Village of **Wauconda** Wastewater Treatment Plant

BACKGROUND

The Wauconda Wastewater Treatment Plant was originally constructed in 1953. The plant has been upgraded several times since then, with the last major expansion occurring in 2006. The plant is located adjacent to commercial and residential areas in the southwest portion of the Village at the intersection of Slocum Lake Road and Brown Street. The plant has a permitted design average flow of 1.9 million gallons per day (MGD) and a design maximum flow of 5.963 MGD. Fiddle Creek, a tributary of the Fox River, receives all of the discharge.

Back row left to right: Alex Pryde, Brad Fink, Nathan Mau, Jason Spratt, Frank Burton, Jacob Mann
Front row left to right: Luke Markko, Anna Kootstra, Humberto Reyes & Connie Watkins

Click HERE to return to Table of Contents

The Wauconda Wastewater Treatment Plant consists of two parallel but interconnected treatment plants. The original treatment plant ("Old Plant") was upgraded in 1985 and utilizes a bio-tower/trickling filter process. When the plant was expanded in 2006, a parallel activated sludge process ("New Plant") was constructed. Flow is split and balanced between the two plants, combining at a UV disinfection facility prior to discharge. The solids treatment process is common to both plants. The plant also has excess flow treatment facilities for flows in excess of 5.963 MGD.

The treatment process consists of influent pumping, screening, grit removal, primary clarification, activated sludge, fixed film and solids contact, secondary clarification, chemical phosphorus removal, filtration, UV disinfection, post aeration, sludge thickening, aerobic digestion, sludge storage, and land application of sludge.

In addition to the wastewater treatment plant, Wauconda also owns and operates a wastewater collection system including over 56 miles of 6-inch through 30-inch diameter sanitary sewers and 1,442 manholes. The collection system also contains 18 wastewater pumping stations and approximately five miles of forcemain. Staff also maintain an industrial pretreatment program.

INFLUENT PUMPING

Dry Weather Pump Station

Dry Weather Pump Station

The dry weather pump station is a submersible pump station equipped with three pumps (2 @ 1,000 gpm, and 1 @ 2,800 gpm). The dry weather station pumps the influent flow to the activated sludge plant's headworks facility for preliminary treatment. The balance of the flow not pumped to the activated sludge plant is diverted by gravity to the bio-tower plant's headworks facility. Variable frequency drives (VFD) control the flow and are paced to match the influent sewage flow conditions.

Wet Weather Pump Station

When influent flows exceed the design capacity of the treatment plants during wet weather flow events, the excess flows are diverted to the wet weather pumping station. The wet weather pump station is a duplex submersible pump station with two 2,800 gpm, 60 HP pumps. The wet weather flows are lifted to a flow control structure which diverts the flow to the excess flow treatment facilities.

BIO-TOWER TREATMENT TRAIN

Bio-Towers/Trickling Filters

The bio-tower treatment train is designed to treat an average daily flow of 1.4 MGD and a design maximum flow of approximately 4.0 MGD. The bio-tower treatment train includes screening, grit removal, primary clarification, trickling filters with a solids contact tank, secondary clarification, and sand filtration.

Preliminary Treatment

The headworks treatment facility provides preliminary treatment via an aerated grit tank for grit removal and a mechanical bar screen. The removed grit is washed and disposed of in a dumpster along with the debris removed by the bar screen.

Primary Treatment

Four 504 sq. ft. rectangular primary clarifiers receive the flow from the headworks facility. The primary clarifiers remove the readily settleable suspended solids and scum. Primary sludge pumps convey the collected sludge and scum from the primary clarifiers and pump it to the aerobic digesters.

Bio-Tower Pumps & Bio-Towers

The effluent from the primary clarifiers is pumped to the top of the two bio-towers/trickling filters. There are six, 1,600 gpm pumps with three pumps dedicated to each bio-tower. The pumps operate on variable frequency drives to enhance operational efficiency. Each bio-tower is 50 feet in diameter with a media depth of 28 feet. The bio-towers are filled with a plastic honeycomb media which supports a bio-film of microorganisms that provides biological treatment of wastewater as it flows down through the media. The wastewater is circulated through the media which induces an updraft through the media further enhancing the biological treatment process. The effluent from the bio-towers and the bio-film that sloughs off is conveyed to the solids contact tank.

Solids Contact Tank

Solids Contact Tank

The solids contact tank is an aerated basin which receives the effluent from the bio-towers and a portion of the settled sludge from downstream secondary clarifiers to aid in settling. Additionally, ferric chloride is added to the solids contact tank to provide chemical phosphorus precipitation with removal in the final clarifiers and sand filters.

Final Clarifiers Nos. 1 and 2

Final clarifiers Nos. 1 and 2 receive the effluent from the solids contact tank and provide final settling prior to the filtration at the sand filters. The 50-foot diameter circular clarifier units are equipped with rotating mechanisms which collect the settled sludge for removal. A portion of the sludge is returned to the solids contact tank. Airlift pumps return the balance of the settled sludge to the primary clarifiers. The clarified effluent overflows the weirs and is conveyed to the sand filters.

Sand Filters Nos. 1 and 2

Sand Filters

Prior to disinfection, the effluent from final clarifiers Nos. 1 and 2 is filtered through two sand filters, which were constructed in 1985. The traveling bridge sand filters utilize a granular media to provide effluent polishing and further reduce suspended solids, BOD, and phosphorus in the treated effluent. Backwashing of the filter cells removes and returns the captured solids to the head of the plant for additional treatment and removal. The filtered effluent is conveyed to the UV disinfection facility where it combines with the filtered effluent from the new plant prior to disinfection.

ACTIVATED SLUDGE TREATMENT TRAIN

The activated sludge train is designed to treat an average daily flow of 0.5 MGD and a design maximum flow of approximately 2.0 MGD. The activated sludge treatment train includes screening, grit removal, activated sludge, secondary clarification, and sand filtration.

Preliminary Treatment

The headworks treatment facility at the new plant utilizes a 4-foot diameter cylindrical fine screen with a screen opening of one quarter inch for removal of screenings. A 10-foot diameter vortex grit chamber provides grit removal. The removed grit is further washed and disposed of in a dumpster with the debris removed by the bar screen. The effluent flow from the vortex grit unit is measured by a Parshall flume.

Flow Balancing

Following the Parshall flume, flow to the new plant is regulated by a magnetic flow meter and control valve. The balance of the flow is directed to a flow control structure which routes the flow to either the old bio-tower plant or the excess flow facilities.

Aeration Tanks

Aeration Tanks

A combination of raw waste water, ferric chloride, and return activated sludge are mixed prior to entry into two parallel channels. Coarse bubble diffusers are utilized to promote mixing and maintain desired dissolved oxygen levels. The two parallel aeration tanks are single pass basins with a water depth of 20 feet and an average MLSS concentration of 2,000 mg/l.

Aeration Blowers

Four 900 cfm, 60 HP blowers are installed to provide air to the aeration tanks and aerobic digester Nos. 3 and 4. All four blowers discharge to a common air header that supplies air to the aeration tanks and aerobic digester Nos. 3 and 4.

Final Clarifier

Final clarifier No. 3 receives the effluent from the aeration tanks and provides final settling prior to the filtration. The 50-foot diameter, circular clarifier unit is equipped with a rotating mechanism which collects the settled sludge for removal. A portion of the sludge is returned to the aeration tanks. Sludge pumps transfer the remaining portion of the waste activated sludge to aerobic digesters Nos. 1 and 2 for further treatment and stabilization. The clarified effluent overflows the weirs and is conveyed to effluent sand filter.

Sand Filter No. 3

Prior to disinfection the effluent from final clarifier No. 3 is filtered through sand filter No. 3, which was constructed in 2006. The travelling bridge sand filter further reduces suspended solids, BOD and phosphorus in the treated effluent. Backwashing water is returned to the head of the plant for treatment and removal. The filtered effluent is conveyed to the UV disinfection facility where it combines with the filtered effluent from the old plant prior to disinfection.

Click HERE to return to Table of Contents

UV DISINFECTION

Flows from the bio-tower treatment train and the activated sludge treatment train are combined prior to the UV disinfection facilities. The UV Disinfection system is a single channel, two-bank system sized for a design flow of 6.0 MGD. The two banks are each equipped with six modules and eight 250-watt lamps per module. The ultraviolet light emitted from the module lamps and transmitted through the treated effluent provides disinfection of the plant's discharge.

POST AERATION/DISCHARGE

Prior to discharge to Fiddle Creek, the final effluent is aerated to increase dissolved oxygen levels. The post aeration tank is equipped with a diffuser and blower to provide aeration of the final effluent. Immediately downstream of the post aeration tank is a Parshall flume to provide flow metering prior to discharge to Fiddle Creek.

EXCESS FLOW TREATMENT

Flows exceeding the design maximum flow of the bio-tower and activated sludge treatment trains receive excess flow treatment. During excess flow events the Wet Weather Pump Station pumps the influent to a flow control structure which balances and maximizes the influent flows between the two plants and routes the excess flows to the Excess Flow Treatment Facilities. The Wauconda WWTP has the capability to treat excess wet weather flows in the amount of 3.53 million gallons per day.

Excess Flow Clarifier

Excess Flow Clarifier

The first treatment step for the excess/wet weather flows is through the excess flow clarifier. The 50-foot diameter, circular clarifier unit is utilized to remove both the floatable and settable solids. The scum and sludge pumps transfer these materials to the digester for treatment and stabilization. The clarified effluent is then conveyed to a chlorine contact tank.

Chlorine Contact Tank

The effluent flows from the excess flow clarifier are routed through a chlorine contact tank for disinfection prior to discharge. The excess flows are dosed with chlorine to maintain a residual chlorine level of 0.75 mg/l. The disinfected flows from the chlorine contact tank are combined with the main plant discharge downstream of the UV channel. The excess flows are metered and sampled independent of the main plant outfall.

SOLIDS HANDLING

The solids handling and treatment system at the Wauconda WWTP receives and treats the waste sludge from both the bio-tower and activated sludge treatment trains. The components of the solids handling system consist of sludge pumping, sludge thickening, aerobic digestion, blowers, and liquid sludge storage. Sludge land application is provided on contracted basis.

Sludge Pumping

Sludge pumping is accomplished with a variety of different types of pumps. Primary sludge pumping from the primary clarifiers is performed with plunger pumps. Return activated sludge (RAS) pumping at the solids contact tank is done with airlift pumps. Centrifugal pumps are used for the RAS pumping at the activated sludge plant. Sludge transfer pumping between the digesters, sludge storage and gravity belt thickener is accomplished with positive displacement type pumps.

Gravity Belt Thickener

Gravity Belt Thickener

A gravity belt thickener is used to thicken sludge ahead and within the digesters. The gravity belt thickener removes free water from the sludge which reduces the volume of sludge and enhances sludge stabilization and treatment.

Aerobic Digesters

Sludge treatment and stabilization is accomplished by aerobic digestion. There are four aerobic digesters at the Wauconda WWTP with a total volume of approximately 422,000 gallons.

Aerobic Digesters Nos. 1 and 2

Digesters Nos. 1 and 2 are circular units and were constructed with the old plant. Digesters Nos. 3 and 4, constructed with the new plant, are rectangular units, and are located in the lower level of the pre-treatment building beneath the gravity belt thickener and odor control equipment.

Air to Digesters Nos. 1 and 2 is provided with two dedicated centrifugal blowers. Air lances in the digester units provide aeration and mixing of the sludge. The digesters are covered to retain heat for enhanced sludge treatment. The units are operated in series with raw sludge feed to digester No. 1 and then transferred to digester No. 2 before being conveyed to the sludge storage tanks.

Digesters Nos. 3 and 4 receive air from the aeration blowers for the activated sludge tanks. A common discharge header is used to supply air to both the digesters and the aeration tanks.

Sludge Storage

Liquid Sludge Storage Tank

Two liquid sludge storage tanks are provided to store the digested sludge prior to removal for final land application. The storage tanks are in-ground concrete tanks with a total volume of 1,030,000 gallons. The sludge transfer pumps remove the stabilized sludge from the digesters and pump it to the storage tanks. Sludge is stored throughout the winter and is land applied during the spring, summer and fall months as weather allows. The village uses the services of a contract hauler to remove and land apply the liquid sludge.

PERSONNEL

The Village of Wauconda's Sewer Division operates under the Direction of The Director of Public Works and Superintendent of Operations. The Division is comprised of two sections, a Water Reclamation Treatment Plant and a Lift Station/Collections System. Both Water Reclamation and Collections are staffed with a total of seven full-time employees,

- Brad Fink, Director of Public Works
- Alex Pryde, Superintendent of Operations
- Connie Watkins, Assistant to the Director
- Jacob Mann, Foreman of Water Reclamation
- Nate Mau, Foreman of Collections System
- Luke Markko, Class 1 Operator
- Anna Kootstra, Lab Technician
- Frank Burton, Maintenance Service Technician
- Humberto Reyes, Maintenance Service Technician
- Jason Spratt, Maintenance Service Technician CS

Click HERE to return to Table of Contents