

Neenah-Menasha Sewerage Commission (NMSC) modifications

By Thomas J. Kispert, PE, BCEE, CCS, Associate/Senior Project Engineer and
Amy J. Vaclavik, PE, BCEE, Associate/Senior Project Engineer

The Neenah-Menasha Sewerage Commission (NMSC) was formed as a 66.0301 commission (formally 66.30) in the early 1980's to provide an interceptor sewer system and wastewater treatment facilities to serve the following municipalities:

- City of Neenah
- City of Menasha
- Town of Menasha Utility District (East)
- Waverly Sanitary District
- Town of Neenah Sanitary District #2
-

There is also one contracted industrial user.

A regional interceptor to serve the Town of Menasha (East) and portions of the City of Menasha was constructed in 1986. The wastewater treatment facilities, which had only served the cities of Neenah and Menasha, were upgraded in 1986 to serve as a regional facility. The plant was designed for an average flow of 13 mgd and for average monthly biochemical oxygen demand (BOD) and total suspended solids (TSS) of 17,955 lbs./day and 15,800 lbs./day, respectively. The secondary treatment system was expanded in 2000 to accommodate increased loadings.

FACILITIES PLANNING

A majority of the unit processes and control systems at the treatment facility have been in service for 26 years. Age, environmental conditions and continued use have taken a toll on equipment, processes and controls throughout the facilities. Rather than taking a piecemeal approach to upgrades, and sacrificing cost savings and construction related synergy, the NMSC authorized that a wastewater facilities plan be undertaken to estimate future flows and loadings to the year 2030. Biosolids management issues, as they related to the need for a new biosolids storage facility due to the notice of termination from the current hauler, were to be incorporated in the planning document. The facilities plan has been completed and approved by the Department of Natural Resources (DNR) and the modifications project is moving forward.

The plant is located in the city of Menasha. The site is already congested, and there is little room for new facilities. Additionally, there are existing homes surrounding the site. Developing a plan that meets the future goals of the NMSC is an on-going challenge.

Facility Needs

During the facilities planning process, four categories of needs were identified as follows:

- Capacity
- Plant condition
- Permit requirements
- Biosolids management

Capacity

The current flows and loadings to the plant were documented and analyzed during the facility planning process. Development and population growth information was obtained from east central regional planning commission and industrial customers were contacted to gather information about their future plans regarding wastewater discharges. With no significant change in flows and loadings projected by industrial customers, and projected future flows and loadings for the service area being near or below current plant design values, the existing design criteria for flows and BOD loadings were used for facility planning purposes. The review of historical plant loading data showed that the average suspended solids (SS) loadings exceeded the design average value 58% of the time. Therefore, there is a need to increase the SS treatment capacity of the plant, and the downstream effect on the solids processing train would also require evaluation.

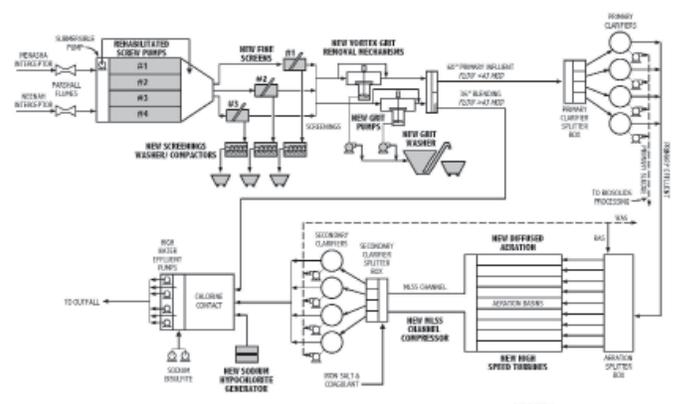


FIGURE 1
LIQUID TRAIN
NEENAH-MENASHA
WASTEWATER TREATMENT FACILITIES MODIFICATIONS
NEENAH-MENASHA SEWERAGE COMMISSION

Plant Condition

Since the last major upgrade at the plant in 1986, the NMSC has been proactive relative to plant needs, regulatory and technology upgrades, and maintenance. Most equipment has exceeded its expected life expectancy or has been

recently replaced. A walk-through was conducted with engineers and plant operations staff to identify shortcomings throughout the plant. In addition to specific process system needs, there were many plant-wide needs identified including:

- Heating, ventilation and temperature control systems
- Flow metering
- Supervisory Control & Data Acquisition (SCADA), control system upgrades
- Separate temperature control in electrical rooms
- Hose reel replacement
- Flood switches in lower levels of structures
- Gas detection equipment
- Upgrade building sump pumping systems
- Lighting system upgrades
- Electrical gear upgrades

Permit Requirements

The current WPDES permit expires December 31, 2013. At that time, it is anticipated that the effluent discharge limits for phosphorus will be reduced via a compliance schedule. The proposed change for NMSC, which discharges to the Fox River, is likely to drop from 1.0 mg/l to 0.2 mg/l. The current upgrades to the treatment works include a design concept for incorporating facilities for phosphorus removal at a later date.

The impact of NR 217 and the total maximum daily load (TMDL) on the lower Fox River will also reduce TSS discharges. As most TSS discharges are attributable to agriculture and urban sources, there are no anticipated permit changes relative to TSS or BOD.

Biosolids Management

During the facilities planning process, a number of needs associated with the digesters and biosolids processing systems were identified. Options for biosolids disposal also require evaluation because the current hauler contract for removal, storage and disposal of biosolids expired on October 31, 2011. At this time, the biosolids are being landfilled, and NMSC continues to investigate cost effective, long-term solutions.

Future Conditions

To evaluate and size facilities for a wastewater management system, future population, wastewater flows and pollutant loadings must be estimated for the service area. Wastewater flows and loadings are a function of sewer population, per capita water use, commercial and industrial discharges, public authority flows and infiltration/inflow. (I/I).

The current and proposed design parameters are listed on Table #1.

Table #1 Wastewater Treatment Facilities
PROPOSED UNIT PROCESS DESIGN CRITERIA
NEENAH-MENASHA SEWERAGE COMMISSION

	Current Design 2020	Proposed Design 2030
DESIGN YEAR	2020	2030
POPULATION	57,858 / Year 2005	73,953
<i>FLOW (mgd)</i>		
Average Annual Flow	13	13
Max 24-Hour Flow	43	43
Peak Hour Flow	65	65
Max 7-Day Flow	35.5	35.5
Max 30-Day	20	20
<i>BOD (lbs./day)</i>		
Average Daily	24,573	24,573
Maximum Daily	46,689 (1.9:1)	46,689 (1.9:1)
Maximum 7-Day	36,860 (1.5:1)	36,860 (1.5:1)
Maximum 30-Day	29,321	29,321
<i>SS (lbs./day)</i>		
Average Daily	18,564	21,952
Maximum Day	37,128 (2:1)	43,904
Maximum 7-Day	27,846 (1.5:1)	32,928
Maximum 30-Day	24,117 (1.3:1)	28,538
<i>P (lbs./day)</i>		
Average Daily	320	320
Maximum Daily	640 (2:1)	640 (2:1)
Maximum 30-Day	384 (1.2:1)	384 (1.2:1)
<i>TKN (lbs./day)</i>		
Average Daily	2,664	2,664
Maximum Daily	3,996	3,996
Maximum 7-Day	3,197	3,197
Maximum 30-Day	2,930	2,930

Recommended Facilities Modifications

The recommended plan, described in the December 2010 facilities plan and approved by the DNR, includes improving/upgrading the existing unit processes, continued Infiltration/Inflow (I/I) reduction programs in the member communities, increasing biosolids digestion through-put, and utilizing centrifuges for biosolids dewatering with 180-days of off-site storage provided near the land application sites. The recommended plan includes:

Plant-Wide

Flow meters will be added/replaced on all process lines that provide useful data for plant operations. SCADA and control systems will be provided to allow reliable and

efficient operation of unit processes and equipment. A GIS web-based work order management and records/maintenance system will be provided to maintain equipment and document changes. Heating, ventilating and temperature control systems will be upgraded to provide reliable, energy efficient operation. Gas monitoring equipment will be provided in areas where the potential exists for a hazardous atmosphere. Energy efficient lighting will be provided to improve work conditions. The electrical infrastructure will also be upgraded to improve reliability.

Headworks

Ventilation and electrical system improvements will be made to enhance operator safety. New screenings washer/compactors will be provided, as well as new grit pumps and a grit washer. Manually operated electrical actuators will be added to existing stop gates for control of flows within the channels.

Primary Clarifiers

New clarifier drives will be provided, along with new scum collection equipment. The sludge pumps will be equipped with new check valves and air systems/piping.

Aeration System

New membrane diffusers and piping, air valves, and energy efficient blowers with automatic dissolved oxygen (D.O.) control will be provided for each train. Repairs and modifications to the existing blower buildings are also required.

Final Clarifiers

The drive for Clarifier #4 will be upgraded to match the three other clarifiers. New scum pumping systems and return activated sludge (RAS) piping will be provided. Humidity control will be improved in the pump room and tunnel.

Digesters

New instrumentation, thickened sludge pumps, secondary transfer pumps, automated valves, heat exchanger flushing, secondary digester mixers, and digester gas drying/siloxane removal will be provided. The existing boiler/heat exchangers will be replaced, and the capacity of the existing heat exchangers increased. Sludge pumping systems will be upgraded for better reliability and control.

Service Building

The belt filter presses (BFP) and conveyor will be replaced with centrifuges and a new conveyor system. A new off-site Biosolids Storage Facility will be constructed to provide 180-days of storage.



Screw pump rehab

Disinfection
A new hypochlorite generator will be provided, along with flow pacing of the bisulfite feed system.

IMPLEMENTATION
The NMSC is now proceeding with the equipment procurement and wastewater treatment facilities modifications, as approved in the facility plan.

To obtain the facility equipment that would effectively meet the needs of the plant and operations staff, the NMSC decided to proceed with equipment procurement bidding in advance of the final design and bidding of the modifications project.

Prior to bid opening, the equipment had to be prequalified. Bids were obtained on 18 separate equipment procurement contracts in the Fall of 2011. This allowed plant operations staff and engineers to evaluate the equipment that would be provided, and to identify the specific equipment that would be supplied. The plans and bidding documents for the modifications project, to be bid as a general construction project, are being prepared based on the actual equipment accepted.

A comparative evaluation of the equipment bids was conducted by plant operations staff and engineers. This provided a selection process that allows NMSC to determine which piece of equipment provides the best overall value to the commission, while meeting the specified performance requirements. The details of the comparative evaluation process were described in the bidding documents. The bids were scored on the following criteria:

- Capital cost
- Ease of operation & maintenance
- Location & quality of service
- Performance
- Scope of supply
- Estimated 20-year life cycle cost
- Materials/quality of construction
- Manufacturing certifications

Following the completion of the evaluation, engineers and plant operations staff recommended to the NMSC



New sodium hypochlorite generator

specific equipment. Contracts were issued to the successful equipment manufacturers/vendors (bidders). The next step was to process the shop drawings for each equipment item. That process has now been completed, and the final facilities modification plans and specifications are being prepared for bidding. It is anticipated that bids will be opened during the summer of 2012. Construction is expected to begin in the Fall of 2012 and continue for approximately one year.



New screw pump bay

ADDITIONAL ITEMS

Equipment Replacement

During the time when the facility plan was being reviewed and the equipment procurement specifications were being prepared, it became obvious that some equipment would need to be replaced sooner rather than later. The NMSC decided to move forward with replacement of the on-site hypochlorite generation facilities and rehabilitation of the screw pumps.

The existing on-site hypochlorite generation facilities had reached the end of their useful life in the summer of 2011. The system could only produce 0.4% solution in lieu of the needed 0.8% solution. The facility plan recommendations included the replacement of the generator. DNR approval was obtained to move forward with replacement of the generator. Quotes were obtained for generators and a new generator was purchased directly by the NMSC. The new generator is capable of generating 1,200 pounds per day (ppd). The generator was installed by NMSC plant operations staff.

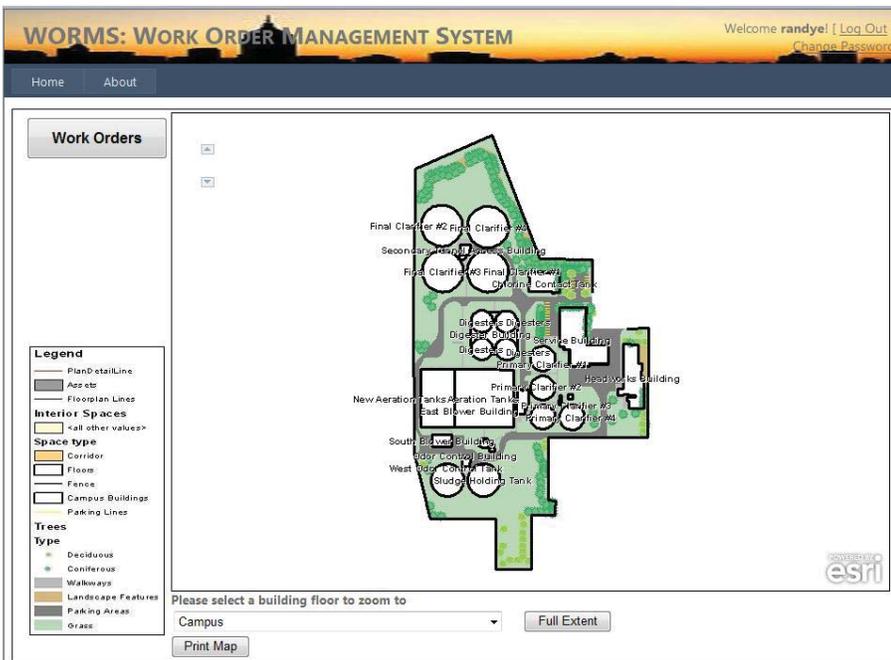
The screw pumps were in need of repair or replacement when the facilities planning process was started. It was decided to rehabilitate the four 96-inch diameter influent screw pumps. Each screw pump was rebuilt and recoated, which saved an estimated \$1.0 million, as compared to new screw pumps or a new pump station.

Work Order Management System

The NMSC, as part of its daily plant operations, initiated development of a GIS system to manage work orders and asset information in a spatial database. The pending plant modifications project provides an excellent opportunity to gather important asset information and populate the GIS system with pertinent information. The GIS system, called WORMS (Work Order Management System) will provide operators access to critical asset information throughout the plant. The GIS system is a web-based system, built on top of ESRI's ArcServer technologies, allowing operators access anywhere they have an intranet connection available. The system operates as a login-based system, with permissions granted at the user level.

The users at the administrator level can perform three primary tasks: create assets/work orders, view assets/work orders, and search assets/work orders. The users at the operator level only view work orders assigned to them by the administrator. The interactive mapping (GIS) component automatically links all work orders and assets to the physical location in the plant. The users are able to zoom to the physical location of the active work order and view other work orders/assets that are in close proximity. They can then identify on that particular asset and view any relevant information on that asset. From

here, they will also be able to view operation & maintenance (O&M) manuals, shop drawings, asset photographs or videos that have been linked to the asset. The WORMS provides not only a maintenance work order system, but it incorporates a full blown operations manual as well.



WORMS screen

PROJECT FINANCING

The opinion of probable cost for the wastewater treatment

facilities modification project is \$25 million. The NMSC intends to obtain long-term financing through the Clean Water (CWF) Fund loan program. The CWF loan will also cover the cost of the hypochlorite generation facilities and the screw pump rehabilitation.

The NMSC had to obtain interim financing to cover project costs incurred prior to obtaining the CWF loan. This financing includes unique challenges because the NMSC is not a municipality and cannot obtain CWF financing.

Each of the member communities will be required to sell bonds to the State, and the financing will be managed by the NMSC. A high level of cooperation will be required. An implementation grant has been obtained from Focus on Energy for the blowers

and the fine pore aeration system. It is possible that other financial incentives may also be obtained from the Focus on Energy program.