Chapter 8: Common Treatment Facilities, Programs, Operational Improvements and Policies for the Recommended Plan

8.1 <u>Introduction</u>

The purpose of this chapter is to document the variety of treatment-related facilities that are "common" to all alternatives and therefore will be automatically part of the Recommended Plan.^a (Note that the common treatment elements listed in this chapter are all facilities; there are no common treatment programs, operational improvements, or policies.) The treatment facilities listed in this chapter are a subset of the facilities, programs, operational improvements, and policies (FPOPs) listed in Chapter 8 of the *Facilities Plan Report*, which contains the complete list of all facilities, treatment, and conveyance FPOPs.

The treatment-related FPOPs that are to be part of the Recommended Plan, regardless of the outcome of the alternatives evaluation consist of the following:

- Committed Milwaukee Metropolitan Sewerage District (MMSD) Treatment Projects:
 - Projects with construction contracts as of December 31, 2006
 - Projects identified by the May 2002 Wisconsin Department of Natural Resources (WDNR) Stipulation but not yet completed (1)
 - Projects that were identified as committed by MMSD as of December 31, 2006 and included in the MMSD 2007 Annual Budget (2,3)
- Recommended MMSD Treatment Projects projects included in the MMSD 2007 Annual Budget, but not yet committed
- Other Recommended MMSD Treatment Projects projects not in the MMSD 2007 Annual Budget, but recommended for inclusion
- Additional Treatment Recommendations general wastewater treatment plant and utility issues identified in Chapter 4 and 5 that are recommended for inclusion

These common elements are discussed in more detail in the following sections.

8.2 <u>Committed Milwaukee Metropolitan Sewerage District Treatment Projects</u>

The first set of treatment-related projects that are part of the Recommended Plan regardless of the outcome of the alternatives evaluation are the committed MMSD treatment projects. These are defined as projects that have a construction contract as of December 31, 2006, those that are required as part of the 2002 WDNR Stipulation (but not completed as of December 2006), and those that MMSD identified as committed projects as of December 31, 2006 and included in the MMSD 2007 Annual Budget.

When this 2020 facilities planning effort was initiated, MMSD was in the midst of an aggressive design and construction program generated by recommendations made in the 2010 Facilities Plan and stipulated to be completed by 2010 per the 2002 WDNR Stipulation. This set of projects

^a The treatment Recommended Plan is presented in Chapter 9 of this report.

was the first element in the 2020 Baseline. The Stipulated projects originally totaled \$906 million as defined in the MMSD 2002 Capital Budget. Many of these projects have been completed as of the end of 2006. The long-term projects that were identified in the 2002 WDNR Stipulation but were not completed as of the end of 2006 are listed in the MMSD 2007 Annual Budget. These projects are designated as "Stipulated" projects in Table 8-1. The other projects listed in Table 8-1 are those that MMSD identified as committed as evidenced by the award of a construction contract by the commission as of December 31, 2006 and included in the MMSD 2007 Annual Budget.

8.3 <u>Recommended Milwaukee Metropolitan Sewerage District Treatment Projects</u>

Table 8-2 lists the next set of projects that are part of the Recommended Plan regardless of the outcome of the alternatives evaluation. They are treatment projects that are included in the MMSD 2007 Annual Budget, but MMSD has not yet committed to construct as evidenced by MMSD Commission award of a construction contract. This section reviews most of those projects that were examined as part of this 2020 FP, listed in Table 8-2. The specific details for each project were taken from the MMSD 2007 Annual Budget.(4) Other minor recommended MMSD projects mentioned in Chapters 4 and 5 that are not mentioned here are included at the end of the MMSD 2007 Annual Budget under the Capital Line Item list. Note that Project J01009 has been estimated by the 2020 FP to be a higher construction cost than is noted in the MMSD 2007 Annual Budget.

Each of these projects was reviewed by the 2020 FP team. The projects should proceed, because they meet various needs identified in the 2020 FP analysis. The purpose and scope of the projects as identified in the MMSD 2007 Annual Budget meets the needs identified in the 2020 FP. Some additions and clarifications to the projects are given below.

J01009: Conceptual Design to Upgrade JIWWTP ISS Pump Station

For this project, the cost estimate developed for 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.(5).

The differences between the costs developed by MMSD and the costs developed by the 2020 FP is that the 2020 FP costs include additional scope which was addressed in the 2002 Technical Memorandum. This additional scope involves pump and motor replacement of the existing pumps, which is not contemplated in the project that generated the estimate shown in Table 8-2.



Project	Purpose	Cost (\$ M) ¹
J01003: JIWWTP Inline Pump Station (Cone Valve Isolation) (J026)	The purpose of this project is to identify and make provisions for a cost-effective option to isolate the screening shaft, pump suction header (piping) and cone valves. The project will also allow maintenance access to the 42-inch cone valves. (Stipulated Project)	\$2.1
J01006: JIWWTP Preliminary Treatment Facility Upgrade Project	The purpose of this project is to improve the capture of objectionable material that is detrimental to downstream equipment and processes, replace equipment and facility systems that have reached the end of their useful lives, and upgrade electrical and HVAC systems to current Codes and standards.	26.9
J02002: JIWWTP Phase 2 Wet Weather Secondary Capacity Improvements	The purpose of this project is to relocate pickle liquor feed points, so as to improve solids settling in the secondary clarifiers, particularly during wet weather events. The feeding of pickle liquor in the treatment process is needed about 5% of the time for phosphorous removal to meet phosphorous discharge limit in the Plant effluent. (Stipulated Project)	1.9
J04006: Milorganite® Processing Facilities Upgrade	The purpose of this project is to improve the reliability and efficiency of the Milorganite® processing operation and improve the District's ability to meet product orders. Replacement of the components listed will reduce instances of unscheduled equipment shutdowns. (Stipulated Project)	5.6
J06010: Sitework Phase III, Dockwall Phase II (J009)	The purpose of this project is to replace a failing dockwall along JIWWTP. (Stipulated Project)	8.2
J06014: Jones Island Instrumentation and Controls (I&C) Upgrades — Final	The purpose of this project is to restore service life and reliability of the process control and monitoring system at JIWWTP. (Stipulated Project)	17.8
J06020: Metasys & Simplex System Upgrade	The purpose of this project is to extend the service life of the fire protection and suppression systems at JIWWTP. The project also addresses upgrades to the existing Metasys HVAC system to allow for more reliable monitoring.	3.4
S04007: South Shore Variable Frequency Drives Priorities 1 & 2	The purpose of this project is to increase the reliability and dependability of variable frequency drives at SSWWTP.	1.1
S06004: South Shore I&C Upgrade — Final	The purpose of this project is to restore the service life and reliability of the process control and monitoring system at SSWWTP. (Stipulated Project)	14.8
Subtotal	Stipulated Projects	\$50.4
Subtotal	Committed Projects that are not Stipulated	\$31.4
Total		\$81.8

J = Jones Island S = South Shore HVAC = heating, ventilating and air conditioning JIWWTP = Jones Island Wastewater Treatment Plant SSWWTP = South Shore Wastewater Treatment Plant I&C = instrumentation and controls

NOTES:

Stipulated projects are those that were listed in 2002 WDNR Stipulation but not yet completed as of December 2006.

Committed projects are those that were not specifically listed in the 2002 WDNR Stipulation but identified by MMSD as committed projects as of December 31, 2006, construction has been initiated, and included in MMSD 2007 Annual Budget.

The sum of the rounded components may not equal the total due to rounding.

1) All costs are total project costs from MMSD 2007 Annual Budget. Therefore, cost provided may include previous expenditures.



TABLE 8-1 COMMITTED TREATMENT PROJECTS FOR THE RECOMMENDED PLAN 2020 TREATMENT REPORT 5/20/07 TR_8.T001.07.05.20.cdr

MMSD Project Number	Project Description	Cost (\$ M) ¹
J01008	Upgrade Primary Clarifier Mechanisms	\$5.9
J01009	Conceptual Design to Upgrade JIWWTP ISS Pump Station	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	Security Cameras at Both WWTPs	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 ³		\$74.0

HVAC = heating, ventilating and air conditioning JIWWTP = Jones Island Wastewater Treatment Plant RAS = return activated sludge S = South Shore

TAS/IPS = thickened activated sludge/interplant solids pump station wet wells

J = Jones Island ISS = Inline storage system PACs = process air compressors VFDs = variable frequency drives SSWWTP = South Shore Wastewater Treatment Plant

NOTES:

The sum of the rounded components may not equal the total due to rounding. Other projects noted in Chapter 4 and 5 are addressed in the MMSD Annual 2007 Budget on the table following page 276 — in the "Proposed Capital Line Item" table.

1) All costs are total project cost from the MMSD 2007 Annual Budget.

2) As noted in Section 8.3, the 2020 Facilities Plan construction cost estimate is \$25 million.

3) If the construction cost estimate of \$25 million from the 2020 Facilities Plan is used for the JIWWTP ISS Pump Station (project number J01009), the total cost would be \$92.8 million.



TABLE 8-2 RECOMMENDED MILWAUKEE METROPOLITAN SEWERAGE DISTRICT PROJECTS – INCLUDED IN 2007 ANNUAL BUDGET 2020 TREATMENT REPORT 5/20/07 TR_8.T002.07.05.20.cdr

8.4 <u>Other Recommended Milwaukee Metropolitan Sewerage District Treatment</u> <u>Projects</u>

The next set of projects that are part of the Recommended Plan are projects that address MMSD system "gaps" that were identified during the 2020 facilities planning effort. These projects are not in the MMSD 2007 Annual Budget, but are recommended for inclusion as a result of this 2020 facilities planning effort.

8.4.1 Unit Process/Regulation Review

In Chapter 4, *Treatment Assessment – Existing Condition*, a review of JIWWTP and SSWWTP unit processes was made in terms of alignment with the current Wisconsin Administrative Code, Department of Natural Resources (NR) 110/204 regulations, and advisory 10-States Standards.(6,7) 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* with regard to current design criteria or regulations/advisory standards under 2020 Baseline flow and wasteload conditions. Those unit processes, along with the current design regulation or advisory standard that did not match the unit process operation under future conditions, are listed in Table 8-3.

A review of these items against Wisc. Admin. Code requirements, committed MMSD projects, and recommended MMSD projects indicated that there are no issues of concern regarding the unit processes at the treatment plants. Based on this review, the 2020 FP is not recommending any projects based upon NR 110 regulations. The NR 110 regulations apply to new or modified sewerage systems, not systems that were designed before current regulations were put into place. In addition, the Wisc. Admin. Code does not require that the advisory 10-States Standards be met.

All operational problems that exist in these unit processes are being addressed under the following committed and recommended MMSD treatment facilities projects:

- JIWWTP Primary Clarification: the recommended MMSD 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, so as to improve solids settling in the secondary clarifiers. Also, the MMSDidentified Secondary Clarifier Mechanism (J02007) Project will increase the reliability and dependability of all 33 secondary clarifiers at JIWWTP.
- SSWWTP Secondary Clarification: the recommended MMSD SSWWTP Secondary Clarifier Upgrade (S02005) Project will increase the reliability and dependability of all 24 secondary clarifiers.



Unit Process No.	Unit Process Title	Regulation or Standard				
		Current NR 110 Regulation	Advisory 10-States Standards			
		Jones Island Wastewater Treatment Plant				
4 Prin Clarifi	Primary	NR 110.18.2 (d).1:	Sec. 72.21 – Maximum hourly surface settling rate for primary clarification			
	Clamication	 Maximum hourly surface settling rate for primary clarification is 1 500 gpd/sf 	Sect. 72.43 – Maximum hourly weir loading rate is 30,000 gpd/sf			
		 Average day weir loading rate for primary clarification is 15,000 gpd/lf 	Projected peak hourly surface overflow rate is 2,100 gpd/sf and projected peak hourly weir loading rate is 96,200 gpd/lf			
		Projected peak hourly surface overflow rate is 2,100 gpd/sf and projected average day weir loading rate is 30,400 gpd/lf				
6 Se Cla	Secondary Clarification	Meets regulations as listed in NR 110.18, Settling tanks	Sec. 72.232 – with chemical addition, maximum hourly surface overflow rate is 900 gpd/sf			
			Projected peak hourly surface overflow rate is 1,150 gpd/sf			
		South Shore Wastewater Treatment Plant				
6	Secondary Clarification	NR 110.18.2 (d).1 – Maximum hourly surface overflow rate for clarification after activate sludge treatment is 1,200 gpd/sf	Sec 72.232 – with chemical addition, maximum hourly surface overflow rate is 900 gpd/sf			
		Projected peak hourly surface overflow rate is 1,270 gpd/sf	Projected peak hourly surface overflow rate is 1,270 gpd/sf			

gpd = Gallons Per Day If = Lineal Feet sf = Square Feet WDNR = Wisconsin Department of Natural Resources WWTP = Wastewater Treatment Plant

NOTES:

1) Current NR 110 regulations and advisory 10-States Standards were updated after the WWTP unit processes were constructed. Applicable NR 110 regulations were most recently updated May 2001. 10-States Standards were most recently updated in 2004. NR 110 applies to new or modified sewerage systems. NR 110.04 authorizes the WDNR to approve alternate requirements.

2) All unit processes not listed in this table have been determined to meet current NR 110 requirements and advisory 10-States Standards.

Sources: Appendix 5C, MMSD System Revised 2020 Baseline Mass Balance Analysis, Jones Island and South Shore O&M Manuals, Individual Unit Process O&M Manuals, NR 110, 10-States Standards.



TABLE 8-3 **MILWAUKEE METROPOLITAN SEWERAGE DISTRICT COMPARISON OF REVISED 2020 BASELINE OPERATION OF PROCESSES TO CURRENT DESIGN REGULATIONS AND ADVISORY STANDARDS** 2020 TREATMENT REPORT 5/20/07 TR_8.T003.07.05.20.cdr

8.4.2 Hydraulic Analysis of Jones Island Wastewater Treatment Plant

The 2020 FP recommends that a hydraulic capacity analysis of JIWWTP be conducted. The costs for this analysis are assumed to be included in the plant rehabilitation allowance.

Project Purpose

The purpose of the project is 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. This determination of hydraulic capacity may identify issues that would have to be addressed in order to assure the full capacity of JIWWTP as 300 MGD maximum day and 330 MGD maximum hour.

Project Scope

The scope consists of a hydraulic analysis on the entire JIWWTP. This would include evaluation and documentation of the peak hourly and maximum daily flows that can be hydraulically passed by each unit process.

8.4.3 Capacity Analysis of South Shore Wastewater Treatment Plant

The 2020 FP recommends that a capacity analysis of SSWWTP be conducted at an estimated total project cost of \$300,000.

Project Purpose

The purpose of the project is to determine the current actual maximum day and peak hour treatment and hydraulic capacities at SSWWTP with the completion of multiple improvement projects installed in recent years. The current design capacities, based upon the existing Operation and Maintenance (O&M) Manual, are a maximum day of 250 MGD and a peak hour of 300 MGD.(8) However, as discussed in Chapter 4, *Treatment Assessment – Existing Condition*, historical performance indicates that the plant can sustain flows of 300 MGD for more than a single day and still meet effluent quality permit requirements. The data suggests that 300 MGD may not be the limit on peak day flow. Because the influent flow is limited to 300 MGD by the metropolitan interceptor sewer (MIS) Control Structure, it is possible that SSWWTP could possibly handle even higher flows. An increase in existing SSWWTP capacity would decrease the size of treatment facilities required to meet the additional wet weather treatment capacity being recommended in Chapter 9, *Alternatives Analysis* in this report and in the 2020 FP.

Project Scope

The scope consists of hydraulic and process analyses on the entire SSWWTP. This would include evaluation and documentation of the peak hourly and maximum daily flows that can be treated by each unit process and still meet effluent quality permit requirements. The scope would be similar to the scope of the *Wet Weather Optimization Study*, which was done before all improvement projects were completed, but should also include detailed, site-specific wastewater quality testing that is not typically done so a comprehensive model can be developed.(9)



8.4.4 Rehabilitate ISS Pump Station

Originally developed as a 2020 FP recommended project, the project consisted of reviewing the entire ISS Pump Station to improve the general performance and increase capacity. The scope of the project was included by MMSD as part of an already identified project and so was moved to Section 8.3. The project is discussed in Section 8.3.2, *J01009: Conceptual Design to Upgrade JIWWTP ISS Pump Station*. Note that the estimate of the 2020 FP for this project is higher than the estimate in the MMSD 2007 Annual Budget.

8.4.5 Jones Island Wastewater Treatment Plant Aeration and Blower Systems Evaluation

The 2020 FP recommends that the JIWWTP Aeration and Blowers Systems be evaluated at an estimated cost of \$300,000 for the engineering analysis, and a conceptual total project cost estimate of \$15 million.

Project Purpose

The purpose of the project is to modify the current air supply to the JIWWTP aeration basins to more accurately match the treatment needs of the system. As discussed in Chapter 5, *Treatment Assessment – Future Condition*, it appears that the mixing required to prevent the existing diffusers from plugging with solids is much higher than the oxygen demand requirements now that the wasteload from LeSaffre Yeast is gone. The existing diffusers installed in many of the JIWWTP aeration basins must be supplied with air even if the aeration basin is not in service (due to plugging issues). Also, due to the size (each unit is 5,500 HP) of the existing process air compressors (PACs), more air is often supplied than is needed to meet the oxygen demand of the wastewater. Projections of future wasteloads as shown in Chapter 5 indicated that this issue will continue since future wasteloads to JIWWTP are not expected to increase. Matching air supply to the treatment needs of the treatment system will reduce electrical usage of the PACs significantly.

Project Scope

The scope consists of a conceptual design effort focusing on the costs and benefits of this proposed project including an evaluation of the return on investment. If justified by the preliminary engineering study, the design engineering and construction effort will commence to install smaller process air blowers, new membrane diffusers in all the aeration basins to allow for shut down of air flow when aeration basins are removed from service, and motorized aeration basin inlet and discharge gates. A conceptual estimate of design cost is \$1.7 million and a conceptual cost estimate for construction is \$13 million.

Operating Budget Impact

The operating budget impact is the possibility of large long term energy savings (preliminary estimates are approximately \$1 million per year or more in savings at current electric rates). Payback would involve reduced electrical demand and use charges and reduced maintenance costs. Motorized inlet and outlet gates (as already installed in six of the basins) would enhance the facility's ability to respond to increased wet weather flows while operating more efficiently during normal dry weather flows.



8.4.6 Geotechnical/Structural Analysis of Both Wastewater Treatment Plants

The 2020 Facilities Plan recommends that a geotechnical and structural analysis of both WWTPs be conducted at a conceptual cost estimate of \$800,000 for preliminary engineering. If deficiencies at either plant are identified during this preliminary engineering phase, additional design and construction costs could be incurred.

Project Purpose

The purpose of this project is to determine the structural reliability of all of the facilities at both JIWWTP and SSWWTP, especially structures that will be nearly 100 years old by the year 2020, such as the JIWWTP west plant aeration basins, tunnels and galleries. A full WWTP structural/ geotechnical analysis (which would include the inspection of the wood pilings under many of the structures), which has not been done since the early 1980s, would assess the structures to see if there are any potential future expenditures that need to be planned and budgeted.

Project Scope

The scope consists of assessments of the structural integrity of facilities at JIWWTP and SSWWTP. The assessments will include on-site review of facilities, data gathering from existing design drawings and prior structural reports, identification of deficiencies due to structural deterioration and ground support, and repair recommendations including cost estimates. The project would lead into design engineering and construction efforts to correct all deficiencies identified, but the budget for these activities cannot be determined until the structural and geotechnical assessments are completed.



8.5 Additional Treatment Recommendations

In Chapter 4, *Treatment Assessment – Existing Condition*, some general wastewater treatment plant and utility issues were identified that the 2020 FP is recommending that MMSD consider correcting. These items include:

- <u>Treatment Plant Wastewater Characterization and Modeling</u>
 - 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®.(10) This intensive wastewater sampling is recommended as a part of the SSWWTP Capacity Analysis discussed in Section 8.4.3. This sampling could also be considered if the scope was expanded for the JIWWTP Hydraulic Analysis discussed in Section 8.4.2.
 - Treatment Plant Hydraulic and Process Modeling This recommendation was not discussed in Chapter 4, but expands on the discussion under Wastewater Characterization. There are now many types of software available to model both treatment plant hydraulics and process characteristics. These models help the user determine the impacts of process changes and how to optimize the changes and the process treatment. A hydraulic model of SSWWTP should be developed concurrent with the SSWWTP Capacity Analysis discussed in Section 8.4.3. The process model can be used to evaluate the capability of process changes to achieve the desired benefits. A hydraulic model of JIWWTP should also be developed concurrent with the JIWWTP Hydraulic Analysis discussed in Section 8.4.2, and a process model be considered if the scope of the project is expanded. The MMSD should take responsibility for the models so that they are available for all projects and are updated for all projects.
- <u>O&M Manuals</u> Create a central file location where electronic copies of all O&M Manuals are located and kept up to date for use by MMSD and operations personnel.
- <u>Existing Utility Information Consolidation</u> Consolidate all existing utility information onto one set of drawings for each plant to eliminate the review of all historical drawings as is required each time a construction project is planned. This would improve design efforts in that accurate and up to date utility drawings would be available.



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) Milwaukee Metropolitan Sewerage District, *Stipulation Annual Report* (December 31, 2006)
- (3) Milwaukee Metropolitan Sewerage District, *Milwaukee Metropolitan Sewerage District* 2007 Annual Budget (November 2006)
- (4) Ibid.
- (5) M. Macaulay, Final Memorandum to J. Hung, 2002 ISS Pump Station Technical Memorandum (May 29, 2002)
- (6) Wisconsin Department of Natural Resources, *Wisconsin Administrative Code*, Volume 11, Chapter NR 110 (Revisor of Statutes Bureau, May 2001)
- (7) 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)
- (8) Milwaukee Metropolitan Sewerage District, South Shore Operation & Maintenance Manual: Plant Summary and Administration (March 1, 1986)
- (9) XCG Consultants Ltd, *Wet Weather Flow Optimization Study for Jones Island and South Shore WWTP* (December 5, 2001)
- (10) Brown and Caldwell, *MMSD CMOM Readiness Review and Implementation Strategy* Development Strategic Plan (December 2005)

