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GROUNDWATER

OPERATION AND MAINTENANCE PLAN

Allen Harim Foods, LLC

Wastewater Treatment System

May 30, 2019

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1 Executive Summary

1.1 Overview

1.1.1 Project Narrative

The purpose of Harbeson's Operation and Maintenance Manual is to:

- Provide a Reference Guide for Harbeson's Wastewater personnel;
- Identify key design elements, systems and materials that are critical to long term quality and performance of Harbeson's Wastewater System;
- Develop and/or collect any available operation and maintenance information/manuals on each of these components and organize in an easy usable format; and

- Aggregate this information into a single resource that can be used by employees and management personnel to guide overall operation and maintenance activities.

1.1.2 Process Design Summary

Wastewater flow rates

1. Peak Flow ≤ 2,800 gpm = 4.0 MGD
2. Maximum flow rate ≤ 2,100 gpm =3.00 MGD during processing shifts
3. Average flow rate = 1,667 gpm = 2.40 MGD during processing shifts

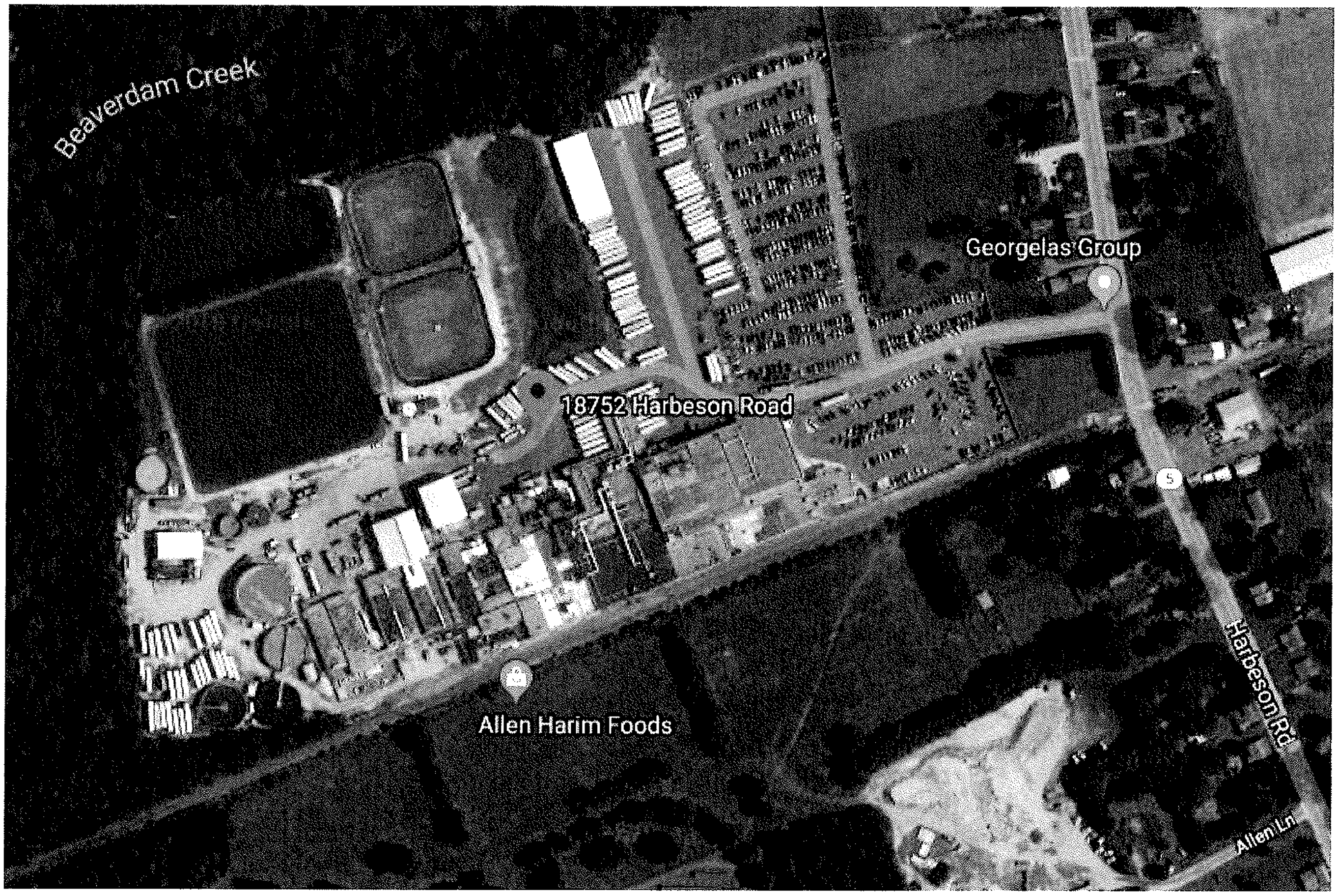
1.1.3 Design Influent Flow Characteristics

Screened, raw wastewater pollutant concentrations and loading at the maximum daily wastewater flow volume of 2 MGD:

Table 1-1 Screened Raw Wastewater Pollutant Concentrations and Loadings

Pollutant	Pollutant Concentration		Pollutant Concentrations	
	Average	Maximum	Average	Maximum
BOD (total)	1,950 mg/L	2,250 mg/L	32,526 #/day	37,530#/day
BOD (soluble)	650 mg/L	850 mg/L	10,842 #/day	14,178 #/day
TSS	1,000 mg/L	1,500 mg/L	16,680 #/day	25,020 #/day
USS	400 mg/L	600 mg/L	6,672 #/day	10,080 #/day
TKN	135 mg/L	175 mg/L	2,252 #/day	2,919 #/day
Ammonia-N	20 mg/L	30 mg/L	334 #/day	500 #/day
TP	19 mg/L	22 mg/L	317 #/day	367 #/day

1.2 Overview Map



1.3 Collection System Plans

Not Applicable.

1.4 Treatment System Plans

See attached plan set, which is also on file at DNREC.

1.5 Disposal System Plans

See attached plan set for the onsite infrastructure for delivering the treated effluent to Artesian Wastewater for disposal. This disposal is taking place under a separate permit.

1.6 Current Operations Permit

See **Error! Reference source not found.**.

This will be replaced by the proposed operations permit to treat and deliver to Artesian Wastewater for disposal.

1.7 <u>Other Relevant DNREC Permit</u>

Not applicable.

1.8 <u>Outside Flow Streams</u>

Dagsboro Hatchery

The Allen Harim Harbeson WWTP accepts wastewater from the Dagsboro Hatchery. The Dagsboro Hatchery generates on the average 15,000 gallons per day (gpd). This wastewater stream is largely sanitation water and production process water. This waste stream is hauled to the Harbeson WWTP in 6,000 gallon tankers by Denali Water Solutions. The Dagsboro wastewater is off loaded at the manhole outside and downstream of Offal. There is no sanitary component to this wastewater

Pinnacle Processing Facility

Process wastewater from the Deboning operation at the Pinnacle Processing Facility is hauled to the Allen Harim Harbeson WWTP. The Pinnacle plant generates approximately 30,000 gallons per day (gpd). The wastewater is production wastewater and sanitation wastewater. The Pinnacle waste stream is hauled to the Harbeson WWTP in 6,000 gallon tankers by Denali Water Solutions. The Pinnacle wastewater is off loaded at the manhole outside and downstream of Offal. There is no sanitary component.

2 Management and Staffing

2.1 <u>Outline of Management Responsibilities and duties.</u>

As Environmental Manager Michael Sausé currently has Direct Responsible Charge (DRC) and overall management responsibility of the Allen Harim Harbeson Wastewater Treatment Facility. The wastewater operators cover three shifts, seven days per week to oversee the operations and maintenance of the Harbeson wastewater facility to ensure permit compliance with discharge requirements. Processes include flow equalization, dissolved air flotation thickener, anoxic ponds, complete mixed activated sludge, final clarification, chlorination, de-chlorination, sludge digestion and screw press. Duties include, but are not limited to; operation of equipment, operation checks, process control checks, minor preventive and corrective maintenance, process laboratory testing, housekeeping, etc .

2.2 Describe the various jobs titles, qualifications, experience, training etc.

All licensed wastewater operators in the State of Delaware are required to take at a minimum of 20 hours of approved training every two years in order to maintain an active wastewater license.

Operators receive this training at Delaware Technical Community College at the Environmental Training Center. A list of approved courses is provided from the college every 6 months when it is updated for the upcoming semester. The employee is required to pay for the training in advance and receive reimbursement from Allen Harim Foods, LLC once the training has been completed. It is the responsibility of the employee to obtain the necessary training and maintain an active wastewater license.

On-site are the manuals for the Operation of Wastewater Treatment Plans. A field Study Training Program from California State University is the school in which this training program is developed and updated. These manuals are used by Delaware Technical Community College for their wastewater training courses.

Plant specific training is provided by Allen Harim Foods, LLC. Each training topic is documented with a sign off sheet for each employee to acknowledge that he or she has received this training. The training curriculum for the Allen Harim Training Program is as follows:

The subjects listed under core curriculum will be counted as universal and applied to the AIM Training score. The # trained indicates the number of employees both active and inactive trained in the subject. The subjects listed under other subjects are those which employees in the department have completed, and are deemed to be relevant.

Table 2-1 Training Required

Department	**Core Curriculum**	**Other Courses**
690-Shift 1 Waste Water H	New Hire Orientation	CBT Lift Truck
690-Shift 1 Waste Water H	Workers Compensation	CBT Pallet Jack
690-Shift 1 Waste Water H	CBT Electrical Safety	Certification Pallet Jack
690-Shift 1 Waste Water H	CBT Lockout Tagout	Certification Lift Truck

690-Shift 1 Waste Water H	CBT Hazard Communication	Hot Work
690-Shift 1 Waste Water H	SWP New Hire Checklist	CBT Confined Space
690-Shift 1 Waste Water H	Certification LOTO	
690-Shift 1 Waste Water H	SWP Safe Lifting	

2.3 **Define work hours, duties and responsibilities of each staff member.**

Table 2-2 Allen Harim Harbeson Wastewater Plant Staffing

Name	**Duties**	**Work Hours**	**Certification Level**
Michael R. Sausé	Environmental Manager	DRC Entire Plant	DE Level 4 (required) Multi-Plant #522
Position Vacant	Wastewater Supervisor	Back up DRC	DE Level 3
Dawn Bowles	Laboratory Supervisor	3rd shift DRC	DE Level 2 #982
Eldon Potts	Wastewater Operator	1st shift	DE Level 1 #851
Glenn Morris	Wastewater Operator	1st shift	DE Level 1 #1020
Valdanio Vernet	Wastewater Lead Operator	2nd shift DRC	DE Level 3 #925

Terrell Mackey	Wastewater Operator	2nd shift	DE Level 1 OIT #
Ithamar Blanchard	Wastewater Operator	3rd shift	DE Temp. Operator License

3 Facility Operation and Maintenance

3.1 Treatment System operation and Maintenance

The wastewater treatment system consists of Primary Screening (via Offal), Grit Removal, an approximate 60,000 gallon Dissolved Air Flotation (DAF) device, two 1.5 million gallon Anoxic Biological Nutrient Removal (BNR) Basins (Anoxic BNR A and Anoxic BNR B), a 1.6 million gallon Aeration Cell (Complete Mixed Activated Sludge [CMAS 1]), a 0.5-million gallon Aeration Cell (CMAS 2), a 5,600 gallon Flocculation Tank, a pair of 0.424 million gallon Clarifiers, and a 28,250 gallon Chlorination/Dechlorination Contact Tank. The treatment train also includes two 134,000 gallon Aerobic Digesters for sludge treatment.

An estimated 1.5 million gallons of poultry process water are input into the wastewater treatment system per operational day from the Harbeson Facility. An additional 50,000 gallons/day will be discharged upstream of the Offal transported in from the Pinnacle Processing Facility. The sanitary wastewater average daily flow is estimated based on the number of employees present at the facility each day and a design flow of 35 gallons/employee/shift, as referenced in 15A North Carolina Administrative Code 02T.0114. The boiler blowdown average daily flow is estimated by Plant Maintenance personnel based on experience.

See the Process Flow Schematic in Appendix A.

3.2 Wastewater Plant start-up and shut down procedures

This procedure is used to start the wastewater system after a shutdown, i.e., no discharge to the stream or water flow to or from the plant.

3.2.1 Start Up

1. Water Meter Reading at 2200 hrs. and record in LOG BOOK.
2. Check Wastewater Ponds and Pond Blower Building for proper operation.
3. Go to Pond Pump House and open the brown valve next to the window.
4. Turn on Pond Pumps; 'C', 'B', and then 'A'.
5. Open CMAS 1 Recycle valve; approximately 3 turns.
6. Turn on Magnesium Hydroxide Pump.
    - Set pump speed at 118 RPM, unless otherwise directed.
    - Check DAF Effluent Pit to verify Magnesium is pumping.
7. Increase Clarifier Polymer to 1600 mL/min. (800 mL/min = 30 second Drawdown)
8. Increase Clarifier Aluminum to 40 Speed and 35 Stroke, unless otherwise directed.
9. Make rounds to check for proper operation of the Wastewater Plant.
    - Daily Checklist

- Chemical Inventory

10. When the Final Effluent starts…
11. Turn on the Water Reuse Pump
12. Turn on the Chlorine Pump
13. Turn on the Bisulfite Pump
14. Go into storage room and close the Well Water Valve and open the Water Reuse Valve a ¼ turn. (Only done in the winter months)
15. If needed, adjust CMAS 1 Recycle valve to set your desired Final Effluent Flow. May take an hour or so after flow begins to determine whether adjustments need to be made.
16. Before the 3rd shift ends, operator must do the following:
    - pH Meter Calibration
    - Chlorine Test
    - pH Test
17. Water Reading at 0445 hrs. and record in LOG BOOK.
    - DAF Start-up at 0500 hrs.

3.2.2 Shut Down

1. DAF Shutdown: ½ hour after kill time or unless otherwise directed.
    - Turn off DAF Aluminum Pump and close valve on wall.
    - Turn off DAF Polymer Pump and close both valves.
    - Skim all sludge from surface of DAF and pump all sludge to Frat Tank.
    - When all sludge has been skimmed, turn off DAF Influent Pumps 'A' and 'B'.
    - Close the DAF Recycle valve.
2. Water Reading at 1800 hrs. and record it in the LOG BOOK.
3. Close CMAS 1 Recycle Valve.
    - Turn valve to the right (clockwise) to close.
4. Pond Pump House
    - Turn off ALL Pond Pumps
    - Close the brown valve in the corner next to the window
5. Pond Blower Building & Wastewater Lagoons, 'A' and 'B'.
    - Check all Blowers, Mixers, and Air-O-Lators for proper operation.
6. RAS Building
    - Turn off the WAS valve. Meter should read zero (0) GPM.
    - Set RAS to 500 GPM
    - Check Scum Pit and pump controls. Pumps 'A' and 'B' should be ON and set on AUTO.
7. Check the following for proper operation:
    - CMAS 1 and 2 Blowers and Mass Transfer Pump
    - Clarifier

- Storm water Stations 002 and 003
  - Make sure pumps are set to AUTO and press RESET button.
- Digesters 'A' and 'B'
  - Aerators should be ON, unless otherwise instructed.

8. When the Final Effluent flow reaches 200 GPM.........
   - Turn OFF the Water Re-Use Pump.

     - *During the winter months, the operator must go into the storage room and close the Water Re-Use valve and open the Well Water valve, at least a ¼ turn. This will help prevent freezing of the Chlorine and Sodium Bisulfite pipes going to the Chlorine Contact Chamber.*

9. When the Final Effluent Flow stops..........
   - Turn OFF the Chlorine Pump
   - Turn OFF the Sodium Bisulfite Pump
   - Decrease the Clarifier Polymer pumping rate to 300-600 mL/min. *(Must do a drawdown to set correctly.)* Clarifier Polymer Tank should be at least ¾ full.
   - Set Clarifier Aluminum Pump on INTERNAL and turn SPEED down to 5.
   - Turn OFF Magnesium Hydroxide Pump, unless otherwise instructed.
     - Verify mixers are ON in both Magnesium tanks.
10. Verify the WASTEWATER SHUTDOWN PROCEDURE to ensure that ALL has been done correctly.
11. Make sure SECURITY has the Water Reading sheet for the weekend.

3.3 On-Site Water Supply Wells

3.3.1 Operating Procedures

Refrigeration personnel perform daily check (five day work week) checks on four of the wells MW-2, MW-4, MW-5, and MW-7. First, Refrigeration personnel go to the individual wells to record meter reading. In the building behind Compressor Room A (System A), to complete the remainder of the checklist. In this building is a surge tank as well as controls for the wells which maintains the water pressure for the plant.

All completed checklist are kept in refrigeration department. Wastewater personnel take daily readings on MW-3 as part of the daily rounds and documented on daily reading checklist.

3.3.2 Maintenance

Monthly Static water testing is done. All other maintenance on the wells is performed by an outside vendor, AC Schultes.

3.3.3 Manufacturer's Specifications

The Manufacturer has provided:

- Amtrol Well-X-Trol Pre-Pressurized Water System Well Tank (O&M) for MW #3 only.

3.4 Primary Screening

Used process water leaves the production plant from two sources; the first includes scrap meat and the second is from the Picking Room which includes feathers. These two sources of flow enter the Offal pre-treatment facility. The wastewater containing meat goes to the meat pit where it is pumped via one of three 6" Gorman-Rupp centrifugal pumps. This water is pumped into two rotating tumblers that allow the meat to be collected and discharged into an auger. The meat auger then carries the meat to a trailer where it will be collected and then hauled to the rendering plant.

The other source of water contains feathers. This water enters the Offal pre-treatment facility and goes through two rotating tumblers that remove the feathers. The feathers fall into a small horizontal auger and then is picked up by a large diagonal auger that carries the feathers to a trailer. The feathers are collected in the trailer and are hauled off-site to the rendering plant. The water is pumped to a secondary tumbler that is on the second level known as the mezzanine. Water from the feather pit is pumped via one of three 6" Gorman-Rupp centrifugal pumps.

All of the water that remains after the meat and feathers are removed are pumped to the wastewater treatment plant for treatment.

3.4.1 Operating Procedures

Used process water leaves the production plant from two sources; the first includes scrap meat and the second is from the Picking Room, which includes feathers. These two sources of flow enter the Offal pre-treatment facility. The wastewater containing meat goes to the meat side and flows directly through two rotating tumblers, which allow the meat to be collected and discharged into a horizontal meat auger. The auger then carries the meat to an incline auger, which carries the meat up and drops it into a trailer. The meat is then hauled to the rendering plant. The water is pumped from the pit to a secondary tumbler that is on the second level, known as the mezzanine. Water from the meat pit is pumped via one of three 6" Gorman-Rupp centrifugal pumps. Any meat that goes through the secondary tumbler is sent down a chute and go through the primary rotating tumblers again.

The other source of water contains feathers. This water enters the Offal pre-treatment facility and goes through two rotating tumblers that separate the water from the feathers. The feathers fall into a small horizontal auger which carries them to a large incline auger. The feathers are then carried up to a chute. The feathers exit the chute into a horizontal auger screw that carries the feathers into the trailer. The feathers are then hauled off-site to the rendering plant. The water is pumped from the pit to a secondary tumbler that is on the second level, known as the mezzanine. Water from the feather pit is pumped via one of three 6" Gorman-Rupp centrifugal pumps. Any feathers that go through the secondary tumbler are sent down a chute and go through the primary rotating tumblers again.

All of the water that remains after the meat and feathers are removed are pumped to the wastewater treatment plant for treatment.

To ensure a good operation, the Offal operator's should do the following:

1. Frequent hosing down of the rotating tumblers in the pits and on the mezzanine. Clean tumblers allow a good separation of meat and feathers from the water, which prevents excessive water in the augers.
2. Visually check the meat and feather pit levels. A high water level could cause mechanical problems or excessive meat and feathers to fall into the pit itself. An extremely low level could cause mechanical problems as well as a result of pumps running dry.
3. Check meat and feather pump stations to ensure pumps are running and pumping properly. Each pump has a 3" discharge line and valve installed on the pump housing, which allows the operator to physically see whether a pump is pumping at a high rate or if it needs priming.

    - There are three pumps for the meat pit (#1, #2, #6). Pump #1 has an ON/OFF float control and it's required to be on at all times during plant production or non-production hours. During production hours, it's ideal for the operator to use a minimum of two pumps because of the high rate of flow entering the meat pit.
    - There are also three pumps for the feather pit (#3, #4, #5). Pump #3 has an ON/OFF float control and it's required to be on at all times during plant production or non-production hours. Pump #5 (ditchwater pump) is required to be on at all times during production hours. Pump #4 is a spare and it's only used when needed.

4. Monitor blood tanks on the meat and feather trailers. During production, blood is pumped from the processing plant and directly to the blood tanks. The operator must visually check these tanks often enough to prevent overfilling. Blood spills are washed into the pits and eventually pumped back to the wastewater plant.
5. Swapping full trailers with empty trailers. The Offal operator is responsible for pulling loaded trailers out and setting them on the designated pad for further draining of the water. Operator must immediately fill the bay with an empty trailer.

- Swapping trailers may take several minutes so the necessary equipment will have to be turned OFF to eliminate/minimize waste product on the floor, in the pits, auger jams, etc. Once the empty trailer is in position, the equipment can be turned ON again.

No load is to exceed 80,000 lbs. or the waste product will be brought back to Offal and the excessive weight will be unloaded. Draining the blood tank is not recommended if there is a trailer overweight

3.4.2 Maintenance

Maintenance performed on this equipment is weekly. The Maintenance Department is responsible for the Offal.

3.5 Flow Equalization Basin

Water is pumped from the raw water influent pit into the 450,000 gallon Equalization Basin. Aerzen blowers provide initial pre-aeration to the wastewater prior to it being pumped to the DAF at the head of the treatment train.

3.5.1 Operating Procedures

None required after initial settings were determined.

3.5.2 Maintenance

Regular maintenance on the blowers is performed as recommended in the manufacturer's literature.

3.6 Dissolved Air Flotation

Purpose of the DAF Influent Pump Station:

- This pump station receives raw wastewater from the Equalization Basin
- Pumps provide the proper of Polyluminum Chloride and Anionic Polymer.
- Two whitewater pumps are used for re-circulation.

3.6.1 Operating Procedures

Flow is pumped from the DAF influent pit to the DAF via two 8" Gorman-Rupp centrifugal pumps. These pumps operate on a level system in the DAF influent pit that allows the pumps to operate in a lead / lag mode of operation. When the DAF is not online the pumps are shut off.

Once wastewater flow enters the DAF it is mixed with two chemicals; Aluminum Chloride and ChemTreat P-806 polymer solution. This mixture of chemicals and wastewater results in coagulation and flocculation of the oils and grease. This product that floats to the surface is known as DAF sludge. The DAF sludge is skimmed into a hopper by a series of paddles that are spaced every five feet apart. The operation of the skimming equipment which is comprised of paddles, sprockets and chains is programmed to come on every 8 minutes to push the sludge into the hopper. Once the hopper is full it is necessary to pump the sludge to the frac tank located outside the wastewater building.

A sludge contractor removes the sludge from the frac tank on a daily basis.

The feed of Polyaluminum Chloride can be controlled manually or automatically. On manual control the typical setting for the LMI Aluminum Chloride pump is 35% speed and 35% stroke. The settings can be adjusted according to the turbidity in the DAF effluent. Only the Wastewater Manager or the Wastewater Assistant Supervisor should make operation changes to the feed of Aluminum Chloride.

If the feed of Polyaluminum Chloride is performed on the automatic mode of operation, a pH controller will measure the pH of the DAF water in the tank and the pH determined by the controller will raise and lower the feed of Polyaluminum Chloride to meet the pH set point that has been determined as optimum for the operation.

Table 3-1 Trouble Shooting Air Flotation Unit Problems

Problem	**Possible Cause**
High suspended solids	Improper chemical feed Floc breakup caused by overagitation Insufficient dissolved air pressure Skimmer rate needs to be adjusted Exceeding hydraulic or solids capacity Post-precipitation of coagulant in effluent Weir adjustment required
High BOD	High oil content in effluent High water-soluble organic content High suspended solids
High turbidity	Improper coagulant feed High oil content pH adjustment required Overdose of chemicals

Anionic Polymer Solution is pumped from one of two polymer tanks located adjacent to the DAF. Only Tanks 1 or 2 can be used since Tank 3 is designated for clarifier polymer. Tanks 1 and 2 are to the right of Tank 3. There are two moyno polymer pumps, located in front of Tanks 1 and 2, that can be used to pump the polymer solution into the DAF. The speed of these pumps is controlled by a dial on the DC Drive and a chemical drawdown is required to determine the polymer usage. The drawdown is performed in a calibration column located on the discharge line of the polymer tanks.

Instructions to Perform a Polymer Drawdown:

1. Close valve to shut off flow from polymer tank to pump.
2. Open the valve on the calibration column and allow the pump to drawdown the polymer that's already in the column.
3. Gradually open the shutoff valve for the polymer tank and slowly fill the calibration column until it passes the start point.
4. Close the shutoff valve for the polymer tank; leaving the valve on the calibration column open.
5. When the polymer level in the column reaches the start point, press start button on the stopwatch and time drawdown for 15 seconds.
6. When the time on stopwatch reaches 15 seconds, immediately close the valve on the calibration column and open the shutoff valve for the polymer tank.
7. Use the graduation marks on the calibration column to determine the dosage in 15 seconds and multiply the dosage by four.
   (Example: 2,500 mL/seconds x 4 = 10,000 mL/minute)
8. Make adjustments if needed by adjusting the dial on the DC Drive and repeat steps 1 through 7 to achieve the desired dosage.

ChemTreat P-806 Polymer Solution is prepared at the top of tanks 1 and 2, which is located on the catwalk adjacent to the DAF. Each tank has its own water supply line and water jet educator for polymer dispersing.

Instructions for Making P-806 Polymer in Tanks 1 and 2:

1. Open water valve and fill polymer solution tank about one foot above the bottom impeller.
2. Prior to making the polymer, turn on the tank mixer for 15-20 minutes to ensure proper mixing of the water just added and the small amount of polymer that remained in the empty tank.
3. Place the 55 lb. bag of polymer next to the tank and open bag using a knife or scissors.

4. Each tank is made with a half bag (27.5 lbs.). Use the scale next to polymer tanks in order to monitor weight.
5. Open water valve to begin filling tank.
6. Place the suction hose inside the bag and guide it around as the polymer is being sucked up through the hose, into the water jet eductor, and dispersed into the tank.
7. After all polymer is dispersed, allow tank to continue mixing and filling with water. Fill tank until it's approximately one inch below the overflow hole, which is located at the top, right-hand side of the tank.
8. Once the tank is full, allow tank to mix for an additional 30 minutes, or longer if needed. Polymer must be completely dissolved.
9. Turn mixer off after mixing is complete.

Dry Polymers

- Viscosity and molecular weight limit solution strengths.

  - Maximum recommended solution strengths:
  - Catatonics = 0.5% (0.04 pound/gallon)
  - Anionic and nonionics = 0.25% (0.02 pound/gallon)

- Polymer performance typically improves as solution strength is decreased.
- Solutions must be prepared by using an adjustable educator to wet the polymers.
- A low-speed mixer (350 — 450 rpm) must be used to mix polymer in the tank.
- Cationic polymer solutions require 30 — 60 minutes to prepare; 45 — 60 minutes are required for anionic.
- Mixing should be continued until no undissolved polymer is observed. Mixer should then be turned off.
- Solution shelf life is limited (typically two to four days).

3.6.2 Maintenance

Maintenance is performed on this equipment is documented in EMS system which produces work orders weekly, monthly, quarterly, and /or annually.

3.6.3 Manufacturer's Specifications

The Manufacturer has provided:

- Edur Multi-Phase DAF Pump LBUX602C160L (as of 9/6/11 not in service);
- Shanley Pump Edur Segmental Type Pump (as of 9/6/11 not in service);
- Shanley Pump Edur DAF Whitewater Pump (as of 9/6/11 not in service) (Info Sheet);
- North American Electric DAF Effluent Pump B Motor;
- WSI Water/Flotation Solution Binder (O&M);

- Watson Marlo Pump (maintenance);
- Ravens Industries Drawing 5000 gallon Caustic Storage Tank; and Gorman-Rupp Pumps

3.7 Outfalls

3.7.1 Outfall 001

Outfall 001 receives storm water collected in Drainage Area 002 and Drainage Area 003 sumps; in other words, storm water generated in these drainage areas is diverted prior to discharging from their respective outfalls to the on-site wastewater treatment system, where it is subsequently discharged via Outfall 001.

Once the new proposed Operations Permit is in effect, treated effluent will be sent to Artesian Wastewater for disposal.

3.7.1.1 Operating Procedures

Outfall 001 is the discharge point for treated effluent from the wastewater treatment plant. Once the effluent leaves the chlorine contact tank the flow is measured in a parshall flume prior to be discharged at outfall 001.

The parshall flume and Outfall 001 shall be inspected on a regular basis throughout the period of treated effluent discharge. The inspection shall include visual observation of any floating materials, solids, paper, trash, foam, etc. No objectionable materials shall be discharged at Outfall 001. The only discharge shall be treated effluent that is clear and free of turbidity. The parshall flume shall also be inspected for accumulation of algae growth in the off-white channel. Any algae that accumulates shall be removed using a wire brush that is kept adjacent to the parshall flume.

The Outfall 001 discharges treated wastewater into Bearverdam Creek just beyond the fence in back of the wastewater treatment plant. The gate at the fence is identified as Outfall 001.

The outfall beyond the fence should be inspected once per shift during periods of treated effluent discharge. The inspection should confirm that no floating or objections solids or foam are being discharged to Beaverdam Creek. The inspection should also make certain that no branches, trees or other objects are blocking the flow of treated water to the stream. Grass cutting and weed control at the Outfall 001 is imperative to maintain the beauty and integrity of this outfall.

3.7.1.2 Maintenance

Maintenance is performed on an as needed basis primarily grounds keeping and stream maintenance.

3.7.1.3 Manufacturers Specifications

The Manufacturer has provided:

- Hach Sigma Power Supply SD900 Composite Sampler

3.7.2 Outfall 002

3.7.2.1 Operating Procedures

Drainage Area 002 is approximately 42,282 square-feet in size. Average daily storm water generated in this drainage area is calculated by multiplying the collection area by the average annual rainfall depth, obtained from the National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) data inventory for the Wilmington, DE station, and dividing by the number of days in a calendar year. Storm water generated in this drainage area is conveyed to a concrete sump prior to reach the outfall, which would convey storm water to Beaverdam Creek. Wash water, generated via vehicle/equipment washing, and hosing down of areas at the site, is also conveyed to the sump associated with Outfall 002. The average daily flow of wash water was estimated by plant personnel based on experience. Water collected in the sump is transferred to Anoxic BNR A via a high flow rate Gorman-Rupp pump operated on a float system where it is subsequently treated and discharged via Outfall 001. Water, including storm water and wash water, is only discharged from Outfall 002 during atypical precipitation events during which the capacity of the wastewater treatment system is being approached.

3.7.2.2 Maintenance

Maintenance is performed on this equipment is documented in EMS system which produces work orders weekly, monthly, quarterly, and /or annually.

Clean Delaware performs monthly clean out of the sumps at 002, 003 and holding shed (work order for this).

3.7.2.3 Manufacturers Specifications

The Manufacturer has provided:

- Gorman-Rupp Co. Self-Priming Centrifugal Pump (O&M)

3.7.3 Outfall 003

Drainage Areas 4 & 5 are approximately 70,528 square-feet in size. Average daily storm water generated in this drainage area is calculated by multiplying the collection area by the average annual rainfall depth, obtained from the NOAA's NCDC data inventory for the Wilmington, DE station, and dividing by the number of days in a calendar year. Storm water generated in this drainage area is conveyed to a concrete sump prior to reaching the outfall, which would convey storm water to Beaverdam Creek. Water collected in the sump is transferred to Anoxic BNR A via a high flow rate Gorman-Rupp pump operated on a float system, where it is subsequently treated and discharged via Outfall 001. Water is only discharged from Outfall 003 during a typical precipitation event during which the capacity of the wastewater treatment system is being approached. Note that no recordable discharge has occurred from Outfall 002 during the past three years.

3.7.3.1 Operating Procedures

The storm water station and Outfall 003 shall be inspected once per shift and recorded on the daily check list during periods that rain is not occurring. There is a 4 inch Gorman-Rupp storm water pump located in the storm water station that is controlled by the level in the inside sump. As the water level in the sump rises the float in the sump will trigger the pump to come on. The operator should inspect that this float is free and in working order. The pump should also be tested only if there is sufficient water in the sump to operate the pump.

The outfall is comprised of a swale lined with rocks, silt fence to damn the storm water flow and filter it. There are also two straw bales on the downstream side of the silt fence. There is a sampling station located downstream of the silt fence and straw bales. This sampling station is used only if there is a discharge. The sampling station should be inspected to ensure that it is free of dirt, rocks and other materials that would inhibit proper sampling and possible sample contamination.

3.7.3.2 Maintenance

Maintenance is performed on this equipment is documented in EMS system which produces work orders weekly, monthly, quarterly, and /or annually.

3.7.3.3 Manufacturer's Specifications

- Gorman-Rupp Co. Self Priming Centrifugal Pump (O&M)
- Gorman-Rupp T Series (T6A60-B) (see Book 5).

3.7.4 Outfall 004

Drainage Area 6 is approximately 550,000 square-feet in size. Average daily storm water generated in this drainage area is calculated by multiplying the collection area by the average annual rainfall depth, obtained from the NOAA's NCDC data inventory for the Wilmington, DE station, and dividing by the number of days in a calendar year. Storm water is conveyed to an approximate one acre storm water retention pond, located in the northern portion of the site, prior to being discharged to Beaverdam Creek.

3.7.4.1 Operating Procedures

The storm water retention pond and Outfall 004 are located between the trailer parking lot and the anoxic ponds. This outfall should be inspected once per shift at the same time the operator inspects the anoxic ponds.

The storm water retention pond should be free of floating materials; plastic, grease, oil, etc. If materials is observed floating on the storm water retention pond the operator shall notify the wastewater manager and/or the Yard Supervisor who will coordinate the cleaning of the pond. Use of an outside contractor may be required to facilitate the cleaning.

The operator inspecting the pond shall make note of whether or not the retention pond is overflowing the concrete dam and weir. If the pond is overflowing it should be noted in the plant log book. If the pond is not overflowing the amount of free board between the weir and the pond level should be noted and recorded.

The storm water retention pond and weir should be free of excess vegetation. Yard maintenance on this area is essential to the esthetics of this area.

3.7.4.2 Maintenance

Maintenance is performed on an as needed basis primarily grounds keeping and stream maintenance.

3.8 ANOXIC BNRS

There are two ponds Anoxic BNR A and Anoxic BNR B. Each pond is 1.5 million gallons capacity, TOTAL 3 MILLION. Also serves as equalization ponds to control the plant flow to stream. One Surface (Center Mixer) Mixer and two Aerators in each pond. Recycle is increased ->decreases plant effluent, ie. Flow to stream. The Anoxic BNRs is used for de-nitrification or conversion of nitrates from CMAS to remove total nitrogen. The Benshaw Redi Start Solid State Control (Soft Start) is on Anoxic Blower B only allows the equipment to come on line gradually. Tuthill Blowers provide air to the anoxic BNRs. Checks are made three times a day.

Two flow equalization basins also known as Anoxic BNR's are used to provide hydraulic flow equalization and additional pretreatment for removal of soluble and colloidal BOD, suspended solids and FOG. Biological wastewater pretreatment is provided in two 1,5 million gallon volume basins. Anoxic Reactor #1 is designed to function as either an anaerobic (zero DO/zero nitrate) reactor, or as an anoxic (low DO) and Reactor 1B is designed to function as an anoxic (low DO) reactor providing combined 7 day hydraulic flow equalization, carbonaceous BOD removal, phosphorus removal and nitrate removal.

3.8.1 Operating Procedures

Pump into the BNRs using three DAF effluent pumps.

The flow out is control by three pond pumps (less the recycle to pond A from CMAS 1) (see specific manufactures guide for operation).

Wastewater personnel check the ponds as part of part of the daily rounds and read the meter on the pond pump discharge.

3.8.2 Anoxic BNR A (Pond A)

Treated DAF effluent is pumped to the Anoxic BNR Pond A via four Gorman-Rupp 8" centrifugal pumps. The pumps are controlled by a high / low level control system in the DAF effluent pit. Flow pumped from these pumps goes directly to Pond A. The pipe that discharges into the Pond is submerged below the low level water line.

Recycle flow from CMAS 1 flows by gravity back to either Pond A, Pond B, or Pond A and Pond B. The recommended mode of operation is to have the recycle flow introduced into Pond A exclusively.

There are two air-o-laters on the north and south sides of Pond A. There is also a center mixer in Pond A. The air and mixing equipment should be checked by the operator once per shift with observations noted and recorded on the daily check sheet.

There should be an even distribution of air in Pond A. Air is provided by three Tuthill 75 HP blowers located in the Pond Blower Building located between Ponds A and B.

3.8.2.1 Maintenance

Maintenance is performed on this equipment is documented in EMS system which produces work orders monthly, quarterly, and semi-annually:

- Monthly on all three pumps – which include oil check, see work order
- Semi-Annually on all three pumps, see work order
- Quarterly PM for Tuthill blowers

3.8.2.2 Manufactures Specifications

- Aertec Aegrid Aeration System; for specific Installation, Operation and Maintenance Manual;
- Benshaw RediStart Solid State Starter Hardware Manual RBX/RCX PowerStack which includes technical information, installation, troubleshooting, etc.;
- Benshaw RediStart Solid State Starter Software Manual MX Control;

- Aqua-Aerobic Systems (Center Mixer) – AquaDDM Direct Drive Mixer-Blender (Jan 98) which includes installation, operation and maintenance for this specific piece of equipment;
- Aqua-Aerobic Systems – AquaDDM Direct Drive Mixer-Blender (Jan 03);
- Sparling Tigermag EP Flow Meter Pond Pump flow meter which includes installation, operation and maintenance;
- Tuthill Equalizer Model 6000's parts list and maintenance manual; and
- Gorman-Rupp T Series (T6A60-B).

3.8.3 Anoxic BNR B

The flow from Anoxic BNR A flows into Anoxic BNR B, via a submerged equalization line. As with Pond A, there are two air-o-laters and one center mixer. This equipment should be checked for proper operation once per shift and recorded on the daily check sheet. Even distribution of air in the pond should also be check and noted the on the daily check sheet.

Mixed liquor is pumped from Anoxic BNR B into CMAS 1 via four 6" Gorman-Rupp centrifugal pumps. The flow from these pumps, minus the recycle flow from CMAS 1 back to Anoxic BNR A, determines the plant effluent flow.

The level in both ponds should be monitored closely. If the pond level is approximately one foot below the white discharge pipe for sanitary wastewater then the recycle flow must be decreased to allow for more flow to be pumped from the Anoxic BNR's.

For further nitrate removal you also have the ability to recycle flow from Anoxic BNR B back to Anoxic BNR A. There is a valve on the pipe on the back wall that will accomplish flow back to Anoxic BNR A.

3.8.3.1 Operating Procedures

Pond A, there are two air-o-laters and one center mixer. This equipment should be checked for proper operation once per shift and recorded on the daily check sheet. Even distribution of air in the pond should also be check and noted the on the daily check sheet.

3.8.3.2 Maintenance

Maintenance is performed on this equipment is documented in EMS system which produces work orders weekly, monthly, quarterly, and /or annually.

3.9 Aeration Cells

Following the Anoxic BNR's is a Complete Mix Activated Sludge (CMAS) system that provides activated Sludge Final Treatment. Equalized, pretreated, wastewater is pumped from the Anoxic

BNR's aka flow equalization basins at a relatively constant 24 hours/day, 5-7 days/week into the downstream activated sludge final treatment system for removal of soluble and colloidal BOD, ammonia nitrogen, total nitrogen, and total phosphorus.

CMAS 1 is a 1.6 million gallon aeration tank with two 300 HP Hoffman blowers and a third Aerzan Blower. CMAS 2 is a 500,000 gallon aeration tank with three 75 HP Hoffman blowers.

3.9.1 Aeration Cell 1

Flow from the anoxic ponds enters CMAS 1 for aeration, BOD reduction, nitrification and dentirification. D.O. levels are maintained between 0.5 mg/L and 2.0 mg/L. The blowers cycle on and off according to the D.O. reading in the tank. The purpose for this cycling and range of dissolved oxygen is to allow for nitrate conversion known as denitrification.

The target nitrate level in this tank is 20 mg/L for warm weather; the target nitrate level in this tank is 10 mg/L for colder weather.

Return Activated Sludge (RAS) from the final clarifier enters CMAS 1 via a 6" Gorman-Rupp centrifugal pump.

Recycle flow from this tank is sent by gravity back to Anoxic BNR A for nitrate conversion or denitrification.

Mixed Liquor Suspended Solids (MLSS) in CMAS 1 should be between 3000 mg/L and 4,000 mg/L. Lowering or raising the MLSS is accomplished by Waste Activated Sludge (WAS) control.

3.9.1.1 Operating Procedures

The anoxic ponds enters CMAS 1 for aeration, BOD reduction, nitrification and dentirification. D.O. levels are maintained between 0.5 mg/L and 3.0 mg/L. The blowers cycle on and off according to the D.O. reading in the tank. The purpose for this cycling and range of dissolved oxygen is to allow for nitrate conversion known as denitrification.

The target nitrate level in this tank is 20 mg/L for warm weather; the target nitrate level in this tank is 10 mg/L for colder weather. If nitrates are higher you may have to put a delay between the cycles of the blowers according to nitrate removal requirements.

Return Activated Sludge (RAS) from the final clarifier enters CMAS 1 via a 6" Gorman-Rupp centrifugal pump.

Recycle flow from this tank is sent by gravity back to Anoxic BNR A for nitrate conversion or denitrification.

Mixed Liquor Suspended Solids (MLSS) in CMAS 1 should be between 3000 mg/L and 4,000

Return Activated Sludge (RAS) from the clarifier to CMAS 1 should be at least fifty (50) per cent of the plant effluent flow.

3.9.1.2 Maintenance

Maintenance is performed on this equipment is documented in EMS system which produces work orders weekly, monthly, quarterly, and /or annually.

3.9.1.3 Manufacturer's Specifications

The Manufacturer has provided:

- Honeywell Circular Chart Recorder DR4300;
- MTS Jet Aeration System MT4JM-25 Submittal Data (Dec 1993);
- MTS Jet Aeration System MT4JM-25 Installation, Operation and Maintenance Manual (Feb 1994);
- Hoffman Blower 1181070, 1181071, 1181072, Operating and Maintenance Manual;
- HIS Cast Iron Multistage Centrifugal Blower, Installation, Operation and Maintenance Manual;
- Endress Hauser FMU 806 – 862 Ultrasonic Measurement;
- Endress Hauser FDU 80 – 85 Prosonic Measurement;
- HIS Cast Iron Multistate Centrifugal Blower;
- ATEC Complete Mix Activated Sludge Tank;
- Danfoss Evita Oxy – sensor for measuring dissolved oxygen; and
- Honeywell Progeny ADO Dissolved Oxygen Analyzer

3.9.2 Aeration Cell Two

CMAS 2 is a 500,000 gallon aeration tank that receives mixed liquor flow from CMAS 1. Aeration is provided by three 75 HP Hoffman Blowers. Course air diffusers in the tank deliver the air to the mixed liquor in the tank.

3.9.2.1 Operating Procedures

Optimum Dissolved oxygen for this tank is 2.0 mg/L to 4.0 mg/L. This D.O. range will ensure that BOD reduction and nitrification occur.

Laboratory testing for process control of the activated sludge system shall be performed on a daily basis. See the section on sampling for testing procedures that are necessary to maintain optimum conditions for treatment of activated sludge.

3.9.2.2 Maintenance

Maintenance is performed on this equipment is documented in EMS system which produces work order quarterly, semi-annual and /or annually.

All repairs and major maintenance on Hoffman blowers are performed by outside vendors. Annual laser alignment of the blowers is performed by an outside contractor. At this time the blower is inspected for routine maintenance requirements.

3.10 <u>Flocculation Tank</u>

Polyaluminum chloride chemical feed and Cationic Polymer chemical feed occur in this tank. Flow enters the tank from CMAS 2 and mixes with the chemicals for flocculation, coagulation that promote sludge settling and phosphorus removal.

3.10.1 <u>Operating Procedures</u>

Polyaluminum chloride chemical feed and Cationic Polymer chemical feed occur in this tank. Flow enters the tank from CMAS 2 and mixes with the chemicals for flocculation, coagulation that promote sludge settling and phosphorus removal.

3.10.2 <u>Maintenance</u>

No maintenance is performed on the flocculation tank, visually inspections are performed weekly at a minimum, and only deficiencies are recorded in log book.

3.11 <u>Clarifiers No. 1 &2</u>

The final clarifiers located adjacent to CMAS 2 receives mixed liquor flow from CMAS 2 by gravity via the flocculation tank. When flow enters the center column of the clarifiers it has been mixed with polyaluminum chloride and cationic polymer. The clarifiers provides a zone for the sludge blanket to settle with return activated sludge (RAS) being pumped back to CMAS 1. The flow that leaves the clarifiers is referred to as secondary or clarifier effluent. This effluent should be clear with a high degree of treatment observed.

3.11.1 <u>Operating Procedures</u>

There are sludge collection systems that rotates the entire circumference of the clarifiers. This collection system allows the sludge to accumulate at the suction pipes for the RAS pumps which are located in the adjacent building. This pump is a 6" Gorman-Rupp centrifugal pump. There is also a WAS pump.

Operating Problem Procedures

The most common operating problems in activated sludge are not in metabolizing wastes, but rather in removing the solids and bugs from the water in clarification.

Table 3-2 Typical Factors Affecting Clarification

Problem	**Cause**
Hydraulic problems	Flow exceeds hydraulic capacity of the clarifier. Excessive recycle flow rate
Bulking sludge	Excessive MLSS Young sludge Filamentous bacteria Low pH
Rising sludge	Septic conditions in clarifier Denitrification
Ashing	Low F:M (<0.05) Excessive grease Old sludge
Pin floc or straggler floc	Young sludge Old sludge
Foam	Young sludge Nocardia caused by low F:M Surfactants

Components of Natural Waters

- Dissolved particles
    - CA, Mg, Cl, Na—cannot be removed with polymer treatment.
    - Measured by water conductivity.
    - Requires both chemical and physical processes to remove.
- Suspended particles

- Silt, mud, metals, oils, and mineral precipitates.
- Can be removed by polymer.
- All particles have ionic charge.

Forces Exerted on Suspended Particles

Types of Forces

The types of forces exerted on particles suspended in a liquid medium should be understood to comprehend the mechanism used to accomplish the separation of liquid from solids. There are basically four forces involved:

- **Gravity** is the force that pulls suspended solids down toward the bottom of the vessel in which they are suspended.
- **Vander Waals** are the short-range, attractive forces between suspended particles. These forces tend to draw suspended particles toward each other.
- **Brownian** are the forces that impart motion to colloidal suspended particles through collision between the particles and molecules of the suspending media.
- **Electrostatic repulsion** is a repulsive force between particles which tends to keep them apart. It is the major force keeping solids in suspension; therefore, it is the force that polymers counteract. Without polymer treatment, the closer the suspended solids come to one another, the more strongly they repel each other.

For efficient removal, the particles need to be enlarged with small particles. Electrostatic repulsion keeps particles suspended.

Stokes' Law

Gravitational forces tend to allow settling of solids from suspension, just as electrostatic repulsive forces tend to make a suspension stable. The summary of this rather complex mathematical equation shows that the rate of particle settling is directly proportional to the radius of the particle squared, inversely proportional to the viscosity of the suspending solution, and directly proportional to the difference in density between the particle and its suspending media.

In attempting to settle suspended solids, there is very little we can do to affect the viscosity of the water suspending the solids or the difference in density between solids and the suspending water. We can, however, influence the radius of the suspended particles by promoting particle growth.

The primary factor in determining whether a suspension will settle or remain stable is the **particle size of the suspension**. For example, a particle of sand one millimeter in diameter will take three seconds to settle one foot in a given vessel. If that particle were broken into particles of 0.000001 millimeter in diameter, it would take at least 63 years to settle that one-foot distance.

The one-millimeter particle of sand, according to Stokes' Law, will settle and be influenced very little by electrostatic repulsion. When the sand is ground into particles of 0.000001 millimeter in diameter, electrostatic repulsion will play a much greater role than gravity.

The use of polymers to separate solids from liquid media is a method by which the chemistry of water and wastewater solids is altered to allow gravity to become the dominating force imposed on the finely divided particles, thereby causing them to settle within the time constraints dictated by the treatment plant design.

Polymers are capable of reacting with suspended particles through electrical attraction of opposite charges and by the fact that they are very large molecules, easily becoming entangled with particles they contact. Thermal motion further contributes to these reactions by causing polymer molecules to "bump into" suspended particles more frequently.

Definition of a Polymer

A polymer is an organic substance made up of giant molecules formed by the union of simple molecules (monomers). Coagulants have fewer repeating monomers in the structure and, therefore, exhibit lower molecular weights. Flocculants have several repeating monomer units and, therefore, have extremely high molecular weights. Flocculants generally have the characteristic slimy feed before and after mixing with water.

Coagulation and Flocculation

1. Coagulation
   - Neutralizes the surface charge of a particle.
   - Uses high-charge, low-molecular-weight polymers or inorganic coagulants.
   - All surface charge does not need to be negated; usually only 30–40% is necessary.
   - Usually performs best at pH levels 6.0–7.0.
   - Once a charge is negated, the particles form microfloc.
   - More efficient in warmer water.
   - Polymers work better than inorganic salts at expanded pH ranges.
   - Maximum mixing energy required; cannot have too much.
   - Can be difficult in low-solids water.
   - Oil demulsification is a coagulation process.
   - Usually followed by flocculation.
2. Flocculation
   - "Glues" coagulated particles together.

- Polymers vary in charge.
- High molecular weight.
- Must be mixed prior to application: 0.1–0.5% maximum.
- Polymer is activated when mixed.
- Dosages are usually 1–5 parts per million (ppm).
- Requires good mixing, but not too rapid. Rapid mixing will cause floc to shear.
- Overfeed will result in "stringers."

Table 3-3 Polymers involved in Flocculation

Classification	**Charge**
Nonionic	None
Anionic	Negative
Cationic	Positive
Amphoteric	Both positive and negative

Phosphorous Removal

Aluminum Coagulants

- Produce aluminum phosphate floc.
- Most are effective at pH of 6.0.
- Typical alum requirements for phosphorus removal:

Table 3-4 Alum Requirements

Percent Phosphorous Reduction	Al:P	Weight Ratio Alum:P

75	1.2:1	13:1
85	1.5:1	16:1
95	2:1	22:1

Reaction with Aluminum Chloride

$AlCl_3 + PO_4^{-3} \Rightarrow AlPO_4 + 3HCl$

Biological Processes

- 1 ppm phosphorous is consumed for every 100 ppm BOD in wastewater.
- "Luxury uptake" can increase removal.

Determining Chemical Dosages

Jar tests are used to evaluate chemical dosages. The key to effective jar testing is to simulate mixing and settling conditions in the plant as closely as possible. Laboratory units are available to run four or six individual tests simultaneously. The jar tester has a variable speed motor that allows control of the mixing energy in the jars.

Clarification results are sensitive to chemical dosage, mixing energy, and length of mixing. The coagulant should be added with high energy to disperse it in the water and promote increased frequency of collisions. The duration may be less than one minute. A flocculant may be added during the last few seconds of the rapid mix or during a slow-mix period. During the slow-mix period, floc building proceeds. Care must be taken not to shear floc with excessive mixing.

When mixing is complete, the jars are allowed to settle. Treatment dosages are then evaluated based on floc settling, floc formation and strength, and clarity.

Jar Test Procedure

JAR TEST PROCEDURE USED FOR DETERMINING POLYMER and ALUMINUM CHLORIDE DOSAGE TO THE CLARIFIER.

1. Prepare solutions of polyaluminum chloride and cationic polymer.

- 1.0% solution of polyaluminum chloride – 4 ml AlCl3 in 396 ml water
- 0.1% solution of cationic polymer – 0.4 ml P838E in 400 ml water

2. Collect a sample from the CMAS 2 with no chemicals added.

Sample should not sit for more than 15 minutes.

3. Measure either 500 ml or 1000 ml samples of mixed liquor for each beaker.
4. Turn mixer on and set at maximum rate before adding aluminum chloride.
5. Add chemicals to the beakers, varying the dosage of only one chemical at a time. Reduce mixer speed to 100 RPM before adding P838E. Be sure to include dosages relative to current plant dosage.

Dosages in 1000 ml beakers:

- 1 ml of 1.0% solution of aluminum chloride equals 10 ppm_v
- 1 ml of 0.1% solution of P838E equals 1 ppm_v

Dosages in 500 ml beakers:

- 1 ml of 1.0% solution of aluminum chloride equals 20 ppm_v
- 1 ml of 0.1% solution of P838E equals 2 ppm_v

6. After chemicals have been added and mixed, cut off mixer and withdraw paddles.
7. Estimate the settling rate and the supernatant clarity two to three minutes after withdrawing paddles.
8. At the end of the settling time, samples of the supernatant can be drawn for turbidity measurement.
9. Choose best jar based on speed of floc formation, settling rate, and clarity or turbidity.
10. Calculate chemical dosage requirements. See attached page for calculations for target dosages.

Figure 3-5 Secondary Clarification P838E Feed Rates

Clarifier Influent Flow	Ml/Min Polymer Solution Feed*				
	0.5	1.0	1.5	2.0	2.5

MGD	ppm	ppm	ppm	ppm	ppm
1.0	526	1051	1577	2103	2628
1.1	578	1157	1735	2313	2891
1.2	631	1262	1893	2523	3154
1.3	683	1367	2050	2734	3417
1.4	736	1472	2208	2944	3680
1.5	789	1577	2366	3154	3943
1.6	841	1682	2523	3364	4206
1.7	894	1787	2681	3575	4468
1.8	946	1893	2839	3785	4731
1.9	999	1998	2996	3995	4994
2.0	1051	2103	3154	4206	5257
2.1	1104	2208	3312	4416	5520
2.2	1157	2313	3470	4626	5783
2.3	1209	2418	3627	4836	6045
2.4	1262	2523	3785	5047	6308
2.5	1314	2628	3943	5257	6571

Polymer Solution - 0.250%

*Based on 0.25% solution (5.0 gallons P838E per 2000 gallons water)

3.11.2 Maintenance

Maintenance is performed on this equipment is documented in EMS system which produces work orders weekly, monthly, quarterly, and /or annually.

3.11.3 Manufacturer's Specifications

The Manufacturer has provided:

- Top Line Centrifugal Pump Model TF-C Series (O&M);
- Aqua-Aerobic Systems, Inc. (O&M); and
- Envirex Clarifier (O&M)

3.12 Chlorination

Clarifier effluent is discharged by gravity and is dosed with chlorine prior to reaching the effluent pump station. Disinfection is attained through dosing of sodium hypochlorite. A 15% strength sodium hypochlorite solution is used for disinfection by chlorination. Sodium hypochlorite liquid solution is stored in a bulk tank and pumped to a solution water line for transfer to the inlet of the contact basin.

3.12.1 Operating Procedures

1. Chlorine Residual and pH

Monitoring of the final effluent for chlorine residual must be done at a minimum of once per day and reported on the lab sheet hanging on the wall (see attached sheet). A sample shall be taken before the sodium bisulfate is injected to ensure there is adequate chlorine to kill the bacteria. A residual of not less than 1.0 mg/L shall be kept at all times. The Hach DR/890 Colorimeter shall be used to measure the chlorine in both of these samples.

A pH test must be run at a minimum of once per day. To test for pH the Oakton Ion 510 Series pH meter must be used. The meter shall be calibrated using buffer solutions; 4.01, 7.0 and 10.01. These buffer solutions must be poured fresh each time the meter is calibrated. The results shall be recorded on the same sheet as the chlorine residual.

2. Turbidity Test

Turbidity is measured continuously in the Metering and Monitoring building.

- Water Re-Use Pump
- Reuse water is pumped back to the chicken processing facility. This pump will continually pump treated chlorinated effluent water to the Offal area, Trailer Hydrants near Shipping, wastewater belt filter press and dilution water for the chlorine and sodium bisulfate that is fed to the chlorine contact basin. The controls for this pump are in the Motor Control Room. There is an disconnect at the MCC and a Controller located adjacent to the MCC.

3.12.2 Maintenance

Routine maintenance is performed as per the manufacturer's recommendations

3.13 Digesters

Two 134,000 gallon aerobic digester, Digester A and Digester B, are provided for the digestion of waste activated sludge prior to being pumped to the belt filter press.

3.13.1 Operating Procedures

Waste activated sludge (WAS) is pumped to either Digester A or Digester B depending on the volume in the digester tank. There is no control alarm for high level so it is important that a frequent visual check be performed on the digester as you are pumping WAS to either digester. Once the digester is full the waste activated sludge flow must be switched to the other digester.

Each digester is equipped with a surface aerator / mixer. The contents of the digester must be thoroughly mixed and aerated to provide aerobic digestion which will enhance the de-waterability of the sludge.

When it has been determined by the operator that sufficient mixing and aeration has occurred the aerator should be shut off and the sludge in the digester should be given time to allow for the settling and compaction of solids. Once the sludge has settled, you must lower the decant pipe into the clear water. This will allow this water known as decant to flow back to the DAF effluent pit where it is then pumped to the anoxic ponds. When the decant has been removed from the digester, it is now ready to be dewatered using the belt filter press.

As the digester is being dewatered, the surface aerator will be mixing the contents in the digester. Therefore, it's important that the operator perform a frequent visual check of the level in the digester to prevent the surface aerator from resting on the bottom of the digester tank while it's ON. When the level reaches the top of the service door (low level), it's ideal for the operator to stop dewatering that digester and switch dewatering to the other digester if the level is high enough.

It's necessary for the operator to maintain the waste activated sludge at the low level mark or higher to allow sufficient mixing and aeration. If not, septic conditions may occur and freezing during cold temperatures.

3.13.2 Maintenance

Maintenance is performed on an as needed basis.

3.14 Press

3.14.1 Operating Procedures

Sludge from either Digester, A or B, is pumped to the screw press.

Start Up Procedure for the Belt Filter Press

1. Before start-up, check the following:
   - Top and lower belts for alignment and tension.
   - Air compressor must be on and valve open on discharge line.
   - Air valve must be open on belt filter press.
   - Check top and lower belt tracking sensors to ensure operation.
2. Determine which digester, A or B, to be pumped from. Open and close valves accordingly to direct digester sludge to the belt press.
3. Open valve for Re-use water.
4. Turn on water booster pump.
5. Turn on belt drive for press and allow to run several minutes while observing the following:
   - Tears, rips, or separation of belt seams.
   - Noises, which may be the result of mechanical problems.
   - Alignment of the belts.
6. Turn on conveyor belt and press auger (same on/off switch) to ensure operation.
7. Turn on DynaBlend by doing the following:
   - Open water inlet valve.
   - Make sure valve on discharge end of DynaBlend is open.
   - Turn on polymer LMI Pump. Set to INTERNAL.
8. Turn on the Nemo sludge pump #3.
9. Verify sludge is being pumped to belt press by doing the following:
   - Checking flow meter for gal/min. being pumped or,
   - Climbing ladder to observe the pumping of sludge across the belt.

10. Make adjustments to belt speed, polymer feed, water, and/or sludge pumping rate if needed to prevent/minimize the loss of solids while going through the belt filter press.

Shutdown Procedure for the Belt Filter Press

1. Turn off Nemo sludge pump.
2. Turn off the polymer LMI pump and close the water inlet valve on the DynaBlend.
3. Allow Belt Filter Press to run for 20-30 minutes to clear belts of sludge and to be cleaned by belt washers. Powerwash Belt Filter press, clean conveyor belt, and floor around Press.
4. When finished cleaning, turn off conveyor belt and auger, belt filter press, booster pump, and then close the Re-use water valve.

Wastewater operators are required to frequently hose off the press and pay close attention to the full operation of the press.

3.14.2 Maintenance

Table 3-1 Troubleshooting & Solutions for Press

Problem	**Possible Causes/ Solutions**
Poor gravity drainage	Improper conditioning Belt speed too high Inadequate cloth washing Doctor blade buildup
High cake moisture	Improper conditioning Belts blinded Belt speed too high Inadequate compression Sludge overload
Solids squeezed through belt	Polymer underdosed Applied pressure too high

	Belt speeds too high Sludge overload
Cake extruding out sides	Improper conditioning Belt speeds too low Applied pressure too high Sludge overload
Improper belt tracking	Drum or roll misalignment Limit switches out of position Limit switches not functioning Insufficient belt tension Sludge build-up on rolls and drums

Maintenance is performed on this equipment is documented in EMS system which produces work orders monthly, semi-annual, annual and every two years.

3.14.3 Manufacturers Specifications

The Manufacturer has provided:

- Komline-Sanderson Liquid/Solid Separation & Drying Products, Instruction Manual;
- Ingersoll-Rand Air Compressor T30 Model 2545 Parts List;
- Ingersoll-Rand Air Compressor Models 2340, 2475, 2545, 7100, 15T, 3000 Owner's Manual;
- Ingersoll-Rand Pressure Switches Models 2340, 2475, 2545, 7100, 15T, 3000 Supplemental;
- Netzsch Nemo Progressing Cavity Pump;
- Campbell Hausfield Air Compressors Cast Iron Series; and
- Poly Blend, Stranco, Inc. for Model PB 600-2 (O&M) Danfoss Magflo Electromagnetic Flowmeters.

3.15 DAF Effluent Pumping

Treated wastewater from the DAF flows into the DAF effluent pit. Magnesium Hydroxide is added to this pit to provide alkalinity and pH control throughout the anoxic ponds and CMAS aeration system. There are three 8 inch Gorman Rupp pumps that pump the DAF effluent to the Anoxic BNR A.

The DAF effluent pit is also capable of receiving flows from other locations on an as need basis: Draining of all tanks can be accomplished by gravity flow from CMAS 1, CMAS 2, Clarifier, Old Clarifier and the Chlorine Contact Chamber. When a tank is taken out of service it is slowly drained to the DAF effluent pit. All flow that reaches the DAF effluent pit is pumped to the anoxic ponds.

3.15.1 Operating Procedures

The three Gorman Rupp pumps are programmed to operate in a lead, lag and standby mode of operation to ensure that the pit is pumped and does not overflow. An overflow of this pit will flood the wastewater building and run into the roadway. The pumps are programmed to start and stop based on a pressure signal transmitted by a transducer that is located in the pit. As the pit fills with treated water the pressure will increase on the transducer causing the pump(s) to come on. When the pit is pumped down and the pressure drops, the transducer will sense this and shut the pump(s) off.

Start-up Procedure

1. Turn DAF Influent pumps ON with the two disconnect switches.
    - Pumps 'A' and 'B' should be set on AUTO.
2. Open DAF Recycle valve. (Located under catwalk behind Polymer tank 1)
3. Check DAF Influent pit to ensure a flow of DAF Recycle.
4. Check Polymer tanks '1' and '2'.
    - Determine which tank will be used for start-up. Usually it's the one with the least amount of polymer solution remaining in the tank.
    - If both Polymer tanks are empty, Polymer should be made immediately in one tank before starting the DAF Polymer pump.
    - Check Polymer tank shutoff valves. The valve on the tank that's being used should be the only one open. The valve on the unused tank should be closed.
5. Turn on the DAF Polymer pump by doing the following:
    - Open valve on the inlet line for the Polymer pump.
    - Open valve on the discharge line for the Polymer pump.
    - On the DC Drive (Pump Controller), flip the left switch up to RUN. Then, hold the right switch upward on START for several seconds until the pump begins running.
6. Perform Polymer drawdown. (Feed rate is usually between 10,000 and 13,000 mL/min.)
7. Turn on DAF Aluminum Chloride pump by doing the following:
    - Open valve on discharge line of pump.
    - Set pump on INTERNAL
    - Set SPEED at 40

- Set STROKE at 40

8. Turn on DAF Skimmer.
   - Ensure operation of skimmer.
   - Set switch to AUTO.
9. As raw wastewater enters the DAF, the mixture of Polymer and Aluminum will create sludge on the surface of the water in the DAF tank. If no sludge is present, adjustments will need to be made to the Polymer and/or Aluminum dosage.

DAF Shutdown Procedure

1. Shut off Aluminum Chloride pump.
   - Close valve on discharge line of pump.
   - Leave SPEED and STROKE settings the same.
2. Turn off DAF Polymer pump.
   - Push the two switches on DC Drive (Pump Controller) downward.
   - Close valves on pump inlet line and pump discharge line.
3. Turn DAF Skimmer to MANUAL and allow all sludge to skim off the water's surface in the DAF tank. This may take 30-45 minutes or longer.
4. Once skimming is complete, turn skimmer OFF and pump all sludge out of the DAF Sludge Hopper.
5. Turn the DAF Influent pumps off with the two disconnect switches.
6. Close the DAF Recycle valve under the catwalk.

3.15.2 Maintenance

Maintenance is performed on this equipment is documented in EMS system which produces work orders monthly and quarterly.

Manufacturers Specifications

The Manufacturer has provided:

- Gresco Line Series XT/XU specification
- Gorman Rupp T-8

3.16 Motor Control Center Room

3.16.1 Operating Procedures

The Motor Control Center (MCC) room is located between the DAF effluent pumps and the belt filter press. The main control panel for the following equipment is located on this control panel which is located in this room. The equipment is as follows:

1. Magnesium Hydroxide Pump
2. DAF Effluent Pumps A, B & C
3. Belt Filter Press Auger
4. Polymer Mixers
5. Well #3 Pump
6. Storm Water 002 / 003 Pumps
7. Water Re-Use Pump
8. Digester Mixers A & B
9. Dilution Water Pump

3.16.2 Maintenance

Any repairs/maintenance required is performed as needed by outside vendors or licensed electrician. Whenever working on any plant equipment that has a main disconnect on the Motor Control Center (MCC) the Lockout /Tagout Program shall be used. See Appendix IV for the Permit Required Confined Space Program

3.16.3 Manufacturers Specification's

- Enterra Instrumentation Technologies: Series 7000 recorder/Totalizer (Operating Instructions);
- Honeywell Series AR 100 Recorder – Controller (Operation/Troubleshooting);
- Eurotherm Chessell Model 392 Circular Chart Recorder (O&M); and
- Graphic Controls Marking System Parts

3.17 Pond Pumping

There are three Gorman Rupp T-6 6 inch centrifugal pumps to provide pumping of wastewater from Anoxic BNR B to CMAS 1. These pumps are located in the pond pump house that is adjacent to the Anoxic BNR's. There is also a Motor Control Center (MCC) for all of the equipment associated with the Anoxic BNR's. This equipment includes Tuthill Blowers, Aerolaters, Center Mixers, and Pond Pumps.

3.17.1 Operating Procedures

It is necessary to operate all three pond pumps when the wastewater treatment plant is on line. A reduction in flow from the pond pumps will result in a reduction in recycle flow from CMAS 1 back to Anoxic BNR A. This will impair the process of denitrification in the anoxic ponds.

The first thing you do when you go to put the Pond Pumps on line is to open the brown valve on the discharge line. If this valve is not open the pumps will not be able to pump flow to CMAS 1. This brown valve is located on the discharge pipe next to the front window of the building.

When the plant is put on line, usually on Sunday night, it is necessary to start Pond Pump A first and get the discharge line primed. Once the discharge line is primed you can shut down Pond Pump A. The next thing to do is to bring Pond Pumps B & C on line. You can check that each pump is pumping by the check valve arm being in an upright position and by the reading on the flow meter that is located on the discharge line. Once Pond Pumps B & C are on line and both are pumping you can then bring Pond Pump A on line. The total flow from all three Pond Pumps is approximately 2400 gallons per minute (gpm).

3.17.2 Maintenance

Maintenance is performed on this equipment is documented in EMS system which produces work orders weekly, monthly, quarterly, and /or annually.

3.17.3 Manufacturers Specifications

The Manufacturer has provided:

- Gorman-Rupp T-660B (O&M)
- Gorman-Rupp T-6A60B (O&M)

4 Monitoring Program

4.1 Treatment System

4.1.1 Influent and effluent

A monitoring program is required at the treatment facility for several reasons. The control of the treatment process can be maintained with laboratory data. Compliance is also verified through monitoring of plant effluent. Record of the facility's operation is made available for further study and possible efficiency improvement. Laboratory testing also aids in the analysis of problems and their prevention.

The treatment system monitoring program provides the basis for process control and produces a record of how the treatment facilities are operating. This information keeps the operating personnel informed of plant efficiencies and helps in predicting problems that may be developing in the system. Because laboratory test results are a record of plant performance, they are often evaluated by regulatory bodies. For these reasons, it is essential a treatment system's laboratory testing program produce complete and accurate results.

The laboratory is located in the wastewater office trailer and is equipped to perform some of the simpler tests required for process plant process monitoring. Tests for MLSS, COD, Phosphorus, Ammonia, Nitrate, Total Nitrogen, Alkalinity, Chlorine residual , pH and temperature will be performed in the laboratory onsite; tests for NPDES permit requirements will be done on a contractual basis using a testing laboratory. Laboratory testing can be used for process control, monitoring plant efficiency and to provide historical data.

The value of results from wastewater lab testing is dependent upon the sample being representative of the source from which it is taken. There are two types of samples being taken for wastewater lab analysis:

Composite Sample

A combination of individual samples taken at selected time intervals, for some specified period, to minimize the effect of the variability of the individual sample. Samples may be of equal volume or proportional to flow at time of sampling. A maximum of two hours is permitted by DNREC between collections of individual composite samples, and these must be promptly refrigerated. The method of sampling must be recorded, as well as the time date, location and person doing the sampling.

Grab Sample

A single sample that's taken at neither a set time nor flow and collected in less than 15 minutes. This type of sample is used (1) for a special analysis where a particular constituent of the wastewater is thought to have changed considerably from its normal value, (2) for routine analysis where a particular constituent is thought to remain constant in concentration, regardless of flow conditions, or (3) for a routine analysis where a particular constituent is critical at only one specific time of day, say at the time of maximum flow.

4.1.1.1 Operating Procedures

Composite Sample

A combination of individual samples taken at selected time intervals, for some specified period, to minimize the effect of the variability of the individual sample. Samples may be of equal volume or proportional to flow at time of sampling. A maximum of two hours is permitted by DNREC between collections of individual composite samples, and these must be promptly refrigerated. The method of sampling must be recorded, as well as the time date, location and person doing the sampling.

It is required that we sample our effluent for the parameters noted in the NPDES permit. Most of the sampling requirements are based on a composite sample taken over a 24 hour period. To accomplish this, on a weekly basis the composite sampler is set up on Tuesday at midnight and is taken off line on Wednesday at midnight.

The procedure for setting up the Sigma composite sampler is as follows:

1. Obtain ice from the ice house and bring to the sampler which is located at the end of the chlorine contact chamber. Take the top off of the sampler and place the ice in the bottom of the sampler.
2. Inspect the suction tube to ensure that it is clean and there is no algae buildup. Replace tubing if necessary. It is stored in the shed behind the wastewater building.
3. Complete the required information on the Chain of Custody sheet starting with the time of sampler set-up.
4. Place the sample container in the center of the sampler over the ice.
5. Place the top of the sampler over the sample container. Ensure that the sample delivery tube goes into the sample container.
6. Snap and secure the sides of the top to the bottom of the sampler.
7. Hit Power. Hit Run. Hit Enter.
8. Collect sample at the end of the run time which is Wednesday at midnight.
9. Record on the Chain of Custody the time the sampler is taken off line.
10. Shake the sample and transfer into the EnviroCorps sample containers.
11. Refrigerate all samples.

Complete all other information that is required on the Chain of Custody Sheet.

It is required that we verify the volume of the aliquot sample collected by the Sigma sampler on a monthly basis. This procedure is documented below for the purposes of training and sample verification.

1. A 1000 ml graduated cylinder will be required for aliquot sample verification.
2. Go to the composite sampler and plug it in.
3. Remove the top cover from the sampler.
4. Place the 1000 ml graduated cylinder on a level surface.
5. Remove top of the sampler and place discharge line in the graduated cylinder.
6. Push manual operation on the sampler key pad.
7. A grab sample will come up that should measure 100 ml.
8. Push Enter.

Repeat 4 times and record the volume of each sample on the Sampler Aliquot Verification sheet. Record all information requested for that sample verification procedure.

Grab Sample

A single sample that's taken at neither a set time or flow and collected in less than 15 minutes. This type of sample is used (1) for a special analysis where a particular constituent of the wastewater is thought to have changed considerably from its normal value, (2) for routine analysis where a particular constituent is thought to remain constant in concentration, regardless of flow conditions, or (3) for a routine analysis where a particular constituent is critical at only one specific time of day, say at the time of maximum flow.

The following is a list of general guidelines for sampling wastewater:

- Sample should be taken at location where the wastewater is as completely mixed as possible.
- Samples should be taken during the maximum flow period. The time of taking the samples should be consistent with production periods.
- Particles greater than one-quarter inch should be excluded when sampling.
- Any floating materials, growths, etc., which may have collected at a sampling location should not be included when sampling.
- If samples are to be kept for an hour or more prior to testing, they should be immersed in ice water to retard bacterial action or all samples which are not immediately analyzed should be preserved by refrigerating at 4 deg. To 10 deg. C (39 deg. to 50 deg F). For some tests, other preservatives are used. Additional information is provided in the references list in Section 4-F.
- All samples should be collected at points in conduits where the flow is highly turbulent so that a well-mixed sample is obtained. Furthermore, it is very important that the

sample container being used is clean and that samples are accurately labeled for later identification.

- Proper sampling equipment should be provided and safety precautions should be exercised during all sampling.

- Consideration should be given to the relationship between the plant's daily flow variation and detention time through the units so that influent and effluent samples relate to the same waste.

Monitoring at Allen Harim

- The following table depicts the sampling protocol which will be used by Allen Harim to maintain compliance with the regulations:

Influent & Effluent Monitoring Table 1

Parameter	**Unit**	**Frequency**	**Sample Type**	
			Influent	**Effluent**
Flow	Gallons Per Day	Continuous	Recorded	Recorded
BOD_5	mg/L	2 x Month	Grab	Composite
TSS	mg/L	2 x Month	Grab	Composite
Total Dissolved Solids	mg/L	Quarterly	N/A	Grab
Fecal Coliform	Col/100 ml	Quarterly	N/A	Grab
Total Nitrogen	mg/L	1 x Week	Grab	Composite
Ammonia Nitrogen	mg/L	Monthly	Grab	Composite
Nitrate/ Nitrite as Nitrogen	mg/L	Monthly	Grab	Composite
pH	S.U.	3 x per Week	Grab	Composite
Total Phosphorus	mg/L	Monthly	Grab	Composite
Chloride	mg/L	Quarterly	Grab	Composite
Turbidity	NTU	Continuous	N/A	

1. In the event that a sample from the Allen Harim metering and monitoring building exceeds the Action Thresholds defined in **Table 4** or **Table 5** (below), the corresponding actions will be taken as described in Section 4.0.

Table 3: Action Thresholds for Parameters with Upper Bounds

Parameters	Unit	Sample Type	Action Threshold
Total Nitrogen	mg/L	Composite	> 30
BOD_5	mg/L	Grab	> 10
TSS	mg/L	Grab	> 10
Fecal Coliforms	col./100 mg	Grab	> 20
Turbidity	NTU	Continuous	> 5

Table 4: Action Thresholds for Parameters with Upper and Lower Bounds

Parameters	Unit	Sample Type	Lower Action Threshold	Upper Action Threshold
pH	S.U.	Grab	< 6	> 9
Chlorine Residual	mg/L	Continuous	< 0.5	> 4

2. Continuous Sensors:
   - Continuous monitoring sensors will monitor for flow rate, pH, turbidity, oxidation/reduction potential, and chlorine residual. These continuous results will be visible for remote viewing in the SCADA systems of both Allen Harim and AWMI.
     - The continuous monitoring of flow is required by **§6.8.2.3**.
     - The continuous monitoring of turbidity is required by **§6.3.2.3.3.2.5**.
     - The monitoring frequency for chlorine is not specified in the regulations, though a residual is required by **§6.3.2.3.3.2.3.1**.
     - The continuous monitoring of pH and oxidation/reduction potential are not required by regulation, and are provided as a supplemental source of information to aid Allen Harim operators. These are not intended for direct permit compliance but have been incorporated into the design as a further operational tool.

3. Additional Sampling
   - Allen Harim will perform additional sampling to assess the health of the wastewater treatment plant system and the effectiveness of treatment. Parameters tested may include but not be limited to the following.
     - COD
     - Nitrates
     - Total Nitrogen
     - Dissolved Oxygen
   - Process control monitoring of these constituents provides for a supplemental source of information between compliance monitoring events to show the system is operating effectively. These measurements may be used to approximate the concentration of other,

regulated constituents as a "first indicator" of system health.

- In order to provide an early indicator of potential exceedances of BOD_5 and Total Nitrogen, the surrogate parameters of COD and Nitrate will be field tested. These results will be correlated to BOD_5 and Total Nitrogen as part of regular operations to provide an early indication of problems so that additional, formal, tests of the regulated contaminant(s) can be initiated outside of the regular schedule.
  - The following grab samples will be taken 5 days per week by Allen Harim staff and analyzed in the on-site laboratory:
    - Field Test: COD
    - Field Test: Nitrate
  - For a period of one year, the following grab samples will be taken on a weekly basis (at the same time as the field-tested grab sample) and analyzed by the contracted laboratory:
    - Lab test: BOD_5
    - Lab test: TN
  - During this year, a correlation between the field tests and the lab tests will be developed as well as an accepted range for the field tests to fall into. The regulation calls for BOD mg/L of 10 mg/L. A threshold for Field Tested COD and Field Tested Nitrate will be established that correlates to the permitted BOD_5 and TN limits.
    - Until this correlation is established, provisional values of 10 mg/L COD and 25 mg/L Nitrate will be used.
    - The supplementary sensors for Oxidation Reduction Potential (ORP), Specific Conductance and pH will also be analyzed during this yearlong study to see if a useful correlation between them and any of the regulated contaminants can be established.
  - After the initial year, BOD_5 and TN testing will revert to 2 times per month, while the daily, 5 days a week Field Test for COD and Nitrate will continue.
- If a daily Field Test result is above the established limit more will be taken over a 24 hour period. If the average of those Field Tests taken over the 24 hour period indicates that the regulated contaminant for which they are a surrogate is likely out of compliance based on the previously established correlations, then a composite sample will immediately be taken for analysis by the

contracted laboratory of the regulated constituent. If the sample result is above the permitted limit, the Corrective Measures in Section 3.5.2.1 will be taken.

Corrective Measures

A routine compliance sample as defined in Influent and Effluent Monitoring Table that is above the Action Threshold means that Allen Harim is out of compliance with its permit conditions, and must divert flow to its onsite storage lagoon and take corrective measures to return to discharging compliant effluent.

Action Steps:

1. Notify DNREC and Artesian of sample results.
2. Immediately divert flow into Allen Harim offline storage lagoon.
    a. Allen Harim and Artesian will review available Operations data and develop an Action Plan for resuming normal discharge.
        i. As part of this Action Plan Artesian may temporarily cease spray operations to assess the water quality in the ANSRWRF storage lagoon.
3. Allen Harim increases the sampling frequency to daily samples of the type defined in the Influent and Effluent Monitoring Table.
    a. Sampling frequency returns to normal after three consecutive results less than or equal to the Action Threshold.
4. Allen Harim performs troubleshooting and corrects flow to return to compliance.

Sequence Diversion

The following sequential diversion of non-compliant effluent will occur when WWTP effluent exceeds the above action limits.. The first 2.0 million gallons of flow would go to the old storm water lagoon. The next 2.0 million gallons will go to the anoxic ponds. If the diversion exceeds 4.0 million gallons, the additional flow will be diverted to the old anaerobic lagoon. Diversion to the old anaerobic lagoon will not occur unless it is absolutely required. The old anaerobic lagoon will be in the process of cleaning with a new liner installed. Synagro has agreed to accept diversion water during the clean out process (see appendix 5).

It is not expected that Allen Harim will have to divert non-compliant effluent to Artesian. If diversion occurs, the procedures above will ensure environmental protection for the groundwater and the nearby stream. Allen Harim is working with Choptank Environmental, LLC on groundwater and stream monitoring. Other environmental professionals are available if necessary.

4.2 Soil Sampling and Testing

Not Applicable.

4.3 Monitoring ambient conditions

Operator should be kept at all times in the facility. The log should include perception and wind speed based on the closest meteorological station, including any on site observations.

4.4 Interpretation of monitoring results and effect on facility operation.

4.4.1 Treatment System

Allen Harim will treat all effluent under one Operations Permit to be held by Allen Harim, and send the effluent to ANSRWRF to be disposed of under a separate Operations Permit to be held by AWMI. Monitoring results from the effluent of the treatment process will be collected by Allen Harim operators who are appropriately licensed by DNREC, analyzed by labs appropriately certified by the EPA, and reviewed by both Allen Harim and AWMI wastewater staff for compliance with service agreements and permit conditions. O&M adjustments at these facilities, including system upgrades as needed, will be performed in accordance with service agreements and permit conditions.

4.4.2 Disposal System

The transition point between treatment by Allen Harim and disposal by AWMI will be at the metering and monitoring building on Allen Harim's Harbeson site. Effluent quantity and quality will be monitored to ensure that the conditions of both the Allen Harim and AWMI operating permits are maintained. In order for both parties to ensure compliance of their permit conditions, the following provisions will be in place:

4. Composite & Grab Samples:
    - Allen Harim will be responsible for taking samples of the treated effluent at the metering and monitoring building in the frequency determined by their treatment operations permit. All lab samples results will be directly sent by the lab to both Allen Harim and AWMI.
    - Upon contacting Allen Harim, AWMI may go on-site to the Allen Harim metering and monitoring building to take supplemental samples at its discretion. In an emergency, AWMI may enter immediately after checking in at the guard house to perform these samples. Otherwise, 24 hours written notice must be provided. Allen Harim may have a representative present and request split samples if desired.
5. Continuous Sensors:
    - Continuous monitoring sensors will monitor for flow rate, pH, turbidity, oxidation/reduction potential, and chlorine residual. These continuous results will be visible for remote viewing in the SCADA systems of both Allen Harim and AWMI.
        - The continuous monitoring of flow is required by **§6.8.2.3**.
        - The continuous monitoring of turbidity is required by **§6.3.2.3.3.2.5**.

- The monitoring frequency for chlorine is not specified in the regulations, though a residual is required by **§6.3.2.3.3.2.3.1**.
- The continuous monitoring of pH and oxidation/reduction potential are not required by regulation, and are provided as a supplemental source of information to aid Allen Harim operators. These are not intended for direct permit compliance but have been incorporated into the design as a further operational tool.

6. AWMI operators will review both regular and supplemental sample results for compliance with Allen Harim's permit conditions and service agreement with AWMI. In addition to identifying non-complying wastewater results, operators will note trends or spikes which may indicate a risk of future non-compliance. Upon identifying such trends or non-compliant results, AWMI operators will contact Allen Harim operators to alert them of the concern and coordinate any necessary corrective measures, O&M adjustments, and/or system upgrades.
7. In the event that a sample from the Allen Harim metering and monitoring building exceeds the Action Thresholds defined in **Table 4** or **Table 5** (below), the corresponding actions will be taken.

Table 4: Action Thresholds for Parameters with Upper Bounds

Parameters	**Unit**	**Sample Type**	**Action Threshold**
Total Nitrogen	mg/L	Composite	> 30
BOD_5	mg/L	Grab	> 10
TSS	mg/L	Grab	> 10
Fecal Coliforms	col./100 mg	Grab	> 20
Turbidity	NTU	Continuous	> 5

Table 5: Action Thresholds for Parameters with Upper and Lower Bounds

Parameters	**Unit**	**Sample Type**	**Lower Action Threshold**	**Upper Action Threshold**
pH	S.U.	Grab	< 6	> 9
Chlorine Residual	mg/L	Continuous	< 0.5	> 4

4.4.3 Corrective Measures

A regular sample that is above the Action Threshold means that Allen Harim is out of compliance with its permit conditions, and must take corrective measures to return to discharging compliant effluent. AWMI must temporarily suspend spray operations until the concentrations within the lagoon can be confirmed.

Action Steps:

5. Notify DNREC and Artesian of sample results.
6. If a sample result is above the Action Threshold, Allen Harim immediately diverts flow to on-site storage lagoon. If the continuous monitoring for turbidity or chlorine is above the Action Threshold, flow will be automatically diverted to the on-site storage lagoon.
    a. Flow may not resume to AWMI until an action plan is approved by Allen Harim and AWMI.
    b. AWMI will temporarily cease spray operations and commence procedures per their O&M plan.
7. Allen Harim increases the sampling frequency to daily samples.
    a. Sampling frequency returns to normal after three consecutive results less than or equal to the Action Threshold.
8. Allen Harim performs troubleshooting and corrects flow to return to compliance.

4.5 Process Control for Nitrates and Total Nitrogen

Nitrates comprise approximately 95% of the calculated Total Nitrogen that is reported to DNREC. For that reason process control for nitrates is the primary focus in meeting Total Nitrogen limits of 30 mg/L. Nitrates are formed in the nitrification process where ammonia as N is converted to Nitrite and then to the final nitrogen form of Nitrate. Nitrates can be reduced in the WWTP effluent through a process of denitrification. This is where recirculation of the CMAS MLSS is recirculated to the anoxic ponds where Dissolved Oxygen (D.O.) levels are 0.5 mg/L or less. The CMAS 1 tank is also part of the denitrification process. The CMAS 1 blowers are operated on a cycle operation. The blowers run until the D.O. reaches 3 mg/L. The blowers then shut off until the D.O. reaches 0.3 mg/L. There is a typical delay of 20 minutes before the blower comes back on again to start the cycle. This down time with the blowers provides more anoxic conditions to allow for the denitrification process.

Allen Harim in house laboratory testing will be conducted on a daily basis. The testing will include Ammonia as N, Nitrates and Total Nitrogen (Hach Field Testing Kits) Testing will be done on grab samples from CMAS 1, CMAS 2 and composite sampling for the Final Effluent to Artesian. The limit for Total Nitrogen is 30 mg/L. The process control strategy to control

Nitrates and Total Nitrogen is noted below:

1. When total nitrogen or Nitrate results > 25.0 mg/L the delay on CMAS 1 blowers will be increased by 10 minutes; i.e. 20 minutes to 30 minutes

2. Only one pond blower will be used at the anoxic ponds.

3. Nitrates and Total Nitrogen testing will occur a second time four hours after the increase in delay.

4. If the Envirocorp results are > 30.0 mg/L manual diversion will occur until the total nitrogen and Nitrates results are < 30 mg/L. A sample of effluent will be taken to Envirocorp Labs for Rush Testing with analytical results provided the next day. Diversion will continue until indicators reflect the system is back in compliance. It should be noted that Envirocorp results are typically lower than Allen Harim In House results.

5. It is fully expected that increasing the delay will quickly result in lower total nitrogen and Nitrate results.

4.6 <u>Groundwater Monitoring Program</u>

The monitoring well network at the facility consists of four (4) wells (MW-01 through MW-04) that are screened across the uppermost water-bearing zone at the site and provide 360-degree coverage of the of the 10 MG storage lagoon and the two (2) 1.5 MG anoxic ponds. Well construction details are provided in the table below.

Table 1 – Well Construction Details

LOCAL WELL ID	MW-01	MW-02R	MW-03R	MW-04
DNREC WELL ID	260091	262357	262358	260094
DIAMETER (in)	0.75	0.75	0.75	0.75
SCREEN INTERVAL (ft-bgs)	8-18	9 - 19	5.5 - 15.50	5.5 - 15.5
WELL DEPTH (ft-bgs)	18.00	19.00	15.50	15.50
NORTHING[1,3] (m)	80,091.29	80,128.89	80,060.20	79,950.20
EASTING[1,3] (m)	211,113.07	211,015.48	210,911.56	210,987.33
TOC ELEV[2,3] (ft)	38.10	41.28	38.19	35.70
STICK-UP LENGTH[3] (ft)	Flush-mount	2.37	2.41	Flush-mount

Notes:

BGS = Below Ground Surface
TOC = Top-of-Casing
ELEV = Elevation (ft), referenced to the NAVD88

(1) Referenced to Delaware State Plane Coordinate System, NAD83 horizontal datum, meters.
(2) Referenced to NAVD88 vertical datum.
(3) Well Surveys performed on November 20, 2017 (Wells 260091 - 260094) and August 7, 2018 (Wells 262357 and 262358) by Pennoni Associates, Inc.

In accordance with Section 6.8.1.7 of the Delaware *Regulations Governing the Design, Installation, and Operation of On-Site Wastewater Treatment and Disposal Systems (hereinafter "Regulations")*, groundwater monitoring will be performed on a quarterly basis. Depth-to-water measurements will be collected from the top-of-casing (TOC) measuring point on each well prior to groundwater sampling. Groundwater samples will be collected from each well using a peristaltic pump and following low flow methodology and the criteria established in ASTM *Standard Practice for Low Flow Purging and Sampling for Wells and Devices Used in Groundwater Quality Investigations* (ASTM Standard Practice D 6771-18).

In accordance with Section 6.8.1.8 of the *Regulations*, groundwater samples will be analyzed for the constituents listed in embedded **Table 2** below. All samples will be relinquished under appropriate chain-of-custody protocol to Envirocorp Labs, Inc. in Harrington, DE for analysis. Per Section 6.8.1.9 of the *Regulations*, pH, temperature, specific conductance, and dissolved oxygen will be measured in the field using a calibrated meter.

Table 2: Analytical Parameters

Schedule and Reporting

Quarterly groundwater monitoring will begin during the 2nd calendar quarter of 2019. Groundwater monitoring results obtained during a calendar quarter shall be summarized and reported on a DNREC-approved form postmarked or submitted no later than the 28th day of the month following the completed reporting period.

4.7 10MG LAGOON LEVEL MONITORING

The 10MG storage lagoon will be retrofitted with manual and electronic water level measurement.

Manual Measurement

Manual measurement will consist of the installation of a staff gauge with a graduated scale in 1/10′ and 1/100′ increments. The staff gauge will be set in the lagoon via a non-intrusive bottom anchor or via a boom from the lagoon berm. Visual measurements will be taken each operating day and recorded to the nearest 1/10′ in a log book. The staff gauge will be installed by June 30, 2019.

Electronic Measurement

Water level measurement will be continuously measured and logged at 15-minute intervals to avoid overflows of the storage lagoon. An ultrasonic sensor or pressure transducer will be installed in a stilling well set in the lagoon via a non-intrusive bottom anchor or via a boom from the perimeter berm. The sensor shall have a minimum resolution of 0.01′ or better, a full-scale accuracy of ± 0.1% or better, and a long-term stability of 1% of full-scale or better. The sensor will be connected to a notification system that will notify the licensed wastewater operator if a high-water level (e.g. the minimum freeboard requirement of 3′ below the lowest point of the berm) is reached.

5 Records and Reports

5.1 Records

All reports must be kept on site for a total of 5 years. Included in kept reports are:

- Worksheets used in determining information provided on the report forms plus any records of raw data
- calibration and maintenance records
- Quality Assurance Records provided by the labor party on all equipment and chemicals
- DNREC reports
- Flow Charts

5.1.1 Maintenance Records

Both preventive and corrective maintenance activities should be kept in operator log.

5.1.2 Operating Records

A daily record must be kept in site at all times. The following is included in operator log:

1. Time Spent at the treatment facility on any date
2. Details of the operation and maintenance performed on the treatment system on any date including both preventative and corrective maintenance.
3. Record and calculate influent and effluent totalizer flows daily.
4. A record of any deviations from the operation and maintenance manual.
5. A record of all actions taken to correct any violations of the Environmental Protection Act and Departments Regulations.
6. Record the date, volumes and destination of BioSoilds removed from the facility.
7. Chemical tank levels and chemical feed rates daily.

5.2 Reporting

Signed copies of all required reports shall be submitted to the Department at:

Ground Water discharges Section
Division of Water Resources
Department of Natural Resources & Environmental control
89 Kings Highway
Dover, Delaware 19901

5.2.1 Monthly Reports

The monitoring requirements and instructions for reporting are included in the operations permit. These reports are to be summarized each month or quarter and then summited to the Department.

5.2.2 Annual Reporting

The permittee shall submit to the Department an annual operation report on or before February 1 of each year. The annual operation report shall summarize operational and maintenance activities at the facility along with management and administration of the facility including the following

1. Influent flow into the treatment system
2. Effluent flow to disposal system
3. Total number of equivalent dwelling units
4. Effluent BOD_5 annual average concentration
5. Effluent total TSS concentration
6. Effluent total nitrogen annual average concentration and annual total nitrogen mass load.
7. Effluent total phosphorus annual average concentration and annual total phosphorus mass load.
8. BioSoilds Removed
9. Daily rainfall, temperature, wind speed and direction.
10. Documentation verifying the calibration of effluent and influent flow meters.

5.2.3 Noncompliance Reporting

The permittee shall report to the Department's Enforcement Section at 800-662-8802 any unpermitted release or discharge of any contaminant into the air, or a pollutant into surface waters, ground water or onto land as soon as the permittee has knowledge of the release or discharges.

Within 24 hours of becoming aware of any actual or anticipated noncompliance which may endanger public health or the environment, the operator must make an oral report to the Department at 302-856-4561. The operator must also submit a written report of the noncompliance to DNREC within 5 days of becoming aware of any actual or potential noncompliance. The report shall include the following:

1. A description of and cause for the noncompliance with any such limitation or condition.
2. The period of noncompliance, including exact date and time; or if not corrected, the anticipated time the noncompliance is expected to continue

3. Steps being taken to reduce eliminate and or prevent recurrence of the noncompliance conditions.

6 Emergency Contingency Planning

6.1 Server Weather Procedures

In the event of a hurricane, Noreaster or Blizzard Allen Harim will do the following:

1. Allen Harim has a contract with United Rentals to provide an emergency generator for anticipated severe weather conditions. The generator(s) will be delivered and hooked up by United Rentals. They will be used to provide power throughout the severe weather event.
2. During heavy rain events the Storm Water Stations will be shut down after the first 30 minutes of receiving flow. DNREC is notified in advance. Sampling only occurs if conditions are safe.
3. The wastewater plant will be staffed during severe weather events by at least two operators. Allen Harim operators have Level 2 driving restriction waivers.
4. The DAF will not run. The goal will be to maintain a safe level in the anoxic ponds.

6.2 Power Outage and Wastewater Emergency Shutdown

1. Close CMAS I Recycle valve……
2. Anoxic Ponds
   - **a.** Turn off Anoxic Ponds Main Breaker…… located in Pond Pump house
   - **b.** Turn off all three Pond Pumps….. using on/off switches and disconnects
   - **c.** Close brown valve on discharge line….. located next to window in Pond Pump house
   - **d.** Turn off all three Pond Blowers…… using disconnects located on back of Pond Blower building and the on/off switches inside of building
   - **e.** Turn off all Center Mixers and Air-o-Laters using disconnects located around ponds 'A' and 'B'…… Six of them all together

3. CMAS I
   - **a.** Turn off CMAS I Blowers 'A' and 'B'…… using disconnects located inside CMAS I building
   - **b.** Turn off Aerzan blower
   - **c.** Turn off CMAS I Mass Transfer Pump…… using disconnect located inside CMAS I building

4. CMAS II
    a. Turn off CMAS II Blowers 'A', 'B', and 'C'…… using disconnects located inside of CMAS II building
    b. Turn off the Clarifier Spray Bar Pump….. using disconnect located inside CMAS II building and with the on/off switch on top of the clarifier….. right above the pump

5. RAS Building
    a. Turn off RAS Pumps 'A' and 'B'…… using the disconnects located inside of RAS building
    b. Turn off the WAS pump and close the **WAS** valve….. meter should read '0' GPM when closed
    c. Turn off the Scum Pit Pumps…… using the disconnects located on side of the RAS building
6. Magnesium Hydroxide System
    a. Turn off Magnesium Hydroxide pump…… using the red on/off switch located on the Magnesium pump control panel
    b. Turn off Magnesium tank mixer….. using the disconnect mounted on side of the tank
    c. Turn off the Magnesium Hydroxide System……. Using the disconnect in the MCC Room

7. Wastewater Main Building
    a. Turn off the <u>MCC MAIN BREAKER</u>…… located in MCC Room
    b. Turn off Water RE-Use Pump….. using disconnect in MCC Room
    c. Turn off SW002 and SW0023…… using disconnects in MCC Room
    d. Turn off Digesters 'A' and 'B' aerators…… using disconnects and on/off switches in MCC Room
    e. Turn off Polymer tank mixers…… using disconnects
    f. located on catwalk
    g. Turn off Nemo Sludge Pumps…… using disconnects next to Nemo Pump 'C'
    h. Turn the Belt Filter Press off….. using the disconnect on the Press Main Panel Box…… also, follow the *Press Shutdown Procedure*
    i. Turn off all the chemical pumps……
        - Chlorine
        - Bisulfite
        - Clarifier Aluminum
        - DAF Aluminum
        - Clarifier Polymer
        - DAF Polymer

6.3 <u>Emergency Contact list</u>

The following list and contact information shall be visible at all times in facility. This list will also be updated as need be.

1. Town Manager
2. Police
3. Fire
4. DNREC
5. DNREC Enforcement
6. Emergency Services (Local)
7. Hospital
8. Consultant
9. Chemical Supplier
10. Telephone Company Service
11. Electric Company Service
12. DRC-Operator
13. Back Up Operators.