Onondaga County Department of
WATER ENVIRONMENT PROTECTION

Oak Orchard
Wastewater Treatment Plant

Wet Weather Operating Plan

July 2014

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Section 1 – Introduction and Overview

Constructed in 1981, the Oak Orchard WWTP has a design flow of 10 MGD and provides advanced secondary treatment of wastewater using an Activated Sludge Processes. Wastewater is collected throughout significant sections of the Town of Clay and portions of the Town of Cicero; along with the Village of North Syracuse. A system of gravity sewers and smaller pumping stations convey sewage from a large portion of the service area through trunk sewers to the Davis Road Pump Station. Flow from this pump station is transported over six (6) miles, through two interconnected force mains (24" and 36") that combine to form a single 30" force main at Euclid in the Town of Clay, which then conveys the sewage to the Oak Orchard WWTP influent headworks. Wastewater influent is primarily from residential and commercial sources; however, there are some industrial users, such as Clintons Ditch Corp.

The wastewater undergoes screening and grit removal in the Headworks Building. Grit removal in accomplished with two (2) aerated grit chambers, which use a mechanical clamshell removal system, followed by mechanical screen rakes (and a bypass manual bar rack when necessary). Wastewater then gravity flows from the mechanical screen rakes into the flow distribution structure, where the flow is evenly split between two (2) primary flocculation tanks with paddle wheel type mixers, then through two (2) primary clarifier tanks. Settled solids in the primary clarifiers are pumped to the gravity thickeners and floating grease is removed. Wastewater then flows into the two (2) Covered Pure Oxygen Activated Sludge aeration tanks, where biological treatment occurs. The treated wastewater (mixed liquor) then flows to the six (6) Secondary Clarifiers where solids settling occurs with the aid of a cationic polymer. Activated sludge collected in the clarifiers is recirculated to the aeration tanks and/or wasted to the two (2) gravity thickener tanks, where it is then hauled to the Metropolitan-Syracuse WWTP for further treatment.

Effluent from the secondary clarifiers flows through a Parshall flume into two (2) lagoons, which operate in series. These lagoons act as polishing basins and aid in additional solids settling and aeration. Effluent from the lagoons then flows to the two (2) chlorine contact tanks for seasonal disinfection using Sodium Hypochlorite, before discharge to the Oneida River. Total phosphorus is removed year round with the use of Aluminum Sulfate. Seasonal nitrification occurs as a function of ambient temperatures. Odor control is provided for odors collected from the grit chambers and the covered primary overflow weirs, which are treated with a duplex scrubber unit, using Sodium Hypochlorite.

- *Plant Bypass* – Oak Orchard WWTP has the capability to bypass flows around the treatment facility, via a valve which can be opened to divert flow from the Davis Road Pump Station into the South Lagoon. This diversion would then flow to the North Lagoon, and then either through or around the Chlorine Contact Tank. All flow eventually enters the Oneida River via Outfall #001. This diversion has <u>never</u> occurred and remains as an emergency bypass only.

<u>Performance Goals</u>

The overall goal of the wet weather operating plan is to provide the best possible treatment to

high flows in an effort to maintain SPDES compliance, minimize the impact of high flows on the treatment process and to resume full treatment quickly as wet weather conditions abate.

- Maintain SPDES compliance.
- Minimize impact on treatment process units.
- Return facility to full treatment capabilities as soon as possible.

Utilization of the Manual

The purpose of this manual is to provide a set of operating guidelines to assist the Oak Orchard WWTP and collection system staff in making operational decisions which will best meet the performance goals and the requirements of the SPDES discharge permit.

During a wet weather event, numerous operational decisions must be made to effectively manage high influent wastewater flow into the Oak Orchard WWTP. Multiple control structures, varying conditions of the treatment processes, equipment service status and varying degrees of intensity and duration of the storm/snowmelt make each event and the reactive operational strategy potentially unique. No manual can describe the decision making process for every possible operating scenario. However, this manual will serve as a useful reference for both new and experienced operators to utilize during wet weather events. Covered specifically are preparations for a pending wet weather event, strategies for processes control during the event and a checklist of critical steps involved to monitor and control processes during an event.

This manual is designed to allow use as a quick reference during wet weather events. It is broken down into sections which cover major unit processes at the Oak Orchard facility. Each section includes the following information:

- Operational Description – Overview of the designated treatment process and associated equipment.
- Pre-Wet Weather Event Activities – Activities to be performed in anticipation of pending wet-weather event.
- During Wet Weather Activities – Major activities to be performed during the wet-weather event.
- Post Wet Weather Activities – Activities to be performed following the wet weather event, and in anticipation of future events.

This manual is a living document. Users of the manual are encouraged to identify new steps, procedures, and recommendations to improve the overall utility of the manual. All recommendations shall be submitted to the user's immediate supervisor for consideration for inclusion in the manual.

Section 2 - Wet Weather Operational Strategy

a. Wet Weather Operation Condition # 1

This occurs when conditions are otherwise dry yet a heavy rain has fallen over a two (2) or three (3) hour period and subsided. Subsequently, plant influent flows (monitored on-site) will increase, but not rapidly, as the increase in flow is due to I/I issues, which would take time to build in the collection system. When observed to trend upward to 10 MGD, proceed as follows:

1. Increase the oxygen feed to the aeration tanks in anticipation of solids being conveyed in the collection system that were previously settled out, causing a higher oxygen demand in the activated sludge system.
2. Do a visual observation of the post-aeration floc channels. The size of the floc and separation from the water will determine when, and if the polymer feed should increase to prevent solids from washing over the secondary weirs.
3. At the 10 MGD flow point, the 3rd stage aeration mixers are turned off to settle out some solids in the aeration tanks, attempting to avoid high secondary tank sludge levels.

   Note: Experienced operators can often predict with high certainty when or if plant flows will exceed 10 MGD and often turn-off the 3rd stage aerators in advance. This is a judgment call based on experience and current plant conditions (i.e. sludge blanket levels in the secondary settling tanks, and overall sludge volume in the system). That stated, 10 MGD is an approximate number used to establish a guideline for when to turn off the aerators. Turning off aerators above or below this flow number may be desirable and/or necessary under certain plant conditions.

4. During disinfection season, the Sodium Hypochlorite feed may have to be increased to meet the higher demand.

b. Wet Weather Operation Condition # 2

With the onset of heavy rains or snowmelt accompanied by rain, the flow would eventually climb above 10 MGD. These conditions will require extra steps to ensure the best treatment available, considering the decreased detention time throughout the facility. Proceed as follows:

1. The majority of flow received at Oak Orchard is generated at the Davis Road Pump Station. This station is operated and maintained by Oak Orchard staff, Operators at this time would make sure the screen rake is in continuous operation to keep the screenings from building up and effecting flow and wet well levels at the station. Running the screen rake continuously in hand also saves premature wear on the electric motor brake on the screen rake motor, which may occur from the screen rake starting and stopping continuously in high flow conditions.
2. Flow from Davis Road Pump Station is pumped to Oak Orchard via parallel force mains (FM), the first being a 24” in diameter, and the other 36” in diameter. Although the 36”

force main sections are generally being used during times of the year with traditionally high flows, keep in mind that the 24" main will be primarily used at times to reduce detention time in the force main, thus reducing overall sodium hypochlorite use at Davis Road Pump Station. If needed, Operators would contact the Flow Control Division to open the 24" line in order to have both available for the increased flow needs.

3. At a flow reaching 15 MGD, the 2nd stage aeration mixers will also be turned off, allowing for a larger acquiesced area in these tanks to prevent more solids from both entering the secondary clarifiers, and possibly washing over the effluent weirs.
4. Polymer feed may need to be adjusted for the increased flow. However, there may not be a need, as there should be fewer solids leaving the aeration tanks. This is determined by both a visual of the post-aeration floc channels, and secondary clarifier sludge blanket levels.
5. During disinfection season, the Sodium Hypochlorite feed may have to be increased to meet the higher demand.
6. The Sodium Hypochlorite feed at Davis Road Pump Station, used for hydrogen sulfide control in the force main, shall be shut down as the hydrogen generation will be decreased due to dilute waste water and lessened detention time in the force main.

c. Wet Weather Operation Condition # 3

This will occur with the onset of heavy extended rainfall coupled with a deep snowpack and rapid warming; however, these conditions may also take place in the summer from just rain. At the point of influent flow to the plant, reaching 20 MGD or more, process becomes greatly inhibited. The large amount of solids, grit, and screenings that were washed from the collection system have generally subsided at this time, and the flow will be made up of much more rain water, than actual waste water. Operation becomes more of hydraulically handling the flow than stemming issues from process or residuals entering the plant. Proceed as follows:

1. There are four (4) submersible pumps at Davis Road Pump Station influent wet well. Due to the hydraulic capacity of the force main, only three (3) pumps at a time are effective. The fourth pump in line will be turned-off at this point.
2. If the maximum pumping rate at Davis Road Pump Station is achieved, and the wet well continues to rise, nearing 10', the screen rake should be turned to manual, brought to the top of its travel, and turned off to avoid submersing the motor and drive gear in the channel.
3. When the flow at Oak Orchard nears 20 MGD, the 1st stage aerators shall be turned off, leaving them all off. If this condition persists for a number of hours, the aerators should be turned on for short periods to attempt to oxygenate the MLSS intermittently every few hours.
4. The WAS flow may be turned off if there is a measurable loss of solids over the secondary clarifier weirs.
5. Due to the possibility of water level rising in the lagoons, the ropes securing the lagoon floating aerators should be checked for tension, and adjusted accordingly.
6. The North Lagoon has an adjustable baffle to keep floating debris from entering the

chlorine contact tanks. This may have to be adjusted to allow the maximum flow into the contact tanks.

7. During disinfection season, the Sodium Hypochlorite feed may have to be increased to meet the higher demand.

Section 3 – Process Wet Weather Operation

In general, prior to any wet weather events, the operational staff monitors storm development via internet access to assist in predicting the onset of a wet weather event. This allows both the head operator and operator(s) the ability to review the personnel roster to ensure adequate staff is available and call in additional personnel as required. In addition, the monitoring of storm development allows the operational and maintenance staff to begin pre-wet weather activities as identified herein.

At this time, the Department does not have a policy, mechanism or corresponding procedure for issuing wet weather related advisories to the municipalities that discharge to the County's collection system. The current inter-municipal agreement does not grant the Department authority to minimize, reduce, or even require the implementation of Best Management Practices (BMPs) by the municipalities that discharge to the Oak Orchard service area.

a. Screenings & Grit Removal - Headworks Building

The screenings and grit removal occurs in the Headworks Building which receives wastewater from the Davis Road Pump Station and the Horseshoe Island Force Main which combine at the outfall bunker just upstream of the two (2) covered Aerated Grit Chambers. Wastewater flows through the two (2) covered chambers and passes through two (2) mechanical screen rakes. Grit removal is accomplished using a clam shell removal system. This system deposits the solid grit in roll-off containers. Wastewater then gravity flows from the mechanical screen rakes into the flow distribution structure, where the flow is currently evenly split between two (2) Primary Flocculation tanks, and then two (2) Primary Clarifier Tanks.

Pre-Wet Weather Event Activities

- Make sure all channels are operational.
- Verify that mechanical screen rakes are operational.
- Verify adequate roll-off capacity.

During Wet Weather Activities

- The air feeding the grit chambers may be turned down to prevent inorganics from washing into the Primary Clarifiers.
- Ensure that wastewater flow does not travel over the effluent weirs of the empty/

unused Primary Flocculation Tanks. This may happen at very high flows, e.g. 20 MGD plus. When this occurs, flow through the plant under-drain system may exceed the pumping capacity of the Plant Waste Station. In certain situations this may possibly cause the basement pipe galleries to flood with water, sometimes to significant levels. Bypassing the Primary Flocculation Tanks using the center Primary Influent Channel would cease wastewater from flowing back over the empty Flocculation Tank weirs.

Post Wet Weather Activities

- Return all equipment to dry weather operation.

b. Primary Clarifier System

Under normal operating conditions, wastewater is split evenly via gravity flow and distributed into two (2) Primary Clarifier trains. The influent flow is dosed with Aluminum Sulfate prior to flowing into the Primary Clarifiers. Solids are settled out and floating scum is removed via a traveling Cog Bridge System.

Pre-Wet Weather Event Activities

- Verify the operation of traveling Cog Bridge System.
- Maintain the Aluminum Sulfate dosing system.

During Wet Weather Activities

- Adjust the operation of traveling Cog Bridge System as needed.
- Adjust the Aluminum Sulfate dosing system as needed.

Post Wet Weather Activities

- Return all equipment to dry weather operation.

c. Activated Sludge Treatment – Aeration Tanks

Under normal operating conditions, wastewater is split evenly between two (2) Covered Aeration Trains, where the activated sludge process is accomplished using a Pure Oxygen Feed System along with aerators (mixers). Dosing concentration of Aluminum Sulfate is adjusted as needed, and feed rate is flow paced to increase and decrease as flows fluctuate. A limit has been set on this system to pump no more than 20 GPH, regardless of flow rates. If influent flows are such that air to the aeration tanks must be shut down, Aluminum Sulfate feed is stopped as it has little or no effect if not aerated and mixed.

Pre-Wet Weather Event Activities

- None.

During Wet Weather Activities

- Wet Weather Condition # 1 – Maintain aeration and maintain Aluminum Sulfate dosing as needed, noting 3rd stage aerators are turned off after the flow reaches 10 MGD.
- Wet Weather Condition # 2 – Maintain aeration and maintain Aluminum Sulfate dosing as needed, noting 2nd stage aerators are turned off after the flow reaches 15 MGD
- Wet Weather Condition # 3 – The 1st stage aerators are to be turned off with the flow reaching 20 MGD, or observing a large amount of solids washing over the secondary clarifier weirs. Aluminum Sulfate will be turned off at this time, due to the lack of aeration. Historically, at influent flows of 25 to 30 MGD, the secondary flocculation channels may have a depth that approaches or reaches the high flow bypass slots in the South Secondary Flocculation channel. The bypass flow slots discharge to the Plant Waste Station, and the empty unused South Secondary Flocculation tank. If this is allowed to happen there is a high probability that the plant basement pipe galleries will be flooded with a significant amount of water. In order to prevent this from happening, channel depth can be reduced by raising all of the individual influent gates to the six (6) secondary settling tanks to their maximum allowable height.

Post Wet Weather Activities

- Wet Weather Condition # 3 – Return process air in stages to the Aeration Tanks as indicated based on flow rates and weather conditions. Re-start the Aluminum Sulfate feed once process air is re-established. Adjust as needed.

d. Secondary Clarifier Treatment System

Mixed Liquor flows via gravity to the respective rectangular clarifier via a dedicated channel (North and South Trains). Upstream in this channel cationic polymer is fed to aid settling of solids in the Secondary Clarifiers. Settled activated sludge is collected and drawn from the clarifier via telescoping valves from the sludge hopper in the clarifier, and conveyed to one (1) of two (2) RAS wet wells via piping. From there it is pumped back to the aeration tanks. Skimmer arms collect and channel floatable materials into a trough/pit system for later disposal. Treated/clarified water flows over a peripheral-mounted v-notch weir/lauder and channeled to a common wet well. Secondary effluent from both wet wells combine in a single channel where it is measured through a Parshall flume. The secondary effluent may pass through two (2) lagoons prior to disinfection in a Chlorine Contact Tank or the Lagoon System may be bypassed.

Pre-Wet Weather Event Activities

- Keep weir v-notches clear to prevent short-circuiting.
- Keep weir launders free of build-up.
- Insure that floatable and settleable collection mechanisms are in working order.

During Wet Weather Activities

- Optimal settling efficiency is limited to 1.7 MGD per clarifier.
- As needed, increase sludge withdrawal rates of Waste Activated Sludge (WAS), or turn it off if solids are observed washing over the secondary weirs.
- Increase performance monitoring (sludge depth gauging and visual observation).

Post Wet Weather Activities

- Keep weir v-notches clear to prevent short-circuiting.
- Keep weir launders free of build-up.
- Insure that floatable and settleable collection mechanisms are in working order.

e. Lagoon System

The Lagoon System is comprised of two (2) lagoons (North and South) which operate in series as final polishing for secondary effluent prior to disinfection.

Pre-Wet Weather Event Activities

- Ensure lagoons are unobstructed.

During Wet Weather Activities

- Visual observation of North Lagoon outlet pipe to be sure it is unobstructed.
- Wet Weather Conditions # 2 and # 3 – Monitor floating aerator lines and lagoon sidewall depth.

Post Wet Weather Activities

- Visual observation of the lagoons.

f. Chlorine Contact Disinfection System

The Chlorine Contact Disinfection System receives treated effluent from the North Lagoon. The lagoon effluent gravity flows into the contact tank distribution box where it is split into two (2) parallel contact tanks. Sodium Hypochlorite is introduced for the purpose of disinfection of the final effluent. The disinfection system consists of a chemical transfer system, chemical storage and containment system and a chemical feed

building. Disinfection is required seasonally from May 15 to October 15. The Sodium Hypochlorite is fed directly into the bypass valve bunker located between the outfall of the North lagoon and the influent structure of the Chlorine Contact Tanks.

Pre-Wet Weather Event Activities

- Ensure adequate supply of Sodium Hypochlorite during the disinfection season.
- Maintain weirs and side walls of tanks.

During Wet Weather Activities

- Administer Sodium Hypochlorite for chlorination and monitor the disinfection system for proper operation.

Post Wet Weather Activities

- Check disinfection system, chemical storage.
- Visual observation of the effluent.

g. Sludge Handling Facilities

Primary Sludge and Waste Activated Sludge (WAS) are collected from the clarifiers and pumped to the two (2) Gravity Thickener Tanks. The thickened sludge is then hauled via tanker truck to the Metropolitan-Syracuse WWTP for further treatment.

Pre-Wet Weather Event Activities

- None.

During Wet Weather Activities

- Maintain proper flow to the thickeners, considering the effluent flows to the Plant Waste Station, which needs to be monitored during high flow conditions.

Post Wet Weather Activities

- Despite best efforts some inorganic solids (grit) may end up in the thickeners after periods of high flows. Operators may need to assist Tanker drivers with loading, by flushing into the suction piping of the thickener being drawn off of, in order to avoid plugging or unnecessary wear on the Borger Rotary Lobe thickened sludge transfer pump. It may take multiple loads before the system is cleared off grit.

Appendix A

Oak Orchard WWTP Site Plan with Monitoring Locations

Oak Orchard WWTP Site Plan - Process Units and Sampling Locations