

Chapter 10: Treatment Recommended Plan

10.1 Introduction

10.1.1 Background

As a regional governmental agency providing wastewater treatment and flood management services for 28 municipalities, Milwaukee Metropolitan Sewerage District (MMSD) serves 1.1 million people in a 411 square mile planning area. In order to meet currently projected future growth while maintaining regulatory compliance, MMSD developed the 2020 Facilities Plan (2020 FP), which identifies the facilities, programs, operational improvements, and policies (FPOPs) required by the year 2020 to meet the existing regulatory framework and permitting requirements. The complete Recommended 2020 FP (which includes conveyance, treatment and other recommendations) is presented in Chapter 10 of the *Facilities Plan Report*. This chapter presents the treatment system related portion of the Recommended 2020 FP.

The MMSD's mission is to protect public health, property and the environment by providing wastewater conveyance and treatment services. The wastewater treatment facilities owned by MMSD include the following:

- ◆ Metropolitan Interceptor Sewer (MIS) System
- ◆ Inline Storage System (ISS)
- ◆ Jones Island Wastewater Treatment Plant (JIWWTP)
- ◆ South Shore Wastewater Treatment Plant (SSWWTP)

The existing facilities were constructed or upgraded to meet MMSD's needs through the year 2005 as a part of the Milwaukee Water Pollution Abatement Program (MWPAP). In 1998, MMSD adopted the 2010 Facilities Plan to address MMSD's wastewater conveyance, storage and treatment needs through 2010. A court-ordered stipulation signed with the state of Wisconsin in 2002 requires that the MMSD 2020 FP be adopted by MMSD's Commission and submitted by MMSD to the Wisconsin Department of Natural Resources (WDNR) by June 30, 2007 (2002 WDNR Stipulation).(1)

As discussed in Chapter 10 of the *Facilities Plan Report*, MMSD's primary focus of the 2020 FP must be to develop a Recommended Plan that meets the regulatory requirements regarding MMSD's point sources (e.g., sanitary sewer overflows (SSOs), combined sewer overflows (CSOs), wastewater treatment plant (WWTP) effluent). As a result of the substantial investment that has already been made to effectively reduce both SSOs and CSOs, MMSD has reached a point of diminishing returns in terms of the additional water quality benefits that would result from further significant capital investment to further reduce sewer overflows. The MMSD, however, is required by the 2002 WDNR Stipulation to submit a *Wet Weather Control Plan* that meets its permit requirements and other requirements.^a The 2020 planning process concluded that a 5-year level of protection (LOP) for SSO control under future 2020 population and land use conditions is consistent with state and federal requirements.^b It is important to note that the MMSD facilities are currently in compliance with point source pollution abatement measures

^a As discussed in Section 9.6.4 of Chapter 9, *Alternatives Development of Facilities Plan Report*.

^b See Section 9.6 of Chapter 9 of the *Facilities Plan Report* for more details.



required under state and federal laws. The new facilities recommended in this plan are to achieve a 5-year LOP assuming the anticipated growth in population and land use.^c

10.1.2 Plan Summary

This chapter presents a summary of the treatment related recommendations developed in Chapter 9, *Alternatives Development* of this report, including the recommended Biosolids Plan. The treatment system recommendations are derived from the various treatment options discussed in Chapter 9, *Alternatives Development*.

The 2020 FP recommends a 5-year recurrence interval for the system-wide LOP against SSO events. This chapter summarizes the recommendations of Chapter 9 of this report by listing the recommended improvements to the MMSD treatment system that provide an LOP in the treatment system that is consistent with the 5-year system-wide LOP. The LOP in the treatment system is based on the frequency of tunnel-related SSOs as explained in Chapter 9 of this report. Hydraulic modeling results were used to support the prediction that the treatment capacity enhancement projects provide a minimum of a 5-year recurrence interval for events that exceed the capacity of the treatment system.

This chapter also summarizes the treatment common package projects and programs (discussed in Chapter 8, *Common Treatment Facilities, Programs, Operational Improvements and Policies for the Recommended Plan* of this report) that are recommended to become part of the 2020 FP as presented in Chapter 10, *Recommended Plan* of the *Facilities Plan Report*. These FPOPs are to be included in the Recommended Plan regardless of the outcome of the evaluation of the alternatives because they support the treatment system and the 2020 FP goals.

The 2020 FP was developed during a period when a large number of MMSD FPOP initiatives were already underway. These existing initiatives originated from the 2010 Facilities Plan, the 2002 WDNR Stipulation, internal planning efforts, and other MMSD obligations (such as watercourse flood control and management). The 2020 technical team (MMSD staff and consultants) reviewed and concurred with the existing initiatives, and made recommendations for additional FPOPs. In addition, the 2020 technical team identified recommendations necessary for the local communities to implement in order to support the assumptions made in the 2020 FP.

Consequently, the 2020 FP consists of three different types of recommendations, only two of which are applicable for the treatment system:

- 1) **Recommendations for new FPOPs identified by the 2020 FP.** These are FPOPs that are necessary to achieve the 5-year LOP under future conditions and also further enhance the operation of MMSD's facilities. These treatment recommendations are considered the "2020 FP Recommendations." Estimated costs for these recommendations are provided because they will require incorporation into MMSD's capital planning process. Financing for these FPOPs is presented in Chapter 11, *Implementation Plan*.
- 2) **Existing FPOPs that were identified as necessary to support the goals of the 2020 FP and RWQMPU.** These treatment recommendations are considered as those that support

^c No additional facilities are proposed in the 2020 FP for CSO control because MMSD currently exceeds and is projected to continue to meet its permit requirement for CSO control.

the 2020 FP and are summarized in Table 10-2.^d To assist in financial planning, cost estimates are provided for the FPOPs that will incur significant costs that may be financed over a long time period. Some of these FPOPs have already been included in MMSD's 2007 Annual Budget, some have been included in MMSD's 6-year Capital Financing Plan, and some need to be added to the overall 2020 FP financing plan. Cost estimates represent total project costs and are presented only for illustration purposes because they may represent moneys that have already been partially spent. Financing for these FPOPs is presented in Chapter 11, *Implementation*.

- 3) **Recommendations for local communities.** These include recommendations for the 28 satellite municipalities served by MMSD to prevent increases in infiltration and inflow (I/I) and therefore do not include treatment related recommendations.

Table 10-1 summarizes the recommendations for new FPOPs identified by the 2020 FP and Table 10-2 summarizes the recommendations for the existing FPOPs that support the 2020 FP.

^d See Chapter 8, *Common Treatment Facilities, Programs, Operational Improvements and Policies for the Recommended Plan* for a discussion of Common FPOPs and see Chapter 9, *Alternative Analysis* of this report for a discussion of the evaluation of the alternatives.

FPOP	Chapter 10 Cross Reference for Additional Details	Comments	Preliminary Engineering or Demonstration Project Estimate (\$ M)	Capital Cost Est. (\$ M) ²	Annual O&M Cost Est. (\$ M)	Present Value (\$ M) ³
Perform Capacity Analysis of SSWWTP	Section 10.2, Wet Weather Control Plan — Facilities, Table 10-3, Item No. 1	Needed to confirm the increased capacity at SSWWTP	\$0.3	—	—	—
Increase ISS Pump Station Capacity to JIWWTP to 180 MGD	Section 10.2, Wet Weather Control Plan — Facilities, Table 10-3, Item No. 2	Needed to meet 5-yr LOP under Revised 2020 Baseline conditions	—	\$108	\$0.9	\$119
Increase SSWWTP Secondary Treatment Capacity with physical –chemical treatment methods	Section 10.2, Wet Weather Control Plan — Facilities, Table 10-3, Items No. 3A-3B (range)	Needed to meet 5-yr LOP under Revised 2020 Baseline conditions	0-1.5	97-152	1.4-1.7	116-173
Hydraulic Analysis of JIWWTP	Section 10.2, Wet Weather Control Plan — Facilities, Table 10-3, Item No. 4	Needed to confirm the increased capacity at JIWWTP	—	See note 4	—	See note 4
Evaluation of JIWWTP Aeration System	Section 10.3, Table 10-4, Item No. 3	PE analysis recommended to determine cost savings	0.3	0-15	See note 5	0-15
Geotechnical/ Structural Analysis of Wastewater Treatment Plants	Section 10.3, Table 10-4, Item No. 5		0.8	See note 6	-	See note 6
Biosolids Management	Section 10.4, Table 10-5	Interim Recommendations	—	251 ⁷	See note 8	251 ⁷
Totals			\$1.4-2.9	\$456-526	\$2.3-2.6	\$486-558

ISS = Inline Storage System
 JIWWTP = Jones Island Wastewater Treatment Plant
 LOP = Level of Protection

MGD = Million Gallons per Day
 O&M = Operation and Maintenance
 PE = Preliminary Engineering
 SSWWTP = South Shore Wastewater Treatment Plant

NOTES:

- 1) All costs were escalated using the Engineering News Record Construction Cost Index (ENR-CCI), which was projected to be 10,000 in June 2007.
- 2) Capital Costs include construction cost plus 25% for engineering and 35% for technical services and administration.
- 3) Range of Present Worth, Facility Plan estimates +50/-30%. Costs do not include salvage values.
- 4) Costs have not been determined for this element but they are not expected to be significant and therefore can be included in the ongoing annual budget.
- 5) A potential savings of \$1million/year in operating costs could possibly be achieved if aeration system energy costs can be reduced. Details will be determined in PE analysis.
- 6) Capital costs cannot be estimated until engineering work is completed.
- 7) Includes costs for rehabilitation of drying and dewatering at JIWWTP (see Table 10-4, Item No. 2). The capital costs for the biosolids plan represent continuing with Milorganite® for the long term. These costs may change depending upon the final recommendations for biosolids management which will be completed once various additional analyses are performed.
- 8) Cannot determine O&M costs for biosolids management until a final recommendation is completed.



**TABLE 10-1
 SUMMARY OF 2020 FP
 TREATMENT RECOMMENDATIONS –
 NEW FPOPS IDENTIFIED BY 2020**

2020 TREATMENT REPORT

5/20/07

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FPOP	Chapter 10 Cross Reference for Additional Details	Comments	Preliminary Engineering or Demonstration Project Estimate (\$ M)	Capital Cost Est. (\$ M) ³	Annual O&M Cost Est. (\$ M)	Present Value (\$ M) ⁴
Rehabilitate the ISS Pump Station ⁵	Section 10.3, Item No. 1 in Table 10-4	Included in MMSD Project Initiated 11/06	See note 6	\$25	—	\$25
Ongoing Treatment Upgrades	Section 10.3, Item No. 4 in Table 10-4	Based upon MMSD estimate ⁶	—	1437	—	1437
Additional Treatment Recommendations	Section 10.6.2		—	See note 8	—	See note 8
Committed Projects	Section 10.5.1, Table 10-6	See note 9	—	829	—	829
Recommended Treatment Projects — Included in MMSD's 2007 Annual Budget ¹⁰	Section 10.5.2, Table 10-7		—	6810	—	6810

ISS = Inline Storage System
FPOPs = Facilities, Programs, Operational Improvements and Projects
PE = Preliminary Engineering
SSWWTP = South Shore Wastewater Treatment Plant

NOTES:

- 1) All costs were escalated using the Engineering News Record Construction Cost Index (ENR-CCI), which was projected to be 10,000 in June 2007.
- 2) It is not appropriate to total the costs in this table because they represent total initial costs, of which some moneys may have already been spent or budgeted. These costs are presented for illustration purposes. The necessary financing for these efforts will be presented in Chapter 11, *Implementation Plan*.
- 3) Capital Costs include construction cost plus 25% for engineering and 35% for technical services and administration.
- 4) Range of Present Value, Facility Plan estimates +50/-30%. Costs do not include salvage values.
- 5) This project is based on Project J01009, "ISS Pump Station Equipment Upgrade," which is listed in Table 10-5 and is in the 2007 Annual Budget to address the ISS pump station upgrades. This pump station project was developed and expanded during the 2020 planning process to address the identified need to increase pumping capacity to meet LOP (see Section 10.3 of this Chapter). The *2007 Annual Budget* lists the cost for this project as \$6.2 million, which does not include the additional scope to increase the pumping capacity. The cost for this project has been updated, as shown here, to include the additional scope. Costs for this project are not included under the line item "Recommended Treatment Projects — Included in MMSD's 2007 Annual Budget." See Note 10.
- 6) PE analysis is already underway and therefore costs not presented.
- 7) Reflects MMSD estimate of ongoing capital needs for treatment systems (MMSD Memo 12/28/06). Annual cost for treatment upgrades is estimated to be \$11 million per year for 13 years from 2008 through 2020, for a total project cost estimate within the planning period of \$143 million, as listed in the table.
- 8) Costs have not been determined for these elements but they are not expected to be significant and therefore can be included in the ongoing annual budget.
- 9) Committed Projects are those that were either identified in the 2002 Stipulation (but were not yet complete as of the end of 2006) or that were already in construction and therefore considered committed. This dollar figure represents the total original project cost (rounded sum of costs in Table 10-6). As these projects are completed, the remaining cost decreases until the project is finalized.
- 10) Part of common FPOPs. As stated in Note 5, the *2007 Annual Budget* lists the cost for Project J01009, "ISS Pump Station Equipment Upgrade," as \$6.2 million, which does not include the additional scope represented by the costs developed during the 2020 planning process for "Rehabilitate the ISS Pump Station" as listed in the first line item of this table. Thus, this line item represents the rounded total of Table 10-7 (\$74) minus the \$6.2 million (~\$68 million).

The Recommended Plan for treatment systems consists of the following key elements:

- ◆ Section 10.2 - Wet Weather Control Plan - MMSD Treatment Facilities
- ◆ Section 10.3 - Plan for Existing Treatment Facilities
- ◆ Section 10.4 - Biosolids Plan
- ◆ Section 10.5 - Committed and Common Treatment Facilities
- ◆ Section 10.6 - Other Recommended MMSD Projects

Each of these elements is discussed in more detail in the following sections. As mentioned above, the majority of the recommendations in the Recommended Plan come from the common elements in Chapter 8 and therefore would have been included in any Recommended Plan, regardless of the outcome of the alternatives evaluation. The remainder of the recommendations were identified and developed as a result of the evaluations performed during this planning study and are presented in Chapter 9. The classification of the source of each recommended element of the Recommended Plan is identified in the tables in the following sections as either “Common” (refer to Chapter 8) or “2020 Plan Identified” (refer to Chapter 9).

10.2 Wet Weather Control Plan – Milwaukee Metropolitan Sewerage District Treatment Facilities

The 2020 FP includes an independent *Wet Weather Control Plan* to identify the facility improvements required by state and federal regulations under the current wastewater discharge permit for the 2020 Baseline population and land use. The components of the *Wet Weather Control Plan* are dependent on future population growth, associated land use, and operation of the existing system. The MMSD’s *Wet Weather Control Plan* consists of facilities, programs and policies that are focused on maximizing capture of sewage during wet weather events. The proposed facilities, programs and policies that are a part of the *Wet Weather Control Plan* as related to wastewater treatment are summarized in the next two sections.

The following MMSD facilities are recommended to be constructed or improved as a part of the 2020 FP in order to maximize capture and treatment of sewage during wet weather.

Perform Capacity Analysis of South Shore Wastewater Treatment Plant

As presented in Chapter 9, the 2020 FP identified the need to increase the treatment capacity of SSWWTP in order to achieve an appropriate LOP for SSOs. The Recommended Plan sets forth a recommended LOP of 5 years. The current maximum design capacity of SSWWTP is 250 million gallons per day (MGD). Based on actual historical flow data, however, the 2020 FP used 300 MGD as the maximum capacity. It is possible that the actual maximum capacity may be greater than 300 MGD. A detailed capacity analysis is recommended for SSWWTP in order to update the design capacity. If the capacity of SSWWTP is actually larger than 300 MGD, the need for additional capacity may be reduced, which will reduce the costs for the proposed new physical-chemical secondary treatment system (See subsection, *Increase South Shore Wastewater Treatment Plant Capacity*, below). More details regarding evaluating and increasing the capacity of SSWWTP are discussed in Chapter 9 of this report.

Increase the Inline Storage System Pump Station Capacity to Jones Island Wastewater Treatment Plant

Through the evaluation of the screening and preliminary alternatives, the 2020 technical team determined the need for additional pumping capacity from the ISS to JIWWTP in order to control SSOs to a 5-year LOP. The modeling for the Recommended Plan determined that the pumping capacity from the ISS to JIWWTP must be increased from the existing capacity of 80 MGD to a capacity of 180 MGD in order to assist in meeting the 5-year LOP.

It is recommended that this effort begin with a preliminary engineering (PE) study of the ISS Pump Station capacity considering both current and Revised 2020 Baseline recommended systems. The PE study can be used to determine how to maximize the current system, rehabilitate it, and best add capacity. The MMSD has already acted on this recommendation by issuing a request for proposal (RFP) in November 2006 that addresses the evaluation of the ISS Pump Station.

More details regarding evaluating and increasing the capacity of pumping to JIWWTP are discussed in Chapter 9 of this report and Chapter 9 of the *Facilities Plan Report*.

Increase South Shore Wastewater Treatment Plant Capacity

Through the evaluation of the screening and preliminary alternatives, the 2020 technical team determined the need for additional treatment capacity at SSWWTP in order to control SSOs to an appropriate LOP. The modeling for the Recommended Plan determined that the treatment capacity of the SSWWTP must be increased from the existing capacity of 300 MGD to 450 MGD in order to assist in meeting the 5-year LOP.

The analysis completed in the *State of the Art Report* (SOAR) revealed that the most cost effective and acceptable method to increase treatment capacity at SSWWTP is to add physical-chemical secondary treatment with ultra-violet (UV) disinfection for the physical-chemical secondary effluent. A long term (2-3 year) demonstration project is recommended at SSWWTP in order to adequately address long term operational issues, disinfection effectiveness, and community concerns. In addition to the demonstration project, an evaluation is necessary to determine if increasing the metropolitan interceptor sewer (MIS) flow rate to SSWWTP will require control system refinements at the South 6th Street and West Oklahoma Avenue drop structure (connection to ISS). More details regarding evaluating and increasing the capacity of SSWWTP are discussed in Chapter 9 of this report and Chapter 9 of the *Facilities Plan Report*.

Hydraulic Analysis of Jones Island Wastewater Treatment Plant

A hydraulic capacity analysis of JIWWTP has been identified as a need in this report.[°] The 2020 FP recommends a project to determine the current actual maximum day and peak hour hydraulic capacities at JIWWTP with the completion of two ongoing MMSD projects included in the 2007 Annual Budget (J01006, Prelim Treatment Upgrade and J01008, Upgrade Primary Clarifier Mechanisms) that address upgrading the preliminary treatment system and the primary clarifiers. The details regarding this recommendation are discussed in Chapter 8.

The status and estimated costs for these facilities are summarized in Table 10-3.

[°] See Chapters 4, 5 and 8 of this report.



Facilities to be Constructed	Classification ⁶	Plan Status	Demonstration Project or Preliminary Engineering Estimate (\$M)	Capital Cost Estimate ² (\$M)	Annual O&M Cost Estimate (\$M)	Present Worth Cost ³ (\$M)
1. Perform Capacity Analysis of SSWWTP	Common	Recommended Plan	\$0.3 M	—	—	—
2. Increase ISS Pump Station Capacity to JIWWTP to 180 MGD	2020 Plan Identified	Recommended Plan — Implementation initiated (RFP issued 11/06)	—	\$108	\$0.9	\$119
3A. Increase SSWWTP Capacity with physical-chemical (ballasted flocculation) secondary treatment	2020 Plan Identified	Recommended Plan	—	152	1.7	173
3B. Increase SSWWTP Capacity with physical-chemical (chemical flocculation) secondary treatment	2020 Plan Identified	Recommended Plan — Optional Technology	1.5M	97	1.4	116
4. Hydraulic Analysis of JIWWTP	Common	Recommended Plan — Add scope to existing project (Primary Clarifiers J01008) or undertake after completion of J01008 and S01006	—	See note 4	—	See note 4
Totals (\$ M)			\$1.8	\$205-260⁵	\$2.3-2.6⁵	\$235-292⁵

ISS = Inline Storage System
 JIWWTP = Jones Island Wastewater Treatment Plant

MGD = Million Gallons per Day
 RFP = Request For Proposal
 SSWWTP = South Shore Wastewater Treatment Plant

NOTES:

- 1) All costs were escalated using the Engineering News Record Construction Cost Index (ENR-CCI), which was projected to be 10,000 in June 2007.
- 2) Capital Costs include construction cost plus 25% for engineering and 35% for technical services and administration.
- 3) Range of Present Value, Facility Plan estimates +50/-30%. Costs do not include salvage values.
- 4) Costs have not been determined for these elements but they are not expected to be significant and therefore can be included in the ongoing annual budget.
- 5) Ranges shown to reflect different options for physical-chemical secondary treatment methods at the SSWWTP
- 6) "Common" projects are discussed in Chapter 8; "2020 Plan Identified Projects" are discussed in Chapter 9.



10.3 Plan for Existing Treatment Facilities

The following facilities improvements are to be constructed in order to continue to provide adequate sewage treatment for the MMSD service area. Due to the importance of these facilities, these projects are to be included in the Recommended Plan, regardless of the outcome of the alternatives evaluation.

Rehabilitate the Inline Storage System Pump Station

The MMSD initiated a project in November 2006 to rehabilitate and upgrade the ISS Pump Station. The original purpose of the project was to maximize the pumping capacity from the ISS during wet weather events. The 2020 facilities planning process identified the need to increase the capacity of the ISS Pump Station in order to meet the needs of a 5-year LOP with Revised 2020 Baseline population and land use. Therefore, the project will also evaluate and make recommendations to upgrade the existing ISS Pump Station systems and ensure that the capacity will meet the requirements of the 2020 FP as discussed in Section 10.2 of this chapter.

Rehabilitate the Dewatering and Drying Facility at Jones Island Wastewater Treatment Plant

A preliminary engineering study is required to confirm the requirements for rehabilitating various components of the dewatering and drying systems at JIWWTP. While there are three specific drying and dewatering rehabilitation projects already included in the 2007 Annual Budget (J04013, J04014, and J04015 - see Chapter 8, Table 8-3), the 2020 technical team identified other drying and dewatering rehabilitation that may be required depending upon the recommendations that come from the biosolids handling evaluation. Further details on the rehabilitation of drying and dewatering systems as they relate to the recommendations for biosolids handling can be found in Chapter 9 of this report.

Evaluation of Jones Island Wastewater Treatment Plant Aeration System

A study of the aeration system and associated power needs and costs is recommended to be completed at JIWWTP. The loss of wet industries over the past 10-20 years, and especially the recent loss of LeSaffre Yeast, has greatly reduced the biochemical oxygen demand (BOD) load to JIWWTP. An evaluation should be performed to determine if the size of the aeration system can be reduced, which may in turn reduce long term energy costs. It may be possible to install smaller blowers and new diffusers in the aeration basins, thereby reducing electrical demand. Further details are discussed in Chapter 9 of this report.

Ongoing Treatment Upgrades

The MMSD will continue to fund routine ongoing treatment upgrades that are necessary to provide adequate sewage treatment. The costs are based on historical experience. The MMSD has provided estimates for the ongoing capital needs for existing treatment facilities.^f

Geotechnical/Structural Analysis of Wastewater Treatment Plants

The Recommend Plan includes a recommendation that a full geotechnical and structural analysis be performed on both wastewater treatment plants. Parts of JIWWTP will approach 100 years old by 2020 and a full analysis has not been completed in over 20 years. This study will identify areas that may need repair or replacement in order to prevent any unanticipated expenditure due to structural/geotechnical failures. Further details are presented in Chapter 8 of this report.

^f See Appendix 8D, *Annual Replacement/Reinvestment Cost Memorandum of the Facilities Plan Report*.



The status and estimated costs for existing facilities improvements are summarized in Table 10-4. These costs also include MMSD's estimate of ongoing treatment system capital needs for the period 2008 to 2020.

**TABLE 10-4
PLAN FOR EXISTING MILWAUKEE METROPOLITAN SEWERAGE DISTRICT FACILITIES¹**

Facilities to be Constructed	Classification	Plan Status	Preliminary Engineering Estimate (\$M)	Capital Cost Estimate (\$M)	Annual O&M Cost Estimate (\$M)²	Present Value (\$M)³
1. Rehabilitate the ISS Pump Station	Common	Recommended Plan- PE analysis Included in MMSD Project Initiated 11/06	—	\$25	—	\$25
2. Rehabilitate Dewatering and Drying at JIWWTP (costs covered in the Biosolids Plan)	Common	Recommended Plan	—	See note ⁴	—	See note ⁴
3. Evaluation of JIWWTP Aeration System	Common	Recommended Plan	\$0.3	0 - 15	See note ⁵	0-15
4. Ongoing Treatment Upgrades	Common	MMSD Recommendation	—	143 ⁶	—	143 ⁶
5. Geotechnical/ Structural Analysis of Wastewater Treatment Plants	Common	Recommended Plan	0.8	See note ⁷	—	See note ⁷
Totals			\$1.1	\$168-183	—	\$168-183

ISS = Inline Storage System

PE = Preliminary Engineering

JIWWTP = Jones Island Wastewater Treatment Plant

Notes:

"Common" projects are discussed in Chapter 8, "2020 Plan Identified Projects" are discussed in Chapter 9.

1) All costs were escalated using the Engineering News Record Construction Cost Index (ENR-CCI), which was projected to be 10,000 in June 2007.

2) Capital Costs include construction cost plus 25% for engineering and 35% for technical services and administration.

3) Range of Present Worth, Facility Plan estimates +50/-30%. Costs do not include salvage values.

4) Costs are included in Biosolids Plan (see Table 10-5).

5) A potential savings of \$1million/year in operating costs could possibly be achieved if aeration system energy costs can be reduced. Details will be determined in PE analysis.

6) Reflects MMSD estimate of ongoing capital needs for treatment systems (MMSD Memo 12/28/06). Annual cost for treatment upgrades is estimated to be \$11 million per year for 13 years from 2008 through 2020, for a total project cost estimate within the planning period of \$143 million, as listed in the Table.

7) Cannot determine capital costs until engineering work is complete.



10.4 **Biosolids Plan**

The MMSD currently recycles the biosolids that are a normal byproduct of the wastewater treatment process. The biosolids from JIWWTP are converted to and sold as Milorganite®, a popular natural organic fertilizer. The biosolids at SSWWTP are processed into Agri-Life®, a natural organic product that is applied to the soil at area farms to provide nutrients for the crops. Biosolids that are not used for the production of Milorganite® or Agri-Life® are made into filter cake. Milorganite® production and corresponding sales and revenue are expected to decrease in the coming years due to the decrease in flows from wet industries (with high organic loads). Therefore it was necessary to analyze the long-term trends in Milorganite® production and prepare a future plan for biosolids.

A comprehensive biosolids handling evaluation (including energy needs) was performed as a part of the 2020 facilities planning effort. This biosolids evaluation initially reviewed six screening alternatives. Based on the review of the screening alternatives, three final alternative technologies were further evaluated (landfill, glass fusion technology, and Milorganite®). The following biosolids alternatives were evaluated in detail (they are the three final alternative technologies and combinations thereof):

- ◆ All landfill
- ◆ All “glass fusion technology”
- ◆ All Milorganite® with a less than 6% nitrogen content product
- ◆ All Milorganite® product with product less than 6% nitrogen content land applied
- ◆ Combination of Milorganite® and glass fusion technology
- ◆ Combination of Milorganite® and landfill

An extensive analysis of the alternatives for biosolids management was completed and presented in detail in Chapter 9 of this report. The analysis showed that based on the present value cost estimates for each alternative there was no strong financial basis for making a 2020 recommendation. The 2020 FP recommends that MMSD continue with existing operations for an interim period in order to continue to evaluate the alternative biosolids options and to fully understand the impacts of the loss of wet industries (primarily LeSaffre Yeast). The interim recommendations consist of the following:

- ◆ **Detailed Engineering and Other Analyses**
 - Conduct Milorganite® marketing analysis (assuming 5% or less nitrogen content)
 - Evaluation of Milorganite® nitrogen balance
 - Overall Assessment Report on energy management and power supply/power generation
 - Development of a final Biosolids Management Plan
- ◆ **Facilities Improvements**
 - Maintenance of JIWWTP Dewatering and Drying Facilities
 - New Milorganite® Locomotive



- Interplant solids pumping and pipeline improvements
- New gravity belt thickeners for SSWWTP waste sludge thickening
- Upgrade and maintain SSWWTP plate and frame presses
- Rehabilitate SSWWTP digesters
- ◆ **Operational Improvements**
 - Maximize operation of primary clarifiers

The findings developed through the various analyses will drive the final recommendations for biosolids management. The recommendations for the facilities improvements may change depending upon the final recommended plan for biosolids. The status and estimated costs for the interim recommendations for the biosolids program are summarized in Table 10-5.

Recommended Element	Capital Cost (\$ M)	Comment
Facilities		
Maintenance of JIWWTP Dewatering and Drying Facility	\$115.0	A project that will be implemented in stages over the next 20 years
New Milorganite® Locomotive	3.0	Replaces existing locomotive that is beyond its useful life
Interplant Solids Pumping and Pipeline Improvements	3.0	Involves pumps at both SSWWTP and JIWWTP and the pipeline cathodic protection system
New Gravity Belt Thickeners for SSWWTP Waste Sludge Thickening	7.7	Recommended in a tech memo as part of the 2003 Plant Requested Projects
SSWWTP Digester Rehabilitation	117.0	An increase in primary sludge production is expected due to planned improvements to JIWWTP primary clarifier performance. Includes improved digester mixing, conversion of existing sludge storage units to active digesters and the construction of 5 new 3.5 MG digesters
Total Capital Costs	\$245.7	
Operations		
Maximize Operation of Primary Clarifiers	0.0	This clarifier mechanism project is an existing project. No other capital expenditure is required.
Other Recommended Projects		
Facilities		
Upgrade and Maintain SSWWTP Plate and Frame Presses	5.0	Included as part of 2005 Plant Review Project (Project J06015P06)
Operations		
Overall Planning Report on Energy and Energy Management	0.3	Preliminary Engineering Analysis estimate
Detailed Engineering and Other Analyses	0.0	Costs not expected to be significant
Total	\$251.0⁴	

JIWWTP = Jones Island Wastewater Treatment Plant
MG = Million Gallons
SSWWTP = South Shore Wastewater Treatment Plant

NOTES:

- 1) Recommendation derived from alternative development, as presented in Chapter 9, Section 9.10, *Interim Recommended Biosolids Plan* of this report.
- 2) See Section 9.8 and 9.9 of this report for additional detail.
- 3) Costs are included in the summary Table 10-1.
- 4) Costs do not include salvage value.



10.5 Committed and Common Treatment Facilities

The 2020 Baseline includes all FPOPs that should be implemented regardless of the outcome of the alternatives evaluation. Chapter 8 documents the committed and MMSD identified treatment facilities projects as well as the additional treatment facilities projects identified by the 2020 FP that should be implemented by MMSD regardless of the outcome of the alternatives evaluation. Those committed and common treatment recommendations are summarized below as a part of the Recommended Plan for treatment facilities.

10.5.1 Milwaukee Metropolitan Sewerage District Committed Treatment Facilities

The Recommended Plan includes all the MMSD committed treatment facilities projects that were either identified in the 2002 WDNR Stipulation (but were not yet complete as of the end of 2006) or that were already in construction and therefore considered committed. The list of these projects as of June 30, 2004 was listed in Chapter 5, *Treatment Assessment – Future Condition*. The major committed projects still to be completed are listed in Table 10-6. They are described in greater detail in Chapter 8.

The current total cost for these projects is approximately \$82 million. This dollar figure represents the total original project cost. All these projects are committed by MMSD to be completed.

TABLE 10-6
COMMITTED TREATMENT FACILITIES PROJECTS ^{1,2}

MMSD Project Number	Project Description	Estimated Cost (\$M)
J01003	JIWWTP Inline Pump Station (Cone Valve Isolation) (J026)	\$2.1
J01006	JIWWTP Preliminary Facility Upgrade	26.9
J02002	JIWWTP Phase 2 Wet Weather Secondary Capacity Improvements	1.9
J04006	Milorganite® Processing Facilities Upgrade	5.6
J06010	Sitework Phase III, Dockwall Phase II (J009)	8.2
J06014	Jones Island Instrumentation and Controls (I&C) Upgrades- Final	17.8
J06020	Metasys & Simplex System Upgrade	3.4
S04007	South Shore Variable Frequency Drive Priorities 1&2	1.1
S06004	South Shore I&C Upgrade- Final	14.8
Total		\$81.8

JIWWTP = Jones Island Wastewater Treatment Plant

Notes:

- 1) All costs are total project costs from MMSD Annual Budget. Costs provided may include previous expenditures.
- 2) See Table 8-1 of this report for more details regarding these projects.



10.5.2 Recommended Milwaukee Metropolitan Sewerage District Projects

The MMSD recommended treatment facilities projects are those identified in MMSD's 2007 Capital Budget, but MMSD has not yet committed to build. The major projects are listed in Table 10-7. The 2020 FP recommends that all MMSD recommended treatment facilities projects proceed to construction. Therefore, they are recommended for inclusion in the Recommended Plan. These projects are described in greater detail in Chapter 8.

The projects in Table 10-7 total \$74 million as presented in Table 8-2 of this report. This total includes an estimate of \$6.2 million for project J01009. As noted in Section 8.3 of Chapter 8, the estimated cost for this project developed by the 2020 FP for the ISS Pump Station upgrade was significantly higher than the estimate identified in the MMSD 2007 Annual Budget. The 2020 FP estimate was \$25 million based upon the 2002 ISS Pump Station Technical Memorandum.(2) The difference between the costs developed by MMSD and the costs developed by the 2020 FP is that the 2020 FP costs include additional scope, which involves pump and motor replacement of the existing pumps, which is not contemplated in the original \$6.2 million estimate.

MMSD Project Number	Project Description	Est. Cost (\$M)¹
J01008	Upgrade Primary Clarifier Mechanisms	\$5.9
J01009	Conceptual Design Relating to the Upgrade of the JIWWTP ISS Pump Station Upgrade	6.2 ²
J02004	Upgrade of Electrical Switch Gear for PACs	1.3
J02005	JIWWTP RAS Pump Station Switchgear Ventilation	1.6
J02006	JIWWTP RAS Discharge Pipeline Improvements	2.7
J02007	Secondary Clarifier Drive Replacement	3.3
J04008	Silo Dust System Upgrade	2.7
J04011	RAS Pump Motors and VFD Upgrades	2.8
J04013	Dewatering and Drying VFDs Replacement	1.6
J04014	Dewatering and Drying Dust Containment System	2.2
J04015	Dewatering and Drying Conveyors and Transporters	1.0
J04018	Milorganite® Facilities Improvements — Debris Removal	0.9
J06025	TAS/IPS Wet Wells	1.0
J06029	JIWWTP Project Request Review	0.3
J06030	JIWWTP Security Cameras	0.6
S02004	SSWWTP Blower Engine System Upgrade	19.3
S02005	SSWWTP Secondary Clarifier Upgrade	10.0
S02006	SSWWTP Acid Tank Replacement	2.0
S04006	SSWWTP Polymer Panels and JIWWTP Samplers	0.8
S06006	SSWWTP Masonry Restoration	1.7
S06011	SSWWTP Electrical Substations	2.7
S06012	SSWWTP Project Request Review	0.2
S06013	SSWWTP Valve Replacement and Utility Tunnel Improvements	3.2
Total		\$74.0

IPS = Interplant Solids
ISS = Inline Storage System
JIWWTP = Jones Island Wastewater Treatment Plant
PAC = Process Air Compressor
RAS = Return Activated Sludge
SSWWTP = South Shore Wastewater Treatment Plant
VFD = Variable Frequency Drive

NOTES:

- 1) All costs are total project costs from the MMSD 2007 Annual Budget.
- 2) If the construction cost estimate of \$25 million from the 2020 FP is used for the JIWWTP ISS Pump Station (Project J01009), the total cost would be approximately \$92.8 M.
- 3) "J" projects signify projects to be done at JIWWTP; "S" projects those to be done at SSWWTP.



**TABLE 10-7
RECOMMENDED PROJECTS
BY MILWAUKEE METROPOLITAN
SEWERAGE DISTRICT –
TREATMENT FACILITIES**

2020 TREATMENT REPORT

5/20/07

TR_10.T007.07.05.20.cdr

10.6 Other Recommended Milwaukee Metropolitan Sewerage District Projects

The 2020 FP also identified other treatment facilities projects that should be implemented by MMSD regardless of the outcome of the alternatives evaluation. This list of projects addresses MMSD system “gaps” that were identified in the planning process and are not in the 2007 Annual Budget.

10.6.1 Treatment Issues Identified Under Regulation Review

In Chapter 4, *Treatment Assessment – Existing Condition*, JIWWTP and SSWWTP unit processes were reviewed in comparison with the current Wis. Admin. Code Natural Resources (NR) 110/204 (Sewerage Systems/Domestic Sewage Sludge Management) regulations and advisory 10-States Standards.(3,4) The review identified unit processes at JIWWTP and SSWWTP that did not match current design criteria or regulations/advisory standards under existing conditions. The unit processes were again reviewed in Chapter 5, *Treatment Assessment – Future Condition* to determine how unit processes performed under the Revised 2020 Baseline flow and wasteload conditions to see which items identified in Chapter 4 were still issues in Chapter 5. Those unit processes for which the current design regulation or advisory standard did not match under future conditions were listed in Chapter 8, Table 8-3 of this report.

After reviewing these items against Wisc. Admin. Code requirements and committed and MMSD recommended projects, the 2020 FP is not recommending any further projects to address these issues. The Wisc. Admin. Code does not require that advisory 10-States Standards be met. In addition, NR 110 regulations apply to new or modified sewerage systems, not systems that were designed and installed before current regulations were put into place.

Current operational problems that do exist in these unit processes are being addressed under committed and MMSD recommended treatment facilities projects as follows:

- ◆ JIWWTP Primary Clarification: the MMSD recommended Upgrade Primary Clarifier Mechanisms (J01008) project includes efforts to improve the reliability of the primary clarifiers
- ◆ JIWWTP Secondary Clarification: the committed JIWWTP Phase 2 Wet Weather Secondary Capacity Improvements (J02002) project will relocate pickle liquor feed points to improve solids settling in the secondary clarifiers. Also, the MMSD recommended Secondary Clarifier Mechanism (J02007) project will increase the reliability and dependability of all 33 secondary clarifiers at JIWWTP.
- ◆ SSWWTP Secondary Clarification: the MMSD recommended SSWWTP Secondary Clarifier Upgrade (S02005) project will increase the reliability and dependability of all 24 secondary clarifiers.

10.6.2 Additional Recommendations for Milwaukee Metropolitan Sewerage District to Consider

In Chapter 4, *Treatment Assessment – Existing Condition*, some general WWTP and utility issues were identified that the 2020 FP recommends be addressed. These items include:

- ◆ Wastewater Characterization - The use of intensive wastewater sampling, rather than the available data from standard testing as is currently used, can provide more comprehensive wastewater characterization at critical process locations, which can be



more effectively used in WWTP models such as BioWin®.(5) This intensive wastewater sampling is recommended as a part of the SSWWTP Capacity Analysis discussed in Section 8.3.2.

- ◆ O&M Manuals – Create a central file location for electronic copies of all O&M Manuals for use by MMSD and operator personnel.
- ◆ Existing Utility Information Consolidation – Consolidate all existing utility information onto one set of drawings for each plant to eliminate a review of all historical drawings as is required each time a construction project is planned. This in turn would decrease the chance that utilities may not be accurately located and could be struck during construction.

References

- (1) State of Wisconsin Circuit Court, Stipulation: State of Wisconsin, Plaintiff, v. Milwaukee Metropolitan Sewerage District, Defendant, Case No. 02-CV-2701 (May 29, 2002)
- (2) M. Macaulay (Brown and Caldwell), Final Memorandum to J. Hung, *2002 ISS Pump Station Technical Memorandum* (May 29, 2002)
- (3) Wisconsin Department of Natural Resources, *Wisconsin Administrative Code*, Volume 11, Chapter NR 110 and NR 204 (Revisor of Statutes Bureau, May 2001)
- (4) Wastewater Committee of the Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers, *Recommended Standards for Wastewater Facilities* (Health Education Services Division, 2004)
- (5) Brown and Caldwell, *MMSD CMOM Readiness Review and Implementation Strategy Development Strategic Plan* (December 2005)