

4. CONVEYANCE SYSTEM

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CONVEYANCE SYSTEM

Background

The existing MMSD conveyance infrastructure was evaluated with regard to condition, age, and the ability to meet projected capacity requirements for the year 2020, 2030, and 2060 assuming all wastewater will continue to be treated at the NSWTP. The evaluation provided a baseline for comparison of potential alternatives to treating wastewater at the NSWTP. Future flows used in the evaluation were based on the CARPC analysis of population and flows prepared for the MMSD 2008 Collection System Facilities Plans. Detailed analyses of the existing conveyance system are provided in Appendix C, TM3 – Conveyance Facility Analysis (CFA).

Existing Conveyance System

MMSD owns 94 miles of gravity interceptor sewers, 29 miles of wastewater force mains, and 17 regional wastewater pumping stations. Each municipality within MMSD owns and operates their own sewer collection system which ultimately feeds into MMSD's conveyance system. All 17 pumping stations convey wastewater to the NSWTP. All wastewater treated at the NSWTP is pumped to the treatment plant. The MMSD service area is divided into 2 service areas: an Eastside area and a Westside area. The Eastside area includes service areas for pumping stations 6, 7, 9, 10, 13 and 14. The Westside area includes service areas for pumping stations 1, 2, 3, 4, 5, 8, 11, 12, 15, 16 and 17).

An overall system schematic is presented in Figure 4-1. Detailed pumping station information is presented in Table 4-1.

Table 4-2 summarizes the current hydraulic capacities of pumping stations. Table 4-3 presents the 2008 Collection System Facilities Priority Ranking prepared by MMSD staff.

Table 4-4 summarizes MMSD's existing force mains. The comparison of the capacities of the force mains to the projected peak flows is based on the flows contained in the 2008 MMSD Collection System Evaluation prepared by the CARPC. Average daily flows for each of the pumping stations from 1996 through 2007 are summarized in Table 4-5.

Wastewater is conveyed to the pumping stations through interceptor sewers. Table 4-6 provides an overview of the adequacy of the capacity of interceptor sewers. The Madison Design Curve is used for estimating peak flows in the conveyance system, based on the average day flows. Refer to Section 1 of TM 3 in Appendix C for a detailed description of the Madison Design Curve.

MMSD's 2002 Collection System Facilities Plan and annual reports provide a summary of televising done to review the condition of its existing system. Table 4-7 summarizes the past history of MMSD in reviewing system condition.

Contributory customers also have pumping stations included in their own collection systems. Table 4-8 summarizes contributory customer pumping stations. Collection systems owned by the contributory customers convey their wastewater to these pumping stations. The total length of collection sewers connected to MMSD's system was approximately 1,332 miles in 2008. MMSD maintains some of these pumping stations on a contract basis with its customers as noted in Table 4-8. Average daily flows from each of these contributory customers for the years 2000 through 2007 are summarized in Table 4-9.

Table 4-1. MMSD Regional Pumping Station Description

Pumping Station	Address	Description
PS 1	104 North First Street, Madison	This station receives flow only from its gravity drainage service area. Wastewater is pumped to PS 2 via the Cross Town Force Main (CTFM) or to PS 6.
PS 2	833 West Washington Ave, Madison (Brittingham Park)	This station receives flow from its gravity drainage service area plus a portion of the flow discharge by PS 1.
PS 3	Nine Springs, Madison	This station receives flow only from its gravity drainage service area. The station discharges to a force main shared by PS 2, PS 3, and PS 4.
PS 4	522 John Nolen Drive, Madison	This station receives flow only from its gravity drainage service area. The station discharges to a force main shared by PS 2, PS 3, and PS 4.
PS 5	5221 Lake Mendota Drive, Madison (Spring Harbor)	This station receives flow on a routine basis from its gravity drainage service area but may receive flow bypassed around either PS 15 or PS 16 in alternate operating modes.
PS 6	402 Walter Street, Madison (Olbrich Park)	This is one of three stations that pump to PS 7. PS 1 is piped to discharge to PS 6. Under 2010 operations, a portion of PS 1 flows are discharged to PS 6 while the majority of flows are discharged to PS 2.
PS 7	6300 Metropolitan Lane, Madison	PS 7 is the MMSD's largest station and in many ways its most critical pumping station. This station discharges directly to the NSWTP.
PS 8	967 Plaenert Street, Madison	This station receives flow from its gravity drainage service area in addition to pumped flows from PS 5 and PS 15.
PS 9	4612 Larson Beach Road, Mc Farland	This is one of the three stations that discharge to PS 7. There are no contributory MMSD pumping stations upstream of PS 9.
PS 10	110 Regas Road, Madison (Main Post Office)	This is one of three stations that pumps to PS 7. PS 14 and PS 13 also contribute flow to PS 10.

Pumping Station	Address	Description
PS 11	4760 East Clayton Road, Madison	This station discharges directly to the NSWTP and is the fourth largest pumping station contributing directly to the NSWTP. It receives flow from PS 12.
PS 12	2739 Fitchrona Road, Madison	This station receives pumped flow routinely from PS 16 and PS 17 and as an alternate operating mode PS 15. Flows from this station are pumped to PS 11.
PS 13	3634 Amelia Earhart, Madison (Truax Field)	This station discharges to PS 10 and receives flow from PS 14.
PS 14	5000 School Road, Madison	This station discharges to PS 13. There are no contributory MMSD pumping stations upstream of PS 14.
PS 15	2115 Allen Boulevard, Madison (Marshall Park)	This station receives flow only from its gravity drainage service area. This station normally pumps to PS 8, but can also pump to PS 16.
PS 16	1301 Gammon Road, Madison	This station ordinarily only receives flows from its gravity drainage service area. Alternatively flows from PS 15 may be pumped to PS 16.
PS 17	407 Bruce Street, Verona	This station only receives flows from its gravity drainage service area.

Current Conveyance Deficiencies for Centralized Treatment

Without the construction of satellite plants to potentially divert flow away from existing pumping stations, the pumping station system capacity needs at different planning years are shown in Table 4-10.

Table 4-10. Pumping Station Capacity Expansion Needs

Planning Years	Description
Year 2000-2010	PS 7 Firm Capacity (High Flow Projections) PS 11 Firm Capacity (High Flow Projections) PS 12 Firm Capacity PS 17 Firm and Maximum Capacity (High Flow Projections)
Year 2010-2020	PS 7 Firm Capacity PS 7 Maximum Capacity (High Flow Projections) PS 11 Firm Capacity PS 11 Maximum Capacity (High Flow Projections) PS 12 Firm Capacity PS 12 Maximum Capacity (High Flow Projections) PS 13 Firm Capacity PS 13 Maximum Capacity (High Flow Projections) PS 17 Firm and Maximum Capacity
Year 2020-2030	PS 7 Firm and Maximum Capacity PS 11 Firm and Maximum Capacity PS 12 Firm Capacity PS 12 Maximum Capacity (High Flow Projections) PS 13 Firm and Maximum Capacity PS 14 Firm Capacity (High Flow Projections) PS 15 Firm and Maximum Capacity (High Flow Projections) PS 17 Firm and Maximum Capacity
Year 2030-2060	PS 4 Firm and Maximum Capacity (High Flow Projections) PS 7 Firm and Maximum Capacity PS 9 Firm and Maximum Capacity PS 11 Firm and Maximum Capacity PS 12 Firm and Maximum Capacity PS 13 Firm and Maximum Capacity PS 14 Firm and Maximum Capacity PS 15 Firm Capacity PS 17 Firm and Maximum Capacity

A review of the capacity of the existing MMSD force mains (FM) shows that the following force mains have future flow velocities at peak hourly flow in excess of the nominal maximum velocity target of 8 feet per second and will likely need to be expanded in the time span shown:

- Cross-Town FM (CTFM) (20-inch PVC and 24-inch DIP Only - 2010)
- PSs 2, 3 and 4 FM (2057 - High Flow Projections Only)
- PS 7 FM (2025-2042)
- PS 10 FM (2040 - High Flow Projections Only)
- PS 11 FM (2025-2049)
- PS 17 FM – 16 inch portion (2015-2026)
- PS 17 FM – 20 inch portion (2030-2060)

Table 4-11 presents the approximate percentage of the MMSD total interceptor length that will reach capacity and require expansion during the 50-year planning period. The detailed interceptor sewer capacity needs at different planning periods are summarized in TM3 – Conveyance Facilities Analysis (CFA).

Table 4-11. Interceptor Capacity Expansion Needs

Planning Years	Percentage of the Total Interceptor Length
Year 2010-2020	11.2%
Year 2020-2030	11.5%
Year 2030-2060	15.4%

Existing Facility Condition Assessment

Figure 4-2 shows the age distribution of the MMSD force mains. The general condition of the force mains is good since they tend to operate in a full pipe condition. In early 2009 the PS 6 force main was inspected as a part of an emergency repair and found to be in very good condition despite its being placed in service in 1950. The assessment of condition is based on MMSD inspections of force mains when they are not in service. The percentage of the length of force mains reaching an age of 75 years during the master planning period is as follows:

- By 2015 – 11 percent
- 2016 to 2025 – 3 percent
- 2026 to 2035 – 30 percent
- 2036 to 2045 – 13 percent
- 2046 to 2055 – 8 percent

The force mains for PS 7 and PS 11 may need relief or replacement because of capacity considerations or as a result of limited pressure capabilities by 2020. These replacements will not be required if satellite plants can reduce the flows to PS 7 and PS 11, or, if PS 18 is constructed which would reduce the capacity concerns for the PS 7 force main. PS 18 is a planned future raw sewerage pump station in the City of Monona that would operate in parallel with PS 7 and include a force main to the NSWTP.

The general condition (2008) of MMSD’s interceptors is very good based on the relatively small list of interceptor segments identified as needing repair in TM 3. MMSD has already repaired most of these sewers, or has included their repair in the capital budget. MMSD is in the process of modifying its interceptor inspection program to target higher priority interceptors for more frequent review.

The current conveyance system capacity utilization rates and future capacity needs at different planning years determined in this chapter were used for planning alternatives development in the later phase of the master planning.

Budgeted Capital Improvement Projects

MMSD had prepared a list of capital improvement projects that are scheduled for implementation between 2009 and 2018 to address foreseeable system capacity needs and to improve existing facility conditions. MMSD's capital improvement plan is attached as Appendix K. A summary of the budgeted conveyance system capital improvement projects is presented in Table 4-12.

**Table 4-12. Summary of Conveyance System Capital Improvement Projects
(2009-2018)**

Project	Year of Implementation
West Interceptor Extension Replacement in Middleton	2009
NEI - Truax Extension Rehabilitation at the Airport	2009
Far East Int - Door Creek Extension at Gaston Road	2009
PS 7 Back-up Power at Bridge Road in Monona	2009
West Interceptor - Upstream of PS 5 near Lake Mendota	2009-2011
West Interceptor Replacement at Old University Avenue	2009-2011
NEI - Relief Upstream of PS 10 near Hwy 51	2009-2011
South Interceptor - Baird Street Replacement	2009-2011
Far East Int - Cottage Grove Extension Lining	2009-2011
Pumping Stations 6 & 8 Rehabilitation	2009-2011
Lower Badger Mill Creek Interceptor Project north from Verona	2009-2015
East Monona Interceptor at Fair Oaks u/s of Starkweather Creek	2010-2012
NSVI - Morse Pond Extension near UW Golf Course	2010-2012
P.S. No. 18 Force Main Construction from Monona to NSWTP	2010-2013
P.S. No. 18 Construction on Broadway in Monona	2010-2014
NEI - Far East Int. to Southeast Int. Junction	2012-2014
PS7 - Improvements (in conjunction with PS18 construction)	2013-2015
Pumping Stations 11 & 12 Rehabilitation	2013-2016
Pumping Station 17 Upgrade (Completed in conjunction with LBMCI or SRTP)	2013-2014
Pumping Station 15 Rehabilitation	2014-2018
Pumping Stations 13 & 14 Rehabilitation	2015-2018
Southwest Interceptor - Haywood Extension Rehab or Replacement	2016-2018
Pumping Stations 3, 4, & 9 Revisions	2017-2018