accounted For**	**Total Pumped**	**Unaccounted For**	**Percentage Unaccounted For**
1995	191.436	103.266	8.395	303.097	326.745	23.648	7.2
1996	192.176	104.344	11.831	308.351	354.730	46.379	13.1
1997	191.523	99.456	12.936	303.915	320.809	16.894	5.3
1998	175.844	102.722	11.169	289.735	308.975	19.24	6.2
1999	191.132	103.263	10.512	304.907	347.598	42.691	12.3
2000	198.765	123.098	12.754	334.617	395.569	60.952	15.4
2001	203.709	146.715	11.309	361.733	375.914	14.181	3.8
2002	187.445	150.075	7.341	344.861	381.689	36.828	9.6
2003	203.601	144.187	19.401	367.189	484.86	117.671	24.3
2004	197.577	137.399	47.644	382.62	485.307	102.687	21.2
2005	194.842	164.005	34.672	393.519	442.541	49.022	11.1
2006	209.903	133.769	36.776	380.448	425.963	45.515	10.7

Table 2.8 NUMBER OF SERVICE LINES SAINT PETER, MN	
1995	2351
1996	2372
1997	2403
1998	2530
1999	2777
2000	2942
2001	3088
2002	3290
2003	3515
2004	3705
2005	3867
2006	4071

E. UNACCOUNTED-FOR WATER

Unaccounted-for water is the difference between the water pumped and the amount of water sold to all customers. Unaccounted-for water includes leakage, unauthorized use, inaccurate meters, and unusual causes.

To properly determine an unaccounted-for water percentage for any municipal system, a running total of water billed (including non-cash sales) versus water pumped needs to be prepared. A one-month balance is not effective because billing cycles often do not occur simultaneously. A 12-month running total not only balances out any problems with different billing cycles, it also allows the City to track trends to see if the unaccounted-for rate is changing.

Table 2.7 shows the unaccounted-for water from 1995 to 2006. Figure 2-3 shows the total gallons pumped and the unaccounted-for water in a bar graph format. For the year 2000, the percentage of unaccounted-for water had been high. This high value is most likely due to an accounting or meter reading error rather than leakage in the distribution system.

Although the RTC was connected to the City of Saint Peter water system and the City was delivering water to them from year 2000, a metering station was installed only in November 2004. Until November 2004, RTC was billed on an estimated water usage based on their previous well pumping records and south lift station flow records.

The unaccounted-for water for years 2003 and 2004 is also exceptionally high which is partly due to the estimated billing methods used for the RTC. The City has fixed some major leaks in the system very recently (May 2005) and is expecting the unaccounted-for water level to drop below 15 percent in the future.

The City hired an outside leak detection specialist to detect and fix leaks. Nine (9) major leaks were detected in May 2005 and fixed. These leaks were found in mains (3 leaks), service connections (3 leaks) and hydrants (3 leaks). The flow at these leaks was estimated to range from 0.75 to 3 gpm. The water from these leaks did not come to the surface and therefore, required specialized equipment for detection. The cost for hiring the leak detection specialist for a day is $1,000.00.

In December 2004, the City hired a meter testing company to check the accuracy of the treatment plant and well flow meters against a Panametrics Model PT 868 Ultrasonic Transit-Time flow meter. The difference between various meters and the referenced meter is shown in Table 2.9.

Table 2.9 FLOW RATE DIFFERENCE BETWEEN METER AND A REFERENCE METER SAINT PETER, MN	
Flow Meter	**Percent Difference (%)**
Well #4	13.4
Well #5	-1.8
Well #6	0.0
Well #7	1.9
Well #8	0.6
Well #9	12.4
Well #10	0.9
St. Julien – High Service Pump No. 2	8.1
St. Julien – Backwash Pump	-1.1
Jefferson Plant – High Service Pump	1.7
Jefferson Plant – Backwash	20.4

A general rule of thumb for flow meter accuracy is that if two different flow meters are within 5% of each other's flow values, then the meters are considered to be within their accuracy specifications. Using this guideline, four meters are found to be inaccurate and should be replaced. These meters are shown shaded in Table 2.9.

Currently, the City calculates the unaccounted for water the 15th of each month by comparing the water pumped with the amount of water billed and accounted for. On a monthly basis, unaccounted for water calculations will be subject to many accounting problems.

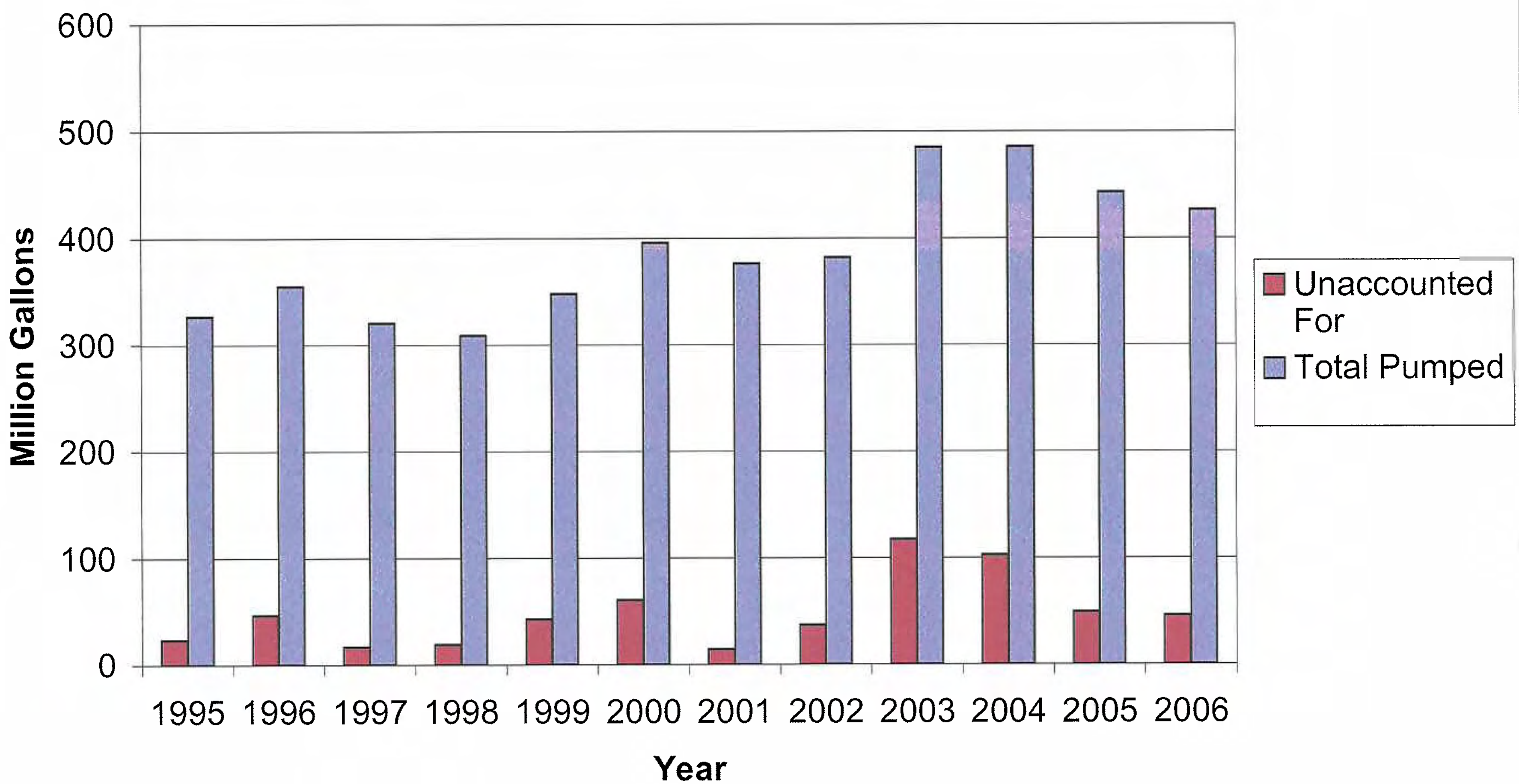
It is recommended that the City calculate the unaccounted for water every month on a rolling 12-month basis. This method would eliminate some of the accounting problems inherent in the calculations.

F. WATER USE PROJECTIONS

Based on the data summarized in this section, the following water use projection criteria will be utilized.

- Water demands will be based on the service area population as outlined in Tables 2.1 and 2.2.
- Average per capita water use will be 110 gpd.
- Maximum day to average day ratio will be 2.0.

FIGURE 2.3
Unaccounted Water Usage
Saint Peter, MN



The projected average day and maximum day water demand from year 2010 to 2040 for the whole system is presented in Table 2.10. These demands separated by the upper and lower systems are presented in Table 2.11.

Table 2.10
PROJECTED AVERAGE DAY AND MAXIMUM DAY WATER DEMAND

Year	Avg. Day Demand (MGD)	Max. Day Demand (MGD)	Max. Day 20-Hr. Pumping Rate (GPM)
2010	1.29	2.58	2150
2020	1.48	2.97	2475
2030	1.68	3.35	2792
2040	1.87	3.74	3117

Table 2.11
PROJECTED AVERAGE AND MAXIMUM DAY DEMAND
FOR LOWER AND UPPER SYSTEMS

Year	Lower System		Upper System	
	Avg. Day Demand (MGD)	Max. Day Demand (MGD)	Avg. Day Demand (MGD)	Max. Day Demand (MGD)
2010	0.83	1.67	0.46	0.92
2020	0.85	1.70	0.63	1.27
2030	0.87	1.74	0.81	1.62
2040	0.88	1.76	0.98	1.97

SECTION 3 - DRINKING WATER QUALITY

A. GENERAL

Drinking water quality is regulated by numerous Federal and State regulations. In addition, the treated drinking water quality must meet local expectations for taste, odor, hardness, and general quality. The ability to test for water contaminants has evolved to parts per billion and less; however, the understanding of health effects of some of these contaminants is still evolving. The U.S. Environmental Protection Agency (USEPA) provides the City the guidelines for producing safe drinking water. Figure 3.1 provides an overview of the regulatory framework as it applies to the Saint Peter water system. This section will provide a background of drinking water regulations, and a summary of existing system water quality data. Water quality design goals will be established based on regulatory requirements, and public expectations.

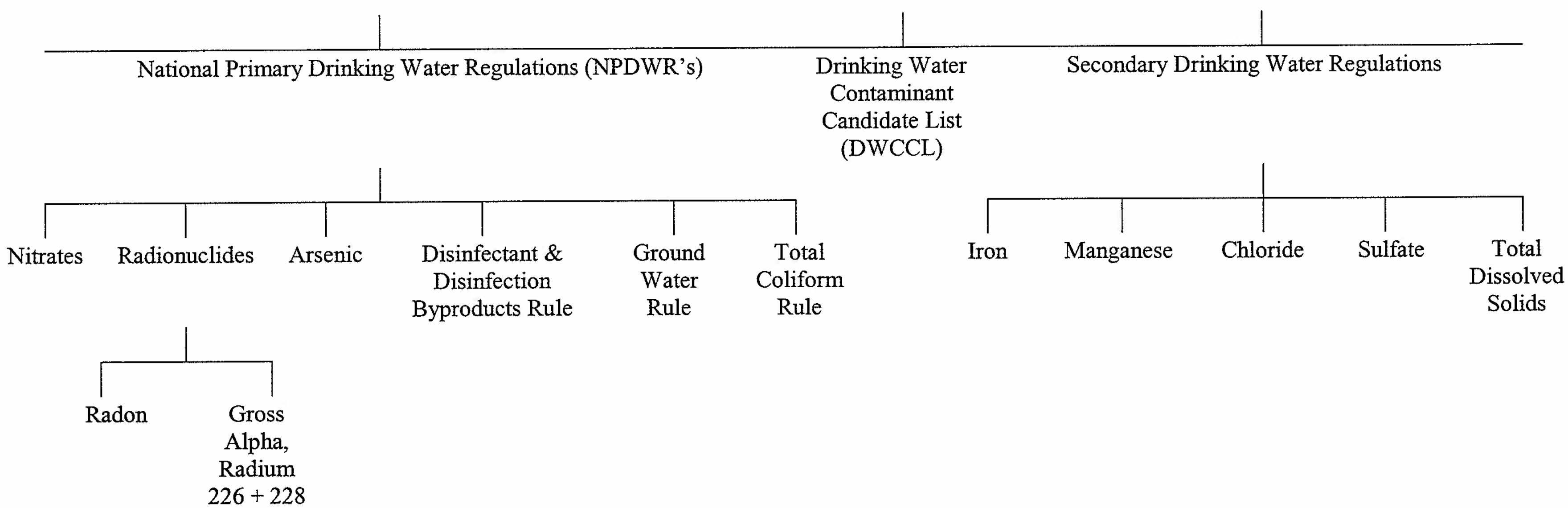
B. SAFE DRINKING WATER ACT (SDWA) REGULATIONS

1. Overview

Through the passage of the Safe Drinking Water Act (SDWA) in 1974, the U.S. Congress authorized the USEPA to establish drinking water regulations that apply to all public water systems in the United States. State governments, through their health departments and environmental agencies, are responsible for implementation and enforcement of the provisions of the Act.

Under the SDWA, the EPA initially proposed National Interim Primary Drinking Water Regulations (NIPDWR). Upon further research and special studies and with the passage of the 1986 Amendments to the SDWA, the interim regulations were adopted as National Primary Drinking Water Regulations (NPDWRs) and 83 contaminants were required to be regulated

FIGURE 3.1 DRINKING WATER REGULATORY FRAMEWORK



Changes were made to the SDWA by the 1996 amendments; however, these amendments retained most of the NPDWRs previously enacted. The 1996 amendments did change the process for selecting contaminants to be regulated, and did mandate new rules regarding arsenic, uranium, radon, and groundwater disinfection. The 1996 amendments place increasing emphasis on ensuring that all new and existing water systems have the technical, managerial and financial capacity to comply with NPDWRs. Systems which do not commit the resources required to comply with the new rules may not be eligible for Drinking Water State Revolving Fund (DWSRF) loans, and may be vulnerable to enforcement actions.

The major components of the SDWA of interest to the City of Saint Peter are as follows:

- National Primary Drinking Water Regulations (NPDWRs)
- Radionuclides Rule (except radon)
- Radon Rule
- Microbial and Disinfection By-Products Rule (M/DBP)
- Total Coliform Rule (TCR)
- Groundwater Rule (future regulations)
- Drinking Water Contaminant Candidate List (DWCCL)

The following paragraphs explain each of these components.

2. National Primary Drinking Water Regulations (NPDWRs)

National Primary Drinking Water Regulations are the enforceable standards with which water suppliers must comply. Currently, there are standards for 92 contaminants, including turbidity, 8 microorganism indicators, 4 radionuclides, 19 inorganic contaminants, and 60 organic contaminants. The United States Environmental Protection Agency (EPA) is required to review and revise, as appropriate, each NPDWR every six years. The latest six-year review was completed in July 2003. Based on this review, the EPA is planning to consider revisions to the Total Coliform Rule (TCR) with new requirements for ensuring the integrity of distribution systems. Appendix A includes a summary of all standards for regulated contaminants.

Based on the well water quality data for the City of Saint Peter, the National Primary Drinking Water Regulations of most concern are nitrates and radionuclides including radon.

3. Radionuclides Rule (except Radon)

The final radionuclides rule was promulgated by the U.S. Environmental Protection Agency on December 7, 2000. The rule updates the maximum contaminant level (MCL) for radium 226/228, alpha emitters, gross beta and photon emitters and sets a new standard for uranium. The compliance date, which applies to all community water systems was December 8, 2003. Maximum limits have been established to avoid adverse health impacts of naturally occurring radionuclides (a measure of radioactivity) and other potential radiation exposure for vulnerable systems near nuclear facilities. Elevated levels of alpha emitters often result in elevated levels of radium 226/228. Based on the chemical analyses done in August 2005, the City of Saint Peter water supply currently does not have a problem with radionuclides; however, water from one well (Well #7) which draws water from the Mount Simon aquifer, has Gross Alpha and Ra-226+228 concentrations that exceed the maximum contaminant level. Well #7 water has Gross Alpha level of 25 pCi/l (MCL 15.4 pCi/l) and Ra 226+228 of 15.7 (MCL 5.4 pCi/l). At present, water from this well is blended with water from Wells 6, 8, 9 and 10 to reduce the radionuclide levels in the drinking water below the maximum contaminant level. It is common for Mount Simon wells in the City of Saint Peter area to have a high level of Ra-226+228 requiring treatment or blending with radium free water.

4. Radon Rule

On November 2, 1999, U.S. Environmental Protection Agency published a proposed regulation for radon in drinking water. The issuance of the final rule has been delayed and was expected to be finished in year 2005. The radon rule is a complex one, since it addresses radon occurrence in both air and water. The proposed maximum contaminant level for radon is 300 pCi/L. An alternative MCL (AMCL) of 4,000 pCi/L in water is available to those states that adopt an Indoor Air Program. The State of Minnesota adopted an Indoor Air Program;

therefore the alternate maximum contaminant level is applicable. The Indoor Air Program requires that the concentration of radon gas in the air shall be less than a threshold level depending on the exposure duration. This program is administered by the Minnesota Department of Health. Since the well water at both treatment facilities passes through the aeration treatment process, this rule should not have any impact on Saint Peter's water system.

5. Microbial and Disinfection By-Products Rules (M-DBP)

Disinfection of drinking water is one of the major public health advances in the 20th Century and has been identified as the primary reason for the increasing life span of humans. Common epidemics such as typhoid and cholera 100 years ago were reduced if not eliminated through disinfection of water supplies; however, chemical disinfectants such as chlorine, chlorine dioxide, ozone, etc. can react with naturally occurring materials in the water to form unintended organic and inorganic byproducts which may pose health risks. A major challenge is to balance the risks from microbial pathogens and disinfection byproducts.

The U.S. Environmental Protection Agency has some existing and developing future rules to address these concerns. Some of these rules apply only to surface water (rivers and lakes), some apply only to ground water (wells) and some others apply to both surface and ground water. They are as follows:

Rule	Applicability
Existing Rules:	
• Interim Trihalomethanes Rule	Surface and Ground Water
• Total Coliform Rule	Surface and Ground Water
• Surface Water Treatment Rule	Surface Water
• Information Collection Rule	Surface Water
• Interim Enhanced Surface Water Treatment Rule	Surface Water
• Stage 1 Disinfectants & Disinfection Byproducts Rule	Surface and Ground Water
• Filter Backwash Recycling Rule	Surface Water
• Long Term 1 Enhanced Surface Water Treatment Rule	Surface Water
Future Rules:	
• Ground Water Rule	Ground Water
• Long Term 2 Enhanced Surface Water Treatment Rule	Surface Water
• Stage 2 Disinfectants & Disinfection Byproducts Rule	Surface and Ground Water

Only the ground water rules apply to the Saint Peter water supply; therefore, the microbial and disinfection byproducts rules, which apply to these supplies, will be discussed in this report.

a. Existing Regulations

Total Coliform Rule – The Total Coliform Rule, revised in 1989, applies to all public water systems and establishes a maximum contaminant level (MCL) for total coliforms.

Total Trihalomethane Rule – In 1979, EPA set an interim MCL for total trihalomethanes of 0.10 mg/l as an annual average. This applies to any community water system serving at least 10,000 people that adds a disinfectant to the drinking water during any part of the treatment process.

Stage 1 Disinfectants and Disinfection Byproducts Rule – The final Stage 1 Disinfectants and Disinfection Byproducts Rule applies to community water systems and non-transient non-community systems and transient non-community water systems, including those serving fewer than 10,000 people, that add a disinfectant to the drinking water during any part of the treatment process.

The final Stage 1 Disinfectants and Disinfection Byproducts Rule includes the following key provisions:

- Maximum residual disinfectant level goals (MRDLGs) for chlorine (4 mg/L), chloramines (4 mg/L), and chlorine dioxide (0.8 mg/L).
- Maximum contaminant level goals (MCLGs) for three trihalomethanes (bromodichloromethane (zero), dibromochloromethane (0.06 mg/L), and bromoform (zero)), two haloacetic acids (dichloroacetic acid (zero) and trichloroacetic acid (0.3 mg/L)), bromate (zero), and chlorite (0.8 mg/L).
- Maximum residual disinfectant levels for three disinfectants (chlorine (4.0 mg/L), chloramines (4.0 mg/L), and chlorine dioxide (0.8 mg/L)).
- Maximum contaminant levels for total trihalomethanes (0.080 mg/L) - a sum of the three listed above plus chloroform, haloacetic acids (HAA5) (0.060 mg/L)- a sum of the two listed above plus monochloroacetic acid and mono- and dibromoacetic acids), and two

inorganic disinfection byproducts (chlorite (1.0 mg/L)) and bromate (0.010 mg/L)).

- A treatment method for removal of DBP precursor material, such as total organic carbon (TOC).

b. Future Regulations

i. Long Term 2 Enhanced Surface Water Treatment Rule and Stage 2 Disinfectants and Disinfection Byproduct Rule

The Safe Drinking Water Act (SDWA), as amended in 1996, required U.S. Environmental Protection Agency to finalize a Stage 2 Disinfectants and Disinfection Byproducts Rule by May 2002; however, this rule was named Long Term 2 and Stage 2 because already interim rules are in place. This rule has not been finalized yet. Although the 1996 Amendments do not require U.S. Environmental Protection Agency to finalize a Long Term 2 Enhanced Surface Water Treatment Rule along with the Stage 2 Disinfectants and Disinfection Byproducts Rule, the U.S. Environmental Protection Agency has chosen to finalize these rules together to ensure a proper balance between microbial and disinfection byproducts risks.

ii. Ground Water Rule

The EPA published the Ground Water Rule on November 8, 2006, which specifies the appropriate use of disinfection and, just as importantly, addresses other components of ground water systems to ensure public health protection. This rule does not have an impact on the City's water system since the City is already disinfecting its treated water supply.

6. Total Coliform Rule

USEPA promulgated a total coliform rule applying to both surface water supplies as well as groundwater supplies on June 29, 1989, which became effective December 31, 1990. A presence/absence approach is now used to determine compliance with the coliform MCL. The Maximum Contaminant Level Goal (MCLG) is zero. In general, coliforms must be absent in at least 95 percent of samples. Compliance is determined on a monthly basis. However, at the last six-year review (1996-2002) conducted by the U.S. Environmental Protection Agency on drinking water standards, the agency decided to propose revisions to the Total Coliform Rule with new requirements for ensuring integrity of distribution systems.

Recommended guidelines for total coliform control are:

- maintenance of detectable disinfectant residual throughout the distribution system;
- proper repair/replacement/maintenance of the distribution system.

7. Inorganic Contaminants Regulated by Primary Drinking Water Regulations

As listed in Appendix A, 20 inorganic contaminants are regulated by the National Primary Drinking Water Standards. They include arsenic, copper, fluoride, lead, mercury, nitrate and nitrites. Impact on Saint Peter's water system by this regulation is presented later.

8. Drinking Water Contaminant Candidate List (DWCCL)

The U.S. Environmental Protection Agency has drinking water regulations for more than 90 contaminants and the complete list is presented in Appendix A. The Safe Drinking Water Act includes a process that the agency follows to identify new contaminants which may require regulation in the future. U.S. Environmental Protection Agency periodically releases a Contaminant Candidate List (CCL). The first list was published in March 1998 and had 60 unregulated contaminants. The second list published in February 2005 carries forward 51 of the original contaminants. In July 2003, EPA announced its decision not to regulate nine contaminants in the original CCL. They are acanthamoeba, aldrin, dieldrin, hexachlorobutadiene, manganese, metribuzin, naphthalene, sodium and sulfate. The current contaminant candidate list (CCL) is presented in Appendix B.

C. SECONDARY DRINKING WATER STANDARDS (GUIDELINES ONLY)

In addition to the National Primary Drinking Water Regulations which cover the contaminants that affect public health, USEPA recommends Secondary Drinking Water Regulations with limits on those contaminants that affect the aesthetic qualities of drinking water. The secondary regulations are intended to serve as guidelines and are not federally or State Health Department enforceable. Table 3.1 lists the secondary standards. Although the water utilities are not required to treat to the Secondary Drinking Water Standards, they should be aware that keeping the quality of drinking water within these guidelines makes it more acceptable to consumers, thereby decreasing complaints.

Table 3.1
USEPA NATIONAL SECONDARY DRINKING WATER CONTAMINANT STANDARDS

Contaminant	**Effects**	**SMCL - mg/L**	**Concern to St. Peter System**
			Yes/No
Aluminum	Colored water	0.05 to 0.2	**No**
Chloride	Salty taste	250	Yes
Color	Visible tint	15 color units	No
Copper	Metallic taste, blue-green stain	1.0	No
Corrosivity	Metallic taste, corrosion, fixture staining	Non-corrosive	
Fluoride	Tooth discoloration	2	No
Foaming Agents	Frothy, cloudy, bitter taste, odor	0.5	No
Iron	Rusty color, sediment, metallic taste, reddish or orange staining	0.3	Yes
Manganese	Black to brown color, black staining, bitter metallic taste	0.05	Yes
Odor	"Rotten egg", musty, or chemical smell	3 Ton	No
PH	Low pH - bitter metallic taste, corrosion; high pH - slippery feel, soda taste, deposits	6.5-8.5	No
Silver	Skin discoloration, graying of the white of the eye	0.10	No
Sulfate	Salty taste	250	No
Total Dissolved Solids (TDS)	Deposits, salty taste, dissolved minerals (contributes to hardness)	500	Yes
Zinc	Metallic taste	5	No

Total dissolved solids, including sulfates and chlorides, generally become a problem only in deep well sources. These constituents impart a mineral taste to the water and can cause gastrointestinal discomfort to those not accustomed to them. Since they are not effectively removed by conventional treatment, selection of a source with low levels of these constituents is quite important or treatment to remove them would be recommended.

Raw water from Wells 4, 5, 7, 8 and 10 have iron levels in excess of the recommended secondary standard level of 0.3 mg/L and the recommended manganese level of 0.05 mg/L is exceeded in the raw water from Wells 7, 8 and 10 as shown in Table 3.2.

Table 3.2
WELL WATER QUALITY DATA

Well	Iron (mg/L)	Manganese (mg/L)	Hardness (mg/L)	Hardness (gr/gal)	TDS (mg/L)
4	1.09	0.037	387	22.6	548
5	1.17	0.035	395	23.1	692
6	0.027	<0.005	340	19.9	465
7	2.67	0.105	583	34.1	1510
8	1.13	0.105	429	25.1	748
9	0.033	0.038	328	19.2	416
10	1.10	0.058	443	25.4	701
Recommended Levels	0.3	0.05	n/a	n/a	500

The shaded areas in Table 3.2 exceed the recommended levels and are removed or reduced by treatment, blending or both for the treated water pumped from the treatment plant.

D. SUMMARY OF WATER QUALITY ISSUES

1. Well Water Quality

The City of Saint Peter utilizes only wells for the supply of water. The well facilities are further described in Section 4 – Existing Facilities. The most recent laboratory analysis for inorganic water quality parameters for each well is presented in Table 3.3.

2. Treated Water Quality

Drinking water is distributed to the City from two water treatment plants. These water treatment plants are further described in Section 4 – Existing Facilities. Water quality data for the finished water from each water treatment plant are presented in Table 3.4.

Table 3.3
WELL WATER QUALITY DATA

Parameter	Well No. 4	Well No. 5	Well No. 6	Well No. 7	Well No. 8	Well No. 9	Well No. 10
Temperature – Field (°C)	10.8	10.8	11.2	11.0	10.5	10.6	10.5
Specific Conductance–Field (µmos/cm)	871	1040	673	2323	1221	642	1105
Specific Conductance–Lab (µmos/cm)	111.6	1319	866.0	2980	1531	811.0	1463
pH – Field (Std. Units)	7.26	7.22	7.82	7.21	7.25	7.33	7.20
pH – Lab (Std. Units)	7.4	7.5	7.6	7.3	7.2	7.4	7.4
Total Alkalinity (mg/L $CaCo_3$)	31.7	325	257	329	384	249	373
Total Hardness (mg/L $CaCo_3$)	387	395	340	583	429	328	443
Fluoride (mg/L)	0.36	0.36	0.16	0.35	0.33	0.18	0.30
Sulfate (mg/L)	135	160	34.1	269	155	42.4	143
Chloride (mg/L)	36.1	78.0	29.8	425	104	21.1	101
Nitrate + Nitrite (mg/L N)	<0.2	<0.2	11.5	<0.2	<0.2	8.78	<0.2
Hydrogen Sulfide (mg/L)	<1	<1	<1	<1	<1	<1	<1
Total Dissolved Solids (mg/L)	548	692	465	1510	748	416	701
Calcium (mg/L)	104	105.0	90.70	146.0	109.0	85.80	114.0
Magnesium (mg/L)	30.9	32.20	27.80	53.00	38.30	27.60	38.30
Potassium (mg/L)	7.87	9.360	2.450	20.80	10.60	2.870	9.140
Copper (mg/L)	<0.005	<0.005	<0.005	0.007	0.040	<0.005	0.012
Iron (mg/L)	1.09	1.170	0.027	2.67	1.130	0.033	1.100
Manganese (mg/L)	0.037	0.035	<0.005	0.105	0.105	0.038	0.058
Lead (mg/L)	<0.5	<0.5	<0.5	<0.5	5.05	1.78	1.09

All analyses were carried out in samples taken in September 2004.

Table 3.4 TREATED WATER QUALITY FROM THE WATER TREATMENT FACILITIES		
Water Quality Parameter	**St. Julien WTP**	**Jefferson WTP**
Lead (mg/L)	< 0.5	<0.5
Copper (mg/L)	<0.005	<0.005
Nitrate+Nitrite (mg/L N)	4.00	0.81
Chloride (mg/L)	77.7	63.5
Fluoride (mg/L)	1.22	1.24
Iron (mg/L)	<0.01	<0.01
Manganese (mg/L)	<0.005	<0.005
pH (Std. Units)	7.8	7.8
Sulfate (mg/L)	105	154
Solids, Total Dissolved (mg/L)	585	603
Alkalinity, Total (mg/L $CaCo_3$)	320	304
Specific Conductance (μmos/cm)	998.0	1009
Nitrogen, Total Kjeldahl	<0.1	0.2
Sulfide, Total (mg/L)	<1	<1
Hydrogen Sulfide (mg/L)	<1	<1
Calcium (mg/L)	98.50	107.0
Magnesium (mg/L)	33.30	34.10
Potassium (mg/L)	6.490	9.140
Hardness, Total (mg/L $CaCo_3$)	383 (22.4 gr/gal)	408 (23.8 gr/gal)
Note: Samples taken for analyses in September 2004.		

3. Impact from USEPA Drinking Water Standards

a. Organic Contaminants (Volatile and Synthetic Organic Contaminants)

No impact is seen from the present or proposed future organics regulations since the City supplies are free of organic contaminants.

b. Inorganics

Arsenic: On January 22, 2001, USEPA adopted a new standard and the public water systems must comply with 10 ppb standard beginning in January 2006. The analyses done in July 2005 indicated that none of the wells in the City water supply system had any detectable level of arsenic. Since the City supply has no arsenic, no impact is seen from this new rule.

Nitrates: Well No. 6 (Ritt Street Well) in the Jordan aquifer has a nitrate concentration of 11.6 mg/L, which exceeds the maximum contaminant level of 10 mg/L for that contaminant. The water from this well is blended with water from wells 7, 8 and 10 to reduce the nitrate concentration in the treated water pumped into the distribution system from the St. Julien Treatment Facility. The nitrate level in the treated water leaving the St. Julien Treatment Facility is 4 mg/L.

Lead & Copper Rule: There is no maximum contaminant level for this rule. However, 90 percent of the samples taken shall have lead and copper below their action levels. The action level for lead is 0.015 mg/L and copper is 1.3 mg/L. The City of Saint Peter has passed all of the lead and copper tests and has no difficulty in meeting this rule.

c. Radionuclides

Currently, only Well No. 7 draws its water solely from the Mount Simon aquifer. Water from Well No. 7 exceeds the maximum contaminant level for Ra-226+228 and Gross Alpha. However, water from Well No. 7 is always blended with water from Wells 6, 8, 9 and 10 to keep the Ra-226+228 and Gross Alpha below maximum contaminant level. The manganese removal treatment process at the St. Julien Water Treatment Facility is also capable of reducing Ra-226+228 and Gross Alpha levels found in the raw water.

Any future well finished in the Mount Simon aquifer to meet the increasing water demand will be subject to this rule and would require treatment or blending.

4. Secondary Drinking Water Standards

Secondary drinking water standards are non-enforceable aesthetic quality standards; however, the public is more aware of the water standards and the City should and does address these as necessary to provide an acceptable supply of drinking water.

5. Drinking Water Priority List

The City's supplies are free of these contaminants and therefore, no action is necessary in this area.

6. Total Coliform Rule and Groundwater Disinfection

To be in compliance with the rule, the City should maintain the detectable level of disinfectant residual. The City is maintaining a chlorine residual in the system to meet this rule. The City currently chlorinates at the St. Julien treatment plant and Jefferson water treatment plant, and water carries a residual when leaving the treatment facilities. The applied chlorine dosage has to be increased in order to maintain a detectable chlorine residual in extremities of the distribution system. The treated water from the St. Julien treatment plant is pumped directly to the Green Hill Reservoir for blending so residents near the treatment facility will not experience fluctuations in the level of chlorine in their drinking water.

7. Microbial and Disinfection By-Products (M/DBP)

Most disinfection by-products are due to reaction of disinfectants with natural organic compound in the finished water. Due to the very low level of total organic carbon (TOC) found in the City's water supply, no problems exist or are anticipated with this rule, and no impacts are foreseen.

8. Wellhead Protection

The existing Wellhead Protection Program is the most effective way to protect the ground water used as a public water supply. Through this program, the City manages potential contamination sources on the land that contribute to their wells.

In 1997, the City of Saint Peter, along with the Minnesota Department of Health, implemented their Wellhead Protection Program by delineating wellhead protection areas. The wellhead protection plan is being updated in 2007. Included in Appendix C is an outline of the steps that the City has taken to ensure the success of this Program.

E. WATER QUALITY MANAGEMENT STRATEGY

In order to provide the citizens of Saint Peter with a safe, consistent source of drinking water, and to economically plan for future treatment needs, a water quality management strategy has been developed. This strategy has six contaminant categories as follows:

1. Organic contaminants, including volatile organic chemicals and synthetic organics;
2. Inorganic contaminants, including heavy metals, nitrates, lead and copper;

3. Radionuclides;
4. Secondary standard contaminants, including aesthetic quality contaminants such as iron, manganese, chloride, sulfates and total dissolved solids (TDS); and
5. Microbial contaminants, including coliforms and other bacterial and viral contaminants.
6. Disinfection byproducts.

For each of these categories, a management strategy has been designated. An overview of the strategies for each category and their current status is provided in Table 3.5.

Membrane treatment has been proposed to remove some contaminants. The membrane treatment process uses a semi-permeable membrane to separate and remove dissolved solids, organics, very small sized colloidal matter, viruses and bacteria from water. Depending on the permeability of the membrane and the pressure used to drive the water across the membrane, the membrane treatment process is classified by different names. They are microfiltration, ultrafiltration, nano-filtration and reverse osmosis.

Table 3.5
OVERVIEW OF WATER QUALITY MANAGEMENT STRATEGY

Contaminant Category	Contaminants Specific to Saint Peter	Management Strategy	Status of Management Strategy
Organic Contaminants	None at this time	Well head protection plan (WHPP)	Currently implementing WHPP
Inorganic Contaminants	Nitrates	Blending/Membrane Treatment	Blending currently, membrane in future
	Lead and Copper	PH corrosion control using zinc orthophosphate	Current treatment
Radionuclides	Radium 226 + 228	Blending	Blending currently, membrane in future
	Gross Alpha	Blending	Blending currently, membrane in future
Secondary Standards Contaminants	Fe	Oxidation/Filtration	Current treatment
	Mn	Oxidation/Filtration	Current treatment
	Chloride	Blending	Blending currently, membrane in future
	TDS	Blending/Membrane Treatment	Blending currently, membrane in future
	Sulfate	Blending/Membrane Treatment	Blending currently, membrane in future
Microbials	Bacterial and viral contaminants	Disinfection	Currently disinfecting w/chlorine
Disinfection Byproducts	None at this time	Well head protection plan (WHPP)	Currently implementing WHPP, membrane in future

SECTION 4 - EXISTING FACILITIES

A. SUPPLY

The City of Saint Peter currently draws its supply from seven wells, Well #4 through Well #10. Table 4.1 that follows provides information on each of the seven wells. Wells #4 and #5 are located near the treatment facility at Jefferson Avenue. Well #6 is located at Ritt Street. Wells #7, #8, #9 and #10 are located within the City's Public Works Complex, which also houses the St. Julien Water Treatment Plant. Figure 4-1 shows the existing water system schematically. Locations of the wells and treatment facilities are shown in Figure 4-2.

Table 4.1
PHYSICAL WELL DATA

	Well No. 4	Well No. 5	Well No. 6	Well No. 7	Well No. 8	Well No. 9	Well No. 10
DNR Permit Number	79-4341	79-4341	79-4341	79-4341	79-4341	79-4341	79-4341
Unique Well Number	209911	209910	209906	433254	473638	473639	473640
Static Water Level	62 ft.	51 ft.	33 ft.	4 ft.	9 ft.	40 ft.	9 ft.
Current Pumping Capacity (GPM)	337	371	350	450	475	325	525
Tested Pumping Capacity (GPM)	750	750	300	900	500	250	500
Pumping Level	80 ft.	81 ft.	69 ft.	12 ft.	130 ft.	92 ft.	190 ft.
Draw Down	18 ft.	30 ft.	36 ft.	8 ft.	121 ft.	52 ft.	181 ft.
Well Diameter	16"	16"	12"	24"	12 x 18"	12 x 18"	12 x 18"
Well Casing Diameter	16"	16"	20"	18"	12"	12"	12"
Total Well Depth	667'	670'	130'	625'	410'	145'	396'
Casing Depth	103'	120'	80'	515'	363'	113'	326'
Year Well Constructed	1951	1957	1972	1987	1991	1991	1991
Pump Type	Submersible	Submersible	Submersible	Vertical Turbine	Submersible	Submersible	Submersible
Water Bearing Formation	Mt. Simon, Jordan, Franconia	Mt. Simon, Jordan, Franconia	Jordan	Mt. Simon	Ironton & Galesville	Jordan	Ironton & Galesville

Two additional wells, Locust Street Well and Chatham Street Well, were in operation until 1986, and were sealed and abandoned due to high concentration of nitrates in the raw water.

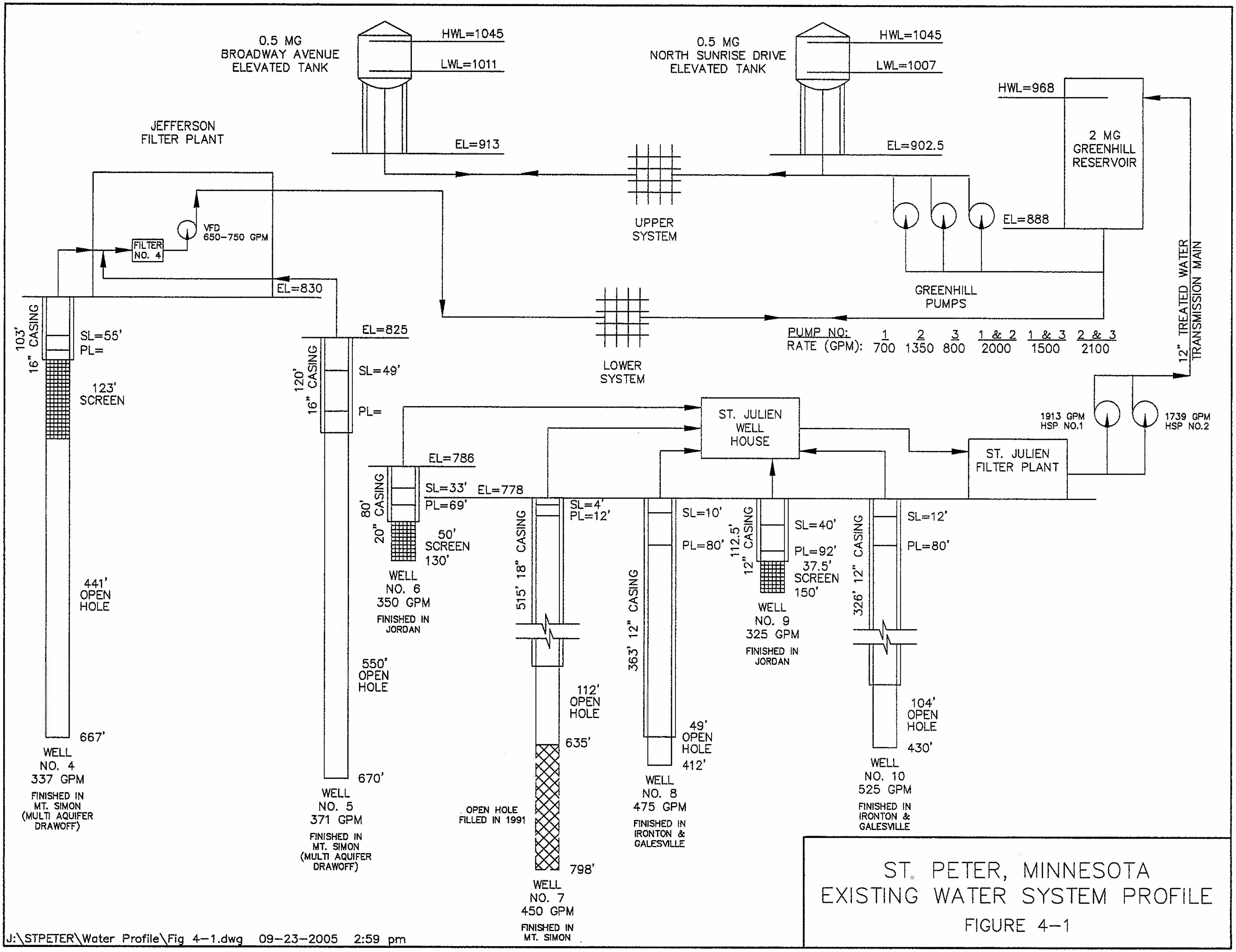
Well #7 was tested with a higher pumping capacity, but the quality of the water was very poor due to the presence of very high levels of chlorides, sulfates and total dissolved solids. The well was determined to be interconnected with the Hinckley aquifer. The Hinckley aquifer was sealed off and the well is pumped at a lower rate and blended with water from Wells #8, #9 and #10.

Currently, water from Wells #6, #7, #8, #9, and #10 are blended in the raw water pipeline before it reaches the St. Julien water treatment plant where it is treated. Water from Wells #4 and #5 are treated at the Jefferson Avenue water treatment plant.

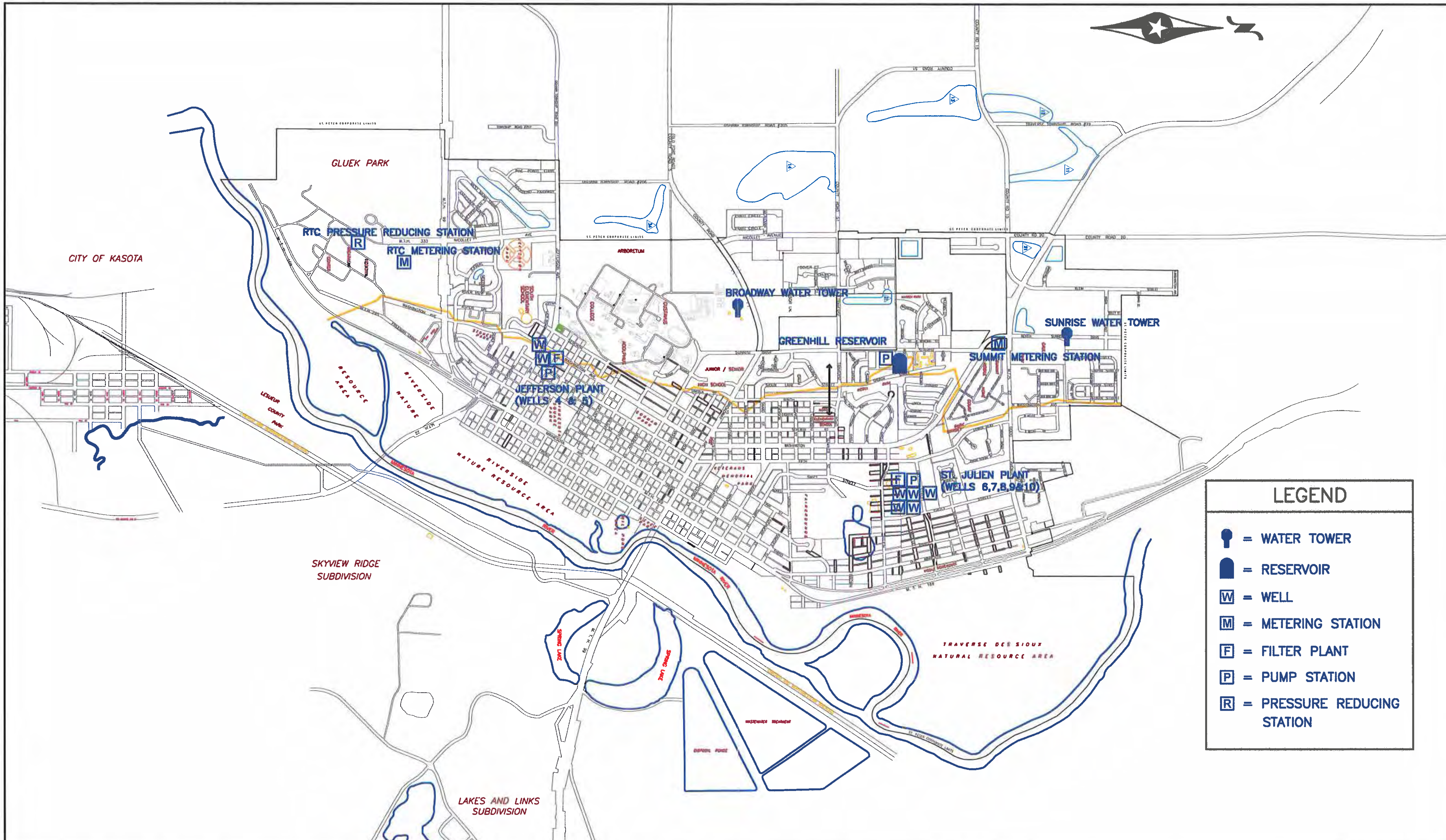
The Wellhead Protection Plan is a plan that manages potential contaminant sources on the land area where water begins its travel into the aquifer and to the city's drinking water supply. In 1993, the Minnesota Department of Health and the City of Saint Peter implemented a Wellhead Protection Plan to help protect water quality in three aquifers. The soil structure above the aquifers can be sandy and allows water to permeate very rapidly to the aquifers. Pollutants can be carried into the groundwater leading to possible contamination of the aquifers. The goal of the plan is to reduce or remove the contaminant sources on the identified land areas.

In the late 1990's, a coalition of local agencies and governments began working in earnest to accelerate changes in the fertilizer practices of the agricultural producers; this initiative included crop consultants and agri-business cooperatives. A Wellhead Protection Plan was completed in 1997. The report is available in the City's Public Works Department Library. This plan is in the process of being updated in 2007.

Wells #4 and #5 receive water from multiple aquifers. Current regulations prohibit the construction of new wells from using multiple aquifers; however, if no expansion in capacity for Wells #4 and #5 is implemented, the wells are allowed to be used and their combined capacity would be around 750 gpm. The combined pumping capacity of various well combinations for Wells #6, #7, #8, #9, and #10 is shown in Table 4.2.



ST. PETER, MINNESOTA
EXISTING WATER SYSTEM PROFILE
FIGURE 4-1



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CITY OF SAINT PETER
LOCATION OF WATER SYSTEM COMPONENTS

MAY, 2005

FIGURE NO. 4-2

Table 4.2 COMBINED WELL PUMPING RATES					
Well Number	Current Individual Well Pumping Rate (GPM)	Combined Well Pumping Rates (GPM)			
		Option 1	Option 2	Option 3	Option 4
6	350	275	275	250	260
7	450	300	300	---	260
8	475	---	425	375	340
9	325	250	250	250	250
10	525	425	---	450	360
Total		1250	1250	1325	1470

1. Geology of Water Bearing Formations

A generalized section of the geologic stratigraphy, or geologic layers of Southern Minnesota, is shown in Figure 4-3. The shallow wells in Saint Peter, whose depth range from 80 to 150 feet, are finished in a highly recharged and productive source of white sandstone called the Jordan Sandstone. This aquifer water bearing rock formation is a common source of water over much of Central and Southern Minnesota. The rock can readily be seen at the Unimin Mines at Ottawa and Kasota. Unfortunately, the formations of rock which lie above the Jordan Sandstone are eroded away in varying degrees across the north-south axis of the City. This erosion was caused by glacial action or the scouring of the ancient River Warren, which created the river valley. These formations if not completely gone, are badly fractured or weathered. The “sand prairie” which lies along the westerly boundary of the City is extremely porous and allows surface water to re-charge the Jordan Sandstone. The contributing area Robart watershed extends to the west onto the next terrace of land. All or most of this land is farmed and nutrients from fertilizers are transported by the surface runoff. Upon reaching the “sand prairie” they readily percolate into the sand and thence, to the Jordan Sandstone.

The former combined storm-sanitary sewer, which had served the City since the late 1800’s, may have contributed, in the past, contaminants to the same formation. This service consisted of an unlined tunnel in the Jordan Sandstone.

With the sewer separation project completed in 1985, the bottom of the tunnel has a sanitary sewer encased in concrete, sealing it from the bottom of the tunnel.

As shown in Figure 4-3, the layer called the "St. Lawrence Confining Bed" is an aquiclude. This means that this rock layer is impervious and prevents the vertical migration of water from the aquifers lying above and below the formation.

There is a deeper aquiclude called the Eau Claire formation at a deeper depth.

Between these two aquicludes is an aquifer called the Franconia-Ironton-Galesville formation.

Below the Eau Claire formation lays a high volume source of water called the Mt. Simon formation.

The City has two deep wells located near the intersection of Washington Avenue and Jefferson Avenue. These wells are drilled into the Mt. Simon formation, but draws water from three aquifers, the Jordan, the Franconia-Ironton-Galesville, and the Mt. Simon. This is no longer allowed by the Minnesota Well Construction Code since if one of the shallower aquifers becomes contaminated, then there is a chance of contaminating the lower formations. There is no evidence at this time that this is happening in these two wells. At a future date, it may become necessary to case off or seal off the upper two aquifers.

B. TREATMENT FACILITY

1. General

The City of Saint Peter has two separate treatment plants. Both provide treatment to remove iron and manganese and dissolved gases in the raw water, and chlorinate the water.

The original treatment facility at the intersection of Jefferson Avenue and Washington Avenue was constructed during the 1940s. This facility at the time consisted of a well and a steel filter unit. The treatment facility was rebuilt in 1952. Over the years, modifications were made to the facility and in 1968 the treatment facility was expanded to house two steel filters. Filter 5 (north filter) was installed in 1968 and Filter 4 (south

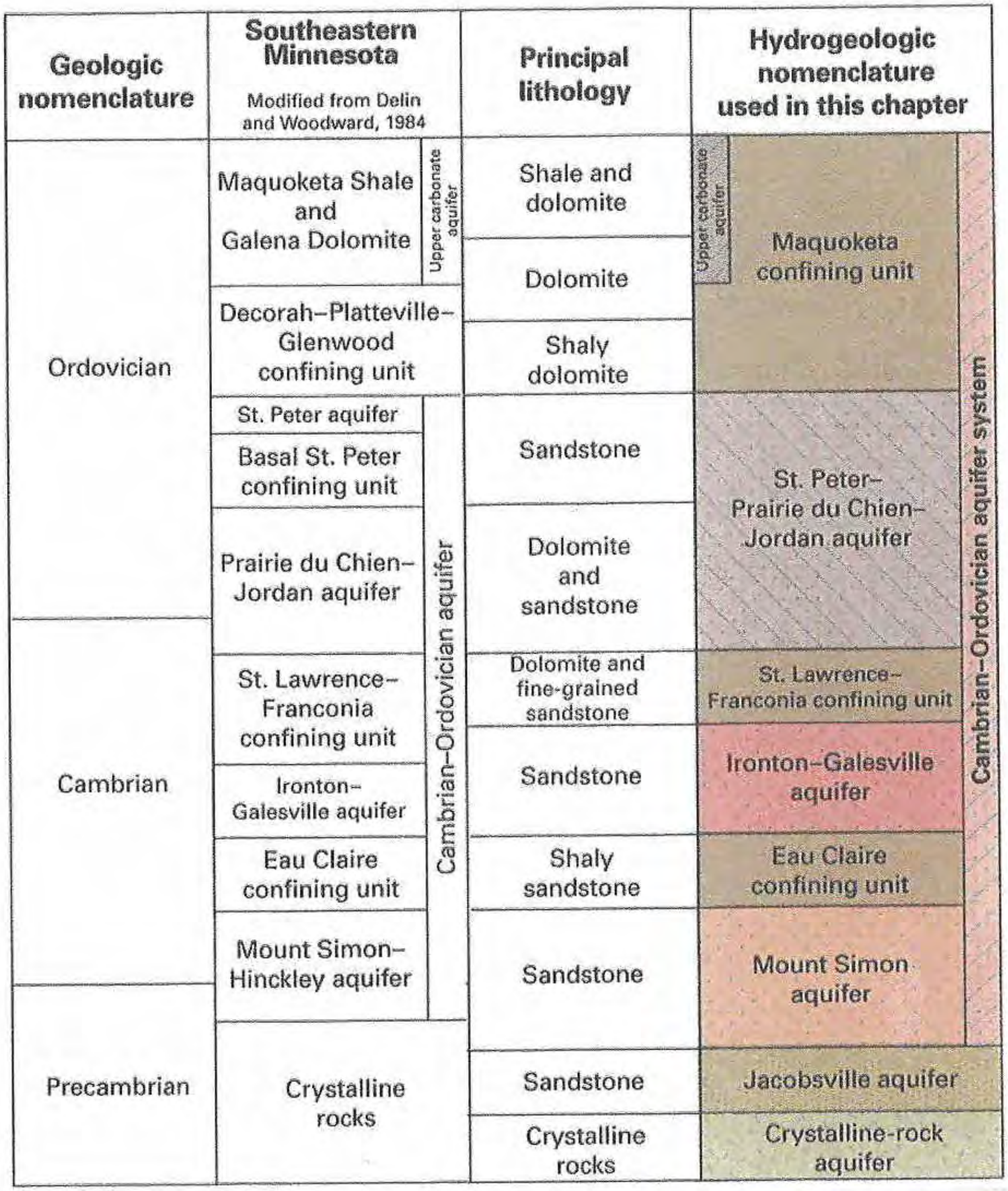


Figure 4-3
Geology of Southern Minnesota

filter) was installed in 1977. Filter 5 was drained and removed in 2000. A new metal roof was installed over portions of the facility in 1998. The remaining EPDM roof was replaced in 2005. The plant's electrical system, SCADA system, and the chemical feed system were refurbished in 2005. The piping, building interior and the outside of the steel filter were also painted in 2005. The pumping to the system is 700 gpm.

The St. Julien water treatment plant was constructed in 1987-88 with concrete filters and put online July 7, 1988. This plant receives raw water from Wells #6, #7, #8, #9, and #10. Treated water from the St. Julien treatment plant is pumped directly to the Greenhill reservoir first before it enters the distribution system. This plant has a rated capacity of 2 million gallons per day. The aerators and the filters have a rated capacity of 1500 gpm. High service pumps No. 1 and 2 have pumping capacities of 1913 gpm and 1739 gpm respectively. When both pumps are operated, the pumping capacity is 2833 gpm.

2. Existing Treatment Facilities Inventory

a. Jefferson Avenue Water Treatment Plant

The Jefferson Avenue treatment plant was originally constructed during the 1940's. Modifications to the plant were made in 1952, 1968 and 1977. This treatment plant treats water from Wells 4 and 5 and pumps treated water directly to the "lower" distribution system. A facilities inventory for the Jefferson Avenue treatment plant is presented in Table 4.3.

Table 4.3
FACILITIES INVENTORY FOR JEFFERSON AVENUE TREATMENT PLANT

Component	Data
South Building	Reconstructed in 1952
North Addition	Built in 1968
Aerator	Integral with the filter units. Type: Spray nozzle.

Table 4.3 FACILITIES INVENTORY FOR JEFFERSON AVENUE TREATMENT PLANT	
Component	**Data**
Filter 4	Steel tank Manufacturer: Tonka Equipment Co. Gravity flow Installed: 1977 Dimensions: 10' x 20' with 4 cells Media: Birm Underdrain: Steel plate Rated Capacity: 700 gpm Backwash: Pumped Auxiliary Wash: None Painted exterior in 2005
Filter 5	Removed in 2000
Clearwell	None. High service pumps take suction directly from filter underdrain plenum
Disinfection	Liquid chlorinator (injection)
Fluoridation	Hydrofluosilicic acid Chemical feed pumps (one for each high service pump) Rated at 24 gpd 50 gallon storage tank per high service pump
High Service Pump 4	Horizontal centrifugal pump Manufacturer: Fairbanks Morse Design Capacity: 750 gpm @ 250' TDH Present Pumping Capacity: 700 gpm Motor HP: 75 Pump Replaced: 1989, motor rebuilt in 1989

b. St. Julien Water Treatment Plant

The St. Julien water treatment plant was constructed in 1988. This plant receives raw water from Wells 6, 7, 8, 9 and 10. Treated water from the St. Julien treatment plant is pumped to the Greenhill reservoir before it enters the distribution system. The aerator, detention tank and filters were designed for a flow rate of 1500 gpm. At this flow rate, the maximum production per day will be 2 million gallons. The existing high service pumps have pumping capacities of 1913 and 1739 gpm individually, and a combined pumping capacity of 2833 gpm. Although the high service pumps have higher pumping capacities than the aerator and the filters, the water production from the treatment plant cannot be increased without adding additional treatment units.

Table 4.4 FACILITIES INVENTORY FOR ST. JULIEN TREATMENT PLANT	
Component	**Data**
Aerator	Aluminum housing 8' x 8' x 9' (H) Capacity: 1500 gpm Induced draft type
Detention Tank	Concrete construction No. of Units: One baffle type 35' L x 10'-6" W x 13'-8" H Volume: 36,000 gallons Detention time at 1400 gpm: 25.8 minutes
Filters	Concrete construction Gravity flow Six cells at 11' x 11' Total filter area = 726 sq. ft. Filter capacity at 2 gpm/sf = 1452 gpm Media: 18" anthracite e.s. = 1.0 mm 12" sand e.s. = 0.5 mm Underdrains: Leopold clay block Control: Variable declining rate Backwash: Gravity backwash, 0-1500 gpm Auxiliary Wash: Pump backwash – 1500-2200 gpm
Disinfection	Chlorine gas in 150 lb. cylinders One, 100 lbs/day gas chlorinator Three solution injectors Automatic residual analyzers: None
Oxidation	Potassium permanganate solution 150 gallon mix/storage tank One chemical feed pump rated at 60 gpd
Fluoridation	Hydrofluosilicic acid 150 gallon storage tank One chemical metering pump rated at 24 gpd
Clearwell	Concrete construction 20' x 32' x 20' (D) Volume (usable): 50,000 gallons
High Service Pumps	Two vertical turbine pumps, 150 hp HSP #1 1913 gpm HSP #2 1739 gpm Combined rate 2833 gpm
Backwash Holding Tank	Concrete construction 20' x 20' x 14.5' (D) Volume (usable): 37,400 gallons
Backwash Disposal Pump	Submersible 75 gpm at 40' TDH 2 hp
Backwash Discharge	Sanitary sewer

C. STORAGE

A summary of the storage tank capacities and elevations is presented in Table 4.5.

Table 4.5 WATER STORAGE FACILITIES					
Location	**Capacity**	**Overflow Elevation**	**Ground Elevation**	**Tank Bottom Elevation**	**Operating Range***
Greenhill	2 MG	968	888	888	83-96
Broadway Ave	0.5 MG	1,045	913	1011	83-96
North Sunrise Drive	0.5 MG	1,045	902.5	1007	83-96
Note: All elevations are USGS datum. * Percentage of total capacity.					

A summary of the Greenhill pumping facilities is presented in Table 4.6.

Table 4.6 GREENHILL PUMPING FACILITIES			
Pump No.	**Rated Capacity (GPM)**		
1	2300		
2	900		
3	1650		
Combined Capacity	1 & 2 3200	1 & 3 3950	2 & 3 2550
Firm Capacity	2550		

The principal purpose of storage is to provide the ability to equalize pumping rates during periods of variable rate of demand. Adequate storage permits a reduction in the size of pumps required to supply a community because peak demands are diminished by the reserves provided by the storage.

The principal reasons for providing storage are as follows:

- To store water for high demand rates.
- To provide supply during pump shutdown periods.
- To equalize pressure in the distribution system.
- For fire protection.
- For emergency requirements (pump failures, power failures).

Storage adequacy can be assessed in several ways. The minimum storage recommended by the Minnesota State Department is equal to average daily demand. By this standard, 1.2-mil gal would be the desired storage today and 1.87-mil gal would be recommended for the year 2040.

Another approach is to consider the individual storage components needed for equalization, fire demand and emergency reserve. Water production and storage must be evaluated together, since a reduction in production may be compensated for by an increase in the storage and vice versa. The storage needed for emergency reserve and fire demand are related and can be considered together.

1. Upper System Storage

The combination of water storage and booster station capacity in the upper system must be adequate to meet maximum storage required by one of the following:

1. Fire flow of 3500 gpm for 4 hours.
2. Supply maximum day demand.
3. Supply equalization storage equal to 20 percent of maximum day demand.

The high service pumps at the St. Julien plant are capable of pumping between 1739 to 1913 gpm. The combined well as shown in Table 4.2 ranges from 1250 to 1470 gpm. The storage requirement of the upper system is dependent upon the pumping capacity available at Greenhill pump station. The higher the pumping capacity, the lower the required storage volume. To determine the storage requirements, the firm pumping available at the pump station is used. The firm pumping capacity is defined as the pumping capacity available with the largest pumping unit out of service. The Greenhill pumping station pumping capacities are shown in Table 4.6. The maximum pumping capacity of a station is the combined pumping of all the pumps operating simultaneously. This capacity will be less than the sum of the individual pumping capacities. Required storage volume for years 2020 and 2040 is shown in Table 4.7. The storage needs of the upper system with North Industrial Park and the Regional Treatment Center (RTC) were evaluated in a separate report titled "Preliminary Engineering Report, Proposed Elevated Storage Tank, Northwest Growth Area" by Bolton & Menk, Inc. (March 2004). The report recommended a new 500,000-gallon elevated tower on North Sunrise Drive. (Report is included in Appendix D.) If growth occurs as projected in this report, according to Table 4.7, additional storage will be needed to meet year 2040 requirements.

Table 4.7 STORAGE REQUIREMENT OF UPPER SYSTEM		
	Year 2020	**Year 2040**
Fire Demand (gpm)	3500	3500
Maximum Day Demand (gpm)	882	1368
Fire Demand + Max. Day Demand (gpm)	**4382**	**4868**
Firm Pumping Capacity (gpm)	1500	2000
Withdrawal from Storage (gpm)	**2882**	**2868**
Fire Flow Duration (hours)	4	4
Fire Fighting Storage (gallons)	691,680	688,320
Equalizing Storage (gallons)	254,000	394,000
Total Storage Required (gallons)	**945,680**	**1,082,320**
Current Storage (gallons)	1,000,000	1,000,000
Additional Storage Required (gallons)	---	82,320

2. Lower System Storage

In the lower system, storage and supply facilities must meet maximum storage required by one of the following:

1. Fire flow demand of 3500 gpm for 4 hours.
2. Supply maximum day demand for the entire water system.
3. Supply equalization storage equal to 20 percent of maximum day demand of lower system.

The maximum daily demand in the lower system is 1.76 mgd. The maximum daily demand in the total system is 3.74 mgd. The firm high service pumping capacity at the St. Julien water treatment plant is 1793 gpm. Since the capacity of the clearwell is only 50,000 gallons, firm pumping capacity used for storage calculations is the treatment capacity which is 1500 gpm. If the Jefferson water treatment plant is in operation, the firm capacity increases to 2200 gpm (1500 gpm at St. Julien Street plant, 700 gpm at Jefferson Avenue Plant). The required storage for year 2040 is 1,455,280 gallons as shown in Table 4.8. This calculation is based on taking into account only the pumping capacity available at the St. Julien Water Treatment Facility.

Since the Greenhill Reservoir has a volume of 2 million gallons, sufficient water storage is available for the lower system.

Table 4.8 STORAGE REQUIREMENT OF LOWER SYSTEM		
	Year 2020	**Year 2040**
Fire Demand (gpm)	3500	3500
Maximum Day Demand-Entire System (gpm)	2062	2597
Fire Demand + Max. Day Demand (gpm)	**5562**	**6097**
Firm Pumping Capacity (gpm)	1500	1500
Withdrawal from Storage (gpm)	**4062**	**4597**
Fire Flow Duration (hours)	4	4
Fire Fighting Storage (gallons)	974,880	1,103,280
Equalizing Storage-Low System (gallons)	340,000	352,000
Total Storage Required (gallons)	**1,314,880**	**1,455,280**
Current Storage (gallons)	2,000,000	2,000,000
Additional Storage Required (gallons)	---	---

D. DISTRIBUTION SYSTEM

The City of Saint Peter water distribution system is divided into two different pressure zones and is referred to as the upper and lower systems. All the water production and treatment takes place in the lower system. Water is transferred to the upper system by booster pumps located at the Greenhill reservoir.

The current storage facilities in the City of Saint Peter consist of a two million gallon (Greenhill) standpipe off Sunrise Drive (lower system) and a 500,000 gallon elevated tank on Broadway Avenue (upper system). A 500,000 gallon elevated tank was recently constructed on North Sunrise Drive (upper system) and became operational on June 9, 2007.

Each of these components, the water distribution piping, booster station, and storage facilities will be evaluated in this section. The infrastructure needs should be evaluated for year 2020 as well as 2040 to minimize over-building and stage projects on a timely manner.

The existing water distribution system consists of over 270,000 feet of watermain between the upper and lower systems. The following chart represents the corresponding length and diameter of watermain in both systems. The current city standard minimum watermain diameter is 8" (based on State Code for fire protection supply). The minimum watermain size standard was set in 1987. The current water distribution map is presented in Figure 4-4. As seen from Figure 4-4 and Table 4.9, 4-inch watermain is not found to the extent of 6-inch watermain. There is approximately 12,718 feet of 4-inch watermain and 96,612 feet of 6-inch watermain. All 4-inch watermain should be replaced with 8-inch watermain. Watermain replacement should be combined with street reconstruction projects. Since 6-inch watermain is found throughout the City, it will not be economical or practical to replace it with 8-inch watermain over a 10 or even 20-year period. However, if a utility or street reconstruction project is undertaken, and the underlying watermain is 4-inches or 6-inches, then it is recommended that the watermain be replaced with an 8-inch or larger watermain.

The current City of Saint Peter standard for watermain pipe material is ductile iron. All new watermains installed since the 1980's have been ductile iron pipe, although some old mains are cast iron. The other most commonly used watermain pipe material is polyvinyl chloride (PVC). Ductile iron pipe has some advantages over other pipe materials. They are as follows:

- Ductile iron has more than eight times the tensile strength of PVC pipe.
- Ductile iron resists up to four times the hydrostatic burst pressure of PVC pipe.
- Strength of ductile iron pipe does not decrease with time as it does with PVC pipes.
- Ductile iron pipe resists up to eight times the crushing load of PVC pipe.
- Ductile iron pipe has more than 13 times the impact strength of PVC pipe.
- Pipe trench bedding conditions are more critical for PVC pipes than ductile iron pipe.
- Direct tapping of ductile iron pipe for services is easier and less expensive than PVC pipe.

Table 4.9
CITY OF SAINT PETER WATERMAIN PIPE LENGTHS BY SIZE

Size (inches)	Length (feet)
4	12,718
6	96,612
8	70,270
10	31,467
12	57,688
16	495

The analysis of a water distribution system often requires the use of a method of modeling the system. A model is prepared which simulates the known conditions as closely as possible. This model provides a basis for the simulation of future operating conditions of the system. From these simulations, determinations can be made as to the improvements which the system will need.

The water distribution system for the City of Saint Peter was modeled using the Haestead WaterCAD Model. The computer network model is used to analyze steady state flows for pipe distribution systems. The information required by the model includes data such as diameter, length, and Hazen-Williams C Factor (the pipe's internal surface quality or dynamic surface roughness factor) for each pipe in the system. Other data required were ground elevation of pipe junctions, elevated storage water levels, and water demand on the system.

The model developed for the City of Saint Peter's distribution system has been calibrated to match known conditions. The model has been utilized to predict pressures, system distribution, available fire fighting flows in different parts of the city, and the effect of various system improvements under future demand conditions for the proposed expanded service areas.

SECTION 5 – RECOMMENDATIONS FOR WATER SYSTEM IMPROVEMENTS

A. GENERAL

This section will present the improvements needed to meet the water demands through year 2040.

The per capita water use increased from 101 gpcd to 113 gpcd from 1980 to 1990. However, in 2000, it decreased to 102 gpcd. In the past, the per capita water use was expected to increase with an increased standard of living; however, due to heavy emphasis on water conservation by the Minnesota Department of Natural Resources (MnDNR) and through the use of water efficient plumbing fixtures mandated by the State Plumbing Code, per capita water use in the future is expected to decrease and level off between 85 and 110 gpcd. A per capita use of 110 gallons per day was used for this report.

B. WATER SUPPLY AND TREATMENT

1. Available Well Capacity

As presented in Section 4, the available well capacity at the Jefferson Treatment Facility is 708 gpm with a firm capacity of 337 gpm. Firm capacity is defined as the total well capacity with the largest well out of service. The pumping capacity of the well field at St. Julien Water Treatment Facility, as presented in Table 4.2, varies from 1250 to 1325 gpm. The firm capacity available with both well fields operating is 1662 gpm (1325 + 337). The available firm capacity is inadequate to meet the future water demand. The required additional well pumping capacity through year 2040 is presented in Table 5.1. Because Well #7 is operated far below its maximum capacity, upgrading to increase Well #7 pumping capacity will cause less additional capacity to be required.

Table 5.1
ADDITIONAL WELL PUMPING CAPACITY REQUIRED

Year	With Jefferson Plant (GPM)		Without Jefferson Plant (GPM)	
	Well No. 7 at Current Capacity	**Well No. 7 at Max. Capacity**	**Well No. 7 at Current Capacity**	**Well No. 7 at Max. Capacity**
2010	488	38	825	375
2020	813	363	1150	700
2030	1130	680	1467	1017
2040	1455	1005	1792	1342

2. Future Water Supply Options

The existing water supply is inadequate to meet the projected water demand by year 2010. The existing firm supply (supply with largest pump out of service) is inadequate to meet the present maximum day demand. A study of a project should begin soon to have resources in place by 2010.

Supply from the Mount Simon aquifer in St. Peter will have Gross Alpha and Ra-226+228 concentrations in excess of the MCL stipulated by the Primary Drinking Water Standards. Blending the water from the Mount Simon aquifer with water from either the Jordan or Franconia and Ironton-Galesville (FIG) aquifer severely limits production capacity of the Mount Simon wells.

Reverse Osmosis (RO) membrane treatment is proposed to remove radionuclide contaminants from Well No. 7 and the future high capacity Mount Simon wells.

The following three alternatives were considered to meet the system demand through year 2030. All three alternatives will be able to meet the year 2030 maximum day demand of 3.4 MGD. A detailed analysis of these three alternatives is beyond the scope of this study.

Alternative 1 – Expand St. Julien Plant and Renovate Jefferson Plant

- Increase the firm well supply at St. Julien water treatment plant to 2.6 MGD by drilling a new Well #11 with a capacity of 900 gpm.
- Increase the pumping capacity of Well No. 7 to 900 gpm.
- Separate the discharge piping from Well House No. 7 to the treatment plant to obtain the maximum flow from each well.
- Expand St. Julien water treatment plant to 2150 gpm capacity.
- Install reverse osmosis membrane treatment at St. Julien water treatment plant.
- Refurbish the steel filter at the Jefferson water treatment plant.
- Add RO membrane treatment at Jefferson water treatment plant to match the water quality at both treatment facilities.
- Estimated cost $6.5 to $7.5 million.
- Risk factors:
  - Wells No. 4 and No. 5 at Jefferson are multi aquifer wells and cannot be rehabilitated without bringing these wells to current construction standards.
  - Life span of renovated steel filter is 20 years.

Alternative 2 – Expand St. Julien Plant and Abandon Jefferson Plant

- Increase firm supply at St. Julien plant to 3.4 MGD.
- Construct new Wells #11 and 12 near St. Julien plant.
- Expand St. Julien treatment capacity to 3.4 MGD
- Install RO membrane treatment at St. Julien plant.
- Increase the high service pumping capacity of St. Julien treatment plant to 2800 gpm.
- Install new trunk watermain from St. Julien treatment plant to Greenhill reservoir.
- Abandon and demolish Jefferson facilities.
- Estimated cost $6.5 to $7.5 million.
- Risk factors:
  - Single treatment facility. Vulnerable to natural disasters, such as tornadoes.
  - Locating two new Mount Simon wells near St. Julien plant could be challenging.

Alternative 3 – New Treatment Facility & RO Treatment Addition to St. Julien Plant

- Drill new Wells #11 and 12 in the vicinity of Greenhill Reservoir.
- Construct a new treatment facility with RO treatment and 1.9 MGD capacity to feed Greenhill Reservoir
- Would require land purchase.
- Add RO membrane treatment to St. Julien plant to match water quality from both treatment plants.
- Abandon and demolish Jefferson facilities.
- Estimated cost $6.5 to $7.5 million.
- Risk factors:
  - Availability of land to build treatment facility.

C. STORAGE

Storage requirements were adequately addressed in the "Preliminary Engineering Report for the Northwest Growth Area" (Bolton & Menk, Inc., March 2004). A new 500,000-gallon elevated tower was completed on June 9, 2007. With this new storage tank, storage requirements are adequately met. From Table 4.7 it is clear that by year 2040, there will be a deficit of 82,320 gallons of storage even with the 500,000 gallon storage tank at North Sunrise Drive on line. Our recommendation is to plan for a future tower of

250,000 to 300,000 gallons capacity. It is not cost effective to upgrade the North Sunrise tower to 600,000 gallons or higher capacity at this time. If the growth occurs as planned, there will be time for the city to re-evaluate options to plan for a new tower west of the current corporate limits as shown in Figure 5-1. This new elevated water tower would be necessary to maintain the minimum water pressure of the future Stage 2 service area in the upper system. The location of the tower is proposed to be same distance from the Greenhill reservoir that the Broadway and North Sunrise Drive elevated towers are. It would be appropriate to purchase land for the new elevated tower site to protect it from having to purchase it from a developer at a later date.

D. DISTRIBUTION SYSTEM

The proposed trunk watermains to serve the expanded service areas and improve flow and pressure in the existing service areas are shown in Figure 5-1. The City distribution system has no overall major weaknesses or low-pressure problems. The minimum static pressure throughout the system is approximately 40 psi.

The Insurance Services Office (ISO) Public Protection Classification Program evaluates the fire department and water system according to a uniform set of criteria defined in the Fire Suppression Rating Schedule (FSRS). The latest report for the City of Saint Peter is found in Appendix D. According to this report, water supply received 32.25% of the maximum 40% credits. The current Public Protection Class for Saint Peter is 5. The protection class can be improved by higher flow at some hydrant locations. However, the City had 5.55% credits deducted due to divergence between the points assigned to the fire department and water supply. It would be more cost effective to correct some of the deficiencies listed for the fire department in the report to move to a better class of protection.

A 12-inch watermain replacement is proposed along Minnesota Avenue from Wabasha Avenue to Locust Street. This improvement should be coordinated with MnDOT proposed improvements of Hwy. 169.

A 10-inch watermain replacement is proposed along 3rd Street from ½ block south of Grace Street to Broadway Avenue and from Livermore Street to Old Minnesota Avenue (south of Brown Street).

For replacement of 4-inch watermains, a priority ranking has been developed based on planned street resurfacing projects and analysis of the WaterCAD model of the Saint Peter water system. The priority ranking is presented below:

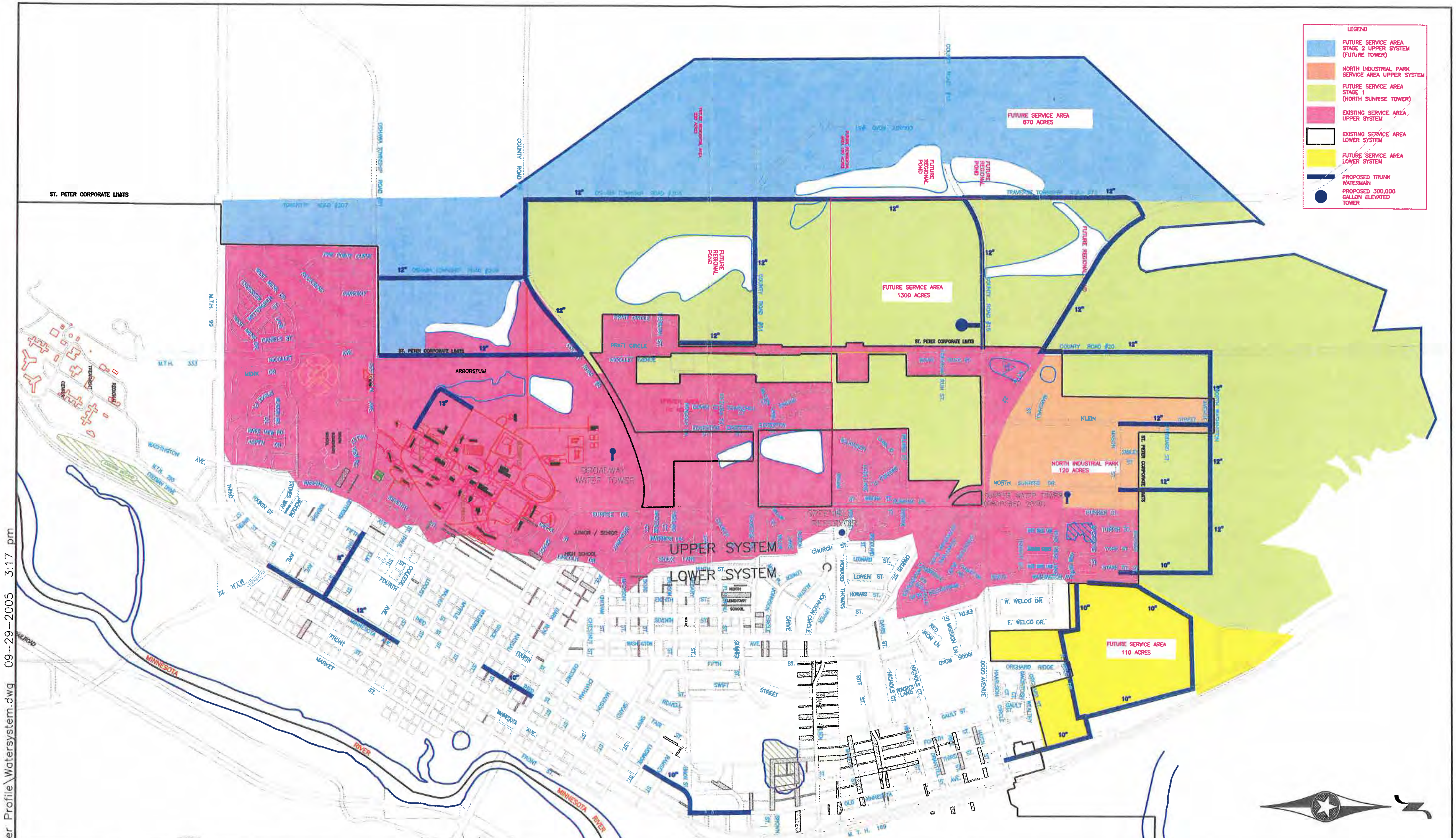
Location	Approximate Length (ft.)	Replacement Priority Ranking
Pine Street	1600	1
Fourth Street	1500	2
Skaro Street	1200	3
Livermore Street	800	3
Minnesota Avenue	800	3
Washington Avenue	1400	4
Union Street	1850	4
Front Street	1500	5

The 6-inch watermains are so pervasive in the system that replacement would have to take place over a long period of time and have to be combined with street reconstruction and other utility replacement projects.

E. WATER CONSERVATION

A new well construction permit from the Minnesota Department of Health or increased water appropriation from the Minnesota Department of Natural Resources would require the City to submit public education programs that are being implemented to reduce water demands. In addition, the City would have to submit an update on conservation measures that are being implemented to reduce water demands. An updated conservation plan will be approved in 2007.

Typical indoor residential water uses are shown in Figures 5-2 and 5-3. Less than 5 percent of the indoor water use is for drinking and cooking. About 60 to 75 percent of this use is for toilets and bathing. An EPA study finds that new residential homes use 1.6 gallons per flush (older models use 6 gallons per flush), which reduces water use by 23 to 46 percent – a savings of about 21,130 gallons of water per year per household (www.epa.gov/own/water-efficiency).



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SCALE FEET

BOLTON & MENK, INC
CONSULTING ENGINEERS & SURVEYORS
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN WILLMAR, MN
BURNSVILLE, MN CHASKA, MN AMES, IA LIBERTY, MO

CITY OF SAINT PETER
PROPOSED TRUNK WATERMAIN EXTENSIONS

SEPTEMBER, 2005

FIGURE NO. 5-1

Figure No. 5-2
Typical Household Water Use (Indoor)

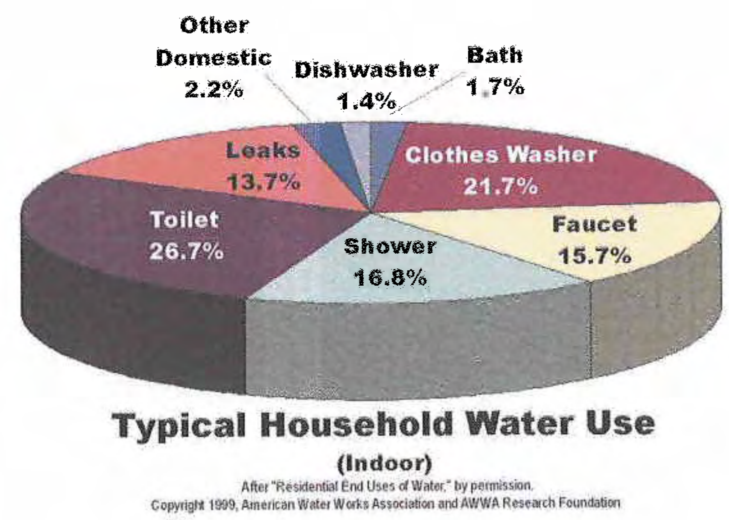
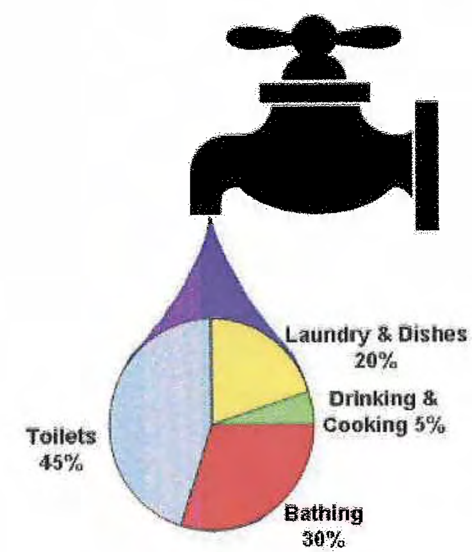


Figure No. 5-3
Indoor Household Water Use (Texas A&M University)



Water use efficiency practices fall into two categories:

1. Engineering practices: practices based on modifications of plumbing fixtures, plumbing or water supply operating procedures to reduce pressure.

2. Behavioral practices: practices based on changing water use habits.

Recommended engineering practices for residential users are:

- Low-flush toilets
- Toilet displacement devices
- Low-flow showerheads
- Faucet aerators
- Pressure reduction if above 50 psi
- Landscape irrigation
- Xeriscope landscape (see Appendix F)

Behavior practices to conserve water are listed in Appendix F.

F. WATER USAGE RATES

The current declining block rate structure is out-of-date and does not distribute charges equitably among residents, business owners and industry. This usage rate structure should be abandoned in favor of one set rate regardless of amount of water used or an increasing block rate to promote conservation.

APPENDIX A

DRINKING WATER STANDARDS
FOR REGULATED CONTAMINANTS

USEPA Drinking Water Standards for Regulated Contaminants				
	Standards			
Contaminant	Regulation	Status	MCLG+ mg/L	MCL* Mg/L
Organics				
Acrylamide	Phase II	Final	zero	TT
Alachlor	Phase II	Final	zero	0.002
Aldicarb	Phase II	Delayed	0.001	0.003
Aldicarb sulfone	Phase II	Delayed	0.001	0.002
Aldicarb sulfoxide	Phase II	Delayed	0.001	0.004
Atrazine	Phase II	Remanded	0.003	0.003
Benzene	Phase I	Final	zero	0.005
Benzo(a)pyrene	Phase V	Final	zero	0.0002
Bromodichloromethane	D/DBP++	Final	zero	NA
Bromoform	D/DBP	Final	zero	NA
Carbofuran	Phase II	Final	0.04	0.04
Carbon tetrachloride	Phase I	Final	zero	0.005
Chlordane	Phase II	Final	zero	0.002
Chloroform	D/DBP	Final	++	NA
2,4-D	Phase II	Final	0.07	0.07
Dalapon	Phase V	Final	0.2	0.2
Di(2-ethylhexyl) adipate	Phase V	Final	0.4	0.4
Di(2-ethylhexyl) phthalate	Phase V	Final	zero	0.006
Dibromochloromethane	D/DBP	Final	0.06	NA
Dibromochloropropane	Phase II	Final	zero	0.0002
Dichloroacetic acid	D/DBP	Final	zero	NA
p-Dichlorobenzene	Phase I	Final	0.075	0.075
o-Dichlorobenzene	Phase II	Final	0.6	0.6
1,2-Dichloroethane	Phase I	Final	zero	0.005
1,1-Dichloroethylene	Phase I	Final	0.007	0.007
cis-1,2-Dichloroethylene	Phase II	Final	0.07	0.07
trans-1,2-Dichloroethylene	Phase II	Final	0.1	0.1
Dichloromethane (methylene chloride)	Phase V	Final	zero	0.005
1,2-Dichloropropane	Phase II	Final	zero	0.005
Dinoseb	Phase V	Final	0.007	0.007
Diquat	Phase V	Final	0.02	0.02
Endothall	Phase V	Final	0.1	0.1
Endrin	Phase V	Final	0.002	0.002
Epichlorohydrin	Phase II	Final	zero	TT
Ethylbenzene	Phase II	Final	0.7	0.7
Ethylene dibromide	Phase II	Final	zero	0.00005
Glyphosate	Phase V	Final	0.7	0.7
HAA5	D/DBP	Final		0.060
Heptachlor	Phase II	Final	zero	0.0004
Heptachlor epoxide	Phase II	Final	zero	0.0002
Hexachlorobenzene	Phase V	Final	zero	0.001
Hexachlorocyclopentadiene	Phase V	Final	0.05	0.05
Lindane	Phase II	Final	0.0002	0.0002
Methoxychlor	Phase II	Final	0.04	0.04
Monochlorobenzene	Phase II	Final	0.1	0.1
Oxamyl(vydate)	Phase V	Final	0.2	0.2
Pentachlorophenol	Phase II	Final	zero	0.001
Picloram	Phase V	Final	0.5	0.5

USEPA Drinking Water Standards for Regulated Contaminants				
	Standards			
Contaminant	Regulation	Status	MCLG+ mg/L	MCL* Mg/L
Polychlorinated byphenyls	Phase II	Final	zero	0.0005
Simazine	Phase V	Final	0.004	0.004
Styrene	Phase II	Final	0.1	0.1
2,3,7,8-TCDD (dioxin)	Phase V	Final	zero	5×10^{-8}
Tetrachloroethylene	Phase II	Final	zero	0.005
Toluene	Phase II	Final	1	1
Toxaphene	Phase II	Final	zero	0.005
2,4,5-TP (silvex)	Phase II	Final	0.05	0.05
Trichloroacetic acid	D/DBP	Final	0.3	NA
1,2,4-Trichlorobenzene	Phase V	Final	0.07	0.07
1,1,1-Trichloroethane	Phase I	Final	0.2	0.2
1,1,2-Trichloroethane	Phase V	Final	0.003	0.005
Trichloroethylene	Phase I	Final	zero	0.005
Trihalomethanes (sum of 4; TTHMs)++	D/DBP**	Final	NA	0.080
Vinyl chloride	Phase I	Final	zero	0.002
Xylenes (total)	Phase II	Final	10	10
Inorganics				
Antimony	Phase V	Final	0.006	0.006
Arsenic	Arsenic	Final	zero	0.01
Asbestos (fibers/L > 10 µm)	Phase II	Final	7 MFL	7 MFL
Barium	Phase II	Final	2	2
Beryllium	Phase V	Final	0.004	0.004
Bromate	D/DBP	Final	zero	0.010
Cadmium	Phase II	Final	0.005	0.005
Chlorite	D/DBP	Final	0.8	1.0
Chromium (total)	Phase II	Final	0.1	0.1
Copper	LCR	Final	1.3	TT
Cyanide	Phase V	Final	0.2	0.2
Fluoride	Fluoride Rule	Final	4	4
Lead	LCR	Final	zero	TT
Mercury	Phase II	Final	0.002	0.002
Nickel	Phase V	Final	0.1	0.1
Nitrate (as N)	Phase II	Final	10	10
Nitrite (as N)	Phase II	Final	1	1
Nitrate + nitrite (both as N)	Phase II	Final	10	10
Selenium	Phase II	Final	0.05	0.05
Thallium	Phase V	Final	0.0005	0.002
Radionuclides				
Beta-particle and photon emitters	R	Final	zero	4 mrem
Alpha emitters	R	Final	zero	15 pCi/L
Radium-226 + 228	R	Final	zero	5 pCi/L
Radon	Radon	Proposed	zero	300 pCi/L; alternative MCL: 4,000 pCi/L
Uranium	R	Final	zero	30 µg/L

USEPA Drinking Water Standards for Regulated Contaminants				
	Standards			
Contaminant	Regulation	Status	MCLG+ mg/L	MCL* Mg/L
Microorganisms				
Cryptosporidium	ESWTR	Final	zero	TT
Escherichia coli	TCR	Final	zero	TT
Fecal coliforms	TCR	Final	zero	TT
Giardia lamblia	SWTR	Final	zero	TT
Heterotrophic bacteria	SWTR	Final*	NA	TT
Legionella	SWTR	Final*	Zero	TT
Total coliforms	TCR	Final	zero	**
Turbidity	SWTR	Final	NA	PS
Viruses	SWTR	Final*	zero	TT

Abbreviations:

LCR – Lead and copper rule
MCLG - maximum contaminant level goal
MCL - maximum contaminant level
MFL – Million fibers per litre
PS – Performance standard
R – Radionuclides rule
TT - treatment technique
++ - Chloroform MCLG was withdrawn
* - Final for systems using surface water; also being considered for groundwater systems.
** - No more than 5% of the samples per month may be positive. For systems collecting fewer than 40 samples per month, no more than 1 sample per month may be positive.

Source: Federal Drinking Water Regulations Update, Frederick W. Pontius, Journal of AWWA 95:3, March 2003.

APPENDIX B

DRINKING WATER CONTAMINANT CANDIDATE LIST
(DWCCL)

Fact Sheet: The Drinking Water Contaminant Candidate List -- The Source of Priority Contaminants for the Drinking Water Program

EPA has drinking water regulations for more than 90 contaminants. The Safe Drinking Water Act (SDWA) includes a process that we must follow to identify new contaminants which may require regulation in the future. EPA must periodically release a Contaminant Candidate List (CCL). EPA uses this list of unregulated contaminants to prioritize research and data collection efforts to help us to determine whether we should regulate a specific contaminant.

In February 2005, we published the second CCL of 51 contaminants. We also provided an update on our work to improve the CCL process for the future that is based, in part, on recommendations from the National Research Council and the National Drinking Water Advisory Council. In addition to making the process used for selecting contaminants easier to understand, our goals for the future are to:

- evaluate a wider range of information
- screen contaminants more systematically, and
- develop a more comprehensive CCL by expanding the number of contaminants being reviewed for inclusion on the next CCL.

You can find more information on the CCL on EPA's website at **www.epa.gov/safewater/ccl/**

Questions and Answers

What is the drinking water CCL?
The drinking water CCL is the primary source of priority contaminants on which we conduct research and make decisions about whether regulations are needed. The contaminants on the list are known or anticipated to occur in public water systems. However, they are currently unregulated by existing national primary drinking water regulations.

How often is the CCL published?
The Safe Drinking Water Act directs that we periodically publish a CCL. We published the first CCL of 60 contaminants in March 1998 and the second CCL in February 2005 after deciding to continue research on the list of contaminants on the first CCL.

What contaminants are included in CCL 2?
The CCL (published in 2005) carries forward 51 (of the original 60) unregulated contaminants from the first CCL, including nine microbiological contaminants and 42 chemical contaminants or contaminant groups (see table). In July 2003, EPA announced its final determination for a subset of nine contaminants from the first CCL, which concluded that sufficient data and

information was available to make the determination not to regulate Acanthamoeba, aldrin, dieldrin, hexachlorobutadiene, manganese, metribuzin, naphthalene, sodium, and sulfate. These nine contaminants were not carried forward to the 2005 CCL.

Does the CCL impose any requirements on public water systems?
No. The CCL alone does not impose any requirements on public water systems. However, we may regulate contaminants on the list in the future. Public water systems would have to follow specific requirements to comply with a regulation.

What happens to contaminants on the CCL?
We carry out studies to develop analytical methods for detecting the contaminants, determine whether they occur in drinking water, and evaluate treatment technologies to remove them from drinking water. We also investigate potential health effects from the contaminants. These efforts help us to determine if actions such as drinking water guidance, health advisories or regulations need to be developed for contaminants on the CCL, or if no action is necessary at this time.

What is a regulatory determination?
A regulatory determination is a formal decision on whether we should issue a national primary drinking water regulation for a specific contaminant. The law requires that we make regulatory determinations for five or more contaminants from the most recent CCL.

In 2003, we made regulatory determinations for nine contaminants from the first CCL. We plan to propose the second cycle of preliminary regulatory determinations from the second CCL in the summer of 2005 and make final regulatory determinations in August of 2006.

It is important to note that we are not limited to making regulatory determinations for only those contaminants on the CCL. We can also decide to regulate other unregulated contaminants if information becomes available showing that a specific contaminant presents a public health risk.

What criteria do EPA consider to make regulatory determinations?
When making a "determination" to regulate, the law requires that we consider three areas:

- projected adverse health effects from the contaminant,
- the extent of occurrence of the contaminant in drinking water, and
- whether regulation of the contaminant would present a "meaningful opportunity" for reducing risks to health.

What is EPA doing to improve future CCLs?
During development of the first CCL, we received comments that indicated a need for a broader, more comprehensive approach for selecting contaminants. In response, we sought the advice of the National Research Council (NRC) on how we could improve the process for selecting contaminants. The NRC's 2001 report provided us with a framework for how we could evaluate a larger number of contaminants and make decisions about those contaminants by applying innovative technologies and expert advice.

We then asked the National Drinking Water Advisory Council (NDWAC) to advise us on how to address the NRC's recommended classification process. The NDWAC's May 2004 report provided us with a number of recommendations on how the process should be managed and principles that we should use in developing future CCLs. We are reviewing the NDWAC recommendations and are on schedule to meet the February 2008 deadline for the third CCL. You can review the NDWAC report on EPA's web site at www.epa.gov/safewater/ndwac/pdfs/report_ccl_ndwac_07-06-04.pdf .

Where can I find more information about this notice and the CCL?

For information on the CCL and the contaminant selection process, please visit www.epa.gov/safewater/ccl/. For general information on drinking water, please visit the EPA Safewater website at www.epa.gov/safewater or contact the Safe Drinking Water Hotline at 1-800-426-4791. The Safe Drinking Water Hotline is open Monday through Friday, excluding legal holidays, from 9:00 a.m. to 5:00 p.m. Eastern time.

Drinking Water Contaminant Candidate List 2

Microbial Contaminant Candidates
Adenoviruses
Aeromonas hydrophila
Caliciviruses
Coxsackieviruses
Cyanobacteria (blue-green algae), other freshwater algae, and their toxins
Echoviruses
Helicobacter pylori
Microsporidia (Enterocytozoon & Septata)
Mycobacterium avium intracellulare (MAC)

Chemical Contaminant Candidates	CASRN
1,1,2,2-tetrachloroethane	79-34-5
1,2,4-trimethylbenzene	95-63-6
1,1-dichloroethane	75-34-3
1,1-dichloropropene	563-58-6
1,2-diphenylhydrazine	122-66-7
1,3-dichloropropane	142-28-9
1,3-dichloropropene	542-75-6
2,4,6-trichlorophenol	88-06-2
2,2-dichloropropane	594-20-7
2,4-dichlorophenol	120-83-2
2,4-dinitrophenol	51-28-5
2,4-dinitrotoluene	121-14-2
2,6-dinitrotoluene	606-20-2
2-methyl-Phenol (o-cresol)	95-48-7
Acetochlor	34256-82-1

Chemical Contaminant Candidates	CASRN
Alachlor ESA & other acetanilide pesticide degradation products	N/A
Aluminum	7429-90-5
Boron	7440-42-8
Bromobenzene	108-86-1
DCPA mono-acid degradate	887-54-7
DCPA di-acid degradate	2136-79-0
DDE	72-55-9
Diazinon	333-41-5
Disulfoton	298-04-4
Diuron	330-54-1
EPTC (s-ethyl-dipropylthiocarbamate)	759-94-4
Fonofos	944-22-9
p-Isopropyltoluene (p-cymene)	99-87-6
Linuron	330-55-2
Methyl bromide	74-83-9
Methyl-t-butyl ether (MTBE)	1634-04-4
Metolachlor	51218-45-2
Molinate	2212-67-1
Nitrobenzene	98-95-3
Organotins	N/A
Perchlorate	14797-73-0
Prometon	1610-18-0
RDX	121-82-4
Terbacil	5902-51-2
Terbufos	13071-79-9

Chemical Contaminant Candidates	CASRN
Triazines & degradation products of triazines	including, but not limited to Cyanazine 21725-46-2 and atrazine-desethyl 6190-65-4
Vanadium	7440-62-2

APPENDIX C

OUTLINE OF WELLHEAD PROTECTION PLAN

EXECUTIVE SUMMARY

The City of Saint Peter obtains its drinking water from seven wells drawing from three different aquifers. These wells are installed in two areas. One area is located in the southern end of the City at the Jefferson Water Treatment Plant. The other well is located at the Public Works site on St. Julien Street.

In 1991, the City of Saint Peter began work with the Minnesota Department of Health to implement a Wellhead Protection Program. The purpose of the wellhead protection is to prevent contaminants from entering the public water supply wells. Developing and implementing a wellhead protection program for the City of Saint Peter will help ensure a safe drinking water supply for the future and help protect the investment the City and its residents have in the water supply system.

The City of Saint Peter's Wellhead Protection Program involves nine (9) steps. Table ES-1 lists these steps and indicates the status of each.

This report has been prepared in accordance with Minnesota Department of Health guidelines to serve as the Wellhead Protection plan document. This document consists of 13 chapters and is in the process of being updated in 2007/2008.

The discussion that follows summarizes the contents of the report. Note that Chapters 1, 4 and 13 contain data elements for the plan.

Table ES-1
Wellhead Protection Plan
City of Saint Peter, Minnesota

Step	Description	Status
1	Designate a wellhead protection coordinator	The person holding the position of Water Utilities Supervisor for the City of Saint Peter is named the City's wellhead protection coordinator.
2	Delineate Wellhead Protection (WHP) drinking Water Supply Management (DWSMA) areas	Performed by Minnesota Department of Health in 1993.
3	Assess the vulnerability of the public water supply wells and the geologic conditions in the DWSMA.	Performed by the Minnesota Department of Health in 1993.
4	Hold a meeting to notify the public and local governments about the delineations and vulnerability assessments and the intent to develop a WHP plan.	February 1994.
5	Conduct an inventory of potential contaminant sources in the DWSMA.	Performed in 1995. Coordinated by Clean Water Partnership.
6	Prepare a WHP management strategy.	Plan of action developed by committee system in 1996.
7	Submit the draft WHP plan to local governments with jurisdiction within the DWSMA.	September, 1997
8	Hold a public meeting in conjunction with a regular City Council meeting to introduce the proposed WHP plan and obtain City Council approval.	December, 1997
9	Submit the WHP plan to Minnesota Department of Health for approval	December, 1997

Definitions

The following acronyms defined below are used throughout the study.

BMP - Best Management Practice

DNR - Department of Natural Resources

DWSMA - Drinking Water Supply Management Area

GPM - Gallons Per Minute

GPD - Gallons Per Day

MGD - Million Gallons Per Day

ISTS - Individual Sewage Treatment System

MDA - Minnesota Department of Agriculture

MDH - Minnesota Department of Health

MnTAP - Minnesota Technical Assistance Program

MPCA - Minnesota Pollution Control Agency

U of M - University of Minnesota

WHP - Wellhead Protection

WHPA - Wellhead Protection Area

Delineation - Chapter 2

Chapter 2 of the report discusses Wellhead Protection Area (WHPA) and Drinking Water Supply Management Area (DWSMA) delineations. A Wellhead Protection Area is the surface and subsurface area surrounding a public water supply well, through which contaminants are likely to move and reach the well. WHPA boundaries are scientifically calculated. The Drinking Water Supply Management Area is the area to be managed. The DWSMA includes the entire WHPA but has boundaries that are determined using identifiable landmarks. The WHPA and DWSMA delineations were performed for the City of Saint Peter by the Minnesota Department of Health.

The City of Saint Peter is located in east central Nicollet county on the west bank of the Minnesota River. The area can be divided into several geomorphic regimes. Rising up from the flood plain of the Minnesota River are a series of relatively flat terraces. Westward from these terraces, the landscape is dominated by gently undulating till plain. The unconsolidated and bedrock deposits in the Saint Peter area combine to form three major aquifer systems. These include the Jordan aquifer, the Franconia-Ironton-Galesville aquifer, and the Mt. Simon-Hinckley aquifer.

The City of Saint Peter currently draws its water supply from seven wells, including wells #4 through #10. Table ES-2 that follows includes information on each of these wells.

Table ES-2
Wellhead Protection Plan
Water Supply Data
City of Saint Peter, Minnesota

	Well #4	Well #5	Well #6	Well #7	Well #8	Well #9	Well #10
DNR Permit Number	79-4341	79-4341	79-7341	79-4341	79-4341	79-4341	79-4341
Unique Well Number	209911	209910	209906	433254	473638	473639	473640
G.P.M.	450	550	300	500	500	250	500
Well Diameter	16"	16"	12"	24"	12 x 18"	12 x 18"	12 x 18"
Well Casing Diameter	16"	16"	20"	18"	12"	12"	12"
Well Depth	667'	680'	130'	798'	410'	145'	396'
Casing Depth	120'	140'	70'	510'	362'	115'	320'
Year Installed	1951	1957	1972	1987	1991	1991	1991
Water Bearing Formation	Jordan Franconia-Ironton-Galesville Mt. Simom		Jordan	Mt.Simon-Hinckley	Ironton & Galesville	Jordan	Ironton & Galesville

The Minnesota Department of Health used computer modeling techniques to delineate WHPA and DWSMA for each of the three major aquifer systems, including the Jordan aquifer, the Franconia-Ironton-Galesville aquifer, and the Mt. Simon-Hinckley aquifer. Five criteria are used in the delineation process. These include the following:

- Time of Travel
- Flow Boundaries including surface and geological boundaries affecting the flow of ground water.
- Daily Volume of Water Pumped from the aquifer
- Groundwater Flow Field
- Aquifer Transmissivity, considering the ability for water to flow through the aquifer.

Time of Travel criterion is used to represent the time it takes for ground water or a contaminant to flow from a point within a well's zone of contribution to a well. In performing the delineation, the WHP area for the Jordan aquifer considers all areas that will contribute to the City's wells regardless of the time of travel needed to arrive at the well. The delineations for the Franconia-Ironton-Galesville aquifer and the Mt. Simon-Hinckley aquifers consider the areas that could potentially contaminate the wells with a 20 year time of travel from the point of contamination to the well.

Figure ES-1 is a map showing the wellhead protection areas for each of the three major aquifer systems.

Vulnerability Assessments - Chapter 3

Vulnerability assessments for the wells and the drinking water supply management areas for the City of Saint Peter were also performed by the Minnesota Department of Health. These assessments are performed in order to rank the wells and DWSMA in terms of how vulnerable they are to becoming contaminated. The assessment is useful in that it helps in determining wellhead protection measures. Wellhead protection measures must be appropriate for the degree of vulnerability. Ensuring that the wellhead protection measures are appropriate reduces the cost of developing and implementing the plan.

Wellhead Protection Areas - All Aquifers
City of St. Peter

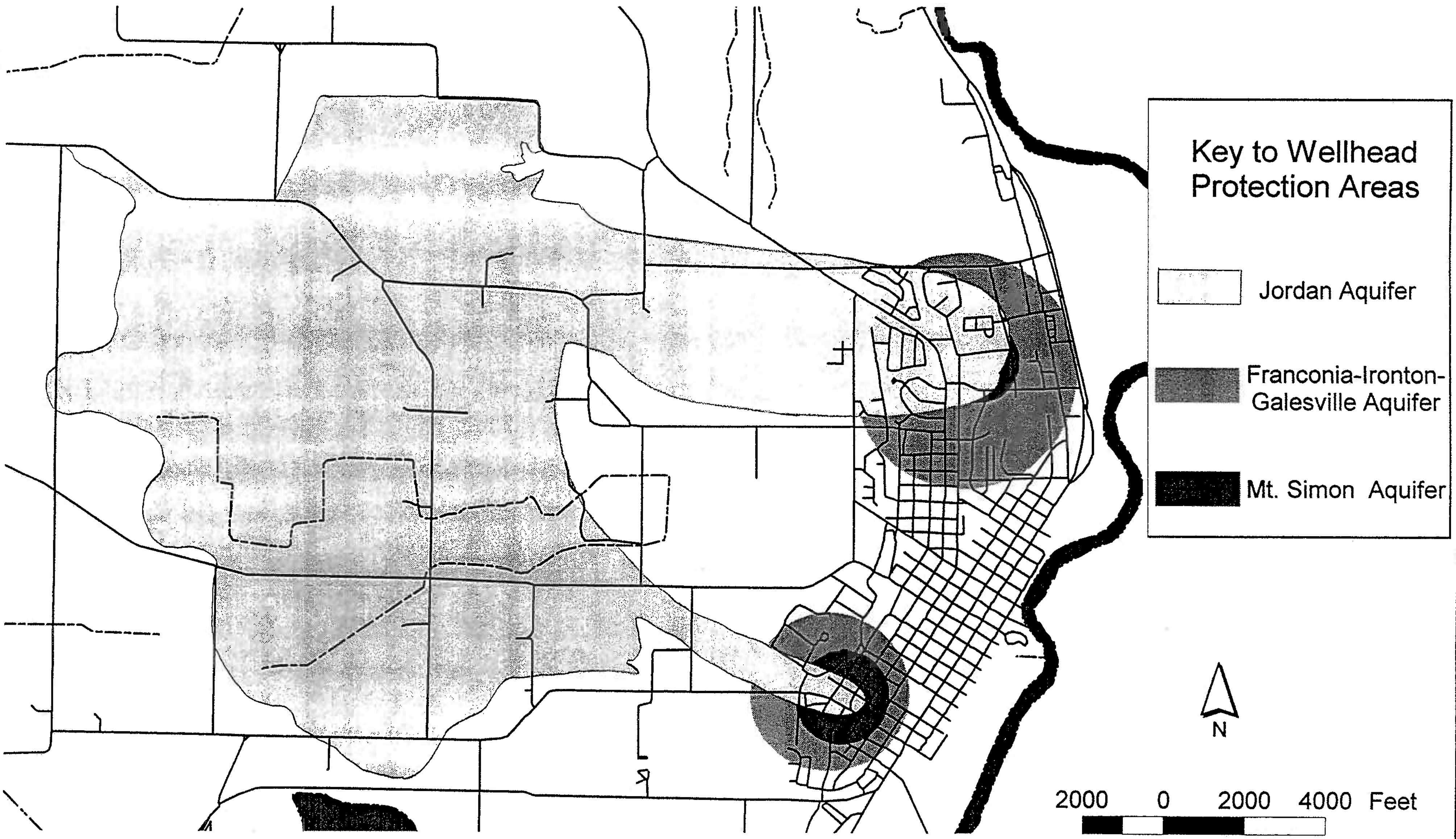


FIGURE ES-1

The vulnerability of water supply wells #4 through #10 was determined by evaluating available information on the 1) geology, 2) well construction, and 3) chemical and isotopic composition of the well water. Likewise, the vulnerability of the DWSMA resulting from the delineation process was determined by evaluating available information on the 1) geology and 2) chemical and isotopic composition of well water from these aquifers.

In summary, the vulnerability assessment of the water supply wells shows the following results.

Well #4, Well #5, Well #6 and Well #9 - Vulnerable

- Jordan aquifer at this location has a high geologic sensitivity rating
- The age of the water indicates that it is relatively susceptible to contamination from activities at the land surface.
- Nitrate-nitrogen has been detected in Wells #6 and #9 at levels close to drinking water standards of 10 parts per million.

Well #7, Well #8, and Well #10 - Not Vulnerable

- The Mt. Simon-Hinckley and Ironton-Galesville aquifers in the subject area has a "very low" sensitivity rating.
- Wells are properly constructed.
- Ancient groundwater from Mt. Simon-Hinckley is considered relatively insusceptible to contamination from activities at the land surface.

Results of the vulnerability assessment of the DWSMA are shown in Figure 3.8. Note that the east side of the management area is considered to have a very high vulnerability, the middle area is considered to have moderate vulnerability, and the west side of the management area is considered to have a low vulnerability. This is a result of the geological features of this area. The west side of the DWSMA consists of a till plain where more than 100 feet of clay-rich till provides a protective cover, making for an area with very low geologic sensitivity. The area in the center of the DWSMA is a sand prairie with low geological sensitivity. The remainder of the land on the east side to the Minnesota River is characterized by terraces, which have a high geologic sensitivity, and therefore, very high vulnerability.

DWSMA Vulnerability Summary

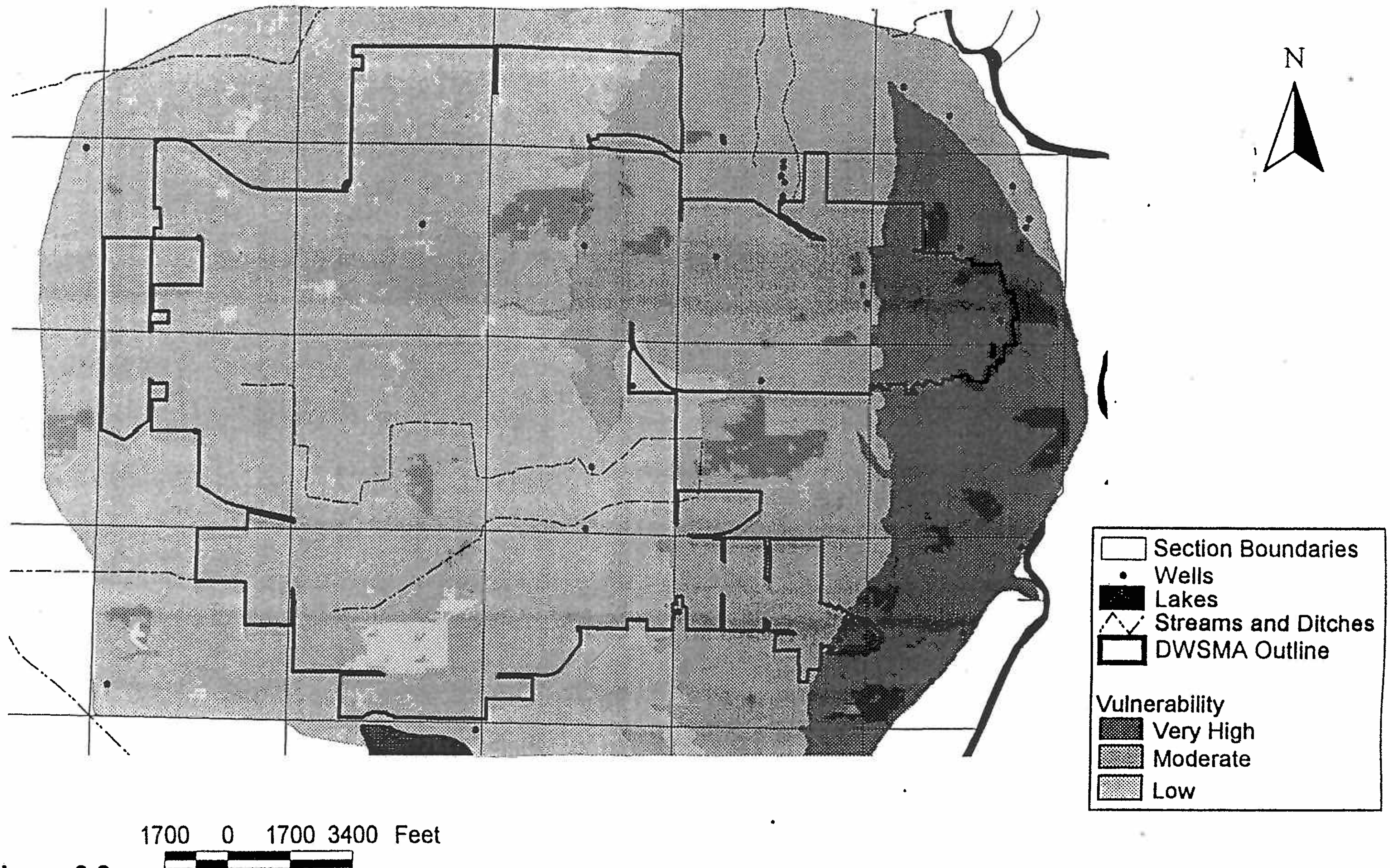


Figure 3.8

Contaminant Source Inventory and Source Management Plan - Chapter 5

The contaminant source inventory process is a means to identify potential contaminant sources which may impact the public water supply. Source management is a process in which the City develops strategies for managing potential contaminant sources identified through the source inventory. The City of Saint Peter worked closely with the Brown-Nicollet-Cottonwood Clean Water Partnership to prepare the contaminant source inventory and in developing source management strategies.

Preparing a contaminant source inventory involved making contacts with the Minnesota Pollution Control Agency, the Department of Agriculture, and the local fire department. A "Potential Contaminant Source Data Collection Form" was completed for each parcel of land in the DWSMA. Information gathered on the Potential Contaminant Source Data Collection Forms for each parcel was entered into a computer data base and compiled to obtain a summary of the various types of contaminant sources in the wellhead protection area. The survey identified 95 sites that are active agricultural crop lands. It also identified a fairly large number of sites that contain bulk storage or material stockpiling of items such as fertilizers, salt, treated wood, volatile organic chemicals, and unidentified drums. Maps were developed showing the locations of various contamination sources within the drinking water supply management area.

A Source Management Plan identifies how potential contaminant sources can be controlled and monitored. The first step in the source management process was to develop a number of committees who would be responsible for developing the management strategies. These committees included a main committee, and four subcommittees, including water supply/wastewater, ag land use, industrial/commercial, and urban sources. Committee members include representatives from the City of Saint Peter, the Chamber of Commerce, Nicollet County staff and commissioners, Traverse and Oshawa Township board members, local farmers and industries, the Minnesota Department of Health, Brown-Nicollet-Cottonwood Clean Water Partnership, the Soil and Water Conservation District, and Gustavus Adolphus College.

Expected Changes to the Environment and Land Use - Chapter 6

In general, substantial growth and development are projected for the City of Saint Peter. The economic base of the Saint Peter area has shown considerable growth during the past ten years. It is anticipated that this economic growth will equal if not exceed that of the previous ten years. The two major employers in the area are the Saint Peter Regional Treatment Center/Security Hospital and Gustavus Adolphus College. These two institutions will continue to be major employers in the Saint Peter area and offer a solid core of employment opportunities within the community.

Most of the land within the city limits of Saint Peter has been developed except for scattered lots available for improvements. Therefore, the City is anticipating development outside of its current City limits. With the Minnesota River on the city's east, and the Regional Treatment Center and Gustavus Adolphus College on the south and southwest, future development in the City of Saint Peter is expected to the west and north.

The 1995 West Side Comprehensive Plan proposed storm drainage system improvements to accommodate growth west of the existing Saint Peter city limits. Minor system improvements consist of the storm sewer system, designed to handle a 5 year storm event. A major overland system is planned for the 100 year storm, to come into operation once the capacity of the minor system has been exceeded. The proposed major system includes drainageways and detention ponds west of Saint Peter. The Minnesota Pollution Control Agency has cited that one of the most effective best management practices for the removal of sediment and pollutants is a detention pond. A detention pond which may be necessary due to hydraulic restrictions also provides the added benefit of improving surface water quality.

Expected Changes to Surface and Groundwater - Chapter 7

As a result of the substantial growth expected for Saint Peter, demands on the city's water system will also increase. The City of Saint Peter currently draws its drinking water from seven wells, Well #4 through Well #10. The City plans to phase out Wells #4 and #5 along with the Jefferson Treatment Plant within the next five to ten years. The 1995 West Side Comprehensive Plan recommends that the City drill a 300 to 400 gpm well in the near future at the Public Works building site to accommodate growth. It is recommended that an additional 1500 gpm well or wells should be planned for the future to accommodate growth and the loss of wells #4 and #5.

The predominant land use in Saint Peter is single-family residential. New development is also expected to be primarily single-family residential. Major changes in the type of land use are not anticipated.

Discharge from the City's wastewater treatment facility also has an impact on surface water. The City of Saint Peter's existing wastewater treatment facility consists of a stabilization pond system with controlled discharge to Paul's Creek followed by the Minnesota River. The existing treatment facility is located in a flood plain, and has had problems with flood waters. In addition, the hydraulic capacity of the facility has been exceeded in recent years. Although the discharge limits have not been exceeded in recent years, it will become difficult to meet the anticipated future stringent discharge limits that will be placed on discharges into Paul's Creek.

In March of 1996, Bolton & Menk, Inc. prepared a Wastewater Treatment Facility Plan for the City of Saint Peter. The Study recommends the continued utilization of the existing stabilization pond system and the construction of a new mechanical wastewater treatment facility near the existing public works building. The long range plan recommends expansion of the new mechanical wastewater treatment facility and abandoning the existing stabilization pond system in ten to twenty years.

Problems and Opportunities - Chapter 8

As with all public water systems, the City of Saint Peter faces a number of problems and opportunities that are discussed in the plan. These are summarized below:

Problems:

- Water from Well #7 must be blended to make the concentration of chlorides and sulfates in the blended water acceptable to the public, and to avoid exceeding the maximum contaminant level for gross alpha. The full capacity of this well is not being utilized.
- New shallow wells would require special treatment for the removal of the high concentration of nitrates in the water. Wells #6 and #9 have high nitrate concentrations, and are blended to ensure that limits are not exceeded.
- Jefferson Street treatment facility is approaching its useful life expectancy and may be phased out along with its associated Wells #4 and #5 within the next five to ten years.

Opportunities

- Treated water suplied to the citizens is in compliance with the primary and secondary drinking water regulations.
- The city's wells have the capability to draw water out of three different aquifers.
- The city uses a SCADA system to automatically monitor and control their entire water system.
- Saint Peter has an excellent working relationship with Nicollet and LeSueur Counties. Working together, they can ensure that development is in the best interest of all involved.
- As residential areas develop in the wellhead protection area, the input of nitrogen into the groundwater due to agricultural practices is reduced.

Wellhead Protection Goals - Chapter 9

Developing and implementing a Wellhead Protection program for the City of Saint Peter will help

- ensure a safe drinking water supply for the future
- protect the investment that the City has in its water supply system
- Comply with the limits set by the Safe Drinking Water Act

Objectives of the Plan and Plan of Action - Chapter 10

The source management process discussed earlier has resulted in a wellhead protection plan of action. The plan of action consists of 44 action steps that were developed by the committee system. These action steps are organized as an action plan for completion. Tables 10.1, 10.2, 10.3, and 10.4 that follow describe each of the action steps.

Evaluation Program - Chapter 11

The City will evaluate the progress of the wellhead protection plan of action annually. The Wellhead Protection Coordinator will complete an annual progress report prior to May 1 of each year.

Contingency Strategy - Chapter 12

A Water Emergency and Conservation Plan for the City of Saint Peter was approved by the Minnesota Department of Natural Resources in February of 1997. The plan discussed preparing and planning for a water emergency, and current and proposed water conservation programs.

Table 10.1
Wellhead Protection Plan
Immediate Objectives
City of Saint Peter, Minnesota

Action Step	Management Strategy	Source of Action	Cost to City
Industrial/Commercial			
IC #2	Display signs on the outer limits of the DWSMA notifying residents to take precaution in handling and transportation of hazardous chemicals. Supply a phone # for notification of emergency and for informational purposes.	City	$500
Urban Sources			
US #7	Work with MnTAP to complete an environmental audit of Public Works and other businesses in the DWSMA.	City, MNTAP	$1,000
Municipal Wells			
MW #2	Explore options to eliminate the use of multi-aquifer wells located at Jefferson filter plant.	City	$1,500

Table 10.2
Wellhead Protection Plan
Immediate and On-Going Objectives
City of Saint Peter, Minnesota

Action Step	Management Strategy	Source of Action	Cost to City
Agricultural			
AL #1	Evaluate research available from the U of M data on current nitrogen management.	City, Nicollet County Extension, MDA (Agronomy Consultants), Clean Water Partnership	$500
AL #3	Participate with County Extension on newsletter mailing or additional information in their newsletter.	City, Nicollet County	$250
Industrial/Commercial			
IC #1	In conjunction with the County emergency preparedness plan, establish a communication link with the City preparedness plan should a large chemical spill occur in the DWSMA that the City of Saint Peter is notified and has input regarding cleanup measures and actions.	City, Nicollet County	$250
IC #5	Establish a mailing list of the DWSMA which can be used for special mailings regardless of which area it falls under.	City, Nicollet County	$500
IS #6	Notify local industry when and where hazardous waste is available to be disposed of. Work with Tri-county to assist industry with hazardous waste disposal	City, Nicollet County	$500
Urban Sources			
US #1	Develop a newsletter for landowners and occupants in the DWSMA and provide information on best management practice (BMP's). Explore mailings with other government agencies.	City, Nicollet County, Clean Water Partnership	$1,000
Private Wells			
PW #1	Provide educational opportunities to private well owners and users concerning adequate maintenance and operation of a private well every 3 years. (Coordinate with ISTS presentation).	City, Nicollet County MDH, Clean Water Partnership	$200 each meeting
Municipal Wells			
MW #1	When given the opportunity to record a video of the well casing. Evaluate any possible cross contamination between aquifers.	City	$2,000 each well

Action Step	Management Strategy	Source of Action	Cost to City
MW #3	Maintain permanent records on well drawdowns, well pumping capacities, filter plant history.	City, MDH	$1,000 annually
MW #4	Develop and maintain an ongoing well maintenance program which demonstrates adequate and proper municipal well management strategies.	City, MDH	$1,000 annually
Individual Sewage Treatment Systems			
ISTS #2	Coordinate delivery of educational programs on ISTS for wellhead protection to area residents. Use existing local government delivery systems for educational programs in the wellhead protection area, including providing information packets at township events, personal visits and mailing to residents inside the DWSMA area.	Clean Water Partnership, Nicollet County Env. Serv., City, Townships	$200 annually
ISTS #3	Coordinate educational and informational meeting for ISTS owners in the DWSMA area every 3 years. Meeting will provide current information on new methods and laws pertaining to ISTS.	City, MPCA, MDH, Nicollet County	$100 each meeting
ISTS #4	Work with the County to ensure list of certified ISTS site evaluators, designers and installers are available to residents in the wellhead area.	Nicollet County	$100 annually
Utility Extension			
UE #1	Evaluate the possibility of extending water and sewer services outside the current city limits that are within the DWSMA.	City, Nicollet County	$500
UE #2	When Utilities are extended in the WHP evaluate if the City should assist in sealing private wells and ISTS.	City, Nicollet County	$2,000
UE #3	When new developments are being planned, evaluate future detention basin locations that may fall within the WHP, for impacts on aquifer recharge and the potential for contamination.	City, Nicollet County, MPCA	$1,000 per development
UE #4	Within the inner zone (200') of each well identify and closely monitor the source contaminants available for future impact.	City, Nicollet County	$500 annually

Table 10.3
Wellhead Protection Plan
Annual Objectives
City of St. Peter, Minnesota

Action Step	Management Strategy	Source of Action	Cost to City
Agricultural			
AL #2	Evaluate historical manure application recordings with Nicollet County Environmental Services.	Nicollet County Env.	$100
AL #4	Hold an annual public meeting with people in the wellhead protection area to update them on information and progress.	City, Nicollet County	$1,000
AL #7	Facilitate a city/county public gathering to bring the awareness of WHP to head using MDA, MDH and MPCA.	City, Nicollet County, MDA, MDH, MPCA	$500
Urban Sources			
US #2	Host an open house at Public Works, show water plant operations, proper disposal of hazardous waste, salt shed storage, and proper vehicle washing operations. Set up displays at Community gatherings (fair, home shows) relating to wellhead protection concerns and educational materials.	City, Nicollet County, Clean Water Partnership	$1,000
US #3	Explore options available to collect hazardous waste from businesses and residents in the DWSMA. Collection should be more convenient.	City, Tri-County Solid Waste	$500
US #5	Complete inventory of known hazardous waste producers who generate and store chemicals within the DWSMA. Work with cooperating state and county agencies to inventory known sources. Work with Fire Department and Industrial Pretreatment to gather all information available (update PCFS software for tracking). (bi-annual)	City	$2,000
US #6	Complete an annual review of City Ordinances for proper disposal of hazardous waste. (Procedure of enforcement).	City	$500
US #9	Provide literature at the Finance Department for new utility customers in Saint Peter. Literature should provide information on Public Works operations, be descriptive of "wellhead protection", this literature would also be available to fertilizer distributors and businesses in the DWSMA.	City	$1,000

Action Step	Management Strategy	Source of Action	Cost to City
Individual Sewage Treatment Systems			
ISTS #1	Inventory existing educational resources related to individual sewage treatment systems in the Saint Peter area to determine types of resources available and additional resources needed. Keep inventory up to date.	Clean Water Partnership Nicollet County Env. Serv.	$200 annually

Table 10.4
Wellhead Protection Plan
5 Year Objectives
City of Saint Peter, Minnesota

Action Step	Management Strategy	Source of Action	Cost to City
Agricultural			
AL #5	Review with coordinating agencies what services, education, and information is available once every 5 years.	City	$500
AL #6	Explore incentives to farmers in WHP	City	$500
AL #8	Assessment of nitrogen management, manure, pesticides once every 5 years.	MDA - Nicollet County Extension	$1,000
AL #9	Evaluate manure application, management plan for farmers every 5 years.	MDA	$500
AL #10	Evaluate overlay zone options every 5 years.	Nicollet County Planning and Zoning	$500
Industrial/Commercial			
IC #3	In conjunction with Fire Department inventory and the wastewater industrial pretreatment program evaluate what processes will be implemented during an industrial hazardous waste spill. Develop a contingency plan with Fire Department which states when the Utility should be notified, discuss responsibilities and sources of correction.	City	$1,000
IC #4	Supply a list of best management practices (BMP's) for business located within the DWSMA. Mn TAP can be possible source on information and can supply an audit for businesses.	City, MnTAP, MPCA	$500
Urban Sources			
US #4	Work with local well driller and a resident in the wellhead protection area and prepare a demonstration of the proper way to seal a well. Invite the media, city council and concerned citizens within the DWSMA area. Do this about once every 3 years.	City	$200

Action Step	Management Strategy	Source of Action	Cost to City
US #8	Identify location of injection wells, identify properties and characteristics of injection wells and prioritize a list for possible sealing.	City, Nicollet County	$1,000
US #10	Promote Saint Peter urban lawn care BMP's using city parks as a demonstration	City, Septeman Well Drilling, Clean Water Partnership	$2,000
Private Wells			
PW #2	Conduct on-site visits with township officers to evaluate WHP measures. Meet with township officers in Oshawa and Traverse townships to discuss items to be included in a WHP mailing (once every 5 years)	City, Counties, Townships	$300 each meeting
PW #3	Explore Ordinance changes which would prohibit private wells inside City limits.	City	$1,000
PW #4	Explore the possibility of creating a budget line item to assist with the sealing of private wells within the City of Saint Peter and the WHP area.	City	$1,500
Individual Sewage Treatment Systems			
ISTS #5	Develop and formalize a policy to allow free disposal of septage from ISTS's in the wellhead protection area at the City's wastewater treatment facility.	City	$200
ISTS #6	Evaluate the current City ordinance relating to ISTS. Determine if changes are needed. Revise ordinance, if needed.	City, MPCA	$500

APPENDIX D

PRELIMINARY ENGINEERING REPORT, PROPOSED ELEVATED STORAGE TANK, NORTHWEST GROWTH AREA (MARCH 2004)

Preliminary Engineering Report

Proposed Elevated Storage Tank

Northwest Growth Area

in

Saint Peter, Minnesota

BMI Project No. M14.34288

March 2004

BOLTON & MENK, INC.
Consulting Engineers & Surveyors

Preliminary Engineering Report

Proposed Elevated Storage Tank

Northwest Growth Area

in

Saint Peter, Minnesota

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

By: Jeffrey A. Domras

Jeffrey A. Domras, P.E.

License No. 26464

Date: 3/30/2004

TABLE OF CONTENTS

APPENDIX

I. EXECUTIVE SUMMARY

This report identifies water storage needs for future growth in the northwest area of the City of Saint Peter. After considering the sites, it is recommended that the City construct a 147' tall, 500,000-gallon, hydro-pillar tower. The tower is anticipated to meet the City's future Upper Distribution System needs until the year 2023 for the following future service areas:

- 120 North Industrial Park
- 1300 acres of future development

The City's 1997 Water Master Plan recommended the construction of a 400,000-gallon tank in the year 2040 to provide added benefits such as increased water pressure and available fire flows. However, this report did not account for the accelerated growth in Saint Peter.

Two tower locations and sizes were evaluated. They are:

- North Industrial Park
- County Road 15 & 51 Intersection
- 500,000 Gallon
- 750,000 Gallon

The North Industrial Park Site is recommended for the following reasons:

- Elevation is within ten feet of the Broadway Tower Site
- Equal distance from the Greenhill Reservoir water source (no altitude valve needed)
- Watermain is currently stubbed to the site making for an easy connection
- City currently owns the property
- Storm sewer is currently stubbed to the site

The 500,000-gallon tower is recommended for the following reasons:

- Provides the necessary storage for future development. Calculations assume 4.3 persons per acre and 135 gallon/day/person.
- A 500,000-gallon tower reduces the risk of water freezing due to a more rapid turn over of water when compared to a 750,000-gallon tower.
- Least expensive, $1,279,700.

There are several options to consider when constructing a tower:

- Styles most common are the hydro-pillar and spheroid
- Heated valve room or vault
- Type of material for roof hatch
- Tower coating method
- Logo
- Wiring Ladder

It is anticipated that construction of the tower will take a minimum of two years, (due to today's market conditions for prefabrication and erection). The City's **current** usage and fire demand requires an additional 80,000 gallons of storage. This adds a "sense of urgency" for the City to pursue preliminary design now if an additional tower is expected to be in-place and operational within the next few years.

II. INTRODUCTION

A. PURPOSE AND SCOPE

The City of Saint Peter's current growth, expanding infrastructure and completion of the new North Industrial Park Subdivision in 2003, requires the City to investigate the best location for a new water tower site. This report will review the need for an elevated storage tank, estimate its size, analyze the benefits of constructing a new tank in two selected locations, estimate costs and recommend a course of action.

III. EXISTING STORAGE AND DISTRIBUTION SYSTEM

A. ELEVATED STORAGE

The City's water distribution system consists of two pressure zones, known as the upper and lower systems. This report is limited to the upper system.

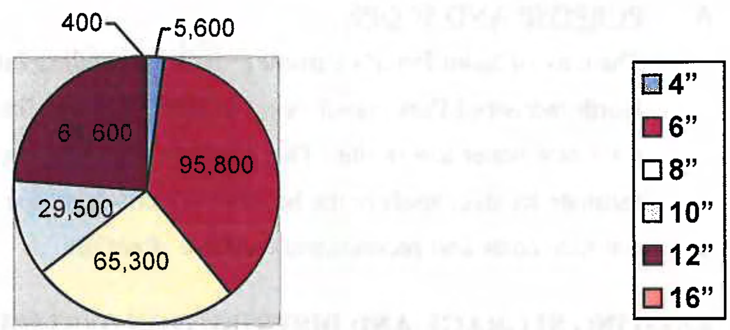
Currently, the upper system is served by a 500,000 gallon elevated storage tank, known as the Broadway Tower. The tank has an operating range of 34 feet between the elevations of 1,011 and 1,045 feet above sea level.

The upper system is supplied water from three pumps at the Greenhill Reservoir. The pumps have a discharge rate of 700, 1350 and 800 GPM at their designed operating points. The Greenhill Reservoir is capable of storing 2 million gallons of fresh water and serves two primary purposes:

1. Provides storage and pressure for the lower distribution system and,
2. Provides intermediate storage for the upper system.

B. DISTRIBUTION SYSTEM

The existing water distribution system consists of over 258,000 feet of watermain between the upper and lower systems. The following chart represents the corresponding length and diameter of watermain in both systems. The current city standard watermain diameter is 8".



A map of the existing distribution system in the study area is shown on Figure 1 of the Appendix.

IV. PROPOSED ELEVATED STORAGE AND DISTRIBUTION SYSTEM IMPROVEMENTS

A. NEED

Factors contributing to the need for elevated storage are demand, pressure and fire flow.

i. Demand

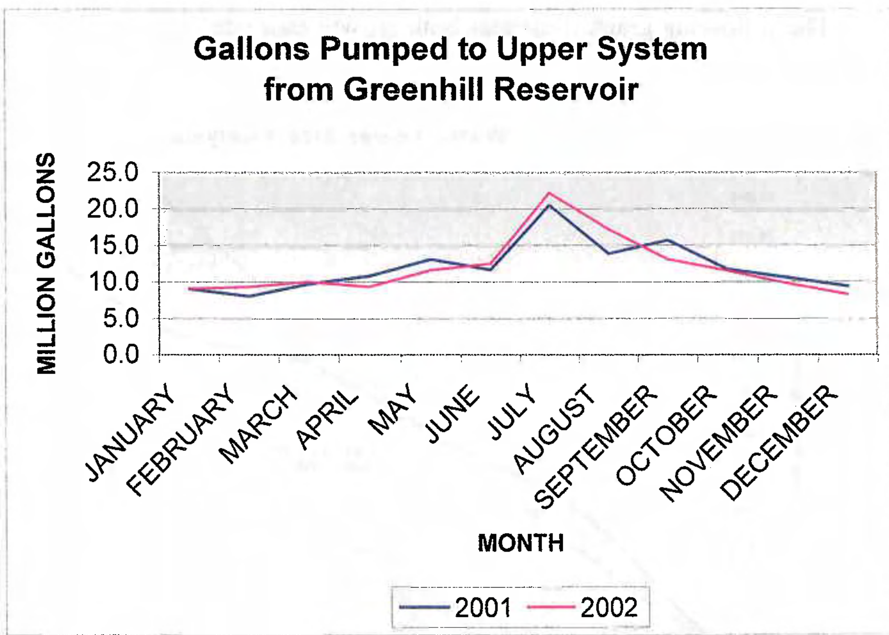
The purpose of storage is to provide the ability to equalize pumping rates during periods of variable demand. Storage permits a reduction in the size of pumps required to supply the City because peak demands are diminished by storage reserves. The principal reasons for providing storage are as follows:

- To provide water during high demands
- To provide water during pump shutdown periods, pump failure or power outage
- To equalize pressure in the distribution system
- Fire protection

Sizing a storage tank to meet the City's future demands requires review of future land use, anticipated service area and current water usage. This report concentrates on the northwest growth area of the City. This area consists of approximately 120 acres of light industrial (North Industrial Park) and potentially hundreds of acres of future development. The Future Land Use and Anticipated Service Area is shown on Figure 2 of the Appendix.[1]. The map shows the estimated service area for a 500,000 gallon tower along with that of a 750,000 gallon tower. It is important to note, service areas are shown for comparison purposes only. Given the location of future development will likely vary from that shown, either tower site will enhance pressure and fire flow to the development area. The North Industrial Park site also provides the additional benefit of being adjacent to potentially large volume users.

The anticipated total service area of 1420 acres for a 500,000 gallon tower represents approximately 66% of the City of Saint Peter's comprehensive growth limits bordered by Robards Creek to the north and the bluff to the west. A 750,000 gallon tank is estimated to serve approximately 1970 acres, or 100% of the comprehensive growth limits.

During the years 2001 and 2002, approximately 144 million gallons of water was pumped each year from the Greenhill Reservoir to the upper distribution system. The following graph illustrates the volume of water pumped each month.[2]



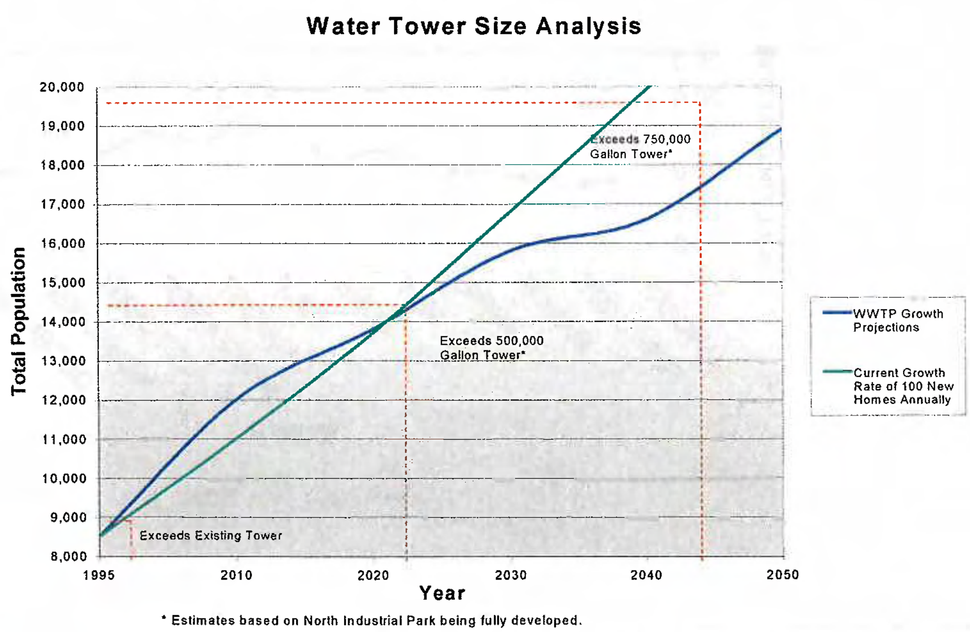
[1] City of Saint Peter Water Master Plan, Bolton & Menk, Inc., 1997
[2] City of Saint Peter Water Utility

Plans to connect the Regional Treatment Center (RTC) to the upper distribution system are being prepared. Currently, the RTC is being supplied by the lower system, but due to pressure problems, it will be supplied by the upper system in 2004. Once connected, the RTC's current demand of approximately 100,000 gallons per day would shift from the lower to the upper system.

With the past and present water use established, the present need for additional elevated water storage can be determined. An average demand of 750 gal/day/acre for North Industrial Park and 580 gal/day/acre (based on 135 gallons/person/day and 4.3 persons/acre) for the remaining service area was used as a basis to establish the service area.

Two approaches were used to estimate how quickly City growth impacted the said service area. The first is the growth rate estimate from the design of the new Wastewater Treatment Plant[3]. This rate is based on historical data and modeled by estimating future growth from past growth.

The second approach is linear and represents 100 new residential units constructed each year. The following graph illustrates both growth estimates:



[3] Wastewater Treatment Facility Plan, March, 1996

The following spreadsheet reflects the calculations used to estimate the volume of elevated storage needed for the anticipated service area. It is important to note that the firm supply available from storage assumes the largest pump is out of service and a fire demand of 3,000 gpm is needed for three consecutive hours.

Daily Usage:

	<------ 90 % of all values	<---- 67 % of all values		---->	------>	Max Day
	-2std dev	1std dev	avg	+1std dev	+2std dev	
	gpd	gpd	gpd	gpd	gpd	gpd
	1,113,886	1,228,905	1,343,924	1,458,943	1,573,961	682,867

Water Tower Sizing:

Assumes Major Structures Are NOT Sprinkled

Average Daily Demand		933 gpm	(existing upper system demand and future developed areas, 120 acres N. Industrial Park & 1300 acre service area, gal / 24 / 60)
Max Hourly Demand		3,266 gpm	(avg daily demand * 3.5)
Present Max Daily Demand		474 gpm	(historic max gal / 24 / 60)
Calculation:			
Fire Demand		3,000 gpm	(assumes future industrial building is NOT sprinkled - could require 3,500 or 4,000)
Max Hourly Demand	+	3,266 gpm	
Peak Usage Rate		6,266 gpm	
Firm Supply Available	-	1,500 gpm	(assumes largest well is out of service)
Withdraw from Storage		4,766 gpm	
Fire Demand Duration		3 hrs	(assumes future industrial building is NOT sprinkled)
Removal from Storage During Fire Occurance		857,967 gal	(withdrawl * duration * 60 min/hr)
Equalizing Storage	+	136,573 gal	(20% max daily demand)
Total Storage Demand		994,540 gal	
Current Storage Avail.	-	500,000 gal	Tower at Broadway
ADDED STORAGE REQ'D		**494,540 GAL**	Use a 500,000 Tower

The calculations indicate a new 500,000-gallon elevated storage tank would be necessary to adequately supply the upper system demand within the proposed development areas. At the estimated growth rate shown on the previous figure, it is estimated a 500,000 gallon tower would adequately meet the demand until the year 2023. By comparison, a 750,000 gallon tower meets the estimated demands until year 2046 Both estimates are based on the North Industrial Park, and the respective service areas for each, being entirely developed.

ii. Pressure

The existing Broadway Avenue Tower is calculated to provide between 38 and 76 psi of static pressure throughout the upper distribution system at its lowest operating elevation of 1,011 feet. When the tank's water level reaches its maximum elevation of 1,045 feet, the upper system static pressure is estimated to vary between 52 and 90 psi. System pressure will decrease as demand increases. The resulting system pressure is defined as a residual pressure. Distribution systems are typically designed to maintain a normal working residual pressure of 60 to 80 psi with a minimum working residual pressure of 35 psi.[4]

iii. Fire Flows

The Insurance Services Office (ISO) Commercial Risk Services maintains a database of Needed Fire Flows (NFF) throughout the City of Saint Peter. NFF values are based on the types of buildings and their use. Usually, multiple story buildings require more fire protection than single story buildings. Also, gathering locations such as schools, churches and auditoriums demand more fire protection than a residential neighborhood. Commercial and industrial sites also require increased fire flow protection, as do hospitals and nursing homes.

After comparing the ISO reports for the NFF in future growth areas, it was determined that a flow of 2,500 gpm was generally required. To be conservative, a demand of 3,000 gpm of NFF was modeled. It should be noted that the ISO recommends 4,500 gpm for Gustavus Adolphus College (GAC). Although GAC is served from the upper system, it is physically located south of either of the new tower sites being considered. GAC experiences only minimal fire flow improvements (20-70 gpm) from either tower site.

[4] Recommended Standards for Water Works, 1997 Ed.

The "Water CAD" Hydraulic Network Model by Haestad Methods was utilized to calculate the available fire flow in the distribution system. The model determines the volume of water available during a fire flow condition at any point in the current and future distribution systems. Figure 3 represents the available fire flows within the existing system for the study area. That is, the Broadway Avenue Tower serving the upper distribution system and the Greenhill Reservoir serving the lower distribution system.

To enhance fire flow and pressure in the outer regions of a service area, a few options are available. They include constructing large diameter watermain in the service area, watermain looping, a pressure pump and/or new elevated storage tank. A new-elevated storage tank provides the hydraulic head necessary to pressurize the system along with the needed storage for both daily and fire flow conditions.

With the present and future proposed watermain-looping improvements, there is negligible difference in the available upper system fire flow when comparing potential water tower sites. Figure 4 reflects the available fire flows if an additional tower is constructed. A detailed description, including the advantages and disadvantages of each site follows.

B. ALTERNATIVES

The most feasible location for an elevated storage tank depends on a number of criteria such as the relative elevation of the new site to the Broadway Tower, availability of land and distance from existing infrastructure. Based on these criteria, two locations for an elevated storage tanks were ultimately considered. They are:

- Lot 1, Block 3 of the North Industrial Park Subdivision in the northwest corner of the City
- Intersection of County Roads 15 & 51 to the west of the City.

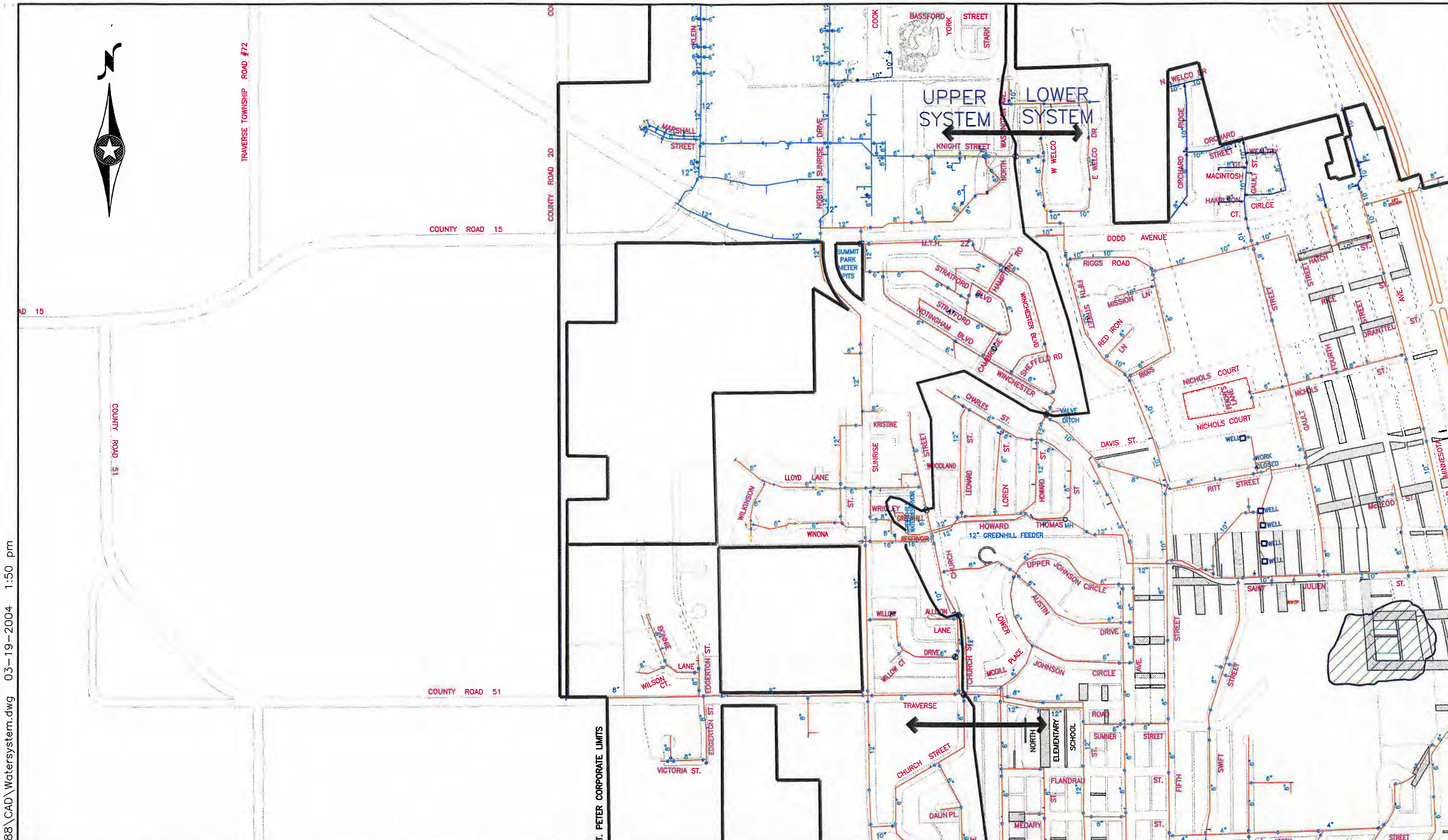
i. Alternative 1-North Industrial Park

1. Location

The proposed North Industrial Park tower site is located on Lot 1, Block 3 along the east side of North Sunrise Drive. The elevation of the site is approximately 902 feet. This site is desirable with respect to elevation as it is approximately 11 feet lower than the existing ground at the Broadway

Tower site. This site's operating range would be similar to the Broadway Tower site and include a HWL of 1045 feet to service the upper system. This site is also desirable because of its distance from the Greenhill Reservoir. The Broadway Tower site is approximately 4,900 feet (pipe length) away from the Greenhill Reservoir while the proposed North Industrial Park tower site is approximately 5,200 feet (pipe length). Systems with more than one tower in the same zone require the distance from the water source (Greenhill Reservoir) to the towers be no more than 10% different. Towers whose distances differ by more than 10% will typically require an altitude valve for producing an artificial restriction at the tower closest to the pump supply. If one tower reaches its maximum operating elevation prior to the other, the excess water would be discharged to the overflow. An altitude valve produces an artificial restriction and causes the pumps to uniformly, but more slowly, fill both towers. This means the pumps work harder, by pumping longer, to fill the towers. Altitude valves are also high cost (approximately $15,000) and require high maintenance. When comparing pipe lengths from the Greenhill Reservoir, the North Industrial Park Tower site is within 6%. Therefore, an altitude valve will not be necessary.

Three different pumping scenarios were considered for filling both the proposed North Industrial Park Tower site and the Broadway Avenue Tower. They include separately filling the towers with each of the Greenhill Reservoir pumps. The pumps have a capacity of 700, 1,350 and 800 GPM. Below is a summary of the respective tower filling rates. Since the Broadway Tower fills multiple times throughout a 24-hour period, an average demand of 2.4 gpm was assigned to all watermain junctions for the purpose of this model.



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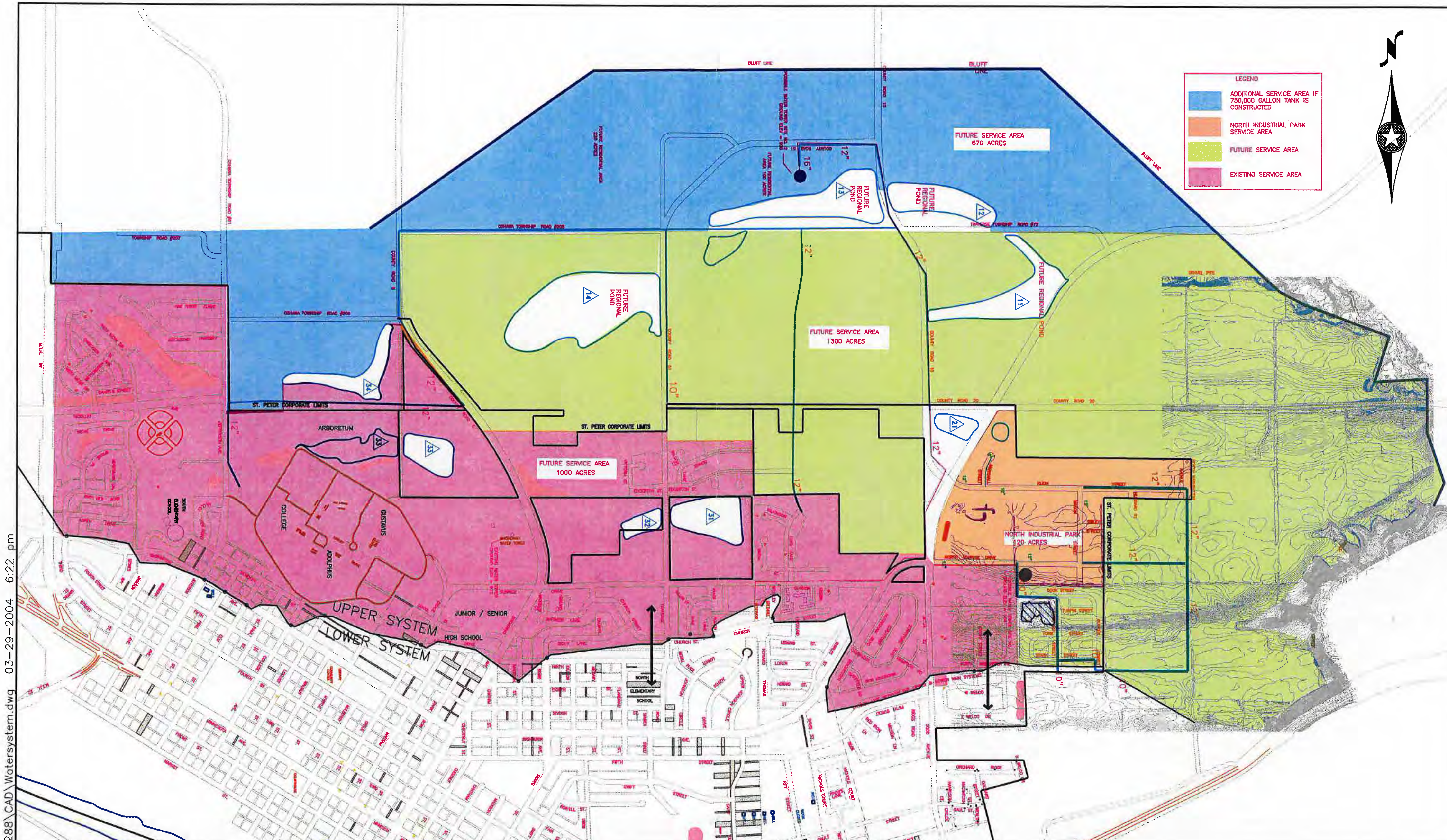
SCALE FEET

BOLTON & MENK, INC
CONSULTING ENGINEERS & SURVEYORS
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN WILLMAR, MN
BURNSVILLE, MN CHASKA, MN AMES, IA LIBERTY, MO

CITY OF SAINT PETER
EXISTING
WATER DISTRIBUTION SYSTEM

MARCH, 2004

FIGURE NO. 1



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CITY OF SAINT PETER ZONING PLAN FUTURE SERVICE AREA

MARCH, 2004

FIGURE NO. 2

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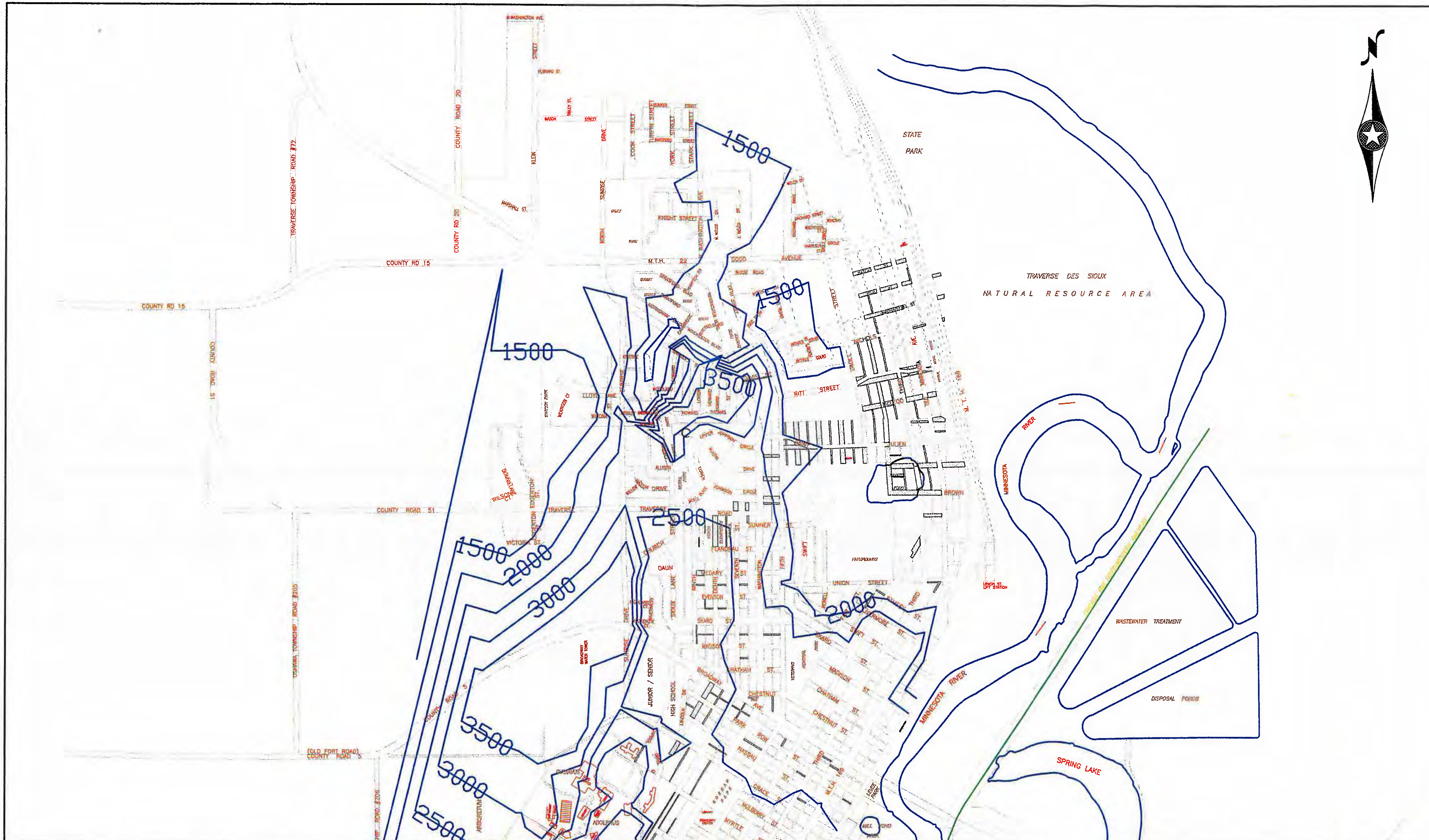

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BURNSVILLE, MN CHASKA, MN AMES, IA

CITY OF SAINT PETER
EXISTING SYSTEM
AVAILABLE FIRE FLOWS

MARCH, 2004

FIGURE NO. 3

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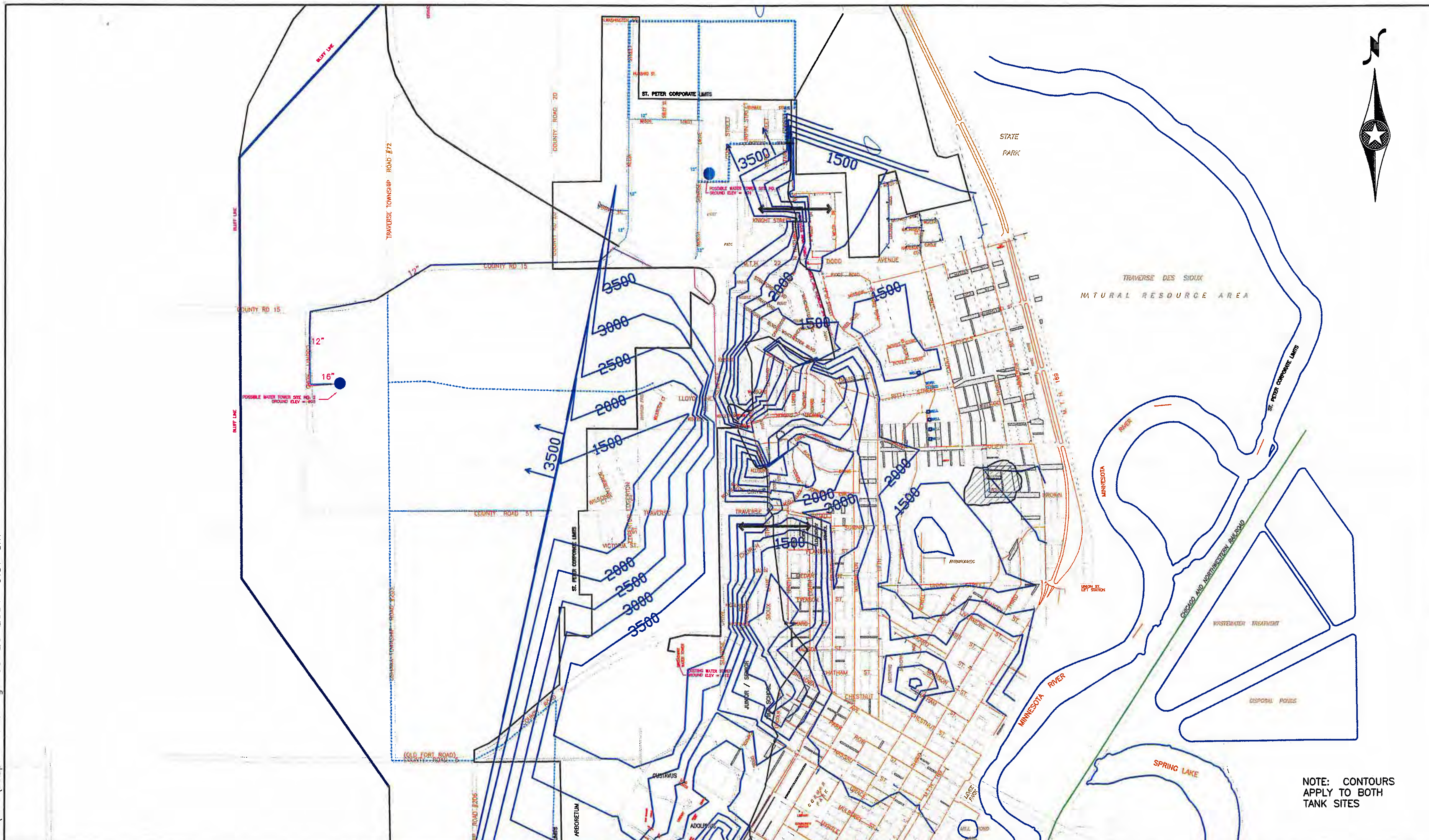

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BURNSVILLE, MN CHASKA, MN AMES, IA LIBERTY, MO

CITY OF SAINT PETER
ALTERNATE 1 & 2 WATER TOWERS
AVAILABLE FIRE FLOWS IN GPM

MARCH, 2004

FIGURE NO. 4

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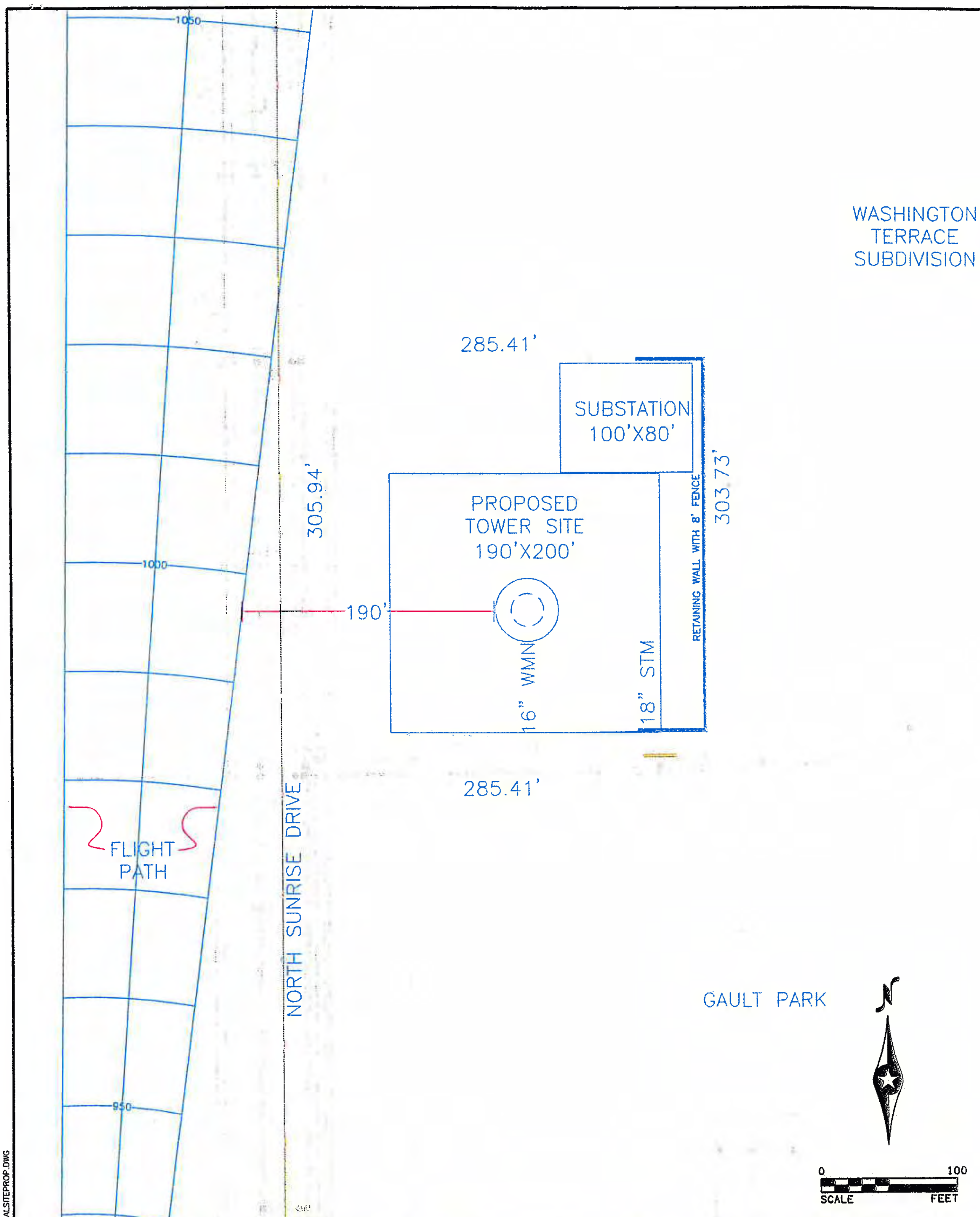

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CITY OF SAINT PETER
NORTH INDUSTRIAL PARK
ALT-1 TOWER SITE

MARCH, 2004 FIGURE NO. 5

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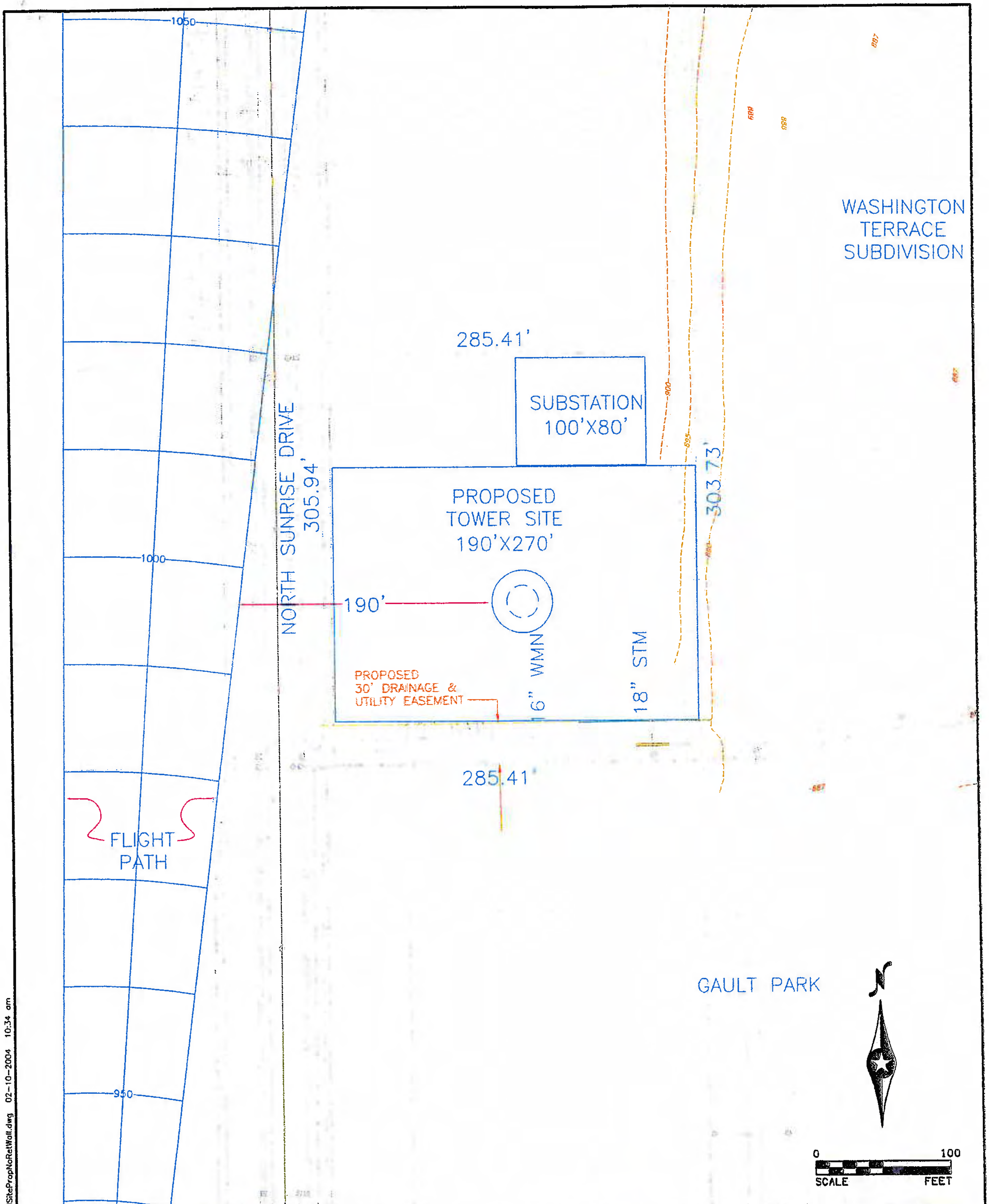

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CITY OF SAINT PETER
NORTH INDUSTRIAL PARK
ALT-1 TOWER SITE

MARCH, 2004 FIGURE NO. 5A

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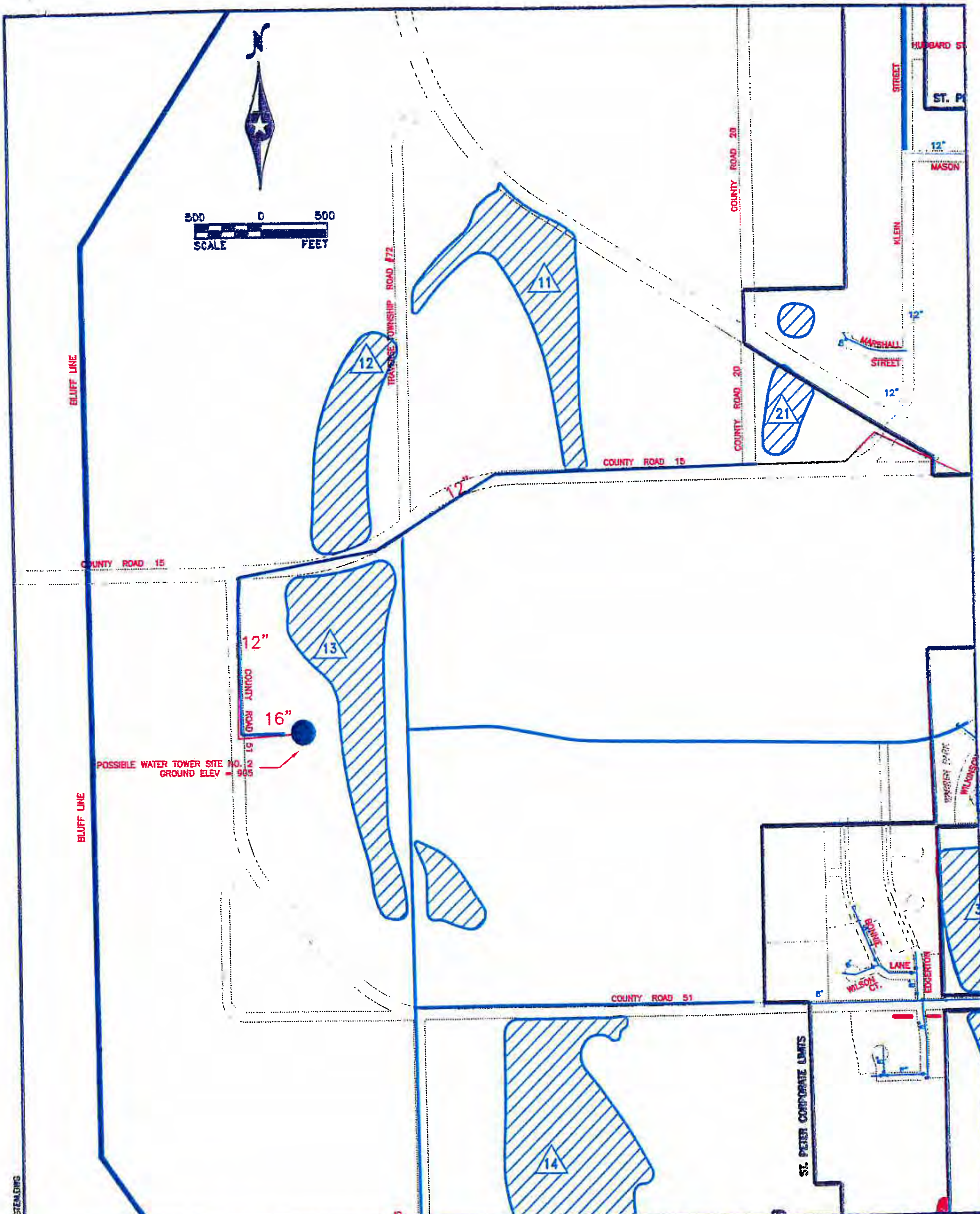

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BURNSVILLE, MN CHASKA, MN AMES, IA LIBERTY, MO

CITY OF SAINT PETER
COUNTY RD 15 & 51 INT.
ALT-2 TOWER SITE

DECEMBER, 2003

FIGURE NO. 6

PRELIMINARY PROJECT COST ESTIMATE

WATER TOWER
CITY OF SAINT PETER
BMI PROJECT NO. M14.34288
F:\STPE\M1434288\spread\[CostEst.xls]Sheet1

DATE: 18-Mar-04

ITEM NO.	ITEM	APPROX. QUANT.	UNIT	UNIT PRICE	AMOUNT
500,000 HYDROPILLAR WATER TOWER AT THE NORTH INDUSTRIAL PARK SITE - ALTERNATE 1					
1	FOUNDATIONS, STEEL, FABRICATION, ERECTION, PAINTING	1	LS	$850,000.00	$850,000.00
2	SCADA SYSTEM	1	LS	$60,000.00	$60,000.00
3	16" WATERMAIN	100	LF	$30.00	$3,000.00
4	16" VALVE	1	EA	$2,500.00	$2,500.00
5	CONTROLS	1	LS	$33,000.00	$33,000.00
6	WIRRING LADDER	1	LS	$5,000	$5,000.00
				SUBTOTAL	**$953,500.00**
				CONTINGENCIES 10%	**$95,400.00**
				ESTIMATED SUBTOTAL	**$1,048,900.00**
				ENGINEERING 18%	**$188,800.00**
				CITY ADMIN 4%	**$42,000.00**
				ALTERNATE 1: TOTAL	**$1,279,700.00**
RETAINING WALL OPTION					
1	RETAINING WALL	4920	SF	$25.00	$123,000.00
2	SELECT GRANUALR BORROW	4900	CY	$4.00	$19,600.00
				SUBTOTAL	**$142,600.00**
				CONTINGENCIES 5%	**$7,100.00**
				ESTIMATED SUBTOTAL	**$149,700.00**
				ENGINEERING	**$9,000.00**
				CITY ADMIN 4%	**$6,000.00**
				RETAINING WALL TOTAL	**$164,700.00**

FIGURE 7

PRELIMINARY PROJECT COST ESTIMATE

WATER TOWER
CITY OF SAINT PETER
BMI PROJECT NO. M14.34288
F:\STPE\M1434288\spread\[CostEst.xls]Sheet1

DATE: 18-Mar-04

ITEM NO.	ITEM	APPROX. QUANT.	UNIT	UNIT PRICE	AMOUNT
750,000 HYDROPILLAR WATER TOWER AT THE NORTH INDUSTRIAL PARK SITE - ALTERNATE 1					
1	FOUNDATIONS, STEEL, FABRICATION, ERECTION, PAINTING	1	LS	$1,100,000.00	$1,100,000.00
2	SCADA SYSTEM	1	LS	$60,000.00	$60,000.00
3	16" WATERMAIN	100	LF	$30.00	$3,000.00
4	16" VALVE	1	EA	$2,500.00	$2,500.00
5	CONTROLS	1	LS	$33,000.00	$33,000.00
6	WIRRING LADDER	1	LS	$5,000	$5,000.00
				SUBTOTAL	**$1,203,500.00**
				CONTINGENCIES 10%	**$120,400.00**
				ESTIMATED SUBTOTAL	**$1,323,900.00**
				ENGINEERING 18%	**$238,300.00**
				CITY ADMIN 4%	**$53,000.00**
				ALTERNATE 1: TOTAL	**$1,615,200.00**

FIGURE 8

PRELIMINARY PROJECT COST ESTIMATE

WATER TOWER
CITY OF SAINT PETER
BMI PROJECT NO. M14.34288
F:\STPE\M1434288\spread\[CostEst.xls]Sheet1

DATE: 18-Mar-04

ITEM NO.	ITEM	APPROX. QUANT.	UNIT	UNIT PRICE	AMOUNT
500,000 HYDROPILLAR WATER TOWER AT THE COUNTY ROAD 15 & 51 INTERSECTION SITE - ALTERNATE 2					
1	FOUNDATIONS, STEEL, FABRICATION, ERECTION, PAINTING	1	LS	$850,000.00	$850,000.00
2	SCADA SYSTEM	1	LS	$60,000.00	$60,000.00
3	12" WATERMAIN TO SITE	5870	LF	$45.00	$264,150.00
4	16" WATERMAIN	60	LF	$60.00	$3,600.00
5	12" VALVE	8	EA	$1,400.00	$11,200.00
6	16" VALVE	1	EA	$2,500.00	$2,500.00
7	CONTROLS	1	LS	$33,000.00	$33,000.00
8	ALTITUDE VALVE @ BROADWAY AVE. TOWER	1	LS	$15,000.00	$15,000.00
9	WIRRING LADDER	1	LS	$5,000	$5,000.00
				SUBTOTAL	**$1,244,500.00**
				CONTINGENCIES 10%	**$124,500.00**
				ESTIMATED SUBTOTAL	**$1,369,000.00**
				ENGINEERING 18%	**$246,400.00**
				CITY ADMIN 4%	**$54,800.00**
				ALTERNATE 2: TOTAL	**$1,670,200.00**

NOTE: ESTIMATE DOES NOT INCLUDE LAND COST

FIGURE 9

APPENDIX E

ISO PUBLIC PROTECTION CLASSIFICATION RESULTS
FOR CITY OF SAINT PETER

ISO
111 NORTH CANAL STREET SUITE 950 CHICAGO, IL 60606-7270
TEL: (312) 930-0070 (800) 444-4554 FAX: (312) 930-0017

June 28, 2005

Jerry Hawbaker, Mayor
City of St Peter
227 S Front St
St Peter, MN 56082

RE: Public Protection Classification Results
St Peter, Nicolett County, MN

Dear Mayor Hawbaker:

We wish to thank you and the other community officials for your cooperation during our recent Public Protection Classification (PPC) survey. ISO is the leading supplier of statistical, underwriting, and actuarial information for the property/casualty insurance industry. Most insurers use the PPC classifications for underwriting and calculating premiums for residential, commercial and industrial properties.

ISO has completed its analysis of the structure fire suppression delivery system provided in your community. We would like to report that your previous classification of Class 5 continues to apply. That means your community's fire suppression services are keeping up with the demands of a changing environment. Congratulations on continuing to fulfill your commitment to serve the needs of your community's property owners and residents.

Enclosed is a summary of the ISO analysis of your fire suppression services. If you would like to know how your community's classification could improve, or if you would like to learn about the potential effect of proposed changes to your fire suppression delivery system, please call us at the phone number listed below.

The PPC program is not intended to analyze all aspects of a comprehensive structure fire suppression delivery system program. It is not for purposes of determining compliance with any state or local law, nor is it for making recommendations about loss prevention or life safety.

If you have any questions about your classification, please let us know.

Sincerely,

Public Protection Department

312-930-0070 Ext. 6209

Encl.

cc: Fire Chief Block

THE ISO PUBLIC PROTECTION CLASSIFICATION (PPC) PROGRAM

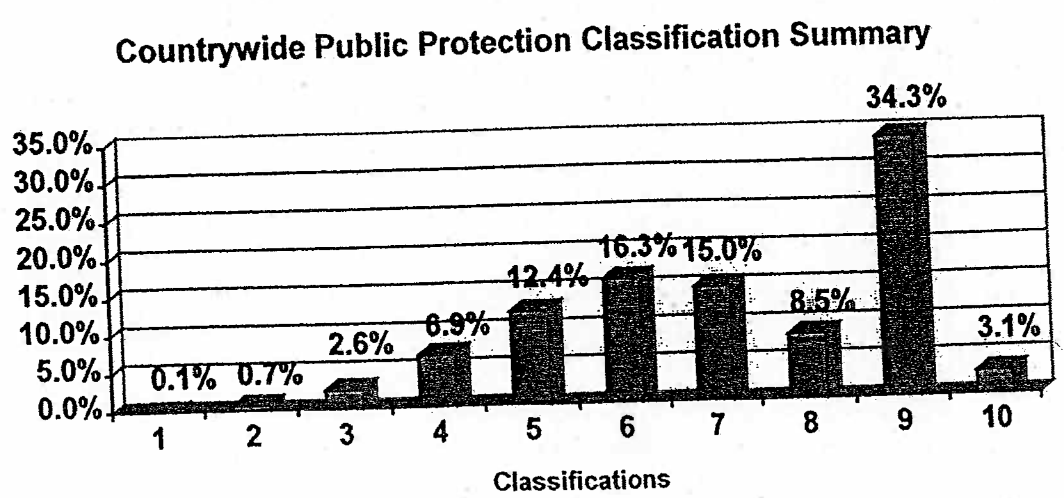
ISO's PPC program evaluates communities according to a uniform set of criteria defined in the Fire Suppression Rating Schedule (FSRS). This criteria incorporates nationally recognized standards developed by the National Fire Protection Association and the American Water Works Association.

Using the FSRS, ISO objectively reviews the fire suppression capabilities of a community and assigns a Public Protection Classification – a number from 1 to 10. Class 1 represents exemplary fire protection, and Class 10 indicates that the area's fire suppression program does not meet minimum recognition criteria.

The FSRS allocates credit by evaluating the following three major features:

- Fire alarm and communication system. This review accounts for 10% of the total classification which centers upon a community's facilities and support for handling and dispatching fire alarms.
- Fire department. This review accounts for 50% of the total classification which focuses upon items such as engine companies, ladder or service companies, distribution of fire stations and fire companies, equipment carried on apparatus, pumping capacity, reserve apparatus, department manning, and training.
- Water supply system. This review accounts for 40% of the total classification highlighting the water supply a community uses for fire suppression, including hydrant size, type, and installation, as well as the inspection frequency and condition of fire hydrants.

When ISO develops a single classification for a community, all of the community's properties receive that classification. In many communities, ISO develops a split classification (for example, 5/9). Generally, the first class, (Class 5 in the example) applies to properties within a defined distance (5-road miles in most states) of a fire station and within 1000 feet of a fire hydrant. The second class (Class 9 in the example) applies to properties beyond 1000 feet of a hydrant but within the defined distance of a fire station. ISO generally assigns Class 10 to properties beyond the defined distance of a fire station.



INSURANCE SERVICES OFFICE, INC.

CLASSIFICATION DETAILS

Graded Area: St Peter
County: Nicolett
Date Surveyed: January, 2005 Total Credit: 59.34 Class: 5
State: MN
Pop.: 10000

RECEIVING AND HANDLING FIRE ALARMS

This section of the Fire Suppression Rating Schedule reviews the facilities provided for the general public to report fires, and for the operator on duty at the communication center to dispatch fire department companies to the fires.

	Credit	
	Actual	Maximum
1. Credit for Telephone Service (Item 414)		
This item reviews the facilities provided for the public to report fires, including the listing of fire and business numbers in the telephone directory.	1.08	2.00
2. Credit for Operators (Item 422)		
This item reviews the number of operators on-duty at the communication center to handle fire calls.	1.86	3.00
3. Credit for Dispatch Circuits (Item 432)		
This item reviews the dispatch circuit facilities used to transmit alarms to fire department members.	3.25	5.00
4. Total Credit for Receiving and Handling Fire Alarms:	6.19	10.00
Relative Classification for Receiving and Handling Fire Alarms:	4	

CLASSIFICATION DETAILS

Graded Area:	St Peter		
County:	Nicolett		State: MN
Date Surveyed:	January, 2005	Total Credit: 59.34 Class: 5	Pop.: 10000

FIRE DEPARTMENT

This section of the Fire Suppression Rating Schedule reviews the engine and ladder-service companies, equipment carried, response to fires, training and available fire fighters.

	Credit	
	Actual	Maximum
1. Credit for Engine Companies (Item 513)		
This item reviews the number of engine companies and the hose equipment carried.	6.69	10.00
2. Credit for Reserve Pumpers (Item 523)		
This item reviews the number of reserve pumpers, their pump capacity and the hose equipment carried on each.	0.43	1.00
3. Credit for Pump Capacity (Item 532)		
This item reviews the total available pump capacity.	5.00	5.00
4. Credit for Ladder-Service Companies (Item 549)		
This item reviews the number of ladder and service companies and the equipment carried.	4.71	5.00
5. Credit for Reserve Ladder-Service Companies (Item 553)		
This item reviews the number of reserve ladder and service trucks, and the equipment carried.	0.35	1.00

CLASSIFICATION DETAILS

Graded Area: St Peter
County: Nicolett
Date Surveyed: January, 2005 Total Credit: 59.34 Class: 5 State: MN Pop.: 10000

FIRE DEPARTMENT
(continued

	Credit Actual	Credit Maximum
6. Credit for Distribution (Item 561)		
This item reviews the percent of the built-upon area of the city which has an adequately-equipped, responding first-due engine company within 1.5 miles and an adequately-equipped, responding ladder-service company within 2.5 miles.	2.26	4.00
7. Credit for Company Personnel (Item 571)		
This item reviews the average number of equivalent fire fighters and company officers on duty with existing companies.	4.76	15.00+
8. Credit for Training (Item 581)		
This item reviews the training facilities and their use.	2.25	9.00
9. Total Credit for Fire Department:	26.45	50.00+
Relative Classification for Fire Department:	5	

+ This indicates that credit for company personnel is open-ended, with no maximum credit for this item.

CLASSIFICATION DETAILS

Graded Area: St Peter
County: Nicolett
Date Surveyed: January, 2005 Total Credit: 59.34 Class: 5 State: MN Pop.: 10000

WATER SUPPLY

This section of the Fire Suppression Rating Schedule reviews the water supply system that is available for fire suppression in the city.

	Credit Actual	Credit Maximum
1. Credit for the Water System (Item 616) This item reviews the supply works, the main capacity and hydrant distribution.	27.25	35.00
2. Credit for Hydrants (Item 621) This item reviews the type of hydrants, and method of installation.	2.00	2.00
3. Credit for Inspection and Condition of Hydrants (Item 631) This item reviews the frequency of inspections of hydrants and their condition	3.00	3.00
4. Total Credit for Water Supply:	32.25	40.00
Relative Classification for Water Supply:	2	

Grading Sheet For: St Peter, MN
Nicolett County

Public Protection Class: 5

Surveyed: January, 2005

Feature	Credit Assigned	Maximum Credit
Receiving and Handling Fire Alarms	6.19%	10.00%
Fire Department	26.45%	50.00%
Water Supply	32.25%	40.00%
*Divergence	-5.55%	
Total Credit	59.34%	100.00%

The Public Protection Class is based on the total percentage credit as follows:

Class	%
1	90.00 or more
2	80.00 to 89.99
3	70.00 to 79.99
4	60.00 to 69.99
5	50.00 to 59.99
6	40.00 to 49.99
7	30.00 to 39.99
8	20.00 to 29.99
9	10.00 to 19.99
10	0 to 9.99

*Divergence is a reduction in credit to reflect a difference in the relative credits for Fire Department and Water Supply.

The above classification has been developed for use in property insurance premium calculations.

PUBLIC PROTECTION CLASSIFICATION

IMPROVEMENT STATEMENTS
FOR
St Peter
Nicolett County, MN

Prepared by
INSURANCE SERVICES OFFICE, INC.
111 North Canal St., Ste 950, Chicago, IL 60606
312-930-0070 FAX 800-711-6431

The following statements are based upon the criteria contained in our Fire Suppression Rating Schedule and upon conditions in St Peter, MN during January, 2005. They indicate the performance needed to receive full credit for the specific item in the Schedule, and the quantity you have provided. Partial improvement will result in receiving a partial increase in the credit. These statements relate only to the fire insurance classification of your city. They are not for property loss prevention or life safety purposes and no life safety or property loss prevention recommendations are made.

RECEIVING AND HANDLING FIRE ALARMS

Credit For Telephone Service (Item 414).

Actual = 1.08%; Maximum = 2.00%

For maximum credit in the Schedule, there should be 2 incoming telephone lines reserved for receiving notification of fires (and other emergency calls). You have 1 line reserved.

For maximum credit in the Schedule, there should be 2 incoming lines reserved for notification of fires (and other emergency calls) plus 1 additional lines for conducting other fire department business. Since the designated business line is to a location that is not attended during normal business hours, 1(one) line has been deducted from the number of creditable reserved fire lines.

For maximum credit in the Schedule, fire calls should be immediately transferred from the answering point to the dispatcher who should obtain the needed information. Your fire calls are received by the answering point and the information is then transmitted to the dispatcher.

For maximum credit in the Schedule, both the number to report a fire and the fire department business number should be listed under "Fire Department" in the white pages directory (or government section of the white pages). Your fire number is not listed and your business number is not listed under "Fire Department".

Credit For Operators (Item 422).

Actual = 1.86%; Maximum = 3.00%

For maximum credit in the Schedule, 2 operators are needed on duty at all times. You have an average of 1.23 operators on duty.

Credit For Dispatch Circuits (Item 432).

Actual = 3.25%; Maximum = 5.00%

For maximum credit in the Schedule, the primary alarm dispatch circuit should be monitored for integrity in accordance with National Fire Protection Association Standard, 1221.

For maximum credit in the Schedule, the alarm dispatch circuit should have an emergency power supply in accordance with National Fire Protection Association Standard, 1221.

Total credit for Receiving and Handling Fire Alarms (Item 440)

Actual = 6.19%; Maximum = 10.00%

FIRE DEPARTMENT

Credit For Engine Companies (Item 513).

Actual = 6.69%; Maximum = 10.00%

For maximum credit in the Schedule, 3 engine companies are needed in your city.
These are calculated as follows:

3 for the Basic Fire Flow of 3500 gpm.

You have 3 engine companies in service.
These are calculated as follows:

72 percent for Engine E501 because of insufficient equipment.
Additionally Engine E501 is lacking: an adequate pump testing program.

56 percent for Engine E506 because of insufficient equipment.
Additionally Engine E506 is lacking: a minimum of 1200' of hose carried (of which 800' needs to be 2½ in. or larger), an adequate pump testing program.

71 percent for Engine E511 because of insufficient equipment.
Additionally Engine E511 is lacking: a minimum of 1200' of hose carried (of which 800' needs to be 2½ in. or larger), an adequate pump testing program.

Credit For Reserve Pumpers (Item 523).

Actual = 0.43%; Maximum = 1.00%

For maximum credit in the Schedule, 1 fully-equipped reserve pumper is needed. You have 0 reserve pumpers.

Credit For Pump Capacity (Item 532).

Actual = 5.00%; Maximum = 5.00%

Credit For Ladder And Service Companies (Item 549).

Actual = 4.71%; Maximum = 5.00%

For maximum credit in the Schedule, 1 ladder company is needed in your city.

This is calculated as follows:

1 ladder company due to method of operation.

You have 1 ladder company
This is calculated as follows:

94 percent for Ladder combining L508 with EQ502, E511 and E506 because of insufficient equipment and insufficient aerial device testing.

Credit For Reserve Ladder And Service Companies (Item 553).

Actual = 0.35%; Maximum = 1.00%

For maximum credit in the Schedule, 1 fully-equipped reserve ladder truck is needed.
You have 2 reserve ladder trucks.
These are calculated as follows:

11 percent for Ladder EQ507 because of insufficient equipment, insufficient aerial device testing and insufficient aerial device length.

35 percent for Ladder combining EQ502 with E511 and E506 because of insufficient equipment, insufficient aerial device testing and insufficient aerial device length.

Credit For Distribution (Item 561).

Actual = 2.26%; Maximum = 4.00%

For maximum credit in the Schedule, all sections of the city with hydrant protection should be within 1½ miles of a fully-equipped engine company and 2½ miles of a fully-equipped ladder, service, engine-ladder or engine-service company. The distance to be measured along all-weather roads.

Credit For Company Personnel (Item 571).

Actual = 4.76%; Maximum = 15.00%

An increase in the average response of fire department members by one person will increase the fire department credit by 0.21.

Credit For Training (Item 581).

Actual = 2.25%; Maximum = 9.00%

For maximum credit in the Schedule, the training program should be improved. You received 25 percent credit for the current training program and the use of facilities.

For maximum credit in the Schedule, pre-fire planning inspections of each commercial, industrial, institutional and other similar-type building should be made twice a year by company members. Records of the inspections should include complete and up-to-date notes and sketches.

Total credit for Fire Department (Item 590)

Actual = 26.45%; Maximum = 50.00%

WATER SUPPLY

Credit For Supply System (Item 616).

Actual = 27.25%; Maximum = 35.00%

For maximum credit in the Schedule, the needed fire flows should be available at each location in the city. Needed fire flows of 2500 gpm and less should be available for 2 hours, 3000 and 3500 gpm for 3 hours and all others for 4 hours. See the attached table for an evaluation of fire flow tests made at representative locations in your city.

All AWWA standard hydrants within 1000 feet of a building, measured as hose can be laid by apparatus, are credited; 1000 gpm for hydrants within 300 feet; 670 gpm for 301 to 600 feet; and 250 gpm for 601 to 1000 feet. Credit is reduced when hydrants lack a pumper outlet, and is further reduced when they have only a single 2½-inch outlet.

Credit For Hydrants (Item 621).

Actual = 2.00%; Maximum = 2.00%

Credit For Inspection and Condition of Hydrants (Item 631).

Actual = 3.00%; Maximum = 3.00%

For maximum credit in the Schedule, all hydrants should be inspected twice a year, the inspection should include operation and a test at domestic pressure. Records should be kept of the inspections. Hydrants should be conspicuous, well located for use by a pumper, and in good condition.

Total credit for Water Supply (Item 640)

Actual = 32.25%; Maximum = 40.00%

FIRE FLOW TESTS

St Peter, MN

Tests witnessed on May 18, 2005

Test No.	Needed Fire Flow† gpm	Limited By Supply Works, gpm	Limited by Distribution Mains (flow tests), gpm	Limited By Hydrant Spacing, gpm
1	2250		1600	
2†	4000		1900	2500
2a	2500		1900	
3†	5000	4161.64	2700	
3a	3000		2700	
4	3000		1900	
5	2500		2100	
6	2250			
7	2500			
8	3500		2100	1500
9†	4500	4161.64	3300	3500
9a	1000			
10	3500		1300	
11	2000			
12	1750			
13	3500			3170
14	1000			

†Needed fire flows exceeding 3500 gpm are not considered in Item 616 (CSS) Credit for System Supply

City St Peter
County Nicolett State MN

613 & 614 HYDRANT FLOW DATA (MC(1) & HD(1))

Test No.	Location	Needed Fire Flow	Service Level	Pressure (PSI) Static	Residual	Pitot	Orifice	Flow GPM	Flow GPM@ 20 psi	Hydrant Condition
1	W Menk Dr & Daniels St	2250	2	60	26			1500	1600	OK
	W Menk Dr & Alpine St					11	4.5	1500		OK
2	Jefferson Ave & Schorlarship	4000	2	64	34			1560	1900	OK
	Jefferson Ave & S end of Schorlarship					12	4.5	1560		OK
2a	Jefferson Ave & Schorlarship	2500	2	64	34			1560	1900	OK
	Jefferson Ave & S end of Schorlarship					12	4.5	1560		OK
3	GAC & Baseball Field (W of Lund Center)	5000	2	58	36			2020	2700	OK
	S end of Lund Center					20	4.5	2020		OK
3a	GAC & Baseball Field (W of Lund Center)	3000	2	58	36			2020	2700	OK
	S end of Lund Center					20	4.5	2020		OK
4	Washington Ave & Walnut St	3000	1	68	26			1750	1900	OK
	5th St & Walnut St					15	4.5	1750		OK
5	St Paul St & 5th St	2500	1	72	56			1120	2100	OK
	Elm St & 5th St					6	4.5	1120		OK
6	Minnesota Ave & Elm St	2250	1	79	42			1860	2400	OK
	Minnesota Ave & Pine St					17	4.5	1860		OK

City St Peter
County Nicolett **State** MN

613 & 614 HYDRANT FLOW DATA (MC(1) & HD(1))

Test No.	Location	Needed Fire Flow	Service Level	Pressure (PSI) Static	Residual	Pitot	Orifice	Flow GPM	Flow GPM@ 20 psi	Hydrant Condition
7	Minnesota Ave & Nassua St	2500	1	82	60			1690	3000	OK
	Minnesota Ave & Grace St					14	4.5	1690		OK
8	Sumner St & Swift St	3500	1	73	54			1190	2100	OK
	Union St & Swift St					7	4.5	1190		OK
9	Capital Dr & N end of High School	4500	2	78	60			1750	3300	OK
	S end of High School					15	4.5	1750		OK
9a	Capital Dr & N end of High School	1000	2	78	60			1750	3300	OK
	S end of High School					15	4.5	1750		OK
10	9th St & Flandrau St	3500	1	48	38			750	1300	OK
	8th St & Medary St					2	4.5	750		OK
11	Sunrise Dr & Traverse Rd next hyd S	2000	2	66	54			2340	4800	OK
	Sunrise Dr & Traverse Rd					27	4.5	2340		OK
12	Gault St & Julien St	1750	1	80	60			2510	4500	OK
	Gault St & Ritt St					31	4.5	2510		OK
13	Nichols St & Old Minnesota Ave	3500	1	84	58			2430	4000	OK
	Dodd Ave & Old Minnesota Ave					29	4.5	2430		OK

2005

City St Peter

County Nicolett State MN

613 & 614 HYDRANT FLOW DATA (MC(1) & HD(1))

Test No.	Location	Needed Fire Flow	Service Level	Pressure (PSI)			Orifice	Flow GPM	Flow GPM@ 20 psi	Hydrant Condition
				Static	Residual	Pitot				
14	Knight St & W Welco next hyd S	1000	1	54	26			1690	1900	OK
	Knight St & W Welco next hyd N					14	4.5	1690		OK

APPENDIX F

INFORMATION ON WATER CONSERVATION

Volume 1, Issue 1

May 2003

www.deq.state.ok.us

Use Less Stuff

Conserve Water and Save Money

Because water is usually so plentiful, available and cheap, we often casually disregard its importance and consider it an almost limitless resource. Ilda Hershey, DEQ Water Quality Division, says, "We often take water for granted because all we have to do is turn on the faucet to get it—so we may use more than necessary."

"Water flows from its source—such as a river or well—through pipes to water treatment plants where it is cleaned. From the water treatment plant, it moves through pipes to our homes. Then it flows out of our faucets on demand. After water swirls down the drain or is flushed down the toilet, it flows to a wastewater treatment plant where it is cleaned before being released into a river or other water source.

> *"We often take water for granted because all we have to do is turn on the faucet to get it—so we may use more than necessary."*
>
> *—Ilda Hershey*

Why conserve water? Water treatment costs money. It requires workers, buildings, pipes and materials to clean or treat the water. The more water we use, the more water must be treated or cleaned, and that costs money. Water conservation can also help solve water shortage problems such as those occurring this year in several western states. Many businesses reduce their water use by recycling water and using new equipment that requires less water. Many farmers and ranchers are using more efficient irrigation systems. It is important that citizens do their part as well.

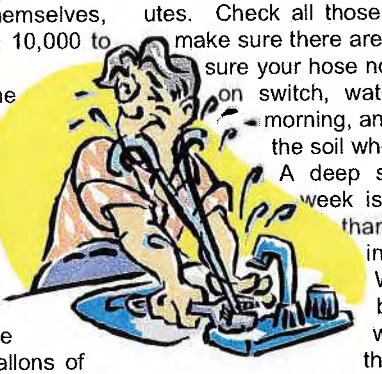
Since world water usage has tripled since 1950 , users and suppliers in several states in the U.S. have been forced to deal with the harsh reality of dwindling water supplies. Episodes of water shortages and drought have already reared their ugly heads in Oklahoma, too. While local and state governments are working toward becoming prepared to deal with these emergencies, decision-makers, water managers and citizens must also realize that there are water use guidelines that can often stave off critical dry periods and the hardships associated with them.

Conservation of our water resources—specifically, activities designed to reduce water demand and improve efficiency of use—and ensuring the availability of fresh water for future generations involves changing habits and altering the manner in which we conduct our daily routines. In the home, the key is starting simply, such as turning off water when it is not being used, then gradually taking more advanced steps to reduce water consumption. On a larger scale, improved landscape designs, irrigation scheduling and better methods of irrigating crops, reclamation and reuse of wastewater, water budgeting and adoption of rate controls have all had considerable success in reducing both use and demand.

For approximately $10 to $20, the average homeowner can install two low-flow showerheads, place dams or bottles in their toilet tanks, put low-flow aerators on the faucets and repair dripping faucets and leaky toilets. Showers and faucets account for approximately 25% of your indoor water use. The average tank on the back of your toilet holds about 6 gallons of water. Only 2-3 gallons are needed per flush, but all 6 go down the drain. In fact, almost 40% of the water that comes into your home goes down the toilet. A small drip from a leaky faucet isn't just a drop in the bucket—even a slow leak can waste 4-5 gallons of water a day, not to mention a lot of money wasted as well. Worn-out washers, one of the most common causes of leaky faucets, is also the easiest and cheapest to fix. In just one year, these modifications can pay for themselves, saving a family of four from 10,000 to 25,000 gallons of water.

Simply changing some personal habits can also save a lot of water. Does the water run while you wash your face, brush your teeth, or shave? Letting the faucet run just while you brush your teeth—for 3 minutes in the morning and 3 minutes in the evening—wastes up to 9 gallons of water per day. Washing dishes by hand while the water is running for just 10 minutes uses about 15 gallons of water, much of it wasted. This method wastes water even if you turn off the tap while you scrub. Washing a small load in a dishwasher wastes up to 12 gallons of water. Washing dishes in a tub or partitioned sink with two sections, one for sudsy water and the other for rinse water, uses about 4 gallons of water. How much water goes down the drain before you get water cold enough to drink? On average, 24 cups of clean water are wasted each time we wait for the water to turn cold by letting it run. If you'll fill a reusable bottle with tap water and keep it in the refrigerator, you will save about 550 gallons of water per person each year. How much water do you need to get your body clean? The average shower uses 5 gallons per minute. This means you could save 25 gallons of water by staying in the shower for 5 minutes instead of 10. A bath can use 30 to 50 gallons of water--up to twice the amount you need for a 5-minute shower.

Outdoors, even more water and money can be saved through water conservation in lawn and garden areas. If you have a lawn and water it, there's a good chance it's being over-watered by a third. The average quarter-acre of lawn gets about 22,000 gallons a week more than it needs! Most established lawns need only one to one-and-a-half inches of water a week. Water early in the morning or early evening to avoid evaporation. Keep your grass between 2" and 3" to provide natural shade that will help the soil stay moist. Leave grass clippings on the lawn to retain moisture. If you have a garden, at least 50% of the water you use may be wasted through inefficiency. You probably use about 60 gallons of water every time you water for just 10 minutes. Check all those connections to make sure there are no leaks, make sure your hose nozzle has an off/on switch, water early in the morning, and direct water to the soil where it is needed. A deep soaking once a week is more effective than shallow watering every day. Whenever possible, landscape with native plants that require little water and upkeep. Also, you might want to consider installing a drip irrigation system.



Oklahoma's Use Less Stuff Campaign provides ideas to help citizens develop sustainable lifestyles. More information, including a power point presentation, can be found on the DEQ website: <deq.state.ok.us> or by contacting campaign coordinator, Susie Shields, at (405) 702-5166 or <susie.shields@deq.state.ok.us>.

Welcome to Xeriscape Colorado!

Colorado WaterWise Council

The Voice of the Colorado Water Efficiency Community

XERISCAPE™

Xeriscape™ Colorado

What Is Xeriscape?

Demo Gardens

Upcoming Events

Resources & Reference

Articles

Xeriscape Colorado is a program of **Colorado WaterWise Council**
P.O. Box 40202
Denver, CO 80204-0202
303-893-2992
xeriscape@coloradowaterwise.org

www.coloradowaterwise.org

WHAT IS XERISCAPE?

"What is Xeriscape? This question confuses many people who expect Xeriscape to be a specific look or specific group of plants. Xeriscape is actually a combination of seven common-sense gardening principles that save water while creating a lush and colorful landscape.

These Seven Fundamental Principles of Xeriscape are:

Plan and Design...

for water conservation and beauty from the start.

Create Practical Turf Areas...

of manageable sizes, shapes, and appropriate grasses.

Select Low Water Plants...

and group plants of similar water needs together. Then experiment to determine how much and how often to water the plants.

Use Soil Amendments...

like compost or manure as needed by the site and the type of plants used.

Use Mulches...

such as woodchips, to reduce evaporation & to keep the soil cool.

Irrigate Efficiently...

with properly designed systems (including hose-end equipment) and by applying the right amount of water at the right time.

Maintain the Landscape Properly...

by mowing, weeding, pruning and fertilizing properly.

Expanded information about each of the Xeriscape fundamentals may be obtained by contacting the local Xeriscape program in your area, reading one or more of the many books published about Xeriscape, or by logging onto any of the web sites listed under Resources & Reference.

Xeriscape is NOT...

("zero"scapes often mistaken for Xeriscape)

Is there a positive in the negative?

Jim Knopf, ASLA (American Society of Landscape Architects), of Boulder, Colorado suggests the following considerations:

• Xeriscape is **NOT** dry only.

> Even though dry-only landscaping can be quite spectacularly colorful, and even lush, limited areas of more highly-watered landscape are completely consistent with wise water use. For example, heavily-irrigated athletic field turf makes sense, since it recovers quickly from heavy use.

• Xeriscape is **NOT** just rocks and gravel.

> Although dry (xeric) rock gardens can be truly marvelous, there are many wonderful choices other than rock for the xeric portions of Xeriscape designs.

Xeric implies no added water. By definition, Xeriscape means some water applied in well-controlled amounts and locations in the landscape.

• Xeriscape is **NOT** necessarily lawn-less landscaping.

Some lawn, even of species that are more highly watered, can be consistent with wise water use. "Less-lawn landscaping", rather than "Lawn-less landscaping" is an appropriate statement.

• Xeriscape is **NOT** native plants only.

Although there are vast arrays of wonderful plants indigenous to all regions, non-invasive introduced plants, that are well-adapted to the local regional climate, are wonderful additions to landscaping that uses water frugally. For example, many iris, tulips, and even roses are examples of introduced plants that are well adapted to nonirrigated landscaping in the Rocky Mountain region.

• Xeriscape is **NOT** a boring mono-culture of spiny plants.

On the contrary, well planned Xeriscapes are splendid examples of the beauty and diversity that make neighbors envious. For more information on Xeriscape and other horicultural topics, please visit www.planttalk.org.