Water Supply and Distribution Plan

Dayton, Minnesota

February 2007

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

February 1, 2007

Honorable Mayor and City Council
City of Dayton
12260 South Diamond Lake Road
Dayton, Minnesota 55327

Re: Water Supply & Distribution Plan
Dayton, Minnesota
Bonestroo File No. 174-05121-1

Dear Mayor and Council:

Transmitted herewith is the Water Supply and Distribution Plan for the City of Dayton. The plan is intended to serve as a guide for the expansion of the City's trunk water system. The information presented in this report is based on costs and data that were available in 2005.

This report updates and expands upon previous water distribution system reports. A layout of the ultimate trunk water supply and distribution system is presented on Figure 1 at the back of the report. Preliminary cost estimates for water mains, well, and storage facilities have been prepared to serve as a basis for area and connection charges.

We would be pleased to discuss the contents of this report and the findings of our study with the City Council and Staff or other interested parties at any mutually convenient time.

Respectfully submitted,

BONESTROO, ROSENE, ANDERLIK & ASSOCIATES, INC.

Mark A. Hanson, P.E.

Mark D. Wallis, P.E.

I hereby certify that this 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.

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Mark D. Wallis, P.E.

Date: February 1, 2007 Reg. No. 19145

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Executive Summary

Introduction

This Comprehensive Water Supply and Distribution Plan for the City of Dayton has been developed to meet the anticipated near-term and ultimate needs of the Dayton municipal water system. Figure 1, located in the map pocket at the back of this Plan, identifies the anticipated water facilities and infrastructure proposed to serve Dayton through the ultimate build-out. Although this plan presents an "ultimate system", flexibility does exist for Dayton Officials and staff to make adjustments in the future that will benefit Dayton as it continues to grow.

Background

The City of Dayton is located in northern Hennepin County about 20 miles north and west of Minneapolis/St. Paul. The City has many natural amenities, most notably the Elm Creek Park Reserve, several lakes, and the Mississippi River, which bounds the City on the north. These amenities will attract people to the City. In addition, the City is served by the I-94 artery, which connects the metropolitan area to the northwest part of the state.

Growth

Dayton's population has increased from approximately 2,600 in 1970 to about 5,000 today. The City is expecting continued growth. Existing water service has been limited to the *Historic Village* and the *Nature's Crossing* development, the latter of which is served by the City of Champlin. The remainder of the City obtains water from private wells.

Sewer service has been limited in Dayton to the *Historic Village*, the *Nature's Crossing* development, and about 50 homes on the north side of Diamond Lake, which are connected with the City of Rogers wastewater treatment facility. The planned completion of the Metropolitan Council Environmental Services Dayton-Champlin and Elm Creek Interceptor sewers will allow municipal utility services to be extended to areas not currently served. This will enable the City of Dayton to serve new areas and will fuel the demand for growth.

Growth in Dayton will also be impacted by the growth potential of its neighboring communities. Several neighbors are able to accommodate additional growth, but others will experience diminished growth as they approach build-out. New developments will likely bypass them in favor of available land in adjacent communities.

Growth through 2010 is limited by the City's Growth Management Policy. Although this Policy does not extend beyond 2010, for the purposes of this document, it was projected that an average of 300 residential building permits per year would be issued between 2010 and 2030. The population projections assume that significant redevelopment will occur where parcel sizes are presently one (1) acre to ten (10) acres, such that ultimate development densities will correspond to the Concept Guide Plan. The projected population for Dayton in accordance with Metropolitan Council density requirements (2.95 units/acre) and Dayton's Growth Management Policy is shown below.

	Projected Population	Population Served By Municipal Water
Current (2005)	5,000	310
2010	8,600	3,300
2020	15,600	12,300
2030	24,600	21,300
Ultimate	57,660	57,660

Existing Facilities

The City of Dayton presently obtains its water supply from a single deep well (Historic Village Well No. 1) in the FIG aquifer system with a capacity of 300 gallons per minute (gpm). Pressure in the water distribution system is provided by a hydro-pneumatic tank with a water capacity of 2,000 gallons. The facility includes chemical feed equipment that provides chlorination and fluoridation. Polyphosphates are added to control iron and manganese. The Historic Village wells serve approximately 120 units.

The Recommended Standards for Water Works (Ten States Standards) place several limitations on hydro-pneumatic systems. Systems should serve no more than 150 units; the minimum tank size should be 10 times well capacity; and well capacity should be 10 times average day demand. Therefore, with a 2,000 gallon tank, the well pump should be 200 gpm or less, and corresponding average day demand should be less than 28,800 gallons per day (gpd). The 2001 Historic Village Water Supply Plan projected 2005 to include 200 units and a 50,000 gpd average day demand. However, the Historic Village has not grown at the projected rate.

Computer Model

A hydraulic analysis of Dayton's ultimate water supply and trunk distribution system was conducted using computer modeling software, simulating the system's response to average and peak demands, tank refill, and fire fighting scenarios. Each condition creates different responses in the water system. The modeling and its results help to identify, gauge and respond to conditions that could result in poor water system performance.

Water Supply/Demand

Projected average and maximum day water demands for various time horizons are presented below. Average day demands are used for estimating required storage capacity. Maximum day water demands are used for sizing supply facilities. Maximum day demands for Year 2030 build-out and for the comprehensive study areas are estimated to be 7.3 MGD and 19.3 MGD, respectively. The per capita demands in the ultimate system decrease due to the assumption that the City develops and successfully implements a water conservation plan.

Year Ending	Served Population	Per Capita Demand (gpcd)	Average Day Demand (MGD)	Max Day Per Capita Demand (gpcd)	Maximum Day Demand (MGD)
2005	310	71	0.02	265	0.08
2010	3,300	145	0.5	350	1.1
2020	12,300	140	1.7	350	4.3
2030	21,300	135	2.9	340	7.3
Ultimate Build-Out	57,660	132	7.6	335	19.3

A critical component of Developing a Comprehensive Water Supply and Distribution Plan is establishing the water supply. Section 4.3 provides detail on well capacity for aquifer systems in Dayton. The water supply for the City of Dayton, for this Comprehensive Water Supply and Distribution Plan is as follows:

Southwest

Southwest Dayton is identified as the area located west and south of Elm Creek Park Reserve and Diamond Lake. This area will be served by connecting to the Maple Grove water system (see Appendix F). Maple Grove has proposed to provide Dayton with water in sufficient quantity to meet an average day demand not to exceed 2.8 Million Gallons per Day (MGD) and a maximum day demand of 5.0 MGD. Based on a maximum day per capita demand of 350 gpcd, this is sufficient to serve 14,200 people. Maple Grove may be willing to increase these limits in the future, depending on their ultimate water needs. For all of Dayton, including North and Southwest Dayton, the 2020 service population is 12,300. Therefore, water supply from Maple Grove should be adequate beyond 2020.

The ultimate maximum day demand for Southwest Dayton is projected to be 9.5 MGD if Dayton develops in accordance with the Comprehensive Plan. Therefore, Dayton must provide an estimated 4.5 MGD of additional supply in Southwest Dayton to satisfy the "ultimate" peak demand. This translates to 3,130 gpm of pumping capacity. At a projected 1,050 gpm well capacity, this demand requires three (3) wells plus one (1) as stand-by--totaling four (4) wells.

Trunk connection charges for Southwest Dayton users will be the same as Maple Grove users are currently charged--$6,800/acre or $1,700/connection. These charges do not include any costs for trunk mains, storage, or supplemental water supply and treatment in Southwest Dayton.

The water volume charge from Maple Grove to Dayton users is proposed to be $1.30/1,000 gallons. This compares to an effective rate of $1.04/1,000 gallons charged to Maple Grove users. The total rate charged to Dayton users will have an additional charge to pay for Dayton's cost for operating and maintaining the water system. These rates should be established by a completing a Water Utility Rate Study.

North

The ultimate maximum day demand for North Dayton is anticipated to be 9.8 MGD if Dayton develops in accordance with the Comprehensive Plan. This equates to 6,800 gpm of pumping capacity. At an estimate 850 gpm well capacity, this would require eight (8) wells plus one (1) stand-by, totaling nine (9) wells

Dayton's north well field is planned to be located in the center of northern Dayton near Zanzibar Lane along North Diamond Lake Road (Co. Rd. 144). Future wells, if they are located in the center of North Dayton, can be connected to a potential water treatment plant if it is located near Zanzibar Lane and Co. Rd. 144, as proposed. Determining the need for a treatment facility, and its location is vital to ensuring that a trunk watermain is adequately sized.

Southeast

Southeast Dayton located east of Elm Creek Park Reserve and south of Elm Creek Road, will be served by the City of Champlin. This is provided for by the Joint Powers Agreement between the Cities of Champlin and Dayton.

Treatment

The iron concentration in the Historic Village well raw water was measured at 0.55 mg/L. The manganese concentration in the well was measured at 0.14 mg/L. The results exceed the secondary (aesthetic) standards for iron and manganese. While these levels of iron and manganese do not pose a health problem, they can present problems with aesthetics (appearance and taste). They can also increase system maintenance, cause staining of laundry and fixtures, clogging of meters and services, as well as other deleterious effects. Customer complaints can be minimized by frequent flushing and cleaning of lines in problem areas.

Maple Grove will provide treated water to southwest Dayton up to the 2.8 MGD average day demand (5.0 MGD maximum day demand) currently allowed in the contract. Dayton may have to supplement Maple Grove's water supply to serve all of Southwest Dayton if it fully develops beyond and exceeds Maple Grove commitments or willingness to offer more capacity. The source of the additional supply will likely be either screened wells drilled into the glacial drift, or bedrock wells drawing from the Franconia-Ironton-Galesville (FIG) formation. It is recommended that the supplemental supply provide a water quality consistent with the Maple Grove supply. Water drawn from both the drift and FIG will likely contain at least trace amounts of iron and/or manganese. It is not known, however, if levels will be high enough to warrant treatment of the supplemental supply in southwest Dayton. In North Dayton, treatment of the source water will be a decision based on the community's perception of the aesthetic quality of the water, desire to improve the aesthetic quality, and the willingness to pay for treatment options. In the event treatment is provided to North Dayton, it is possible to serve a portion of Southwest Dayton with treated water from North Dayton if it is considered during the design.

For this report, water mains have been located and sized with the assumption that all future wells will eventually pump to water treatment plants. Determining the requirement for treatment will eventually need to be made. The location of it is of critical importance to ensuring that a trunk watermain is effectively located and efficiently sized.

Storage

Water storage facilities serve several purposes in a water system, including the storage of water for emergency conditions and providing capacity to meet peak demands which exceed the capabilities of the supply facilities. They also help to maintain constant system pressure and provide for smooth pumping operation by minimizing the starting and stopping otherwise necessary to keep up with varying customer demands.

The only currently available storage is the 2,000 gallon pneumatic tank serving the Historic Village. Projected minimum storage requirements are presented below. Proposed water storage locations are noted below and shown on the Water Supply and Distribution Map (Figure 1) in the pocket folder at the end of this report.

This study recommends the following locations for storage reservoirs:

Site	**Capacity (MG)**	**Comments**
Southwest Elevated Tank	1.50	
SW Water Treatment Ground Storage or Storage Tank in Maple Grove	2.25	
Northeast Elevated Tank	0.5*	Pineview Lane adjacent to Elm Creek Park
	1**	
Northwest Elevated Tank	1.00	Along 152nd Avenue midway between Brockton Lane and Lawndale Lane
North Water Treatment Plant Ground Storage	1.85	
Total	**7.60**	

* Interim
** Ultimate

The ultimate storage required to service North and Southwest Dayton will be dependent on the supply needed to serve the ultimate development. In accordance with Dayton's Comprehensive Plan and the ultimate water demand estimate in this report, that total is 7.6 MGD. For example, based on existing development in Northeast Dayton, it is proposed the interim storage be 0.5 MG. In the future, dependent on many factors, additional storage can be provided at other locations or at the Pineview location based on further review.

For purposes of this report it is assumed that additional storage will be provided at each water treatment plant. If water treatment is not provided and growth occurs as identified in Dayton's Comprehensive Plan, additional storage should be provided at or near proposed treatment plant locations. As stated previously, these decisions can be addressed in the future—depending on Dayton's growth and whether treatment is provided or not.

2020 Capital Improvements

The recommended improvements to meet Dayton's estimated Year 2020 trunk water supply and distribution needs will cost approximately $14.7 million dollars (excluding costs paid to Maple Grove and treatment). These improvements include:

- 4 new wells and pump houses for North Dayton
- 2 interconnections with the Maple Grove distribution system
- 3 new storage reservoirs
- Approximately 28 miles of trunk distribution system improvements

Ultimate Water System

The improvement program for Dayton's ultimate trunk water supply, storage and distribution system is estimated to cost an additional $22.3 million dollars (excluding costs paid to Maple Grove and treatment). The ultimate system shown on the map in the back of this report consists of the near-term improvements plus the following:

- 7 new wells to serve the growth of the City
- 2 new standby wells for redundancy
- An additional 2 ground storage tanks (located at the treatment plants), for a total of 7.6 MG of storage at 5 storage locations
- Approximately 35 miles of additional trunk water distribution mains

Economic Analysis

The City of Dayton, through its contract with Maple Grove and recent projects in Northeast Dayton (Areas 1–6) and Southwest Dayton (Wicht Industrial Park) have begun to identify area connection charges. The Nature's Crossing development in Southeast Dayton, which is served by Champlin, is based on charges in accordance with Champlin. The Historic Village service area is based on charges implemented when that water system was developed in 1999/2000. City officials will need to review to what extent charges will be different or the same for each area as development occurs, and determine if future treatment be included in charges implemented at this time.

Option 1, which is summarized below is one option based on the following assumptions:

- Charges to North Dayton and Southwest Dayton will be different
- Charges for North Dayton are equal to the cost/REU for the NE Dayton Areas 1 – 6 Project.
- Trunk mains and storage are added to Maple Grove charges for Southwest Dayton.
- Supplemental supply and treatment are not included for Southwest Dayton.
- Future treatment costs are not included.
- Charges to Southeast Dayton will be charged independent of North and Southwest Dayton in accordance with Champlin's charges.

Option 1 – Connection Charges

North Dayton

Item	Cost/REU
Distribution, Supply, Storage	$1,600

Southwest Dayton

Item	Cost/REU
Maple Grove	$1,700
Distribution/Storage Dayton	600
	$2,300

In the event the City elects to charge for treatment based on a percentage of the cost at this time, the following charges could be considered:

Item	Cost/REU
Treatment – 100%	$1,000
Treatment – 50%	500
Treatment – 25%	250

Recommendations

Based upon the results and analysis of this study, it is recommended that the Dayton City Council:

1. Adopt this study and the Capital Improvement Program as a guide for the orderly expansion of the City's water system.
2. Adopt the proposed Emergency Preparedness and Conservation Plans included in this study (Appendix A) and submit them to the Metropolitan Council and Department of Natural Resources for their approval.
3. Review the need to supplement Maple Grove's water supply and the future costs paid to Maple Grove.
4. Review well locations in North Dayton and implement the emergency water connection with the City of Champlin.
5. Annually review the Capital Improvements Program and water system service charges to insure that they meet the community development needs.
6. Plan for acquisition of sites for potential wells, storage facilities, water treatment sites, and easements required to connect these facilities to the water system.
7. Monitor water quality and consumer complaints to screen out problems with high iron and manganese concentrations and insure compliance with drinking water quality standards.
8. Enforce the Water Conservation Plan and review it annually for updates.
9. In the future review the need for a Water Treatment Feasibility Report.
10. Implement a Sewer/Water Rate Study to further review the need for the same or different sewer/water charges for each area of the City as it continues to develop.

1. Introduction

1.1 Purpose and Objectives

The purpose of this Water Supply and Distribution Plan, hereinafter referred to as the Plan, is to provide a comprehensive improvement program to meet the near-term and ultimate water supply needs for the City of Dayton. The most recent Water Supply and Distribution Plan was completed for the Historic Village system in 2001. The primary objective of the 2006 Plan is to revise and update the existing Plan, and provide a comprehensive water system plan for the entire City, based on Dayton's anticipated Concept Guide Plan. Specific objectives are as follows:

- **Determine the potential ultimate water demands** expected within the City and the production capacity, treatment capacity, and storage required to meet these demands.

- **Revise the existing and proposed trunk water main system,** as presented in the 2001 Water Supply and Distribution Plan and 2002 Concept Reports, in accordance with present planning.

- **Determine near-term supply, treatment, and storage needs** in order to allow sufficient lead time for the addition of facilities to the system.

- **Hydraulically analyze the existing and ultimate system** to identify weaknesses in the water main system and propose solutions to ensure adequate operating and residual pressures.

- **Optimize supply, treatment, storage, and distribution combinations** to develop an economical and efficient ultimate water system.

- **Develop preliminary cost estimates** for supply, treatment, storage, and distribution facilities to form a basis for a suitable financing program.

- **Provide capacities and locations** of proposed new water storage facilities.

- **Update the 1995 Water Conservation Plan** in order to reduce the overall demand for water and encourage wise use of a limited resource.

- **Update the City of Dayton Wellhead Protection Plan in 2007**

All of the above objectives listed were met in completing this plan.

1.2 Background

The City of Dayton is located in northern Hennepin County about 20 miles north and west of Minneapolis/St. Paul. Approximately 25 percent (the southeast portion) of Dayton is located in the Elm Creek Park Reserve.

The development of a water system capable of supplying and distributing potable water of high quality to all points of demand at acceptable residual pressures requires advance planning. Such a system is dependent upon a strong network of trunk water mains complemented by properly sized and strategically located supply and storage facilities. A comprehensive plan based on the most reliable information presently available is necessary to ensure that adequate facilities are provided during a significant growth period and to allow flexibility for future adjustments.

A municipal water system can be divided into three main categories: 1) supply and treatment facilities, 2) storage facilities, and 3) the distribution system.

- **Supply and Treatment Facilities** include all equipment necessary to supply, pump and treat the amounts of water demanded by the system. For Dayton, it is proposed to consider only groundwater supply sources. The supply facilities thus include the wells, pumps, pump houses, controls, raw water transmission mains, water treatment facilities, and all related appurtenances.

- The **Storage Facilities** are the elevated tanks and ground storage reservoirs used throughout the system to store water for usage during emergency and peak conditions. Water from storage is fed into the system either by gravity or by pumping through a booster station.

- The **Distribution System** is made up of the trunk water mains (primarily 12 inches or larger in diameter), lateral water mains (6 to 8 inches in diameter), service pipes, valves, hydrants, and all appurtenances necessary to convey water from the supply sources and reservoirs to the points of demand. Since the lateral water mains are normally routed along residential streets within a development, it is impossible to predict with any degree of accuracy where future laterals will be placed in undeveloped areas. These lines are excluded from consideration in analyzing the distribution system hydraulics.

2. Population and Water Demands

2.1 General

This section of the Plan develops the performance criteria under which the water system will be evaluated and/or designed. This involves an evaluation of land use, population growth and trends, and estimates of per capita water consumption, including daily and seasonal peaks.

2.2 Design Period

The determination of future system needs is based on conditions projected to occur through the full "build-out" of the City, with special focus on the years 2010, 2020, and 2030. The year 2006 through year 2010 time period is considered to be short enough in duration that any departure from projected assumptions should be minor and will not impact the timing of the recommendations proposed during this time. The 2020 and 2030 time periods serve as a basis for planning major capital improvements where the need may not be imminent (such as storage tanks, and possible water treatment facilities), but the financing will require advanced planning.

This Plan should be revisited and updated as necessary to ensure that the system implementation is keeping pace with development, and conversely, that the forecasted growth assumptions are still valid. A period of four to six years should be appropriate to allow the refinement of the planning and water use information contained herein.

2.3 Planning Area

An important step in the development of a Plan is the identification of a service or planning area to accommodate the projected growth over the design period. Since the City is interested in developing an approach towards "build-out", the planning area is defined to include the entire City boundary.

2.4 Land Use and Population

This Plan is based on the City's Comprehensive Plan, which was completed in 2001 and updated in November 2005. A Concept Guide Plan Map is included in Appendix E. The household and population forecasts are based on the projected land uses within the study areas and the City's Growth Management Policy, which limits the number of building permits the City of Dayton will issue each year to 2010. A summary of the land use within the Planning Area is shown on Table 1. Developable acres are exclusive of areas such as trunk highway right-of-way (ROW), National Wetlands Inventory (NWI), and flood zones and flood fringe.

Table 1. Developable Land Use Summary

Land Use Type	Area (acres)
Estate	393
Low Density Residential	5,887
Moderate Density Residential	543
High Density Residential	365
Total Residential	***7,189***
Commercial/Industrial	1,142
Recreational/Public	1,082*
Undevelopable	2,817
Total Non-Residential	***5,041***
Total	**12,229**

Includes redevelopment of existing residential areas to their guided densities. Does not include Southeast Dayton.
* Does not include Elm Creek Park Reserve.

Population is a very dynamic parameter--difficult to estimate with a high level of accuracy. An added complication is that water studies are focused primarily on the population served, or will be served, by the City's water system. This can be different than a City's total population. Water use is affected by many factors such as land use, water rates, climate, soil conditions, and socio-economic trends. It is, however, associated with population more than any other parameter. Once a population, and it's associated per capita water consumption rate, is determined for a community, future water demands can be projected.

Water supply facilities, such as wells and treatment plants, can be designed in a way that expansion to meet increasing needs can be easily accommodated. Storage capacity may also be phased into a system to keep pace with changing demands. Trunk water mains, whose life may exceed 100 years, cannot be economically increased in size once they are constructed and the costs assessed. Therefore, it is essential that an accurate estimate be made of ultimate population that the trunk water main system will be expected to serve. As a water system is expanded, it is essential that the mains be sized and constructed to serve the ultimate planning area.

2.4.1 Background

The City of Dayton is located in northern Hennepin County about 20 miles north and west of Minneapolis/St. Paul. The City has many natural amenities, most notably the Elm Creek Park Reserve, several lakes, and the Mississippi River, which bounds the City on the north. These amenities will serve to attract people to the City. In addition, the City is served by the I-94 artery, which connects the metropolitan area to the northwest part of the state.

2.4.2 Growth Trends

Dayton's population has increased from approximately 2,600 in 1970 to about 5,000 today. The City is expecting continued growth. Existing water service has been limited to the *Historic Village* and the *Nature's Crossing* development, the latter of which is served by the City of Champlin. The remainder of the City obtains water from private wells.

Sewer service has been limited in Dayton to the *Historic Village*, the *Nature's Crossing* development, and about 50 homes on the north side of Diamond Lake, which are connected with the City of Rogers wastewater treatment facility. The planned completion of the Metropolitan Council Environmental Services Dayton-Champlin and Elm Creek Interceptor sewers will allow municipal utility services to be extended to areas not currently served, and likely fuel demand for growth.

Growth in Dayton will also be affected by the growth potential of its neighboring communities. Several neighbors are able to accommodate additional growth. Some communities may see diminished growth as they approach build-out, and new developments may bypass them in favor of available land in adjacent communities.

2.4.3 Population Forecast

Population forecasts are the estimates of future growth. They are the basis for planning of public utilities and services including sewers, water, roads, parks, schools, etc. While they are useful for these purposes, they are based on variables such as trends, assumptions, and informed judgment. They become more artful as they are projected further into the future. As a result, 5 to 10 year forecasts are more reliable than 20 to 30 year forecasts. Nevertheless, if plans are updated periodically, they can be adjusted to account for changing conditions.

Dayton's 2006 population is estimated as 5,000, but only 310 are thought to be served by water. Growth through 2010 is limited by the City's Growth Management Policy. Although this policy does not extend beyond 2010, this Plan assumes that an average of 300 building permits per year would be issued between 2010 and 2030. The population projections assume that significant redevelopment will occur where parcel sizes are presently one (1) acre to ten (10) acres, such that ultimate development densities will correspond to the Concept Guide Plan.

The ultimate population projection was developed by multiplying the developable acres for each residential land use (as shown in Table 1) by the appropriate factors in Table 2. The overall units/acre (density) established for Dayton by Metropolitan Council is 2.95 units/acre. These figures, units/acre and persons/dwelling, were obtained from established references.

Table 2. Ultimate Population

Land Use Type	Area (acres)	Units/Acre	Persons/ Dwelling	Population (rounded)
Estate	393	0.1	3.0	120
Low Density Residential	5,887	2.3	3.0	40,630
Moderate Density Residential	543	6.0	2.5	8,150
High Density Residential	365	12.0	2.0	8,760
Total	***7,188***	***2.95***	***2.7***	***57,660***

The facilities described in this plan are designed to serve an ultimate population of 57,660 at full build-out of the ultimate study area. Actual growth rates will affect only the timing of construction and not the actual design of the system. Table 3 summarizes the service population projections used for this study. The notes below the table describe how the estimates were developed.

Table 3. Service Population Projections

Year	Estimated Served Population
2005	310
2010	3,300*
2020	12,300**
2030	21,300
Full Build-Out	57,660

* 2010 Connections: Historic Village (200) + NE Dayton (500) + Annually Approved (50 x 6) = 1,000. Total = 1,000 Connections X 3 people/connection = 3,000 + 310 = 3,310.
** 300 building permits/year X 3 people/permit X 10 years = 9,000. Total added population = 9,000.

2.5 Projected Water Use

Projected water use is based on forecast population, land use, and estimates of per capita or per acre consumption. Each of the land use categories was examined. Consideration was given to population density, acreage, and other activities likely to occur compatible with the projected land usage. Average day demand rates were then developed for each land use type and are shown in Table 4.

Table 4. Ultimate Average Day Demand

Land Use Type	Population	Acres	Gallons/ Capita/ Day	Average Day, Gal
Estate	120	393	90	11,000
Low Density Residential	40,630	5,887	90	3,657,000
Med/High Density Residential	16,910	1,296	80	1,353,000
Commercial/Industrial	-	1,142	1500 gpd/ac	1,713,000
Park/Public Facility	-	541	1000 gpd/ac	541,000
Commercial Recreation	-	541	500 gpd/ac	270,000
Total		**9,800**		***7,545,000***

The **average day demand** is the basis for estimating maximum day and maximum hour demands. The average day demand is also used to estimate future revenues and operating costs such as power and chemical requirements. These items are determined primarily by the total annual water requirements rather than by daily or hourly rates of usage.

2.6 Variations in Water Usage

The rate of water consumption varies over a wide range during different periods of the year and different hours of the day. Several characteristic demand periods are recognized as being critical factors in the design and operation of a water system. These demand rates are expressed in million gallons per day (MGD), which in the case of a daily demand indicates the total amount of water pumped in a 24 hour period. Hourly rates can also be expressed in terms of million gallons per day. For hourly rates, the rate in MGD is determined by assuming that the hourly demand would continue at the indicated rate for 24 hours.

The **maximum day demand** is the critical factor in the design of certain elements of the waterworks system, and is frequently 2 – 3 times the average day demand. The primary facilities affected by the maximum day demand are:

- Water supply facilities
- Treatment plant capacity
- Treated water storage requirements

Water supply facilities must be adequate to supply water to meet the maximum day demand, and water treatment facilities must be capable of processing a majority of the water supplied. Sufficient water storage should be provided to meet hourly demands in excess of the water supply capacity. The installed capacities should also include reserves for residential growth, business and industrial development and fire protection.

The highest peak demands on the water system are usually encountered for short periods of time, typically on days of maximum consumption. These short period demands are referred to as instantaneous or peak hour demands. They seldom extend over a period of more than three or four hours, generally during hot summer evenings when the sprinkling load is the highest.

The **peak hour** consumption rates impose critical demands on the distribution system and major elements of the waterworks facilities. They must be designed to meet these demands and provide satisfactory service at all times. Peak hour rates are often estimated to be twice the maximum day rate.

Peak hour demands in Dayton will be supplied through a combination of water from the well pumps and water drawn from storage reservoirs on the distribution system. Although the rate of consumption is high during periods of peak hourly demands, the duration of the extreme rate is relatively short. Therefore, a moderate quantity of water withdrawn from storage reservoirs strategically located on the system assures satisfactory service, minimizes the total peak hour pumping and transmission main capacity required, and permits more uniform and economical operation of wells and booster facilities. Storage on the system is also an important factor in insuring reliability of service during emergencies resulting from power failure, from temporary outages of water supply facilities, and from sudden and unusual demands brought about by fires or line breaks.

The **seasonal variation** in winter and summer water production rates can be attributed to "discretionary" water use. This includes such things as lawn and garden irrigation, car washing, and other recreational use. Understanding discretionary use can be useful when targeting water conservation efforts and estimating capacity to supply non-discretionary demands.

Projected average and maximum day water demands for various time horizons in the City of Dayton are presented in Table 5. As noted, the maximum day water demands are used for the sizing of supply facilities. A record of actual maximum and average day demands should be charted to aid in the sizing and phasing of future facilities. The maximum day demands at build-out of the 2030 and Ultimate study areas are estimated to be 7.5 MGD and 19.3 MGD, respectively. The per-capita demands in the ultimate system decrease due to the assumption that the City develops and successfully implements a water conservation plan.

Table 5. Projected Water Demands

Year Ending	Served Population	Per Capita Demand (gpcd)	Average Day Demand (MGD)	Max Day Per Capita Demand (gpcd)	Maximum Day Demand (MGD)
2005	310	71	0.02	265	0.082
2010	3,300	145	0.5	350	1.1
2020	12,300	140	1.7	350	4.3
2030	21,300	135	2.9	340	7.2
Ultimate Build-Out	57,660	132	7.6	335	19.3

2.7 Fire Demand

Water requirements for fire demand are also a vital consideration in the design of a water supply and distribution system. Fire demand varies greatly from normal usage in that an extremely large quantity of water is required from a concentrated demand point in a very short time period. While the quantity of water used for fires is almost negligible compared to other usage categories, the extremely high usage during an emergency situation frequently governs distribution system design.

The Insurance Services Office (ISO) recommends that a system the size of Dayton's be capable of delivering fire flows of 1,000 gpm to 3,500 gpm for varying durations depending on the demand. For example, commercial and industrial properties that implement fire suppression sprinkling systems require less fire flow than without. In this case, 2,000 gpm is generally considered sufficient for these land uses. Table 6 shows the recommended fire flows used in the design of the Dayton water system. These are based on data from ISO and other sources. Although sprinkling systems lower fire flow demands, a conservative approach is to use the high end of the range.

Table 6. Recommended Fire Flows

Land Use	Required Fire Flow (gpm)	Duration (hrs)
Commercial/Industrial	3,500	3
Institutional/Public	3,500	3
Two Family Residential	1,500	2
Single Family Residential	1,000	2

3. Existing Facilities

3.1 Water Supply

General

The Twin Cities Metropolitan Area is underlain by bedrock formations that are capable of yielding large volumes of water. These formations were deposited in a trough centered below the Seven County Metropolitan Area, forming the Twin City Artesian Basin. The area also includes numerous smaller glacial drift aquifers.

The Twin City Artesian Basin contains a total of seven aquifers: The Mt. Simon, Ironton-Galesville, Franconia, Jordan, Prairie du Chien, and St. Peter. The upper aquifers (St. Peter and Prairie du Chien) have been completely removed by erosion in Dayton. Remnants or "outliers" of the Jordan are present in Dayton, but they are generally less than 50 ft thick and form a minor aquifer.

The Ironton-Galesville and Franconia aquifers are treated as a single aquifer system, and wells may be completed through all three formations. Across much of the Twin Cities Metropolitan area, the Franconia-Ironton-Galesville (FIG) is a minor aquifer system. High yields are possible from this aquifer system in northern Hennepin County and adjacent areas of Anoka County. The Mt. Simon Aquifer is also capable of yielding large quantities, but current Minnesota Statutes limit the use of the Mt. Simon aquifer in the Twin Cities Metropolitan Area to potable uses in locations where no other water source is capable of producing sufficient yields of acceptable quality.

Where the full thickness of the FIG aquifer can be developed, well capacities can be greater than 1000 gallons per minute (gpm) in this area, but well yields are variable. Typical peak well yields in this area are in the range of 700 gpm to 1,200 gpm.

The City of Dayton presently obtains its water supply from a deep well (Historic Village Well No. 1) in the FIG aquifer system with a capacity of 300 gpm. Pressure in the water distribution system is provided by a hydro-pneumatic tank with a capacity of nearly 2,000 gallons. The facility includes chemical feed equipment that provides chlorination and fluoridation. Polyphosphates are added to control iron and manganese.

Well Water Quality/Treatment

The U.S. Environmental Protection Agency (EPA) has established national drinking water standards. These standards contain federally enforceable maximum contaminant level (MCL) standards for substances known to be hazardous to public health.

Water quality parameters are defined and regulated by two sets of standards – Primary and Secondary. Primary Standards are set for those substances known to be a hazard to public health. Secondary Standards are set for those substances that, although not hazardous to public health, frequently cause drinking water to have objectionable aesthetic qualities, such as taste and odor.

Water quality test results on Dayton's raw water may be found in Appendix B. The test results indicate that the raw water exceeds the secondary (aesthetic) standards for iron and manganese. While existing levels of iron and manganese do not pose a health problem, they can present problems with aesthetics (appearance and taste) and system maintenance, cause staining of laundry and fixtures, clogging of meters and services, as well as other deleterious effects. The levels or iron and manganese found are indicative of wells in the area.

Polyphosphates are added to the water in an attempt to sequester the dissolved iron and manganese to prevent their oxidation. Polyphosphates do not remove the iron and manganese from the water, but attempt to hold them in this temporary, non-reactive condition, helping them to pass through the system without their deleterious effects on the systems and services.

Dayton's raw water is also treated with fluoride and chlorine prior to entering the distribution system. The water quality at the wells and in the distribution system is tested periodically to ensure that water quality is within the Primary Standards. Appendix G should be updated as new water quality requirements are promulgated.

3.2 Storage

Water storage facilities serve several purposes in a water system, including capacity to meet peak demands that exceed the capacity of the supply facilities. They also help to maintain constant system pressure, and provide for smooth pumping operation by minimizing the amount of starting and stopping otherwise to keep up with varying customer demands.

Currently, the only storage is the 2,000 gallon pneumatic tank. Existing and proposed water storage locations are shown on the Water Supply and Distribution Map (Figure 1) at the back of this report.

3.3 Distribution System

The existing distribution system consists of a few lateral distribution mains consisting of ductile iron pipe (DIP). The source of water for the distribution system is the Historic Village Well pumping facility.

3.4 Hydraulic Analysis

A hydraulic analysis of Dayton's ultimate water supply and trunk distribution system was conducted using computer modeling software. The results of this model are discussed in more detail in the following section. Given its limited size, computer modeling of the existing system was not deemed beneficial.

3.5 Limitations of Existing Facilities

The Recommended Standards for Water Works (Ten States Standards) place several limitations on hydro-pneumatic systems. Systems should serve no more than 150 units; the minimum tank size should be 10 times well capacity; and well capacity should be 10 times average day demand. Therefore, with a 2,000 gallon tank, the well pump should be 200 gpm or less, and corresponding average day demand should be less than 28,800 gpd. Estimates from the 2001 Historic Village Water Supply Plan projected 2005 to have 200 units, or 50,000 gpd average day demand.

4. Proposed Facilities

4.1 Supply-Storage Considerations

Supply capacity, storage volume, and distribution system capacity are interrelated. Tanks act as additional supply sources during peak periods when the primary supply source is unable to meet the demand. Thus, the storage serves to stabilize peaks in water demand and allows the system to produce water at a lower, more uniform and typically less expensive rate.

Ideally, the distribution system should be capable of carrying the flows from both the supply sources and the tanks without allowing operating pressures to drop below 40 psi or rise above 100 psi. Static pressure should be within a range of 50 psi to 90 psi. Static pressure is defined as the pressure available at the street when all the tanks are full and no one is using water. The pressure must not drop below 20 psi during fires or other emergencies. The system must also be capable of conveying water from the supply source to storage tanks without requiring the development of excessively high pumping heads, resulting in unacceptably high pressures in the system during low usage periods.

There are an infinite number of combinations of supply and storage that can be used to meet peak water demands. An efficient, economical system can be determined through an analysis of supply and storage costs.

For the vast majority of communities, the ideal combination of supply and storage is found when the supply equals *100% of the maximum day demand*. This is consistent with the recommendations in both Recommended Standards for Water Works by Great Lakes Upper Mississippi River Board, and American Water Works Manual of Practice M32 - Distribution Network Analysis for Water Utilities. The City of Dayton supply demand is 19.3 MGD, which is 100% of the maximum day demand for the ultimate population of 57,660 persons (at full build-out of the Ultimate study area).

The amount of storage required for Dayton's water system is estimated to *be 100% of the average day demand,* as recommended by the *Ten States Standards.* The City of Dayton storage capacity is established as 7.6 MG, or 100% of the average day demand for the ultimate population of 57,660 persons (*at full build-out of the Ultimate study area*).

For maximum system reliability and efficiency, supply and storage should be considered separately where there are multiple service areas. Two service areas are planned for the Dayton system, a High Service Area in SW Dayton and a Low Service Area in NE/NW Dayton. It is inefficient to pump water to a high elevation (such as the High Zone) and let the water flow down to lower pressure zones through pressure reducing valves. The cost to pump is high and the cost of pressure reducing systems is high.

Also, pressure reducing valves are high maintenance items and subject to failure. Therefore, it is generally not desirable to rely on a pressure reducing valve system as a major component of a supply source for an area. For these reasons, we have analyzed supply and storage requirements for each zone independently. The resulting supply and minimum storage requirements for the Ultimate system are shown in Table 7.

Table 7. Ultimate System Supply and Storage Requirements

Service Area	Max Day Demand (MGD)	Supply (MGD)		Storage (MG)
		Dayton	Maple Grove	
Southwest Dayton	9.5	4.5	5.0	3.8
North Dayton	9.8	9.8	-	3.9
Total	19.3	14.3	5.0	7.6

Water storage tanks are typically constructed in standard sizes to avoid additional costs associated with custom tank sizes. For that reason, minimum storage requirements within a pressure zone are typically exceeded and rounded up to the next common tank size.

4.2 Hydraulic Analysis

The Dayton water system was analyzed in detail using a hydraulic computer model, WaterCAD. The model describes the entire system, including wells, pumps, tanks, and distribution mains. The model employs two standard methods for water system analysis, the Hazen-Williams energy loss formula and the Hardy Cross procedure. The Hardy Cross procedure balances both flows and energy losses throughout the entire system.

Input for the computer model includes pipe sizes and lengths, point supplies and demands, storage tank characteristics, pump performance curves and ground elevations. The model computes output for various times of the day based and creates a demand curve. These results include pipe flows and velocities, energy losses, pressures at each demand point, pumping rates, and storage tank levels.

Analysis of this computerize output facilitates the design of an economical and adequate water system. Results of this analysis and recommendations for improvements are presented later in this report.

4.3 Raw Water Supply

Wells Required

A total firm production capacity of 19.3 MGD is required to meet the demand conditions in Dayton at build-out of the Ultimate study area. Of this amount, 5.0 MGD will be supplied by Maple Grove, leaving a net of 14.3 MGD (approx 9,800 gpm). This represents 100% of the ultimate system's maximum day demand. Firm well capacity is defined as the pumping capacity available with the largest well out of service. For added reliability in large systems, firm capacity is further defined by reserving one out of every ten wells (using 2, one for each system) as a back-up well. Because Dayton has two systems, a back-up well is recommended for each system. Providing a firm capacity equal to the maximum day demand will result in improved system reliability by enhancing performance during the tank-filling periods, and particularly in the event of an emergency such as a fire. Peak demands will be supplied by storage on the system.

Two well fields, and two interconnections with the City of Maple Grove water system are planned for the Ultimate service area, and these are shown in Figure 1. The North Well Field consists of the existing and proposed wells north of Diamond Lake Rd. S. The proposed wells south of 125th Ave N comprise the South Well Field. Potential water sources and aquifer yield characteristics were identified in the Water Supply Investigation (see Appendix C) which consisted of the Well Field Investigation and Maple Grove Water Supply Investigation. Well sites will need to be acquired by the City. Cost estimates found in Appendix D contain projections for well site acquisition costs.

Wells in the Franconia-Ironton-Galesville (FIG) aquifer system are expected to yield between 700 gpm and 1,200 gpm. The potential yield of a well may be influenced by the number and proximity of other high capacity wells as well as by physical characteristics. Based on the knowledge gained by constructing the well serving the Historic Village, we have estimated the capacity of a typical municipal well in North Dayton will be approximately 850 gpm once the well fields are fully developed. The long-term sustainability of producing the projected ultimate demand from the FIG aquifer is uncertain, however. The potential yield of the aquifer system should be re-evaluated once pumping data are available from future wells. We have estimated that the capacity of a typical municipal well in southwest Dayton will be approximately 1,050 gpm, due in part to fewer wells located within the aquifer and the potential for drift wells in the area.

Appendix B (Well Data) and Appendix C (Well Field Investigation) provide background information related to the well field analysis and recommendations.

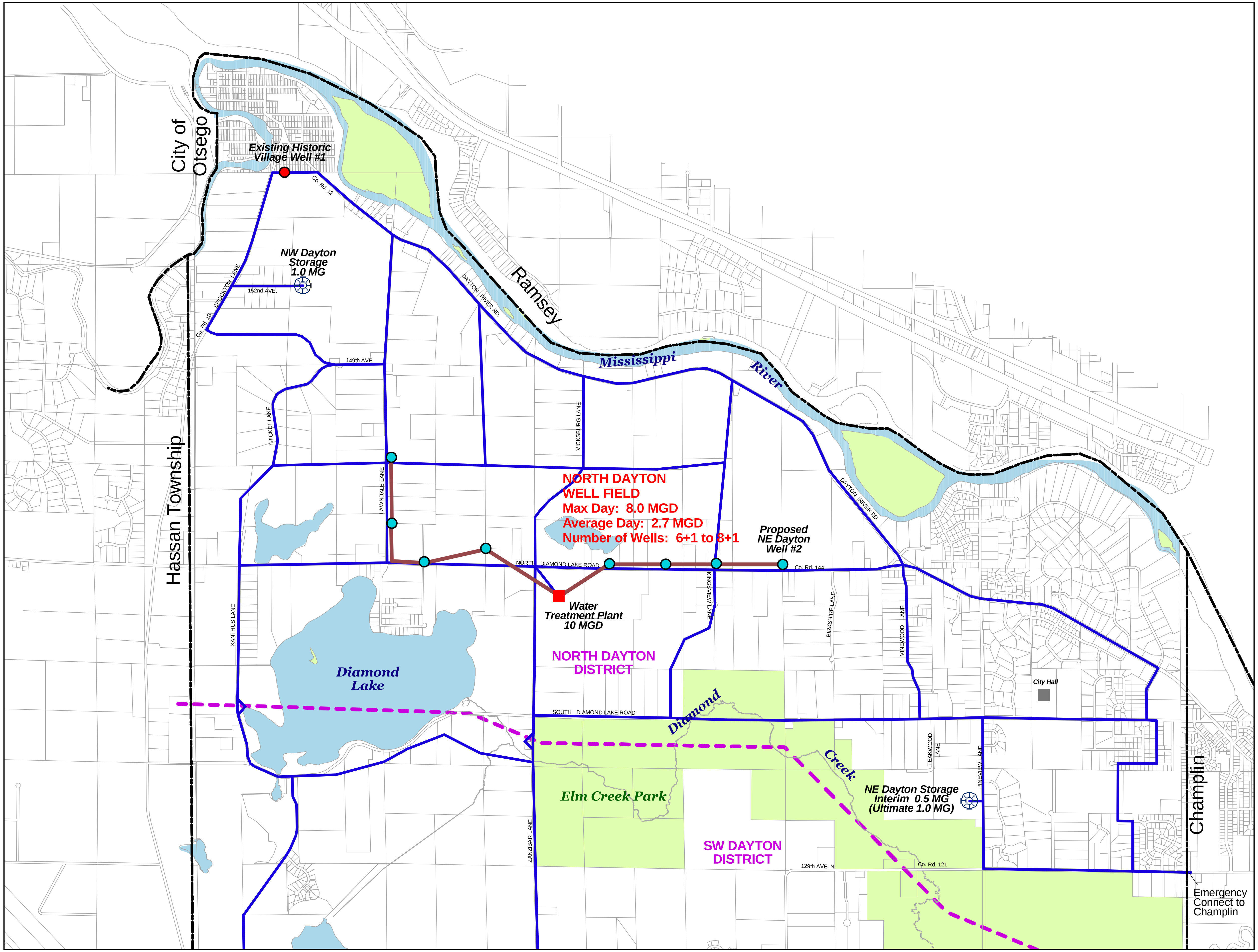
North Well Field

The North Well Field will serve NE/NW Dayton, the Low Zone. At saturation development, the total required firm capacity is 6,800 gpm (9.8 MGD).

<u>North Well Field</u>

Required Firm Capacity	6,800 gpm
Existing Firm Capacity *(Historic Village Well)*	300 gpm
Required Additional Capacity	6,800 gpm
At 850 gpm	**8 wells + 1 standby well**

The Well Field Study investigated the potential yield and the required spacing between wells. Possible future well locations are presented in Figure 2a on the following page.



City of
DAYTON

PROPOSED NORTH WELL FIELD

Figure 2a

- Existing Well
- Future Well
- Treatment Plant
- Water Tank
- Water Pipes
- Trunk Watermain Not Treated
- Pressure Zone Boundary
- City Boundary
- Parcel Base Map

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February 2007

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

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South Well Field and Maple Grove Connections

The proposed connections with the City of Maple Grove water distribution system will serve southwest Dayton, the High Zone, with up to the 2.8 MGD average day demand, and 5.0 MGD (3,470 gpm) maximum day demand currently, as allowed in the contract with the City. At saturation development, the total required firm capacity is 6,600 gpm (9.5 MGD) to the High Zone.

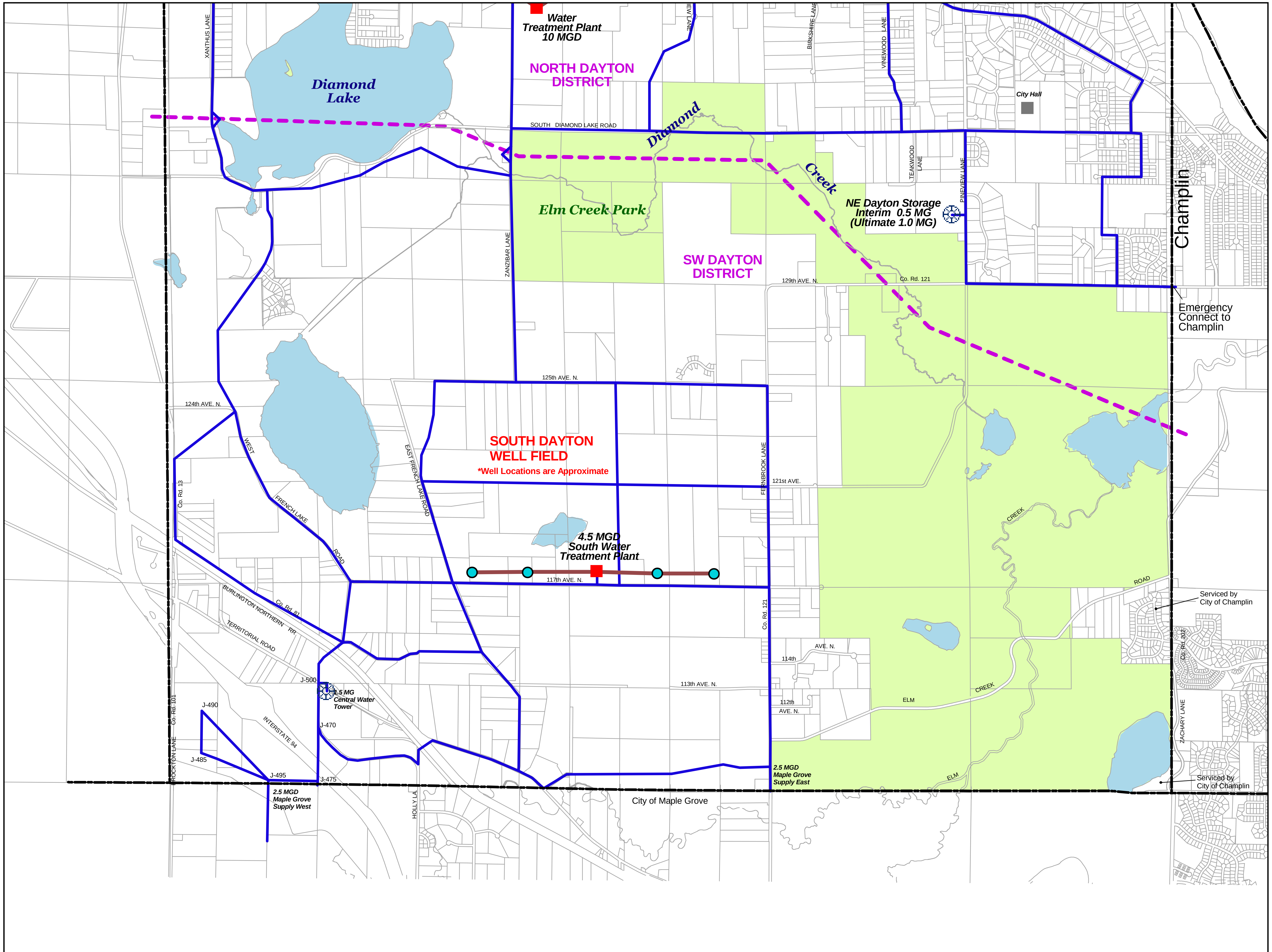
South Well Field

Required Firm Capacity	6,600 gpm peak day
Supply Capacity from Maple Grove	3,470 gpm peak day
Required Additional Capacity	3,130 gpm
At 1,050 gpm	**3 wells + 1 standby well**

The Well Field Study investigated the potential yield and the required spacing between wells. Possible future well locations are presented in Figure 2b on the following page.

Water Supply Strategies

- Review and approve the contract for water service between the City of Maple Grove and the City of Dayton to serve Southwest Dayton.
- Finalize the well location in Northeast Dayton and the emerging water connection with the City of Champlin.
- Plan for acquisition of sites for potential wells, storage facilities, water treatment sites, and easements required to connect these facilities to the water system.
- Monitor water quality and consumer complaints to screen out problems with high iron and manganese concentrations and insure compliance with drinking water quality standards.
- Enforce the Water Conservation Plan and review it annually for updates.
- In the future review the need for a Water Treatment Feasibility Report.
- Complete the proposed connections with the City of Maple Grove water distribution system.
- Acquire well sites either before or in conjunction with development of adjacent areas.
- Construct new wells according to the phasing detailed in this report.



City of
DAYTON

PROPOSED SOUTH WELL FIELD

Figure 2b

- Existing Well
- Future Well
- Treatment Plant
- Water Tank
- Water Pipes
- Trunk Watermain Not Treated
- Pressure Zone Boundary
- City Boundary
- Parcel Base Map

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February 2007

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

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4.4 Water Treatment

The City of Dayton currently obtains its raw water supply from a single deep well completed in the Franconia-Ironton-Galesville (FIG) aquifer system. The area of service of this water supply is restricted to the Historic Village in the northwestern part of the City. The Nature's Crossing development in the southeastern part of the City is served by the City of Champlin water and sanitary sewer systems. Water obtained from the Historic Village well is considered to be safe from pathogenic or disease-causing organisms.

The iron concentration in the Historic Village well was measured at 0.55 mg/L. The manganese concentration in the well was measured at 0.14 mg/L. Iron and manganese precipitates from the water and accumulates in the distribution system, particularly in areas of low demands. When demand increases, or when the system is interrupted for some reason, red and black water problems can occur--causing stains in laundry and plumbing fixtures. If this occurs, customer complaints can be minimized by frequent flushing and cleaning lines in problem areas.

If public complaints and/or high maintenance costs warrant, iron and manganese treatment may become necessary. Although a detailed analysis of the treatment alternatives is beyond the scope of this report, the following paragraphs describe some factors to consider

Iron and manganese may be removed at a water treatment plant. Removal could be accomplished at two water treatment plants—one at each well field. It is anticipated that these treatment facilities would be added after the water system has begun development. The North treatment facility would be completed first because SW Dayton will initially receive treated water from Maple Grove.

For this report, water mains were sized under the assumption that all future wells in the North Well Field will eventually pump to a future water treatment plant, located roughly ½ mile east of the intersection of Diamond Lake Road N and Zanzibar Lane. The water treatment plant will pump water to the entire Low Zone. It was also planned that all wells in the South Well Field will ultimately pump to a South Water Treatment Plant. Pumps in the water treatment plant would supply water to the High Zone to supplement the Maple Grove supply. Figure 1 in the map pocket at the back of the report shows the proposed locations for the water treatment plants.

An alternative method for controlling iron and manganese is to add polyphosphates to the water in the distribution system. Polyphosphates are added to the water at the well pump house with injection equipment. Polyphosphates keep the iron in suspension so that it does not settle out in the system. Unfortunately, polyphosphates are substantially less effective in keeping manganese in suspension in the distribution system. Also, the polyphosphates remain in the water through the wastewater treatment process and eventually become a source of nutrients in the Mississippi River.

Dayton's water is also considered hard, with a measured hardness of 210 mg/L. Installation of an iron and manganese removal plant will not reduce the level of hardness in Dayton's water. However, existing softeners owned by the residents and businesses of Dayton will operate more efficiently since iron and manganese commonly foul softener media, causing short softening cycles.

Water Treatment Strategy

To address future water treatment needs, the City should consider doing a Treatment Feasibility Study to determine the need for treatment. The study should be put off until at least the NE Dayton well has been drilled and in service for a couple of years. In the meantime, the City should begin to identify preferred sites in both the North and South Well Fields for potential water treatment plants. Future water treatment plant sites should be a minimum of five acres in size for an iron and manganese treatment facility. More area may be required if the City wishes to reserve space for expansion to provide softening or treatment for potential future contaminants.

4.5 Storage

The proposed storage sites for the Dayton water distribution system are shown on the Ultimate Trunk Water System Map (Figure 1) at the back of this report. A total of 7.6 million gallons (MG) of storage at 3 to 5 sites is planned. The amount of storage required may be increased or reduced depending on population, water usage patterns, and conservation measures.

The most important considerations in the selection of the type of storage facilities are safety, reliability, ease of operation, and maintenance cost. A gravity-fed type of storage facility, either elevated or ground, provides a safe and reliable source of water, is easy to operate, and allows for smooth operation of pump controls. The potential exists for locating ground storage at water treatment plant sites.

A total effective storage volume of 7.6 million gallons is proposed at 3 elevated tank sites and 2 treatment sites (North Dayton and South Dayton) assuming Dayton develops in accordance with its Comprehensive Plan.

This study recommends the following locations for storage reservoirs:

Site	Capacity (MG)	Comments
Southwest Elevated Tank	1.50	
SW Water Treatment Ground Storage or Storage Tank in Maple Grove	2.25	
Northeast Elevated Tank	0.5*	Pineview Lane adjacent to Elm Creek Park
	1**	
Northwest Elevated Tank	1.00	Along 152nd Avenue midway between Brockton Lane and Lawndale Lane
North Water Treatment Plant Ground Storage	1.85	
Total	**7.60**	

* Interim
** Ultimate

The ultimate storage required to service North and Southwest Dayton will be dependent on the supply needed to serve the ultimate development. In accordance with Dayton's Comprehensive Plan and the ultimate water demand estimate in this report, that total is 7.6 MGD.

For purposes of this report it is assumed 4.1 MG of additional storage will be provided at the proposed future water treatment plants. If water treatment is not provided and growth occurs as identified in Dayton's Comprehensive Plan, additional storage should be provided at or near proposed treatment plant locations. As stated previously, these decisions can be addressed in the future, depending on Dayton's growth and whether treatment is provided or not.

Development should be reviewed periodically to ensure that adequate storage is constructed prior to development. For example, due to existing land uses in Northeast Dayton, it is proposed 0.5 MG storage be provided at this time. In the future, dependent on many factors, additional storage could be provided at other locations or could be increased at the Pineview location if justified. Phasing of elevated water reservoir construction is discussed in more detail later in this report.

A lower number of tanks offers reduced maintenance costs and the advantage of economies of scale associated with construction costs for larger tanks. When considering a potential water reservoir site, a clear space of 400 feet by 400 feet (or larger) should be available to allow adequate room for construction staging and paint containment. Once a reservoir has been constructed, a parcel 250 feet by 250 feet (62,500 square feet) is generally considered acceptable. It allows for future maintenance activities such as repainting and rehabilitation. Storage costs, including site costs, are included in Appendix D. These were estimated based on a 62,500 square foot lot. For that size parcel, the estimated cost is $150,000 per parcel. Construction easements could be obtained for the remaining area needed for tank construction.

4.6 Distribution System

General

The proposed distribution system for the City of Dayton is presented on the Water Supply and Distribution Map (Figure 1) at the back of this report. The system covers the entire City and reflects changes to previous reports and layouts.

The distribution system analysis was performed with the concept that there will ultimately be two well fields and potentially two water treatment plants for the City of Dayton. The sites of the water treatment plants have not yet been finalized, but preliminary sites are shown on the map. A backbone network of trunk water mains will extend in every direction from these sites. Major water mains connect the storage tanks and will be looped throughout the system, providing reliable service.

Two pressure zones are recommended because there is significant topographic relief within the City, and the system in SW Dayton will operate at the same high water level (HWL) as the Maple Grove system, Also, it is desirable to provide a static pressure range of 50 psi to 90 psi (pounds per square inch) for the maximum demand day. As stated earlier, static pressure is defined as the pressure available at street level when all the tanks are full and no one is using water. A static water pressure map is provided in Appendix E.

Homes with a static pressure of greater than 80 psi should be required to install individual pressure reducing valves. Homes with a static water pressure less than 50 psi may desire in-home booster stations. Without a booster pump, a minimum static pressure of 40 psi is necessary for the operation of automatic sprinkler systems. As discussed, under emergency conditions, pressures must be maintained above 20 psi.

The high water levels for the two service areas are as follows:

High Zone (SW Dayton District)	1,110 ft
Low Zone (North Dayton District)	1,060 ft

Pressure reducing valves (PRVs) will be needed between the pressure zones for redundancy and to provide supplementary fire flows to the lower zone. All PRVs should be set so they do not open under normal pressure fluctuations.

Hydraulic Analysis

Hydraulic analysis of the distribution system was performed by a computer program. The program computed flows and residual pressures which were then analyzed to locate problem areas. Water main sizes, storage tank characteristics, and pump controls were then revised and the program was run again until the problem was corrected. Analyses of both the 2020 and Ultimate study areas were conducted.

The time simulation computer analysis was used to design and analyze the performance of the ultimate water system during the maximum demand day. The alternatives that were evaluated during multiple computer runs can be grouped into three categories:

1. Changes in size and location of the projected elevated tanks
2. Changes in diameter of the proposed water mains
3. Addition of new water mains

After evaluating the different alternatives, the selected best option was a trade-off among the following parameters:

1. Tank Operation: Includes minimum level, ending level, and total operation time for each tank.
2. High Pressure Nodes: Identify high pressure nodes during low demand (tank-filling) periods.
3. Low Pressure Nodes: Identify low pressure nodes during high demand periods.
4. High Head Loss Lines: Find pipes with unusually high head loss per thousand feet that need to be replaced, paralleled, or redesigned.
5. Fire Flows: Make sure that all nodes in the distribution system are able to get sufficient fire flows while maintaining a minimum residual pressure of 20 psi.

For the ultimate system shown on the Ultimate Trunk Water System Map (Figure 1) at the back of the report, the lowest pressures do not drop below 35 psi (immediately after peak hour demand) and the highest pressures do not rise above 100 psi (overnight, during tank filling conditions). The maximum head loss is less than 10 ft/1000 ft. These results are discussed in more detail in the following sections.

With few exceptions, all areas are able to meet or exceed the following fire flow recommendations while maintaining adequate residual pressures:

Area	Fire Flow (gpm)
Single Residential	1,000
Two Family Residential	1,500
Commercial/Industrial	3,500

4.7 Water System Phasing

The projected population served by the Dayton water system at build-out of the 2020 and Ultimate study areas is 12,300 and 57,660, respectively. Based on the projected population growth, the timing of additions to the supply and storage facilities were estimated and are presented in Table 11. These additions will keep pace with the increasing needs of the community and at the same time maintain a desirable balance between storage and supply for economy and reliability. If growth rates deviate significantly from the City's forecasts, if a major water consumer is added to the system, or if conservation measures produce an outcome different than anticipated, the phasing schedule of Table 11 should be revised in accordance with the latest available data.

5. Economic Analysis

5.1 Cost Estimates

One of the objectives of this report is to determine the cost of constructing Dayton's water supply and distribution system. The cost estimates presented in this report were based on current construction costs. They can be correlated to the value of the ENR (Engineering News Record) Index for Construction Costs of approximately 7880 (December 2006). Future changes in this index are anticipated to reflect cost changes in the proposed facilities. During interim periods, between full evaluation of projected costs, capital recovery policies and procedures can be linked to this index. The estimated cost to construct Dayton's Trunk Distribution System, including treatment is included in Appendix D and summarized in Table 8.

Table 8. Dayton Trunk Infrastructure Cost Summary

System Component	North Dayton	SW Dayton	Total
Supply*	$ 7,035,000	$ 3,660,000	$10,695,000
Storage	$ 4,500,000	$ 3,300,000	$7,800,000
Maple Grove Area Charge	$ -	$11,555,000	$11,555,000
Distribution	$ 10,729,000	$13,907,000	$24,636,000
Lateral Benefit	($ 7,416,000)	($10,197,000)	($17,613,000)
Subtotal	$ 14,848,000	$22,225,000	$37,073,000
Treatment	$ 16,078,000	$ 8,927,000	$25,005,000
Total Ultimate System Cost	$ 30,926,000	$32,152,000	$62,078,000

* does not include treatment costs

Southwest (SW) Dayton is to be served by Maple Grove. The contract between Dayton and Maple Grove provides for Dayton paying area/connection charges to Maple Grove for water supply, treatment, storage, and over sizing of trunk mains in Maple Grove. Therefore, the cost estimate to construct Dayton's water supply and distribution system must include costs paid to Maple Grove. The Contract for Water Service between the City of Maple Grove and Dayton is included in Appendix F. The estimated cost to Maple Grove based on maximum day demand is summarized in Table 9 in accordance with the Contract for Water Service between Maple Grove/Dayton.

Table 9. Maple Grove Cost Summary

Land Use Type	Acres / Units	Residential Equivalent Unit	# REU's	2006 Rate	Charge
Low Density and Med / High Density w/ Laundry	3,848 units 1,304 acres	1.0/unit	3,848	$ 1,700 / unit	$ 6,542,000
Med / High Density w/ out Laundry	1,314 units 445 acres	.8/unit	1,051	$ 1,360 / unit	$ 1,429,000
Commercial / Industrial	495 acres	4.0/acre	1,980	$ 6,800 / acre	$ 3,366,000
Recreation / Public Facility	257 acres	0.5/acre	128	$ 850 / acre	$ 218,000
Institutional	0	4.0/acre	0	$ 6,800 / acre	$ 0
Total	2,501 acres		7,007		$ 11,555,000

The contract states Maple Grove will provide treated water to Southwest Dayton up to the 2.8 MGD average day demand (5.0 MGD maximum day demand). Ultimate build-out of southwest Dayton is expected to result in an estimated 3.75 MGD average day demand (9.5 MGD maximum day demand). As a result, Dayton may have to supplement Maple Grove's water supply to serve all Southwest Dayton if it fully develops beyond what Maple Grove can serve. The source of the supply to supplement Maple Grove's supply in Dayton will likely be either screened wells drilled into the glacial drift or bedrock wells drawing from the Franconia-Ironton-Galesville (FIG) formation.

The Contract for Water Service between Maple Grove/Dayton does not include an ultimate cost to Maple Grove. However, it does include the approximate number of acres (4,000 acres) and number of REU's (12,200) for all of SW Dayton expected to be served by Maple Grove. Summarized below in Table 10 is the water demand, acres served, and REU's noted in the contract between Maple Grove/Dayton. Also noted is the ultimate demand and supplement demand Dayton may have to provide if it fully develops in accordance with 2001 Comprehensive Plan.

Table 10. Water Demands SW Dayton

	Maple Grove Contract	SW Dayton Supplement	SW Dayton Ultimate
Average Day Demand	2.8 MGD	0.95 MGD	3.75 MGD
Maximum Day Demand	5.0 MGD	4.5 MGD	9.5 MGD
Number Acres	4,000 acres		4,904 acres
Number of REU's	12,200 REU's		13,735 REU's

It is recommended that the supplemental supply in SW Dayton provide a water quality consistent with the Maple Grove supply. The water drawn from both the drift and FIG in SW Dayton will likely contain iron and/or manganese. However, it is not known at this time if levels will be high enough to warrant treatment of the supplemental water supply in SW Dayton. In North Dayton, treatment of the source water will be a decision made based on the community's perception of the aesthetic quality of the water, significant desire to improve the aesthetic quality, and the willingness to pay for treatment. For purposes of this plan, treatment costs have been included in Table 8.

5.2 Recommended Trunk Water System Improvements

It is anticipated that growth of the water system will continue at a steady rate. A capital improvement program for the City of Dayton's water supply and storage system through 2020 is presented in Table 11. The table includes: (1) an estimate of when facilities will be added, (2) what the improvements are, and (3) the Engineer's Estimate of probable cost in 2006 dollars.

Table 11. Capital Improvement Plan

	Improvement	**Estimated Cost** (Excluding Lateral Benefit)
2006	1 Connection Maple Grove	$700,000
	Meter Manhole Instrumentation	30,000
	12″ Main SW Dayton	$0
	16″ Main SW Dayton	$22,000
	18″ Main SW Dayton	$57,000
	24″ Main SW Dayton	$119,000
2007	Well and Pump House No. 2 NE Dayton	$775,000
	0.5 MG Storage NE Dayton	$2,250,000
	12″ Main NE Dayton	$587,000
	16″ Main NE Dayton	$134,000
2008	12″ Main SW Dayton	$0
	20″ Main SW Dayton	$127,000
	Well and Pump House No. 3 NW Dayton	$775,000
2009 - 2010	12″ Main SW Dayton	$106,000
	16″ Main SW Dayton	$21,000
	12″ Main NE Dayton	$35,000
	12″ Main NW Dayton	$101,000
	14″ Main NW Dayton	$181,000
	Meter Manhole Instrumentation	$30,000
	1.0 MG Storage NW Dayton	$2,250,000
2010 – 2015	Well and Pump House No. 4 NE Dayton	$800,000
	12″ Main NW Dayton	$142,000
	12″ Main NE Dayton	$113,000
	12″ Main SW Dayton	$170,000
	18″ Main SW Dayton	$132,000
	20″ Main SW Dayton	143,000
	1.5 MG Storage SW Dayton	$3,300,000
2015 – 2020	12″ Main NW Dayton	$360,000
	12″ Main SW Dayton	$313,000
	16″ Main SW Dayton	$187,000
	Well and Pump House No. 5 NW Dayton	$775,000
	TOTAL	**$14,735,000**

5.3 Water System Charges

It is common practice in the Metro Area to establish a policy of paying for capital improvements with a combination of area and/or connection charges. Implementing an area charge allows the City to assess property to be developed and developing property a portion of the trunk facility costs, allowing the City to construct and pay for infrastructure improvements before the demand is actually experienced. The remainder of the cost is then assessed as connection charges, to be collected when the units actually connect to the system. The "area charge" is based on gross benefited area, and can be assessed at the time of developer plat approval. Connection charges can be assessed at the time of hook-up and can be used to finance the remaining capital cost, as well as the meter cost. These charges should be reviewed and adjusted annually, applying the ENR construction cost index or another recognized cost index.

5.4 Lateral Benefit / Trunk Oversize

Lateral benefit is the portion of the cost of a trunk water main that would normally be paid for by the developer. It is proposed that any development in Dayton should pay for an 8 inch water main to serve low and medium density residential development, and a 12-inch main to serve commercial, industrial, and high density residential development. If any of these mains are designated for oversizing by the Ultimate Trunk Water System Map (Figure 1), the City would then pay for only the additional cost of the larger pipe.

For watermain that is not installed by a developer, it is assumed that the adjacent / benefited properties be assessed for lateral size (8-inch for residential; 12-inch for commercial-industrial) based on a front foot rate. The City's responsibility would then be the project cost minus the assessment.

5.5 Revenue Per Area/Connection Charges

Table 12 below summarizes residential equivalent units (REU's) for North and Southwest Dayton in accordance with Dayton's Land Use included in its 2001 Comprehensive Plan and Maple Grove's Water Contract. In accordance with Metropolitan Council density requirements for Dayton, the average number of residential units/acres is 2.95.

Table 12. Residential Equivalent Units

		Southwest		North			
	REU's	Acres/ Units	No. REU's	Acres/ Units	No. REU's	Acres/ Units	No. REU's
Residential							
Low Density Medium/High Density w/Laundry	1.0	7,531 units 2,552 ac.	7531	9,625 units 3,262 ac.	9,625	17,156 units 5,814 ac.	17,156
Medium/High Density w/o Laundry	0.8	2,580 units 875 ac.	2,064	1,243 units 421 ac.	994	3,823 units 1,296 ac.	3,058
Commercial/Industrial	4.0/ac.	972 ac.	3,888	170 ac.	680	1,142 ac.	4,568
Recreational/Public	0.5/ac.	505 ac.	252	557 ac.	278	1,062 ac.	530
Institutional	4.0/ac.	---	---	---	---	---	---
Total		**4,904 acres**	**13,735**	**4,410 ac.**	**11,577**	**9,314 ac.**	**25,262**

The City will need to collect area and/or connection charges in order to pay for the anticipated water system infrastructure costs. Table 13 below summarizes the connection charge per REU's with and without treatment for SW and North Dayton. Also noted is the Maple Grove connection charge per REU in SW Dayton in accordance with the Contract.

Table 13. Connection Charges

	SW Dayton	North Dayton	Total
No. REU's	13,735 REU's	11,577 REU's	25,312 REU's
Infrastructure Cost w/o Treatment	$10,670,000*	$14,848,000	$25,518,000
Cost/REU's w/o Treatment	$776/REU	$1,283/REU	$1,008/REU
Cost/REU Maple Grove	$1,700/REU	NA	NA
Treatment	$8,927,000	$16,078,000	
Cost/REU's For Treatment	$649/REU	$1,389/REU	
Total	$3,125/REU	$2,672/REU	

* Does not include cost to Maple Grove as estimated in Table 8 ($11,555,000)

The City will need to review whether to charge a separate connection charge for SW and North Dayton, and whether it should include costs for future treatment or a percentage of treatment. In addition, the ultimate cost to Maple Grove shall be reviewed as Dayton begins to develop its supplement and trunk water mains/storage for SW Dayton. Table 14 below summarizes the connection charge only for SW Dayton for trunk water mains/storage and supply/treatment in Dayton.

Table 14. SW Dayton Connection Charges

	Project Cost	REU's	Connection Charge/REU
Trunk Mains	$3,710,000		
Storage	$3,300,000		
Subtotal	$7,010,000	13,735	$510/REU
Supply	$3,660,000	13,735	$266/REU
Treatment	$8,927,000	13,735	$649/REU
Total			$1,425/REU
Maple Grove (MG)			$1,700/REU
Total w/MG			$3,125/REU

One suggested option for establishing area/connection charges is for SW Dayton and North Dayton to be different based on the fact treated water is supplied to SW Dayton. In addition, because it's not known to what extent Dayton will need to supplement Maple Grove's water supply, trunk mains and storage in Dayton shall be added to Maple Grove's charges. Summarized below in Table 15 are the estimated charges rounded up to the nearest $100 based on the above approach. As noted, the recommended cost/REU for North Dayton is $1,600, which is the same cost/REU proposed for the NE Dayton Areas 1 – 6 Project.

Table 15. Option 1 –Connection Charges w/o Treatment

North Dayton			
Item	**Project Cost**	**Number REU's**	**Cost/REU**
Distribution/Supply/Storage	$14,847,000	11,527	$1,300
Total North Dayton			**$1,300**
Recommended			**$1,600**
SW Dayton			
Item	**Project Cost**	**Number REU's**	**Cost/REU**
Maple Grove	$11,555,000	7,007	$1,700
Dayton Distribution/Supply/Storage	$7,010,000	13,735	$600
Total SW Dayton			**$2,300/REU**

If future treatment costs in Dayton were to be included based on different percentages for North/ SW Dayton, the charges noted below in Table 16 would result.

Table 16. Treatment Connection Charges – Percentages

Treatment – 100%	**Project Cost**	**Number REU's**	**Cost/REU**
North Dayton	$16,078,000	11,527	$1,400
SW Dayton	8,927,000	13,735	700
Total 100% Treatment	**$25,005,000**	**25,262**	**$1,000**

5.6 Implementation

The City shall review and develop a process to assess/collect lateral benefit, area charges and connection charges presented in this chapter. Once the process is developed, the area/connection charges can be adjusted annually to account for changes in the ENR index of construction costs.

City officials shall review the overall approach and determine if a different charge for North and Southwest Dayton is justified. The fact that the water supply from Maple Grove is treated to serve SW Dayton, while the water supply to serve North Dayton is not, provides justification for North Dayton connection/area charges being less than the Southwest area. In addition, the City will need to determine to what extent future treatment costs if treatment is provided in the future should be included in area/connection charges established at this time. Lastly, the City shall review and determine the area/connection charges to be added to the Maple Grove charges for trunk mains, storage, and supply in SW Dayton. Option 1 suggested in this report is one approach. However, other approaches are feasible dependent on policy established by City officials.

Relative to Southeast Dayton, this area is small and is completely served by the City of Champlin. All trunk costs (supply, storage, treatment, trunk mains) will be provided by the City of Champlin. Therefore, it is assumed for purposes of this report that Champlin charges be implemented to serve Southeast Dayton.

Appendix A

Emergency and Conservation Plan

February 1, 2007

DNR Waters
Water Permit Programs Supervisor
500 Lafayette Road
St. Paul, MN 55155-4032

Re: Emergency & Conservation Plan
Dayton, Minnesota
Bonestroo File 174-05121-1

To Whom It May Concern:

Transmitted herewith is the Emergency and Conservation Plan on behalf of the City of Dayton. This plan will be included as part of the City of Dayton's 2008 Comprehensive Plan Update.

If you have any questions please contact Rick Hass (763) 427-4589 at the City of Dayton, or myself at 651-604-4843.

Respectfully submitted,

BONESTROO, ROSENE, ANDERLIK & ASSOCIATES, INC.

Mark Hanson, P.E.

Cc: Rick Hass, Sandy Borders, Samantha Orduno – City of Dayton
Metropolitan Council
390 N Robert St.
St. Paul, MN 55101

DEPARTMENT OF NATURAL RESOURCES - DIVISION OF WATERS and METROPOLITAN COUNCIL
WATER EMERGENCY AND CONSERVATION PLANS

These guidelines are divided into four parts. The first three parts, Water Supply System Description and Evaluation, Emergency Response Procedures and Water Conservation Planning apply statewide. Part IV, relates to comprehensive plan requirements that apply only to communities in the Seven-County Twin Cities Metropolitan Area. If you have questions regarding water emergency and conservation plans, please call (651) 259-5703 or (651) 259-5647 or e-mail your question to wateruse@dnr.state.mn.us. Metro Communities can also direct questions to the Metropolitan Council at watersupply@metc.state.mn.us or (651) 602-1066.

DNR Water Appropriation Permit Number(s)	016076
Name of Water Supplier	City of Dayton
Address	16471 South Diamond Lake Rd, 55327
Contact Person	Rick Haas
Title	Public Works
Phone Number	(763) 427-3224
E-Mail Address	rhass@ci.dayton.mn.us

PART I. WATER SUPPLY SYSTEM DESCRIPTION AND EVALUATION

The first step in any water supply analysis is to assess the current status of demand and supplies. Information in Part I, can be used in the development of Emergency Response Procedures and Conservation Plans.

A. ANALYSIS OF WATER DEMAND.

Fill in Table 1 for the past 10 years water demand. If your customer categories are different than the ones listed in Table 1, please note the changes below.

TABLE 1 Historic Water Demand*

Year	Total Population	Population Served	Total Connections	Residential Water Sold (MG)	C/I/I Water Sold (MG)	Wholesale Deliveries (MG)	Total Water Sold (MG)	Total Water Pumped (MG)	Percent Unmetered/ Unaccounted	Average Demand (MGD)	Maximum Demand (MGD)	Residential gallons/ capita/day	Total gallons/ capita/day
**2001	4705	200	75		0	0		2.8***	0		0.056		
2002	4877	250	100		0	0		6.9	0	0.0189	0.063		75.6
2003	4911	275	110		0	0		7.9	0	0.021	0.073		78.7
2004	4963	292	117	5.91	.192	0	6.10	7.6	19.7	0.021	0.079	57.2	71.3
2005	4,990	310	124	5.92	.27	0	6.19	8.196	24.5	0.022	0.082	54.7	72.4

MG – Million Gallons **MGD** – Million Gallons per Day **C/I/I**- Commercial, Industrial, Institutional

* Data was not available for all categories listed, and was left blank for those considered inaccurate.
**2001 is the first year that the municipal water system was in use, and thus the first year that data is available.
***Data is from a partial year of municipal use.

Residential. Water used for normal household purposes, such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens.

Institutional. Hospitals, nursing homes, day care centers, and other facilities that use water for essential domestic requirements. This includes public facilities and public metered uses. You may want to maintain separate institutional water use records for emergency planning and allocation purposes.

Commercial. Water used by motels, hotels, restaurants, office buildings, commercial facilities, both civilian and military.

Industrial. Water used for thermoelectric power (electric utility generation) and other industrial uses such as steel, chemical and allied products, food processing, paper and allied products, mining, and petroleum refining.

Wholesale Deliveries. Bulk water sales to other public water suppliers.

Unaccounted. Unaccounted for water is the volume of water withdrawn from all sources minus the volume sold.

Residential Gallons per Capita per Day = total residential sales in gallons/population served/365 days

Total Gallons per Capita per Day = total water withdrawals/population served/365 days

NOTE: Non-essential water uses defined by Minnesota Statutes 103G.291, include lawn sprinkling, vehicle washing, golf course and park irrigation and other non-essential uses. Some of the above categories also include non-essential uses of water

Water Use Trends. Discuss factors that influence trends in water demand (i.e. growth, weather, industry, conservation). If appropriate, include a discussion of other factors that affect daily water use, such as use by non-resident commuter employees or large water consuming industry.
The rate of water consumption will vary from year to year, seasonally, and during different hours of the day. Several characteristic demand periods are recognized as being critical factors in the design and operation of a water system. The maximum demands upon the water system are encountered during short periods of time, usually on days of maximum consumption. These short period demands are referred to as hourly demands, and they seldom extend over a period of more than three or four hours, generally during hot summer evenings when lawn sprinkling load is the highest. Because the majority of demand on the system is from residential customers, seasonal fluctuations in water demand are influenced primarily by variations in lawn sprinkling. Growth in the number of service connections is anticipated, which will result in an overall trend toward increases in the annual water demand. Inter-annual climate variations also influence annual water usage. For example, the total volume of water pumped in 2004 was 0.32 MG less than the volume pumped in 2003. This difference can be attributed primarily to differences between the two years in climate and soil moisture during the growing season.

TABLE 2 Large Volume Users - List the top 10 largest users.

Customer	Gallons per year	% of total annual use
18130 Robinson	235,000	3.8
18380 Columbus Street	83,000	1.34
18240 Robinson	77,000	1.24
18190 Robinson Circle	76,000	1.22
18500 Bates Street	66,000	1.07
18520 Robinson Street	59,000	0.95
18620 Bates	53,000	0.9
16421 Division	52,000	0.8
18271 Johnson Street	51,000	0.8
18250 Dayton River Road	47,000	0.76

B. TREATMENT AND STORAGE CAPACITY.

TABLE 3(A) Water Treatment

Water Treatment Plant Capacity	432,000 Gallons per day
Describe the treatment process used (ie, softening, chlorination, fluoridation, Fe/Mn removal, reverse osmosis, coagulation, sedimentation, filtration, others). Also, describe the annual amount and method of disposal of treatment residuals, if any.	
Pressure in the water distribution system is provided by a hydro-pneumatic tank with a water capacity of nearly 2,000 gallons. The facility includes chemical feed equipment that provides chlorination and fluoridation. Polyphosphates are added to control iron and manganese.	

**TABLE 3(B) Storage Capacity - **List all storage structures and capacities.

Total Storage Capacity		**Average Day Demand** (average of last 5 years)
2,000 Gallons		18,000 Gallons per day
Type of Structure	Number of Structures	Gallons
Elevated Storage		
Ground Storage		
Other: Hydro-pneumatic	1	2,000

C. **WATER SOURCES.** List all groundwater, surface water and interconnections that supply water to the system. Add or delete lines to the tables as needed.

TABLE 4(A) Total Water Source Capacity for System (excluding emergency connections)

Total Capacity of Sources	300 Gallons per minute
Firm Capacity (largest pump out of service)	0 Gallons per minute

TABLE 4(B) Groundwater Sources - Copies of water well records and well maintenance information should be included with the public water supplier's copy of the plan in Attachment . If there are more wells than space provided or multiple well fields, please use the List of Wells template (see Resources) and include as Attachment .

Well # or name	Unique Well Number	Year Installed	Well & Casing Depth (ft)	Well Diameter (in)	Capacity (GPM)	Geologic Unit	Status
1	611054	2001	385 / 190	16	300	CFRNCIGL	Active

Status: Active use, Emergency, Standby, Seasonal, Peak use, etc. GPM – Gallons per Minute
Geologic Unit: Name of formation(s), which supplies water to the well

TABLE 4(C) Surface Water Sources

Intake ID	**Resource name**	**Capacity (GPM/MGD)**
	--N/A	

GPM – Gallons per Minute MGD – Million Gallons per Day

TABLE 4(D) Wholesale or Retail Interconnections - List interconnections with neighboring suppliers that are used to supply water on a **regular basis** either wholesale or retail.

Water Supply System	**Capacity (GPM/MGD)**	**Wholesale or retail**
City of Maple Grove- proposed connection in Sumer 2007 to provide water to SW Dayton	2.8 MGD (average day)	Wholesale

GPM – Gallons per Minute MGD – Million Gallons per Day

* The City of Champlin currently serves about 80 homes in the Native's Crossing development in the City of Dayton. However, this area and Dayton's water system are not connected.

TABLE 4(E) Emergency Interconnections - List interconnections with neighboring suppliers or private sources that can be used to supply water on an emergency or occasional basis. Suppliers that serve less than 3,300 people can leave this section blank, but must provide this information in Section II C.

Water Supply System	Capacity (GPM/MGD)	Note any limitations on use
--N/A		

GPM – Gallons per Minute MGD – Million Gallons per Day

D. DEMAND PROJECTIONS.

TABLE 5 Ten Year Demand Projections

Year	Population Served	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Projected Demand (MGY)
2006	900	0.1	0.28	42
2007	1500	0.2	0.48	77
2008	2100	0.3	0.68	112
2009	2700	0.4	0.88	147
2010	3300	0.5	1.1	182
2011	4200	0..6	1.42	226
2012	5100	0.7	1.74	270
2013	6000	0.86	2.06	314
2014	6900	0.98	2.38	358
2015	7800	1.1	2.7	402

MGD – Million Gallons per Day MGY – Million Gallons per Year

Projection Method. Describe how projections were made, (assumptions for per capita, per household, per acre or other methods used).

The average day water demand projections are based on land use, assumptions of population density for land use types, and per capita or per acre water demands. Six land-use types were used to calculate the demand projections.

Land Use Type	People Per Acre	Gallons Per Capita Per Day (gpcd)
Low Density	6	90
Medium Density	10	80
High Density	15	80
		Gallons Per Acre Per Day
Commercial/Industrial		1500
Park/Public Facility		1000
Estate		25

Land use was derived from the City of Dayton Comprehensive Plan. A multiplier of 3 was used to calculate maximum day demand from average day demand for residential areas, and a multiplier of 1.5 was used for commercial/Industrial and park/public facilities land uses.

E. RESOURCE SUSTAINABILITY

Sustainable water use: use of water to provide for the needs of society, now and in the future, without unacceptable social, economic, or environmental consequences.

Monitoring. Records of water levels should be maintained for all production wells and source water reservoirs/basins. Water level readings should be taken monthly for a production well or observation well that is representative of the wells completed in each water source formation. **If water levels are not currently measured each year, a monitoring plan that includes a schedule for water level readings must be submitted as Attachment .**

TABLE 6 Monitoring Wells - List all wells being measured.

Unique well number	Type of well (production, observation)	Frequency of Measurement (daily, monthly etc.)	Method of Measurement (steel tape, SCADA etc.)
611054	Production	--	

Water Level Data. Summarize water level data including seasonal and long-term trends for each ground and/or surface water source. If water levels are not measured and recorded on a routine basis then provide the static water level (SWL) when the well was constructed and a current water level measurement for each production well. Also include all water level data taken during well and pump maintenance.
Static Water Level when pump was installed (3/2001): 49 ft There are no DNR or U. S. G. S. monitoring wells in the CFRN and/or CIGL formations within several miles of the City of Dayton. **Attachment : Provide monitoring data (graph or table) for as many years as possible.**

Ground Water Level Monitoring – DNR Waters in conjunction with federal and local units of government maintain and measure approximately 750 observation wells around the state. Ground water level data are available online www.dnr.state.mn.us/waters. Information is also available by contacting the Ground Water Level Monitoring Manager, DNR Waters, 500 Lafayette Road, St. Paul, MN 55155-4032 or call (651) 259-5700.

Natural Resource Impacts. Indicate any natural resource features such as calcareous fens, wetlands, trout streams, rivers or surface water basins that are or could be influenced by water withdrawals from municipal production wells. Also indicate if resource protection thresholds have been established and if mitigation measures or management plans have been developed.
The aquifer from which the City of Dayton system draws its water is well confined and not

directly connected with any surface water features. Water from the aquifer is discharged to the Mississippi River via leakage into the overlying Quaternary aquifer(s). Withdrawals from the aquifer are not anticipated to have a significant or detrimental impact on flows in the Mississippi River. No resource protection thresholds have been established.

Sustainability. Evaluate the adequacy of the resource to sustain current and projected demands. Describe any modeling conducted to determine impacts of projected demands on the resource.
The City undertook an aquifer availability study in 2005. The study indicated that the Franconia-Ironton-Galesville aquifer is present throughout most of the City in its entire thickness, with yields expected to range between 700-1200 gpm per well. In addition, buried drift aquifers and the Jordan aquifer may also be available in certain areas for municipal water supply wells. Based on the current predictions, the aquifer availability and the estimated sustainable yield appear to be high enough to meet the 2030 demands. Further study may be needed to determine the productivity and sustainability of the aquifers to meet the ultimate demands.

Source Water Protection Plans. The emergency procedures in this plan are intended to comply with the contingency plan provisions required in the Minnesota Department of Health's (MDH) Wellhead Protection (WHP) Plan and Surface Water Protection (SWP) Plan.	
Date WHP Plan Adopted:	Part 1 approved by MDH in October 2005 Part 2 in progress
Date for Next WHP Update:	
SWP Plan:	☒ In Process ☐ Completed ☐ Not Applicable

F. CAPITAL IMPROVEMENT PLAN (CIP)

Adequacy of Water Supply System. Are water supply installations, treatment facilities and distribution systems adequate to sustain current and projected demands? ☐ Yes ☒ No If no, describe any potential capital improvements over the next ten years and state the reasons for the proposed changes (CIP Attachment 2).
The existing hydro-pneumatic system that serves the Historic Village development in NW Dayton is near capacity (based on recommendations from the Ten State Standards). In addition, the Historic Village system does not have a back-up well. Additional development in NW Dayton will require an additional well and elevated storage. A well and elevated storage tank is required to provide water service to the existing homes in NE Dayton that are currently being served by residential wells. An emergency connection to Champlin will delay the need for a back-up well in NE Dayton. Water service to proposed development in SW Dayton will be provided by Maple Grove. A connection is planned to be completed in the summer of 2006. A second connection to Maple Grove will be provided and looped through Dayton as SW Dayton develops. Additional wells, storage and distribution pipes are added with development. The attached CIP assumes that development occurs in accordance with Dayton's Comprehensive Plan.

Proposed Water Sources. Does your current CIP include the addition of new wells or intakes? ☒ Yes ☐ No If yes, list the number of new installations and projected water demands from each for the next ten years. Plans for new production wells must include the geologic source formation, well location, and proposed pumping capacity.
Three new wells are planned to be constructed in the Franconia-Ironton-Galesville aquifer system in the northern part of the City by the year 2015 to meet the demand projections shown in Table 5. The expected well capacity is 850 gpm. Actual capacity may vary based on local aquifer characteristics.

Water Source Alternatives. If new water sources are being proposed, describe alternative sources that were considered and any possibilities of joint efforts with neighboring communities for development of supplies.
An interconnection with the City of Maple Grove water system to serve the southwestern portion of the City of Dayton is planned for 2006. The capacity of this interconnection is expected to be 2.8 MGD (average day). An emergency connection with the City of Champlin water system is also planned.

Preventative Maintenance. Long-term preventative programs and measures will help reduce the risk of emergency situations. Identify sections of the system that are prone to failure due to age, materials or other problems. This information should be used to prioritize capital improvements, preventative maintenance, and to determine the types of materials (pipes, valves, couplings, etc.) to have in stock to reduce repair time.
The existing system was constructed in 2001, and no parts of the system are expected to be prone to failure due to age, materials or other problems.

PART II. EMERGENCY RESPONSE PROCECURES

Water emergencies can occur as a result of vandalism, sabotage, accidental contamination, mechanical problems, power failures, drought, flooding, and other natural disasters. The purpose of emergency planning is to develop emergency response procedures and to identify actions needed to improve emergency preparedness. In the case of a municipality, these procedures should be in support of, and part of, an all-hazard emergency operations plan. If your community already has written procedures dealing with water emergencies we recommend that you use these guidelines to review and update existing procedures and water supply protection measures.

Federal Emergency Response Plan

Section 1433(b) of the Safe Drinking Water Act as amended by the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (Public Law 107-188, Title IV – Drinking Water Security and Safety) requires community water suppliers serving over 3,300 people to prepare an Emergency Response Plan. **Community water suppliers that have completed the Federal Emergency Response Plan and submitted the required certification to the U.S. Environmental Protection Agency have satisfied Part II, Sections A, B, and C of these guidelines and need only provide the information below regarding the emergency response plan and source water protection plan and complete Sections D (Allocation and Demand Reduction Procedures), and E (Enforcement).**

Provide the following information regarding your completed Federal Emergency Response Plan:

Emergency Response Plan	Contact Person	Contact Number
Emergency Response Lead	Rick Hass	612-790-5540
Alternate Emergency Response Lead	Victor Martinez	612-750-1887
Emergency Response Plan Certification Date		

Operational Contingency Plan. An operational contingency plan that describes measures to be taken for water supply mainline breaks and other common system failures as well as routine maintenance is recommended for all utilities. Check here ☒ if the utility has an operational contingency plan. At a minimum a contact list for contractors and supplies should be included in a water emergency telephone list.

The Emergency Phone List and Operational Contingency Plan are not included in the agency review copy for privacy reasons.

Communities that have completed Federal Emergency Response Plans should skip to Section D.

EMERGENCY RESPONSE PROCEDURES

A. Emergency Telephone List. A telephone list of emergency contacts must be included as Attachment 1 to the plan (complete template or use your own list). The list should include key utility and community personnel, contacts in adjacent communities, and appropriate local, state and federal emergency contacts. Please be sure to verify and update the contacts on the emergency telephone list on a regular basis (once each year recommended). In the case of a municipality, this information should be contained in a notification and warning standard operating procedure maintained by the warning point for that community. Responsibilities and services for each contact should be defined.

B. Current Water Sources and Service Area. Quick access to concise and detailed information on water sources, water treatment, and the distribution system may be needed in an emergency. System operation, water well and maintenance records should be maintained in a central secured location so that the records are accessible for emergency purposes and preventative maintenance. A detailed map of the system showing the treatment plants, water sources, storage facilities, supply lines, interconnections, and other information that would be useful in an emergency should also be readily available. Check here ☒ if these records and maps exist and staff can access the documents in the event of an emergency.

C. Procedure for Augmenting Water Supplies. List all available sources of water that can be used to augment or replace existing sources in an emergency. In the case of a municipality, this information should be contained in a notification and warning standard operating procedure maintained by the warning point for that community. Copies of cooperative agreements should be maintained with your copy of the plan and include in Attachment . Be sure to include information on any physical or chemical problems that may limit interconnections to other sources of water. Approvals from the MN Department of Health are required for interconnections and reuse of water.

TABLE 7 (A) Public Water Supply Systems – List interconnections with other public water supply systems that can supply water in an emergency.

Water Supply System	Capacity (GPM/MGD)	Note any limitations on use
--N/A		

GPM – Gallons per Minute MGD – Million Gallons per Day

TABLE 7 (B) - Private Water Sources – List other sources of water available in an emergency.

Name	Capacity (GPM/MGD)	Note any limitations on use
Water Trucks from either Ramsey, Champlin, Maple Grove or Otsego		

GPM – Gallons per Minute MGD – Million Gallons per Day

D. Allocation and Demand Reduction Procedures. The plan must include procedures to address gradual decreases in water supply as well as emergencies and the sudden loss of water due to line breaks, power failures, sabotage, etc. During periods of limited water supplies public water suppliers are required to allocate water based on the priorities established in Minnesota Statutes 103G.261.

Water Use Priorities (Minnesota Statutes 103G.261)

First Priority. Domestic water supply, excluding industrial and commercial uses of municipal water supply, and use for power production that meets contingency requirements.

NOTE: Domestic use is defined (MN Rules 6115.0630, Subp. 9), as use for general household purposes for human needs such as cooking, cleaning, drinking, washing, and waste disposal, and uses for on-farm livestock watering excluding commercial livestock operations which use more than 10,000 gallons per day or one million gallons per year.

Second Priority. Water uses involving consumption of less than 10,000 gallons per day.

Third Priority. Agricultural irrigation and processing of agricultural products.

Fourth Priority. Power production in excess of the use provided for in the contingency plan under first priority.

Fifth Priority. Uses, other than agricultural irrigation, processing of agricultural products, and power production.

Sixth Priority. Non-essential uses. These uses are defined by Minnesota Statutes 103G.291 as lawn sprinkling, vehicle washing, golf course and park irrigation, and other non-essential uses.

List the statutory water use priorities along with any local priorities (hospitals, nursing homes, etc.) in Table 8. Water used for human needs at hospitals, nursing homes and similar types of facilities should be designated as a high priority to be maintained in an emergency. Local allocation priorities will need to address water used for human needs at other types of facilities such as hotels, office buildings, and manufacturing plants. The volume of water and other types of water uses at these facilities must be carefully considered. After reviewing the data, common sense should dictate local allocation priorities to protect domestic requirements over certain types of economic needs. In Table 8, list the priority ranking, average day demand and demand reduction potential for each customer category (modify customer categories if necessary).

Table 8 Water Use Priorities

Customer Category	Allocation Priority	Average Day Demand (GPD)	Demand Reduction Potential (GPD)
Residential	1	16,300	0
Institutional	1	475	0
Commercial	2	265	265
Industrial	2	0	0
Irrigation	3	0	0
Non-essential	6	5,500	5,500 (38,000 Peak Day)
	TOTALS	22,540	5,765

GPD – Gallons per Day

Demand Reduction Potential. The demand reduction potential for residential use will typically be the base demand during the winter months when water use for non-essential uses such as lawn watering do not occur. The difference between summer and winter demands typically defines the demand reduction that can be achieved by eliminating non-essential uses. In extreme emergency situations lower priority water uses must be restricted or eliminated to protect first priority domestic water requirements. Short-term demand reduction potential should be based on average day demands for customer categories within each priority class.

Triggers for Allocation and Demand Reduction Actions. Triggering levels must be defined for implementing emergency responses, including supply augmentation, demand reduction, and water allocation. Examples of triggers include: water demand >100% of storage, water level in well(s) below a certain elevation, treatment capacity reduced 10% etc. Each trigger should have a quantifiable indicator and actions can have multiple stages such as mild, moderate and severe responses. Check each trigger below that is used for implementing emergency responses and for each trigger indicate the actions to be taken at various levels or stages of severity in Table 9.

- ☒ Water Demand
- ☐ Treatment Capacity
- ☐ Storage Capacity
- ☐ Groundwater Levels
- ☐ Surface Water Flows or Levels
- ☐ Pump, Booster Station or Well Out of Service
- ☒ Governor's Executive Order – Critical Water Deficiency (required by statute)
- ☐ Water Main Break
- ☐ Loss of Production
- ☐ Security Breach
- ☒ Contamination
- ☐ Other (list in Table 9)

Table 9 Demand Reduction Procedures

Condition	Trigger(s)	Actions
Stage 1 (Mild)	Demand 90% of well capacity	Odd/Even Sprinkling Ban
Stage 2 (Moderate)	Demand 98% of well capacity	Total Sprinkling Ban
Stage 3 (Severe)	Demand 100% of firm well capacity	Eliminate 6th priority allocation. Eliminate 5th to 2nd priority allocation if demand of 100% of firm capacity continues after elimination of 6th priority allocation.
Critical Water Deficiency (M.S. 103G.291)	Executive Order by Governor & as provided in above triggers	Stage 1: Restrict lawn watering, vehicle washing, golf course and park irrigation and other nonessential uses Stage 2: Suspend lawn watering, vehicle washing, golf course and park irrigation and other nonessential uses

Note: The potential for water availability problems during the onset of a drought are almost impossible to predict. Significant increases in demand should be balanced with preventative measures to conserve supplies in the event of prolonged drought conditions.

Notification Procedures. List methods that will be used to inform customers regarding conservation requests, water use restrictions, and suspensions. Customers should be aware of emergency procedures and responses that they may need to implement.
Notice may be given as deemed appropriate by the Mayor and City Council and may include newspaper articles, radio, and television.

E. Enforcement. Minnesota Statutes require public water supply authorities to adopt and enforce water conservation restrictions during periods of critical water shortages.

Public Water Supply Appropriation During Deficiency. **Minnesota Statutes 103G.291, Subdivision 1.**
Declaration and conservation. (a) If the governor determines and declares by executive order that there is a critical water deficiency, public water supply authorities appropriating water must adopt and enforce water conservation restrictions within their jurisdiction that are consistent with rules adopted by the commissioner. (b) The restrictions must limit lawn sprinkling, vehicle washing, golf course and park irrigation, and other nonessential uses, and have appropriate penalties for failure to comply with the restrictions.

An ordinance that has been adopted or a draft ordinance that can be quickly adopted to comply with the critical water deficiency declaration must be included in the plan (include with other ordinances in Attachment 7 for Part III, Item 4). Enforcement responsibilities and penalties for non-compliance should be addressed in the critical water deficiency ordinance.
Sample regulations are available at www.dnr.state.mn.us/waters

Authority to Implement Water Emergency Responses. Emergency responses could be delayed if city council or utility board actions are required. Standing authority for utility or city managers to implement water restrictions can improve response times for dealing with emergencies. Who has authority to implement water use restrictions in an emergency?

☐ Utility Manager ☐ City Manager ☒ City Council or Utility Board
☒ Other (describe): Mayor

Emergency Preparedness If city or utility managers do not have standing authority to implement water emergency responses, please indicate any intentions to delegate that authority. Also indicate any other measures that are being considered to reduce delays for implementing emergency responses.
--N/A

PART III. WATER CONSERVATION PLAN

Water conservation programs are intended to reduce demand for water, improve the efficiency in use and reduce losses and waste of water. Long-term conservation measures that improve overall water use efficiencies can help reduce the need for short-term conservation measures. Water conservation is an important part of water resource management and can also help utility managers satisfy the ever-increasing demands being placed on water resources.

> Minnesota Statutes 103G.291, requires public water suppliers to implement demand reduction measures before seeking approvals to construct new wells or increases in authorized volumes of water. Minnesota Rules 6115.0770, require water users to employ the best available means and practices to promote the efficient use of water. Conservation programs can be cost effective when compared to the generally higher costs of developing new sources of supply or expanding water and/or wastewater treatment plant capacities.

A. Conservation Goals. The following section establishes goals for various measures of water demand. The programs necessary to achieve the goals will be described in the following section.

Unaccounted Water (calculate five year averages with data from Table 1)		
Average annual volume unaccounted water for the last 5 years	1,500,000	gallons
Average percent unaccounted water for the last 5 years	22.1	percent
AWWA recommends that unaccounted water not exceed 10%. Describe goals to reduce unaccounted water if the average of the last 5 years exceeds 10%.		
Unaccounted water in this city consists of hydrant flushing and ball field irrigation. The City does not currently meter or charge themselves for either of these. Although it is a large percentage of the total water pumped, it is a small amount of water that is not uncommon for a city of this size to provide for ball fields or flushing. The City will attempt to estimate this usage in the future.		

Residential Gallons Per Capita Demand (GPCD)		
Average residential GPCD use for the last 5 years (use data from Table 1)	55	GPCD
In 2002, average residential GPCD use in the Twin Cities Metropolitan Area was 75 GPCD. Describe goals to reduce residential demand if the average for the last 5 years exceeds 75 GPCD.		
All current and future water users are and will be metered. All large meters will be tested, repaired, or replaced based on AWWA recommendations. The billing department uses software for billing purposes and to identify unusual changes in use. The City has instituted a uniform rate system and bills its customers quarterly. A base rate is charged plus a set rate per 1000 gallons used per quarter. All new homes and retrofits of existing homes will have water efficient fixtures according to State and Federal plumbing Codes. The City water system has been designed to ensure that static and residual pressures in the water service area are maintained between 40 psi and 120 psi. Users with pressures above 80 psi will		

be required to install individual pressure reducing valves at the point of service, unless special needs dictate otherwise.

Total Per Capita Demand: From Table 1, is the trend in overall per capita demand over the past 10 years ☐ increasing or ☒ decreasing? If total GPCD is increasing, describe the goals to lower overall per capita demand or explain the reasons for the increase.
--N/A

Peak Demands (calculate average ratio for last five years using data from Table 1)	
Average maximum day to average day ratio	3.7
If peak demands exceed a ratio of 2.6, describe the goals for lowering peak demands.	
The demand ratio is due to the fact that this water system is small and consists mostly of residential use, which in general varies greatly throughout the year. Also, the use of irrigation during the summers greatly increases this ratio. With the odd/even sprinkling ban and other conservation measures, this ratio is expected to decrease.	

B. Water Conservation Programs. Describe all short-term conservation measures that are available for use in an emergency and long-term measures to improve water use efficiencies for each of the six conservation program elements listed below. Short-term demand reduction measures must be included in the emergency response procedures and must be in support of, and part of, a community all-hazard emergency operation plan.

1. **Metering.** The American Water Works Association (AWWA) recommends that every water utility meter all water taken into its system and all water distributed from its system at its customer's point of service. An effective metering program relies upon periodic performance testing, repair, repair and maintenance of all meters. AWWA also recommends that utilities conduct regular water audits to ensure accountability.

   Complete Table 10 (A) regarding the number and maintenance of customer meters.

TABLE 10 (A) Customer Meters

	Number of Connections	Number of Metered Connections	Meter testing schedule (years)	Average age/meter replacement schedule (years)
Residential	121	121		4 / 25
Institutional	1	1		4 / 25
Commercial	2	2		4 / 25
Industrial				4 / 25
Public Facilities				4 / 25
Other				4 / 25
TOTALS	124	124		

Unmetered Systems. Provide an estimate of the cost to install meters and the projected water savings from metering water use. Also indicate any plans to install meters.
--N/A

TABLE 10 (B) Water Source Meters

	Number of Meters	Meter testing schedule (years)	Average age/meter replacement schedule (years)
Water Source (wells/intakes)	1 – Well 1- Proposed Maple Grove Connection	Need to repair/replace meter evaluated every year based on water audit	5 / 25
Treatment Plant	--N/A		

2. **Unaccounted Water.** Water audits are intended to identify, quantify, and verify water and revenue losses. The volume of unaccounted-for water should be evaluated each billing cycle. The AWWA recommends a goal of ten percent or less for unaccounted-for water. Water audit procedures are available from the AWWA and MN Rural Water Association.

Frequency of water audits: ☐ each billing cycle ☒ yearly ☒ other:

Leak detection and survey: ☐every year ☐ every years ☒ periodic as needed
Year last leak detection survey completed: N/A – new system

Reducing Unaccounted Water. List potential sources and efforts being taken to reduce unaccounted water. If unaccounted water exceeds 10% of total withdrawals, include the timeframe for completing work to reduce unaccounted water to 10% or less.
The majority of the unaccounted for water is due to hydrant flushing, and city irrigation. The city will attempt to estimate this usage.

3. **Conservation Water Rates.** Plans must include the current rate structure for all customers and provide information on any proposed rate changes. Discuss the basis for current price levels and rates, including cost of service data, and the impact current rates have on conservation.

Billing Frequency: ☐ Monthly ☐ Bimonthly ☒ Quarterly
☐ Other (describe):

Volume included in base rate or service charge: 0 gallons

Conservation Rate Structures

☐ Increasing block rate: rate per unit increases as water use increases

☐ Seasonal rate: higher rates in summer to reduce peak demands
☒ Service charge or base fee that does not include a water volume

Conservation Neutral Rate Structure
☒ Uniform rate: rate per unit is the same regardless of volume

Non-conserving Rate Structures
☐ Service charge or base fee that includes a large volume of water
☐ Declining block rate: rate per unit decreases as water use increases
☐ Flat rate: one fee regardless of how much water is used (unmetered)

Other (describe):

Water Rates Evaluated: ☐ every year ☐ every years ☒ no schedule
Date of last rate change: 5/25/04

Declining block (the more water used, the cheaper the rate) and flat (one fee for an unlimited volume of water) rates should be phased out and replaced with conservation rates. Incorporating a seasonal rate structure and the benefits of a monthly billing cycle should also be considered along with the development of an emergency rate structure that could be quickly implemented to encourage conservation in an emergency.

Current Water Rates. Include a copy of the actual rate structure in Attachment or list current water rates including base/service fees and volume charges below.
$25.00 base fee per quarter $0.28/1000 gal $1.59 per quarter State Testing Charge

Non-conserving Rate Structures. Provide justification for the rate structure and its impact on reducing demands or indicate intentions including the timeframe for adopting a conservation rate structure.
--N/A

4. **Regulation.** Plans should include regulations for short-term reductions in demand and long-term improvements in water efficiencies. Sample regulations are available from DNR Waters. Copies of adopted regulations or proposed restrictions should be included in Attachment of the plan. Indicate any of the items below that are required by local regulations and also indicate if the requirement is applied each year or just in emergencies.

☐ Time of Day: no watering between am/pm and am/pm
(reduces evaporation) ☐ year around ☐ seasonal ☐ emergency only
☒ Odd/Even: (helps reduce peak demand) ☐ year around ☐ seasonal ☒ emergency only

☐ Water waste prohibited (no runoff from irrigation systems)
Describe ordinance:

☐ Limitations on turf areas for landscaping (reduces high water use turf areas)
Describe ordinance:

☒ Soil preparation (such as 4”-6” of organic soil on new turf areas with sandy soil)
Describe ordinance: 4” topsoil

☒ Tree ratios (plant one tree for every square feet to reduce turf evapotranspiration)
Describe ordinance: minimum of 2 trees (minimum 2” diameter) on each lot, in the front yard

☐ Prohibit irrigation of medians or areas less than 8 feet wide
Describe ordinance:

☐ Permit required to fill swimming pool ☐ every year ☐ emergency only

☐ Other (describe):

State and Federal Regulations (mandated)

☐ Rainfall sensors on landscape irrigation systems. Minnesota Statute 103G.298 requires “All automatically operated landscape irrigation systems shall have furnished and installed technology that inhibits or interrupts operation of the landscape irrigation system during periods of sufficient moisture. The technology must be adjustable either by the end user or the professional practitioner of landscape irrigation services.”

☒ Water Efficient Plumbing Fixtures. The 1992 Federal Energy Policy Act established manufacturing standards for water efficient plumbing fixtures, including toilets, urinals, faucets, and aerators.

Enforcement. Are ordinances enforced? ☒ Yes ☐ No If yes, indicate how ordinances are enforced along with any penalties for non-compliance.
The City of Dayton has adopted the Minnesota State Building Code by reference (Chapter 900, Part 901). The City contracts with Metro West Inspections for all building inspections, including plan reviews, plan checks, fee determination, site inspections, building inspections, and any other follow-up inspections.

5. **Education and Information Programs.** Customers should be provided information on how to improve water use efficiencies a minimum of two times per year. Information should be provided at appropriate times to address peak demands. Emergency notices and educational materials on how to reduce water use should be available for quick distribution during an emergency. If any of the methods listed in the table below are used to provide water conservation tips, indicate the number of times that information is provided each year and attach a list of education efforts used for the last three years.

Current Education Programs	**Times/Year**
Billing inserts or tips printed on the actual bill	
Consumer Confidence Reports	1
Local news papers	
Community news letters	
Direct mailings (water audit/retrofit kits, showerheads, brochures)	
Information at utility and public buildings	
Public Service Announcements	
Cable TV Programs	
Demonstration projects (landscaping or plumbing)	
K-12 Education programs (Project Wet, Drinking Water Institute)	
School presentations	
Events (children's water festivals, environmental fairs)	
Community education	
Water Week promotions	
Information provided to groups that tour the water treatment plant	
Website (include address:)	
Targeted efforts (large volume users, users with large increases)	
Notices of ordinances (include tips with notices)	
Emergency conservation notices (recommended)	
Other:	

List education efforts for the last three years in Attachment N/A of the plan. Be sure to indicate whether educational efforts are on-going and which efforts were initiated as an emergency or drought management effort.

Proposed Education Programs. Describe any additional efforts planned to provide conservation information to customers a minimum of twice per year (required if there are no current efforts).
Only a small portion of the City is currently served by distribution system. As this changes with the proposed development, the City will consider adding information about conservation on their website and local newspaper, and utilize billing inserts.

A packet of conservation tips and information can be obtained by contacting DNR Waters or the Minnesota Rural Water Association (MRWA). The American Water Works Association (AWWA) www.awwa.org or www.waterwiser.org also has excellent materials on water conservation that are available in a number of formats. You can contact the MRWA 800/367-

6792, the AWWA bookstore 800/926-7337 or DNR Waters 651/259-5703 for information regarding educational materials and formats that are available.

6. **Retrofitting Programs.** Education and incentive programs aimed at replacing inefficient plumbing fixtures and appliances can help reduce per capita water use as well as energy costs. It is recommended that communities develop a long-term plan to retrofit public buildings with water efficient plumbing fixtures and that the benefits of retrofitting be included in public education programs. You may also want to contact local electric or gas suppliers to see if they are interested in developing a showerhead distribution program for customers in your service area.

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

Retrofitting Programs. Describe any education or incentive programs to encourage the retrofitting of inefficient plumbing fixtures (toilets, showerheads, faucets, and aerators) or appliances (washing machines).
--N/A

Plan Approval. Water Emergency and Conservation Plans must be approved by the Department of Natural Resources (DNR) every ten years. Please submit plans for approval to the following address:

DNR Waters
Water Permit Programs Supervisor
500 Lafayette Road
St. Paul, MN 55155-4032

or Submit electronically to wateruse@dnr.state.mn.us.

Adoption of Plan. All DNR plan approvals are contingent on the formal adoption of the plan by the city council or utility board. Please submit a certificate of adoption (example available) or other action adopting the plan.

Metropolitan Area communities are also required to submit these plans to the Metropolitan Council. Please see PART IV. ITEMS FOR METROPOLITAN AREA PUBLIC SUPPLIERS.

METROPOLITAN COUNCIL

PART IV. ITEMS FOR METROPOLITAN AREA PUBLIC SUPPLIERS

Minnesota Statute 473.859 requires water supply plans to be completed for all local units of government in the seven-county Metropolitan Area as part of the local comprehensive planning process. Much of the required information is contained in Parts I-III of these guidelines. However, the following additional information is necessary to make the water supply plans consistent with the Metropolitan Land Use Planning Act upon which local comprehensive plans are based. Communities should use the information collected in the development of their plans to evaluate whether or not their water supplies are being developed consistent with the Council's Water Resources Management Policy Plan.

Policies. Provide a statement(s) on the principles that will dictate operation of the water supply utility: for example, "It is the policy of the city to provide good quality water at an affordable rate, while assuring this use does not have a long-term negative resource impact."
The policy of the Dayton water supply system is to provide the consumers with safe, high quality, and affordable drinking water. The system will provide this vital service while assuring the long-term protection of our supply from contamination and excessive depletion.

Impact on the Local Comprehensive Plan. Identify the impact that the adoption of this water supply plan has on the rest of the local comprehensive plan, including implications for future growth of the community, economic impact on the community and changes to the comprehensive plan that might result.
The Water Supply Plan was prepared based on the Land Use Plan for the City contained in the Comprehensive Plan and the household and population forecasts based on the land use plan. The staging of the Capital Improvement Plan (CIP) is in accordance with the Comprehensive Plan and the existing Comprehensive Sanitary Sewer Plan. Future growth of the community will be dependent on successfully carrying out the water system improvements included in the CIP.

Demand Projections

Year	**Total Community Population**	**Population Served**	**Average Day Demand (MGD)**	**Maximum Day Demand (MGD)**	**Projected Demand (MGY)**
2010	8,600	3,300	0.5	1.1	182
2020	15,600	12,300	1.7	4.3	620
2030	24,600	21,300	2.9	7.3	1058
Ultimate	57,660	57,660	7.6	19.3	2774

Population projections should be consistent with those in the Metropolitan Council's *2030 Regional Development Framework* or the Communities 2008 Comprehensive Plan update**.** If population served differs from total population, explain in detail why the difference (ie, service to other communities, not complete service within community etc.).
Population projections are based on Metropolitan Council projections in the adopted Regional

Development Framework. If Dayton's ultimate population is 57,660, significant redevelopment would occur in areas where parcel sizes are presently one to ten acres. The population served is currently less than and will continue to be less than the total population because most of the community is not currently served. Service will be extended to some but not all areas not currently served by private wells. Development will be discouraged in areas not served by utilities.

The City of Dayton recently adopted a resolution and an ordinance regarding the adoption of a Growth Management Policy which limits the number of building permits the City of Dayton will issue each year to 2010. Although the Growth Management Policy does not extend beyond 2010, for the purposed of demand projections, it was assumed that an average of 300 building permits per year will be issued between 2010 and 2030.

PLAN SUBMITTAL AND REVIEW OF THE PLAN

The plan will be reviewed by the Council according to the sequence outlined in Minnesota Statutes 473.175. **Prior to submittal to the Council, the plan must be submitted to adjacent governmental units for a 60-day review period.** Following submittal, the Council determines if the plan is complete for review within 15 days. If incomplete, the Council will notify the community and request the necessary information. When complete the Council will complete its review within 60 days or a mutually agreed upon extension. The community officially adopts the plan after the Council provides its comments.

Plans can be submitted electronically to the Council; however, the review process will not begin until the Council receives a paper copy of the materials. Electronic submissions can be via a CD, 3 ½" floppy disk or to the email address below. Metropolitan communities should submit their plans to:

Reviews Coordinator
Metropolitan Council
230 E 5th Street,
St. Paul, MN 55101

electronically to:
watersupply@metc.state.mn.us

Attachment 1

Emergency Telephone List

Emergency Response Team	Name	Work Telephone	Alternate Telephone
Emergency Response Lead	Rick Hass	612-790-5540	763-427-3224
Alternate Emergency Response Lead	Victor Martinez	612-750-1887	
Water Operator	Rick Hass	612-790-5540	
Alternate Water Operator	Victor Martinez	612-750-1887	
Public Communications			

State and Local Emergency Response Contacts	Name	Work Telephone	Alternate Telephone
State Incident Duty Officer	Minnesota Duty Officer	800/422-0798 Out State	651-649-5451 Metro
County Emergency Director			
National Guard	Minnesota Duty Officer	800/422-0798 Out State	651-649-5451 Metro
Mayor/Board Chair	Doug Anderson	612-840-2758	
Fire Chief	Jim Nordmeyer	763-421-3122	
Sheriff			
Police Chief	Richard Pietrzak	612-481-1961	
Ambulance			
Hospital			
Doctor or Medical Facility			

State and Local Agencies	Name	Work Telephone	Alternate Telephone
MDH District Engineer			
MDH	Drinking Water Protection	651-201-4700	
State Testing Laboratory	Minnesota Duty Officer	800/422-0798 Out State	651-649-5451 Metro
MPCA			
DNR Area Hydrologist			
County Water Planner			

Utilities	Name	Work Telephone	Alternate Telephone
Electric Company	Elk River Utilities	763-441-2020	
Gas Company	Minnegasco	612-372-5050	
Telephone Company	Sprint	1-800-788-3500	
Gopher State One Call	Utility Locations	800-252-1166	651-454-0002
Highway Department			

Mutual Aid Agreements	Name	Work Telephone	Alternate Telephone
Neighboring Water System			
Emergency Water Connection			
Materials			

Technical/Contracted Services/Supplies	Name	Work Telephone	Alternate Telephone
MRWA Technical Services	MN Rural Water Association	800-367-6792	
Well Driller/Repair			
Pump Repair			
Electrician			
Plumber			
Backhoe			
Chemical Feed			

Meter Repair			
Generator			
Valves			
Pipe & Fittings			
Water Storage			
Laboratory			
Engineering firm			

Communications	Name	Work Telephone	Alternate Telephone
News Paper	Champlin Dayton Press	763-425-3323	
Radio Station			
School Superintendent			
Property & Casualty Insurance			

Critical Water Users	Name	Work Telephone	Alternate Telephone
Hospital Critical Use:			
Nursing Home Critical Use:			
Public Shelter Critical Use:			

Attachment 2

Capital Improvement Plan

	Improvement
2006	1 Connection Maple Grove
	Meter Manhole Instrumentation
	12″ Main SW Dayton
	16″ Main SW Dayton
	18″ Main SW Dayton
	24″ Main SW Dayton
2007	Well and Pump House No. 2 NE Dayton
	0.5 MG Storage NE Dayton
	12″ Main NE Dayton
	16″ Main NE Dayton
2008	12″ Main SW Dayton
	20″ Main SW Dayton
	Well and Pump House No. 3 NW Dayton
2009 - 2010	12″ Main SW Dayton
	16″ Main SW Dayton
	12″ Main NE Dayton
	12″ Main NW Dayton
	14″ Main NW Dayton
	Meter Manhole Instrumentation
	1.0 MG Storage NW Dayton
2010 – 2015	Well and Pump House No. 4 NE Dayton
	12″ Main NW Dayton
	12″ Main NE Dayton
	12″ Main SW Dayton
	18″ Main SW Dayton
	20″ Main SW Dayton
	1.5 MG Storage SW Dayton
2015 – 2020	12″ Main NW Dayton
	12″ Main SW Dayton
	16″ Main SW Dayton
	Well and Pump House No. 5 NW Dayton
	TOTAL

Operational Contingency Plan and Emergency Phone List

Emergency Resources

Maintenance

A good maintenance program can identify potential problems before they become an emergency. The City's water system is brand new and is in excellent condition. The following are the major components of Dayton's maintenance program.

Valves: Valves are checked and exercised regularly. Repairs will be done as needed. The City has sufficient personnel and/or contractors "on call" during valve turning operations in case a valve breaks or a leak develops. The city maintains records on valve maintenance.

Hydrants: Every hydrant is exercised and maintained at least once a year. Repairs are done as problems are found. Hydrants are also checked in the winter to make sure they are dry.

Flushing: Dead end pipes are flushed at least once a year.

Breaks/Repairs: The City maintains records of all breaks and repairs. Prior to any street reconstruction project, the break record will be reviewed to determine if the main should be replaced.

The City has an inventory of repair parts, valves, and sleeves at the Public Works Department. Major repairs will require another Contractor. The City has a number of contractors under contract to provide emergency services on a 24-hr "on-call' status. Refer to the Emergency Call Out Telephone Book for a list of pre-selected contractors.

Power

Power for the City is provided by Elk River Municipal Utilities. Well No. 1 is equipped with a generator receptacle so it can be run during power outages. The City is evaluating the purchasing of an emergency portable generator that will be able to operate the well and the lift stations.

Control System

The computerized control systems for water distribution are extremely valuable to water supply operations. Dayton has a well-planned control strategy. Following are a number of alternatives that are implemented for preventing failure of a computerized control system:

1. Routine maintenance programs.
2. Upgraded programs.

3. Tested reversion to manual operations.

Individual control systems that fail and need to be manually operated may require rescheduling and/or the addition of personnel assigned to the system during the emergency.

Communications Systems

Communication systems are vital to water supply operations. Unfortunately, communication lines, such as telephone lines, are susceptible to many types of disasters (storms, construction accidents, etc.). Accordingly, it is important that backup communication systems be maintained and tested regularly.

The City of Dayton currently utilizes hard-wired telephone lines for communication at Well No. 1. All alarms are sent out by an auto dialer that contacts personnel of an alarm. The dialer calls the County Dispatch and the Public Works Director.

Sensors

Water system sensors and detectors are important for recognizing and correcting emergency situations. The vulnerability of the individual system components must be accounted for when considering the type of sensor to use and the placement of these sensors. Flood alarms, pressure transducers and limit switches are checked and calibrated regularly. Preventative maintenance is conducted and visual verification of the accuracy of sensors is maintained. Regular testing and calibration of equipment and controls is verified and run time versus flow measurements is compared.

Security

The safety of a water supply and distribution system is critical to any community, and acts of vandalism or terrorism should never be allowed to compromise this valuable resource. Currently all entrances to facilities are kept locked. Keys to entrances are provided only to operators/maintenance personnel.

Operation and Maintenance Manuals

Operation and maintenance manuals are conveniently located throughout system facilities so as to provide the public works staff with accessible instructions in case of an emergency.

Replacement Parts

An adequate supply of replacement parts is stored at the water utility facilities as recommended by the manufacturers of the equipment in case of an emergency. Several suppliers maintain 24 hour availability to their warehouses. The City regularly communicates with adjacent cities to coordinate products and equipment.

Emergency Response Procedures

Chlorine Malfunction

The chlorination system at Well No. 1 has a duplex automatic switchover, which will automatically feed chlorine from a second cylinder. However, a failure of the chlorinator results in a failure of the chlorination system. The City is currently reviewing ideas for backup systems. The City can institute demand reduction procedures, or use the well with the faulty chlorine system and monitor the water supply to ensure that the proper chlorine residual is maintained. In case of contamination, the City will notify health authorities regarding necessary water-boiling procedures.

Chlorine Leak

If a chlorine leak occurs at Well No. 1, a chlorine alarm and alarm dialer will be actuated and the control system will indicate the extent of the problem. The Fire Department is called to respond to chlorine leaks. The Fire Department has toured the pumphouse to become familiar with the site.

Water Quality

Water quality problems can occur due to difficulties that cannot be managed by the normal treatment process of the system. Difficulties that might be encountered include source contamination, a stoppage of treatment, or contamination of the distribution system. An extensive monitoring program enables operators to detect contamination in the distribution system. Unfortunately, some tests take as long as several days for the necessary data to be generated in a laboratory. When the origin of the water contamination is unknown, each phase of the water supply system should be inspected for possible problems.

When there is reason to believe that a water supply has been contaminated, consumers and health authorities should be contacted without delay. Informing the consumers of the emergency is especially important, as they should be informed on whether to boil the drinking water or not use the water. Daily monitoring of chlorine use and chlorine residual in the water minimizes the chance of bacteriological contamination.

Storms

The effect of storms on water facilities are typically fires, flooding, power outage, or lightning damage to equipment. Structural damage to towers and buildings may also occur depending on the type of storm.

In the event of a power outage, storm damage or lightning damage to equipment, the City will:

1. Determine the available storage volume in the hydro-pneumatic tank.
2. Contact the electric utility and get an estimated time for power restoration.
3. Assess damage to controls and sensing equipment.

Depending on the outcome of the above assessment, Dayton may:

- Do nothing. If the hydro-pneumatic tank storage is sufficient to meet the demands expected during the outage, no action may be required.
- Start Well 1 by use of an emergency generator to operate the well on emergency power.
- Notify the Police and Fire Department of any of the following, as applicable:
    - ✓ Reduced available fire flows
    - ✓ Building damage
    - ✓ Barricaded areas
- Contact the Dayton Emergency Management Director if an emergency is declared.
- Operate the system manually if needed or preferred.

Droughts

Monitoring of the weather can enable one to predict the possibility of a drought occurring. The result of the drought can be increased water demands, power outages, and lowered aquifer levels. During drought periods, well output, well pumping level, and weather will be monitored regularly and system adjustments performed to optimize the resources and reliability of the system. The monitored information will be used to help determine whether any triggers have been reached and the necessity of limiting water consumption as outlined earlier in the report.

Floods

The pumphouse is located well above the 100-year flood elevation. In a flood, the Dayton Emergency Management Director will establish an emergency team, which would include the Public Works Department.

Personnel

In any emergency, it is necessary for the public works staff to know their respective duties in resolving the crisis. At the City, all Utility Division employees are trained in emergency procedures.

Vulnerability Assessment

In preparing for any emergencies that might affect a water system, it is wise to produce a disaster summary. This is a listing of events such as fire, tornadoes, and flooding that might strike the water system. It is then necessary to do a vulnerability assessment of the system. Here the primary components of the water system are individually considered for the effects that a particular catastrophe might impose on them. Furthermore, it is necessary to consider the preventative or corrective measures that might be taken for each facility in case of an emergency.

Emergency Reporting Information

Dayton Utility

Use this form to report an emergency that appears to involve water service. Immediately contact the Public Works Department. Emergency telephone numbers are attached to this form.

1. Person reporting emergency ___________________ Phone no. ___________Time report was received ____________ Date report was received
2. Location of emergency
   Street and house/building number __________________________________Other (approximate location, distance from landmark, etc.)

3. Condition at scene [check appropriate box(es)]

☐ **Escaping Water**	☐ Seepage	☐ Free-flowing
	☐ Gushing	
☐ **Flooding**	☐ Roads	☐ Intersections
	☐ Property	☐ Buildings
☐ **Erosion**	☐ Banks	☐ Foundations
☐ **Electrical Power**	☐ Interruptions	
	☐ Total loss of power	
☐ **Change in Water Quality**	☐ Taste	☐ Odor
	☐ Color	☐ Clearness

4. Briefly describe the situation, citing any actual or potential damage.

5. Access restrictions, if any

6. Assistance already available (who, what are they doing, etc.)

7. Other comments

Signature of Person Who Filled Out Form

*For use by personnel likely to see or become involved in water system emergencies.

Appendix B

Well Data

ANALYSIS OF WATER DEMAND

The Dayton water supply and distribution system was put in service in May 2001. Since the system is extremely new, no data is available for analysis of water demand. As connections are added to the system and water use data becomes available, this plan will be updated. The City will collect the following data on water use:

- Total annual pumpage
- Maximum daily pumpage
- Monthly pumpage
- Water use (billing records) by customer category

EXISTING FACILITIES

The Well No. 1 pumping facility in the Historic Village was put in service May 2001. Pressure on the water distribution system is provided by a hydro-pneumatic tank with a water capacity of nearly 2,000 gallons. The facility includes chemical feed equipment that provides chlorination and fluoridation. Polyphosphates are added to control iron and manganese. Well No. 1 data is provided in the following Table 2. Refer to Appendix D for well water quality information.

Table 2 - Dayton Well Data

	Well No. 1
Unique Well #	611054
Year Installed	2001
Casing Depth (ft)	190
Casing Diameter (in)	16
Pump Disc. Pipe (in)	6
Total Depth (ft)	385
Water Bearing Formation	Franconia-Ironton-Galesville
Static Water Level (ft)	49
Drawdown (ft)	6
Peak Demand Capacity (gpm)	300
Pump Type	Submersible
Last Major Maintenance	N/A

Appendix C

Well Field Investigation

Well Field Investigation (March 2005)

Summary

Tasks Performed

For the Phase I Water Supply Investigation, Well Field Investigation the following tasks were performed:

- Compiled and reviewed existing geologic and hydrogeologic maps and studies for the Dayton area (Hennepin County Geologic Atlas, Surficial Geology of the Anoka 30’ X 60’ Quadrangle, City of Champlin Wellhead Protection Plan)
- Researched and interpreted driller’s log and specific capacity test records in the Minnesota Geological Survey County Well Index
- Analyzed test pumping data for the Historic Village Well No. 1
- Plotted the surficial geologic map and developed a revised (modified from the County Geologic Atlas, 1989) map of bedrock geology and topography
- Plotted estimated potentiometric surface elevations (static water levels) for the water table and the buried drift and Franconia-Ironton-Galesville (FIG) aquifers
- Reviewed proposed well-field investigation areas for geologic suitability for test drilling.

Summary of Findings

- The FIG aquifer is present throughout the region, but it has been eroded significantly in some areas. Bedrock topography is complex within the city.
- The productivity of the FIG aquifer is expected to be higher in areas where the full thickness or close to the full thickness of the aquifer remains. These areas have been identified.
- The FIG is generally productive in the area surrounding Dayton, but aquifer properties are quite variable, even within a single well field. Well capacities in the range of 700 to 1,400 gallons per minute (gpm) are expected in the identified areas, although potential yields at some sites may be lower.
- Well capacity is dependent on site specific conditions including aquifer transmissivity, static water level, well construction and development and other factors. Long-term sustainable yield also depends on the number of wells in an area, well spacing/relative locations and pumping rates.
- Depending on the above complicating factors, FIG aquifer well spacing may need to be from less than 1,000 ft to greater than 3,000 ft. Because vertical leakage to the FIG aquifer is minimal, well drawdown will continue to increase at a gradual rate the longer a

well is pumped. Selection of well spacing should be based on an understanding of the expected length of maximum demand periods.

- A high yield buried sand and gravel aquifer may occur within a bedrock valley along the west and southwestern portions of the city. The exact location, depth, and geologic materials of the bedrock valley are uncertain, however.
- The Jordan aquifer is also present in parts of Dayton. Several locations that may be suitable for construction of high capacity wells in the Jordan aquifer have been identified. It is expected that well capacities in the Jordan aquifer would be lower the capacities in the FIG aquifer in most areas, however.

Recommendations

Based on the results of the Phase I investigation, we make the following recommendations to move into Phase II of the Comprehensive Water Supply and Distribution Plan.

North Well-Field Investigation

- Consider options for drilling a production well on the City Hall property or on a site within the recommended potential well construction area closer to the proposed elevated storage site.
- Identify and obtain a site for a municipal well if the City Hall site is not selected. Prepare plans and specifications for the well.
- A test well would not be required at the City Hall site because the local geologic conditions have been verified based on the deep Dayton Elementary School Well and the fire station well. If this site is chosen, prepare plans and specifications for the well.
- Pumping a municipal well on the City property to the west of the elementary school at full capacity for an extended period of time could potentially result in excessive interference drawdown in the school well. If interference problems were to occur, the City would have to make necessary improvements to the school well to resolve the problem or provide the school with an alternate water supply.
- Confidence in our current understanding of the availability of the FIG aquifer in the other possible well development areas is also good, and a test well would not be required in these areas.
- The potential yield of the FIG aquifer is highly variable, nevertheless. Completing and test pumping a test well would indicate the potential capacity at a specific site before constructing a production well at the site.

South Well-Field Investigation

- Prepare plan/specification for drilling one to three 4” buried drift test holes at the location of the possible storage site between Co. Rd. 81 and Territorial Rd. The need for each additional test hole would be determined based on the materials encountered in each hole. Also prepare specifications for a 6" sand and gravel aquifer test well.

- If test drilling shows the site to be potentially suitable for construction of a high capacity well, drill out the hole to 6" and construct a test well with casing and screen.
- If constructed, test pump the test well and collect and analyze water samples for standard water quality constituents.
- If test drilling indicates that the site is not favorable for a drift well, continue drilling the test hole into the bedrock in order to determine what is the uppermost bedrock unit and the aquifer thickness.
- Based on the test drilling results, determine if conditions indicate that a test well or production well could be constructed at the site. Prepare plans/specifications for a 6" bedrock test well.
- If the test drilling area is not found to be a suitable well site, obtain access to an alternative well site in the vicinity of the other proposed elevated storage site. Drill a 4" test hole into the bedrock to verify geological conditions at the site.
- If geological conditions are found to be suitable, a production well could be constructed at the site. Otherwise, an alternative site should be obtained.
- Again, the potential yield of the FIG aquifer is highly variable. Completing and test pumping a test well would indicate the actual potential capacity at a specific site before constructing a production well at the site.

Conclusions

- It is expected that several well fields or relatively widely spaced wells will be required to meet the projected ultimate water demand for the City of Dayton.
- Positive test drilling results for a test well in the bedrock valley drift would indicate that further development of that aquifer may be possible.
- Potential yield of the FIG aquifer is highly variable. Improved estimates of the ultimate capacities of the proposed well-field investigation areas can be made after pumping tests of the proposed wells have been performed.
- It is uncertain at this time whether or not the FIG aquifer alone will be able to meet the projected ultimate maximum demand. Test pumping data and further analyses will be required to plan well field development and to refine estimates of long-term potential yields.
- Use of the Jordan aquifer could remain an option in the future if the potential yield of the FIG aquifer has been fully exploited within a well field and further capacity from the well field is required.
- The most complete information about aquifer potential yield can be obtained by performing a pumping/recovery test on a completed municipal well while collecting measurements in an observation well such as a previously constructed test well.

Data and Analyses Performed

A search of available sources of geologic and hydrogeologic data was performed. All data providing information about the location and thickness of geologic units, the potentiometric surface of confined aquifers and the water table, and the potential productivity of aquifers were compiled and analyzed. These data consisted primarily of well driller's logs found in the CWI database but also included bedrock and surficial geologic maps produced by MGS and test pumping data collected in Champlin and at the Historic Village Well No. 1 (Figure 1).

The data collected were used to create a map of bedrock geology and topography (Figure 2); a surficial geology map; contours of static water level of the water table, the buried quaternary aquifer(s); a geologic cross section (Figure 3) and the Franconia-Ironton-Galesville aquifer system; and preliminary evaluations of the potential yield of the available aquifers (Figure 4). Several geologic cross-sections were also interpreted to assist with the production of the maps and to assess the potential for exploration of each aquifer. The hydrogeologic data presented may be used to develop a test drilling plan.

Bedrock Geology

Many of the records in CWI do not provide any information about geologic materials encountered or static water levels. A majority of the wells for which useful records are available have been located by MGS or MDH. A search was made for un-located wells with CWI records that would fill in data gaps. Several wells with completed driller's logs were located using address or other location information listed in the CWI records. Nevertheless, a majority of domestic wells are completed in relatively shallow buried sand or sand and gravel deposits and do not provide information about deeper Quaternary or bedrock units.

Based on the information now available, it was clear that significant changes should be made to the bedrock geologic map included in the Hennepin County Geologic Atlas (1989) and published derivatives. The bedrock geologic map and bedrock topographic contours were re-drawn within the City of Dayton (Figure 2). Significant uncertainty remains in some areas where no or few well records are available or where it is difficult to make a geologic interpretation of driller's logs. The areas with greatest uncertainty are marked on the map with dashed unit contacts or bedrock elevation contours.

The general geologic setting is as indicated in the geologic atlas. Dayton is located near the margin of the Twin Cities basin. Variations in the elevations of bedrock units suggest that a high angle fault zone trending toward the east-northeast may cut through the southeastern part of the City. Other faults may also be present in Dayton, but definitive geologic data are two sparse to confidently map the faults. Ordovician age geologic units have been completely removed, and thinned, erosional remnants of the Jordan Sandstone up to 50 ft in thickness remain in some areas. The bedrock surface is dissected by a deep bedrock valley running from north to south near the western boundary of the city and by tributaries to the main valley (Figures 2 and 3). It is not likely that the bedrock valley penetrates into the Eau Claire Formation as indicated in the geologic atlas, however.

The best locations for Franconia-Ironton-Galesville (FIG) aquifer system wells are where the full thickness or most of the Franconia Formation is present (Figure 4). In general, the upper part of the Franconia Formation is expected to be more productive than the lower Franconia. For example, the video log of Historic village Well No. 1 indicates that low angle or horizontal fractures or cavities, which probably transmit a majority of the water flowing through the Franconia formation, are more densely spaced in the upper part of the formation. The potential of the FIG aquifer is discussed further below.

Quaternary Geology

The Quaternary age deposits consist of a complex sequence of unconsolidated glacial sediments and recent alluvial and organic deposits. The oldest Quaternary sediments may be glacio-fluvial sands and gravels derived from Labradorean ice sheets of Pre-Late Wisconsinan age. These deposits are known to occur in the main buried valley in Maple Grove and Osseo, in what was the downstream direction (from Dayton) of flow and sediment transport within the bedrock valley. The presence of this potentially productive aquifer cannot be verified within the City of Dayton because no wells are known to have been drilled to the depth at which these deposits occur within the area that the bedrock valley is believed to occur.

Across most of the city, the oldest glacial deposits are brown to reddish-brown sandy loam and silty loam tills of the Cromwell Formation deposited by the Late Wisconsinan Superior Lobe ice sheet. Some Cromwell Formation sandy outwash lenses and beds of limited extent occur below and within the till. In most areas, the Cromwell Formation deposits are overlain by a relatively thin layer (generally < 20 ft) of outwash derived from the Grantburg Sublobe of the Des Moines Lobe ice sheet (New Ulm Formation). In some areas the New Ulm Formation outwash is thick, but the thicker deposits encountered occur at shallow depths where available head is low.

Surficial deposits across most of the city consist of loamy till of the New Ulm Fm. or recent peat and other organic deposits. Sandy river terrace deposits left by earlier stages of the Mississippi River occur at the surface in the northeast corner of the city. The outwash and terrace deposits are exploited by many of the domestic wells in this area. Because the water table occurs within the terraces, and the sand and gravel aquifer is not protected by low permeability geologic units, the terraces are not an ideal location for developing municipal water supply wells. At depth, the quaternary geology beneath the terraces is similar to the other areas.

In summary, the best locations for test drilling within the Quaternary sediments is in the presumed location of the deep buried valley (Figure 4). The potential of this area is speculative given the lack of data, however.

Preliminary Aquifer Evaluations

Hydrogeologic Setting

The major discharge boundary for ground water in the City of Dayton is the Mississippi River. In general, the water table occurs in low permeability till, and the water table system does not serve as an aquifer. In some areas, the a water table is perched within the surficial sediments above a lower water table that occurs in buried sands or gravels. Except in the southeast corner of the city, where hydraulic head in deeper aquifers is higher than the water table, ground water seeps downward from the water table, and lakes and ponds recharge water to the water-table system.

Hydraulic head in the bedrock aquifers is, in turn, generally lower than heads in the buried Quaternary aquifers (Figure 2). In most areas where the Jordan Sandstone occurs, hydraulic head is likely very close to heads in the buried sand and gravel. In one area, in the northeast quadrant of the city, buried sand and gravel aquifers are absent and the head in the Jordan aquifer is likely elevated above the general trend in heads in the buried Quaternary aquifer.

Given the relatively low permeability of the surficial sediments, recharge rates are relatively low—on the order of one to four or five inches per year with the exception of the river terraces in the northeastern part of the city. Test pumping data indicate that the FIG aquifer is confined, and little leakage from overlying units occurs. The primary source of ground-water flux in the FIG aquifer is from lateral movement from areas of higher hydraulic head.

Franconia-Ironton-Galesville

High yield FIG wells are operating in the nearby communities of Champlin, Rogers, Otsego, and Ramsey. Based on analyses of specific capacity data available for wells in those communities and results from an aquifer test performed in Champlin in 1993, the transmissivity of FIG aquifer in the area generally ranges from 2,000 ft2/day (15,000 gpd/ft) to 4,700 ft2/day (35,000 gpd/ft). The data in CWI indicate a significantly higher specific capacity for some wells, including the Historic Village Well No. 1.

An analysis of test pumping data collected in Well No. 1 indicate that the hydrogeologic setting is complex in the vicinity of the well. One possible explanation for the pattern of drawdown occurring in the well is that the aquifer is very highly permeable within a few hundred feet of the well, but the transmissivity is closer to the typical values (3,900 ft2/day or 29,000 gpd/ft) at greater distances from the well.

The extent and shape of the higher transmissivity area, if it exists, cannot be extrapolated from the data collected in the pumping well. It is possible that a zone of higher transmissivity occurs where highly permeable fractures or cavities are larger, more densely spaced and better connected within the Franconia Formation. After the first minutes of pumping, flow from the rock matrix into the fractures and flow in a less permeable fracture network farther from the well provide a majority of water entering the well. The result is relatively low total drawdown in the well but a rate of increase of drawdown equivalent to the rate that would occur at a location with lower transmissivity.

Until test pumping data are available for a particular site, a transmissivity in the range of 2,000 ft2/day to 4,000 ft2/day can be expected for the FIG aquifer within the City of Dayton. The FIG aquifer is generally likely to yield less water in areas where the Franconia Formation has been significantly eroded, although sedimentary bedrock is typically more permeable near the bedrock surface.

Preliminary well spacing analyses were also performed for the FIG aquifer. Pumping tests should be performed at each well field and the preliminary analyses updated before planning future well locations. In the South area, assuming that the transmissivity of the aquifer at a potential well field site is at the lower end of the typical values for the area (2,000 ft2/day or 15,000 gpd/ft) three wells, equally spaced pumping continuously for one week at a rate of 700 gpm should be space at least 1,700 feet apart to prevent excessive well interference. On the other hand, if transmissivity is near the upper end of typical values in the region (3,800 ft2/day or 28,400 gpd/ft) it may be possible to continuously pump three equally spaced wells for one week at 1200 gpm if the wells are space at least 1,400 feet apart.

All other things being the same, well spacing in North Dayton would have to be farther apart because static water levels decrease toward the north and northeast. Lower static water levels lead to lower available head, and, in turn, total drawdown at the well must be lower. For the lower transmissivity scenario given above, the wells should be spaced more than 3,300 ft apart. For the higher transmissivity scenario, wells should be spaced at least 2,800 ft apart.

These preliminary well spacing analyses assume a total of three equally spaced wells in each well field. If wells are positioned along a line or some other configuration, or if a different number of wells make up the well field, the results would be different. Further, the analyses assume a typical value for the aquifer storage coefficient. Storage coefficient controls the rate at which the drawdown zone spreads from a pumping well, and typically is variable. The storage coefficient for a particular area can be determined only by performing an aquifer test in which drawdown is measured in an observation well in addition to measurements made in the pumping well.

Longer-term sustainability of pumping rates and total aquifer potential yield are highly uncertain at this time. An ultimate city wide demand of 16.7 million gallons per day (MGD) was anticipated. Some of this demand may be supplied by interim or permanent supply from Maple Grove to serve the Southwest area. Assuming that new wells will yield 800 gpm, 15 additional wells will be required to meet the total projected ultimate maximum day demand. It is unclear at this time if the FIG aquifer can yield enough water to meet the ultimate demand for the long term.

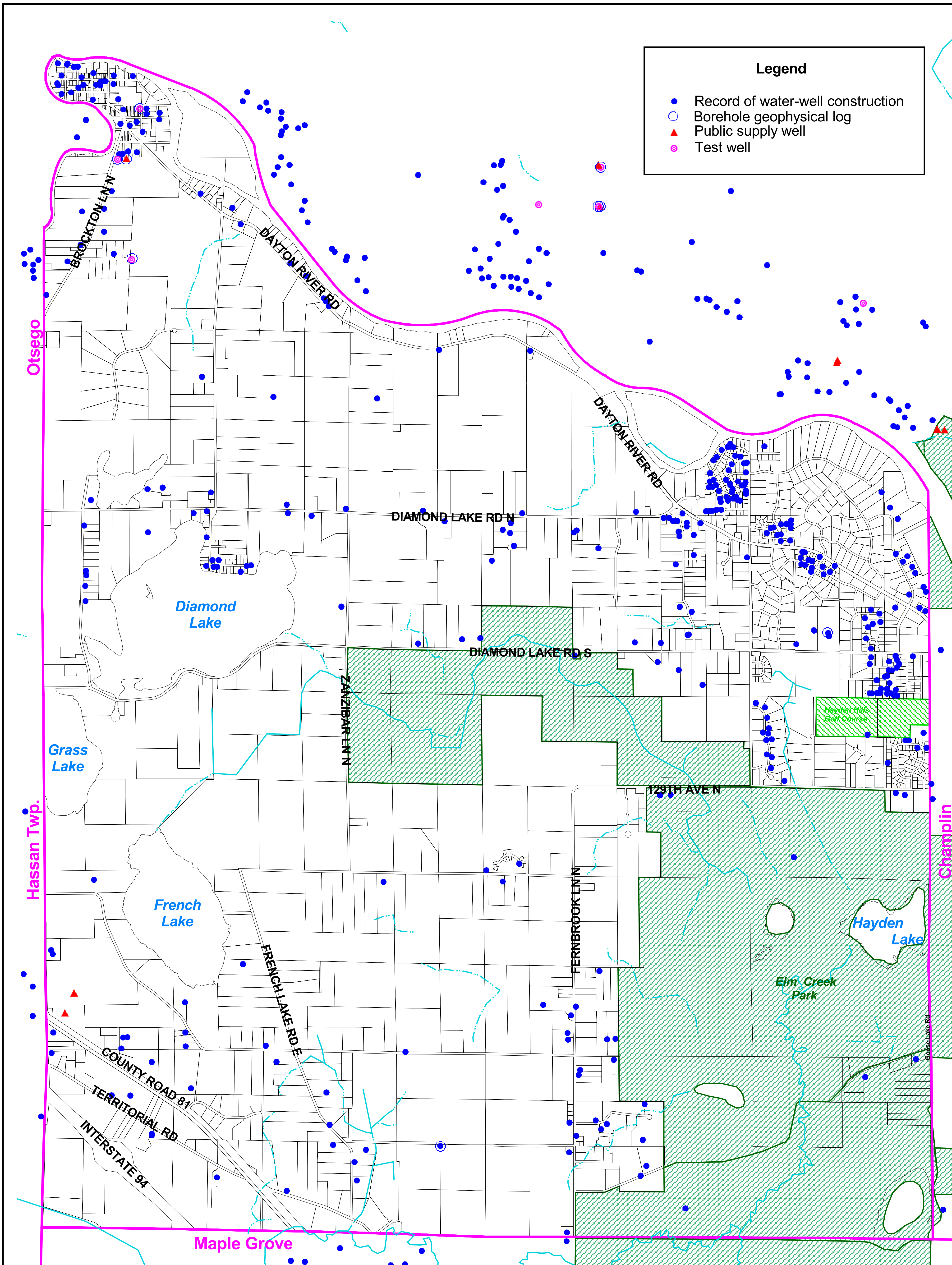
Jordan Aquifer

Relatively thin, erosional remnants of Jordan Sandstone occur in Dayton and surrounding areas. Several areas have been identified in which the sandstone is thick enough and available hydraulic head is high enough for the aquifer to support high capacity wells. In these areas, the thickness of the Jordan is 40 to 45 ft. Wells completed in these areas could likely sustain 400 to 550 gpm yields. In the southwest corner of the city, where the Jordan may be slightly thicker and static water levels are higher, well yields from 600 gpm up to 900 gpm may be possible. It should be noted that data points are more sparse in the southwestern part of the city, and the aquifer potential in this area is more uncertain.

Quaternary Aquifers

In general, buried sand and gravel deposits are relatively thin in the Dayton area. In a few areas, thicker water bearing deposits occur, but these deposits are located too close to the surface to be good candidates for well-field development. Based on the available data, the deep bedrock valley that is known to exist to the south of Dayton is thought to extend northward along the western side of the city. In Maple Grove and Osseo, thick, high transmissivity sand and gravel deposits fill the buried valley. No wells have been completed at the assumed depth of the valley along the assumed location of the valley center within the City of Dayton, however.

Given that the buried sand and gravel aquifer within the valley to the southeast is highly productive, test drilling in the presumed location of the buried valley in the City of Dayton may be justified. Suitable test drilling areas for the buried valley aquifer have also been identified.



City of Dayton

Figure 1

DATA SOURCE MAP

Well Field Investigation

0.5 0 0.5 Miles

February, 2005

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

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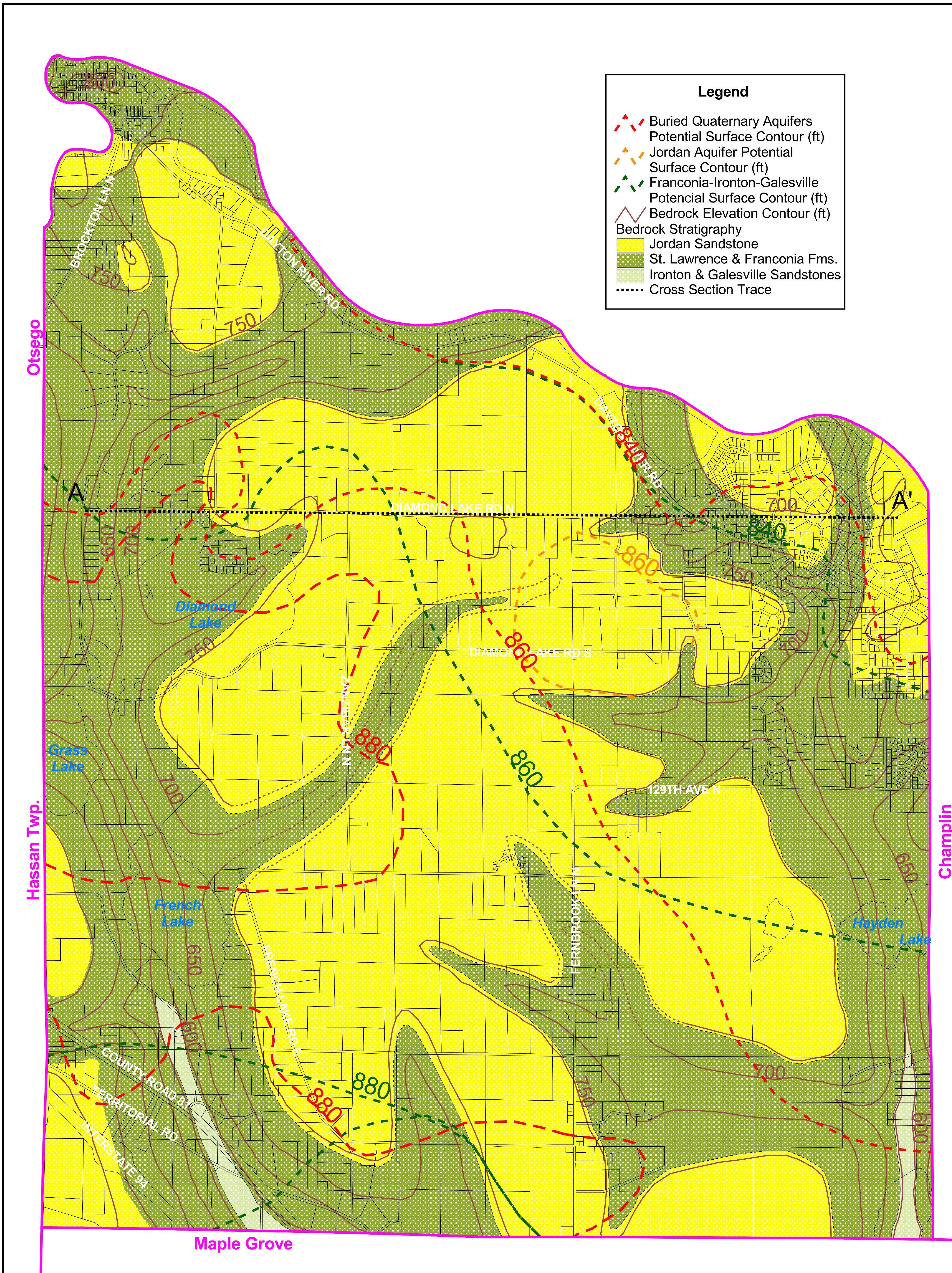

City of Dayton

BEDROCK GEOLOGY & HYDROGEOLOGY

Well Field Investigation

Figure 2

February, 2005

0.5 0 0.5 Miles

N W E S

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

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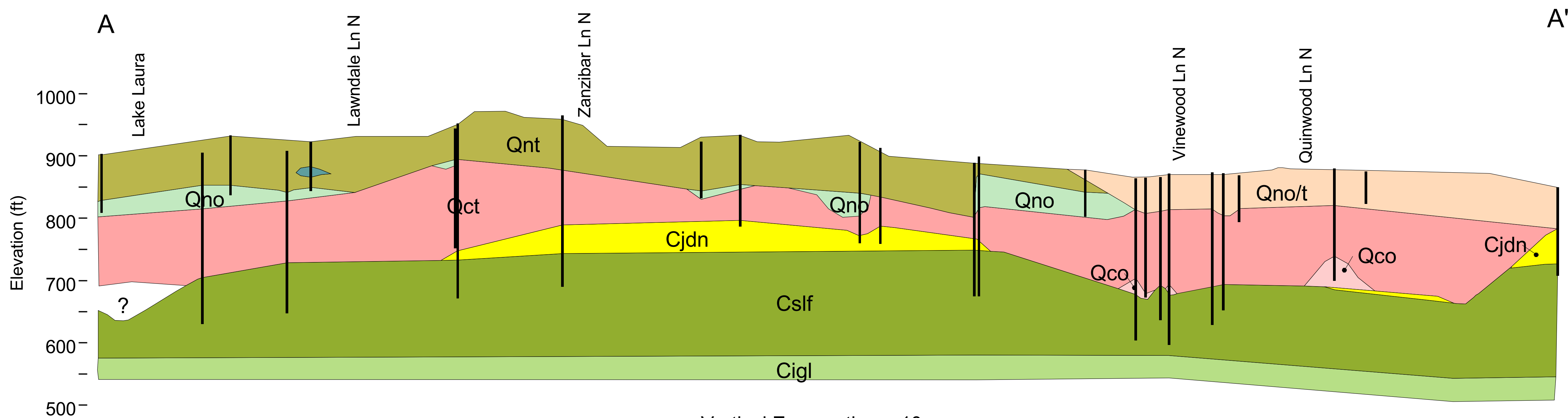

Vertical Exageration = 10 x

Stratigraphic Units

- Qni - ice-contact sand & gravel
- Qno/t - Outwash and terrace deposits
- Qnt - loamy till
- Qno - Outwash sand / gravel
- Qct - sandy to loamy till
- Qco - Outwash sand / gravel
- Cjdn - Jordan Ss
- Cslf - St. Lawrence & Franconia Fms.
- Cigl - Ironton & Galesvill Ss

City of Dayton

Figure 3

GEOLOGIC CROSS SECTION

Well Field Investigation

0.5 0 0.5 Miles

February, 2005

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

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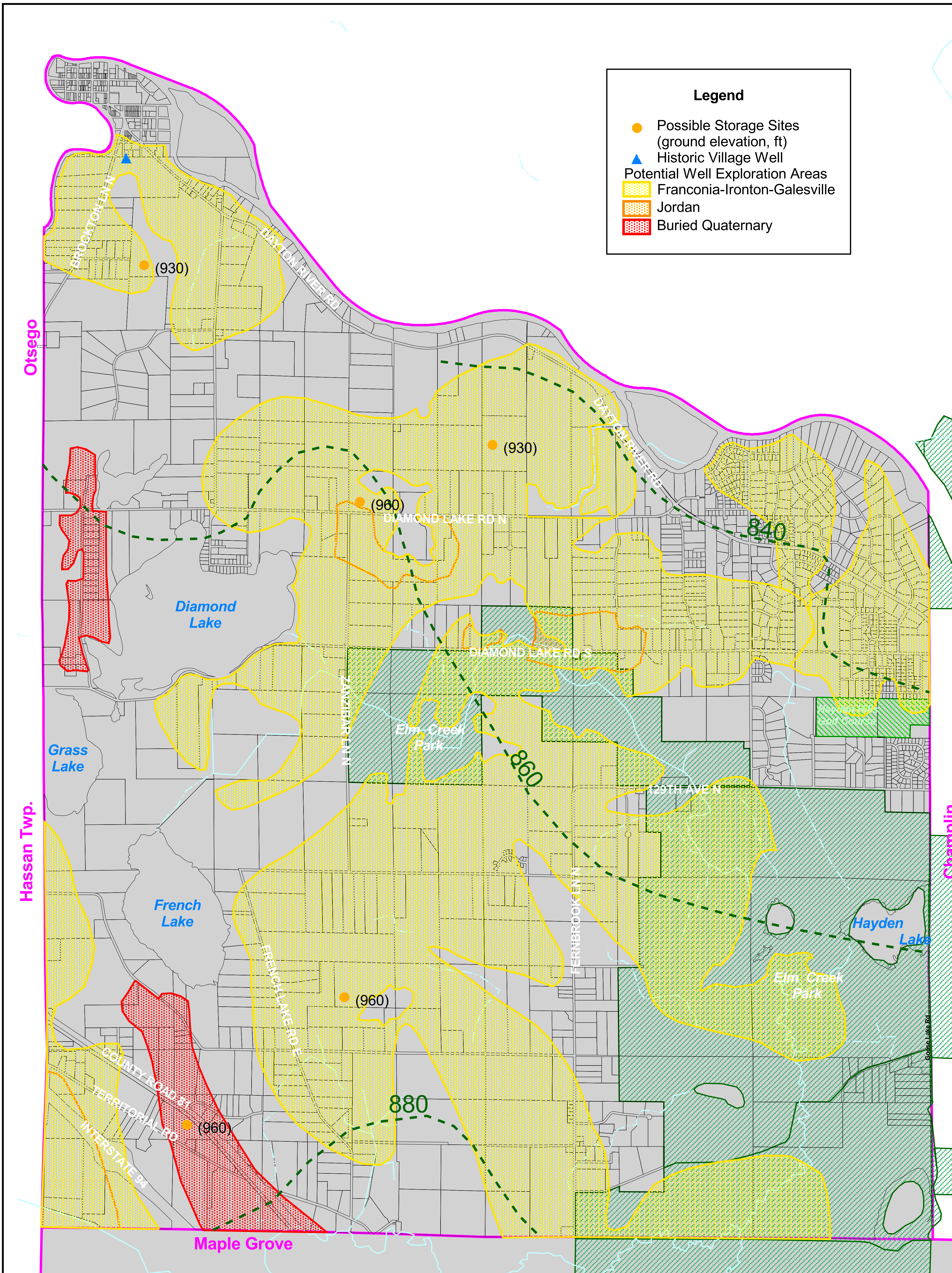

City of Dayton

Figure 4

AQUIFERS

Well Field Investigation

0.5 0 0.5 Miles

February, 2005

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

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Appendix D

Cost Estimate Summary

North Dayton Service Area

Trunk Distribution System Cost Estimate

Dayton Water Supply & Distribution Plan
File 174-05121
5-Jun-06

Distribution

12 inch	125,227	LF	$70	$8,765,890
14 inch	5,041	LF	$85	$428,485
16 inch	18,049	LF	$85	$1,534,165
18 inch	0	LF	$120	$0
20 inch	0	LF	$150	$0
24 inch	0	LF	$159	$0
Sub Total	**148,317**	**LF**		**$10,728,540**
Assume Lateral Benefit				7,415,850
Total				**3,312,690**

Supply

North Well Field (8 - 10 wells, depending on actual yield)	9	EA	$750,000	$6,750,000
Pressure Reducing Stations	2	EA	$30,000	$60,000
Land Acquisition (0.25 ac)	9	EA	***$25,000***	$225,000
Total				**$7,035,000**

Storage

1.0 MG Elevated Reservoir	2	EA	$2,100,000	$4,200,000
Land Acquisition (1.5 ac)	2	EA	***$150,000***	$300,000
Total				**$4,500,000**

Treatment

10 MGD North WTP (incl 0.75 MG Ground Storage)	1	EA	$15,000,000	$15,000,000
Raw Watermain	6797	LF	$85	$577,745
Land Acquisition (5 ac)	1	EA	***$500,000***	$500,000
Total				**$16,077,745**

Summary

Distribution	$3,312,690
Supply	$7,035,000
Storage	$4,500,000
Treatment	$16,077,745
Total	**$30,925,435**

Maple Grove Service Area

Trunk Distribution System Cost Estimate

Dayton Water Supply & Distribution Plan
File 174-05121
5-Jun-06

Distribution

12 inch - Residential	21,669	LF	$70	$1,516,830
12 inch - Commercial / Industrial	36,533	LF	$70	$2,557,310
14 inch	0	LF	$85	$0
16 inch - Residential	600	LF	$85	$51,000
16 inch - Commercial / Industrial	1,698	LF	$85	$144,330
18 inch - Residential	2,871	LF	$120	$344,520
18 inch - Commercial / Industrial	3,764	LF	$120	$451,680
20 inch - Residential	1,431	LF	$150	$214,650
20 inch - Commercial / Industrial	1,584	LF	$150	$237,600
24 inch - Commercial / Industrial	1,336	LF	$159	$212,424
Sub Total	**71,486**	**LF**		**$5,730,344**
Assume Lateral Benefit				4,472,600
Total				**1,257,744**

Supply

Meter Manholes	2	EA	$30,000	$60,000
Total				**$60,000**

Storage

1.5 MG Elevated Reservoir	1	EA	$3,150,000	$3,150,000
Land Acquisition (1.5 ac)	1	EA	***$150,000***	$150,000
Total				**$3,300,000**

Summary	
Distribution	$1,257,744
Supply	$60,000
Storage	$3,300,000
Treatment	$0
Total	**$4,617,744**

SW Dayton Service Area

Trunk Distribution System Cost Estimate

Dayton Water Supply & Distribution Plan

File 174-05121

5-Jun-06

Distribution

12 inch	103,637	LF	$70	$7,254,590
14 inch	0	LF	$85	$0
16 inch	10,843	LF	$85	$921,655
18 inch	0	LF	$120	$0
20 inch	0	LF	$150	$0
24 inch	0	LF	$159	$0
Sub Total	**114,480**	**LF**		**$8,176,245**
Assume Lateral Benefit				5,724,000
Total				**2,452,245**

Supply

South Well Field (6 - 8 wells, depending on actual yeild)	4	EA	$750,000	$3,000,000
Booster Station (1)	1	EA	$500,000	$500,000
Land Acquisition (0.25 ac)	4	EA	***$25,000***	$100,000
Total				**$3,600,000**

Treatment

4.5 MGD South WTP (incl 0.75 MG Ground Storage)	1	EA	$7,875,000	$7,875,000
Raw Watermain	6500	LF	$85	$552,500
Land Acquisition (5 ac)	1	EA	***$500,000***	$500,000
Total				**$8,927,500**

Summary

Distribution	$2,452,245
Supply	$3,600,000
Storage	$0
Treatment	$8,927,500
Total	**$14,979,745**

Appendix E

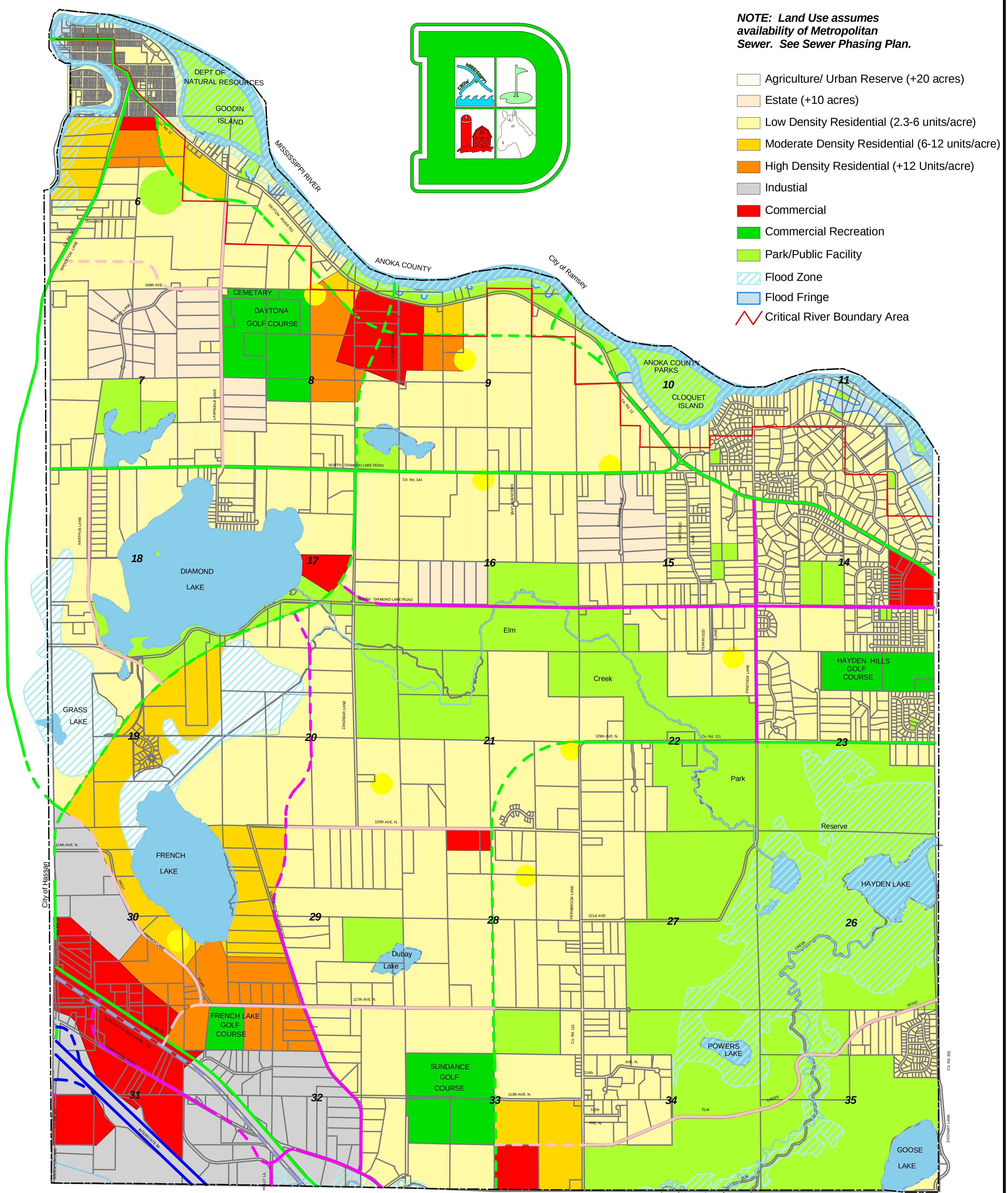
Supplemental Maps

City of

DAYTON, MINNESOTA

CONCEPT GUIDE PLAN

COMPREHENSIVE PLAN UPDATE, NOVEMBER 2005



Existing Community Collector
Proposed Community Collector
Existing Principal Arterial (State)
Proposed Principal Arterial (State)
Existing Minor Arterial (County)
Alternate Proposed Minor Arterial
Existing Neighborhood Collector
Proposed Neighborhood Collector
Proposed Commuter Rail

N W E S

Meters
1000 0 1000

3000 0 3000
Feet

Figure 4

Land Use Map Updates
November, 1999
February, 2000
June, 2005
November, 2005

INGRAHAM & ASSOCIATES
2659 Dupont S. Suite 100 Minneapolis, MN 55408
phone: 612/377-2580 fax: 612/377-1010 e-mail: ingraham@mr.net

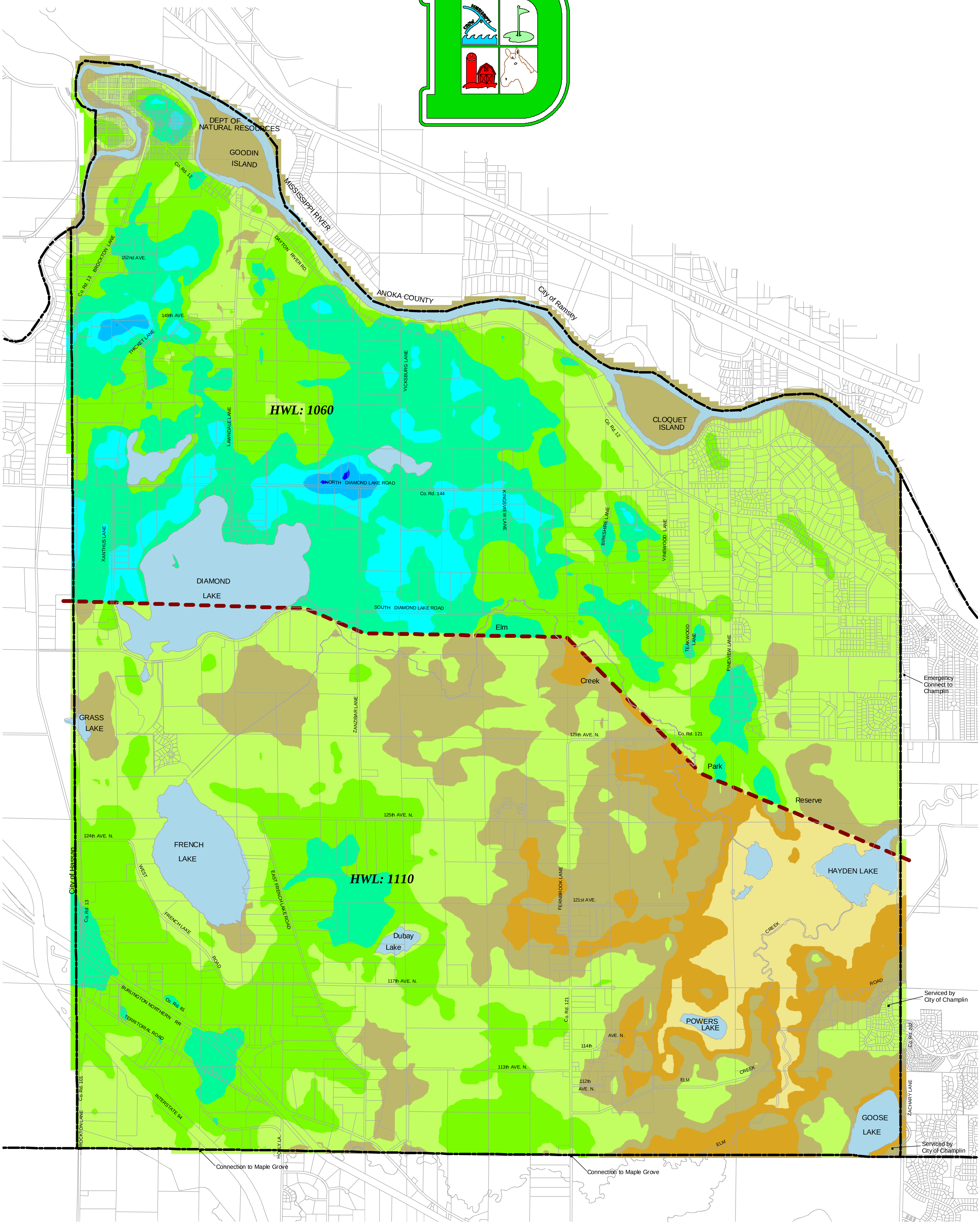
Bonestroo Rosene Anderlik & Associates
Engineers & Architects

i:\174\174map\cad\avprojects\luse.apr

City of

DAYTON, MINNESOTA

Static Water Pressure Map



Legend (in PSI)

- 30 - 39
- 40 - 49
- 50 - 59
- 60 - 69
- 70 - 79
- 80 - 89
- 90 - 99
- 100 - 109
- 110 - 119

Pressure Zone Boundary

City Limits

Parcels

This map displays the Static Water Pressure (in PSI) for the City of Dayton, Minnesota. Static water pressure is a function of the high water elevation (HWL) of the City's storage facility (feet above sea level) and the elevation of the landscape at any given location. The equation to calculate static water pressure is:

(HWL - Elevation) / 2.31 = PSI

N W E S

February 2007

3000 0 3000

Feet

Bonestroo Rosene Anderlik & Associates

Engineers & Architects

i:\174\17405121\cad\gis\avprojects\final_water_supply.apr

Appendix F

City of Maple Grove
Contract for Water Service

CONTRACT FOR WATER SERVICE BETWEEN THE CITY OF MAPLE GROVE MINNESOTA AND THE CITY OF DAYTON MINNESOTA

This contract made and entered in this 8th day of August 2006 by and between the City of Maple Grove, a Municipal Corporation located in Hennepin County, Minnesota hereafter called "Maple Grove" and the City of Dayton, a Municipal Corporation located in Hennepin County, Minnesota hereafter called "Dayton".

Witness:
That the said parties, in consideration of the mutual covenants and agreements herein after set forth, have agreed to and with each other as follows:

1. **Term of Contract**
   This contract shall be for the term of thirty (30) years from the date of execution hereof unless terminated earlier as hereinafter provided. The contract may be cancelled pursuant to notice provided in Section 10 or may be cancelled by either party if laws are enacted by the State of Minnesota or the United States of America which substantially and adversely affect rights, duties, or obligations of either party under this contract. In the event the City of Dayton wants to terminate this contract, the contract shall be terminated provided Dayton reimburses costs incurred by Maple Grove to serve Dayton. It is expressly understood that this contract may be extended by the written consent of both parties.

2. **Water Service**
   A. Maple Grove agrees to furnish and deliver water from the Maple Grove water works system to the southwest portion of Dayton as shown on Exhibit "A" in sufficient quantity to meet an average day demand not to exceed 2.8 Million Gallons per Day (MGD) and a maximum day demand of 5.0 MGD.
   B. Maple Grove will furnish water to the City of Dayton at mutually agreed Connection Points (hereinafter Connection Points) at a minimum pressure as determined by elevation 1066 National Geodetic Vertical Datum of 1929.
   C. The water furnished by Maple Grove shall be the same treated water supplied by Maple Grove to Maple Grove residents.
   D. Dayton agrees that the use of water from the supply furnished by Maple Grove shall be at all times be governed by the applicable rules, regulations and conditions Maple Grove has now in effect or hereafter adopts for the preservation, regulation and protection of its water supply, and Dayton agrees to adopt the rules, regulations or requirements of Maple Grove now or hereafter adopted in connection with use of water in Maple Grove and to enact and enforce such rules, regulations and requirements as Dayton ordinances within one hundred and eighty (180) days after the execution of this contract and to enact any amendments to the regulations hereafter adopted by the City of Maple Grove within sixty (60) days after being notified of such adoption and to adopt the same penalties as those of Maple Grove for the violation thereof and to strictly enforce such rules, regulations and requirements. This section shall be, however, limited to water usage and related matter and does not give Maple Grove the right to prescribe rules for administration and billing for the Dayton water system.

3. **Water System Facilities**
   A. Maple Grove shall own and operate all facilities necessary to the supply, production, storage and transmission of water to the Connection Points, [but not including the master meter or master meters and backflow devices.]
   B. Dayton shall own and operate all facilities necessary for the metering, transmission, and distribution of water from the Connection Points to the points of delivery of water in Dayton. All such facilities shall conform to the Minnesota State Health Department requirements. Dayton shall maintain at no expense to Maple Grove its entire Dayton water system from point or points of delivery.
   C. Dayton shall keep accurate records of watermain construction and number of connections by category and such records shall be subject to inspection and auditing by Maple Grove.
   D. The Connection Points on Maple Grove's facilities shall be made by Maple Grove, but all expense shall be paid by Dayton within thirty (30) days of billing by Maple Grove. The water consumed by Dayton shall be measured by a master meter or meters furnished and maintained by Dayton at its own cost and expense at such reasonable locations to be designated by Maple Grove. Such meters shall be of a make and setting, and shall be installed and housed in a manner approved by Maple Grove. Such meters shall be subject to testing by Maple Grove at any reasonable time.
   E. Backflow prevention devices shall be installed at the Connection Points to assure no backflow or flow through of water through the Dayton system into the Maple Grove system. Dayton shall install and maintain at no expense to Maple Grove said backflow devices.

4. **Connection Charge**
   The City of Dayton shall pay a connection charge based on the current charge then in effect at time of payment to Maple Grove properties for each connection made to the system served with water from Maple Grove based on the following residential connection charges for various types of property

Land Use Type	Residential Equivalent Unit	2006 Rate
Low Density	1.0/unit	$1,700/unit
Medium and High Density with laundry facilities in each unit.		
Medium and High Density without Plumbing included for laundry facilities in each unit	.8/unit	$1,360/unit
Commercial	4.0/acre	$6,800/ac
Industrial	4.0/acre	$6,800/ac
Mixed	4.0/acre	$6,800/ac
Parks	0.5acre	$850/ac
Institutional	4.0/acre	$6,800/ac

The estimated number of Residential Equivalent Units (R.E.U.'s) in southwest Dayton that will be connect to Maple Grove's water supply is shown in the following table:

	Number of Acres	Number of R.E.U.'s
Residential (Low, Medium, High)	2800	8800
Commercial/Industrial	800	3200
Institutional	N/A	N/A
Parks	400	200
Mixed Use	-	-
Total	**4,000**	**12,200**

The City of Dayton agrees to pay Maple Grove three hundred fifty thousand dollars ($350,000) within sixty (60) days of execution of this agreement, and $350,000 when Dayton connects to Maple Grove's water supply, which amount will allow 102.94 acres, or 411.76 R.E.U.'s to connect to Maple Grove's system provided said payments are received by end of 2006. Thereafter Dayton shall pay Maple Grove for each R.E.U. or acre that connects to the system served from Maple Grove at the then current connection charge rate for Maple Grove properties and transmit payment to Maple Grove within 45 days of permit for connection.

5. **Connections Beyond Corporate Limits of Dayton**
Water extensions beyond the Corporate Dayton limits of the City of Dayton and shall be made only with the permission of Maple Grove.

6. **Rates**
Initial water rate for water sold by Maple Grove to Dayton under this agreement shall be $1.30 per 1000 gallons. In the future, the water rate shall be increased by the same percentage of increase for water to Maple Grove residents. Maple Grove's current water rates to Maple Grove residents is $.90 per 1000 gallons and $13.20 annually resulting in a current effective water rate of approximately $1.04 per 1000 gallons based on 100,000 gallons per Residential Equivalent Unit (REU) per year.

7. **Meter Reading and Billing**
Monthly readings of the master meter or meters at the Connection Points of delivery to Dayton shall be made by Maple Grove. Billings by Maple Grove shall be mailed to Dayton and payment on such bills shall be made by Dayton to Maple Grove within 30 days.

8. **Department of Health Connection Fee**
The City of Dayton shall be responsible for collecting and transmitting the state mandated water connection fee (current rate is $5.21/year) to the Minnesota Department of Health for connections made to the Dayton Water Distribution System.

9. **Liability of Maple Grove** -
Maple Grove shall not be liable for interruptions in service; provided, however, that Maple Grove shall not discriminate against Dayton water users in the event of such interruption, and shall reasonably attempt to provide uniform service to all water system users, to the extent possible in the event of such interruption.

10. **Default**
Either party shall have the right to terminate this agreement and the water service provided herein in the event that the other party fails to comply with any of the terms and conditions of this agreement. Any termination shall not take effect unless written notice of termination is provided containing a description the default. The defaulting party shall have thirty (30) days to cure the default. If the default is cured, this agreement shall be reinstated. If it is not cured within the time provided for cure, this agreement and the obligations here under shall terminate. However, such service may be

terminated only after reasonable notice to Dayton, and Dayton shall have a reasonable opportunity to correct any condition which is cited by Maple Grove as a cause for termination of water service.

11. **Indemnification**
Dayton agrees to indemnify and save Maple Grove harmless in accordance with acceptable standards from any and all claims or demands for damages rising out of or which may result from the water supplied pursuant to this agreement and from the use, installation, and maintenance and repair of its facilities as set forth in the contract.

12. **Non-Waiver**
The non-enforcement by either party hereunder of a right provided by this Agreement shall not constitute a waiver of that party's rights to enforce the term or provision of the Contract at a later date.

13. **Effective Date of Agreement**
Effective date of this agreement shall be the date of execution thereof of both parties.

CITY OF MAPLE GROVE

Date

Mayor

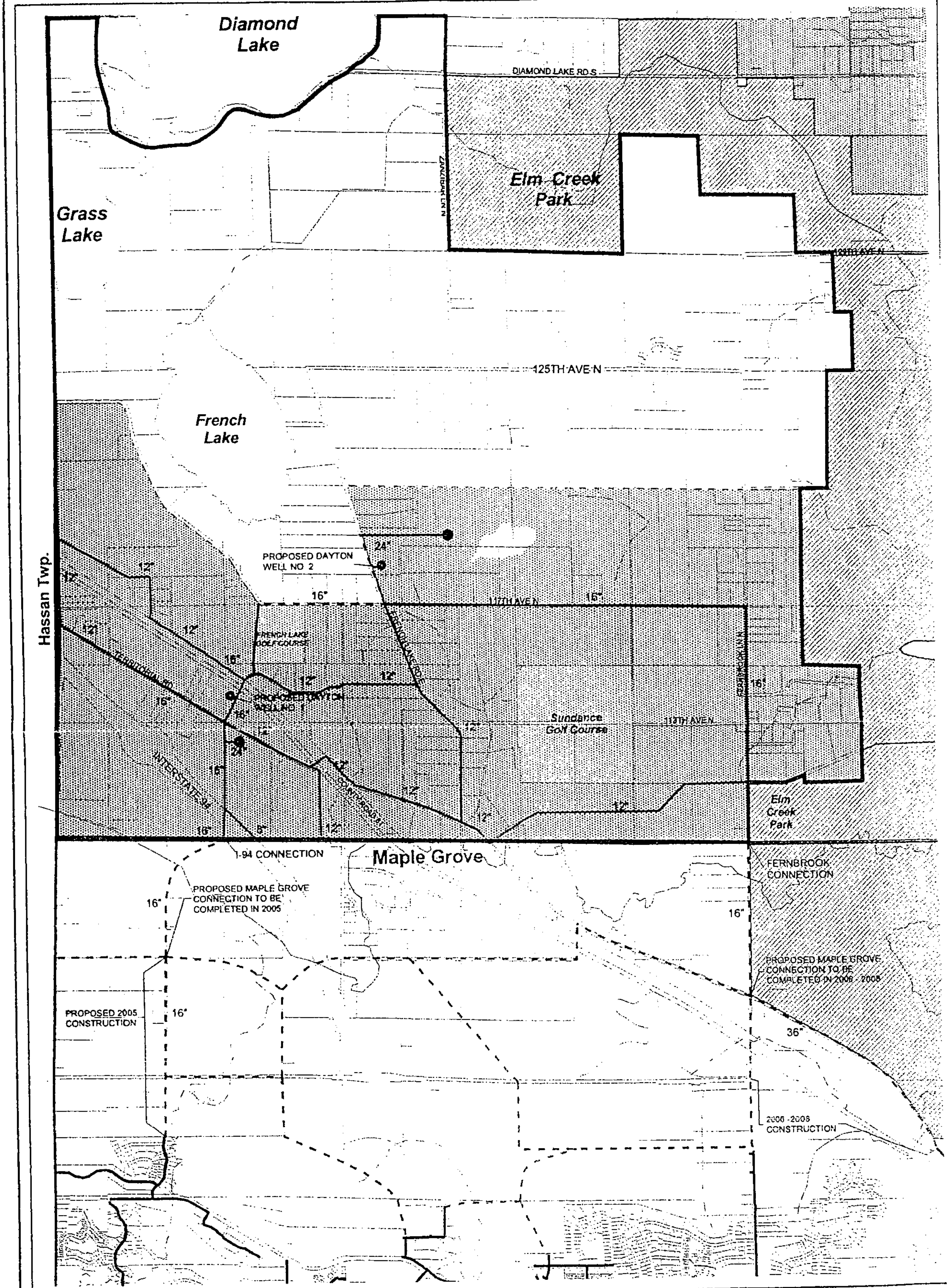
City Clerk

CITY OF DAYTON

October 3, 2006
Date

Mayor

City Clerk



City of Dayton

SW Dayton Trunk Water/ Maple Grove Connection Distribution Plan

Water Supply Investigation

May 2005

- Proposed Well
- Proposed Storage Tank

Trunk Water Mains
- Proposed SW Dayton
- Proposed Maple Grove
- Maple Grove Trunk
- City Boundary

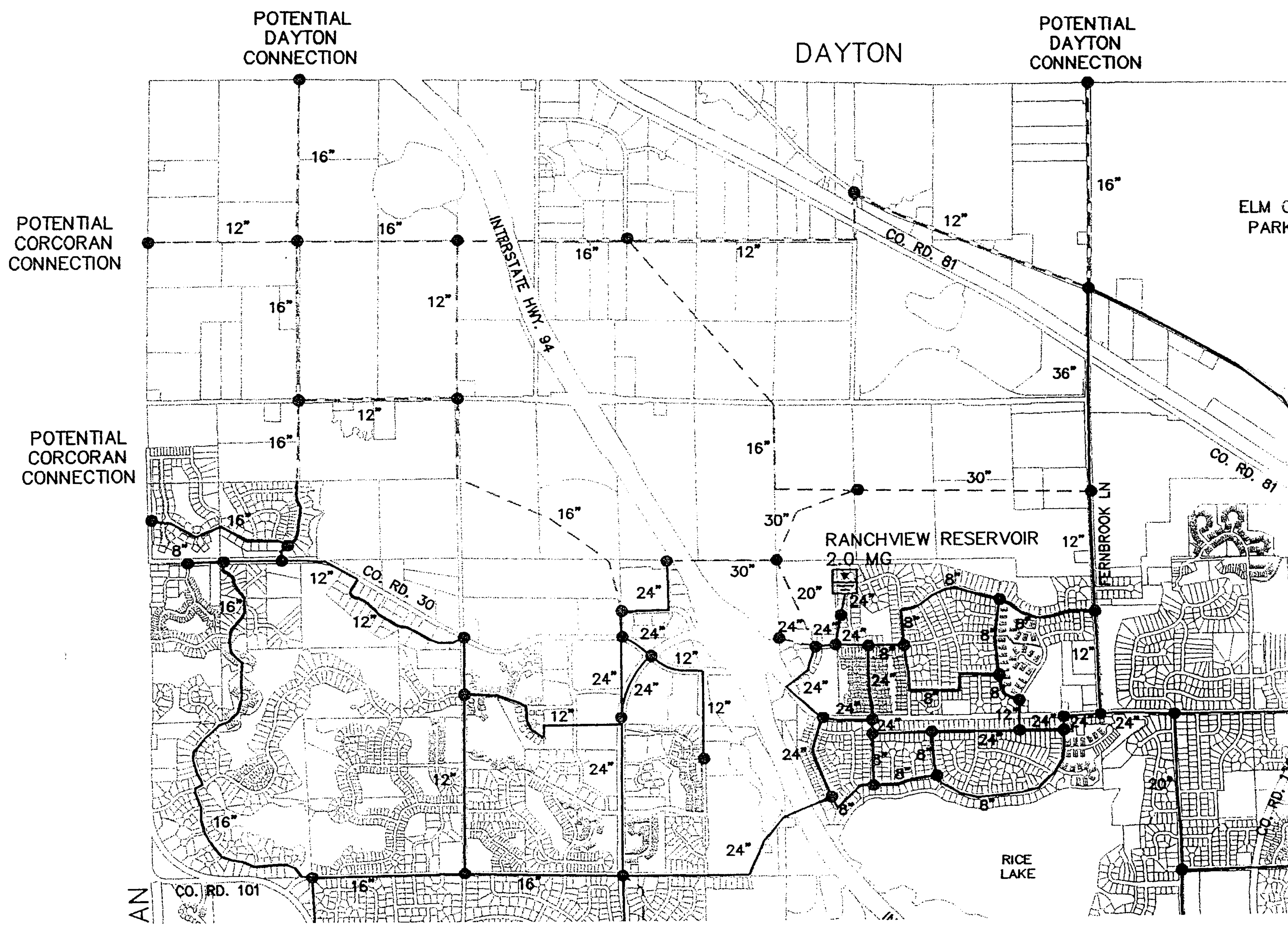
2001 Phasing
- 2000 - 2010
- 2010 - 2020
- 2020+

2020 MUSA Water Service Area

1000 0 1000 Feet

N E S W

Bonestroo Rosene Anderlik Associates Engineers & Architects


POTENTIAL DAYTON CONNECTION
DAYTON
POTENTIAL DAYTON CONNECTION
ELM C
PARK
POTENTIAL CORCORAN CONNECTION
POTENTIAL CORCORAN CONNECTION
INTERSTATE HWY. 94
CO. RD. 81
CO. RD. 81
CO. RD. 30
CO. RD. 101
FERNBROOK LN
RANCHVIEW RESERVOIR
2.0 MG
RICE LAKE
16"
12"
24"
30"
36"
20"
8"

Appendix G

National Drinking Water Standards

EPA National Primary Drinking Water Standards

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Acrylamide	TT[8]	Nervous system or blood problems;	Added to water during sewage/wastewater increased risk of cancer treatment	zero
OC	Alachlor	0.002	Eye, liver, kidney or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops	zero
R	Alpha particles	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation	zero
IOC	Antimony	0.006	Increase in blood cholesterol; decrease in blood sugar	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder	0.006
IOC	Arsenic	0.010 as of 1/23/06	Skin damage or problems with circulatory systems, and may have increased risk of getting cancer	Erosion of natural deposits; runoff from orchards, runoff from glass & electronics production wastes	0
IOC	Asbestos (fibers >10 micrometers)	7 million fibers per Liter (MFL)	Increased risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion of natural deposits	7 MFL
OC	Atrazine	0.003	Cardiovascular system or reproductive problems	Runoff from herbicide used on row crops	0.003
IOC	Barium	2	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits	2
OC	Benzene	0.005	Anemia; decrease in blood platelets; increased risk of cancer	Discharge from factories; leaching from gas storage tanks and landfills	zero
OC	Benzo(a)pyrene (PAHs)	0.0002	Reproductive difficulties; increased risk of cancer	Leaching from linings of water storage tanks and distribution lines	zero
IOC	Beryllium	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries	0.004
R	Beta particles and photon emitters	4 millirems per year	Increased risk of cancer	Decay of natural and man-made deposits of certain minerals that are radioactive and may emit forms of radiation known as photons and beta radiation	zero
DBP	Bromate	0.010	Increased risk of cancer	Byproduct of drinking water disinfection	zero
IOC	Cadmium	0.005	Kidney damage	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints	0.005
OC	Carbofuran	0.04	Problems with blood, nervous system, or reproductive system	Leaching of soil fumigant used on rice and alfalfa	0.04
OC	Carbon tetrachloride	0.005	Liver problems; increased risk of cancer	Discharge from chemical plants and other industrial activities	zero
D	Chloramines (as Cl_2)	MRDL=4.0[1]	Eye/nose irritation; stomach discomfort, anemia	Water additive used to control microbes	MRDLG=4[1]

LEGEND

D	Dinsinfectant	IOC	Inorganic Chemical	OC	Organic Chemical
DBP	Disinfection Byproduct	M	Microorganism	R	Radionuclides

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Chlordane	0.002	Liver or nervous system problems; increased risk of cancer	Residue of banned termiticide	zero
D	Chlorine (as Cl_2)	MRDL=4.0[1]	Eye/nose irritation; stomach discomfort	Water additive used to control microbes	MRDLG=4[1]
D	Chlorine dioxide (as ClO_2)	MRDL=0.8[1]	Anemia; infants & young children: nervous system effects	Water additive used to control microbes	MRDLG=0.8[1]
DBP	Chlorite	1.0	Anemia; infants & young children: nervous system effects	Byproduct of drinking water disinfection	0.8
OC	Chlorobenzene	0.1	Liver or kidney problems	Discharge from chemical and agricultural chemical factories	0.1
IOC	Chromium (total)	0.1	Allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits	0.1
IOC	Copper	TT[7]; Action Level = 1.3	Short term exposure: Gastrointestinal distress. Long term exposure: Liver or kidney damage. People with Wilson's Disease should consult their personal doctor if the amount of copper in their water exceeds the action level	Corrosion of household plumbing systems; erosion of natural deposits	1.3
M	*Cryptosporidium*	TT[3]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	zero
IOC	Cyanide (as free cyanide)	0.2	Nerve damage or thyroid problems	Discharge from steel/metal factories; discharge from plastic and fertilizer factories	0.2
OC	2,4-D	0.07	Kidney, liver, or adrenal gland problems	Runoff from herbicide used on row crops	0.07
OC	Dalapon	0.2	Minor kidney changes	Runoff from herbicide used on rights of way	0.2
OC	1,2-Dibromo-3-chloropropa ne (DBCP)	0.0002	Reproductive difficulties; increased risk of cancer	Runoff/leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards	zero
OC	o-Dichlorobenzene	0.6	Liver, kidney, or circulatory system problems	Discharge from industrial chemical factories	0.6
OC	p-Dichlorobenzene	0.075	Anemia; liver, kidney or spleen damage; changes in blood	Discharge from industrial chemical factories	0.075
OC	1,2-Dichloroethane	0.005	Increased risk of cancer	Discharge from industrial chemical factories	zero
OC	1,1-Dichloroethylene	0.007	Liver problems	Discharge from industrial chemical factories	0.007
OC	cis-1,2-Dichloroethylene	0.07	Liver problems	Discharge from industrial chemical factories	0.07
OC	trans-1,2-Dichloroethylene	0.1	Liver problems	Discharge from industrial chemical factories	0.1
OC	Dichloromethane	0.005	Liver problems; increased risk of cancer	Discharge from drug and chemical factories	zero
OC	1,2-Dichloropropane	0.005	Increased risk of cancer	Discharge from industrial chemical factories	zero
OC	Di(2-ethylhexyl) adipate	0.4	Weight loss, live problems, or possible reproductive difficulties	Discharge from chemical factories	0.4
OC	Di(2-ethylhexyl) phthalate	0.006	Reproductive difficulties; liver problems; increased risk of cancer	Discharge from rubber and chemical factories	zero
OC	Dinoseb	0.007	Reproductive difficulties	Runoff from herbicide used on soybeans and vegetables	0.007
OC	Dioxin (2,3,7,8-TCDD)	0.00000003	Reproductive difficulties; increased risk of cancer	Emissions from waste incineration and other combustion; discharge from chemical factories	zero
OC	Diquat	0.02	Cataracts	Runoff from herbicide use	0.02
OC	Endothall	0.1	Stomach and intestinal problems	Runoff from herbicide use	0.1

LEGEND

D	Dinsinfectant	IOC	Inorganic Chemical	OC	Organic Chemical
DBP	Disinfection Byproduct	M	Microorganism	R	Radionuclides

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Endrin	0.002	Liver problems	Residue of banned insecticide	0.002
OC	Epichlorohydrin	TT[8]	Increased cancer risk, and over a long period of time, stomach problems	Discharge from industrial chemical factories; an impurity of some water treatment chemicals	zero
OC	Ethylbenzene	0.7	Liver or kidneys problems	Discharge from petroleum refineries	0.7
OC	Ethylene dibromide	0.00005	Problems with liver, stomach, reproductive system, or kidneys; increased risk of cancer	Discharge from petroleum refineries	zero
IOC	Fluoride	4.0	Bone disease (pain and tenderness of the bones); Children may get mottled teeth	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories	4.0
M	*Giardia lamblia*	TT[3]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	zero
OC	Glyphosate	0.7	Kidney problems; reproductive difficulties	Runoff from herbicide use	0.7
DBP	Haloacetic acids (HAA5)	0.060	Increased risk of cancer	Byproduct of drinking water disinfection	n/a[6]
OC	Heptachlor	0.0004	Liver damage; increased risk of cancer	Residue of banned termiticide	zero
OC	Heptachlor epoxide	0.0002	Liver damage; increased risk of cancer	Breakdown of heptachlor	zero
M	Heterotrophic plate count (HPC)	TT[3]	HPC has no health effects; it is an analytic method used to measure the variety of bacteria that are common in water. The lower the concentration of bacteria in drinking water, the better maintained the water system is.	HPC measures a range of bacteria that are naturally present in the environment	n/a
OC	Hexachlorobenzene	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from metal refineries and agricultural chemical factories	zero
OC	Hexachlorocyclopentadien e	0.05	Kidney or stomach problems	Discharge from chemical factories	0.05
IOC	Lead	TT[7]; Action Level = 0.015	Infants and children: Delays in physical or mental development; children could show slight deficits in attention span and learning abilities; Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits	zero
M	*Legionella*	TT[3]	Legionnaire's Disease, a type of pneumonia	Found naturally in water; multiplies in heating systems	zero
OC	Lindane	0.0002	Liver or kidney problems	Runoff/leaching from insecticide used on cattle, lumber, gardens	0.0002
IOC	Mercury (inorganic)	0.002	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and croplands	0.002
OC	Methoxychlor	0.04	Reproductive difficulties	Runoff/leaching from insecticide used on fruits, vegetables, alfalfa, livestock	0.04
IOC	Nitrate (measured as Nitrogen)	10	Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	10
IOC	Nitrite (measured as Nitrogen)	1	Infants below the age of six months who drink water containing nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits	1

LEGEND

D	Dinsinfectant	IOC	Inorganic Chemical	OC	Organic Chemical
DBP	Disinfection Byproduct	M	Microorganism	R	Radionuclides

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Oxamyl (Vydate)	0.2	Slight nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, and tomatoes	0.2
OC	Pentachlorophenol	0.001	Liver or kidney problems; increased cancer risk	Discharge from wood preserving factories	zero
OC	Picloram	0.5	Liver problems	Herbicide runoff	0.5
OC	Polychlorinated biphenyls (PCBs)	0.0005	Skin changes; thymus gland problems; immune deficiencies; reproductive or nervous system difficulties; increased risk of cancer	Runoff from landfills; discharge of waste chemicals	zero
R	Radium 226 and Radium 228 (combined)	5 pCi/L	Increased risk of cancer	Erosion of natural deposits	zero
IOC	Selenium	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems	Discharge from petroleum refineries; erosion of natural deposits; discharge from mines	0.05
OC	Simazine	0.004	Problems with blood	Herbicide runoff	0.004
OC	Styrene	0.1	Liver, kidney, or circulatory system problems	Discharge from rubber and plastic factories; leaching from landfills	0.1
OC	Tetrachloroethylene	0.005	Liver problems; increased risk of cancer	Discharge from factories and dry cleaners	zero
IOC	Thallium	0.002	Hair loss; changes in blood; kidney, intestine, or liver problems	Leaching from ore-processing sites; discharge from electronics, glass, and drug factories	0.0005
OC	Toluene	1	Nervous system, kidney, or liver problems	Discharge from petroleum factories	1
M	Total Coliforms (including fecal coliform and *E. coli*)	5.0%[4]	Not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present[5]	Coliforms are naturally present in the environment as well as feces; fecal coliforms and *E. coli* only come from human and animal fecal waste.	zero
DBP	Total Trihalomethanes (TTHMs)	0.10 0.080 after 12/31/03	Liver, kidney or central nervous system problems; increased risk of cancer	Byproduct of drinking water disinfection	n/a[6]
OC	Toxaphene	0.003	Kidney, liver, or thyroid problems; increased risk of cancer	Runoff/leaching from insecticide used on cotton and cattle	zero
OC	2,4,5-TP (Silvex)	0.05	Liver problems	Residue of banned herbicide	0.05
OC	1,2,4-Trichlorobenzene	0.07	Changes in adrenal glands	Discharge from textile finishing factories	0.07
OC	1,1,1-Trichloroethane	0.2	Liver, nervous system, or circulatory problems	Discharge from metal degreasing sites and other factories	0.20
OC	1,1,2-Trichloroethane	0.005	Liver, kidney, or immune system problems	Discharge from industrial chemical factories	0.003
OC	Trichloroethylene	0.005	Liver problems; increased risk of cancer	Discharge from metal degreasing sites and other factories	zero
M	Turbidity	TT[3]	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (e.g., whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing micro-organisms such as viruses, parasites and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.	Soil runoff	n/a
R	Uranium	30 ug/L as of 12/08/03	Increased risk of cancer, kidney toxicity	Erosion of natural deposits	zero

LEGEND

D	Dinsinfectant	IOC	Inorganic Chemical	OC	Organic Chemical
DBP	Disinfection Byproduct	M	Microorganism	R	Radionuclides

	Contaminant	MCL or TT[1] (mg/L)[2]	Potential health effects from exposure above the MCL	Common sources of contaminant in drinking water	Public Health Goal
OC	Vinyl chloride	0.002	Increased risk of cancer	Leaching from PVC pipes; discharge from plastic factories	zero
M	Viruses (enteric)	TT[3]	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste	zero
OC	Xylenes (total)	10	Nervous system damage	Discharge from petroleum factories; discharge from chemical factories	10

NOTES

1 Definitions

- Maximum Contaminant Level Goal (MCLG)—The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.
- Maximum Contaminant Level (MCL)—The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.
- Maximum Residual Disinfectant Level Goal (MRDLG)—The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.
- Maximum Residual Disinfectant Level (MRDL)—The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.
- Treatment Technique (TT)—A required process intended to reduce the level of a contaminant in drinking water.

2 Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million (ppm).

3 EPA's surface water treatment rules require systems using surface water or ground water under the direct influence of surface water to (1) disinfect their water, and (2) filter their water or meet criteria for avoiding filtration so that the following contaminants are controlled at the following levels:

- *Cryptosporidium* (as of 1/1/02 for systems serving >10,000 and 1/14/05 for systems serving <10,000) 99% removal.
- *Giardia lamblia*: 99.9% removal/inactivation
- Viruses: 99.99% removal/inactivation
- *Legionella:* No limit, but EPA believes that if *Giardia* and viruses are removed/inactivated, *Legionella* will also be controlled.
- Turbidity: At no time can turbidity (cloudiness of water) go above 5 nephelolometric turbidity units (NTU); systems that filter must ensure that the turbidity go no higher than 1 NTU (0.5 NTU for conventional or direct filtration) in at least 95% of the daily samples in any month. As of January 1, 2002, for systems servicing >10,000, and January 14, 2005, for systems servicing <10,000, turbidity may never exceed 1 NTU, and must not exceed 0.3 NTU in 95% of daily samples in any month.
- HPC: No more than 500 bacterial colonies per milliliter
- Long Term 1 Enhanced Surface Water Treatment (Effective Date: January 14, 2005); Surface water systems or (GWUDI) systems serving fewer than 10,000 people must comply with the applicable Long Term 1 Enhanced Surface Water Treatment Rule provisions (e.g. turbidity standards, individual filter monitoring, *Cryptosporidium* removal requirements, updated watershed control requirements for unfiltered systems).
- Filter Backwash Recycling: The Filter Backwash Recycling Rule requires systems that recycle to return specific recycle flows through all processes of the system's existing conventional or direct filtration system or at an alternate location approved by the state.

4 No more than 5.0% samples total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per month.) Every sample that has total coliform must be analyzed for either fecal coliforms or *E. coli* if two consecutive TC-positive samples, and one is also positive for *E. coli* fecal coliforms, system has an acute MCL violation.

5 Fecal coliform and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Disease-causing microbes (pathogens) in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms. These pathogens may pose a special health risk for infants, young children, and people with severely compromised immune systems.

6 Although there is no collective MCLG for this contaminant group, there are individual MCLGs for some of the individual contaminants:

- Haloacetic acids: dichloroacetic acid (zero); trichloroacetic acid (0.3 mg/L)
- Trihalomethanes: bromodichloromethane (zero); bromoform (zero); dibromochloromethane (0.06 mg/L)

7 Lead and copper are regulated by a Treatment Technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed the action level, water systems must take additional steps. For copper, the action level is 1.3 mg/L, and for lead is 0.015 mg/L.

8 Each water system must certify, in writing, to the state (using third-party or manufacturers certification) that when it uses acrylamide and/or epichlorohydrin to treat water, the combination (or product) of dose and monomer level does not exceed the levels specified, as follows: Acrylamide = 0.05% dosed at 1 mg/L (or equivalent); Epichlorohydrin = 0.01% dosed at 20 mg/L (or equivalent).

LEGEND

D	Dinsinfectant	IOC	Inorganic Chemical	OC	Organic Chemical
DBP	Disinfection Byproduct	M	Microorganism	R	Radionuclides

National Secondary Drinking Water Standards

National Secondary Drinking Water Standards are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply. However, states may choose to adopt them as enforceable standards.

Contaminant	Secondary Standard
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

Office of Water (4606M)
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www.epa.gov/safewater
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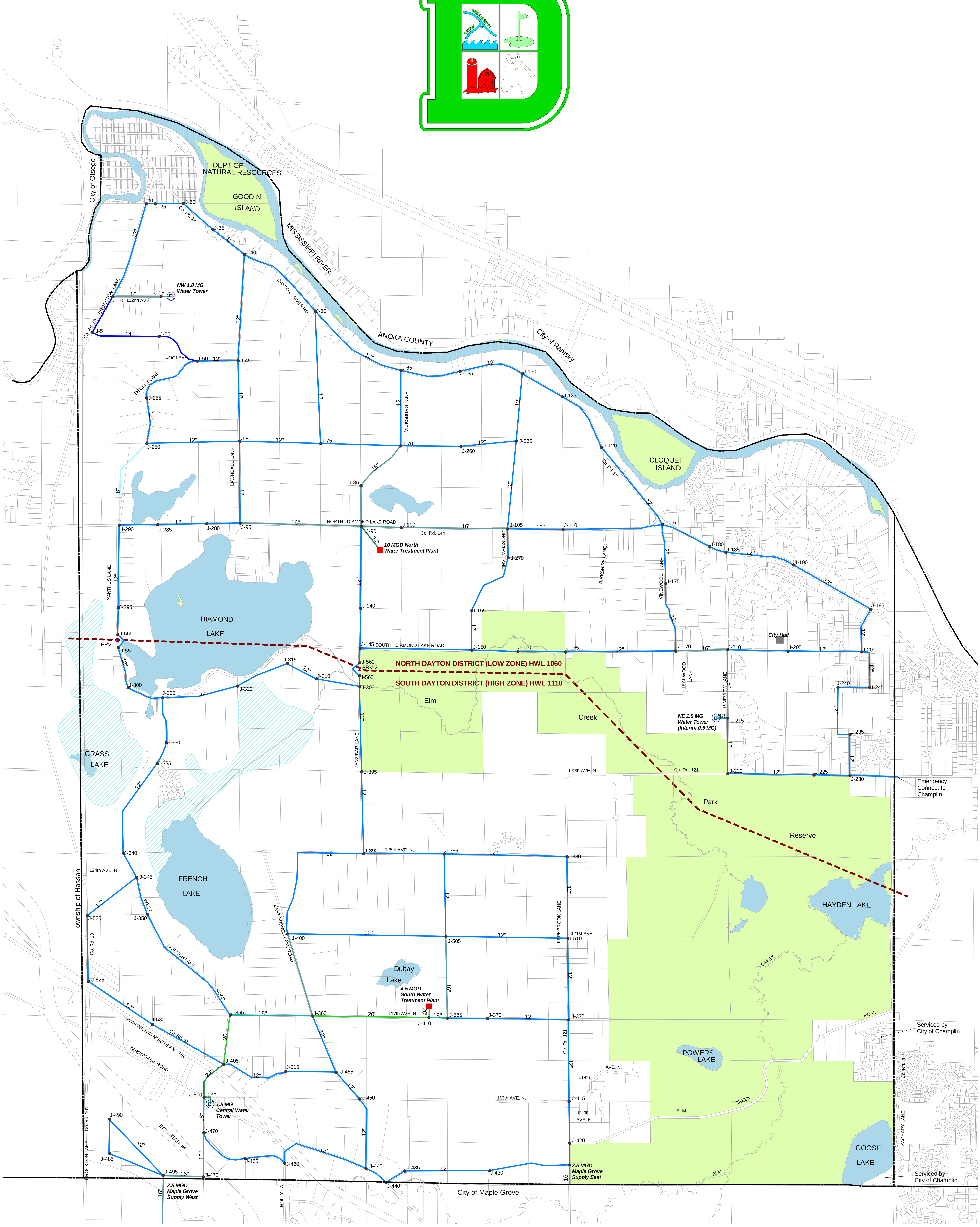
City of

DAYTON, MINNESOTA

Water Supply and Distribution Map



Water Legend

Water Pipes		
8"	Water Tank	Pressure Zone Boundary
12"	Pressure Valve	City Limits
14"	Treatment Plant	Parcels
16"	Junction	
18"		
20"		
24"		

Bonestroo Rosene Anderlik & Associates
Engineers & Architects

N W E S

Figure 1

February 2007

1500 0 1500 Feet

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