PLANT PROFILE:

Northern Moraine Wastewater Reclamation District

By Luke Markko, Superintendent of Northern Moraine WRD

Established in 1969 under the 1917 *Illinois Sanitary District Act*, this regional Sanitary District can be found in Island Lake, IL, nestled between the southwestern Lake and southeastern McHenry counties. The Northern Moraine Wastewater Reclamation District (NMWRD) provides wastewater collection and treatment services to the communities of Island Lake, Lakemoor, and Port Barrington, along with septage receiving from regional service providers. With a facility planning area comprised of 16,700 acres, NMWRD covers a vast territory. In that territory, 3,700 widely spaced acres are currently within the District's corporate boundaries. The original infrastructure of the District was constructed in 1978 and was established as the Island Lake Sanitary District. The District operated as the Island Lake Sanitary District for 25 years until it was decided that the District should have a name that better reflected the regional services it provided, without being different from any single community that it serves. And so, in 2003 the Island Lake Sanitary District became the Northern Moraine Wastewater Reclamation District (NMWRD).

The NMWRD collection system initially consisted of two lift stations positioned in Island Lake, but has seen an increase of over tenfold, leading to 13 lift stations in Island Lake, eight lift stations in Lakemoor, and two lift stations in Port Barrington. This is a total of 23 lift stations. The two lift stations in Port Barrington receive both conventional gravity flows in addition to those originating from a low-pressure sewer system found in portions of the Port Barrington community located along the waters of the Fox River. Here, failing septic systems prone to inundation by floodwaters were replaced by individual grinder pumps installed at over 200 residences to feed into NMWRD's collection system. Each pump is owned and maintained by the District, presenting a significant operations and maintenance burden for staff and requiring a significant stock of spare pumps be maintained. Most of the collection system is about 40 years old or less, so it is comprised of relatively modern materials such as plastic truss pipe, PVC, and HDPE. The Village of Holiday Hills, an unsewered community situated on the banks of the Fox River and Griswold Lake will be connected to the NMWRD collection system later this year. This will bring the total number of lift stations to 24. The age and construction materials in the collection system aid in preventing significant infiltration and inflow, while a lack of significant industrial users limits operation and maintenance troubles to those of domestic grease and more recently flushable wipes. The District has recently finished with the upfitting of a custom televising vehicle to allow staff to televise the collection system following cleaning and to adhere to it's CMOM program without the need for outside

Northern Moraine Wastewater Reclamation District (NMWRD)

Click HERE to return to Table of Contents

contractors. The custom approach with a local upfitter allowed development of a vehicle catered to the District's specific needs such as small narrow streets along with significant cost savings compared to the purchase of prebuilt vehicle. Operations staff have all become certified through the National Association of Sewer Service Companies (NASSCO) in their pipeline, lateral, and manhole certification programs (PACP, LACP, and MACP respectively). These programs train staff in what to look for as they televise approximately 80 miles of pipe and inspect over 1,500 manholes, while creating a standard method of inspection that maintains objectivity.

The NMWRD wastewater treatment facility resides in the southern portion of its service area in an unincorporated area North of the Village of Port Barrington and South of the Village of Island Lake. The current facility site uses eight acres of a 31-acre parcel abutting protected wetlands to the North and West. There are some residences to the South separated by a quarter-mile buffer consisting of grasslands and farmland. This affords the District plenty of room for future growth along with the communities it serves. A solar array is currently under consideration to make use of the large parcel and to offset energy consumption.

The original 1978 construction started with a comminutor and was followed by raw pumping feeding to two 78-foot diameter Topco contact stabilization plants, which have a combined capacity of 1.2 MGD. Downstream of these there was seasonal gaseous chlorination for disinfection, which led effluent to exit the facility in a 4,500-foot, 30-inch outfall pipe, discharging into the Fox River through a submerged structure in the center of the riverbed. This effluent pipeline is still in use today. During that time, the District used 14 drying beds to dewater aerobically digested sludge. In 1991, dechlorination equipment, consisting of gaseous feed of sulfur dioxide, had been installed because of IEPA requirements. A 31-in Rotamat fine screen replaced the comminutor in 1992.

At 20-years-in-age, the facility was nearing capacity in 1998, and was unable to meet new ammonia nitrogen limits set by IEPA. A plant expansion that overhauled nearly the entire facility (completed in 1999) increased capacity, improve treatment for BOD, suspended solids, and meet ammonia nitrogen limits. This meabt plant capacity increased to 2.0 MGD DAF and 5.0 MGD DMF. At the headworks an additional 40-inch Rotamat was installed to provide redundancy and the four raw pumps found replacements with higher capacity, two of which received VFDs to improve efficiency. These fed into the new 1.2 MG oxidation ditch, which consisted of two rings with Orbal Disc Aerators. Downstream two 85-foot diameter clarifiers were constructed with a 4 MGD RAS pump station. Construction continued with a two-channel chlorine contact basin and adjoining chemical feed building that would house the chlorine and sulfur dioxide gas feeds in addition to non-potable water distribution. A portion of the two package plants were repurposed and used as aerobic digesters. Preexisting coarse and fine bubble diffusers were left in place to supply air from three centrifugal blowers. A dewatering building was constructed and housed a 1.5-meter Komline-Sanderson belt filter press to supplement the drying beds. At the time Class B dewatered sludge was conveyed into a dump truck bay within the dewatering building and trucked out to a drying bed dedicated to stockpile use. Following this expansion discharge concentration of ammonia nitrogen went from 20 mg/L to an average of 0.075 mg/L. The design lends itself to easy expansion to 3.0 MGD, with the potential addition of a third ring that can include BNR functions. However, with current average flows around 50% of the 2.0 MGD DAF and projections for population growth not meeting that need until the late 2030s, that expansion is still a number of years in the future.

Disinfection Chemical Storage and Feed

In the years between the 1998 expansion and now, the District has seen a number of projects to replace aging equipment, improve safety, optimize facility operations, and meet new NPDES permit limits.

In 2011, the District purchased the small horse farm adjoining the East boundary of the plant site and converted the house to an administration building and boardroom. The administrative office was relocated from the control building at the plant site and features a drive-up window for the convenience of many customers who make payments in person. Later in 2018, a horse barn adjacent to the administrative office was upgraded with a concrete slab to better house equipment. It also served as an impromptu open air meeting space for a period during the COVID-19 pandemic, even hosting the CSWEA Operations Challenge team as competition arena in 2020.

In the same year, the gaseous chlorine and sulfur dioxide systems were replaced with liquid sodium hypochlorite and sodium bisulfite feeds to improve workplace safety. This was a project District staff designed and constructed themselves at the time. It consisted of three 300-gallon bulk storage tanks for sodium hypochlorite and two 300-gallon bulk storage tanks for sodium bisulfite. Four 55-gallon drums were utilized as day tanks where peristaltic pumps drew

the chemicals from. These required manual refilling daily. An overhaul of this system was completed in 2019 to make improvements that provided separate secondary containment spaces for the bulk storage tanks, new bulk storage tanks with outdoor fill ports, and ventilation lines coming from the storage tanks to the rooftop to eliminate corrosive fumes. District staff custom-built chemical feed skids that draw directly from the bulk storage tanks with new Blue-White M2 peristaltic pumps. This improved efficiency by eliminating the day tanks and the need to refill them daily. Later in 2021, a new non-potable pump skid with VFD-controlled pump motors was installed to replace the aging system from 1999.

Several solids handling improvements have been made over the years. In 2012, improvements were made to the digesters, dewatering, and sludge storage. The full capacity of the old package plants was utilized for aerobic digestion by removing the remaining equipment. Sanitaire medium bubble diffusers were installed across the floor of each of the two digesters and aluminum covers were installed over each. This provides nearly one million gallons of capacity between the two digesters and allows for significant solids reductions. At the same time a Centrisys decanter centrifuge was installed to take dewatering operations away from the belt filter press which was utilized as a backup unit. In 2013 high efficiency centrifugal blower with a 200 HP VFD-controlled motor was installed to provide 100% of the aeration requirements of the digesters while consuming 33% less power than three preexisting blowers still utilized as backups. Five of the existing drying beds were converted into two covered storage bays for stockpiled sludge with approximately nine months of storage capacity.

Later, in 2019, the belt filter press was removed, and work began to reconfigure the sludge conveyance system to eliminate the need to manually relocate dewatered sludge from the dewatering building to the sludge storage bays. An opening was made in an exterior wall of the dewatering building and the existing shaft-less screw conveyor that had originally moved dewatered sludge into a central bay of the building was repositioned to convey out through the opening. The existing conveyor was not long enough to reach an existing drying bed located about 30-feet away. At the time, an additional shaft-less screw conveyor would have cost approximately $2,000 per linear foot. With equipment costs and installation estimated at nearly a quarter million dollars, District staff began experimenting with different types of conveyors to see if there was a more cost-effective option. Initial trials of an agricultural belt conveyor were unsuccessful due to sludge falling under the belt and causing slippage on the drive pulley. Success was found with a grain auger that was rented from a local farm supply yard and piloted for a period. A 61-foot grain auger was

District Staff (L-R): Madalina Roscan, Assistant Clerk; Joe Lapastora, Staff Engineer; Chris Molidor, Operator; Emily Lecuyer, Lab Technician; Elisa Fisher, District Clerk-In-Training; Debi Martin, District Clerk; Luke Markko, Superintendent; Mohammed Haque, District Manager. Photo taken by Jonessa Haas, NMWRD Summer Intern.

Sludge Conveyor and Stockpile

Click HERE to return to Table of Contents

purchased for $10,000. It was installed and fitted with a VFD-driven electric motor to allow speed control, heat trace with insulation to protect against freezing, safety pull cables, and an auger motion sensor to signal back to the centrifuge PLC. This auger has been in service for approximately 18 months and is performing well. A second unit was purchased as a backup. While unconventional, it has proven to be an economic alternative to a shaft-less screw conveyor. Two additional drying beds were converted to a covered sludge storage bay where the conveyor deposits the dewatered sludge. This increased our sludge stockpile capacity to at least one year.

Additional improvements at the headworks have also occurred. In 2013, the 31-inch Rotamat fine screen was replaced with a 36-inch Lakeside Raptor Drum Screen that became the District's primary screen. With the District's headworks and adjacent Control Building located within the 100-year flood plain flood-proofing improvements were made in 2018. This included raising the walls of the raw wet well, modifying the Control Building exterior entryways to accept installation of stoplogs to prevent entry of flood waters along with replacement of one of the raw pumps located in a basement dry well with a fully immersible pump, with plans to replace the remaining three with similar immersible pumps to provide continued operation should flooding occur. In 2019, a Channel Monster channel grinder was installed upstream of the Raptor drum screen to reduce rag accumulation on the lower bearing of the screener and to

Rebuilt North Clarifier

Operator Chris Molidor Measuring Sludge Blanket

Lab Technician Emily Lecuyer Preparing Testing

Operator Tim Hendrickson Cleaning Televising Camera

protect against debris as the District began accepting septage from local haulers.

Improvements at the oxidation ditch began in 2015 with the installation of dissolved oxygen probes and VFDs for the aerator motors to provide DO-controlled pacing of the motors and improve energy efficiency. When a Phosphorous limit coming into effect for the first time in 2019, a chemical feed system was installed to provide CPR. After experimenting with various chemicals and feed points, the second ring of the oxidation ditch was selected as a feed point for an aluminum chloride solution provided by Chemtrade known as Hyper+Ion 1997. Two 1,000 gallon bulk storage tanks were installed in the recessed pit, where the old belt filter press had once sat. This provided an adequate secondary spill containment space. Exterior fill ports and venting were installed as well. Chemical feed is accomplished with a pump skid, equipped with two Blue-White M2 peristaltic pumps.

In 2020, one of the two clarifiers' concrete floors had to be replaced following heaving due to hydraulic forces pushing the floor up during routine maintenance. This required removal of the cover, and removal of most of the existing floor along with the access bridge and the clarifier mechanism. Replacement floor pressure relief valves were installed to supplement the existing relief valves in the walls. A new stainless steel clarifier mechanism was installed along with a new access bridge.

The District's staff currently consists of two full-time Operators, Chris Molidor and Tim Hendrickson, along with part-time Laboratory Technician Emily Lecuyer. This talented and dedicated staff are led by Superintendent Luke Markko. The District is working to expand operational staffing at this time. The Operators are cross trained to operate and maintain all aspects of the collection system and wastewater treatment facility with the ability to assist with laboratory work as needed. The part-time Lab Technician has cross training to perform routine maintenance and perform daily inspections of the facility as well. District Clerk Debi Martin, District Clerk-In-Training Elisa Fisher, and Assistant District Clerk Madalina Roscan handle the administrative work that includes monthly building of over 5,000 District customers. Staff Engineer Joe Lapastora and District Manager Mohammed Haque work to plot a course into the future for the District as they seek and manage grant funding, oversee construction projects, mentor interns, and navigate the legal aspects of running a sanitary district. The Northern Moraine Wastewater Reclamation District is poised to continually improve upon itself as it employs new technologies and explores new ideas to provide a sustainable service to the residents within its service area and to protect downstream users in the Fox River Valley. CS