Plant Profile By Andy Bradshaw

CITY OF MOORHEAD, MN WASTEWATER TREATMENT FACILITY

The City of Moorhead Wastewater Treatment Facility (MWWTF) service area includes the City of Moorhead, City of Dilworth, and the Town of Oakport, MN. There are approximately 15,600 connections, 178 miles of collection system, and 43 lift stations serving a population of 41,334 residents. Average flow to the MWWTF is 4.5 MGD with a design flow of 6.0 MGD and an average wet weather design flow of 9.0 MGD.

Wastewater and solids treatment process

At the MWWTF, preliminary treatment consists of bar screens, aerated grit removal, and a 1.1 MG equalization basin. Flow from preliminary treatment is routed to one of two parallel liquid process trains. Each train consists of a primary clarifier, a high-purity oxygen activated sludge aeration basin, and two final clarifiers. Following final clarification, flow from each train is combined and directed to three polishing ponds (1.1, 3.0, and 4.9 acres, respectively) operated in series. Between the #1 and #2 polishing ponds is a moving bed biofilm reactor (MBBR) for nitrification. Chlorine gas is used for disinfection and sulfur dioxide gas is used for removal of chlorine residual. A nearly two-mile-long outfall pipe transports treated wastewater to the Red River of the North where the outfall discharges a little more than eight river miles upstream of the neighboring City of Fargo, ND wastewater outfall.

Settled solids and scum collected in the primary clarifiers is pumped directly to one of two high-rate primary anaerobic digesters. The other digester receives waste activated sludge (WAS) and secondary scum after it is thickened by one of two gravity belt thickeners. Gravity belt thickener filtrate is sent to the headworks. Solids are treated to Class B standards in the two anaerobic digesters. A third digester can be operated as a primary digester, but the heating and mixing systems are turned off. This third digester provides temporary storage and is equipped with a membrane gas holding cover and stores gas from all three digesters. Digester gas is burned in a dual fuel boiler for heat recovery and a waste gas burner flares any excess gas. Treated biosolids are pumped from the secondary digester to an underground biosolids storage facility. In the storage facility, biosolids are gravity thickened with the supernatant being returned to storage basins in the headworks for controlled pumping to the plant. Thickened biosolids are provided to area farmers and land applied for free.

There are 19 full-time and four part-time employees responsible for all plant and collection system operations, maintenance, laboratory, and administrative duties. In addition, MWWTF staff operate and maintain 124 miles of storm sewer, 89 stormwater ponds, 15 stormwater lift stations, and nine flood control lift stations. A supervisory control and data acquisition (SCADA) system is used to monitor both the plant and all lift stations. Process instrumentation and SCADA work is performed by in-house staff.

Facility improvements

Since the facility was placed online in 1983, a number of improvement projects have been completed. In 1987, difficulties with an ozone disinfection system prompted switching to chlorine disinfection. In 1994, the biosolids storage facility was constructed. The MBBR went online in 2003 as one of the first municipal tertiary applications in the country. In 2004, a headworks project included the addition of new force mains, a new influent channel, the equalization basin, new primary clarifier and final clarifier flow division structures, and replacement of grit handling equipment. During the past year, a solids handling

Click HERE to return to Table of Contents

improvement project was completed that included:

- Replacement of gas heating and mixing systems in the digesters with jet mixing and spiral heat exchangers.
- Replacement of floating digester covers with two fixed covers and a gas-holding membrane cover.
- Replacement of dissolved air flotation (DAF) thickeners with gravity belt thickeners (GBT).
- New boilers for digester and plant heating systems.
- Purchase of 200 acres of farmland which is leased to farmers with provisions to facilitate biosolids disposal.
- Expansion and remodeling of the administration building and lab.

The GBTs thicken WAS to approximately 6% total solids versus only 3.0 to 3.5% using the old DAF thickeners. This volume reduction also results in less digested sludge being pumped to the biosolids storage facility and less biosolids supernatant return to the headworks. Digester gas production has increased and the new membrane cover and new boiler systems have improved gas storage and utilization capabilities.

Industrial pretreatment

Industrial flow accounts for roughly 25 percent of the billable flow to the MWWTF and 35 percent of the influent CBOD5 load. The largest industrial user is a barley malting facility with a discharge of approximately 0.6 MGD at 500 mg/L CBOD5. A hydro-sieve at the malting facility is used to remove excess barley solids and the relatively steady 24-hour per day discharge prevents loading and flow spikes at the MWWTF. There is one very high strength hauled discharge to the MWWTF from a contractor

Click HERE to return to Table of Contents

that cleans sugar, flour, and grain from rail cars. At times, this waste can have a CBOD5 concentration over 200,000 mg/L, so flow is limited to 3,000 gpd. An excess CBOD5 charge is applied to concentrations exceeding 300 mg/L.

2009 flood event challenges

In March and April of 2009, a record flood event occurred on the Red River of the North. During the flood, portions of the sanitary sewer collection system were inundated with river water requiring numerous bypasses from the system to prevent or minimize threats to public health, safety, and severe property damage. Further compounding the flood fight, 3.7 inches of rain and over 17 inches of snow fell within nine days and much of the runoff could not be drained by gravity to the river. In order to protect other parts of the system, three lift stations in an evacuation zone had to be turned off. In addition to bypasses from the collection system, the flood event required emergency operational measures to be implemented at the Moorhead Wastewater Treatment Facility. Due to the high river level, the outfall pipe couldn't handle all the flow and threatened to flood parts of the plant. A portable pump was used to send flow from the polishing ponds to a drainage ditch which ultimately flowed to the river and reduced backup in the outfall pipe. Facility staff worked around the clock to keep wastewater, storm, and flood systems operating. CS