Report

on the

Trunk Sanitary Sewer, Water Main and Storm Sewer

for the

2007 City of Isanti Comprehensive Plan

Prepared for:

The City of Isanti

August 2007
Revised September 19, 2007

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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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Date

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I. INTENT AND ASSUMPTIONS

The intent of this report is to examine and make recommendations on the water system, sanitary sewer system, and the storm sewer system. Assumptions were made throughout the report. The assumptions used in the report are based on what other cities similar to Isanti can expect and on patterns the City of Isanti is currently experiencing.

A. Community Statistics and Population

The Village of Isanti was incorporated February 27, 1901. The city experienced slow steady growth up to the 1990's as a railway and agricultural community. During the later half of the 1990's, the community began experiencing faster growth as a bedroom community to the Twin Cities. From 2000 through 2006, Isanti has more than doubled its population.

1. Existing Population and Households in the Municipal Utilities Service Area

Based on the 2000 census, the City of Isanti has the following population characteristics:

Table 1 – Census Data

1990 Population	1228
2000 Census	
Population	2324
Detached Housing Units	620
Attached Housing Units	214
Occupancy Rate	97.8%
Average Household Size	2.84
Median Household Income	$43,587

The City of Isanti has added a significant number of housing units since the 2000 census. This growth is projected to continue as the Twin Cities metropolitan area expands north along the Trunk Highway 65 corridor. Table 2 shows the population estimates for the City assuming the occupancy rate and household size have remained constant based on residential building permits issued during the past six years.

Table 2 – Building Permits 2001-2006

2001 Construction	
Detached Units	177
Attached Units	72
Added Population	+692
2002Construction	
Detached Units	76
Attached Units	16
Added Population	+256
2003 Construction	
Detached Units	78
Attached Units	24
Added Population	+283
2004 Construction	
Detached Units	120
Attached Units	120
Added Population	+667
2005 Construction	
Detached Units	163
Attached Units	36
Added Population	+553
2006 Construction	
Detached Units	89
Attached Units	0
Added Population	+247

Based on this evaluation, the population as of May 2007 is 5022.

2. Projected Population

The population projections below were developed using past population data. The high estimate assumes that the population will continue growing linearly at the rate it has for the most recent 6 years. The low estimate assumes that the population will grow linearly at the average rate it has over the past 26 years.

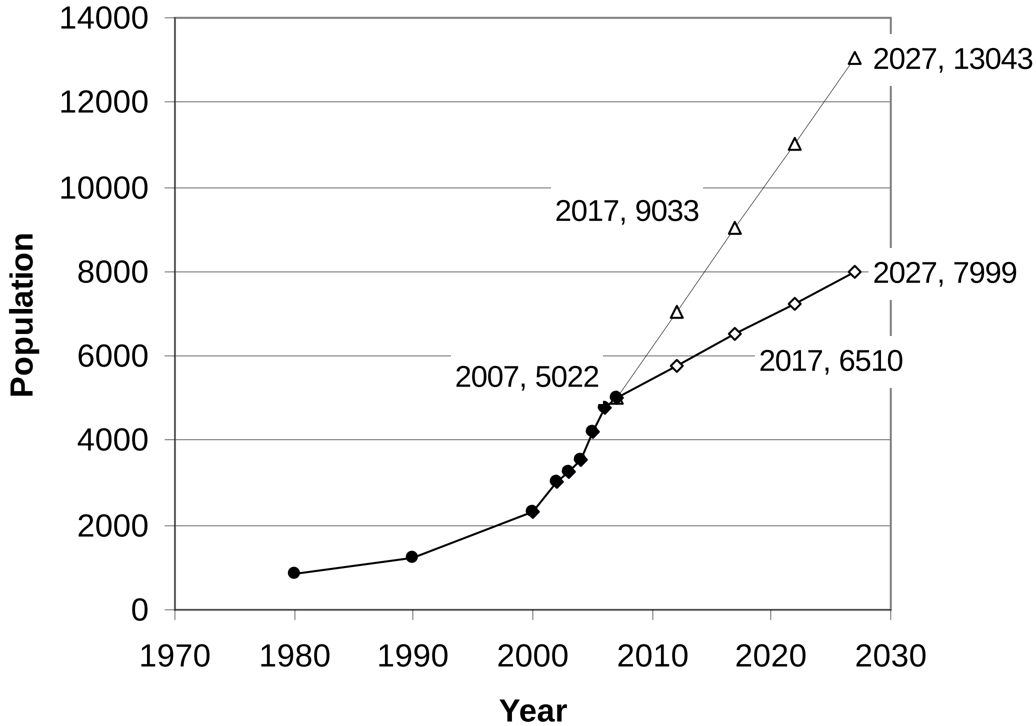

Figure 1 – Population Projections

The actual growth experienced in Isanti from the present through 2027 will likely be somewhere between these two projections.

Changes in the actual future land use patterns, industries and construction types with unusually high water demands, or high fire flow requirements will need to be considered on a case-by-case basis. This report should be reviewed and updated periodically to incorporate any item contrary to the above assumptions.

II. EXISTING WATER SYSTEM

The city's water system consists of four major components. They are:

- Supply
- Treatment
- Storage
- Distribution

Together these four components provide the citizens of the City of Isanti with quality water for consumption and fire fighting. Appendix A includes the existing water system map.

A. Water Supply

All water supplied by the City of Isanti is currently provided by 2 wells. Well # 1 is located adjacent to the old water tower site in the Southwest quadrant of Unity Boulevard and 1st Avenue

North on a 12-inch trunk water main. Well #2 is located west of 1st Avenue North approximately 950-feet North of Well #1 on a dead-end 10-inch trunk water main. Well #3 will be completed in 2007 and is located North of the water tower. Specific parameters of the wells are given in Table 3.

Table 3 – Well Parameters

	Well #1	**Well #2**	**Well #3**
Construction date	5/10/76 Reconstructed 1/31/03	1991	2007
Depth	378 ft	380 ft	380 ft
Ground Elevation (+/- 5ft)	939 ft	937 ft	940 ft
Construction	12" casing to 159 ft, open hole below	18" casing to 273 ft open hole below	18" casing to 307 ft open hole below
Well Capacity	Tested to 500 gpm	Tested to 1500 gpm	Tested to 1750 gpm
Motor size	30 hp	100 hp	100 hp
Variable speed	No	Yes	Yes
Pump Setting	60 ft w/ 10 ft suction	130 ft w/ 10 ft suction	135 ft w/ 10 ft suction
Column	6"	10"	10"
Pump Capacity–single	420 gpm, 0.60 mgd	1200 gpm, 1.7 mgd	1450 gpm, 2.1 mgd
Stand-by power	Receptacle	none	Receptacle

Pump capacities are listed as the pumping rate at typical groundwater elevation and average tower elevation. Single pump capacity is the rate achieved with only one well pump running. When more than one pump is running at any time, the capacity of the pumps will be somewhat lower than the sum of two or more pumps running simultaneously.

Table 4 – Water Demand 2006

	Daily Flow (mgd)	**Per Capita Flow (gpcd)**
Average Annual	0.468	98
Maximum Monthly	0.942	197
Maximum Day	1.306	274

Water from Well #1 is withdrawn from the Ironton-Galesville and Mt. Simon Aquifers. Water from Wells #2 and #3 is withdrawn from the Mt. Simon Aquifer. Both aquifers are known to produce water high in iron and manganese. The Mt. Simon Aquifer is able to provide much higher capacity levels, but sometimes produces water high in radium. The Ironton-Galesville is limited in well capacity, but generally produces water lower in radium. Well #1 extends into both aquifers; therefore, there may be blending of water from both aquifers within the well. This method of construction is no longer allowed by the Minnesota Department of Health. Table 5 shows water quality parameter for each well

Table 5 – Water Quality Parameters

	Well #1	**Well #2**	**Well #3** (Preliminary)	**MDH Standard**
Iron (mg/L)	0.60	1.0	0.46	0.30[2]
Manganese (mg/L)	0.55	0.26	-	0.05[2]
Combined Radium (pCi/L)	1.13-2.6	5.7-6.6	3.17	5.4[1]
Gross Alpha (pCi/L)	3.0	12.6	5.44	15.4[1]

1 – Primary standard (human health)
2 – Secondary standard (aesthetic)

The water from Well #2 exceeds the primary standard for combined radium. The water from all wells exceeds the secondary standard for iron and manganese. It should be noted that the results listed for Well #3 are from a single sample collected prior to the well being put into operation. Samples from a test well located approximately 50 feet from Well #3 indicated Combined Radium in excess of 10 pCi/L.

The wells should be sized to provide the maximum daily demand with the largest unit out of service. Using these criteria, prior to completion of Well #3, Isanti has well capacity adequate to serve a population of 2200. This is substantially lower than the existing population. It has not caused problems in the past because the larger well has not been out of service during times of peak demand.

Operation of the wells is controlled by the water level in the elevated storage tank. At low level, both wells are called to operate until the tower is filled. The effect of this is that for the majority of the distribution system, water from both wells is blended unless one of the wells is out of service. During 2005 and 2006, Well #1 was out of service for a total of 36 days. Well #2 was out of service for 3 weeks during the Fall of 2006 because of water quality impacts apparently caused by the construction of Well #3. Aside from that period, Well #2 has not out of service for more than 24 hours during the past few years.

There is a 1300-ft portion of the main along 1st Avenue North between Well #2 and Well #1 which receives water only from Well #2.

B. Water Treatment

The City of Isanti provides chlorine gas disinfection and fluoridation at Well #1 and Well #2 according to the Minnesota Department of Health. Potassium permanganate is added to sequester iron and manganese. Similar treatment will be installed at Well #3.

C. Water Storage

There are many reasons for a city to have water storage. Some are:

- Eliminate the need for continuous pumping,
- To equalize pumping rates and pressures throughout the day,
- To equalize supply and demand over a long period of high consumption and
- To provide Insurance Services Office (ISO) required fire flow capacities

The existing water tower was manufactured by Chicago Bridge and Iron and placed in service in 2003. The tank is located on the water tower service drive West of East Dual Boulevard.

The old 100,000-gallon elevated water tower was demolished in 2005.

Specific parameters of the existing water tower are given in Table 6.

Table 6 – Existing Water Tower

Capacity	750,000 gallons
Overflow Elevation	1092 ft
Low Water Elevation	1052 ft
Typical Operating Elevation	1085 ft
Ground Elevation at Tower	943 ft
Static Pressure at Tower	61 psi

The currently required ISO fire flow is 2250 gpm for a duration of 120 minutes. Assuming the future ISO requirement increases to 3000 gpm for a duration of 180 minutes, with the addition of Well #3, the tower is large enough to serve a population of approximately 9,900. This capacity can be increased by adding storage and/or adding well capacity.

D. Distribution System

A distribution system consists of a network of pipes, fire hydrants, valves, meters and service lines. The distribution system delivers water to homes, businesses and industry for drinking, irrigation, fire protection and other uses. This distribution system must be able to meet maximum water demands in addition to fire flow requirements and maintain adequate pressures throughout the system. Valves are placed to isolate portions of the system for maintenance, repairs, cleaning and allow for future additions to the system.

The City's water distribution network consists primarily of 6-inch to 16-inch ductile iron pipe. The developed portion of Isanti West of TH 65 ranges from 920 to 950 feet above sea level. Areas proposed for development on the East side of TH 65 range from 940 to 970 feet above sea level.

Given these ground elevations, the existing tower offers a range of 50 psi to 70 psi static pressure. Friction losses in the distribution system especially during high flows and in areas that are located on dead-end mains sometimes reduce the pressure to below acceptable levels

III. EXISTING SANITARY SEWER SYSTEM

A sanitary sewer system is an underground carriage system for transporting domestic and industrial wastewater to treatment and disposal. Appendix B includes the existing sewer system map.

The main components of a sanitary sewer system are:

- Gravity Collection
- Lift Stations and Force Main
- Treatment and Disposal

A. Gravity Collection System

Sewer pipes are hydraulic conveyance structures that carry wastewater to a treatment plant. A typical method of conveyance used in sewer systems is to transport wastewater by gravity along a downward sloping pipe gradient. These sewers, known as gravity sewers, are designed so that the slope and size of the pipe is adequate to maintain flow towards the discharge point without surcharging manholes or pressurizing the pipe.

The gravity sanitary sewer main in Isanti ranges in size from 8” to 18” and on the average, currently transports about 275,000 gallons of wastewater daily. The existing system currently has few issues with capacity.

In 2000, the City investigated the cause of recurrent sanitary sewer backups, frequent root removal and excessive sewer maintenance. Video observation of portions of the sanitary sewer identified numerous areas of vitrified clay sewer with offset joints and root intrusion.

In 2002, the existing V-C sewer on 5th Avenue collapsed. Emergency work was completed to repair this pipe.

In response to the problems identified in the 2000 video, the City has removed existing V-C pipe in older parts of the City and replaced it with PVC pipe. This has eliminated a major source of inflow and infiltration, as well as improving the structural integrity of the collection system.

There are limited portions of V-C pipe remaining in the area generally south of downtown. The area of greatest concern at this time is the sanitary sewer crossing the BNSF railroad at Broadway, running south along the railroad to Elizabeth and west to 2nd Avenue. This line is undersized, experiences root intrusion and has caused sewer backups at a property on Broadway.

B. Lift Stations and Force Main

Wastewater lift stations are facilities designed to move wastewater from lower to higher elevation through pumps and force mains. For example, a sewage lift station is used to pump wastewater uphill from a low-lying neighborhood to a gravity collection system of pipes. Key elements of lift stations include:

- wastewater receiving well (wet-well)
- screen or grinding to remove coarse materials (for large lift stations)
- pumps
- motors
- power supply system with emergency power provisions
- equipment control
- alarm system
- odor control system and ventilation system

Currently, the City of Isanti operates and maintains nine lift stations. Table 7 shows the parameters for each lift station.

Table 7 – Lift Station Parameters

Lift Station		Year Constructed	Pump Motors	Pump Capacity
Main (Old WWTF)	C1	1997	50Hp	1100 gpm @ 85'
Credit Union	H1	Controls in 2005	2Hp	200 gpm @ 20'
Ind. Park	G1	2001	5 Hp	400 gpm
1st Ave. (near city hall)	E1	1968	5 Hp	300 gpm @ 35'
RRM – 2nd	D1	2005	5 Hp	125 gpm
Deerhaven	F2	2004	3 Hp	100 gpm
South Park	F1	2005	5 Hp	180 gpm
8th Avenue (Fairway Blvd.)	J1	2006	20 Hp	700 gpm @ 62'
Palomino Ridge	I1	1999	3 Hp	200 gpm @20'

All lift stations have two operating pumps installed. The Main Lift Station includes a third pump rated at 400 gpm. This pump pumps to an equalization basin to reduce peak flows. The 8th Ave Lift Station has space for a third 700 gpm pump to be installed when flows warrant. This would increase the capacity of the lift station to 1400 gpm.

All lift stations pump to another section of gravity sewer with the exception of the Main and 8th Ave lift stations. These lift stations pump directly to the WWTF.

The Main Lift Station pumps through a 12-inch force main. The ultimate capacity of this force main is approximately 1800 gpm and is limited by pump availability rather than force main velocity.

The 8th Ave Lift Station pumps through dual 10-inch force mains. The ultimate capacity of this force main is approximately 2600 gpm and is limited by pump availability rather than force main velocity.

C. Treatment and Disposal

The current wastewater treatment facility (WWTF) was constructed in 1995. The WWTF has an average wet weather flow capacity of 0.657 MGD with an average day dry weather flow capacity of 0.587 MGD. This treatment plant replaced the old wastewater treatment plant located south of Spirit Brook Drive. A lift station was installed at this location to pump the sewage to the wastewater treatment plant currently in use.

The average monthly influent flow recorded over the past year is approximately 250,000 gpd. The actual flows will be somewhat higher due to the industrial park lift station does not flow through the flow meter. However, at current pumping rates, the industrial park lift station adds less than 25,000 gpd. In 2007, Isanti is at about 44% of its flow capacity.

The 2006 population estimate for Isanti is 5,206. This is an estimate prepared by the State Demographer based on housing permits. Based on this estimate, Isanti averages 53 gallons per person per day. This is not a reasonable assumption. A typical city has a per capita wastewater flow of 120 gpcd. The per capita wastewater production in Isanti may be low for a combination of the following reasons:

- The actual population is lower because:
    - Not all building permits pulled result immediately in occupied housing

    - Housing may now have fewer than 2.84 occupants on average.
- Commercial development currently lags residential development. As commercial development comes, the per capita water and wastewater usage will move into the typical range.
- The Inflow and Infiltration (I/I) generally assumed for per capita wastewater generation is lower in Isanti because of the soils.

Assuming that Isanti will eventually generate a typical volume of wastewater as other communities, but will continue to have lower than typical I/I, the wastewater flow will eventually approach 100 gpcd. Using this value, the existing WWTF has a population capacity of approximately 6,250.

The City discharges to the Rum River through a15-24” outfall line constructed in 1997. The line has a capacity of approximately 4.46 mgd. Because the existing treatment system consists of ponds which have the advantage of equalizing flow, the existing outfall is adequate for a population of approximately 16,000 people. If a different treatment system were installed with a lower hydraulic detention time, the population capacity would decrease somewhat, but should be adequate for a population of up to 14,000 under any circumstance.

IV. EXISTING STORM SEWER SYSTEM

The storm sewer system provides a means of transport for storm water runoff from streets to infiltration basins or surface water. Appendix C includes the existing storm sewer system map.

The main components of a storm sewer system are:

- Catch basins
- Storm sewer pipe
- Wet Detention Ponds
- Dry Ponds
- Infiltration basins

A. Collection System

The storm water collection system collects water through catch basins, field inlets and flared end section inlets. Inlets and piping are typically sized to transport a 5-yr rain event in residential development (10-yr in commercial/industrial developments) without allowing water to pond in the street.

Storm sewers in Isanti typically range from 12 to 30” in diameter. Isanti does not currently have any storm sewer lift stations.

The City has adopted Engineering Standards with storm sewer design requirements, but does not currently have a Storm Water Management Ordinance. The City is considering implementing a Storm Water Management Ordinance in 2007.

Some storm sewers in the old part of town have become undersized as the City has grown. The majority of the undersized sewers have been replaced as street projects have been completed. One remaining undersized section is the storm sewer on Elizabeth between 1st and 2nd Avenue and the storm sewer extending south along 2nd Avenue from Elizabeth to Spirit Brook.

B. Detention, Treatment and Disposal

In the late 1990's, Isanti began requiring new developments to mitigate post-construction runoff to below preconstruction runoff rates. Developments constructed prior to this time typically have storm sewer collection and discharge directly to Park Brook or Spirit Brook.

More recent developments have used a combination of dry and wet ponds to reduce storm water runoff rates and pollutants. Typically, ponds are sized to serve only the developments for which they are constructed. Isanti does not have any regional storm water ponds.

In 2004, the City began requiring infiltration basins for developments proposed in land locked basins.

V. RECOMMENDATIONS FOR WATER SYSTEM

The City of Isanti's water system was simulated on a computer. The following discusses the water model and gives recommendations how Isanti could update four major components of the water system to continue to provide water to this growing community. The four major components that were examined are:

- Water supply
- Water Treatment
- Water storage and
- Distribution system

A. Water Supply

As the City of Isanti grows, the demand for water will grow. The City currently has a reliable capacity (the capacity with the largest well, Well #2, out of service) of approximately 420 gpm, or 0.55 mgd. During the past couple of years, there have been numerous occasions when the water demand exceeded the capacity of Well #1.

1. Well and Pumphouse #3

Construction of Well and Pumphouse #3 is underway and will be completed in the Fall of 2007. Well #3 will increase source capacity to the pumping rate of the two smallest wells. The third well will have a capacity of 1450 gpm; therefore, the reliable source capacity for the City will increase to 1620-gpm. This will be adequate to supply water for a community with a population of about 8,500.

Adding Well #3 may not address the problem with combined radium. Initial tests in Well #3, have been below the MCL; however, as the Mt. Simon aquifer is known to be high in radium, the City should not consider this a long term solution to the radium water quality issue. Well blending may be a viable solution until water treatment is implemented. The 2007 Well Blending Project will connect the wells into a common main prior to connection to the distribution system. This will also provide a connection point to transport water to a future treatment facility.

2. Well and Pumphouse #4

When the population grows beyond 8,500 it may be necessary to construct a fourth well. If Well #4 draws from the Mt. Simon aquifer, it should be separated from Wells #2 and #3 to minimize the impact on the water level in those wells. Well #4 could be located on City property in Bluebird Park. If Well #4 were designed to draw from the Ironton-Galesville aquifer, it could be constructed at the existing Water Tower site near Well #3. Under this scenario, Well #4 would have a lower capacity, but could be used for blending to meet Combined Radium standards if treatment is not provided.

3. Water Treatment

Well #2 has consistently violated the EPA standard for Combined Radium 226 + 228. As a result, the City has been required by the Minnesota Department of Health to notify the public of the exceedance and take corrective action. Well #1 is below the limit. The initial test shows Well #3 being under the limit; however, tests collected from a smaller test well in the same area were consistently higher than the limit.

The Department of Health recognizes several methods of treatment to reduce radium levels. These include;

- Blending
- Limiting production from the noncompliant well
- Reverse Osmosis (home water softener)
- Lime Softening
- Reverse Osmosis membranes
- Electro-Dialysis
- Greensand Filtration

Blending and limiting production from the noncompliant well are the easiest and least costly solution to the problem. If this solution is adopted for the long term, a new well will be required in the Ironton-Galesville aquifer or the surfacial drift. Blending will not improve the water quality with respect to iron or manganese.

Lime softening, reverse osmosis and electro-dialysis produce softened water. The excess iron, manganese, calcium and magnesium are removed. These processes tend to be relatively expensive as the quality of water (softened) is higher than in a filtration system.

Greensand filtration is commonly used in Minnesota to remove iron and manganese; however, it does not remove calcium or magnesium. Greensand filtration offers the following advantages:

1. Radium can be removed to below maximum concentration limits
2. Iron and manganese can be removed to below secondary standard (nuisance) limits
3. Existing home water softeners can still be used to control Ca+Mg hardness
4. Treatment systems can be easily expanded.

5. Construction costs are lower in comparison to other systems applicable for radium removal.

One proprietary adsorption process for removing radium has been pilot tested in Minnesota. The results of this study seemed to indicate equipment problems when applied on water with high iron concentration. This process is not recommended for the City of Isanti until several large-scale applications on high-iron water sources have been demonstrated to operate well.

The City is considering construction of a treatment facility in the future. A Pilot Study completed in July 2007 demonstrated the ability of greensand filtration with Hydrous Manganese Oxide addition to remove radium to below primary standards. Iron and manganese were removed to below secondary standards.

B. Water Storage

Currently, the City of Isanti has Water Tower #1 with a capacity of 750,000-gallons. This water is required for fire protection and to supply the city with enough water during peak use. As the population grows and the ISO fire flow requirements increase, the City will require additional elevated water storage. Future towers should be located strategically to alleviate pressure issues as well as provide the required storage. Two locations which could be considered are the southwest and the far east portions of the City.

1. Water Tower #2

As the southwestern portion of Isanti develops, it may be desirable to add a tower in that area. This would provide storage to meet increasing fire demands and alleviate issues with pressure during peak use. The water tower should be built on the high point of elevation 950 South of Isanti Meadows East of CSAH 23. Both towers would be in the same pressure zone. The volume of the tower would be approximately 300,000 gallons depending on the ISO requirement and the extent of the development.

2. Water Tower #3

As the East side of Isanti develops, a 300,000-gallon water tower should be installed on the East side. It would be in the same pressure zone as the other towers. This tower would help with fire demand as well as maintaining pressures on the East side of the city. The tower should be located at the high point with an elevation of approximately 970. As the East side of Isanti develops, there may be some areas with elevation above 965 that experience lower pressures during high use. This is unlikely to be a significant issue for many years.

C. Distribution System

The following water main looping and replacement projects will be required to maintain pressure within the distribution system during fire flow. Some of the recommended projects can be done as a part of developer improvements.

1. Replace the 6” main on Palomino Road from Pinto to TH 65 with 1500 lf of 10” main. A 10” main was installed in 2005 to the east side of TH 65 at this location. Replacing the existing 6” will removal a bottleneck to service of future development along CR 55. Palomino Road is tentatively scheduled for mill and overlay in 2015. If development in

the southeast area warrants, the street could be reconstructed through the area of the proposed water main.

2. Replace the 6" main on Isanti Parkway West from the WWTF to 3rd Avenue North with 800 lf of 12" main. This work should be done when development between Whiskey Road and 3rd Avenue north of Isanti Parkway dictates.
3. 3300 lf of 10" trunk water main along Railroad Avenue from Palomino Road to South Passage. This can be done as a part of the Railroad Avenue Reconstruction project when that project is ordered.
4. 500 lf of 10" trunk water main from the intersection of North Brookview Lane and 5th Ave. to Nina Street near Nina Court. A developer has install approximately 150 ft of water main as a part of the Brookview South 6th Addition project. The remaining 500 ft may have to be installed as a City project.

There are three locations in the existing system that experience higher velocities during fire flow situations in the Southwest corner of the City. They are:

- On Sixth Avenue between South Brookview Lane and Marion Street.
- CSAH 23 between North Brookview Lane and Marion Street.
- Isanti Parkway West from the Wastewater Treatment Facility West to 3rd Avenue North.

The completion of the four will reduce the velocities on the above locations from 8 feet per second to 3 feet per second. Therefore, completing the revolving loan projects should reduce the high velocity locations listed above. It is recommended the projects be completed in the following order:

1. Trunk water main loop to Nina Street
2. Palomino Road water main replacement
3. Trunk water main loop along Railroad Avenue
4. Isanti Parkway water main replacement

D. Summary of Water System Improvements

Trunk water main extended beyond the current service area will generally be added as necessary to accommodate development. The cost to install the trunk water main will be borne by the developer of the property to be served. If larger trunk water main is required, the City may participate with the developer using the City's *Policy on Oversizing*.

The projects listed in Table 8 are recommended for construction in accordance with the population. In general, detailed design should begin early enough to put plans out for bids in April of the year in which they are to be constructed.

Table 8 – Water System Improvement Projects

Project	Est. Cost[2]	Approximate Population
Water Supply Projects		
Well #3 and Pump House (under construction)	$960,000	5,000
Well #4 and Pump House	$960,000	8,500
Water Treatment Facility	$6,700,000	
Water Storage Projects		
Elevated Storage in southwest (300,000 gallons)	$850,000	9,900
Elevated Storage in east (300,000 gallons)	$850,000	13,300
Water Distribution Projects[1]		
Nina Street Loop	$30,000	5,000-1st Priority
Railroad Avenue Loop	$165,000	5,000-3rd Priority
Palomino Road Main Replacement	$75,000	5,000-2nd Priority
Isanti Parkway Main Replacement	$40,000	5,000-4th Priority

1-Costs listed for Water Distribution projects include only the water distribution system improvements. It may be possible to complete some of the projects in combination with street improvement projects; however, those costs are not included in this estimate.
2-Estimated costs include 15% contingency and 20% engineering. Costs of easements (if necessary) are not included.

In addition to the projects listed above, the following ongoing actions are recommended for the water system:

- Periodically perform fire flow tests during flushing to verify adequacy of supply.
- Upgrade the existing distribution system (add and/or replace valves) during Street Reconstruction projects
- Update the water model as city grows to evaluate proposed developments and improvements
- Adjust Trunk Utility Fee to an appropriate rate to pay for future Water Distribution Projects.
- Adjust the Water Access Charge to an appropriate rate to pay for future Water Storage and Water Distribution projects.

VI. RECOMMENDATIONS FOR SANITARY SEWER SYSTEM

The Isanti sanitary sewer system currently works well for the City. The City of Isanti is experiencing rapid growth. To keep up with the growth, the following components of the sanitary sewer system were examined:

- Gravity Pipe and Appurtenances
- Lift stations and Force Mains
- Treatment and Disposal

A. Gravity Pipe and Appurtenances

1. Assumptions

The analysis of the existing and proposed sewer systems was completed with the following assumptions:

1. Existing Average Annual Residential Flow Rate = 220 gpd/rec
2. Existing Average Annual Commercial Flow Rate = 750 gpad
3. Future Average Annual Flow Rate in Unsewered Areas = 750 gpad
4. Peaking Factor
   Peak Hourly Wet Weather Flow = $[18+(P)^{1/2}]/[4+(P)^{1/2}]$
   where, P = service population in thousands

2. Future Extensions

Gravity sanitary sewer pipe will be added as necessary to accommodate development. The cost to install the piping will be borne by the developer of the specific property. If larger trunk sewer is required to accommodate future development, the City of Isanti may participate with the developer with the developer using the City's *Policy on Oversizing*.

3. Upgrades to Existing System

There are four locations on the existing sanitary sewer system collection system that will require upgrades as development continues. The upgrades are:

1. The existing 8" main crossing the BNSF railroad at Broadway Ave should be upgraded to 12". The sanitary sewer in this area is a bottleneck to flow from a 200 acre area roughly bounded by the BNSF Railroad, Broadway Street including the properties on the south side, the Richard-Shaun-Candy neighborhood, TH 65 and Spirit Brook. The area includes large tracts of undeveloped land on CSAH 5, in the industrial park and along Main Street. The upgrade should be completed before the proposed Main Street Hotel is completed.
2. The existing 18" main from CSAH 23 to the Main Lift Station along Spirit Brook should be upgraded to 24" as the City of Isanti continues to develop west of TH 65. This main receives wastewater flow from the majority of land in the City of Isanti on the west side of TH 65. It will eventually also receive wastewater flow from the 100 acre area south of CR 55 and east of TH 65. The main has adequate capacity to handle an additional 380 acres of development in its service area.
3. The existing 12" main on CSAH 23 from North Brookview to Birch Street SW should be upgraded to 18" as the City of Isanti develops to the Southwest. The existing main has capacity to handle an additional 190 acres of development in its service area. This main flows into the main identified above.

The attached Comprehensive Sanitary Sewer Map shows the locations of the upgrades.

B. Lift Stations and Force Mains

Where gravity sewers do not flow to the Wastewater Treatment Plant, lift stations and force mains will have to be constructed to treat the wastewater. Developers will construct lift stations and force mains as necessary to sewer different areas of the city.

The existing lift stations and force mains are generally in good repair. Regular maintenance and inspections will continue to be necessary. The City should plan to replace lift station pumps every 15-20 years. If the average run-time for the lift station exceeds 25% of capacity, the City should consider replacing the pumps with higher capacity pumps. The main lift station may need an upgrade to allow for larger pumping rates as the area west of TH 65 develops.

Future lift stations should be constructed in the general locations to serve the general areas shown on the Comprehensive Sanitary Sewer Map. Where lift stations must be constructed with extra depth or additional pumping capacity to serve future developments, the City may participate with the developer using the City's *Policy on Oversizing*.

Some lift stations not shown on the plan may be necessary to serve smaller areas of lower topography. These lift stations will be the developer's responsibility.

C. Treatment and Disposal

The Rum River is designated as an Outstanding Resource Value Water (ORVW). This designation means that mass loading cannot exceed those established by permit at the time of ORVW designation. For Isanti this means 25 mg/L CBOD and 30 mg/L TSS at 272,000-gpd.

As the monthly average flow increases above 272,000-gpd, the discharge concentration will decrease proportionately. Therefore, at a flow of 657,000-gpd, the allowable concentrations will be 10.4 mg/L of CBOD and 12.4 mg/L of TSS. Typically, sand filters can reliably meet a 15 mg/L TSS discharge standard.

The WWTF does not have problems meeting the current discharge requirements however during the winter, the existing clarifiers are not usable because of freezing problems. Because of this the facility may have difficulty meeting the discharge limits as the flow increases and the allowable discharge concentrations decrease.

It is generally not considered cost-effective to treat wastewater to below 5 mg/L BOD or TSS. Given this assumption, the practical limits for wastewater treatment expansion will be reached at a maximum monthly flow of approximately 1.36 mgd, slightly more than double the current capacity. Using conventional activated sludge technology, wastewater generated in excess of this amount cannot be treated to a low enough standard to allow discharge to surface water. Using similar assumptions for per capita wastewater generation and I/I, the existing WWTF discharge point is limited to an ultimate population capacity of approximately 12,950. As wastewater treatment technology is continually evolving, the City should carefully consider the type of technology used in its next WWTF upgrade to allow the greatest capacity for surface water discharge.

The municipal services boundary shown on the comprehensive water and sanitary maps gives an indication of the boundary that would contain approximately 12,950 Isanti residents.

The upgrades listed below will be required as wastewater production increases.

- **Clarifier Upgrade** – May be necessary as average flows increase above 272,000-gpd and discharge standards decrease below 30 mg/L for TSS. This may be accomplished with changes in operation to minimize and mitigate the incidence of freezing within the clarifiers.
- **Additional Wastewater Treatment Capacity** – Will be necessary as average annual flows increase above 544,000-gpd. The following items may be necessary to increase the capacity of the wastewater treatment facility:
  - New clarifier and sand filter
  - Convert aerated pond system to activated sludge system
  - Add sludge treatment process

D. Sanitary Sewer Service Outside Municipal Service Area

Although immediate projections suggest that the population will be served by the existing system for this planning horizon, it is necessary for the City to plan for alternative methods of WWT outside the proposed Municipal Services Boundary.

Because there is not another surface water discharge option in Isanti, the wastewater treatment system should be planned as a soil-based treatment and/or discharge system.

The options for soil-based discharge include:

- Individual Sewage Treatment Systems (ISTS) – fully decentralized treatment
  - Will require large lots for individual tanks and a minimum of 2 drainfields. This type of subdivision typically requires a contiguous acre of buildable land per structure.
- Cluster Systems – collection and local treatment – Medium Sewage Treatment System (MSTS)
  - Typically allows smaller lots, can be more efficient if done correctly, however requires a large area of open space for treatment.
- Municipal style collection and centralized treatment with discharge to groundwater – Large Sewage Treatment System (LSTS).
  - Standard subdivision and lot sizes; however will have the most upfront cost to the City and will take the longest to develop. However, ultimately is the most efficient and reliable system.

1. ISTS

ISTS commonly are septic tanks or wetland treatment systems followed by drainfields. The MPCA defines ISTS as serving flows of 2,500 gpd or less. This is the treatment method currently used outside of the WWTF service area. The advantages are:

- Capacity is constructed as needed on a home-by-home basis.
- For areas with good infiltration characteristics, ISTS are typically the lowest cost alternative.
- Operation and maintenance costs can be left to the home owner.

The disadvantages:

- Homes must be required to provide an alternative drainfield site location and should provide two alternative locations. This dramatically increases the size of individual lots.
- The City will likely be required to assume regulatory authority of ISTS from Isanti County.
- Large lot developments are very expensive to serve with municipal utilities because of the amount of pipe necessary to serve relatively few homes.
- System requirements can vary dramatically, depending on the size of the building served and the local soil type.
- System performance and reliability can vary dramatically depending on maintenance by the owner.
- Systems can impose limits on use of adjacent properties such as well location.

2. Cluster Systems (MSTS)

Cluster systems allow small lot developments sharing a collection and treatment system. As defined by the MPCA, MSTS have flows ranging from 2,501 to 10,000 gallons per day. Systems are typically designed for clusters of roughly 10 to 40 equivalent residential units.

The advantages:

- Developments can be designed based on smaller lots.
- If required in the future, clusters can be more economically incorporated into centralized systems than ISTS
- More available treatment technologies than ISTS
- Less space required for treatment system than for ISTS treating a comparable number of homes
- Multi-phased developments can serve an ultimate population on a neighborhood by neighborhood level rather than providing unused capacity
- Each development can be responsible for its own wastewater treatment
- Community system managed by a Homeowners Association (Can be positive or negative)
- Opportunity to be innovative with respect to wetland treatment systems and natural resource preservation
- Ability to preserve large tracts of open space for the community
- Open space areas have potential to be placed in permanent easements that will remain open forever, and will contribute to the small town more rural character of the community

The disadvantages
A lack of “ownership” of the system may result in undesirable items discharged to system
Operation and maintenance must be provided by a homeowner’s association or by the City
The City will be required to assume regulatory control of the systems
Cost of potentially hooking up systems to a municipal system can cause higher costs to the homeowner due to an existing system

3. Municipal Collection and Treatment (LSTS)

As defined by the MPCA, LSTS serve flows greater than 10,000 gpd.

The advantages:

- Developments can be designed based on smaller lots
- Can serve a larger ultimate population under one system
- Greatest number of feasible treatment technologies
- Least amount of space required on a per home basis
- Only one additional facility for the City to operate and maintain

The disadvantages:

- The recently imposed “nitrate nitrogen policy” requires the facility effluent to either:
    - meet a 10 mg/L total nitrogen concentration at the end-of-pipe (before discharge to the drainfield), or
    - demonstrate that groundwater dilution will reduce groundwater nitrate concentrations to less than 10 mg/L at the property boundary.
- The MPCA is the regulatory authority

- Requires a larger collection system
- Requires a disproportionate amount of land from fewer land owners

E. Summary of Sanitary Sewer System Improvements

The Isanti sanitary sewer system currently works well for the City. The City of Isanti is experiencing rapid growth. To keep up with the growth, the following components of the sanitary sewer system were examined:

- Gravity Pipe and Appurtenances
- Lift stations and Force Mains
- Treatment and Disposal

Sanitary sewer extended beyond the current service area will generally be added as necessary to accommodate development. The cost to install the trunk sewer will be borne by the developer of the property to be served. If larger trunk sewer is required, the City may participate with the developer using the City's *Policy on Oversizing*.

Table 9 shows the opinion of probable costs, monitoring triggers and planning horizons for the sanitary sewer system improvement projects recommended within the municipal services boundary.

Table 9 – Sanitary Sewer System Improvement Projects Inside the Municipal Services Boundary

Sewer Main Projects[1]	Trigger	Est. Cost[4]	Planning Horizon[2]
Railroad crossing at Broadway	Construction of Main Street Hotel or other significant wastewater generator.	$150,000	current
Upgrade from CSAH 23 to the Main Lift Station along Spirit Brook	Development of 380 additional acres in area generally west of TH 65	$200,000	10+ years
Upgrade on CSAH 23 from North Brookview to Birch Street SW	Development of 190 additional acres in area generally west of TH 65 and south of Spirit Brook	$270,000	10+ years
Lift Station Projects			
Replace Main LS Pumps	When average monthly Lift Station flows exceed 390,000 gpd	$100,000	10+ years
Upgrade 8th Ave LS – add pump	When average monthly Lift Station flows exceed 250,000 gpd	$10,000	10+ years
Replace 1st Ave LS Pumps		$30,000	current
Replace other LS Pumps	Plan for 20 year replacement	$30,000	10+ years
Wastewater Treatment			
Clarifier Upgrade	When discharge reaches 70% of permitted mass loading	unknown	5-10 years
Additional Wastewater Treatment Capacity	When wastewater flow exceeds 522,000 gallons per day	$7,000,000[3]	5-10 years

1-Costs listed for Sewer Main projects include only the sewer system improvements. It may be possible to complete some of the projects in combination with street improvement projects; however, those costs are not included in this estimate.
2-Planning horizons consider equipment service life and high population growth estimate as presented in the Isanti Comprehensive Plan. Projects required for population beyond 8,900 are listed as 10+ years.
3-It may be desirable to stage WWTF upgrades. This should be evaluated in a WWT Facility Plan completed approximately 3 years prior to the initial need for upgrade.
4-Estimated costs include 15% contingency and 20% engineering. Costs of easements (if necessary) are not included.

The following recommendations apply to developments proposed outside the Municipal Services Boundary.

- ISTS should not be allowed on platted lots within the City's ultimate planning area.
- MSTS may be allowed at City Council discretion provided that the MSTS are required to connect to a municipal system when it becomes available.
- MSTS should be designed by professional engineers licensed in the State of Minnesota and certified to design soil based treatment systems.
- MSTS should be operated by certified WWTF operators.
- A suitable area should be reserved for a LSTS soil-based treatment and disposal site.

In addition to the projects listed above, the following ongoing actions are recommended for the sanitary sewer system:

- Periodically televise sewer to check for sources of Inflow/Infiltration.

- Upgrade the existing collection system (replace clay tile with PVC) during Street Reconstruction projects.
- Periodically perform pump tests to verify lift station capacity. Alert City Council when lift station is operating at 25% of maximum capacity.
- Track WWTF discharge mass loadings monthly. Alert City Council when loadings are 60% of permitted values.
- Adjust Trunk Utility Fee to an appropriate rate to pay for future Sewer Main Projects and Lift Station projects.
- Adjust the Sewer Access Charge to an appropriate rate to pay for future WWTF upgrades.

VII. RECOMMENDATIONS FOR STORM SEWER SYSTEM

Isanti will become a Designated MS4 in 2012. Municipal Separate Storm Sewer Systems (MS4s) designated by rule include cities and townships with a population of at least 5,000 and discharging, or the potential to discharge, to valuable or polluted waters. These designated MS4s are required to obtain NPDES/SDS permit coverage by February 15, 2007, or 18 months following the US census in which they meet the population criteria.

The City is considering a *Storm Water Ordinance* based on models prepared by Minnesota Planning, Minnesota Pollution Control Agency and Project NEMO (Non-point Education for Municipal Officials) and the *Isanti Engineering Design Standards*.

A. Collection System

The City's Engineering Standards set forth requirements for new storm sewer collection systems.

The existing collection system has two main trouble spots:

1. The previously identified undersized storm sewer on Elizabeth Street and 2nd Avenue should be replaced.
2. As construction projects are completed in areas for which storm sewer is inadequate, upgrades to the existing storm sewer should be completed. These will be identified on a case-by-case basis, primarily in areas that are not currently served by storm sewer.

B. Treatment and Disposal

The City has required new development construct storm water treatment systems for less than 10 years. Projects constructed prior to this should have treatment added when feasible. The City has addressed some areas using storm water detention ponds constructed in conjunction with street reconstruction projects and/or proposed new development. This practice should continue.

In some areas, it will not be feasible to address storm water treatment issues by constructing a detention pond. In those areas, the City may wish to consider a system of vegetated swales and rain gardens to provide storm water treatment. These could be implemented as individual stand-alone systems, or as a publicly-maintained, integrated system.

Existing platted areas that should be considered for future storm water treatment include:

1. Original Townsite
2. Lindberg's Addition
3. Palomino Acres
4. Brookview South 1st through 5th Addition
5. Isanti Hills and Isanti Hills 1st through 4th Rearrangement
6. Hillock 1st and 2nd Addition
7. Southeast Quadrant of CSAH5/CSAH23
8. Dual Industrial Park

Some of theses areas have been partially addressed in past street reconstruction projects. Because the storm water upgrades are highly dependant on the specific project, existing land use and land availability, it is not possible to propose a budgetary cost for these projects.

C. Summary of Storm Sewer Improvements

Storm sewer extended beyond the current service area will generally be added as necessary to accommodate development. The cost to install the storm sewer will be borne by the developer of the property to be served. Regional ponds have not been used in Isanti. If regional ponds are desired, the City may wish to develop a policy to allocate costs to the benefiting property owners.

The projects listed in Table 10 are recommended for construction in accordance with the population. In general, detailed design should begin early enough to put plans out for bids in April of the year in which they are to be constructed.

Table 10 – Storm Water System Improvement Projects

Project	Est. Cost[2]
Storm Water Collection Projects	
Elizabeth Street Storm Sewer	$59,000
2nd Avenue Storm Sewer	$83,000
2nd Avenue Pond	$30,000

1-Costs listed for Storm Water Collection projects include only the storm water system improvements. It may be possible to complete some of the projects in combination with street improvement projects; however, those costs are not included in this estimate.
2-Estimated costs include 15% contingency and 20% engineering. Costs of easements (if necessary) are not included.

In addition to the projects listed above, the following ongoing actions are recommended for the storm water system:

- Establish a schedule for maintenance of City-owned storm water infrastructure.
- Consider implementing a Storm Water Utility to develop a funding source for ongoing storm water system maintenance.
- Continue to upgrade the existing storm water collection and treatment system during Street Reconstruction projects.

- Encourage the use of Rain Gardens and Vegetated Swales, especially in developed areas with inadequate storm water treatment facilities.
- Encourage the use of infiltration basins in all parts of the City.
- Require the use of infiltration basins in landlocked areas of the City.
- Consider implementing options as discussed in *Chapter 5.4 Stormwater Management of the Isanti Comprehensive Plan*.