Airview-Kentucky (Wastewater)
Engineering Memorandum
Date: December 22, 2018

Wastewater Treatment Facility Understanding

The wastewater treatment facility is made up of a standard extended aeration activated sludge facility. It doesn't appear this system has an active permit to operate. The plant consists of an aeration tank, flow equalization, mechanical clarifier, and chlorine disinfection. The aeration appeared to have a reasonable appearance for a mixed liquor however, the clarifier had a lot of floc and appeared to have discharged sludge into the area outside the circular portion of the clarifier that is pumped to the creek. It is my understanding they are injecting liquid chlorine into the discharge pipe. This discharge pipe discharges on the top of a contact chamber that is set in the middle of the flowline of the creek. The treatment system has an abandoned lagoon cell that appears to have been used as a polishing cell. Per the operator, this cell was causing issues with the quality of the effluent and was taken off line.

Various items of concern exist as this facility. The flow equalization tank is in poor shape and is covered with failing grates that are allowing leaves to enter the plant. (Appendix Picture 1)

While the aeration appeared to be reasonable operating, standard testing parameters were not performed when we were present to determine the quality of the mixed liquor. Due to the upkeep of the remaining portions of the facility, I do not believe the diffusers have been checked and/or cleaned in some time. (Appendix Picture 2)

The mechanical clarifier appears to be working properly. However, the supernatant water of the clarifier had a large amount of floc and/or sludge coming to the surface. While this might be a operational issue in regards to control of the mixed liquor and return sludge flow, the clarifier is not operating at an optimal level. The clarifier discharges to the outside of the circular wall of the clarifier. This area is the discharge water that is pumped to the creek. Sludge was observed in this area and therefore was being pumped to the creek. (Appendix Picture 3)

The effluent pipe conveying sewage to the creek is a flexible 2" hose laying on the ground. It runs over the ground, across the abandoned lagoon berm, down the backside of the lagoon and into the contact chamber. This pipe has a leak that is spraying onto the backside of the lagoon berm. It has a leak that is running down the backside of the lagoon berm and is causing erosion. If this continues to go unrepaired, the berm may fail causing the abandoned lagoon cell to discharge into the creek. Per the operator, they anticipate sludge being present in the lagoon and this is a potential for additional contamination of the creek. (Appendix Picture 4)

The contact chamber installed in the creek channel has failed. Currently, the effluent of the plant pumps into the contact chamber. This flow appears to immediately be dumping into the creek without going through the contact chamber. This causes two issues of not receiving proper time for contact to

reduce the e. coli levels of the effluent but also having a high chlorine residual. This is very harmful to wildlife. (Appendix Picture 5)

The quality of the creek bed downstream of the effluent was also very poor. Sludge deposits coated almost the entire channel for hundreds of feet downstream of the effluent. This will again cause issues with wildlife and needs to be cleaned immediately. (Appendix Picture 6)

The abandoned lagoon cell is a liability. The fencing around the cell is failing. Trees are growing through the fence as well as on the berms of the lagoon which is causing concern for safety and security of this liability. (Appendix Picture 7) Tree growth on a lagoon berm will include roots that penetrate the soil and create paths through the soil for the lagoon water to travel. (Appendix Picture 7) Through time, the berm will fail from this occurring. The overflow of the berm also has concerns. The area is eroding but also has sludge deposits. This cell needs to be repaired or closed to eliminate the liability and contamination it is causing in the creek. (Appendix Picture 8)

The current operator stated that the plant struggles to meet limits. Upgrades are necessary to bring this facility back into compliance. The shape of this facility is detrimental to the environment and needs to be addressed as soon as possible.

Improvements Remove trees from around the facility to decrease leaves in the treatment process. Replace all the aeration piping and diffusers. Blowers might need to be replaced but should be inspected to determine efficiency upon ownership transfer. The facility will need a more experience operator that will monitor for facility chemistry. The system should look at additional flow equalization, the addition of sludge holding, repair of the clarifier and consideration to converting the facility to an IFAS process with a moving bed biological reactor. For the effluent, the facility should look to have an ultraviolet unit up by the equipment and evaluate the feasibility of gravity flow to the creek flowline.

Wastewater Collection System Understanding

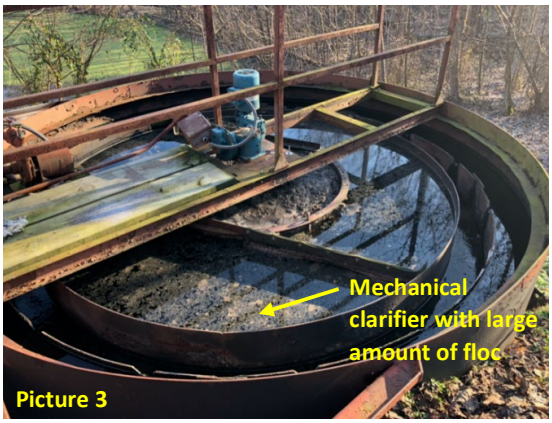
In meeting with the operator, the system has 203 customers. The operator stated that the system has serious inflow and infiltration problems. If this is not addressed, the system will continue to discharge sludge into the creek as shown in the pictures as well as not meet other limits specified in the permit. Funds should be invested into the collection system or the quality of the effluent will be an ongoing problem. No maps of the system were provided. The system will need to be mapped for future operation as it appeared nothing has been compiled for our review or operational maintenance purposes. The system should also be smoke tested. Video inspection is anticipated on parts of the system as well.

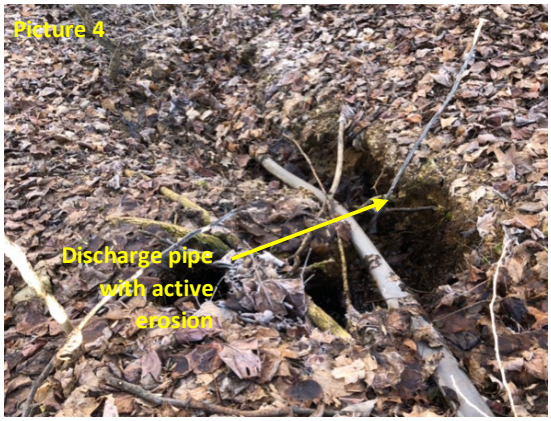
Improvements Required: Map the system. Smoke test and video inspect the collection system.

APPENDIX


Flow equalization tankage
Picture 1

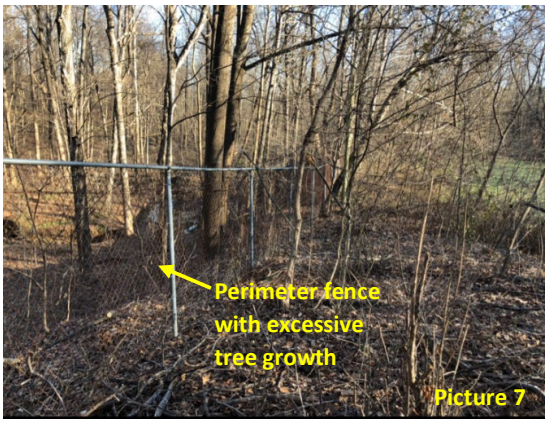

Aeration tankage
Picture 2

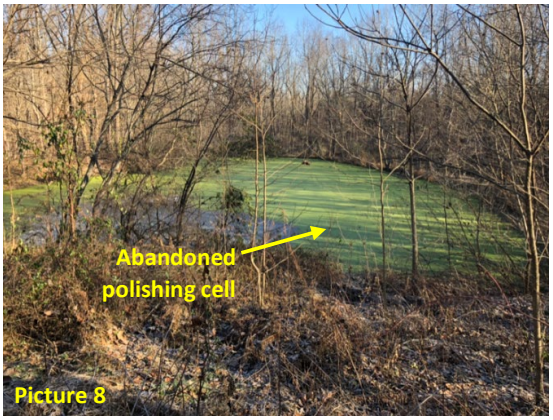

Mechanical clarifier with large amount of floc
Picture 3


Picture 4
Discharge pipe with active erosion


Disinfection contact chamber
Picture 5


Sludge Deposits in creek channel
Picture 6


Perimeter fence with excessive tree growth
Picture 7


Abandoned polishing cell
Picture 8

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Arcadia Pines (Wastewater) – No discharge/No permit
Engineering Memorandum
Date: October 5, 2019

Wastewater Treatment Facility Understanding

The Arcadia wastewater treatment facility is located in West Paducah, KY. The plant services about 33 customers which is approximately 100 people. The facility consists of a no-discharge lagoon.

The facility does not have a discharge permit and has minimal oversight from permitting entities. The Kentucky Department of Environmental Protection governs wastewater permits with discharges but does not have any oversight on non-discharging systems such as this facility. The KDEP leaves management and oversight up to the local Health Departments. In speaking with head of the Health Department in this county, they will perform field inspections only when a complaint is filed. Therefore, we recommend investigation with the Health Department for quantity and relevance of complaints in the near future. Conversations with the head of the Health department made me believe they have construction plans for this system in their files. However, he didn't have time to research the files at the prior to drafting this memo.

During our visit to the lagoon, various site components were showing signs of failure and minimal maintenance. The single cell Lagoon has limited access. The perimeter fencing needs repairs at multiple locations. The berms have multiple varmint holes that are compromising the integrity of the lagoon berm. Varmint traps were located on the site and appears to be an ongoing problem. The lagoon itself has major erosion around the inner edge and has a minor leak on the south side of the lagoon discharging into the storm ditch. On the surface of the lagoon there is one overflow pipe. Due to vegetation in the area we could not locate the discharge point for the overflow. Lagoon grounds were mowed, and the area was clean. In the Neighborhood there is ongoing housing construction north of the lagoon. There appears to be an undeveloped portion of the subdivision that could be developed in the near future.

This facility does not have an operating permit. It also does not have any monitoring or testing limits imposed on the facility that need to be reported. Therefore, this system does not show up in the EPA's Echo website for evaluation.

21 Design Group, Inc.
1351 Jefferson St, Suite 301
Washington, MO 63090

Improvements: The perimeter fence needs repair. The berm is leaking and has various varmint holes that need to be repaired. The overflow discharge point needs to be located.

Wastewater Collection System Understanding

The collection system flow gravity feeds to the lagoon from the Arcadia neighborhood. No other information regarding the collection system was provided to the Engineer for review to drafting this memo. We recommend researching the Health Department's files to see if they have construction plans for the collection system.

Improvements Required: Perform smoke testing, evaluate system and create GIS mapping for future maintenance needs. Research Health Department files.

Brocklyn-Kentucky (Wastewater)
Engineering Memorandum
Date: December 26, 2018

Wastewater Treatment Facility Understanding

The wastewater treatment facility is made up of a standard extended aeration activated sludge facility. It doesn't appear this system has an active permit to operate. The permit appears to have expired on May 31, 2018. The plant consists of an aeration tank, clarifier, polishing earthen cell, and chlorine disinfection. The aeration appeared to have a reasonable appearance for a mixed liquor however, the clarifier had a lot of floc and sludge at the surface. It is my understanding they are utilizing chlorine tablets for disinfection. This discharge from the clarifier is pumped to the polishing cell. After a period of storage in the polishing cell, the pond discharge gravity flows into the chlorine tablet feeder and contact chamber. The contact chamber is also acting like a re-aeration tank to meet dissolved oxygen requirements. (See Appendix 1 for overall picture)

Various items of concern exist as this facility. There is no flow equalization at this facility. The incoming gravity flow enters directly into the aeration tank at the influent manual bar screen. (Appendix Picture 2)

While the aeration appeared to be reasonable operating, standard testing parameters were not performed when we were present to determine the quality of the mixed liquor. Due to the upkeep of the remaining portions of the facility, I do not believe the diffusers have been checked and/or cleaned in some time. Additionally, in review of the EPAs Echo violations listed, the facility is starting to violate limits more often and may be due to non-maintenance of the equipment. Additionally, the tank size appears to be borderline on having the aeration tank volume necessary to serve the 168 customers served. Furth measurements will be necessary to determine if the current capacity is adequate or an expansion is necessary. (Appendix Picture 3)

The clarifier appears to be working properly. However, the supernatant water of the clarifier had a large amount of floc and/or sludge coming to the surface. While this might be an operational issue in regards to control of the mixed liquor and return sludge flow, the clarifier is not operating at an optimal level. The clarifier discharge is pumped to the polishing cell for final treatment. (Appendix Picture 4)

The polishing cell is a poorly designed treatment structure. A deteriorating concrete block wall (Appendix Picture 5) is partially surrounding the pond while the remaining pond surround is earthen. The earthen portion of the pond is allowing overland flow from yards to drain directly into the pond which will bring additional pollutants into the cell and contaminate the effluent. (Appendix Picture 6) Having overland flow will also increase the effluent flow during rain events and will increase chemical usage in the disinfection process. The pond has various issues of concern. To review the operational affects of this polishing cell, it also requires the review of the clarifier. The clarifier has a lot of sludge and floc in the supernatant water of the clarifier above the sludge blanket. This supernatant is pumped

to the polishing cell. While this cell can protect sludge from discharging into the stream, the cell must be periodically cleaned to avoid sludge build up and recontamination of the effluent. I can't confirm sludge levels from this visit. Sludge judging of this cell should be completed. Additionally, I'm not aware of the depth of this cell. A shallow cell may have algae growth that will cause effluent problems. Since no aeration exists in the cell to improve mixing, I anticipate the cell turning over similar to a pond and may have contamination of the effluent from solid deposits on the cell bottom. (See polishing cell photo in Appendix Picture 7)

The contact chamber does not have typical baffling and may experience short circuiting. While it doesn't appear there are any violations for E. Coli, the contact chamber should be replaced or disinfection should be converted to Ultraviolet disinfection. (Appendix Picture 8)

Depending on further inspection of the contact chamber, it might be able to be salvaged if solely used for re-aeration to meet dissolved oxygen levels. This will be evaluated in the design and operational stage of the system transfer period.

The effluent quality looks clean as it was leaving the re-aeration tank. The effluent discharges into the existing stream that runs through the middle of the treatment facility yard.

Improvements: Install flow equalization, replace aeration system, replace sludge return lines, sludge judge polishing cell, evaluate the polishing cell to determine the benefit of this part of the treatment, regrade around perimeter of polishing cell with gutter system to redirect water if staying in use, install ultraviolet disinfection, and repair and repaint re-aeration tank to extend life of tankage.

In lieu of maintaining the polishing cell, the owner should evaluate the benefits of installing a cloth drum filter at the effluent and possibly converting the polishing cell to flow equalization.

Wastewater Collection System Understanding

Per records provided by the owner, the system has approximately 168 customers. These customers are served by a gravity sewer system. Per the operator, Inflow in infiltration is believed to be a problem on this facility. A flow meter should be installed to determine extend of the I and I problems. Funds should be invested into the collection system or the quality of the effluent will be an ongoing problem. No maps of the system were provided. The system will need to be mapped for future operation as it appeared nothing has been compiled for our review or operational maintenance purposes. The system should also be smoke tested. Video inspection is anticipated on parts of the system as well.

Improvements Required: Map the system. Install a flow meter. Smoke test and video inspect the collection system.

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APPENDIX


Picture 1
Overall Plant

Picture 2
Influent


Picture 3
Aeration tank


Picture 4
Clarifier


Picture 5
Failing Wall


Picture 6
Overland flow

Picture 7
Polishing Cell

Picture 8
Contact Chamber/
Re-aeration Tank

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Construction Support
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Wastewater Collection

Carriage Park (Wastewater) – No discharge/No permit
Engineering Memorandum
Date: October 5, 2019

Wastewater Treatment Facility Understanding

The Carriage Park wastewater treatment facility is located in West Paducah, KY. The plant services about 36 customers which is approximately 108 people. The facility consists of a no-discharge lagoon.

The facility does not have a discharge permit and has minimal oversight from permitting entities. The Kentucky Department of Environmental Protection governs wastewater permits with discharges but does not have any oversight on non-discharging systems such as this facility. The KDEP leaves management and oversight up to the local Health Departments. In speaking with head of the Health Department in this county, they will perform field inspections only when a complaint is filed. Therefore, we recommend investigation with the Health Department for quantity and relevance of complaints in the near future. While we do have some plans on file, conversations with the head of the Health department made me believe they have construction plans for this system in their files as well. However, he didn't have time to research the files at the prior to drafting this memo.

During our visit to the lagoon, various site components were showing signs of failure and minimal maintenance. The two cell Lagoon has limited access. The perimeter fencing needs repairs at multiple locations. The berms have multiple varmint holes that are compromising the integrity of the lagoon berm. The lagoon had an ongoing leak along the northeast berm that would be an illegal discharge. The lagoon itself has major erosion around the inner edge and has overgrown brush on the inner berms that needs removed. While we did not have construction plans with us during our site, visit, I recommend bringing plans and comparing them to the onsite features. The plans have a lateral bed at the southwest corner of the lagoon that was apparently sized to accept 19,000 gpd. I anticipate this customer base discharging around 7,000 gpd and therefore, may have access capacity to accept additional flow. Consideration should be given to accepting the flow from the Timberland-JoAnn Estates subdivision, that is also included in this acquisition. However, flow monitoring to confirm available capacity and permitting with the Health Department to achieve this connection.

This facility does not have an operating permit. It also does not have any monitoring or testing limits imposed on the facility that need to be reported. Therefore, this system does not show up in the EPA's Echo website for evaluation.

Improvements: The perimeter fence needs repair. The lagoon berm is leaking and should be repaired. Remove overgrowth from the inside of the lagoon berms.

Wastewater Collection System Understanding

The collection system flow gravity feeds to the lagoon from the Carriage Park neighborhood. No other information regarding the collection system was provided to the Engineer for review to drafting this memo. We recommend researching the Health Department's files to see if they have construction plans for the collection system.

Improvements Required: Perform smoke testing, evaluate system and create GIS mapping for future maintenance needs. Research Health Department files.

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Center Ridge Water District (Water, KY0180549)
Engineering Memorandum
Date: September 18, 2019

Water distribution Understanding

A full distribution system review was not completed during the site visit. A distribution map was provided to CSWR representatives and this map was provided to the Engineer for review. Locations of flushing hydrants and valves are included on the map, but not confirmed at this time.

All connections are metered within the system.

Improvements required: Ensure adequate number of flushing hydrants and valves included in system.

Water storage and well house Understanding

The system consists of one well house and one well. This well pumps to a 1060-gallon hydro-pneumatic storage tank. According to 10 State Standards, the system is required to have two well pumps, but from our understanding this system is grandfathered in and is not required to have two wells. From a count conducted on the service area map there are 51 customers, but Kentucky's Drinking Water Branch states this system is serving 92 customers with a total population of 273. With 51 connections the population would be around 153. With 35 gallons being used per day per person, the total amount of hydro-pneumatic storage needed for this population would be 5,355 gallons. The hydro-pneumatic storage tank is lacking in capacity. In accordance to the lacking capacity, our recommendation would be increasing the size of the hydro-pneumatic storage tank. The size we recommend would be a 6,000-gallon storage tank that would easily meet the minimum storage capacity needed to serve this area.

The well house structure looks to be in reasonable shape but will need some finish carpentry work and standard maintenance to bring the system close to CSWR standards. The existing structure is a block building with no obvious structural concerns during the site visit. The ceiling has open wood rafters that should have moisture resistant ceiling with insulation. Electrical wiring is exposed and should enclosed in conduit. Additionally, the well head wiring should be inspected by an electrician and also properly enclosed in conduit. Interior and exterior PVC pipe needs to be converted to steel to avoid possible freezing.

According to 10 State Standards the need for backup power is required. The backup power must be enough that water can be pumped to the distribution system during power outages to meet the average daily demand. This site currently has a generator on site for standby power.

The system does chlorinate the water using sodium hypo chlorate. The chlorination system is outdated and needs to be updated or replaced pending cost analysis. There needs to be new pumps installed along with a chlorine analyzer.

To allow remote monitoring we recommend installing a Mission Monitoring system equipped with a pressure transducer and a magnetic flow meter.

Improvements required: Existing building cleanup and finish carpentry items. Wiring should be inspected and properly installed to avoid electrical hazards. Install new chlorination system, mission remote monitoring system, chlorine analyzer, magnetic flow meter, and increase hydro storage.

Wellhead with Exposed Wiring

Active Well House, Generator, and Wellhead

Hydro-Tank, Chlorination System, No Ceiling

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Construction Support
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Center Ridge Water District #2 (Water, KY0180509)
Engineering Memorandum
Date: September 14, 2019

Water distribution Understanding

A full distribution system review was not completed during the site visit. A distribution map was provided to CSWR representatives and this map was provided to the Engineer for review. Locations of flushing hydrants and valves are included on the map, but not confirmed at this time.

All connections are metered within the system.

Improvements required: Evaluate the system for valving and flushing hydrant locations.

Water storage and well house Understanding

The system consists of two well houses. One well is enclosed in each house. Only one well is in service and the second is out of service due to well house PVC pipe freezing/cracking. Piping is disconnected and not in working order. The active well is serving 127 customers with a total population of 377. It is disinfected with a 12.5% bleach with a single chlorine pump. The hydropneumatic storage tank in the well house has holes due to rusting and has surpassed its useful life. The tank will need to be repaired or replaced pending cost analysis. This system contains a PVC well head that is designed to prevent freezing by allowing the water to gravity flow down into the well, which poses sanitary concern. The system is setup with one well that pumps to the hydro-pneumatic storage tank. It is unclear on the exact amount of storage in this hydro-pneumatic storage tank and believed to be less 1,000 gallons. Hydropneumatic storage is typically sized to provide 35 gallons of storage per person served. With a population of 377 (Per Kentucky Drinking Water Watch) times 35 gallons per person, the amount of storage recommended is 13,195 gallons. Due to the serious lack of storage capacity, we recommend tying this system to Center Ridge Water District #3. Upgrading and running one system for both Center Ridge Water District #2 and #3 was depicted on plans that were provided to us during our site visit. It is recommended that the operational well in District #2 be placed in an “emergency” classification as it appears the two wells at District #3 can meet demand requirements. Additional details for upgrading the District #3 wells to ensure they are capable of meeting the system demand is discussed in the Engineering Memorandum for “Center Ridge Water District #3”.

The two wells in this District will have to be evaluated for any concerns that may pose a problem once they are out of use. The site should also be evaluated for material that can be salvaged and used to upgrade the system in Center Ridge Water District #3.

Consideration should be given to closing the second well that is currently not connected due to failing piping in the well house. The active well house will need some building repair work to extend its useful life.

The well that will remain in service has a well house in poor condition. The building has minimal insulation that is mostly falling from the walls, gravel floor, no insulation in the ceiling, and open rafters. It is recommended that if the well stays in service, finished carpentry will be necessary to bring the system to CSWR acceptable standards.

Improvements required: Place active well on "emergency" backup classification. Close well that is not active. Building Repair for well that will be placed on "emergency" classification. Construct interconnect with Center Ridge Water District #3.

Wellhouse of Active Well to be placed on "Emergency" Classification

Holes in Tank Due to Rusting

Typical interior finishing in well to remain in service as "emergency backup"

Wellhouse of Dilapidated Well to be closed Per State Guidelines

Broken Pipes in Dilapidated Well House

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Center Ridge Water District #3 (Water, KY0180502)
Engineering Memorandum
Date: September 16, 2019

Water distribution Understanding

A full distribution system review was not completed during the site visit. A distribution map was provided to CSWR representatives and this map was provided to the Engineer for review. Locations of flushing hydrants and valves are included on the map, but not confirmed at this time.

All connections are metered within the system.

Improvements required: Evaluate the system for valving and flushing hydrant locations.

Water storage and well house Understanding

The system consists of two wells and one well house. Single wells are housed in a small block structures and covered with a sheet of tin which are providing little insulation or climate control, if any. The wells pump to a hydro-pneumatic storage tank. The tank is located mostly outside the well house with the end terminating on the interior of the building. This system is serving 70 customers with an estimated total population of 208. It is anticipated the average daily flow for this system to be 8,750 to 12,250 gallons per day. Hydropneumatic storage is typically sized to provide 35 gallons of storage per person served. With a population of 208 (Per Kentucky Drinking Water Watch) times 35 gallons per person, the amount of storage recommended is 7,280 gallons. The tank does not meet capacity requirements for the service area. It is being recommended that this service area be connected to Center Ridge Water District #2. This will increase the number of connections to 197. For this to be done it is recommended an 80' standpipe will be needed in order to ensure a pressure of 30 psi. A booster station would also be installed with the standpipe that would be used only during high usage events and would allow full capacity credit of the standpipe. The booster station will ensure that the system maintains 30 psi and allow us to utilize full capacity of the tank. Ten State Standards Requires two wells on site, so both will have to be upgraded. One well is in poor condition. It is leaking and has exposed wires which poses safety concerns. In order to alleviate these concerns, pitless wellhead adaptors are recommended. Capacity for both wells must also be evaluated to verify their pumping capacity will be adequate to serve the system. There are also PVC electrical conduits exposed on the surface at this site and extend across the roadway. These will need to be properly buried to avoid crushing and potentially shorting out the system. The system also consists of PVC piping and needs to be replaced with steel.

The well house structure looks to be past its useful life and new building is needed.

According to Ten State Standard the need for alternate power is required. It was confirmed that a quick connect to attach a generator is considered adequate for alternate power and will need to be installed

in case of a power outage. Additionally, the standpipe will provide water and pressure during power outages and should also alleviate this concern.

The system currently disinfects with a chlorine solution. However, no labeling was onsite to determine actual disinfectant being utilized. With the age and current state of the well house, I recommend replacement of existing chlorine equipment as well as installation of a chlorine analyzer

To allow remote monitoring we recommend installing a Mission Monitoring system equipped with a pressure transducer and a magnetic flow meter.

Improvements required: New well house structure, new well house piping, electrical overhaul, install pitless adaptor and steel piping to wellhouse, install all electrical wiring in conduit to eliminate hazard, bury electrical conduit, install standpipe and booster station, install mission monitoring system, add quick connections on site, new chlorination system. Install interconnect with District #2 to minimize future maintenance.

Failing Well House

Exposed Electrical Conduit

Block Structure Housing Well

Exposed Electrical Wiring and PVC Piping That Needs to Be Converted to Steel

Civil Engineering
Surveying & Mapping
Potable Water
Wastewater Treatment

21 DESIGN

Civil Site Design
Construction Support
Transportation
Wastewater Collection

Center Ridge Water District #4 Water (KY0183106)
Engineering Memorandum
Date: September 18, 2019

Water distribution Understanding

A full distribution system review was not completed during the site visit. A distribution map was provided to CSWR representatives and this map was provided to the Engineer for review. Locations of flushing hydrants and valves are included on the map, but not confirmed at this time.

All connections are metered within the system.

Improvements required: Ensure adequate number of flushing hydrants and valves included in system

Water storage and well house Understanding

The system consists of one well house and one well. This well pumps to a hydro-pneumatic storage tank. According to 10 State Standards, the system is required to have two well pumps, but from our understanding this system is grandfathered in and is not required to have two wells. From a count conducted on the service area map there are 28 customers, but Kentucky's Drinking Water Branch states this system is serving 47 customers with a total population of 140. With 28 connections the population would be around 84. With 35 gallons being used per day per person, the total amount of hydro-pneumatic storage needed for this population would be 2,940 gallons. The hydro-pneumatic storage tank is lacking in capacity. In accordance to the lacking capacity, our recommendation would be increasing the size of the hydro-pneumatic storage tank. The size we recommend would be a 3,500-gallon hydro-pneumatic storage tank that would easily meet the minimum storage capacity needed to serve this area.

The well house structure is a concern. The exterior is in reasonable shape but has signs of rotting on the bottom that is in contact with the ground. This will need some attention to extend the life of the existing siding material and building structure. There is foamboard on the interior that is providing some insulation. However, unless foam board is 100% sealed, it will provide minimal true insulation from freezing. The interior also needs a ceiling to be installed along with insulation to properly seal in the structure from the weather. Additionally, wiring is exposed and should be enclosed in conduit. Steel piping on interior of well house should also be considered in case of heat loss.

According to 10 State Standards the need for backup power is required. The backup power must be enough that water can be pumped to the distribution system during power outages to meet the average daily demand. It was confirmed that a quick connect to attach a generator is considered adequate for alternate power and will need to be installed in case of a power outage so the system can maintain pressure.

The system does chlorinate. The chlorination system is outdated and needs to be replaced. Improvements should include new chlorine pumps, chlorine scale, containment, and analyzer.

To allow remote monitoring, we recommend installing a Mission Monitoring system equipped with a pressure transducer and a magnetic flow meter.

Improvements required: Building repair/cleanup (insulation, install ceiling, repair any damage due to water), steel piping in wellhouse, install electrical wiring in conduit to eliminate hazard.

Active Well House

Exposed Wiring and Foamboard Being Used for Insulation

Civil Engineering
Surveying & Mapping
Potable Water
Wastewater Treatment

21 DESIGN

Civil Site Design
Construction Support
Transportation
Wastewater Collection

The Delaplain Disposal – Delaplain WWTP KY0079049
Kentucky
Engineering Memorandum
Date: September 11, 2020

Introduction

The Delaplain wastewater treatment facility is located north of Georgetown, Kentucky approximately 19 miles north of Lexington, Kentucky. This facility services 290 residences and 33 commercial or industrial contributors. The system operates under Kentucky DEP Permit number KY0079049 and Agency ID number 3901.

Existing Flows and Loadings and Projections

The existing facility is authorized to treat up to 240,000 gpd.

According to the permit application submitted by Delaplain Disposal Co., the flow contribution is 55% commercial and 45% industrial. According to data available on EPA's Echo site and data submitted to 21 Design Group, Inc. by current ownership, the flows to the facility for 2020 are very roughly approximated below:

- Annual Average Daily Flow – 240,000 – 260,000 gpd
- **Maximum Monthly Average Daily Flow – 360,000 gpd**
- Maximum Weekly Average Daily Flow – 475,000 gpd
- Maximum Daily Average Daily Flow – 910,000 gpd
- Peak Hourly Flow – 1,200,000 gpd

The maximum monthly average daily flow and peak flows are concerning relative to the existing rated capacity and plant size. The plant has a clarifier that is ½-1/3 of the required size at this time. This is consistent with the current ownership's believe that I&I is a problem and flow equalization would be helpful, and it also makes some sense of the excursions in TSS (during wet weather).

The flow peaking factor for the facility is clearly significant, and because of the significant commercial contribution, it's very likely that there' significant variability and spikes in BOD, TSS and ammonia loadings. During excursions in the past, BOD levels were significantly higher than TSS levels, indicating incomplete treatment. We know that one of the original 50-hp centrifugal blowers was replaced recently (to maintain current capacity rating, not to increase aeration capacity), and it's likely that this improvement was made to address the high BOD events observed. It is unclear at this time if the improvement to blower capacity will meet demands from the flow and loading spikes, but it would seem likely that the blower capacity is inadequate based on current vs design flows.

Based on what we've seen and heard to date, the significant industrial contributor has not historically become an issue in operation or in permit compliance.

Based on discussions with current Ownership, the local region is growing rapidly, the area serviced is growing, and they anticipate growth in flows and loadings.

Permit Limitations and Historical Compliance Performance

The plant is authorized to discharge up to 240,000 gallons per day (gpd) by the KDEP per the operating permit. **As discussed above, the facility has discharged flows significantly in excess of this value a number of months this year and is likely to exceed this annual flow rate in 2020.**

A summary of the existing permit limits is described below:

- BOD5 – 10/15 mg/L (Monthly average/Maximum Weekly Average)
- TSS – 30/45 mg/L
- NH3-N – 2/3 mg/L
- NH3-N – 5/7.5 mg/L
- E-Coli – 130/240 mpn/100 ml
- Total Residual Chlorine – 0.011/0.019 mg/L
- Total Phosphorus – Report Only
- Total Nitrogen – Report Only
- Dissolved Oxygen – No limit

A review was performed of EPAs Echo compliance website which lists violations of wastewater treatment plants across the country. The Delaplain wastewater treatment plant has exceeded permit limitations several times in recent months and years for Total Suspended Solids, Ammonia Nitrogen, Total Residual Chlorine, E-Coli, and CBOD5.

Wastewater Treatment Facility Existing Conditions

The original facility included the following features:

- Two influent lines; one comes by gravity from the east side of the facility, and the other enters via forcemain from the west side of the facility.
- Comminutor to grind and remove influent solids
- Manually cleaned bar screen
- Aeration tank
- Two 50 hp centrifugal blowers used to aerate the aeration tank

- Circular clarifier with scum collection and air lift of scum to digester
- RAS/WAS box
- Surge Chamber and transfer pump to convey stored wastewater into the aeration tank
- Aerobic Digester
- Chlorine feed point and chlorine contact tanks
- Dechlorination feed point and dechlorination contact tanks
- Control panels for various subcomponents in the system including the controls for the clarifier, blowers, and surge tank transfer pumps.
- PD blower that appears to serve the aerobic

The existing facility has aged, showing the need for fresh coatings, protection from exposed wires, and spot welding repairs, but it is in relatively good working order.

The comminutor is no longer utilized, and the manual bar screen appears to result in overflows periodically from the uncleaned bar screen rack. The air pattern in the aeration tank indicates relatively turbulent mixing conditions using coarse bubble diffuser design that would likely not be improved significantly with diffuser replacement. It was unclear whether the surge tank is utilized or if the surge tank transfer pumps are in working condition. The existing gaseous chlorine and gaseous sulfur dioxide systems were in working condition according to the operators (however the chemical solution feed lines were not evident).

Functionality of the Existing System

The functionality of the existing plant is similar to other activated sludge systems. However, this system is challenged by:

- **The system is seeing flows (and most likely loadings) significantly in excess of original capacity.** This results in the need to carry very high mixed liquor concentrations and to maintain a very healthy sludge age in a limited range or face challenges during wet weather to retain biomass. (Based on effluent results, it appears this is a real problem here).
- The existing clarifier has a 10’ depth and a 25’ diameter. Because the 10-State Standards require 12’ deep clarifiers, this tank is not acceptable as a secondary clarifier for activated sludge systems. At the maximum 10-State Standards surface overflow rate of 1,000 gpd/sf, the 25’ diameter clarifier can only handle peak flows up to about 490,000 gpd. The peak daily flow and peak hourly flows to the plant significantly exceed this flow rate at this time, so the clarifier is very undersized for use in an activated sludge application.
- There is only 1-large zone of treatment, and it’s difficult to make system repairs without multiple tanks to allow the system to be taken off line.
- There are no provisions evident for using the surge tank beyond overflowing the bar screen. It is currently not convenient to use the surge tank.
- There is only 1-operating blower for the aeration tank, and because it’s centrifugal and there’s no modulating inlet suction valve or VFD, it’s either on or off.

- It doesn't appear to include provisions for decanting supernatant from the digester (which is most likely undersized now).
- The contact time for disinfection appears to be limited.
- The current ownership believes the previous operator did not perform well; a new, effective operator has taken over recently.
- The use of gaseous chlorine and gaseous sulfur dioxide poses addition risks to operators and the neighboring community, and it's somewhat uncommon to many operators.
- Currently no remote monitoring is in place at the site. This makes it difficult for the operators to know when the facility is failing. Operational monitoring should be completed to monitor the quality of effluent, which should then be compared to the operating permit.

Wastewater Treatment Facility Recommended Improvements

- Because the facility receives flows and loadings in excess of current capacity (by roughly 40-50%), we believe there will be a need to upgrade the system BOD, TSS and NH3-N reduction capacity. We also believe the facility faces excessive I&I, so flow equalization and an influent pump station will be helpful to reduce demands on the final clarifier.
- The failure of the original comminutor results in the need to collect significant screenings in multiple 5-gallon buckets. We recommend the addition of a mechanically cleaned screen for this application.
- The improvements proposed to integrate the above two recommendations includes the addition of a "roughing" MBBR (targeting 70% BOD reduction in a 40 minute hydraulic retention time or 10,000 gallons); the addition of equalization with 4-hours of hydraulic retention time or 60,000 gallons and an influent pump station with variable frequency drives with an influent flow meter; the addition of metal salt addition in the EQ and clarifier to improve solids capture during wet weather, and the addition of a tertiary auto-strainer for solids separation downstream of the existing clarifier.
    - Note that a variance will be required for acceptance of the secondary clarifier due to the 10' deep tank height and the high surface overflow rate.
    - This improvement is expected to reduce peak flows to the clarifier by up to 25%
    - This improvement is expected to reduce the required mixed liquor concentration by as much as 70% without requiring modifications to the existing aeration header or blowers.
    - This improvement is expected to minimize solids carry over into the clarifier during peak flow events relative to existing conditions.
- We recommend the addition of current density baffles to the side wall of the clarifier (in addition to the above described roughing MBBR and EQ tank improvements) to improve clarifier performance and to allow for regulatory acceptance of surface overflow rates in excess of the typically allowable surface overflow rates. The new roughing MBBR could be used in conjunction with the use of the new EQ tank for temporary clarification to achieve temporary treatment during installation of the current density baffles.

- The addition of a tertiary automatic straining system will add protection for the system from BOD and TSS excursions during wet weather events.
- The use of an in-line UV disinfection system will be used to achieve compliance with the disinfection requirements. (Note that the industrial contribution could impact UVT transmittance and this should be checked over a period of several samples prior to ordering equipment).
- While the above improvements should allow a good operator to significantly improve performance, the addition of an alum feed system to promote improved solids capture during wet weather events (in both the equalization tank and in the clarifier) will provide a margin of error to allow the system to achieve considerably improved permit compliance.
- There is a potential that a second clarifier will be required at some point in the future if I/I issues increase.

Wastewater Collection System Understanding

The collection system consists of gravity sewer as well as five separate lift stations. The plant has an hourly peak flow factor of almost 6:1, so I and I is considered a large issue for the collection system and should be dealt with sooner rather than later as it is negatively affecting the plants ability to meet the effluent discharge limits enforced by Kentucky. (Note however that while the 4:1 peak day: average day flow peaking factor and the 6:1 peak hour: average day ratios cause problems within this plant, they aren't large peaking factors relative to many plants. Some degree of I/I reduction can be expected, but we are not likely to achieve 2:1 or even 3:1 peaking factors with I/I reductions).

Industrial Pump Station 1 is located directly south of the wastewater facility along Interstate 75 and conveys all of the systems wastewater to the treatment plant. The wet well is outfitted with dual 20 hp non-clog pumps from Myers and has a discharge force main diameter of 6". Moonlake Pump Station 1 conveys wastewater through 4" force main across Interstate 75 directly to Industrial Park Pump Station 1 and is outfitted with dual 25 hp pumps from Myers. The station is poorly located in terms of ease of access, which will make maintenance and upgrades difficult to perform. A list of Pump Stations with specifications for each pump is located in the Appendix.

Wastewater Collection System Recommended Improvements

- GIS shapefiles should be developed for future maintenance. System mapping at the fingertips of the operators will enhance the level of service and timing of responses to emergency and customer issues.
- Install flow monitoring, perform smoke testing, perform video inspection at selected locations, evaluate systems and create GIS based maintenance priority list to help understand and reduce the effect of I and I on the system.
- A manual transfer switch should be installed at each lift station to allow for the use of a portable generator during emergencies.

Total Project Cost Estimate

Opinion of Capital Cost Summary Delaplain WWTP		
DESCRIPTION OF WORK		**2020 Cost**
Initial Improvements		**$435,000**
Mission systems at 5 Lift Stations and Plant		$50,000
Site improvements at lift stations		$20,000
Supplemental blower addition		$43,000
MBBR, mechanical screen , EQ and Influent Pump Station addition, flow meter		
MBBR Media		$100,000
MBBR Diffusers		$12,000
EQ Tank Diffusers		$10,000
Influent Pump Station Equipment		$25,000
Influent Flow Meter		$5,000
Mechanically Cleaned Bar Screen		$45,000
Concrete and Excavation		$125,000
Secondary Improvements		**$462,000**
Install manual transfer switches (plant;5 lift stations)		$62,500
Install new electrical distribution panel		$30,000
Remove sludge from existing system and rehab clarifier and aeration tanks		$100,000
Install current density baffles		$30,000
Tertiary auto-strainer		$50,000
Strainer Feed pump system		$30,000
UV Disinfection equipment		$55,000
Alum feed system		$25,000
Building (250 sf)		$37,500
Site work and yard piping		$42,000
Total		**$897,000**

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APPENDIX

Aeration Tank

Circular Clarifier

Bar Screen

Gaseous Chlorine Storage

Industrial Pump Station 1 (INPS1)

#1 Pump - 9/11/13: Myers 4" non-clog pump, 20 hp, 230 volt, 3 phase, 10" impeller Model #4VC200M4-23, SN 10013516

#2 Pump – 5/29/18: Myers 4" non-clog pump, 20 hp, 230volt, 3phase, w/50' cord, upper & lower T.C. seals and 10" oversized impeller SN 10554284

Industrial Pump Station #2 (INPS2)

#1 Pump – 12/14/12: Meyers 4VH75M4-23, 7.5 hp, 230 volt, 26 amps, 60 hertz, 3 phase, SN 00165030.
11/2018 – extensive rebuild – Clark Electric.

#2 Pump 12/28/2018: Meyers MY 4VH75M4-23,7.5 hp, 230 volt, 3 phase, 35' cord, 8" oversize impeller. SN 10582019.

Moon Lake Pump Station #1 (ML1)

#1 pump - 2/18/15: 4RCX250M2-43-35, 25 hp 3/460 volt with 35' cable. Lower TX seal, 5.88" oversized impeller. SN 10080201

#2 pump - 5/19/14: 4RCX250M2-43-35 25HP 3/460 volt with 35' cable. SN 10246932

Moon Lake Pump Station #2 (ML2)

#1 Pump - 10/2016: Myers 4V75M4-23-35 4" sewage pump 7.5 hp, 230 volt 3 phase w/standard seals and 35'cord serial 7.5" std impeller, SN10365415.

2 Pump - 8/2017 Myers 4V75M4-23 7 ½ hp, 3 ph, 230 volt, SN 10519205

Riffton Meadows Pump Station (RM)

#1 Pump – 2007: WGX30H-21-25, 3 hp, 3450 RPM, 230 volt, 1 phase, Impeller 5" SN GX304-4-25

#2 Pump - 2007: WGX30H-21-25, 3 hp, 3450 RPM, 230 volt, 1 phase, Impeller 5"

Fox Run Utilities (Wastewater)
Engineering Memorandum
Date: December 31, 2018

Wastewater Treatment Facility Understanding

The wastewater treatment facility is made up of a standard extended aeration activated sludge facility. It doesn't appear this system has an active permit to operate. The permit appears to have expired on June 30, 2018. The plant consists of an influent pump station, aeration tank, clarifier, polishing filter, and chlorine disinfection. The aeration appeared to have a reasonable appearance for a mixed liquor however, the clarifier had a high volume of sludge with it appearing to have the sludge blanket at the surface of the water. Typically the sludge blanket would be below around 4' of supernatant clear water on the top of the clarifier. After the clarifier, the water travels to what used to be a polishing sand filter. This filter is no longer treating as originally designed but does have some filter media in the bottom per the operator. Additionally, this tankage is now acting as a contact chamber for the liquid chlorine being injected prior to discharging to the stream. (See Appendix 1 for overall picture)

Various items of concern exist as this facility. There is minimal flow equalization at this facility from the influent pump station. There is no sludge holding to waste sludge when needed.

The influent pump station will need to be overhauled in order to ensure reliability. The size of the influent pumps are unknown. The pumps will need to be pulled, inspected, and evaluated for capacity. The facility is using a flexible black hose instead of a metal and or buried pipe that will help avoid freezing and break down from sun exposure. This pipe should be replaced. Additionally, the operator believes there is inflow and infiltration issues in the system. Additional capacity should be added to the influent pump station to provide more consistent flow to the plant if additional analysis confirms this need. (Appendix Picture 2)

While the aeration appeared to be reasonable operating, standard testing parameters were not performed when we were present to determine the quality of the mixed liquor. Due to the upkeep of the remaining portions of the facility, I do not believe the diffusers have been checked and/or cleaned in some time. Additionally, in review of the EPAs Echo violations listed, the facility is starting to violate limits more often. It appears monitoring reports were not submitted for the first 3 quarters of 2018. Seeing this, it is difficult to determine the actual improvements necessary for repairs. However, I estimate the aeration tank being approximately 25'x 12'x8' deep. This would provide around 18,000 gpd capacity which is close to the 20,000 gpd capacity listed on the permit. Understanding that there are only 34 customers, I anticipate this producing a normal flow rate of around 6,800 gpd. Therefore, the aeration tank appears to be sufficient from a sewage flow rate. (Appendix Picture 3)

The clarifier is currently poorly maintained. Sludge was to the surface and the was actually had a solid appearance. As poor of a condition this facility was in during the site visit, it is difficult to determine what is salvageable. The condition of the clarifier might be an operational issue in regards to control of

the mixed liquor and return sludge flow, the clarifier is not operating at an optimal level. Some repairs recommended will consist of replacing the returns with new steel piping and installing surface skimmers. (Appendix Picture 4 & 5)

The polishing chamber receives flow from the clarifier and is currently acting like a contact chamber for disinfection. It is difficult to determine if this portion of the treatment process is performing as designed and consistent with the current operating permit.

The effluent quality looks clean as it was leaving facility and discharging into the creek.

Outside the addition of sludge holding and the addition of flow equalization to the influent pump station, we feel the capacity will be sufficient for the customers connected to the system. I do feel that the main issue with this facility will be simply operation and maintenance of the plant.

Improvements: Install flow equalization, install sludge holding, replace aeration system, replace sludge return lines and install a surface skimmer, and repair and repaint tankage to extend life of tankage.

Wastewater Collection System Understanding

Per records provided by the owner, the system has approximately 34 customers. These customers are served by a gravity sewer system. Per the operator, Inflow in infiltration is believed to be a problem on this facility. A flow meter should be installed to determine extend of the I and I problems. Funds should be invested into the collection system or the quality of the effluent will be an ongoing problem. No maps of the system were provided. The system will need to be mapped for future operation as it appeared nothing has been compiled for our review or operational maintenance purposes. The system should also be smoke tested. Video inspection is anticipated on parts of the system as well.

Improvements Required: Map the system. Install a flow meter. Smoke test and video inspect the collection system.

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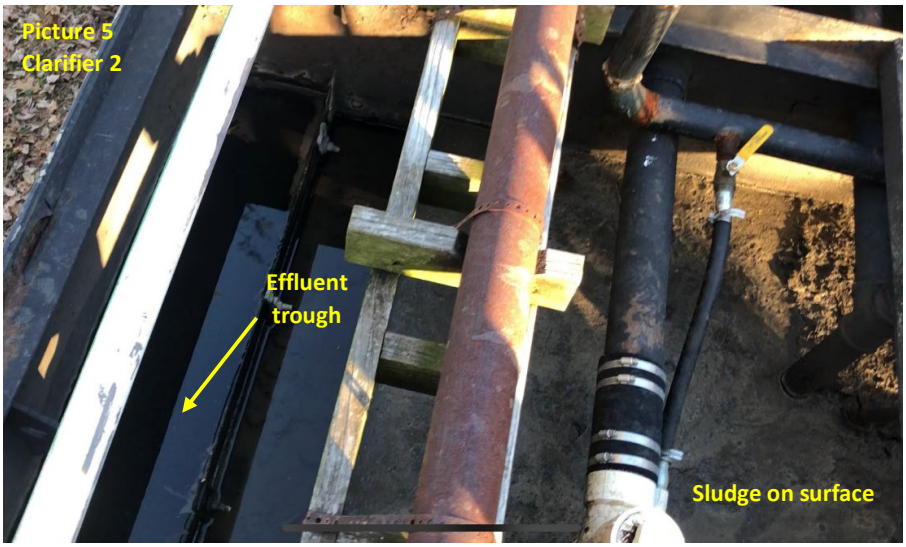
APPENDIX

Picture 1
Overall Plant

Picture 2
Influent Pump Station

Picture 3
Aeration Tank


Picture 4
Clarifier 1
Sludge on surface


Picture 5
Clarifier 2
Effluent
trough
Sludge on surface

Golden Acres-Kentucky (Wastewater, KY0044164)
Engineering Memorandum
Date: February 17, 2019

Wastewater Treatment Facility Understanding

The wastewater treatment facility is made up of a standard extended aeration activated sludge facility. It doesn't appear this system has an active permit to operate. The permit appears to have expired on February 1, 2015. The plant consists of an aeration tank, clarifier, and chlorine. (Appendix Picture 1) The facility appears to be in reasonable shape. Structure, air piping, and sludge returns appear they are still capable of functioning. However, the plant was not operating in the pictures and video provided. You will also notice that the aeration and the clarifier liquid coloration and makeup appear to be the same. The facility looks like it hasn't been operating as of lately. I performed a quick estimate of capacity. The facility's operating permit states it has capacity of 25,000 gpd. I believe the actual capacity is closer to around 18,000 gpd. It does appear that there are only about 31 houses that would be serviced by the facility. If this is the case, the facility does appear to have the capacity to treat for normal flows (without I and I problems) from the houses that are connected.

A review was performed of EPAs Echo compliance website which lists violations. Prior to the first quarter of 2018, the facility exceeded only ammonia on two quarters and E. coli on one quarter over 10 quarters of testing. After the first quarter of 2018, the plant started to exceed limits on Ammonia, DO, E. Coli, and CBOD. Observing these results and if violations occurred in this manner, I would tend to believe an equipment failure occurred at the facility or the facility has been abandoned. Keep in mind the previous note that the liquid makeup in aeration and clarifier were very similar, which would make me believe one of these two ideas is true. (See Picture 2)

While the plant appears adequate, there are a few items of concern for the facility. The facility looks to be a reasonable facility that can be salvaged. However, the facility is not operating and you can see the rock discoloration where the water level of the plant has reached. (Appendix Picture 3)

The system does have a substantial amount of rock discoloration around the plant. (Appendix Picture 3) Additionally, this appears to be a designed in approach with the facility. I and I must be exorbitant for the facility to back wastewater up approximately 2' above the tank. This design approach also causes problems with increased I and I due to its nature of sitting in a bowl. The facility's grading is built up around the facility and appears to be designed to shed overland rainwater directly into the facility. This will cause issues of overloading the plant, washing leaves into the plant and disrupting the process, and will be a liability for electrocution and potential for equipment failure. At a minimum, I would recommend to modify grades at least down to the ponding water level, but also provide flow equalization up at the front of the treatment process. I and I must be evaluated and for a facility of this size, will be detrimental for treatment as well as expense to repair.

The aeration process of the treatment facility appears to be in reasonable shape. From the coloration of the aeration liquid, I do not see a benefit in running any samples to trouble shoot the facility. However,

the facility needs to have a startup in order to provide a true evaluation. It is recommended that the diffusers be pulled and checked. Most likely they will need replaced. If sludge were to enter the piping or diffuser holes, this would cause fouling and the diffusers would need to be replaced. This is not a real expensive item to replace and can be done as a maintenance project for a reasonable cost. Blowers should be evaluated as well to determine if they have the capacity to provide the aeration needed. Again, seeing the facility meet limits for 2.5 years prior to these last couple of quarters, I would believe the blowers have the capacity if they will function. (Appendix Picture 3)

I am unable to evaluate the clarifier's functionality in the state it is in. This facility appears to not be functioning and it is not possible to evaluate. However, in estimating the capacity, it appears the volume should be sufficient to operate efficiently to meet limits for serving the estimate 31 homes. I also believe the clarifier can provide treatment for around 18,000 gpd. Again, see note above in regards to meeting limits for 2.5 years. The clarifier should be cleaned, put into operation, and further evaluated for size after actual dimensions and/or as-built drawings are provided. (Appendix Picture 4)

Minimal pictures were provided of the chlorination system that would aid in 21DG providing an opinion of its state. However, the system has violated E. coli in the past and it should be evaluated. The facility does not have a TRC limit which tends me to believe the system does not have dechlorination. You should plan for dechlorination, which is minimal cost to add to the facility. Again, this system did violate E. coli in the last few quarters but appeared to meet limits in the same 2.5 year period stated above, with the exception of one single event.

No pictures were provided of the stream or effluent but in review of the clarifier, I do not believe the facility was meeting limits during your visit.

It did not appear any monitoring was in place for this facility. I recommend Mission monitoring be installed for improvement control and access.

Improvements: Provide flow equalization, replace diffusers, regrade around the treatment plant, install new fencing due to grading, install mission monitoring, install dechlorination.

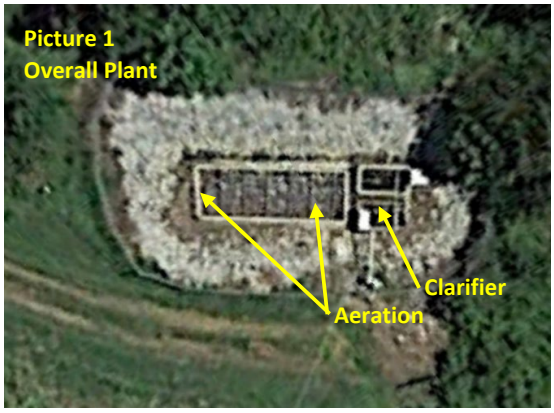
Wastewater Collection System Understanding

No information in regards to the collection system was provided to the Engineer for review to drafting this memo. It is recommended to obtain actual DMRS and/or flow data for the facility from the current owner to evaluate how bad I and I is a problem. It appears I and I is a problem due to the perimeter pictures around the wastewater facility. However, a pipe could have clogged to cause the discoloration. Additional research should be completed to determine the quality of the collection system.

No maps of the system were provided. The system will need to be mapped for future operation as it appeared nothing has been compiled for our review or operational maintenance purposes. The Engineer was not informed if this system was all gravity, pressure, or had any pump stations. The system should also be smoke tested. Video inspection is anticipated on parts of the system as well.

Improvements Required: Map the system. Install a flow meter. Smoke test and video inspect the collection system.

APPENDIX


Picture 1
Overall Plant
Clarifier
Aeration


Picture 2
Clarifier/Aeration


Picture 3
Rock discoloration/Aeration


Picture 4
Clarifier

Civil Engineering
Surveying & Mapping
Potable Water
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Civil Site Design
Construction Support
Transportation
Wastewater Collection

Great Oaks-Kentucky (Wastewater, KY0080845)
Engineering Memorandum
Date: February 19, 2019

Wastewater Treatment Facility Understanding

The wastewater treatment facility is made up of a standard extended aeration activated sludge facility. It doesn't appear this system has an active permit to operate. The permit appears to have expired on May 1, 2012. The plant consists of an aeration tank, clarifier, and chlorine. (Appendix Picture 1) The facility most likely has dechlorination due to meeting past TRC limits but I could not determine if present from the information provided. The facility has not had any preventive maintenance in a number of years. This can be seen in the excessive flaking paint and rusted metal components. The air piping and sludge returns appear to be getting by but need to be replaced. Some of this piping is PVC and will not have a long useful life as they are installed. The plant appeared to have some treatment occurring. However, the videos only showed portions of the process actually operating while other sections of the aeration appeared stagnant. Additionally, I could not see if the sludge returns from the clarifier were actually functioning. You will also notice that the wastewater facility has some vegetation growing in various portions of the facility and these will need to be removed to avoid affecting the facility process. I performed a quick estimate of capacity. The facility's operating permit states it has capacity of 70,000 gpd. I believe the actual capacity is closer to around 65,000 gpd. It does appear that there are only about 161 houses that would be serviced by the facility. If this is the case, the facility does appear to have the capacity to treat for normal flows (without I and I problems) from the houses that are connected.

A review was performed of EPAs Echo compliance website which lists violations. Prior to 2018, the facility exceeded only ammonia, E. coli, and CBOD once during the 9 previous monthly quarters. However, the first quarter of 2018, the plant started to exceed limits on Ammonia, DO, E. Coli, TRC, and CBOD. Observing these results and if violations occurred in this manner, I would tend to believe an equipment failure occurred at the facility or the facility has been abandoned. I do not believe the facility was fully operating and so it would most likely be one of these two items.

While the plant appears adequate, there are a few items of concern for the facility. The facility looks to have the capacity to serve the current customer base but has gone unmaintained for an extended period of time. The tankage will need to be sand blasted and painted to extend the life of the facility. (See Picture 2)

The influent pump station should receive some investment. The structure appears to be a manhole without the cone section and manhole lid. The actual lid is a rusted metal cap that is serving the purpose, but is failing. I'm also concerned about the emergency storage volume of this influent station. I question that if power goes out or a pump goes down, how long will your operator have to respond to the call before the station is overflowing. If I and I is bad, you could also over top the station which would also become a liability for the owner. I will recommend additional flow equalization volume at

the head of the facility and connected to the manhole. It will also be recommended to raise the top of this manhole structure and provide a property lid. (See Picture 3)

The aeration process of the treatment facility appears to be in reasonable shape. However, some portions of the tankage was either on a timer based situation or not functioning. The current owner has PVC piping installed for aeration that some of the components have already failed and have been removed. Additionally, some of the aeration piping and diffusers might be fouled up and should be replaced with a metal header to provide a more secure system. Blowers should be evaluated as well to determine if they have the capacity to provide the aeration needed. Again, seeing the facility meet limits for 9 quarters prior to the issues of 2018, I would believe the blowers have the capacity if they will function. But I will assume blower replacement in the budget. (Appendix Picture 4)

The clarifier appears to be adequate in size to provide treatment for the current customer base. While limits are not being met over the last 12 months, I feel the track record before 2018 shows the clarifier can produce a quality effluent. However, I feel the clarifier can be further evaluated after operational control is acquired. I will recommend replacing the sludge returns while the contractor is on site replacing the air header system of the aeration. (Appendix Picture 5)

Minimal pictures were provided of the chlorination system that would aid in 21DG providing an opinion of its state. However, the system was meeting limits prior to the last quarter of 2017. Therefore, I feel the system will be adequate but may need some investment to repair anything that might be damaged.

No pictures were provided of the stream or effluent but in review of the clarifier, I do not believe the facility was meeting limits during your visit.

It did not appear any monitoring was in place for this facility. I recommend Mission monitoring be installed for improvement control and access.

Improvements: Provide flow equalization, replace diffusers, replace return sludge lines, install mission monitoring, replace blowers, sand blast and repaint tankage and all metal components.

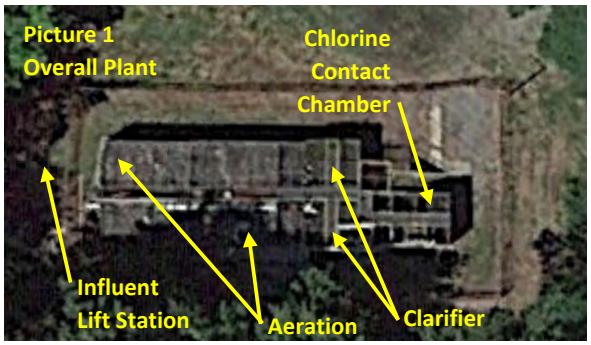
Wastewater Collection System Understanding

No information in regards to the collection system was provided to the Engineer for review to drafting this memo. It is recommended to obtain actual DMRS and/or flow data for the facility from the current owner to evaluate how bad I and I is a problem. It was discussed with CSWR that there doesn't appear to be an excessive I and I problem. Additionally, and if there were I and I problems, I would also expect to see remnants outside the influent pump station. While the influent pumps might be oversized for there use, only further investigation can provide a true recommendation to the influent flow and I and I situation at this facility.

No maps of the system were provided. The system will need to be mapped for future operation as it appeared nothing has been compiled for our review or operational maintenance purposes. The Engineer was not informed if this system was all gravity, pressure, or had any pump stations. The system should also be smoke tested. Video inspection is anticipated on parts of the system as well.

Improvements Required: Map the system. Install a flow meter. Smoke test and video inspect the collection system.

APPENDIX




Picture 5
Clarifier

Civil Engineering
Surveying & Mapping
Potable Water
Wastewater Treatment

21 DESIGN

Civil Site Design
Construction Support
Transportation
Wastewater Collection

Herrington Haven Subdivision – Herrington Haven WWTP KY0053431 Kentucky
Engineering Memorandum
Date: September 11, 2020

Introduction

The Herrington Haven wastewater treatment facility is located in Lancaster, Kentucky approximately 5 miles northeast of Danville, Kentucky. This facility services 21 parcels. The system operates under Kentucky DEP Permit number KY0053531 and Agency ID number 3901.

Wastewater Treatment Facility Existing Conditions

The plant is authorized to discharge up to 9,800 gallons per day (gpd) by the KDEP per the operating permit.

A summary of the existing permit limits are described below:

- BOD5 – 30/45 mg/L (Monthly average/Maximum Weekly Average)
- TSS – 30/45 mg/L
- NH3-N – 20/30 mg/L
- E-Coli – 130/240 mpn/100 ml
- Total Residual Chlorine – 0.011/0.019 mg/L
- Total Phosphorus – Report Only
- Total Nitrogen – Report Only
- Dissolved Oxygen – 2.0 mg/L minimum

The subdivision has 19 occupied residences out of the 21 parcels, so little additional growth in flow or loading is expected. Based off of the number of possible connections and assuming 375 gpd of flow per customer, we expect to reach the 7,875 gpd when the entire subdivision is occupied, so the 9,800 gpd of capacity would seem to be adequate.

A review was performed of EPAs Echo compliance website which lists violations of wastewater treatment plants across the country. The Herrington Haven wastewater treatment plant has exceeded permit limitations several times in recent

months and years for E-Coli, Total Residual Chlorine and Total Phosphorus. Note that the permit shown on the KYDEP website indicates that Total Phosphorus levels are to be reported but there is no limit; however, the EPA Echo website describes effluent limit exceedances for Total Phosphorus. Additional research will be required to understand this discrepancy.

The existing facility includes an extended aeration package plant including a mechanically cleaned bar rack screen, a single aeration basin, two hopper bottomed clarifiers, and a chlorine contact tank. Downstream of the packaged plant there is a V-notched weir box that is used for dechlorination contact time and flow monitoring.

The packaged plant has aged and shows significant signs of wear and corrosion. The blowers and diffusers are in need of replacement, and one of the two RAS lines has broken off into the aeration basin. The access platform became dangerous to use and has since been removed. The basin does not include handrail needed to protect operators or visitors from falling into the package plant.

Functionally, the system also has some limitations:

- The plant was installed behind retaining walls on 3 of 4 sides and includes very limited perimeter property boundary, with little room to work or add improvements.
- The plant is theoretically above the flood elevation (which exists just southwest of the plant), but the plant has historically flooded several times according to operators.
- The facility has somewhat limited site access for bringing in drums of liquid chemicals (if metal salt addition or disinfection chemicals are required).
- According to operators, the all gravity collection system results in significant I&I, impacting system performance.
- The system does not include aerobic digestion / sludge storage to allow for routine wasting or maintenance of a healthy mixed liquor concentration throughout the year.
- The blower has reached the end of its useful life.
- The operator believes it is necessary to turn off aeration during wet weather events to minimize the loss of solids and to retain a healthy biomass.
- The clarifier influent and effluent each enter/exit through a single pipe, and the clarifier level control is with a horizontally placed pipe (no weir), so there's poor flow distribution through the clarifier surface area that exists.
- There is no ideal place for chlorine tablet addition or dechlorination tablet addition.
- The apex of the V-notch weir used for flow monitoring was submerged during the site visit, making any reading from it inaccurate. (The ultrasonic flow meter was also located downstream of the V, so the system installation is incorrect).
- The V-notch weir structure is located offsite (outside of the property limits) and within the flood zone.

The wood fencing around most of the site is generally in good shape.

Currently no remote monitoring is in place at the site. This makes it difficult for the operators to know when the facility is failing. Operational monitoring should be completed to monitor the quality of effluent, which should then be compared to the operating permit.

Wastewater Treatment Facility Recommended Improvements

- The condition of the tank calls for taking the facility off line for structural repair, at a minimum to include the addition of either supplemental or replacement stiffeners, safety handrail, welding repairs, and the addition of a new RAS line from one of the hopper bottomed clarifiers to the front end of the plant.
- A new roughing MBBR in the form of a 4-foot diameter, 11-foot deep manhole will be installed upstream of the existing influent manhole to remove BOD, reducing the load and in turn stabilizing the existing system and improving nitrification.
- The new system will generate significantly less sludge than previously, so sludge handling needs will significantly decrease.
- The 10' foot deep clarifier will function much better in this application than with only the existing activated sludge system, as the roughing MBBR will reduce the amount of activated sludge mixed liquor required to meet effluent objectives. This will reduce the risk of solids carry over during wet weather significantly.
- The effluent from the aeration basin will be evenly distributed into and through the clarifier, and the level control in the clarifier will be maintained with the addition of a weir trough and weir.
- Aluminum sulfate (alum) will be introduced in the extended aeration effluent, upstream of the influent into the clarifier.
- A flow meter will be installed in the clarifier effluent piping, in route to the contact tank.
- Peroxyacetic acid will be introduced directly into the contact tank in lieu of attempting to install chlorination and dechlorination tablet feeders in the limited hydraulic profile. The PAA chemical requires less contact time, and will more consistently achieve the necessary disinfection objectives.
- The existing chlorine contact tank will be equipped with diffusers to help in meeting the dissolved oxygen effluent limit.

The blowers will be replaced and serve the roughing MBBR, extended aeration system, and post-aeration system.

Wastewater Collection System Understanding

While no mapping was provided, the collection system consists of only gravity collection.

According to the operator, the collection system consists of 8" and 10" gravity sewers, and the high groundwater table results in significant peak flow events at the facility. Wastewater enters the wastewater treatment plant through a gravity sewer.

Wastewater Collection System Recommended Improvements

- The system should be evaluated to create mapping and develop GIS shapefiles for future maintenance. System mapping at the fingertips of the operators will enhance the level of service and timing of responses to emergency and customer issues.
- Perform smoke testing, perform video inspection at selected locations, evaluate systems and create GIS based maintenance priority list.

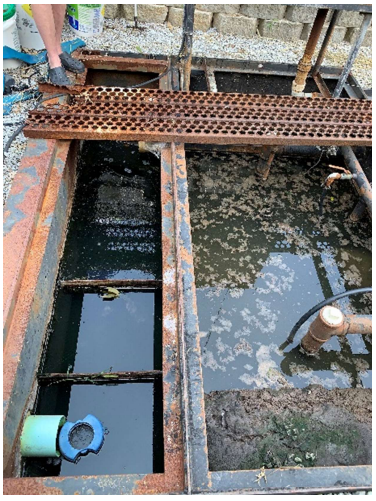
Total Project Cost Estimate

Opinion of Capital Cost Summary
Herrington Haven, KY

DESCRIPTION OF WORK	2020 Cost
Initial Improvements	**$30,000**
Install Mission monitoring - plant	$15,000
Blower replacement	$14,000
Temporary RAS line addition	$3,000
Secondary Improvements	**$147,200**
Install manual transfer switch in electrical service	$7,500
Install new electrical distribution panel	$12,000
Remove sludge from existing system and rehab	$20,000
Install Roughing MBBR Manhole	$20,000
Install MBBR media, sieves, diffusers	$50,000
Install Aluminum Sulfate feed and storage system	$12,000
Install Peroxyacetic Acid feed and storage system	$18,000
Install flow meter	$3,200
Install aeration in existing contact chamber	$4,500
Total	**$177,200**

APPENDIX

Aeration Tank, Clarifier, Contact Tank



Clarifier and Contact Tank

Manually Cleaned Bar Screen

WWTP Electrical Meter

Civil Engineering
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Potable Water
Wastewater Treatment

21 DESIGN

Civil Site Design
Construction Support
Transportation
Wastewater Collection

Kingswood Kentucky (Wastewater, KY00101419)
Engineering Memorandum
Date: April 2, 2019

Wastewater Treatment Facility Understanding

The wastewater treatment facility is made up of a standard extended aeration activated sludge facility. The permit does have an active permit that authorizes to discharge until midnight, July 31, 2019. The facility appears to consist of an aeration tank, comminutors at the influent for breaking down solids, aerobic digestion in the sludge digestor, clarifier, ultraviolet disinfection followed by post aeration. The facility appears to have a good quality structure with adequate capacity to serve the customers. I performed a quick estimate of capacity and it appears the structures are adequate for the 124 customers currently connected to the system.

A review was performed of EPAs Echo compliance website which lists violations. Prior to July 1, 2017, the system appeared to be a regular offender of violations in regards to effluent limits. It does appear that the facility has improved but am unaware if this was due to improvements made or possibly a new operational service taking over at the facility. Again, the system still appears to be exceeding limits but violations are more sporadic. Since July 1, the facility has had violations in 4 of the 7 quarters, which consisted of violations of TSS, Ammonia, E. coli, and BOD. Understanding that the tankage and piping appear to be adequately sized, I would tend to believe that the system violations may be more from operational issues rather than capacity of facility.

Further evaluating the facility capacity, the operating permit states 40,000 gpd capacity. Estimating sizes of the units from photos, I would believe the facility has this capacity. Lastly and from our experience on facilities this size, I would tend to believe the typical user has a daily flow rate between 150 gpd to 200 gpd. Using 200 gpd as a conservative number, I would estimate the daily flow from 124 customers to be around 24,800 gpd. Keep in mind that some permitting entities recommend a design flow rate of anywhere from 350 gpd to 400 gpd per home for new systems. If existing flow is available, that can typically be used and I recommend a new magnetic flow meter to track this flow. However, the system is believed to have excess capacity and should not have a problem meeting limits on a more consistent basis if properly maintained.

The aeration tankage appears to be adequately sized from the preliminary investigation discussed above. Furthermore, it is standard for CSWR operators to regularly verify the aeration diffusers are clean. Additionally, daily monitoring and testing is completed to further confirm their facilities are operating where desired. No data was provided but I can only assume the standard CSWR operator protocols are not being completed.

The clarifier appears to be working properly. The facility has only violated TSS limits in two of the last 7 quarters. While this might also be an operational issue in regards to control of the mixed liquor and

clarifier maintenance/cleanliness, the clarifier is not operating at an optimal level. The clarifier should be cleaned as well as evaluated for size after actual dimensions and/or as-built drawings are provided.

Minimal pictures were provided of the facility that would aid in 21DG providing an opinion of its state. I recommend that an additional site visit be completed prior to finalizing evaluation and improvements necessary. While it does appear the area inside the fence and the around the facility is reasonably maintained during the site visit by CSWR, the treatment facility inconsistency at meeting limits would again make me believe this facility has an operational issue that can be overcome.

The effluent quality looks clean as it was discharging to the stream. There was minimal signs of residue in the stream that can most likely be eliminated with better quality control on the operational side of the facility. (Appendix Picture 4)

It did not appear any monitoring was in place for this facility. I recommend Mission monitoring be installed for improvement control and access.

The shed appears to be all brick with asphaltic shingles. It appears it is in reasonable shape but will need a roof and gutter inspection on the next site visit. At a minimum, it looks like the roof will need replaced in the near future. The structure appears to be acting as the blower housing to keep them out of the weather as well as sound reduction for the adjacent homes.

Access appears to be in good shape and will allow ease of maintenance and upgrades in the future.

Improvements: Pull and inspect diffusers and possible replacement. Install Mission monitoring and a new magnetic flow meter. Minor cleanup and repair of roof on storage/blower house. Perform various operational improvements that will likely allow the facility to return to meeting effluent limits.

Wastewater Collection System Understanding

No information in regards to the collection system was provided to the Engineer for review to drafting this memo. It is recommended to obtain DMRS and/or flow data for the facility from the current owner to evaluate if I and I is a problem. If the owner is knowledgeable on wastewater systems, they may also be able to shed some light on if I and I is a problem. This would be adequate to start our evaluation period until actual flow monitoring and smoke testing of the system is completed.

No maps of the system were provided. The system will need to be mapped for future operation as it appeared nothing has been compiled for our review or operational maintenance purposes. The Engineer was not informed if this system was all gravity, pressure, or had any pump stations. However, the annual reports show that most of the collection system is 4" PVC, which would make me believe it is a low pressure system. Further investigation is needed, but if it is determined the system is gravity, the system should also be smoke tested. Video inspection is anticipated on parts of the system as well.

Improvements Required: Map the system. Install a flow meter. Determine if system is gravity or low pressure and decide if smoke testing and video inspection of the collection system is warranted.

Civil Engineering
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Wastewater Treatment

21 DESIGN

Civil Site Design
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Transportation
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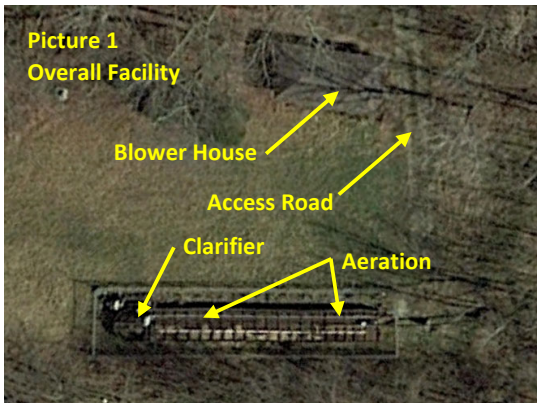
APPENDIX



Civil Engineering
Surveying & Mapping
Potable Water
Wastewater Treatment

21 DESIGN

Civil Site Design
Construction Support
Transportation
Wastewater Collection

Lake Columbia-Kentucky (Wastewater)
Engineering Memorandum
Date: December 28, 2018

Wastewater Treatment Facility Understanding

The wastewater treatment facility is made up of a standard extended aeration activated sludge facility. The system has an active operating permit that is set to expire on November 30, 2019. The plant consists of an influent splitter/bar screen box, aeration tank, clarifier, and chlorine disinfection. Upon entering the site, it is very visible the plant is in disarray and is not being managed properly. Therefore, and through a combination of the actual structure and continual operational maintenance, the system has failed. This facility is a continual contamination and is surprising that any of the limits are being met. In review of the Echo website hosted by the EPA, the system has well exceeded the ammonia limits of the permit for a minimum of 12 consecutive testing periods. Additionally, the system violated CBOD, Chlorine residual, E. coli, Ammonia, and TSS. It shall also be noted that the system has been written up for violations consisting of Improper Operation and Maintenance, failure to notify, 25 counts of late and missing DMR measurements. (See Appendix 1 for overall picture)

This facility has seen it's useful life and needs a complete overhaul and/or replacement.

There is no flow equalization at this facility. The incoming gravity flow enters directly into a bar screen box structure that has failed and the bar screen has been removed. (Appendix Picture 2.) This structure should be repaired.

The aeration tank sits above the surface. It has a number of large rust holes that show obvious signs of failure. These holes could be patched. However, I have concerns on the integrity of the remaining structure as it is not typical for the plant to rust completely through to this extent. (Appendix Picture 3.) Additionally, the facility liquid in no way has a resemblance of a mixed liquor. Items that should have been caught by the bar screen are piled on the surface of the water. The facility was not running upon arriving or leaving the site. I believe this portion of the treatment facility has completely failed. (Appendix Picture 4.)

The clarifier has received a number of patch repairs. The baffle for the effluent consists of treated lumber held in place by vise-grips on a rusted through baffle. (Appendix Picture 5.) The clarifier sludge returns were not running while we were on site. The operator did turn on the skimmer temporarily while we were there and it appeared working. However, the integrity of the structure and piping is in poor shape. The wiring of the control panel is exposed, not fastened, and is a safety issue for anyone working on this facility or on the plant. (Appendix Picture 6.)

The contact chamber does not have typical baffling and may experience short circuiting. This facility has seen violations of both residual chlorine and E. Coli. This facility is obviously struggling to meet limits with it's current setup. Upgrades should consist of converting to ultraviolet. (Appendix Picture 7)

The effluent quality is very poor. There were remnants of toilet paper on the banks of the receiving stream. (Appendix Picture 8)

Improvements: This plant will need major reconstruction. Various processes will need to be evaluated. I anticipate an entire new treatment facility with possible reuse of the existing facility as flow equalization. Additionally, the system should include a new bar screen with flow meter. The chlorine contact chamber should be abandoned and ultraviolet disinfection would be recommended.

Wastewater Collection System Understanding

Per records provided by the owner, the system has approximately 33 customers. These customers are served by a gravity sewer system that was once a mobile home park. From my experience, collection systems from mobile home parks are typically poorly maintained and constructed. Inflow and infiltration will be a problem. This was confirmed by the operator in our discussions. No maps of the system were provided. The system will need to be mapped for future operation as it appeared nothing has been compiled for our review or operational maintenance purposes. The system should also be smoke tested. Video inspection is anticipated on parts of the system as well.

Improvements Required: Map the system. Install a flow meter. Smoke test and video inspect the collection system.

APPENDIX

Picture 1
Overall Plant

Picture 2
Influent bar

Picture 3
Failing structure

Picture 4
Solids in aeration

Picture 5
Effluent baffle

Picture 5
Blower and controls

Picture 7
Contact Chamber

Picture 8
Toilet Paper at effluent

LH Treatment-Kentucky (Wastewater, KY0081591)
Engineering Memorandum
Date: February 17, 2019

Wastewater Treatment Facility Understanding

The wastewater treatment facility is made up of a standard extended aeration activated sludge facility. It doesn't appear this system has an active permit to operate. The permit appears to have expired on December 31, 2018. The plant consists of an aeration tank, clarifier, and chlorine disinfection with dechlorination. (Appendix Picture 1) The facility appears to have a good quality structure, air piping, sludge returns, and capacity to continue to be efficient towards treatment. I performed a quick estimate of capacity and it appears the structures are adequate for the 276 customers currently attached.

A review was performed of EPAs Echo compliance website which lists violations. Prior to July 1, 2017, the system appeared to be a regular offender of violations in regards to effluent limits. It is my understanding they recently completed upgrades to the facility and total performance has improved. However, the system still appears to be exceeding limits but violations are more sporadic. In 2018, the facility violated CBOD, TRC, E. coli, Ammonia, DO and TSS as least once. Understanding that the tankage and piping appears to be efficiently laid out and seems in good quality with adequate capacity, I would tend to believe that the system violations may be more from operational issues rather than capacity of facility.

While the plant appears adequate, there are a few items of concern for the facility. The facility looks relatively new and in reasonable shape. However, the system continues to violate at least one limit each testing period.

The aeration process of the treatment facility appeared to have a reasonable mixed liquor. However, standard operational testing has not been provided to us for evaluation on the operational control of the facility. Daily testing should be completed until an understanding of the facility is clear. Additionally, I'm not aware of the current operator's maintenance practice. The diffusers should be pulled from the tank and inspected in case they have fouled due to not performing preventative maintenance. While the aeration tank mixed liquor looked reasonable, it is obvious consistent operation control is not occurring. (Appendix Picture 2)

The clarifier appears to be working properly. However, the supernatant water of the clarifier appeared to have a large amount of floc releasing and/or coming to the surface. While this might also be an operational issue in regards to control of the mixed liquor and sludge returns, the clarifier is not operating at an optimal level. Allowing floc to discharge the facility can lead to surpassing the limits imposed on the facility. As discussed above, various limits were exceeded in 2018. Avoiding excessive floc in the clarifier is vital in maintaining a healthy facility. Additionally, the effluent trough appears to have some green algae attached to the bottom, which if not cleaned, may build up and cause issues with

effluent samples periodically. The clarifier should be cleaned as well as evaluated for size after actual dimensions and/or as-built drawings are provided. (Appendix Picture 3)

Minimal pictures were provided of the chlorination system that would aid in 21DG providing an opinion of its state. However, the system has violated E. coli and TRC in the past year and they should be evaluated. Again, these violations could be due to poor operational and maintenance practices.

The effluent quality looks clean as it was discharging to the stream. There were no signs of sludge or buildup in the stream. (Appendix Picture 4)

It did not appear any monitoring was in place for this facility. I recommend Mission monitoring be installed for improvement control and access.

It also appeared that the shed needed to be cleaned up. Various supports are not conventional and consist of buckets and wood holding up some piping. Sunlight is also coming through the walls that will tend to let rain into the building. This will allow the building to deteriorate faster than desired. Insulation appears to be failing and should be repaired. The shed should be cleaned up to allow better access and conventional supportive items.

Improvements: Pull and inspect diffusers and possible replacement. Install Mission monitoring. Clean up shed for adequate installation and cleaner environment. Perform operational improvements that will likely allow the facility to return to meeting effluent limits.

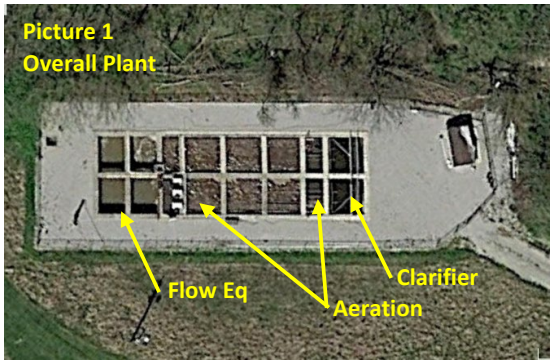
Wastewater Collection System Understanding

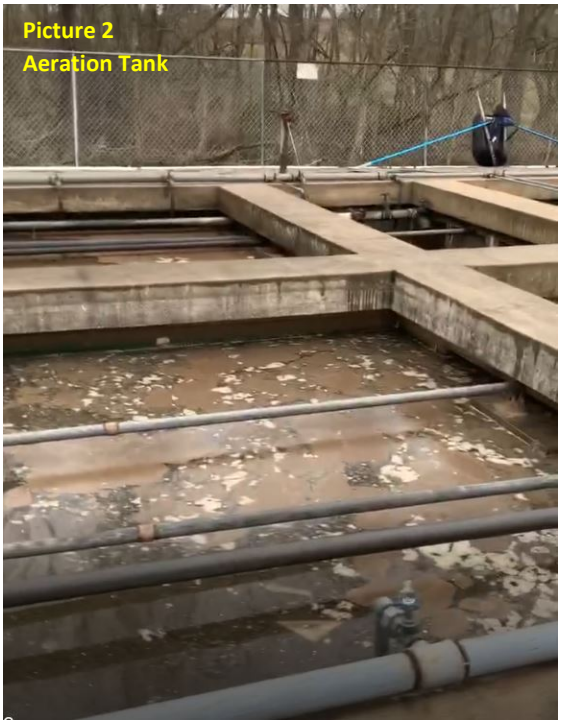
No information in regards to the collection system was provided to the Engineer for review to drafting this memo. It is recommended to obtain DMRS and/or flow data for the facility from the current owner to evaluate if I and I is a problem. If the owner is knowledgeable on wastewater systems, they may also be able to shed some light on if I and I is a problem. This would be adequate to start our evaluation period until actual flow monitoring and smoke testing of the system is completed. The system does have a flow meter installed at the effluent and it is recommended to get access to the data that is being compiled.

No maps of the system were provided. The system will need to be mapped for future operation as it appeared nothing has been compiled for our review or operational maintenance purposes. The Engineer was not informed if this system was all gravity, pressure, or had any pump stations. The system should also be smoke tested. Video inspection is anticipated on parts of the system as well.

Improvements Required: Map the system. Install a flow meter. Smoke test and video inspect the collection system.

APPENDIX


Picture 1
Overall Plant
Flow Eq
Aeration
Clarifier


Picture 2
Aeration Tank


Picture 3
Clarifier


Picture 4
Effluent

Civil Engineering
Surveying & Mapping
Potable Water
Wastewater Treatment

21 DESIGN

Civil Site Design
Construction Support
Transportation
Wastewater Collection

Marshall Ridge (Wastewater) – No discharge/No permit
Engineering Memorandum
Date: October 5, 2019

Wastewater Treatment Facility Understanding

The Marshall Ridge wastewater treatment facility is located in West Paducah, KY. The plant services about 40 customers which is approximately 120 people. The facility consists of a no-discharge lagoon.

The facility does not have a discharge permit and has minimal oversight from permitting entities. The Kentucky Department of Environmental Protection governs wastewater permits with discharges but does not have any oversight on non-discharging systems such as this facility. The KDEP leaves management and oversight up to the local Health Departments. In speaking with head of the Health Department in this county, they will perform field inspections only when a complaint is filed. Therefore, we recommend investigation with the Health Department for quantity and relevance of complaints in the near future. Conversations with the head of the Health department made me believe they have construction plans for this system in their files. However, he didn't have time to research the files at the prior to drafting this memo.

During our visit to the lagoon, various site components were showing signs of failure and minimal maintenance. The two cell Lagoon has limited access. The perimeter fencing needs repairs at multiple locations. The berms have multiple varmint holes that are compromising the integrity of the lagoon berm. The lagoon itself has erosion around the inner edge and has overgrown brush on the inner berms that needs removed. While we did not have construction plans with us during our site, visit, I recommend bringing plans and comparing them to the onsite features. It appears the lagoon system is followed by a lateral field for sub-surface discharge. Remnants of construction debris and/or repair materials were in the woods in the vicinity I would anticipate the drainage field.

This facility does not have an operating permit. It also does not have any monitoring or testing limits imposed on the facility that need to be reported. Therefore, this system does not show up in the EPA's Echo website for evaluation.

Improvements: The perimeter fence needs repair. Inspection of the lateral field should be completed and compared to any design plans that the Health Department may have. Remove overgrowth from the inside of the lagoon berms. Repair inside berms where erosion is occurring.

Wastewater Collection System Understanding

The collection system flow gravity feeds to the lagoon from the Marshall Ridge neighborhood. No other information regarding the collection system was provided to the Engineer for review to drafting this memo. We recommend researching the Health Department's files to see if they have construction plans for the collection system.

Improvements Required: Perform smoke testing, evaluate system and create GIS mapping for future maintenance needs. Research Health Department files.

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Wastewater Treatment

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Civil Site Design
Construction Support
Transportation
Wastewater Collection

21 Design Group, Inc.
1351 Jefferson St, Suite 301
Washington, MO 63090

Persimmon Ridge (Wastewater)
Engineering Memorandum
Date: December 31, 2018

Wastewater Treatment Facility Understanding

The wastewater treatment facility is made up of a two cell aerated lagoon system with chlorine disinfection. It doesn't appear this system has an active permit to operate. However, the proposed permit was on public notice with comment due date of July 26, 2018. I'm not aware if they received any comments from the public on this system. The first cell is fully aerated while the second cell is partially aerated. The second cell also has a baffle spanning the lagoon cell to create a non-aerated or anaerobic zone that can help reduce solids in the effluent. From the anaerobic zone, the lagoon effluent has liquid chlorine added for disinfection prior to the contact chamber. Overall, the appearance of the lagoon looks well maintained. (See Appendix 1 for overall picture)

Various items of concern exist as this facility. However, the main concern for this facility is that it will not be capable of meeting permit limits for ammonia on a consistent basis. The incoming flow enters the system through a pump station with a flow meter. Data was not provided to 21 Design Group, Inc. for review and analysis at the time of drafting this memorandum.

The first lagoon cell had four aerators functioning upon the site visit. One additional aerator was removed from the lagoon cell and sitting on the lagoon bank. Lagoon systems are typically designed to have all equipment functioning. This aerator needs to be repaired and placed back into service. Additionally, I reached out to the operator and they do have issues with the first aerator which gets pulled every other month due to being fouled up with rags. Operational changes should be made to reduce the fouling up of the aerator. (Appendix Picture 2, 3, & 4)

The second lagoon cell has 3 aerators in the cell. However, none of them were running during the site visit. Lagoon systems are typically designed to have all equipment functioning. Additionally, the lagoon cell is mostly covered with duckweed. Duckweed does have pros and cons for existing within a lagoon. It can help remove nutrients and keep algae blooms. Alternatively, duckweed will reduce dissolved oxygen levels and will die off returning some of the nutrients to the lagoon as sludge at the bottom of the cell. As duckweed breaks down on the bottom of the cell, it could release ammonia to cause problems with sampling. Duckweed prefers stagnant water and does not like surface aeration. Therefore, if the aerators were all functioning, the amount of duckweed would be less. If the aerators were all functioning, the duckweed would be reduced and make it easier to control. Additionally, aeration can also reduce algae blooms as well. The owner should evaluate the existence of the duckweed and decide if it is beneficial at this facility. In review of the aerator layout, one of the aerators in the final cell is downstream of the baffle. The owner should evaluate the design and effluent quality to determine if this aerator should be up stream of the baffle. (Appendix Picture 5)

Next to the contact chamber, the liquid chlorine is housed in a small equipment shed. The contact chamber should be evaluated for capacity to provide contact time. In conversations with the operator after the site visit, they stated she is constantly adjusting the chlorine feed pump flow rate based on lagoon effluent flow. Chemical usage is either wasted or under chlorinated. The system should be modified to either utilize ultraviolet disinfection or setup to automatically adjust chlorine pump. The operator stated that they have struggled to meet disinfection requirements in the past and feel it was due to the chlorine dosage levels not being sufficient for disinfection. Additionally, the blower was operating providing some re-aeration in the contact chamber prior to discharging. (Appendix Picture 6)

The discharge pipe was recently installed that removed the irrigation lake from being a part of the treatment process. This is consistent with the proposed permit that has yet to be issued by the state. In conversations with the operator, the owner/operator had concerns that the lagoon wildlife and overland flow coming into the irrigation lake may have been causing contamination issues on their DMRs. Therefore, they felt direct discharge would help bring the effluent quality closer to consistently meeting limits. At the time of the visit, the effluent discharge was almost directly on soil and should have some type of erosion protection. Additionally, the effluent appeared to have an algae problem. The owner should look to have the aeration operating in the final cell to reduce the potential for algae blooms in the wastewater prior to discharging. (Appendix Picture 7)

The system aeration appears to be having issues with keeping aerators in operation. Additionally, over time, equipment becomes less efficient. The owner should replace the aerators to provide better treatment within the lagoon systems. This will improve the effluent quality while reducing sludge build up. Lagoon sludge levels were not provided at the time of the site visit.

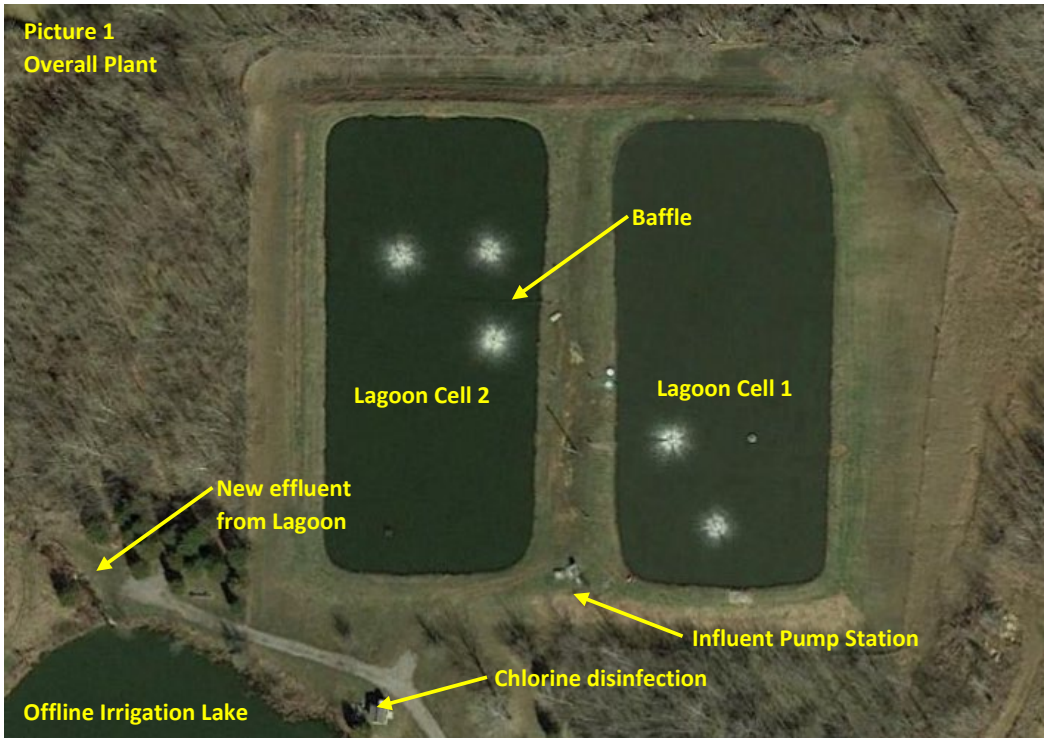
Improvements: Replace surface aerators with a more efficient system, evaluate sludge levels within the lagoon, evaluate electrical service for any aeration modifications, modify programming and electrical to either install an ultraviolet unit or auto-adjusting chlorine pump, and install rip-rap protection at effluent into creek.

Wastewater Collection System Understanding

Per records provided by the owner, the system has approximately 355 customers. These customers are served by a gravity sewer system that includes five pump stations. A gravity collection system will have inflow and infiltration issues. The extent is unknown and data wasn't provided to 21 Design Group, Inc. at the time of the inspection. The treatment facility being a lagoon system has a large volume of storage that reduces peaks that wastewater facilities struggle to treat. However, funds should be invested into the collection system. If the collection system continues to degrade, I and I from the collection system can become excessive and does increase the equipment size and costs on future treatment. General system mapping was provided. The data should be evaluated for accuracy and made more accessible to the operator for ease of use. The system should also be smoke tested. Video inspection is anticipated on parts of the system as well.

Improvements Required: Review system mapping for accuracy. Smoke test and video inspect the collection system.

APPENDIX


Picture 1
Overall Plant
Baffle
Lagoon Cell 2
Lagoon Cell 1
New effluent
from Lagoon
Influent Pump Station
Chlorine disinfection
Offline Irrigation Lake

Civil Engineering
Surveying & Mapping
Potable Water
Wastewater Treatment

21 DESIGN

Civil Site Design
Construction Support
Transportation
Wastewater Collection


Picture 2
Cell 1


Picture 3
Cell 1 at influent


Picture 4
Aerator on bank


Picture 5
Cell 2 - Non-operating aerator


Picture 6
Disinfection with re-aeration


Picture 7
New effluent

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Randview (Wastewater) – No discharge/No permit
Engineering Memorandum
Date: October 7, 2019

Wastewater Treatment Facility Understanding

The Randview wastewater treatment facility is located in western Kentucky on the west side of Mayfield. The plant services about 54 customers which is approximately 162 people. The facility consists of a no-discharge lagoon.

The facility does not have a discharge permit and has minimal oversight from permitting entities. The Kentucky Department of Environmental Protection governs wastewater permits with discharges but does not have any oversight on non-discharging systems such as this facility. The KDEP leaves management and oversight up to the local Health Departments. In speaking with head of the Health Department in this county, they will perform field inspections only when a complaint is filed. Therefore, we recommend investigation with the Health Department for quantity and relevance of complaints in the near future. Conversations with the head of the Health department made me believe they have construction plans for this system in their files. However, he didn't have time to research the files at the prior to drafting this memo.

During our visit to the lagoon, various site components were showing signs of failure and minimal maintenance. The system is setup oddly of two lagoon cells that are approximately 2,000 feet apart. A representative of the sewer system stated that one of the lagoons has a lift station at the effluent that pumps to the second lagoon cell. Investigation will be needed to determine capacity of the components to determine if the system can function as it is today. The two Lagoon cells have limited access due to minimal maintenance around the perimeters of each lagoon cell. Heavy vegetation berm cutting will be needed to avoid possible failure and/or leaking of the lagoons. From pictures, we were unable to evaluate the integrity of the berms. The perimeter fencing needs repairs at multiple locations. I recommend researching the health department for construction plans and then comparing them to the onsite features. While the lagoon cells appear small to simply be stand along lagoons losing wastewater by simply evaporation, I believe the system most likely has a drainage field applying the flow sub-surface after pretreatment from the lagoons.

This facility does not have an operating permit. It also does not have any monitoring or testing limits imposed on the facility that need to be reported. Therefore, this system does not show up in the EPA's Echo website for evaluation.

Improvements: Remove all berm vegetation for further inspection and possible repair. The perimeter fence needs repair. Inspection of the discharge to determine if the system has a lateral field and compare to any design plans that the Health Department may have. Repair inside berms where erosion is occurring.

Wastewater Collection System Understanding

The collection system flow gravity feeds to the lagoon from the Randview neighborhood. No other information regarding the collection system was provided to the Engineer for review to drafting this memo. However, we recommend researching the Health Department's files to see if they have construction plans for the collection system.

Improvements Required: Perform smoke testing, evaluate system and create GIS mapping for future maintenance needs. Research Health Department files.


Tree fallen on lift station


Unmaintained Lagoon

River Bluff (Wastewater) – KY0043150
Engineering Memorandum
Date: October 5, 2019

Wastewater Treatment Facility Understanding

The River Bluff wastewater treatment facility is located in River Bluff, KY approximately 10 miles northeast of Louisville and serves 180 customers which is approximately 540 people. During our visit to the plant, various site components were showing signs of failure and aging. The plant has had multiple effluent violations in the recent past, however most of them are not much higher than their respective limits.

The plant is an activated sludge system with grinding, activated sludge, chlorine disinfection, and dichlorination. The metal tanks holding the wastewater treatment components are showing various signs of aging, and all of them are developing severe amounts of rust. All the control panels on site seem to be in declining condition and will need electrical inspections to ensure they meet all safety requirements. Most will probably need to be either repaired or replaced. The system currently has two blowers installed, and both need to be inspected and either replaced or repaired if necessary. There is an influent lift station. An inspection should be completed after acquisition to determine shape of pumps as well as if they are the properly installed. The return, skimmer, influent, and effluent lines appear to be PVC. Some of the older returns are still in place but appear to have corroded to a level that would deem them inoperable. An inspection of each line should be completed upon startup and replaced as needed.

The facility's influent pipe appears to be laying across the chainlink fence and held down by the 3 strand barb wire. This is not a typical installation. The pipe should be properly buried to avoid freezing, sun damage of the PVC, and to protect the system from vandalism.

This facility is utilizing chlorine disinfection. If the amount of chemicals is properly controlled, it can continue to be a viable disinfection treatment system. However, if chemical usage and costs continue to rise, the owner may need to consider ultraviolet disinfection. This should be considered after operational control is assumed and an evaluation on true cost of chemicals. Additionally, not everyone is properly trained to use chlorine gas and this should be evaluated for safety reasons of future operations.

The estimated flow is about 66,000 gallons according to the effluent discharge permit. In evaluating the number of customers connected, I would anticipate existing flow being around 30,000 to 35,000 gpd. If the facility was constructed consistent with the capacity listed on the permit, the system should have excess capacity. Before selecting the blower and or pump replacements, a hydraulic analysis should be completed to select the proper equipment for the application.

It is evident that operations are struggling to maintain the plant. No remote monitoring is in place at the site which makes it difficult for the operators to know when the facility is failing. We recommend a mission remote monitoring system which will give information such as pump failure, blower failure, and high-level alarms. A generator quick connect should also be added to the plant to provide electricity during power outages which would ensure the plant can run 24/7.

A review was performed of EPAs ECHO compliance website which lists prior violations issued to the system. According to the ECHO report, it has multiple effluent violations in recent history, however, none of them are major, and the plant is doing a reasonable job of treating wastewater.

In the future, after operational control is taken by Central States Water Resources, I recommend pulling aerations and diffusers for an inspection. If an annual inspection program is put in place, diffuser replacement can be drastically reduced and overall system performance improved. Due to the low quality of preventative maintenance performed on the site equipment, it is estimated that many of the air diffusers will be needing a replacement.

Improvements: Due to the extent of the failure to maintain the systems by the previous owners, I recommend the improvements be staged. The first phase of improvements should include the inspection and replacement of blowers/service filters as needed, lift station pump inspection and repair/replacement, installation of Mission monitoring/generator quick connect/flow meter, inspection and replacement/repair of control panels, and inspection and replacement of diffusers that have failed. After a period of operation and facilities evaluations regarding capacity and permit limits, a second phase will be put into action to either expand or replace the current treatment facility in its entirety.

Wastewater Collection System Understanding

No mapping was provided for this collection system. While minimum flow equalization was observed at the facility, further evaluation of the collection will be necessary to minimize the amount of I and I entering the system. If this is minimally controlled, it will be difficult for the wastewater systems to meet limits.

Since no flow monitoring is installed, flow monitoring should be considered using a magnetic flow meter to evaluate whether I and I is currently a problem.

The system does have two lift stations. This lift station have been poorly maintained. Pumps should be pulled and inspected. A safety inspection should be completed on the control panels to ensure reliability.

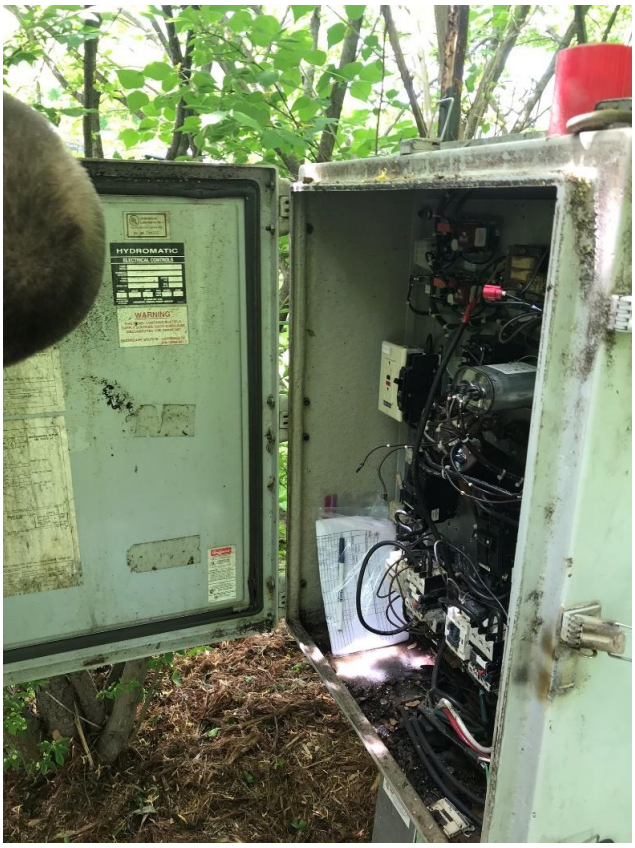
With no current utility mapping available, the system should be evaluated to create mapping and develop a GIS site for future maintenance. System mapping at the fingertips of the operators will enhance the level of service and timing of responses to emergency and customer issues.

Improvements Required: Inspection lift stations for quality, performance and safety. Perform smoke testing, evaluate system and create GIS mapping for future maintenance needs.

APPENDIX

Treatment Tanks are rusting and have gone unmaintained

Influent PVC line is fastened to the top of the fence and should be properly buried.



Lift station control panels appear to be poorly wired and are a safety concern.

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Springcrest Sewer – Springcrest Wastewater Disposal System
Kentucky
Engineering Memorandum
Date: September 11, 2020

Introduction

The Springcrest Sewer facility is located in Keene, Kentucky approximately 7 miles southwest of Lexington, Kentucky. According to the Rough Service Area map, this utility services 45 parcels. The system includes a low pressure sewer system and an irrigation disposal system.

In review of the original subdivision drawing, it seems that the subdivision was originally designed to serve 48 parcels, including parcels not shown on the current Rough Service Area map. The additional parcels that may be served are shown below. The occupancy of the existing subdivision is close to full capacity.

Wastewater Treatment

Each of the existing homes utilizes a septic tank for wastewater treatment and a low pressure pumping system to convey effluent to the low pressure main that conveys wastewater to the common disposal site. The pump pits are each 3' in diameter, have a 5' total depth, are constructed of FRP, and include 18" opening in the cover. The gray water conveyed through the low service lines are routed through a single 4" forcemain to the wastewater disposal facility.

The original drawings of the system indicate that the homeowners own and maintain their septic systems, but that the utility owns and maintains all of the low pressure pump stations and pressure main. The inspection of the system did not include an assessment of the individual pump stations.

It is recommended that CSWR review the existing tariff to confirm ownership and operations responsibilities and liabilities. It is also recommended that the low pressure pump stations be inspected to determine reliability of each of the 45-48 pumping system.

Wastewater Irrigation Disposal System

Flow from the single 4" force main enters the flow irrigation pump wet wells. There are 4, 6' diameter precast concrete wet wells and each is hydraulically connected with a 10" pipe that spans from wet well to wet well.

Electrical / Control Building and Irrigation Area in Background

Each of the 4 wet wells is equipped with a triplex pumping system to convey wastewater to a specific zone of the irrigation system (Zones 1-4). Each zone includes 2 subzones, and if 1 subzone is in service, one pump is required to operate to maintain pressure; if two zones are in service, two pumps are utilized. Each pump station includes a standby pump.

There is a single control panel for all four irrigation pumping systems located in a masonry building between the pump stations and the irrigation area. The pump stations, controls, electrical gear and masonry building internals all appear to be in good working order.

There is limited security at the facility. There is a gate to the site, but the utility has not historically been able to keep the gate locked because the electric utility has easement access rights through the gate to the high voltage electric service lines running adjacent to the sewer facility, and the access is frequently used. The building can be secured to protect the electrical and control facilities. However, the low pressure sewer pump stations throughout the system and the irrigation pump stations are currently accessible to those willing to trespass.

This application may not require the addition of fencing around the pump station sites for a couple of reasons: a) the site is remote; to enter the site, you have to drive off the paved streets and into a field through a gate that says no trespassing; and b) there are no tanks to fall in at this site and the hatches into each wet well have lockable hatches and padlocks. We recommend that security concerns be discussed with the electric utility and that locks on the entrance gate be maintained by both CSWR and the electric utility.

Over 5-acres are irrigated with the gray water. The irrigation network includes the following features:

Zone 1

- Over 1,475’ of 4”, 140’ of 3” and 115’ of 2” transmission main piping
- Zone 1A – 1,890 FT of 1-1/4” lateral lines with 5/32” orifices
- Zone 1B = 2,100 FT of 1-1/4” lateral lines with 5/32” orifices

Zone 2

- Over 800’ of 6”, 215’ of 3” and 100’ of 2” transmission main piping
- Zone 2A – 2,800 LF of 1-1/4” lateral lines with 5/32” orifices
- Zone 2B – 3,010 LF of 1-1/4” lateral lines with 5/32” orifices

Zone 3

- Over 344’ of 4”, 132’ of 3” and 134’ of 2” transmission main piping
- Zone 3A – 1,960 LF of 1-1/4” lateral lines with 5/32” orifices
- Zone 3B – 3,840 LF of 1-1/4” lateral lines with 5/32” orifices

Zone 4

- Over 1,367’ of 6”, 940’ of 4”, 283’ of 3”, and 137’ of 2” transmission main piping
- Zone 4A – 4,830 LF of 1-1/4” lateral lines with 5/32” orifices
- Zone 4B – 4,250 LF of 1-1/4” lateral lines with 5/32” orifices

Wastewater Collection System Recommended Improvements

- The system should be evaluated to create mapping and develop GIS shapefiles for future maintenance. System mapping at the fingertips of the operators will enhance the level of service and timing of responses to emergency and customer issues.
- Each low pressure system pump station should be inspected. It is assumed that 5 pumps will be replaced initially.
- Each irrigation pump station should be inspected. It is assumed that 3 pumps will be replaced initially.
- The pump vault hatches should be replaced with lockable hatches.
- An inventory of assets should be developed and spare pumps, controllers, and valves acquired to allow CSWR to maintain effective, timely service.

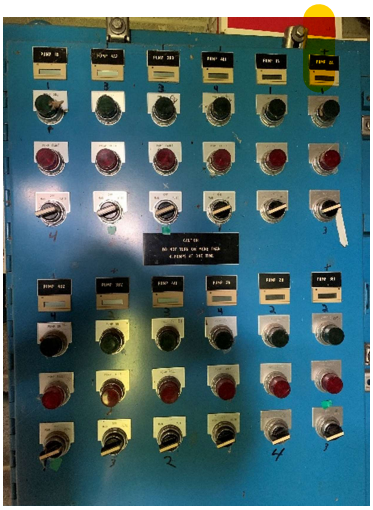
Total Project Cost Estimate

Opinion of Capital Cost Summary	
Springcrest, KY	
DESCRIPTION OF WORK	**2020 Cost**
Initial Improvements	**$47,000**
Install Mission monitoring - Plant	$15,000
Hatch replacement on 4 wet well covers	$8,000
Irrigation pump replacement and installation (3 pumps total)	$9,000
Low pressure pump and controls replacement (5 systems)	$15,000
Secondary Improvements	**$29,000**
Replace system valves	$5,000
Replace additional irrigation pumps (3 pumps total)	$9,000
Replace additional low pressure pumps/controls (5 systems)	$15,000
Total	**$76,000**

APPENDIX

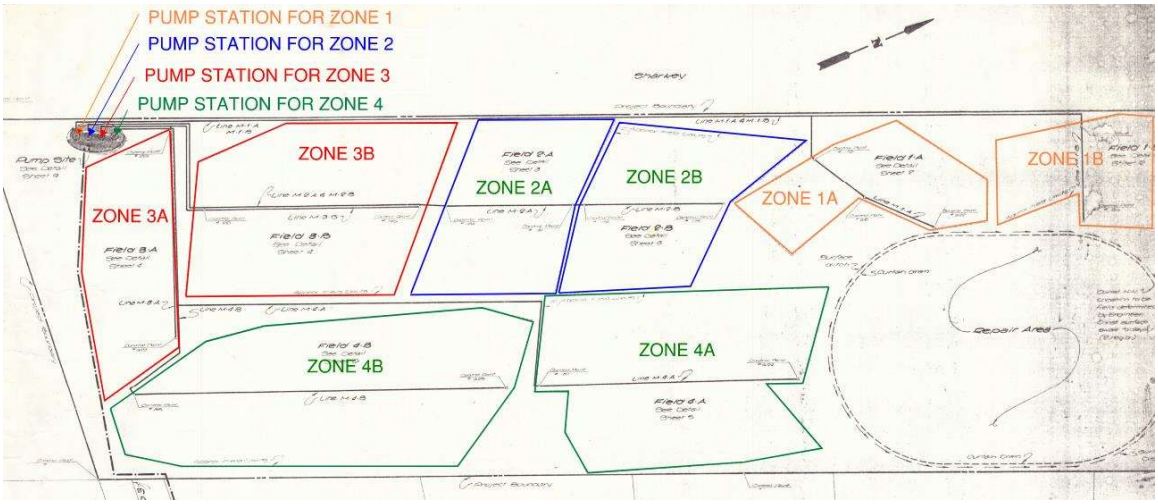
Triplex Irrigation Pump Station No. 1

Triplex Irrigation Pump Station Nos. 3 & 4



Irrigation Pump Stations Control Panel

Irrigation Area



Map of Irrigation System

Irrigation Vicinity Map

Timberland (Wastewater) – KY0083755
Joann Estates, Inc.
Engineering Memorandum
Date: September 23, 2019

Wastewater Treatment Facility Understanding

The Timberland wastewater treatment facility is located in Heath, KY approximately 10 miles west of Paducah. The plant services about 70 customers which is approximately 210 people. During our visit to the plant, various site components were showing signs of failure and aging. The plant has been placed on significant noncompliance status for each of the last twelve quarters.

The plant consists of an extended aeration activated sludge system and an aerated lagoon. All blowers in the system will need to be inspected and either replaced or repaired, as well as all influent pumps in the lift station on site. There is a good chance that any working pumps could possibly be reaching the end of their useful life, so an inspection of each pump should be done to ensure it is operating on the performance curve in order to handle the demand required by the system. Any broken pumps will need to be either repaired if possible or replaced entirely. The return, skimmer, influent, and effluent lines are currently PVC and need to be replaced with steel to ensure longevity and reliability of the system. PVC has low durability and is prone to cracking when exposed to sunlight for extended periods of time. Consideration should be given to pumping excess flow to the southwestern lagoon if it has adequate flow capacity.

Structurally, the existing steel wastewater facility is severely rusted and will need a thorough inspection, painted and potentially patched if the tank remains in service. Additionally, the chlorine contact chamber was constructed out cinder blocks, has limited walls to maximize contact time, and is degrading.

The aeration volume provided by this system is about 16,288 gallons and the clarifier provides a volume of 2,672 gallons. According to design treatment calculations, all minimum standards for activated sludge treatment are met except for aeration volume and clarifier detention time for maximum permitted flow. The permitted flow at this facility is 25,000 gallons, but we estimate average daily flow at about 14,000 gallons based on 70 customers. This customer count was taken from the current service area map. The system also has a polishing lagoon after the treatment facility which has a volume of approximately 400,000 gallons, assuming a depth of three feet. The lagoon has some minimal aeration at best which also extends to the chlorine contact chamber, which has some aeration that is attempting to increase the dissolved oxygen prior to discharging.

As a part of this acquisition, Carriage Park will also be purchased under this ownership. Carriage Park is a no discharge lagoon system that is directly adjacent, and to the south of this facility. If Carriage Park

has capacity for additional flow, consideration should be given to pumping the Timberland flow to the Carriage Park and avoiding future maintenance and system upgrades.

It is evident that operations are struggling to maintain the plant, and currently no remote monitoring is in place at the site which makes it difficult for the operators to know when the facility is failing. We recommend remote monitoring by Mission which will give information such as pump failure, blower failure, and high-level alarms. A generator quick connect should also be added to the plant to provide electricity during power outages which would ensure the plant can run 24/7.

A review was performed of EPAs ECHO compliance website which lists prior violations issued to the system. According to the ECHO report, it has been placed on significant noncompliance status each of the past twelve quarters

This facility is utilizing chlorine disinfection after the lagoon, which will work better than ultraviolet disinfection due to level of turbidity currently in the system. However, once the system is running properly, consideration should be given to installing ultraviolet disinfection which would lower operational cost and be more consistent on disinfection.

In the future, after operational control is taken by Central States Water Resources, I recommend pulling the aeration and diffusers for an inspection. If an annual inspection program is put in place, diffuser replacement can be drastically reduced and overall system performance improved. Due to the low quality of preventative maintenance performed on the site equipment, it is estimated that many of the air diffusers will be needing a replacement.

Improvements: If Carriage Park has capacity to receive this facility's flow, we recommend shutting down the treatment system and overhauling the existing influent lift station to pump water to the Carriage Park facility. If Carriage Park doesn't have the excess capacity, I recommend the improvements be staged. The first phase of improvements should include the inspection and replacement of blowers/service filters as needed, lift station pump inspection and repair/replacement, installation of Mission monitoring/generator quick connect/flow meter, inspection and replacement/repair of control panels, replacement of all PVC, and inspection and replacement of diffusers that have failed. After a period of operation and facilities evaluations regarding capacity and permit limits, a second phase will be put into action to either expand or replace the current treatment facility in its entirety.

Wastewater Collection System Understanding

No mapping was provided for this collection system. While minimum flow equalization was observed at the facility, further evaluation of the collection will be necessary to minimize the amount of I and I entering the system. If this is minimally controlled, it will be difficult for the wastewater systems to meet limits.

Since no flow monitoring is installed, flow monitoring should be considered using a magnetic flow meter to evaluate whether I and I is currently a problem.

With no current utility mapping available, the system should be evaluated to create mapping and develop a GIS site for future maintenance. System mapping at the fingertips of the operators will enhance the level of service and timing of responses to emergency and customer issues.

Improvements Required: Perform smoke testing, evaluate system and create GIS mapping for future maintenance needs.

APPENDIX

Chlorination Contact Chamber not up to code

PVC lines need to be replaced

Activated Sludge – Extended Aeration tank beginning to rust/fail

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Woodland Acres – Woodland Acres WWTP KY0096100
Kentucky
Engineering Memorandum
Date: September 11, 2020

Introduction

The Woodland Acres wastewater treatment facility is located in Shepherdsville, Kentucky approximately 17 miles south of Louisville, Kentucky. This facility services 121 parcels. The system operates under Kentucky DEP Permit number KY0096100 and Agency ID number 479.

Wastewater Treatment Facility Existing Conditions

The plant is authorized to discharge up to 25,000 gallons per day (gpd) by the KDEP per the operating permit.

A summary of the existing permit limits are described below:

- BOD5 – 10/15 mg/L (Monthly average/Maximum Weekly Average)
- TSS – 30/45 mg/L
- NH3-N – 4/6 mg/L in Summer
- NH3-N – 10/15 mg/L in Winter
- E-Coli – 130/240 mpn/100 ml
- Total Residual Chlorine – 0.011/0.019 mg/L
- Dissolved Oxygen – 7.0 mg/L minimum

The subdivision has 121 parcels and little additional buildout would seem possible. Based off of the number of possible connections and assuming 250 gpd of flow per customer, 30,000 gpd of average daily flow would be expected when the available lots are fully occupied.

A review was performed of EPAs Echo compliance website which lists violations of wastewater treatment plants across the country. The Woodland Acres wastewater treatment plant has exceeded permit limitations several times in recent months and years for E-Coli, BOD, and Ammonia.

The existing facility includes an extended aeration package plant including a mechanically cleaned bar rack screen, a single aeration basin, equalization basin with two influent pumps (one portable), aerobic digestion, rapid sand filter, and a chlorine contact tank. Dechlorination is utilized downstream of disinfection.

The packaged plant has aged and shows significant signs of wear and corrosion. The blowers and diffusers are in need of replacement, and one of the two RAS lines has broken off into the aeration basin. The basin appears to have been modified over time with changes to original structural components. The basin does not include handrail needed to protect operators or visitors from falling into the package plant.

Functionally, the system also has some limitations:

- The entire community is challenged by high ground water levels. The site visit was conducted during a moderate storm event that resulted in significant stormwater challenges in the streets and wastewater flow challenges at the plant. During the visit the blowers had been turned off to inventory solids, and both influent pumps were continuously pumping at what appeared to be a rate higher than the plant was capable of processing. When the blowers were turned on briefly, the noise was significant and the discharge pressure was likely excessive.
- According to operators, the all gravity collection system results in significant I&I, impacting system performance.
- The blower discharge pressure may be excessively high..
- The operator believes it is necessary to turn off aeration during wet weather events to minimize the loss of solids and to retain a healthy biomass.
- The tertiary treatment basin (rapid sand filter, contact tank and dechlorination tank) is highly corroded.
- There is no ideal place for chlorine tablet addition or dechlorination tablet addition.
- There is no flow monitoring at this time.
- The facility includes significant amounts of exposed wiring.

The fencing around most of the site is generally in relatively good condition, and there is significance footprint available for the addition of improvements.

Currently no remote monitoring is in place at the site. This makes it difficult for the operators to know when the facility is failing. Operational monitoring should be completed to monitor the quality of effluent, which should then be compared to the operating permit.

Wastewater Treatment Facility Recommended Improvements

- The condition of the tank calls for taking the facility off line for structural repair, at a minimum to include the addition of access bridge improvements, safety handrail, welding repairs, and the addition of a new RAS line from one of the hopper bottomed clarifiers to the front end of the plant. Because of this, it makes sense to take advantage of the down time to upgrade the

system to an MBBR treatment system to simplify operations and improve performance during wet weather events. The conversion from extended aeration activated sludge to MBBR will include the addition of baffle walls, new diffusers, new blowers, media, and media retention sieves.

- The smaller footprint MBBR will allow a fraction of the existing tank to be used for digestion. The new system will generate significantly less sludge than the existing extended aeration system as well, so sludge handling needs will significantly decrease.
- The 10' foot deep clarifier is adequate for a fixed film type system, and will function much better in this application than with the existing activated sludge system.
- The effluent from the three stage MBBR will be evenly distributed into and through the clarifier, and the level control in the clarifier will be maintained with the addition of a weir trough and weir.
- A flow meter will be installed in the clarifier effluent piping, in route to the contact tank.
- Peroxyacetic acid will be introduced directly into the contact tank in lieu of attempting to install chlorination and dechlorination tablet feeders in the limited hydraulic profile. The PAA chemical requires less contact time, and will more consistently achieve the necessary disinfection objectives.
- Alum will be introduced into the clarifier to improve settleability when required to consistently achieve solids reduction and in turn, BOD effluent limit compliance.
- The existing chlorine contact tank will be equipped with diffusers to help in meeting the dissolved oxygen effluent limit.
- Three blowers will replace the existing two blowers. One will serve the aeration tank needs, air lift needs, and post-aeration needs; one will serve the digester needs; and one will serve as standby for both applications.

Wastewater Collection System Understanding

While no mapping was provided, the collection system consists of only gravity collection.

According to the operator, the collection system consists of 8" and 10" gravity sewers, and the high groundwater table results in significant peak flow events at the facility. Wastewater enters the wastewater treatment plant through a gravity sewer.

Wastewater Collection System Recommended Improvements

- The system should be evaluated to create mapping and develop GIS shapefiles for future maintenance. System mapping at the fingertips of the operators will enhance the level of service and timing of responses to emergency and customer issues.
- Perform smoke testing, perform video inspection at selected locations, evaluate systems and create GIS based maintenance priority list.

Total Project Cost Estimate

Opinion of Capital Cost Summary		
Woodland Acres, KY		
DESCRIPTION OF WORK		**2020 Cost**
Initial Improvements		**$30,000**
Install Mission monitoring - plant		$15,000
Blower replacement		$12,000
Temporary RAS line addition		$3,000
Secondary Improvements		**$345,500**
Install manual transfer switch in electrical service		$7,500
Install new electrical distribution panel		$15,000
Remove sludge from existing system and rehab		$65,000
Install Baffles for 3-Stage MBBR		$50,000
Install MBBR media, sieves, diffusers, blower		$160,000
Install Aluminum Sulfate feed and storage system		$12,000
Install Peroxyacetic Acid feed and storage system		$18,000
Install digester system blower		$8,000
Install flow meter		$5,000
Install aeration in existing contact chamber		$5,000
Total		**$375,500**

APPENDIX

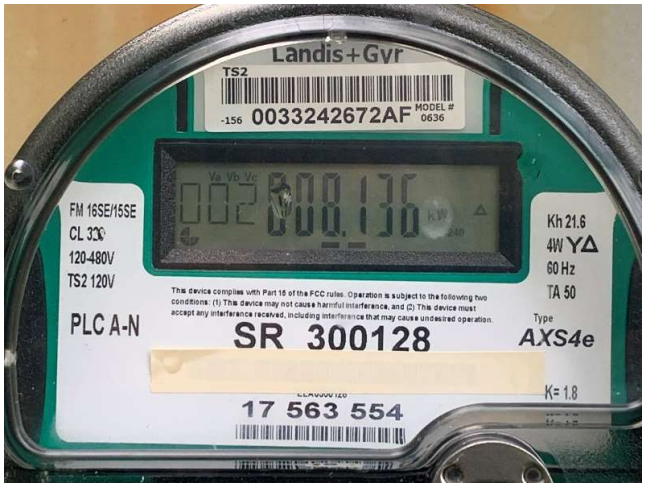
Blowers, EQ Basin, and Electrical Cables

Electrical Boxes and Electrical Cabling

**EQ Basin, Portable Pump Discharge,
Digester, Miscellaneous Electrical Cables**

**Clarifier Performance During Wet Weather
(and No Aeration in Aeration Tank)**

Chlor/Dechlor Structure



WWTP Electrical Meter