

Facilities Plan: Wastewater Collection and Treatment Facilities

City of Willmar, Minnesota
May 1, 2006

I HEREBY VERIFY THAT THIS PLAN, SPECIFICATION OR
REPORT WAS PREPARED BY ME OR UNDER MY DIRECT
SUPERVISION AND THAT I AM A DULY REGISTERED
PROFESSIONAL ENGINEER UNDER THE LAWS OF THE
STATE OF MINNESOTA.

Edward S. Nason

DATE May 1, 2006 REG. NO. 17273

Prepared by
 **DONOHUE**[®]
& ASSOCIATES

**CITY OF WILLMAR
WASTEWATER COLLECTION AND TREATMENT FACILITIES
FACILITIES PLAN
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ABBREVIATIONS AND ACRONYMS

ADW	Average Dry Weather
CBOD5	5-day Carbonaceous Biochemical Oxygen Demand
EAW	Environmental Assessment Worksheet
EIW	Environmental Information Worksheet
FEMA	Federal Emergency Management Agency
GLSSWD	Green Lake Sanitary Sewer and Water District
JOTS	Jennie-O Turkey Store
mg/L	Milligrams per liter
mgd	Million gallons per day
mL	Milliliter
MM	Maximum Month
MPCA	Minnesota Pollution Control Agency
MW	Maximum Week
NPDES	National Pollutant Discharge Elimination System
ppd	Pounds per day
RCPLi	Residential, Commercial, Public, and Light Industrial
TBOD5	5-day Total Biochemical Oxygen Demand
TKN	Total Kjeldahl Nitrogen
TM	Technical Memorandum
TP	Total Phosphorus
TSS	Total Suspended Solids

EXECUTIVE SUMMARY

Purpose

The purpose of this Facilities Plan is to:

1. Complete the facilities planning effort started previously by others, and set forth a technically sound, cost-effective wastewater conveyance and treatment Plan that will accommodate growth until the Year 2030 or beyond; and
2. Satisfy the requirements of Chapter 7077.0272 – Facilities Plan for Wastewater Treatment Systems and receive MPCA approval.

Future Service Area

Lines delineating the proposed planning and future service areas are shown on Figure 3-1. The planning area represents the area that is anticipated to be serviced within the next 50 years. Primary collection system components are sized to accommodate flows from the planning area. The future service area represents the area that is anticipated to be serviced by the end of the facilities planning period (Year 2030). Wastewater treatment system components are sized to accommodate flows and loadings from the future service area.

Future Population

A summary of the populations used to develop current and future flows and loadings is summarized in the table below. The Recommended Plan was designed to accommodate this future population.

<u>Area</u>	<u>Year 2005</u>	<u>Year 2030</u>
City of Willmar	18,488	24,919
Eagle Lake Sanitary District	961	961
Rural Service Area	0	1356
Surrounding Communities	0	0
Total	19,449	27,236

Recommended Plan

The Recommended Plan is outlined below. This Plan was developed to accommodate growth within the City of Willmar's sewer service area until Year 2030 or beyond, and eliminate the conditions that have historically produced objectionable wastewater-related odors.

1. Construct a new wastewater treatment facility at the site of the existing Sludge Transfer and Storage Facilities. This facility would be operational in late Year 2010 and treat all wastewater generated within the City of Willmar's sewer service area. Municipal wastewater and production-related wastewater from the JOTS will be treated in separate treatment processes. The facility will include the following processes: raw wastewater pumping (municipal only), fine screening with screenings washing/compacting

(municipal only), extended aeration activated sludge in oxidation ditches preceded by high F:M selectors, secondary settling, UV disinfection, effluent aeration, liquid solids thickening, and liquid solids storage. See Figures 5-16 and 5-17.

2. Implement minor upgrades to the existing wastewater treatment facility with the purpose of maintaining compliance until the proposed new wastewater treatment facility is operational in late Year 2010.
3. Construct two pump stations and forcemains to convey production-related wastewater from the JOTS' production facilities to the proposed new wastewater treatment facility. See Figure 5-1.
4. Construct a large-diameter gravity interceptor to convey all municipal wastewater to the proposed new wastewater treatment facility. See Figure 5-1.
5. Construct a pump station at the site of the existing wastewater treatment facility to pump wastewater from this location to the proposed new large-diameter gravity interceptor. Abandon structures at the existing wastewater treatment facility that are no longer necessary or useful. See Figures 5-1, 5-2, and 5-3.

Cost Opinion

An opinion of probable cost for the Recommended Plan is summarized below.

Opinion of Probable Construction Cost in Millions Recommended Plan

Collection System	18.2
Existing Wastewater Treatment Facility – Interim Period	0.3
Existing Wastewater Treatment Facility – Future Period	2.8
New Wastewater Treatment Facility	49.1
Total	70.4

User Charge System

All costs presented in the discussion below are in Year 2005 dollars. Future costs may be influenced by inflation. A summary of the costs used to generate the fees presented below are included in Appendix C.

Residential, Commercial, Public, and Light Industrial

The City of Willmar is pursuing a total of \$20M in State and Federal grants. It is also working with a public finance advisor to determine the most advantageous method to structure the associated debt and generate the required revenue. Final user charges can not be determined until all grants have been awarded, all professional service fees have been paid, all construction-related fees have been paid, and the City has “closed” on the selected funding mechanisms. Nevertheless, several simple preliminary user rates have been developed so the rate-paying community can make simple comparisons with current rates.

The current simplified monthly residential user charge includes two fees: a fixed fee of \$8.18 per month and a usage fee of \$8.50 per 1000 cf. Two preliminary usage fees are listed below. Both fees assume all residential, commercial, public, and light industrial users pay a monthly fixed fee equal to the current residential fixed fee (\$8.18 per month). Based on historical water sales and the assumption that the anticipated program-related debt is financed at an annual interest rate of 3.5% for 20 years, these fees would generate revenues that equal the anticipated annual costs.

Usage Fee if City receives \$0M in Grants	\$49 per 1000 cf
Usage Fee if City receives \$20M in Grants	\$38 per 1000 cf

Historical residential water sales reveal that a “typical” residential user purchases 675 cf of water per month. Using the \$8.18 per month fixed fee and the two potential usage fees listed above, the corresponding typical monthly residential fees are listed below.

Monthly Fee if City receives \$0M in Grants	\$41 per month
Monthly Fee if City receives \$20M in Grants	\$34 per month

Jennie-O Turkey Store

Preliminary cost-sharing calculations that estimate the costs to treat production-related wastewater from the JOTS are included in Appendix C. These calculations assume the JOTS’ share of the debt is financed at an annual interest rate of 3.5% for 20 years. The calculated annual JOTS cost share is slightly more than \$2.2M.

1 INTRODUCTION

1.1 Location

The City of Willmar, Minnesota is the Kandiyohi County Seat, and is located approximately 100 miles west of the Twin Cities. Figure 1-1 provides location maps showing the location of both the City of Willmar and Kandiyohi County. Figure 1-2 shows the City of Willmar relative to the rest of Kandiyohi County.

1.2 Background

This Facilities Plan was preceded by several previous planning reports. A chronology of previous planning efforts is listed below.

1. *Wastewater Treatment Facilities Plan* (Bonestroo, Rosene, Anderlik, & Associates, 1992) – This Facilities Plan recommended capital improvements to the liquid and solids treatment trains. The recommended liquid train improvements were never implemented. As discussed below, the City did subsequently upgrade the solids train.
2. *Wastewater Plan Review* (Stanley Consultants, 1994) – This report was commissioned by Jennie-O Foods, Inc. to review the recommendations in the 1992 Facilities Plan. This Plan estimated that the City would need a wastewater treatment system upgrade as early as the Year 2000. The recommendations of this Plan are listed below.
 - City complete a sewer system evaluation survey to identify sources of excess inflow and infiltration and determine if it is cost effective to remove this excess clearwater flow. The City subsequently completed this survey, and implemented the remedies it deemed cost effective.
 - City construct sludge storage facilities in accordance with the 1992 Facilities Plan. The City subsequently constructed these facilities.
 - JOTS construct pretreatment facilities to reduce its TBOD5 and TSS loadings. JOTS subsequently constructed these facilities.
 - City update the 1992 Facilities Plan after the City and JOTS complete the previous recommendations.
3. *Report on Proposed Sludge Transfer and Storage Facilities* (Bonestroo, Rosene, Anderlik, & Associates, 1995) – This Report served as the Design Report for the existing Sludge Transfer and Storage Facilities. It also reiterated what previous wastewater reports had stated: the existing wastewater treatment system would need to be upgraded prior to Year 2005. It also stated “Based on these needs the City has recently acquired property approximately three miles west of developed areas as a site for a future treatment plant.” The existing Sludge Transfer and Storage Facilities were constructed on this site. Consistent with these original intentions, the Recommended Plan in this Facilities Plan recommends a new wastewater treatment facility be constructed on this site.

4. *Comprehensive Sanitary Sewer Plan* (Bonestroo, Rosene, Anderlik, & Associates, 1996) – This report documented the findings of the inflow and infiltration study and recommended collection system improvements that were deemed cost-effective methods of inflow and infiltration reduction. The City has since implemented these recommended improvements.
5. *Wastewater Treatment Facilities Plan* (Bonestroo, Rosene, Anderlik, & Associates, 2000) – In the fall of 1998, after the City and JOTS had implemented the recommendations in the 1994 Stanley Consultants Report, the City commissioned the completion of this planning report. This report evaluated a host of wastewater treatment system upgrade alternatives. The three primary alternatives are listed below.
 - Construct a new wastewater treatment facility and jointly treat the City's and the JOTS' production-related wastewater. Abandon the existing wastewater treatment facility.
 - Construct a new wastewater treatment facility to treat the JOTS' production-related wastewater, and upgrade the existing wastewater treatment facility to treat the City's wastewater.
 - Construct a new wastewater treatment facility to supplement the existing facility. This new facility would jointly treat the City's and the JOTS' production-related wastewater. The City would operate two wastewater treatment facilities: the existing and the proposed new.

The recommendation of this report was to construct a new wastewater treatment facility at the site of the existing Sludge Transfer and Storage Facilities to jointly treat the City's and the JOTS' production-related wastewater. This facility would be operational in Year 2010 and replace the existing wastewater treatment facility. The existing wastewater treatment facility would be upgraded so it was capable of maintaining compliance until Year 2010, and then be abandoned after the new facility was operational.

This report recommended where the proposed new treatment facility would be constructed; however, it devoted little or no effort to determine the most desirable and cost-effective means of conveyance and treatment.

1.3 Purpose

The purpose of this Facilities Plan is to:

1. Complete the facilities planning effort started previously by others, and set forth a technically sound, cost-effective wastewater conveyance and treatment Plan that will accommodate growth until the Year 2030 or beyond; and
2. Satisfy the requirements of Chapter 7077.0272 – Facilities Plan for Wastewater Treatment Systems and receive MPCA approval.

2 EXISTING CONDITIONS

2.1 Existing Service Area

Technical Memorandum 101.2 provides detailed documentation of the existing service area.

Figure 2-1 shows the existing wastewater service area and various land uses within the service area. The Willmar Wastewater Treatment Facility serves the City of Willmar and the Eagle Lake Sanitary District. Developed areas surrounding Eagle Lake, Willmar Lake, and Foot Lake lie inside the service area. Developed areas surrounding Skataas and Swan Lakes lie outside the service area.

Figure 2-2 shows the two watersheds that drain water from the City of Willmar. The north side of the City and land west of the City drain to the Hawk Creek watershed. Hawk Creek discharges to the Minnesota River, which discharges to the Mississippi River on the south side of the Minneapolis-St. Paul metropolitan area near the Minneapolis-St. Paul International Airport. The south side of the City drains to the South Fork of the Crow River. The Crow River discharges to the Mississippi River upstream and northwest of the Minneapolis-St. Paul metropolitan area. The existing Willmar Wastewater Treatment Facility discharges final treated effluent to the Hawk Creek watershed.

2.2 Existing Population

Technical Memorandum 103.1 provides detailed documentation of the existing service area population.

According to the original United States Census Bureau, the City of Willmar's Year 2000 population was 18,351. That population has been adjusted by the State Demographic Center to 18,488. All population projections developed for the purpose of this Facilities Plan are based on a Year 2000 population of 18,488.

After reviewing and considering recent and long-term growth trends, the City elected to use a 1% annual growth rate to estimate future populations. Using this growth rate and a Year 2000 population of 18,488, the Year 2005 population would be 19,431. However, in the spirit of conservatism, future flow and loading projections assumed the Year 2005 population was 18,488. This is discussed further in Chapter 3.

2.3 Existing Wastewater Collection System

Technical Memorandum 101.3 provides detailed documentation of the existing collection system.

As of September 2005, the existing collection system included 1,709 manholes and 93.5 miles of pipe ranging in diameter from 8 to 38 inches. The City of Willmar owns and operates 16 wastewater pump stations, and operates nine county-owned pump stations for the Eagle Lake Sanitary District. Technical Memorandum 101.3 provides an accounting of the collection system piping and pump stations.

As a parallel effort to this Facilities Plan, the City of Willmar is developing a Comprehensive Collection System Plan. This plan will document estimated collection system capacities, estimated present-day drainage basin flows, and projected future drainage basins flows. A comparison of the projected flows and existing capacities will be used to formulate prioritized recommendations for future collection system improvements.

2.4 Existing Wastewater Treatment Facility

Technical Memorandum 101.4 provides detailed documentation of the existing wastewater treatment facility.

The existing wastewater treatment facility is comprised of treatment-related structures at two locations. These locations are shown relative to the City of Willmar and neighboring communities on Figure 2-3. The distance between these facilities is shown on Figure 2-4. Liquid treatment, solids thickening, solids stabilization, maintenance, laboratory analysis, and administration are provided at the facility located at 1400 SE 7th Street (Figure 2-5). Biosolids storage is provided at the facility located in the SE ¼, Sec 23, T119N, R36W (Figure 2-6).

2.4.1 NPDES / SDS Permit

The existing wastewater treatment facility is governed by National Pollution Discharge Elimination System (NPDES) and State Disposal System (SDS) Permit MN 0025259 issued on December 29, 2004.

Permitted Outfalls

The NPDES Permit regulates three separate discharges at three different locations. Those discharges are described below

Emergency Discharge (SD001) – Wastewater discharged from SD001 must have received secondary treatment and been disinfected. This outfall is located at Ditch No. 23A (T119N, R35W, Section 23), and must be used in accordance with the Special Requirements defined in the Permit and listed below.

- 7.1 If County Ditches No. 46 and No. 10 cannot accommodate the wastewater flow due to backup or flooding caused by ice build-up or other conditions, the Kandiyohi County Board of Commissioners may require the Permittee to divert treated wastewater, on an emergency basis, through Discharge SD001 into County Ditch No. 23A. Such discharge shall be in accordance with the Kandiyohi County Permit dated June 26, 1979 and any updates, and as directed by the Kandiyohi County Board of Commissioners.
- 7.2 During periods of discharge to County Ditch No. 23A, the Permittee shall follow the monitoring requirements provided in the Limits and Monitoring Requirements of this permit. The Permittee shall be limited to discharge no more

than 440 pounds of phosphorus to County Ditch No. 23A during any calendar year. This amount shall not be exceeded without prior authorization from the MPCA. The Permittee shall send a request detailing the reasons for the need for additional discharge and shall notify the Big Kandiyohi Lake Property Owners Association, Inc. and the Kandiyohi County Coordinator of the request. The Permittee is required to notify the MPCA prior to any diversion of wastewater to County Ditch No. 23A.

- 7.3 Any use of Discharge SD001, other than directed above in conjunction with the Kandiyohi County Board of Commissioners, shall be in accordance with the bypass requirements of Chapter 6, Section 12 of this permit.

Final Effluent Discharge (SD002) – This outfall is located at Ditch No. 46 (T119N, R35W, Section 20) is where the final effluent is discharged during normal operating conditions.

Drain-Tile Discharge (SD004) – This outfall is located at Ditch No. 19 (T119N, R36W, Section 23). On the biosolids storage facility site, a perforated PVC drainage tile system is connected to a pump station. The purpose of this pump station is to control local groundwater elevations. According to the Permit, it is necessary to control the groundwater elevation in the vicinity of the biosolids storage basin for structural reasons and to prevent it from “floating”

Permitted Capacity

According to the Permit, the existing treatment facility is designed to treat an average wet weather flow of 5.04 mgd with a TBOD5 concentration of 290 mg/L. This flow and concentration is equivalent to a TBOD5 loading of 12,189 ppd. A subsequent section shows the existing plant may not be able to, as it is currently configured and operated, consistently treat this loading and produce permit-compliant effluent.

Final Effluent Limits

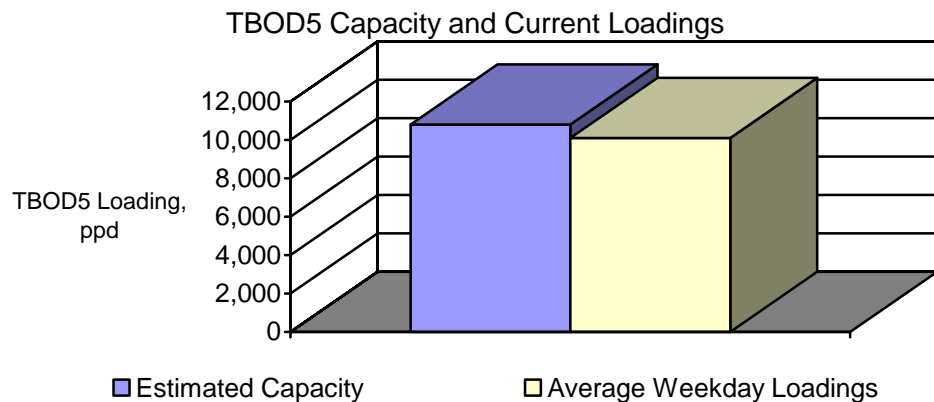
The primary effluent limits that govern final effluent discharged from SD002 (Ditch No. 46) are listed below. No ammonia or phosphorus limits currently apply to this discharge.

<u>Parameter</u>	<u>Limit</u>	<u>Type</u>
CBOD5	20 mg/L	Monthly Average
TSS	30 mg/L	Monthly Average
Fecal Coliform	200 / 100 mL	Monthly Geometric Mean , May - Oct
pH Minimum	6.0	Daily Minimum
pH Maximum	9.0	Daily Maximum

The existing facility has several shortcomings or issues that are certain or have the potential to become problematic prior to late Year 2010 when the proposed new wastewater treatment facility is expected to be operational. Technical Memorandum 101.4 outlines these shortcomings and TM 105.2.1 evaluates alternatives to address these shortcomings.

2.4.2 Plant-Wide Capacity

For the existing wastewater treatment facility, the capacity limiting parameter is TBOD5. Calculations in TM 101.4 derive a plant-wide TBOD5 capacity using historical data. This capacity assessment considers both the performance of the current unit processes as well as the historical plant-wide operating scheme. The estimated average TBOD5 capacity for the existing treatment facility as it is currently configured and operated is approximately 10,800 ppd-TBOD5. This is less than the permitted TBOD5 capacity of 12,189 ppd-TBOD5.



The above figure illustrates the need for this facilities plan and the implementation of its recommendations. Average weekday (Monday – Friday) TBOD5 loadings are 94% of the estimated organic capacity of the facility.

2.4.3 Odor

The treatment facility has been the source of odor complaints. Several odor-control projects have lessened the frequency of complaints; however, the ultimate source of those odors remains.

2.4.4 Compliance Maintenance

Average TBOD5 loadings will be at or very near the plant-wide TBOD5 capacity in Year 2010 if loadings from the JOTS remain at their current levels, and will be exceeding the plant-wide TBOD5 capacity in Year 2010 if JOTS’ loadings increase over this period. The existing treatment facility must be operated in a manner that realizes its maximum capacity until the proposed new wastewater treatment facility is operational. Consistent compliance may be in jeopardy unless minor improvements are made to enhance the plant-wide TBOD5 capacity. In addition to the marginal TBOD5 capacity, the existing facility has

several shortcomings or issues that are certain or have the potential to become problematic prior to late Year 2010. A listing of these shortcomings or issues is provided below. A subsequent section evaluates alternatives to address these items.

Plant-Wide TBOD5 Capacity – Potential alternatives to enhance TBOD5 capacity include CEPT, adjusting the trickling filter rotor speed to provide periodic filter flushing, pre-digestion solids thickening, and increasing the solids storage volume. The later two alternatives would reduce internal sidestream loadings and in turn increase the capacity available to treat raw wastewater.

Raw Wastewater Flow Metering – The existing raw wastewater flow meter cannot record flows greater than approximately 6,000 gpm. This is less than the peak pumping capacity of the downstream pump station.

Emergency Raw Wastewater Pumping – There is currently no redundancy for the one emergency raw wastewater pump.

2.5 Historical Flows and Loadings

Technical Memorandum 101.5 provides detailed documentation of historical wastewater flows and loadings. These flows and loadings are summarized below.

<u>Flow</u>	<u>RCPLi</u>	<u>JOTS</u>	<u>Combined</u>
Average Dry Weather (ADW)	1.79	1.74	3.53
Average Day (AD)	2.25	1.41	3.66
Average Wet Weather (AWW)	3.63	1.69	5.04
Maximum Week (MW)	2.68	2.03	4.71

1. All values expressed as mgd
2. Not all RCPLi and JOTS values are additive because of the nature of the data sets used to calculate them.

<u>TBOD5</u>	<u>RCPLi</u>	<u>JOTS</u>	<u>Combined</u>
Weekday Average Day	3372	6691	10,101
Average Day (AD)	3372	5345	8744
Maximum Month (MM)	5430	9005	11,302
Maximum Week (MW)	5983	9700	15,684

1. All values expressed as ppd
2. Weekday Average Day represents the average Monday – Friday loading.
3. Not all RCPLi and JOTS values are additive because of the nature of the data sets used to calculate them.

<u>TSS</u>	<u>RCPLi</u>	<u>JOTS</u>	<u>Combined</u>
Weekday Average Day	4032	1930	5989
Average Day (AD)	4032	1452	5503
Maximum Month (MM)	6494	3480	7235
Maximum Week (MW)	8051	4317	11,512

1. All values expressed as ppd
2. Weekday Average Day represents the average Monday – Friday loading.
3. Not all RCPLi and JOTS values are additive because of the nature of the data sets used to calculate them.

<u>TKN</u>	<u>RCPLi</u>	<u>JOTS</u>	<u>Combined</u>
Average Day (AD)	667	1136	1803
Maximum Month (MM)	1067	1817	2885
Maximum Week (MW)	1168	1988	3155

1. All values expressed as ppd
2. Not all RCPLi and JOTS values are additive because of the nature of the data sets used to calculate them.

<u>TP</u>	<u>RCPLi</u>	<u>JOTS</u>	<u>Combined</u>
Average Day (AD)	114	264	337
Maximum Month (MM)	143	330	421
Maximum Week (MW)	154	357	455

1. All values expressed as ppd
2. Not all RCPLi and JOTS values are additive because of the nature of the data sets used to calculate them.

3 FUTURE CONDITIONS

3.1 Service Area

Technical Memorandum 102.1 provides detailed documentation of the proposed future service area.

Lines delineating the proposed planning and future service areas are shown on Figure 3-1. The planning area represents the area that is anticipated to be serviced within the next 50 years. Primary collection system components are sized to accommodate flows from the planning area. The future service area represents the area that is anticipated to be serviced by the end of the facilities planning period (Year 2030). Wastewater treatment system components are sized to accommodate flows and loadings from the future service area.

The anticipated land uses within the proposed planning and future service areas are shown on Figure 3-2. The northernmost portions of these areas have been intentionally omitted from this figure to enhance the resolution within the urban areas of the future service area. The land use within the omitted northern regions is entirely residential.

3.1.1 Delineation

Multiple meetings and workshops were conducted with various stakeholders and decision makers to define the boundaries of the future service area and planning area. Participants included representatives from the City of Willmar's Engineering, Public Works, Wastewater Treatment, and Planning departments, as well as representatives from Kandiyohi County, the GLSSWD, and the MPCA. The boundaries shown on Figure 3-1 are the products of these working sessions.

The northern most boundaries are in relative close proximity to the neighboring GLSSWD's wastewater service area. Representatives from the City of Willmar, GLSSWD, and Kandiyohi County met on September 23, 2005 to discuss these boundaries. At that meeting, these parties agreed that the City of Willmar would include 300' north of STH 27 in the planning area. A letter documenting the understanding regarding the northernmost boundaries and signed by the GLSSWD is included in Appendix A. None of the other boundaries lie adjacent to a neighboring service area.

3.1.2 Urban Areas

The anticipated growth and expansion pattern for the City of Willmar, as defined by the City's Planning Department, largely defined the future service area and planning area boundaries. Expansion is expected west along the STH 40 and USH 12 corridors, east along the USH 12 corridor, and south along the STH 23 and USH 71 corridors. Areas north and west of Foot Lake are expected to see continued residential development. Wetlands, high groundwater, and surface water features will likely preclude significant growth and expansion southeast of the City.

3.1.3 Rural Areas

The “Lakes” area north of Willmar is experiencing significant new development, and is an area with high potential for future growth. The future service area includes Swan, Skataas, Eagle, Long, Point and King Lakes, and the planning area extends further to the north to include developments adjacent to STH 27.

3.1.4 Surrounding Communities

The City of Willmar contacted neighboring communities to see if these communities were interested in becoming part of the future service area. An excerpt from the July 2005 letter that was sent to Blomkest, Kandiyohi, Pennock, Priam, Raymond, and Svea is provided below. Copies of these letters are included in Technical Memorandum 103.1.

“The City of Willmar is in the process of relocating its current wastewater treatment plant (WWTP) to an area southwest of the City. As part of our planning efforts for this relocation, we are attempting to identify neighboring communities that might be interested in connecting to Willmar’s sanitary sewer system. We feel this relocation project offers a unique opportunity to consider the potential cost benefit of a regional wastewater treatment facility that treats wastewater from the City of Willmar and neighboring communities.

We are currently in the planning stage for the new wastewater treatment facility. At this time, we are encouraging your community and other surrounding communities to discuss your short- and long-term wastewater treatment needs with us and each other. We wish to explore the potential cost savings associated with a regional wastewater treatment facility for interested communities.

The new wastewater treatment plant will be operational in the fall of 2010. The planning document will be completed by July 2006. To meet this schedule, it is important that we discuss all regional issues as soon as possible.”

None of the surrounding the communities that received this invitation to participate elected to participate.

3.2 Population

Technical Memorandum 103.1 provides detailed documentation of the population projections for the three components of the future service area: the City of Willmar, the Eagle Lake Sanitary District, and the rural areas that comprise the balance of the future service area. The methodology used to predict the future service area population was defined by the City of Willmar’s Planning Department and based on recent historical population trends.

3.2.1 City of Willmar

Figure 3-3 shows historical populations and several projections. The State Demographic Center estimates the Year 2030 population to be 20,468. To achieve this population, the annual growth rate would be less than 0.5%. The City's Planning Department believes this projection is low.

A review of historical housing starts from 2000 – 2004 shows 413 new homes were constructed during that period. The US Census Bureau determined the average household size in the City of Willmar was approximately 2.5 people per household. Using 2.5 people per housing start, this construction would have added 1033 new residents. If these residents were added to the Year 2000 population of 18,488, these additional residents would represent a 1.1% annual growth rate.

The City's Planning Department recommended a 1% annual growth rate to estimate future populations for the purposes of developing future flows and loadings. This assumed annual growth rate appears consistent with recent housing construction information and the historical upward population trend, and would result in a Year 2030 population of 24,919.

3.2.2 Eagle Lake Sanitary District

According to the City's Planning Department, the Eagle Lake Sanitary District includes 356 residential connections. The US Census Bureau determined that the average household size of owner-occupied housing units in the City of Willmar was approximately 2.7 people. Applying this household size to the number of connections produces a residential population of 961. The population of the Eagle Lake Sanitary District is not expected to increase.

3.2.3 Rural Service Area

The City believes that some areas outside the City limits and the Eagle Lake Sanitary District will be served by the wastewater treatment facility during the 20-year planning period (see TM 102.1). The residential areas outside the City and inside the future service area are referred to here as the "rural service area".

The existing rural service area population was estimated by counting the number of homes within the area of interest using aerial photographs and assuming an average household size of 2.7 people. The estimated Year 2005 population is 1315. The City decided to assume a 1% annual growth rate in these rural areas. Using this growth rate, the estimated population in the area now, and the assumption that 80% of the rural homes will be connected, the Year 2030 rural population connected to the collection system is 1356.

3.2.4 Service Area Population Summary

A summary of the populations used to develop current and future flows and loadings is summarized in the table below.

<u>Area</u>	<u>Year 2005</u>	<u>Year 2030</u>
City of Willmar	18,488	24,919
Eagle Lake Sanitary District	961	961
Rural Service Area	0	1356
Surrounding Communities	0	0
Total	19,449	27,236

3.3 Future Flows and Loadings

Technical Memorandum 103.1 provides detailed documentation of future wastewater flows and loadings. These flows and loadings are summarized below.

<u>Flow</u>	<u>RCPLi</u>	<u>JOTS</u>	<u>Combined</u>
Average Dry Weather (ADW)	2.74	2.18	4.92
Average Day (AD)	3.47	1.77	5.24
Average Wet Weather (AWW)	5.40	2.11	7.51
Maximum Week (MW)	8.54	2.54	11.08
Peak Wet Weather	-	-	27.36

1. All values expressed as mgd
2. Not all RCPLi and JOTS values are additive because of the nature of the data sets used to calculate them.

<u>TBOD5</u>	<u>RCPLi</u>	<u>JOTS</u>	<u>Combined</u>
Weekday Average Day	6315	8364	14,679
Average Day (AD)	6315	6714	13,029
Maximum Month (MM)	10,170	11,256	21,426
Maximum Week (MW)	11,205	12,125	23,330

1. All values expressed as ppd
2. Weekday Average Day represents the average Monday – Friday loading.
3. Not all RCPLi and JOTS values are additive because of the nature of the data sets used to calculate them.

<u>TSS</u>	<u>RCPLi</u>	<u>JOTS</u>	<u>Combined</u>
Weekday Average Day	7209	2413	9621
Average Day (AD)	7147	1838	8984
Maximum Month (MM)	11,511	4350	15,861
Maximum Week (MW)	14,271	5396	19,667

1. All values expressed as ppd
2. Weekday Average Day represents the average Monday – Friday loading.
3. Not all RCPLi and JOTS values are additive because of the nature of the data sets used to calculate them.

<u>TKN</u>	<u>RCPLi</u>	<u>JOTS</u>	<u>Combined</u>
Average Day (AD)	1138	1410	2548
Maximum Month (MM)	1820	2255	4075
Maximum Week (MW)	1992	2466	4458

1. All values expressed as ppd
2. Not all RCPLi and JOTS values are additive because of the nature of the data sets used to calculate them.

<u>TP</u>	<u>RCPLi</u>	<u>JOTS</u>	<u>Combined</u>
Average Day (AD)	237	330	567
Maximum Month (MM)	235	413	647
Maximum Week (MW)	255	446	701

1. All values expressed as ppd
2. Not all RCPLi and JOTS values are additive because of the nature of the data sets used to calculate them.

As Technical Memorandum 103.1 documents, the proposed production-related flows and loadings for the JOTS were proposed by the JOTS. Their general concurrence with the proposed flows and loadings as well as the Recommended Plan presented later in this Facilities Plan is documented in Chapter 9.

3.4 Infiltration and Inflow

Technical Memorandum 103.2 provides detailed documentation of infiltration and inflow analysis. This analysis finds that current infiltration rates are non-excessive, but current inflow rates are excessive. The peak-hourly-wet-weather flow to average-wet-weather flow ratio warrants consideration of flow equalization alternatives. Such alternatives were

developed and considered as part of the Alternatives Evaluation phase. The City will continue its efforts to identify inflow sources and remove them. Past and current efforts are outlined below.

1975

An infiltration and inflow study was completed in 1975 during the planning process for the last major upgrade to the existing wastewater treatment facility (Banister-Short-Elliot-Hendrickson & Associates, 1975).

1996

A second infiltration and inflow study was conducted in 1996 as part of a comprehensive sewer planning effort (Bonestroo, Rosene, Anderlik & Associates, 1996). That effort targeted collection system basins that experience severe wet-weather flows. Manhole inspections and smoke tests were conducted throughout the targeted areas. Problems were identified and corrected.

Present Day

The City strives to control inflow through normal sewer maintenance, elimination of obvious sources, and an ordinance restricting sump pump discharges to the sanitary collection system.

The City plans to aggressively pursue and eliminate cost-effective inflow. To this end, the City has recently completed the initial phase of a collection system flow monitoring program. The purpose of this program was to identify inflow sources by monitoring collection system flows during wet-weather events, and thereby provide the basis for subsequent inflow reduction efforts. In early September 2005, collection system flow meters were installed at eight strategic locations near the existing wastewater treatment facility and upstream in major trunk lines. This effort better defined peak wet-weather flows and prioritized major drainage basins for further investigation.

In addition to this flow monitoring effort, in September 2005 the City completed a system-wide survey of the sanitary collection system. This survey included documentation of manhole elevations (rim and invert), pipe diameters, pipe materials, pipe conditions, manhole interior conditions, manhole cover conditions, and manhole susceptibility to surface flooding. The City will use the information generated by this effort, in addition to the information generated by the flow monitoring effort, to develop a prioritized inflow reduction program.

Considering the past efforts to identify and remove obvious inflow sources, the City believes much of the excessive inflow originates from pervasive sources scattered throughout the collection system. Many of these sources may be sump pumps and foundation drains that discharge to the sanitary collection system. Experience throughout the industry has found inflow of this nature to be difficult, expensive, and time consuming to eliminate. In light of the apparent widespread nature of the inflow sources and the experience offered by other municipalities that have attempted to eliminate excessive inflow, the City intends to proceed with facility planning using current

estimated peak flows without consideration of alternatives to reduce current inflow rates. Nevertheless, the City intends to continue and keep the MPCA well informed of its current collection system flow monitoring program and subsequent efforts aimed at inflow reduction.

3.5 Wastewater Treatability

Technical Memorandum 103.2 provides detailed documentation of an evaluation of the expected treatability of the existing raw wastewater as a composite from all sources within the existing service area, as well as the expected treatability of several sources of interest. Past performance and current information suggests that the wastewater produced by all known sources within the existing and future service areas is not, from a treatability perspective, expected to be problematic.

3.6 Regulatory Landscape

Technical Memorandum 104.1 documents the anticipated final effluent limits for the proposed new wastewater treatment facility and discusses other pertinent certain and potential regulatory requirements.

Final Effluent Limits

MPCA-provided effluent limits for a discharge to Hawk Creek in the vicinity of the proposed new wastewater treatment facility are outlined below. The limits listed below assume the City selects the CBOD5/ammonia-nitrogen linkage option (recommended).

<u>Parameter</u>	<u>Limit</u>	<u>Type</u>
CBOD5	20 mg/L	Monthly Average
TSS	30 mg/L	Monthly Average
Ammonia	5 mg/L	Monthly Average
Minimum Dissolved Oxygen	6 mg/L	
Phosphorus	1 mg/L	
Fecal Coliform	200 / 100 mL	Monthly Geometric Mean , May - Oct
pH Minimum	6.0	Daily Minimum
pH Maximum	9.0	Daily Maximum

The receiving waters downstream of the proposed discharge location are affected by mercury. A nondegradation demonstration will be required when the City applies for the NPDES discharge permit associated with the proposed wastewater treatment facility.

Biosolids

The Federal Regulations that control and regulate the management of municipal biosolids are the 40 CFR Part 503, "Standards for the Use and Disposal of Sewage Sludge; Final Rule," Federal Register 58: 9248 – 19415, February 19, 1993, and its subsequent amendments, commonly referred to as the "503 Regulations." These regulations establish two classifications of biosolids: Class A and Class B. State and federal regulations allow

municipal wastewater treatment facilities to produce and land-apply both classifications. Technical Memorandum 104.1 discusses recent activities relating to the Federal Biosolids Regulations. Some of these activities may one day result in changes to the 503 Regulations; however, the present-day regulations are expected to remain in effect for at least the next several permit cycles (e.g., 10 years).

4 ALTERNATIVES EVALUATION

Alternatives were developed for three distinct treatment system components: the collection system, the existing wastewater treatment facility, and the proposed new wastewater treatment facility. Alternatives were developed and evaluated in the series of Technical Memorandums listed below. These three components are documented in three “series” of Technical Memorandums. The 105.1 series documents an evaluation of collection system alternatives, the 105.2 series documents existing wastewater treatment facility alternatives, and the 105.3 series documents the new wastewater treatment facility alternatives.

Collection System

TM 105.1.1 Primary Interceptor Alternatives

Existing Wastewater Treatment Facility

TM 105.2.1 Existing WWTF – Interim Period

TM 105.2.2 Existing WWTF – Future Period

New Wastewater Treatment Facility

TM 105.3.1 Preliminary Treatment

TM 105.3.2 Primary and Secondary Treatment

TM 105.3.3 Disinfection

TM 105.3.4 Solids Thickening

TM 105.3.5 Solids Stabilization

TM 105.3.6 Solids Dewatering

TM 105.3.7 Solids Storage

TM 105.3.8 Odor Control

TM 105.3.9 Staffing

The alternatives that were deemed “feasible” in the 105 series Technical Memorandums are capable of satisfying the applicable effluent, water quality, and public health requirements for the 20-year planning period (i.e., Years 2010 – 2030). Each of the 105 series Technical Memorandums recommends an alternative for the corresponding component or unit process. These recommendations are based on the component-specific evaluation documented in the Technical Memorandum as well as system-wide considerations. The selected system-wide plan is presented in Chapter 5.

4.1 Methodology

Competing alternatives were evaluated in accordance with the methodology presented below. Economic and non-economic factors were considered during the evaluation process.

4.1.1 Economic Evaluation

Opinions of probable capital costs, partial annual costs, and corresponding 20-year present worth costs were developed for individual alternatives as appropriate. The annual costs that were developed and considered as part of the alternatives evaluation were, as stated above, “partial” annual costs. These “partial” costs do not include all operating costs associated with an alternative. Rather, they include “significant” components of the total annual operating cost

that are *unique to a particular alternative* and in turn that have the potential to affect the relative cost effectiveness of an alternative (e.g., UV electricity and bulb replacement for UV disinfection versus sodium hypochlorite for chlorine disinfection). These “partial” annual costs were one component of the 20-year total present worth costs. Equipment replacement costs and salvage values were only considered if they had a significant relative effect on the corresponding 20-year total present worth cost.

In each Technical Memorandum, the various costs were summarized in a table similar to the example below.

Alternative	Capital	Annual	Total Present Worth
Alternative 1			
Alternative 2			
Alternative 3			

Technical Memorandum 103.2 documented an analysis of current infiltration and inflow rates. This analysis determined that current inflow rates are, in accordance with the formal MPCA definition, “excessive.” Numerous alternatives were developed and evaluated to accommodate this excessive inflow; however, none of these alternatives were aimed at eliminating this excessive inflow. Considering past efforts by the City to identify and remove obvious inflow sources, the City believes much of the excessive inflow originates from pervasive sources scattered throughout the collection system. Experience throughout wastewater field has found inflow of this nature to be at best difficult, expensive, and time consuming to eliminate, or in many instances entirely evasive. In light of the apparent widespread nature of the inflow sources and the experiences of other municipalities that have attempted to reduce inflow from such sources, the City elected to develop alternatives that accommodate current estimated peak flows using either flow equalization or pump-and-treat strategies. The alternatives evaluation considered the cost effectiveness of these two peak flow strategies.

4.1.2 Non-Economic Evaluation

Advantages and disadvantages associated with each alternative were summarized in a table similar to the example below.

Alternative	Advantages	Disadvantages
Alternative 1		
Alternative 2		
Alternative 3		

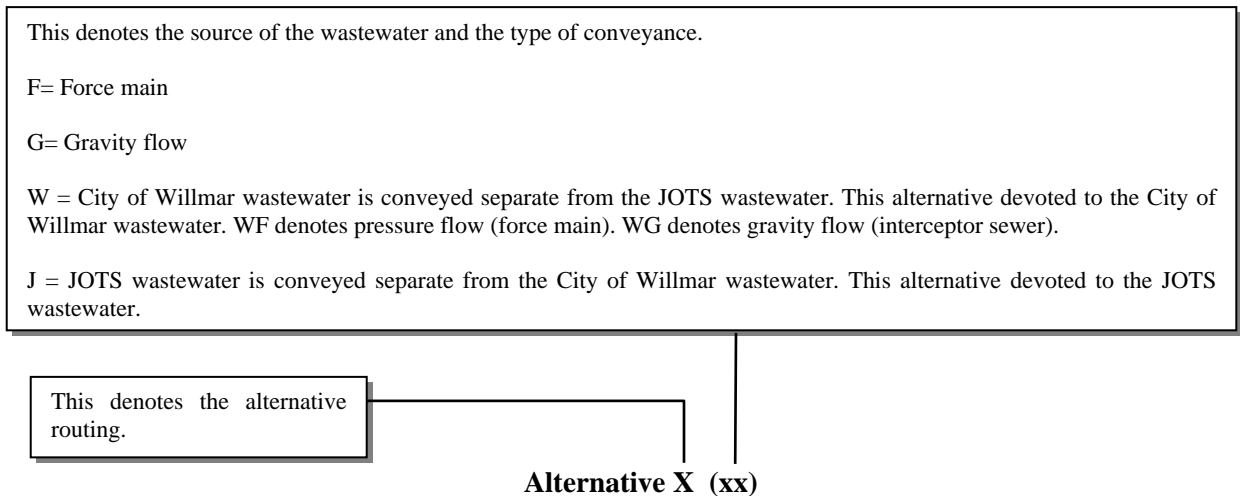
Competing collection system alternatives were assigned a “qualitative evaluation score” based on consideration of 12 criteria (Figure 4-1). Competing treatment facility alternatives were assigned a “qualitative evaluation score” based on consideration of 16 criteria (Figure 4-2).

As stated previously, the alternatives that were deemed “feasible” and advanced to the detailed evaluation phase are capable of satisfying the applicable effluent, water quality, and public health requirements for the 20-year planning period (i.e., Years 2010 – 2030). Each alternative that received a qualitative score is a feasible alternative capable of satisfying all project requirements.

4.2 Naming Convention

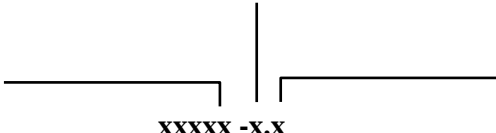
4.2.1 Collection System Alternatives

These alternatives were identified using the designators that denote the source of the wastewater, the type of conveyance, and the route of the alternative. A generic designator is shown below.



4.2.2 Treatment Facility Alternatives

Treatment facility alternatives are identified using designators that denote the technology or process being considered, the liquid treatment train configuration, and the percentage of JOTS' flow and loading increase. A generic designator is shown on the next page.

<p>This denotes the technology or process being considered.</p>	 <p style="text-align: center;">XXXXX -X.X</p>	<p>This denotes the % increase for JOTS flows and loadings: 1 = 25%, 2 = 100%.</p>
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This denotes the liquid treatment train configuration.

C= City of Willmar and JOTS wastewater is combined and treated together. This alternative devoted to the combined wastewater or associated residuals.

W = City of Willmar wastewater is treated separate from the JOTS wastewater. This alternative devoted to the City of Willmar wastewater or associated residuals. WA denotes un-equalized flow. WB denotes equalized flow.

JOTS = JOTS wastewater is treated separate from the City of Willmar wastewater. This alternative devoted to the JOTS wastewater or associated residuals.

4.3 Chapter 7077 Specific Considerations

Chapter 7077.0272 *Facilities Plan for Wastewater Treatment Systems* requires consideration of several non-economic issues. These are discussed below.

4.3.1 Impacts on Existing Wastewater Treatment Systems

Collection system alternatives were developed to convey wastewater to the proposed new wastewater treatment facility site. None of these alternatives would overwhelm or negatively affect a portion of the existing collection system, including sewers and lift stations.

Treatment facility alternatives were developed to alleviate current or future shortcomings. None of these alternatives would negatively affect the existing wastewater treatment system.

4.3.2 Potential Environmental Impacts

Alternatives were developed to achieve a single objective: convey wastewater to the proposed new wastewater treatment facility site and treat wastewater at that site. The feasible alternatives that were developed in the Technical Memorandums were deemed “feasible” after considering both economic and non-economic factors. One of the foremost non-economic factors was the certain or potential, short-term or long-term environmental impacts. An alternative was only advanced to the alternatives evaluation phase and documented in a Technical Memorandum if its associated environmental impacts were no more severe than those of any “typical” wastewater conveyance or treatment alternative. None of the alternative means of achieving the primary objective

appear to offer an obvious and significant “environmental advantage” relative to the others.

An Environmental Information Worksheet (EIW) is included in Appendix B. Following MPCA approval of this Facilities Plan, environmental aspects will be documented in far greater detail in the form of an Environmental Assessment Worksheet.

5 RECOMMENDED PLAN

The Recommended Plan is merely the sum total of the recommendations in each of the 105 series Technical Memorandums.

5.1 Collection System

The collection system recommendation to convey all wastewater to the proposed new wastewater treatment facility is listed below.

Raw Wastewater Conveyance

Alternative A
See Figure 5-1,
See TM 105.1.1

Recommendation

Construct a gravity interceptor from the existing wastewater treatment facility to the proposed new wastewater treatment facility. This interceptor diameter would range from 48-inches near its origin to 54-inches further downstream. The gravity sewer would run along a route south from the existing wastewater treatment facility to 28th Avenue, then west along 28th Avenue (or 28th Avenue extended) to the new wastewater treatment facility. A utility easement would need to be acquired west of the existing city limits. With this alternative, the Ortenblad lift station could be eliminated, and replaced with a gravity sewer that connects to the new 54-inch interceptor.

Construct a pump station at the JOTS' Benson Avenue production facility to pump production-related wastewater generated at that facility to the JOTS-owned pretreatment system at the Willmar Avenue production facility. Construct a forcemain from the Benson Avenue pump station to the Willmar Avenue pretreatment system.

Construct a pump station at the JOTS' Willmar Avenue production facility to pump pretreatment system effluent from the Willmar Avenue production facility to the proposed new wastewater treatment facility. The pretreatment system would provide preliminary treatment of all production-related wastewater from the JOTS. Construct a forcemain from the proposed new Willmar Avenue pump station to the secondary treatment system that treats the JOTS wastewater at the proposed new treatment facility.

Design Parameters

Gravity Interceptors

48-Inch Diameter Capacity – 20.3 mgd

54-Inch Diameter Capacity – 24.4 mgd

Pump Stations

Type of Pump – Submersible, centrifugal

Benson Avenue Firm Capacity – 500 gpm

Willmar Avenue Firm Capacity – 2500 gpm

5.2 Existing Wastewater Treatment Facility – Interim Period

The “interim period” refers to all time from the present until the proposed new wastewater treatment facility is operational. Proposed improvements to the existing facility during this interim period are aimed at enhancing the performance and/or reliability of the existing facility until the proposed new facility is operational. These proposed improvements are listed below.

All unit processes at the existing wastewater treatment facility will remain fully functional while the proposed new wastewater treatment facility is being constructed.

Raw Wastewater Flow Measurement

EIFM-C
See TM 105.2.1

Issue

The existing raw wastewater flow meter is a 12-inch Parshall flume located upstream of the mechanical coarse screen at the entrance to the raw wastewater pump station. With the current meter set up, the maximum flow capacity is 6000 gpm. Past wet weather flow rates have exceeded this maximum capacity. Furthermore, the fluctuating headloss across the downstream coarse screen has the potential to adversely affect the accuracy of this meter.

Recommendation

Replace the existing raw wastewater flow meter. Provide an acoustic doppler flow meter (ADFM) upstream of the existing Parshall flume. This meter would provide adequate capacity to measure peak instantaneous flow and offer superior accuracy to the Parshall flume. Its accuracy would not be affected by the presence of the downstream coarse screen or other factors that affect the hydraulic-grade line at the meter location. At the candidate closed-pipe location, the ADFM could be coupled with a pressure transducer to detect the presence of surcharge conditions and, when surcharged, the water surface elevation (or hydraulic grade line) above the top of the pipe. The pipe and pressure transducer can be easily relocated in the future when the raw wastewater flow is routed to a different location.

Design Parameters

The maximum flow measuring capacity would exceed the rated 10,000 gpm pumping capacity of the downstream raw wastewater pump station.

Excess Flow Pumping

EIEP2-C
See TM 105.2.1

Issue

Raw wastewater flows that exceed the rated capacity of the four existing electric-motor-driven, centrifugal raw wastewater pumps (2200 gpm each) are currently pumped by a single gas-engine-driven, centrifugal pump (4000 gpm). Using the strict definition of firm pumping capacity (i.e., the capacity with the largest unit out of service), the existing WWTF has no redundant excess flow pumping capacity.

Recommendation

Install a single submersible centrifugal pump within the existing wet well at the existing Excess Flow Pump Station.

Design Parameters

No. New Pumps – 1
Type of Pump – Submersible, centrifugal
Capacity – 4000 gpm

No. Existing Pumps – 1
 Capacity – 4000 gpm
 Firm Excess Flow Capacity – 4000 gpm

**Capacity
 Enhancement**

EIEC1-C
 See TM 105.2.1

Issue

A previous performance evaluation of the existing primary clarifiers (without chemical addition) showed TBOD5 and TSS removals averaged 20% and 44%, respectively. Typical values are generally 35% and 65%, respectively. Chemically enhanced primary treatment (CEPT) has provided TBOD5 and TSS removals as high as of 50 – 80% and 80 – 90%, respectively.

Recommendation

If bench-scale and full-scale evaluations find chemical addition enhances primary treatment at the existing WWTF, then install a full-scale chemical feed system to feed a metal salt upstream of the existing primary clarifiers.

Design Parameter

The specific metal salt and the required dosage would be defined during subsequent bench-scale and full-scale investigations. A typical system would feed ferric chloride at roughly 40 mg/L.

**Capacity
 Enhancement**

EIEC2-C
 See TM 105.2.1

Issue

Researchers and wastewater treatment facility operators have found that periodically slowing down the distributor to a fraction of the conventional distributor arm speed for 5 – 10% of the operating time provides enhanced media flushing. This in turn has been found to enhance trickling filter performance. This operating strategy has been referred to as the SK concept.

Recommendation

Modify the algorithm governing the distributor arm speed to implement the SK flushing strategy. The distributor arm would operate at a slower rate for 1 – 2 hours per day.

Design Parameter

The control strategy would be developed during a subsequent full-scale investigation. The initial strategy will operate the distributor arm at 3.2 rev/hour for approximately 1.5 hours.

**Capacity
 Enhancement**

EIEC5-C
 See TM 105.2.1

Issue

At present raw wastewater loadings and digested solids concentrations, the current off-site solids storage volume is marginal.

Recommendation

During preliminary design, assess the technical and financial feasibility of constructing all or part of the recommended additional liquid solids storage volume at the existing Sludge Transfer and Storage Facilities during the interim period. In essence, this would be a mere acceleration of the design and construction schedule associated with one component of the proposed new wastewater treatment facility.

Design Parameter

Not applicable. The total additional liquid solids storage volume is defined as part of the new wastewater treatment facility evaluation. All or a portion of this total volume would be constructed as part of this Alternative.

5.3 Existing Wastewater Treatment Facility – Future Period

The “future period” refers to all time after the proposed new wastewater treatment facility is operational. Proposed future period improvements to the existing facility are listed below.

Figure 5-2 shows a rendering of the existing facility as it is currently configured. Figure 5-3 shows a rendering of the existing facility after the proposed submersible pump station is constructed and existing structures are removed.

Raw Wastewater Pumping

EFSPS-WA

See Figure 5-4
See TM 105.2.2

Recommendation

Construct a submersible pump station to pump the un-equalized flow from the upstream municipal drainage basins to the proposed new wastewater treatment facility. The existing administration, maintenance, and laboratory building as well as the existing anaerobic digester building would be used for City-related activities. Other process-related structures would be demolished.

Design Parameters

No. of Pumps – 5
Type of Pumps – Submersible, centrifugal
Capacity per Pump – 5.08 mgd
Firm Capacity – 20.3 mgd

5.4 New Wastewater Treatment Facility

Unit process recommendations and preliminary design parameters are listed below for the proposed new wastewater treatment facility.

Production-related wastewater from the JOTS would receive pretreatment prior to being discharged to the proposed new wastewater treatment facility. Pretreatment would include screening, flow equalization, dissolved air flotation, and pH adjustment.

Raw Wastewater Pumping

ARWWP-WA

See Figure 5-5
See TM 105.3.1

Recommendation

Construct a raw wastewater pump station to pump the peak un-equalized municipal flow from the upstream collection system. This pump station would use Archimedes pumps (screw pumps). Production-related wastewater from the JOTS would be discharged to a downstream process (i.e., this pump station would not pump JOTS’ production-related wastewater).

Design Parameters

No. of Pumps – 3
Type of Pumps – Archimedes
No. of Stages per Pump – 2
Capacity per Pump – 11.9 mgd
Firm Capacity – 23.76 mgd

**Preliminary
Treatment**

2FSAP-W

See Figure 5-6
See TM 105.3.1

Recommendation

Construct an elevated screening structure downstream of the raw wastewater pump station to provide fine screening of the pumped raw wastewater. Two mechanically-cleaned fine screens would be installed to provide a firm hydraulic capacity equal to the peak un-equalized design flow. Debris captured by the fine screens would be washed and compacted prior to being deposited in a refuse container. A washer/compactor would be devoted to each fine screen. Production-related wastewater from the JOTS would be discharged to a downstream process (i.e., these fine screens would not screen JOTS' production-related wastewater).

Design Parameters

No. of Fine Screens – 2
Screen Opening Size – 3 or 6 mm (1/4 or 1/8 inch)
Capacity per Screen – 23.76 mgd
Firm Capacity – 23.76 mgd
No. of Washer/Compactors – 2 (one per screen)

**Preliminary
Treatment**

NOGRIT-W

See TM 105.3.1

Recommendation

Do not construct a grit removal process. Allow grit to settle and accumulate in downstream basins. Design these basins such that they may be periodically (e.g., annually) removed from service for cleaning and grit removal.

Design Parameters

Not applicable

**Hauled-In Waste
Receiving**

HWR-W

See Figure 5-7
See TM 105.3.1

Recommendation

Construct a two-basin hauled-in waste receiving station. Each basin would hold 7000 gallons. Hauled-in waste would be metered to either a downstream raw wastewater pump station or an aeration basin. Potential sources of hauled-in waste include septage, holding tank contents, leachate, and industrial byproducts. The City may elect to accept hauled-in wastes when municipal raw wastewater loadings allow. Treatment facility design flows do not include an allowance for loadings attributed to hauled-in wastes.

Design Parameters

No. of Receiving Basins – 2
Volume per Basin – 7000 gal

**Secondary
Treatment –
Municipal**

CODCP-C.1

See Figure 5-8
See TM 105.3.2

Recommendation

Construct an oxidation ditch system to provide extended air activated sludge treatment of the municipal fraction of the raw wastewater, and remove phosphorus using chemical precipitation. No production-related wastewater from the JOTS would be discharged to or treated in this system. The oxidation ditch system would include the components listed below.

- Preliminary effluent flow splitting structure
- F:M selector basins
- Conventional oxidation ditches
- Contact aeration basin to attenuate peak solids loadings
- Mixed liquor flow splitting structure

- Final clarifiers
- RAS/WAS pump station
- Scum pump station
- Chemical storage and feed system (phosphorus removal)

Design Parameters

No. of Selector Basins – 2
 No. of Oxidation Ditches – 3
 No. of Contact Aeration Basins - 1
 Total Oxidation Ditch Volume – 4 Mgal
 Volumetric TBOD5 Loading – 12 #TBOD5/kcf
 No. of Secondary Clarifiers – 3
 Clarifier Diameter – 120 ft
 Clarifier Sidewater Depth – 15 ft
 Peak Surface Overflow Rate – 700 gpd/sf
 No. RAS Pumps – 4
 RAS Pumping Control – Flow Proportional
 No. WAS Pumps – 3
 No. Scum Pumps - TBD

Secondary Treatment – Food Processor

CODCP-JOTS.1

See Figure 5-9
 See TM 105.3.2

Recommendation

Construct an oxidation ditch system to provide extended air activated sludge treatment of the JOTS' fraction of the raw wastewater, and remove phosphorus using chemical precipitation. The oxidation ditch system would include the components listed below.

- Preliminary effluent flow splitting structure
- F:M selector basins
- Conventional oxidation ditches
- Final clarifier
- RAS/WAS pump station
- Scum pump station
- Chemical storage and feed system (phosphorus removal)

Design Parameters

No. of Selector Basins – 2
 No. of Oxidation Ditches – 2
 Total Aerated Volume – 15 #TBOD5/kcf
 No. of Secondary Clarifiers – 1
 Clarifier Diameter – 80 ft
 Clarifier Sidewater Depth – 15 ft
 Peak Surface Overflow Rate – 720 gpd/sf
 No. RAS Pumps – 2
 RAS Pumping Control – Flow Proportional
 No. WAS Pumps – 2
 No. Scum Pumps - TBD

Disinfection

UV-C.1B

See Figure 5-10
 See TM 105.3.3

Recommendation

Construct a UV disinfection system to disinfect the peak hourly flow from the City of Willmar and the JOTS, and satisfy the effluent disinfection requirements.

Design Parameters

UV Dosage – 30,000 $\mu\text{W-S}/\text{cm}^2$

No. Banks – 2

No. Modules per Bank – 17

No. Lamps per Module - 8

Capacity – 27.36 mgd

Effluent Aeration

EA-C.1B

See Figure 5-11

See TM 105.3.3

Recommendation

Construct a fine-bubble diffusion system to aerate the peak hourly flow from the City of Willmar and the JOTS, and satisfy the effluent dissolved oxygen requirements.

Design Parameters

Minimum Final Effluent DO – 6 mg/L

Capacity – 27.36 mgd

Solids Thickening – Municipal

GBT-W

See Figure 5-12

See TM 105.3.4

Recommendation

Construct a solids thickening system to thicken WAS from the municipal secondary system prior to long-term biosolids storage.

Design Parameters

No. Gravity Belt Thickeners – 2

Belt Width per Thickener – 1 m

TWAS Concentration – 5-6%

Solids Thickening – Food Processor

GBT-JOTS.1

See Figure 5-13

See TM 105.3.4

Recommendation

Construct a solids thickening system to thicken WAS from the JOTS' secondary system prior to long-term biosolids storage.

Design Parameters

No. Gravity Belt Thickeners – 2

Belt Width per Thickener – 1 m

TWAS Concentration – 5-6%

Solids Stabilization

ND

See TM 105.3.5

Recommendation

Operate the oxidation ditch systems such that the extended aeration process followed by long-term biosolids storage provides adequate solids stabilization for a land application program using subsurface injection or incorporation. The purpose of the subsurface injection or incorporation is to satisfy the vector attraction requirements. Biosolids generated by secondary treatment of production-related wastewater from the JOTS are not governed by the Federal "503" biosolids regulations. For this reason, these biosolids will be thickened and stored separately from the biosolids produced during secondary treatment of municipal wastewater. Biosolids will be disposed on permitted agricultural fields in accordance with State and Federal regulations.

Design Parameters

Not applicable

**Solids Storage –
Municipal Solids**

LSSGLST-W

See Figure 5-14
See TM 105.3.7

Recommendation

Erect glass-lined steel liquid solids storage tanks to supplement the existing liquid solids storage volume. The total storage volume to store municipal biosolids will provide 180 days of storage time. The tanks will be mixed using external pumps and internal mixing-jet nozzles.

Design Parameters

Storage Time – 180 days

**Solids Storage –
Food Processor
Solids**

LSSGLST-

JOTS.1

See Figure 5-15
See TM 105.3.7

Recommendation

Erect glass-lined steel liquid solids storage tanks to supplement the existing liquid solids storage volume. The total storage volume to store the JOTS' biosolids will provide 180 days of storage time. The tanks will be mixed using external pumps and internal mixing-jet nozzles.

Design Parameters

Storage Time – 180 days

Figure 5-16 shows a rendering of the proposed new wastewater treatment facility. Figure 5-17 shows a conceptual site plan.

5.5 Construction Costs

Opinions of probable construction costs for the various components of the Recommended Plan are listed below.

5.5.1 Collection System

An opinion of probable construction cost for all collection system components required to convey all municipal and production-related JOTS wastewater to the proposed new wastewater treatment facility is \$18.2M.

5.5.2 Existing Wastewater Treatment Facility – Interim Period

An opinion of probable cost for this component of the Plan is listed below. Line item costs above the first subtotal were developed in the corresponding 105 series Technical Memorandum.

Opinion of Probable Construction Cost Existing Wastewater Treatment Facility – Interim Period

Enhance Flow Monitoring		34,100
Upgrade Existing Excess Flow Pump Station		78,500
Chemically Enhanced Primary Treatment		53,900
Trickling Filter SK Factor		0
Increase Liquid Solids Storage Volume		0
Subtotal		166,500
Civil, Plumbing, HVAC, I+C, Electrical	32%	53,157
Subtotal		219,657
Contingency	30%	65,897
Total		285,554

5.5.3 Existing Wastewater Treatment Facility – Future Period

An opinion of probable cost for this component of the Plan is listed below. Line item costs above the first subtotal were developed in the corresponding 105 series Technical Memorandum.

Opinion of Probable Construction Cost Existing Wastewater Treatment Facility – Future Period

Submersible RWW Pump Station		1,448,500
Civil, Plumbing, HVAC, I+C, Electrical	54%	786,840
Subtotal		2,235,340
Contingency	25%	558,835
Total		2,794,175*

5.5.4 New Wastewater Treatment Facility

An opinion of probable cost for this component of the Plan is listed below. Line item costs above the first subtotal were developed in the corresponding 105 series Technical Memorandum.

Opinion of Probable Construction Cost New Wastewater Treatment Facility

Raw Wastewater Pump Station		2,547,200
Fine Screening and Screenings Washing/Compacting		1,266,300
Hauled-In Waste Receiving Station		196,600
Conventional Oxidation Ditch with Chemical P Removal		
Willmar		10,003,900
Jennie-O Turkey Store		5,747,600
Disinfection and Effluent Aeration		1,110,700
Solids Thickening		2,057,100
Solids Storage		4,554,000
Support Systems		1,550,000
Demolition of Existing Facility		610,400
Subtotal		29,643,800
Civil, Plumbing, HVAC, I+C, Electrical	42.5%	12,600,000
Subtotal		42,243,800
Contingency	16.2%	6,843,496
Total		49,087,296

5.5.5 Total Plan

An opinion of probable cost for the entire Recommended Plan is summarized below.

Opinion of Probable Construction Cost in Millions Recommended Plan

Collection System	18.2
Existing Wastewater Treatment Facility – Interim Period	0.3
Existing Wastewater Treatment Facility – Future Period	2.8
New Wastewater Treatment Facility	49.1
Total	70.4

5.6 Annual Costs

An itemized listing of anticipated Year 2010 annual costs is provided in Appendix C. These represent the estimated costs of administration, operations, maintenance, and equipment replacement after the proposed new wastewater treatment facility and associated collection system components are placed into full-time service. The estimated Year 2010 costs are presented *in terms of Year 2005 dollars* (i.e., - the Year 2010 costs do not include any adjustment for potential inflation). Anticipated annual costs are summarized below.

Anticipated Year 2010 Annual Costs in Millions Recommended Plan

Wastewater Treatment Administration, Operations, Maintenance	1.52
Biosolids Administration, Operations, Maintenance	0.1
Collection System Administration, Operations, Maintenance	0.15
Equipment Replacement	0.27
Total	2.04

6 ENVIRONMENTAL ISSUES

6.1 Environmental Information Worksheet

An EIW for the Recommended Plan is included in Appendix B. Following MPCA approval of this Facilities Plan, the City will prepare and submit to the MPCA a more comprehensive and thorough EAW for the Recommended Plan.

6.2 Floodplain

The proposed new wastewater treatment facility would be constructed such that it would remain fully operational during a 25-year flood and be protected from flooding during a 100-year flood. Floodplain elevations have not been established by FEMA for the proposed new wastewater treatment facility site. These elevations will, however, be established during the subsequent preliminary design phase and the completion of the EAW. Subsequent submittals to the MPCA will confirm that the existing facility will be designed in a manner that provides the necessary performance and protection during flooding. These submittals will also show if the existing sludge transfer and storage facilities are adequately protected and, if necessary, proposed improvements to protect them.

6.3 Hawk Creek Hydraulics

Meeting materials from a Hawk Creek Watershed meeting are included in Appendix D. These materials document an analysis of how the proposed increased peak flow from the proposed new wastewater treatment facility would affect the water surface elevations in Hawk Creek. The most salient findings are listed below.

- The proposed peak flow from the proposed new wastewater treatment facility (27.4 mgd) represents a small fraction of the total flow in the stream: 7% at Priam and 2% at Maynard.
- The proposed peak flow increase would raise the Hawk Creek water surface by a very small amount during the spring thaw period: 2.9" at Priam and 1.2" at Maynard.

7 USER CHARGE SYSTEM

All costs presented in the discussion below are in Year 2005 dollars. Future costs may be influenced by inflation. A summary of the costs used to generate the fees presented below are included in Appendix C.

Residential, Commercial, Public, and Light Industrial

The City of Willmar is pursuing a total of \$20M in State and Federal grants. It is also working with a public finance advisor to determine the most advantageous method to structure the associated debt and generate the required revenue. Final user charges can not be determined until all grants have been awarded, all professional service fees have been paid, all construction-related fees have been paid, and the City has “closed” on the selected funding mechanisms. Nevertheless, several simple preliminary user rates have been developed so the rate-paying community can make simple comparisons with current rates.

The current simplified monthly residential user charge includes two fees: a fixed fee of \$8.18 per month and a usage fee of \$8.50 per 1000 cf. Two preliminary usage fees are listed below. Both fees assume all residential, commercial, public, and light industrial users pay a monthly fixed fee equal to the current residential fixed fee (\$8.18 per month). Based on historical water sales and the assumption that the anticipated program-related debt is financed at an annual interest rate of 3.5% for 20 years, these fees would generate revenues that equal the anticipated annual costs.

Usage Fee if City receives \$0M in Grants	\$49 per 1000 cf
Usage Fee if City receives \$20M in Grants	\$38 per 1000 cf

Historical residential water sales reveal that a “typical” residential user purchases 675 cf of water per month. Using the \$8.18 per month fixed fee and the two potential usage fees listed above, the corresponding typical monthly residential fees are listed below.

Monthly Fee if City receives \$0M in Grants	\$41 per month
Monthly Fee if City receives \$20M in Grants	\$34 per month

Jennie-O Turkey Store

Preliminary cost-sharing calculations that estimate the costs to treat production-related wastewater from the JOTS are included in Appendix C. These calculations assume the JOTS share of the debt is financed at an annual interest rate of 3.5% for 20 years. The calculated annual JOTS cost share is slightly more than \$2.2M.

8 PUBLIC INVOLVEMENT

8.1 Stakeholders

A list of addresses used for public notifications is included in Appendix E. Each of these entities received a notification regarding the two public information meetings held during the preparation of this Facilities Plan.

8.2 Public Meetings

The notifications for and the meeting materials from the two public information meetings held during the preparation of this Facilities Plan are included in Appendix F. The meeting materials from the January 31, 2005 Public Works and Safety Committee meeting are also included in this Appendix.

8.3 Public Comments and Responses

During the public meetings, several questions were posed by elected officials and the general public to better their understanding of the facilities planning process and the Recommended Plan. City staff in attendance and/or individuals working on behalf of the City in attendance provided the requested information immediately after those questions were posed. The City has received no comments opposing the Recommended Plan either during or in response to one of the public meetings.

9 ORDINANCES AND AGREEMENTS

9.1 Jennie-O

A copy of the existing Wastewater Discharge Permit for Jennie-O Foods, Inc. is included in Appendix G. Following MPCA approval of this facilities plan, this Agreement will be revised to accommodate the Recommended Plan and its associated costs. A letter of intent from the JOTS is also included in Appendix G. The City intends to submit this revised Agreement to the MPCA at the time the subsequent NPDES Permit application is submitted.

9.2 Hawk Creek

A copy of the existing Petition for an Outlet into Joint County Ditch No. 7 (Hawk Creek) is included in Appendix H. This Petition is commonly referred to as the “Hawk Creek Discharge Permit.” The City has begun the process to have this document revised to accommodate the proposed increased peak flow, increased average flow, and changed discharge location. The City intends to submit this revised “Permit” to the MPCA at the time the subsequent NPDES Permit application is submitted.

9.3 Ordinances

No additional ordinances or modifications to existing ordinances are required for the Recommended Plan to be implemented successfully.

10 RESOLUTION

A copy of the resolution adopting this Facilities Plan is included in Appendix I.

11 IMPLEMENTATION SCHEDULE

A proposed implementation schedule for the recommended plan is outlined below. This is a tentative schedule subject to change; however, the final milestone is an MPCA requirement that is not flexible. Effluent from the proposed new wastewater treatment facility must be in compliance with a 1 mg-P/L limit by the end of November 2010.

DRAFT Facilities Plan to City	April 2006
FINAL Facilities Plan to City	May 2006
FINAL Facilities Plan to City	May 2006
Design	May 2006 – December 2007
Bidding	January – March 2008
Construction	May 2008 – August 2010
Start-Up	August 2010
Compliance with 1 mg-P/L	November 2010