

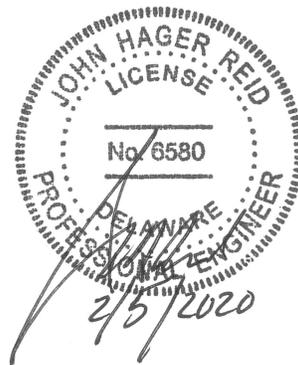
Final Design Summary of Wastewater Treatment System Upgrade



Mountaire Farms of Delaware, Inc.
Millsboro, Delaware

February 5, 2020

DNREC Re-Submission



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Table of Contents

| | | |
|-----|--|----|
| A. | General Design Requirements and Summary..... | 1 |
| B. | 7 Day FEB/Anaerobic Lagoon #1, #2 And #3 Second Stage Pretreatment System (New) .. | 10 |
| C. | Anaerobic Lagoon By-Pass/Short Circuit Carbon Source Influent Pump | 18 |
| D. | Anaerobic Lagoon #1 and #2 Effluent Pump Station (New)..... | 19 |
| E. | Dissolved Air Flotation DAF Cell #3 For Temporary/Optional Post Treatment Of Anaerobic Lagoon Effluent (Existing)..... | 21 |
| F. | Chemical Feed Equipment for DAF Cell #3 Pretreatment System (Existing)..... | 25 |
| G. | DAF Cell #3 Effluent Pump Station (Existing)..... | 26 |
| H. | Anaerobic Lagoon #3 Effluent Pump Station (New) | 27 |
| I. | Anoxic Reactor #1 (New)..... | 29 |
| J. | Nitrification Reactors #2A (New) and #2B (Modification) | 36 |
| K. | Nitrate Recycle Pump Station (New) | 43 |
| L. | Anoxic Reactor #3 (Modification) | 44 |
| M. | Aerobic Reactor #4 (Modification) | 48 |
| N. | Clarifier Influent Flow Splitter & Flocculation Tank (New) For Existing Clarifiers #1 & #2 | 54 |
| O. | Final Clarifiers #1 & #2 (Modification) | 56 |
| P. | Return Activated Sludge (RAS) Pump Station (New) | 58 |
| Q. | Sludge Wasting Requirements (Modification)..... | 58 |
| R. | Waste Activated Sludge Pump Station (New)..... | 59 |
| S. | Tertiary Filter Influent Pump Station (New) | 60 |
| T. | Tertiary Filtration System (New) | 61 |
| U. | Ultraviolet (UV) Final Effluent Disinfection System (New) | 65 |
| V. | Effluent Flow Meter (New)..... | 67 |
| W. | Waste Activated Sludge Aerobic Digestion Tanks (Existing & Modification) | 67 |
| X. | Screw Press Sludge Dewatering System (New)..... | 70 |
| Y. | Plant Site Pump Station #1 (New)..... | 73 |
| Z. | Plant Site Pump Station #2 (Modification)..... | 75 |
| AA. | Chemical Storage-Feed Equipment For Activated Sludge Process And For Nitrogen Removal (Existing And New) | 76 |
| BB. | Expected Final Effluent Quality In Treated Wastewater Discharged Into The Existing Spray Irrigation Lagoon..... | 79 |

CC. DAF Pretreatment System (Future)..... 80
DD. Final Effluent Storage Pond and Pump Station (Future)..... 80
EE. Offspec Water Recycle Plan (Prepared by Mountaire Farms) 80

Appendix 1 – Location Map

Appendix 2 – Site Map

Appendix 3 – Nitrogen Balance and Storage Calculations

Appendix 4 – Flow Diagram

Appendix 5 – Hydraulic Profile

Appendix 6 – P&IDs

Appendix 7 – Controls and Integration

Final Design Summary

A. General Design Requirements and Summary

1. Owner Contact Information

- a. Facility Name: Mountaire Farms of Delaware, Inc.
Wastewater Treatment Plant
- b. Contact Person: Scott Thompson, Senior Director of Engineering,
- c. Email Address: sthompson@mountaire.com
- d. Mailing Address: P.O. Box 1320, 29292 John J. Williams Hwy,
Millsboro, DE 19966
- e. Phone Number: (302) 934-3466

2. Project Summary

- a. Mountaire Farms of Delaware, Inc. is a poultry processing facility with onsite rendering and feed mill located outside of the Town of Millsboro in Sussex County. The facility is located at 29005 John J. Williams Hwy southeast of the intersection of John J Williams Hwy and Maryland Camp Road (Road 304). The Wastewater Treatment System Upgrade contained in this report will provide onsite wastewater treatment of wastewater generated by the Mountaire Farms Facilities.
- b. Tax Map: 234-32.00-117.00
- c. Hydrologic Unit Code: 020403030203, Swan Creek-Indian River
- d. 100 Year Flood Zone: Zone X, Elevation 18.03 feet ASL
- e. Equivalent Dwelling Units (Flow): 18,200 EDUs (Based on 220 gpd/EDU)
- f. Equivalent Dwelling Units (BOD): 150,000 EDUs (Based on 0.46#BOD/day/EDU)
- g. Design Average Daily Flow: 2.6 MGD, 7 days/week
- h. Design Max Month Daily Flow: 4.0 MGD, 7 days/week

3. Description and Purpose of the Wastewater Treatment System Project

- a. Mountaire Farms must upgrade the efficiency of the existing wastewater treatment system at the Millsboro, Delaware processing complex in order to comply with restrictive discharge permit limitations for disposal of treated wastewater by spray irrigation.
- b. This wastewater treatment system upgrade project is required to provide wastewater treatment capability to comply with this new permit TN limit.

- c. The proposed wastewater treatment system upgrade project includes the installation of improvements to the system wastewater pretreatment components and the activated sludge biological nitrogen removal (BNR) treatment system components. The project also includes the installation of a new tertiary sand filtration system for final effluent polishing. A new screw press sludge dewatering system will be installed to increase waste activated sludge handling capacity.
 - d. The existing Spray Storage Lagoon will continue to be used for final effluent storage prior to disposal in the existing spray irrigation fields.
4. Summary and Scope of Proposed Wastewater Treatment System Improvements Included in the Project
- a. One new 22 MG volume Anaerobic Lagoon (AL) is included to provide second stage wastewater pretreatment downstream of the existing first stage pretreatment DAF Cells #1 and #2; and, provide 7 day hydraulic flow equalization of pretreated wastewater upstream of the BNR final treatment system. The AL includes a bottom liner. The AL includes a new AL Effluent Pump Station with three self priming pumps, controls and pump enclosure building.
 - b. The existing Dissolved Air Flotation (DAF) Cell #3 is provided for temporary/optional use for post treatment of AL effluent wastewater by chemical coagulation, flocculation and flotation. The new DAF system includes a pipeline flocculator; DAF Control panel; DAF sludge collection tank and DAF sludge pumps, sludge piping and pump controls. DAF Cell #3 is designed to be operated to provide post treatment downstream of the Anaerobic Lagoons. The new DAF Cell is provided with a new DAF Cell Effluent Pump Station.
 - c. The existing two stage activated sludge biological treatment system is upgraded into a state of the art four stage biological nitrogen removal (BNR) system to achieve high efficiency total nitrogen removal by biological nitrification.
 - d. One new four stage activated sludge biological nitrogen removal (BNR) final treatment system is provided including new first stage Anoxic Reactor #1; new second stage Nitrification Reactor #2; retrofitted Anoxic Reactor Zone #3 and Aerobic Reactor Zone #4 of the Crom tank; and, two existing gravity Final Clarifiers retrofitted with new rapid suction sludge removal mechanisms.
 - 1) One new Anoxic Reactor #1 is provided with associated jet mixing equipment and piping to operate as first stage anoxic activated sludge reactor in the four stage BNR process to provide BOD removal and removal of nitrate nitrogen by biological denitrification.

- 2) One new Nitrification Reactor #2 is provided with associated jet aeration and mixing equipment and piping to operate as a second stage reactor downstream of new Anoxic Reactor #1 in the four stage BNR process to provide removal of TKN and ammonia nitrogen by biological nitrification.
 - 3) The outer tank section of the existing Crom tank will be retrofitted into Anoxic Reactor #3. Anoxic Reactor Zone #3 is provided with mixing equipment to function as a third stage anoxic activated sludge reactor in the four stage BNR process to provide final nitrate nitrogen removal with supplemental carbon source solution dosage if necessary.
 - 4) The center tank section of the existing Crom tank will be retrofitted into new Aerobic Reactor #4. Aerobic Reactor Zone #4 is provided with mixing and aeration equipment and air supply blowers to operate downstream of Anoxic Reactor Zone #3 as a fourth stage aerobic activated sludge reactor in the four stage BNR process to provide final BOD and ammonia nitrogen removal.
- e. The Two existing 110 ft. dia. X 12 ft. SWD Final Clarifiers (FC) will continue to operate in parallel; and, new Return Activated Sludge (RAS) Pumps and associated piping, controls and RAS flow meters are installed to provide accurate RAS flow rate and flow rate control from each clarifier back into Anoxic Reactor #1 or Nitrification Reactor #2. One new rapid suction sludge removal mechanism will be installed in each existing Final Clarifier to improve clarifier TSS removal efficiency and settled biosolids removal capacity.
 - f. One new Tertiary Filter System with deep bed, upflow continuous backwash sand filters is provided for tertiary filtration polishing of clarifier effluent in order to reduce final effluent TSS, BOD, TN and TP concentrations.
 - g. New Chemical Feed Building is provided for enclosure of magnesium hydroxide solution bulk storage tank and solution pumps, carbon source solution bulk storage tank and solution pumps.
 - h. New Chemical Storage/Feed Equipment is provided for nitrate nitrogen removal including two new non-flammable carbon source (CS) solution bulk storage tanks and CS solution feed pumps for new Anoxic Reactor #3.
 - i. The existing Oxidation Ditch (OD) basin is retrofitted to function as a first stage aerobic digestion basin for waste activated sludge. The OD aerobic digestion basin will be operated upstream and in series with the two existing waste activated sludge (WAS) storage basins which will be used as second and third stage WAS aerobic digestion basins.

- j. One new Screw Press System is provided for mechanical dewatering of aerobically digested and gravity thickened WAS. The new Screw Presses are part of a complete WAS sludge dewatering system.
- k. One new Wastewater Equipment Building #1 is provided for enclosure of jet pumps, air supply blowers, nitrate recycle pumps, and electrical controls for the BNR System.
- l. One New Wastewater Equipment Building #2 is provided for enclosure of the new RAS pumps, WAS pumps, Filter Influent Pumps, Chemical Storage and mix tanks, chemical solution pumps, Tertiary Filters, UV contact channel and Electrical Motor Controls.
- m. One new Wastewater Equipment Building #3 is provided for the enclosure of the sludge press dewatering system and Electrical Motor Controls.
- n. The existing Oxidation Ditch effluent pump station is retrofitted into a Plant Site Pump Station #2 for collection of drainage flows from the new and existing wastewater Equipment Building(s).
- o. One new submersible Plant Site Pump Station #1 is provided for collection of drainage flows from the new Wastewater Equipment Building #1, new Chemical Feed Building and new Wastewater Equipment Building #3.
- p. New Electrical Instrumentation and Controls will be provided for the proposed wastewater treatment system improvements.

5. Wastewater Sources

a. Processing Facility

- 1) Wastewaters discharged from the processing plant, rendering plant and DAF sludge centrifuge receive pretreatment through the existing and new Dissolved Air Flotation (DAF) Cells; partially pretreated wastewater discharged from the DAF Cells and raw wastewater discharged from the hatchery, the grainery, the feed mill and the boiler room, combined with sanitary wastewater will receive pretreatment and equalization in the existing and new Anaerobic Lagoons; and all pretreated wastewater will receive final treatment through an activated sludge biological nitrogen removal (BNR) treatment system; a tertiary filter system; and, a new UV disinfection system to reduce high concentrations of BOD, Suspended Solids, Oil & Grease, TKN; Ammonia Nitrogen, Total Nitrogen, Total Phosphorus, Fecal Coliform pollutants to comply with permit limitations before being discharged on existing spray irrigation fields. The existing chlorine disinfection system, located after the existing Spray Irrigation Lagoon, will remain as a backup disinfection system.

b. Sanitary Wastewater

- 1) Sanitary wastewater generated from the bathroom facilities at the Millsboro complex is treated with process wastewater through the on-site biological wastewater treatment system with effluent disinfected and discharged by spray irrigation.

c. Stormwater

- 1) Stormwater collected from areas of industrial activity will flow into existing Anaerobic Lagoons #1 and #2 for flow equalization and treatment with process wastewater.

6. Wastewater Flow Volumes and Pollutant Concentrations and Loadings¹

a. Production Capacities

1) Chicken Processing Plant

- a) The chicken processing plant maximum day production capacity = 540,000 chickens/day at 9.25#live weight kill/bird, 5 days/week. Periodically a 6 day kill week may be required.

2) Rendering Plant

- a) The rendering plant maximum day production capacity = approximately 2,500,000# raw material/days, 5 days/week.

b. Wastewater Volumes

1) Chicken Processing Plant Wastewater

- a) The maximum wastewater flow volume to be discharged from the chicken processing plant @ 6.50 gallons/bird/day = 3,510,000 gallons/day, 5 days/week plus approximately 300,000 gallons/day, 2 days/week on weekend days.

- b) The average wastewater flow volume to be discharged from the chicken processing plant @ 6.00 gallons/bird/day = 3,250,000 gallons/day, 5 days/week plus approximately 300,000 gallons/day, 2 days/week on weekend days.

¹Conservative (high) assumptions regarding wastewater flows and production capacities have been used in order to ensure the design reflected in this FDS is more than capable of treating existing flows. These assumptions do not necessarily reflect the actual or anticipated flows from the facility.

2) Rendering Plant Wastewater

- a) The design maximum wastewater flow volumes discharged from the rendering plant are 200,000 gallons/day of condensate wastewater, 6.0 days/week and approximately 200,000 gallons/day of floor drainage wastewater, 6.0 days/week plus 50,000 gallons/day on Sundays.

3) DAF Centrifuge Stickwater Wastewater

- a) The DAF Sludge Centrifuge will generate approximately 100 gpm = 144,000 gallons/day of stickwater wastewater, 6 days/week. This raw Stickwater will be diluted with approximately 100 gpm of pretreated wastewater discharged from the existing large DAF Cell #1.

4) Wastewater Flow from Miscellaneous Sources

| Wastewater Source | Wastewater Volume |
|--------------------------|--------------------------|
| Sanitary Wastewater | 40,000 gpd |
| Hatchery Wastewater | 18,000 gpd |
| Feed Mill Wastewater | 20,000 gpd |
| Grainary Wastewater | 12,000 gpd |
| Boiler Room Drainage | 10,000 gpd |
| Stormwater | 200,000 gpd |
| Total | 300,000 gpd |

c. Wastewater Pollutant Concentrations

Table #1
Wastewater Pollutant Concentrations
and Wastewater Flow Volumes

| Parameter | Pretreated Mixture of Poultry Plant Wastewater and Rendering Plant Drainage Wastewater Discharged from DAF Cell #1 | Raw Rendering Plant Condensate Wastewater⁽⁶⁾ | Pretreated Centrifuge Stickwater⁽¹⁾ Wastewater Discharged from DAF Cell #2⁽²⁾ |
|------------------------------------|---|--|--|
| Maximum Flow Volume ⁽³⁾ | 3.710 MGD⁽³⁾ | 0.20 MGD | 0.2882 MGD⁽²⁾ |
| COD ⁽⁴⁾ | 2,700 | 8500 | 4,400 |
| BOD ⁽⁵⁾ | 1,750 | 5500 | 2,663 |
| TSS ⁽⁵⁾ | 500 | 300 | 600 |
| TKN ⁽⁵⁾ | 250 | 1100 | 340 |
| Ammonia N ⁽⁴⁾ | 42 | 1050 | 130 |
| Total Phosphorus ⁽⁴⁾ | 35 | 100 | (4) |
| FOG ⁽⁴⁾ | 200 | 200 | 200⁽⁴⁾ |

⁽¹⁾@ 100 gpm before dilution

⁽²⁾After 50/50 dilution with DAF Cell #1 effluent wastewater and DAF pretreatment by chemical coagulation, flocculation and flotation.

⁽³⁾The total maximum flow volume treated thru DAF Cell #1 = 3.51 MGD (process) + 0.20 MGD (RPDW) = 3.710 MGD. Approximately 100 gpm = 0.1441 MGD of the DAF Cell #1 effluent is used to dilute stickwater before pretreatment thru DAF Cell #2. The net wastewater flow volume that is discharged from DAF Cell #1 into the downstream Anaerobic Lagoons = 3.710 MGD – 0.1441 MGD = 3.566 MGD. The wastewater flow volume that is discharged from DAF Cell #2 into the downstream Anaerobic Lagoons = 0.2882 MGD.

⁽⁴⁾No data for COD, TP & FOG; values are estimated based on best professional judgement by Engineer.

⁽⁵⁾Based on data provided by Mountaire Farms for period from 1/1/16 to 11/30/16.

⁽⁶⁾No data available; values are estimated based on best professional judgement by Engineer.

Table #2
DAF Cell #1 Pretreatment
System Effluent Pollutant Concentrations in
Partially Pretreated Wastewater Discharged into
Anaerobic Lagoon Pretreatment System

| Parameter | Pollutant Concentration ⁽¹⁾ |
|------------------|---|
| BOD | 1,750 mg/L |
| TSS | 500 mg/L |
| TKN | 250 mg/L |
| Ammonia Nitrogen | 42 mg/L |
| FOG | 200 mg/L |

⁽¹⁾The DAF Pretreatment System operation and chemical treatment program used will be selected and automatically controlled to produce pretreated DAF Cell #1 effluent pollutant concentrations that are within the pretreatment system effluent quality specified in Table #2. Discharge of excessive concentrations of pollutants from the DAF Cell #1 pretreatment systems could overload the Anaerobic Lagoons with suspended solids and FOG, and, upset the performance of the activated sludge biological nitrogen and phosphorus removal final treatment system.

Table #3
Diluted Centrifuge Stickwater DAF #2 Pretreatment
System Effluent Pollutant Concentrations in
Partially Pretreated Wastewater Discharged into
Anaerobic Lagoon Pretreatment System

| Parameter | Pollutant Concentration⁽¹⁾ |
|------------------|--|
| BOD | 2,663 mg/L |
| TSS | 600 mg/L |
| TKN | 340 mg/L |
| Ammonia Nitrogen | 130 mg/L |
| FOG | 200 mg/L |

⁽¹⁾Based on DAF pretreatment of stickwater diluted with pretreated wastewater discharged from DAF Cell #1 in a 50/50 ratio and then pretreated by chemical coagulation, flocculation and dissolved air flotation thru DAF Cell #2.

B. 7 Day FEB/Anaerobic Lagoon #1, #2 And #3 Second Stage Pretreatment System (New)

1. General Description of Process

- a. The existing process wastewater and stickwater wastewater DAF Cells will continue to provide first stage wastewater pretreatment upstream of the two existing Anaerobic Lagoons and one new Anaerobic Lagoon. The BOD, TSS, O&G and TKN loadings into the Anaerobic Lagoons will be controlled by the chemical treatment program used in the existing upstream DAF Cells #1 and #2, and, in new DAF Cell #3.

2. Design Assumptions

a. Wastewater Flow Sources

1) From Chicken Processing Plant

- a) The maximum daily wastewater flow volume discharged from the poultry processing plant = 3.51 MGD, 5 days/week @ 540,000 chickens/day and 6.50 gallons/bird and 0.30 MGD, 2 days/week on weekends.
- b) The average daily wastewater flow volume discharged from the poultry processing plant = 3.25 MGD, 5 days/week @ 540,000 chickens/day and 6 gallons/bird and 0.30 MGD, 2 days/week on weekends.

2) From Rendering Plant

- a) The maximum daily floor drainage wastewater flow volume = 200,000 gallons/day, 6.5 days/week + 50,000 gallons/day on Sundays.
- b) The maximum daily condensate wastewater flow volume = 200,000 gallons/day, 6.5 days/week.

3) From DAF Sludge Centrifuge

- a) The maximum daily stickwater wastewater volume = 100 gpm = 0.1441 MGD, 6 days/week.

4) From Miscellaneous Sources

- a) Sanitary Wastewater = 40,000 gallons/day
- b) Stormwater \leq 200,000 gallons/day
- c) Hatchery, Feed Mill, etc. \leq 60,000 gallons/day

- 5) Wastewater Pretreatment by Existing DAF Cells
 - a) Screened processing plant wastewater discharged from the offal room is pretreated with rendering plant floor drainage wastewater by existing DAF Cell #1.
 - b) Rendering plant condensate wastewater is not pretreated by a DAF Cell.
 - c) Centrifuge stickwater is pretreated by existing DAF Cell #2.
- b. Wastewater Flows into Anaerobic Lagoon
 - 1) Maximum daily volume of combined processing plant wastewater and rendering plant floor drainage wastewater discharged from the existing DAF Cell #1 pretreatment system into Anaerobic Lagoons #1 and #2 = 3.510 MGD + 0.20 MGD – 0.1441 MGD (to DAF Cell #2) = 3.566 MGD, 5 to 6 days/week.
 - 2) Maximum daily volume of centrifugal stickwater wastewater = 100 gpm = 0.1441 MGD, 6 days/week.
 - 3) Maximum daily volume of diluted and pretreated centrifuge stickwater wastewater discharged from the existing DAF Cell #2 pretreatment system = 0.2882 MGD, 6 days/week including 100 gpm = 0.1441 MGD of dilution water discharged from DAF Cell #1.
 - 4) The total maximum daily volume of pretreated wastewater discharged from DAF Cells #1 and #2 into the downstream Anaerobic Lagoon = 3.566 MGD + 0.2882 MGD = 3.854 MGD if no wastewater by passes the Anaerobic Lagoons.
 - 5) Maximum daily volume of raw condensate wastewater discharged from the rendering plant directly into Anaerobic Lagoons #1 and #2 = 0.20 MGD, 6.5 days/week.

- 6) The maximum influent wastewater flow volume and pollutant loading into the Anaerobic Lagoons will occur if all wastewater is discharged into the ALs for pretreatment and 7 day hydraulic flow equalization. In this case, the maximum total influent wastewater flow volume discharged into the AL from DAF Cell #1, DAF Cell #2 and the Rendering Plant will be approximately 3.854 MGD (DAF Cell #1) including 0.1441 MGD (100 gpm stickwater) + 0.20 MGD (RP Condensate Wastewater) = 4.054 MGD on processing days. In this maximum influent wastewater flow condition, the total maximum wastewater flow volume discharged into the AL per week is calculated as follows:

| Flow Source | Volume | #days/week | Total Volume/Week |
|---------------------|-----------|------------------|-------------------|
| DAF Cell #1 | 3.854 MGD | 6 ⁽¹⁾ | 23.12 MG |
| Process Weekend | 0.30 MGD | 1 | 0.30 MG |
| RPCW ⁽²⁾ | 0.20 MGD | 6.5 | 1.300 MG |
| RPDW ⁽³⁾ | 0.05 MGD | 0.5 | 0.025 MG |
| Sanitary & Misc | 0.10 MGD | 6 | 0.60 MG |
| Stormwater | 0.20 MGD | 2 | 0.40 MG |
| Σ | | | 25.75 MG |

⁽¹⁾For 6 day processing week

⁽²⁾Rendering Plant Condensate Wastewater

⁽³⁾Rendering Plant Drainage Wastewater

- 7) **A reduced influent wastewater flow volume and pollutant loading into the AL will occur if a portion of the DAF Cell #1 effluent wastewater by-passes the AL in order to provide a carbon source feed into the downstream activated sludge treatment system.** If approximately 30% of the DAF Cell #1 effluent by-passes the AL, then the total wastewater flow volume discharged into the AL from DAF Cell #1, DAF Cell #2 and the Rendering Plant Condensate Wastewater will be approximately 3.575 MGD (DAF Cell #1) x 0.70 + 0.1441 MGD (DAF Cell #2 Stickwater) + 0.21 MGD (RPCW) = 2.86 MGD on processing days. In the by-pass flow condition, the total wastewater flow volume discharged into to AL is calculated as follows:

| Flow Source | Volume | #days/week | Total Volume/Week |
|-----------------|-----------------------------|------------------|-------------------|
| DAF Cell #1 | 3.854 MGD x 0.70 = 2.70 MGD | 5 ⁽¹⁾ | 13.50 MG |
| Process Weekend | 0.30 MGD | 2 | 0.60 MG |
| RPCW | 0.20 MGD | 1.30 | 1.30 MG |
| RPDW | 0.05 MGD | 0.5 | 0.025 MG |
| Sanitary & Misc | 0.10 MGD | 6 | 0.60 MG |
| Stormwater | 0.20 MGD | 2 | 0.40 MG |
| Σ | | | 16.43 MG |

⁽¹⁾For 5 day processing week

- 8) **The maximum month day flow (MDF) AL effluent pumping rate = 25.75 MG/7 days = 3.70 MGD ≤ 4.00 MGD, 7 days/week.**
- 9) **The reduced AL average day flow (ADF) effluent pumping rate = 16.43 MG/7 days = 2.35 MGD ≤ 2.60 MGD, 7 days/week.**

c. Wastewater Pollutant Concentrations and Loadings

Table #4
Maximum Pollutant Loadings into Existing and New Anaerobic Lagoons

| Parameter | DAF Cell #1 Effluent Wastewater | | Raw Rendering Plant Condensate Wastewater | | DAF Cell #2 Effluent, (Diluted and Pretreated Centrifuge Stickwater Wastewater) | | Sanitary & Misc | | Stormwater | | Σ | |
|----------------------------------|---------------------------------------|---------|--|---------|--|---------|-----------------|---------|------------|---------|----------|---------|
| | Concen. | Loading | Concen. | Loading | Concen | Loading | Concen | Loading | Concen | Loading | Concen. | Loading |
| Flow | 3.57 MGD ⁽¹⁾ | | 0.20 MGD | | 0.2882 MGD ⁽²⁾ | | 0.10 MGD | | 0.20 MGD | | 4.36 MGD | |
| Pollutant | mg/L | #/day | mg/L | #/day | mg/L | #/day | mg/L | #/day | mg/L | #/day | mg/L | #/day |
| BOD | 1,750 | 52,104 | 5,500 | 9,174 | 2,663 | 6,400 | 800 | 667 | 100 | 166 | 1,884 | 68,511 |
| TSS | 500 | 14,887 | 360 | 631 | 600 | 1,442 | 350 | 292 | 300 | 500 | 487 | 17,721 |
| Nitrate + Nitrite ⁽⁴⁾ | | | | | | | | | | | 0.17 | 6.2 |
| TKN | 250 | 7,443 | 1,100 | 1,835 | 340 | 817 | 100 | 83 | 15 | 25 | 281 | 10,203 |
| Ammonia N | 42 | 1,250 | 1,050 | 1,751 | 130 | 312 | 25 | 21 | 5 | 8.3 | 92 | 3,342 |
| Total Nitrogen ⁽³⁾⁽⁴⁾ | | | | | | | | | | | 281 | 10,203 |
| TP | ND | ----- | ND | ----- | ND | ----- | 8 | 7 | 2 | 3.3 | 27 | 993 |
| FOG | < 200 | 5,955 | < 200 | 334 | < 100 | 240 | 100 | 83 | 20 | 33.3 | < 200 | 6,645 |
| Sodium ⁽⁵⁾ | | | | | | | | | | | 190 | 6,910 |
| Chloride ⁽⁴⁾ | | | | | | | | | | | 231 | 8,400 |
| pH ⁽⁴⁾ | | | | | | | | | | | 6.94 | |

ND = no wastewater test data

⁽¹⁾3.51 MGD Process Plant + 0.20 MG RP Drainage – (100 gpm = 0.1441 MGD to DAF Cell #2 for Dilution) = 3.57 MGD

⁽²⁾Stickwater Volume @ 100 gpm = 0.1441 MGD + DAF Cell #2 Effluent Volume Dilution Water @ 100 gpm = 0.1441 MGD = 200 gpm = 0.2882 MGD

⁽³⁾TN = TKN

⁽⁴⁾Average values for the period of August 2018 to July 2019 provided by the Owner and collected at the Existing Anaerobic Effluent.

⁽⁵⁾Average value for the period of September 2019 to October 2019.

3. Equalization Volume Calculation

- a. The maximum storage volume required to provide 7 day hydraulic flow equalization =

$$(4.36 \text{ MGD} - 3.70 \text{ MGD})(5 \text{ days}) \leq 3.30 \text{ MG} \leq 4.00 \text{ MG}$$

4. 7 Day FEB/Anaerobic Lagoon Volumes

- a. The two existing Anaerobic Lagoons #1 and #2 each with an effective volume of approximately 7.25 MG will continue to be operated in parallel to provide second stage anaerobic pretreatment of wastewater.

- b. One new Anaerobic Lagoon #3 with a total volume of 22.0 MG will be installed and operated downstream of the two existing Anaerobic Lagoons to provide combined 7-day hydraulic flow equalization and second stage anaerobic pretreatment of wastewater. The new Anaerobic Lagoon #3 will have a bottom elevation of 13 feet Above Sea Level (ASL). The Geotechnical Study prepared by Hillis-Carnes Engineering Associates dated March 19, 2018 indicated the Seasonal High Ground Water level in the area of the new Anaerobic Lagoon #3 is approximately 7.5 feet below existing grade. Existing grade in the area is approximately 18.5 feet ASL making the Seasonal High Ground Water level approximately 11 feet ASL.

- c. Existing Anaerobic Lagoons #1 and #2 (Per Lagoon)

| | | |
|---------------------------------------|---|---------|
| Maximum Volume @ Normal HWL | = | 7.25 MG |
| Solids Storage Volume | = | 1.00 MG |
| Maximum Effective Volume @ Normal HWL | = | 6.25 MG |
| Maximum 7 Day Equalization Volume | = | 0 MG |
| Minimum Effective Volume @ Normal LWL | = | 6.25 MG |

- d. New 7 Day FEB Anaerobic Lagoon #3

| | | |
|---------------------------------------|---|----------|
| Maximum Volume @ Normal HWL | = | 22.00 MG |
| Solids Storage Volume | = | 2.00 MG |
| Maximum Effective Volume @ Normal HWL | = | 20.00 MG |
| 7 Day Equalization Volume | = | 4.00 MG |
| Minimum Effective Volume @ Normal LWL | = | 16.00 MG |
| Average Effective Volume | = | 18.00 MG |

5. Anaerobic Lagoon BOD Loading Rate and Hydraulic Detention Time Calculation

a. @ Maximum Loading

1) $BOD = 68,511 \text{#BOD/day}$

2) $\text{Minimum Total Effective Lagoon Volume} = 6.25 \text{ MG}(2) + 16.00 \text{ MG} = 28.50 \text{ MG}$
 $= 3,800 \times 10^3 \text{ft}^3$

3) $\text{Maximum BOD Loading Rate} =$

$$BODL = \frac{68,511 \text{#BOD/day}}{3,800} = 18 \text{#BOD/1,000ft}^3$$

4) $\text{Minimum Hydraulic Detention Time:}$

$$HDT = \frac{28.50 \text{ MG}}{4.36 \text{ MG}} = 6.5 \text{ days}$$

- b. At a maximum BOD loading rate $\leq 20 \text{#BOD/1,000 ft}^3$, the anaerobic lagoons are expected to provide an average BOD removal efficiency of approximately 70% during the winter season and approximately 80% during the summer season.

6. Expected Anaerobic Lagoon Effluent Quality

a. With No Anaerobic Lagoon By-Pass

- 1) After first stage partial pretreatment of processing plant wastewater and rendering plant drainage wastewater in DAF Cell #1; and, centrifuge stickwater in DAF Cell #2, and, second stage pretreatment of DAF Cell #1 effluent, DAF Cell #2 effluent, and, rendering plant condensate in the Anaerobic Lagoons, the following Anaerobic Lagoon #3 effluent and activated sludge process influent pollutant concentrations and loadings are expected if 100% of the DAF Cell #1 and #2 effluent wastewater and RPCW is treated in the Anaerobic Lagoons:

Table #5

| Pollutant | Average | | Maximum | |
|-----------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| | Pollutant Concentration | Pollutant Loading ⁽¹⁾ | Pollutant Concentration | Pollutant Loading ⁽²⁾ |
| | mg/L | #/day | mg/L | #/day |
| BOD | 2,000(0.20) = 400 ⁽³⁾ | 8,675 | 2,000(0.30) ≤ 600 ⁽⁴⁾ | 20,016 |
| TSS | 500(0.50) < 250 | 5,425 | 500(0.70) < 350 | 11,676 |
| TKN | 300 | 6,505 | 300 | 10,008 |
| Ammonia N | 250 | 5,425 | 250 | 8,340 |
| TP | 30 | 650 | 30 | 1,000 |
| FOG | < 50 | 1,100 | < 100 | 3,336 |

⁽¹⁾@ Average Day Flow (ADF) = 2.60 MGD, 7 days/week

⁽²⁾@ Maximum Month Day Flow (MDF) = 4.00 MGD, 7 days/week

⁽³⁾@ 80% BOD removal during summer season

⁽⁴⁾@ 70% BOD removal during winter season

⁽⁵⁾@ C/N ratio = 20,016/10,008 = 2.0/1

b. With 30% Anaerobic Lagoon By-Pass

- 1) Up to 30% of the total daily wastewater flow volume may be by-passed around the Anaerobic Lagoons in order to provide increased carbon source loading into the activated sludge (AS) treatment system. This by-pass or short circuit flow will be pumped out of AL By-Pass/Short Circuit Carbon Source Pump Station into the AS system 7 days/week, 24 hours/day. If 30% of the total flow is by-passed and 70% of the flow is pretreated and equalized in the Anaerobic Lagoons, the total AS process pollutant loadings are summarized in the following table:

Table #6

| Pollutant | 30% AL By-Pass | | 70% AL Treated | | Combined ⁽³⁾ | |
|-----------|-------------------------|----------------------------------|-------------------------|----------------------------------|-------------------------|-------------------|
| | Pollutant Concentration | Pollutant Loading ⁽¹⁾ | Pollutant Concentration | Pollutant Loading ⁽²⁾ | Pollutant Concentration | Pollutant Loading |
| | mg/L | #/day | mg/L | #/day | mg/L | #/day |
| BOD | 1,874 | 18,755 | 600 | 14,011 | 982 | 32,766 |
| TSS | 487 | 4,874 | 350 | 8,173 | 391 | 13,047 |
| TKN | 288 | 2,882 | 300 | 7,006 | 296 | 9,888 |
| Ammonia N | 92 | 921 | 250 | 5,838 | 203 | 6,759 |
| TP | 27 | 270 | 30 | 701 | 29 | 971 |
| FOG | 200 | 2,002 | < 100 | 2,335 | 130 | 4,337 |

⁽¹⁾@ 1.20 MGD, 7 days/week = 30% Total Flow

⁽²⁾@ 2.80 MGD, 7 days/week = 70% Total Flow

⁽³⁾@ 4.00 MGD, 7 days/week = Total Flow

⁽⁴⁾C/N ratio = 32,766/9,888 = 3.3/1

C. Anaerobic Lagoon By-Pass/Short Circuit Carbon Source Influent Pump

1. General Description

- a. The new AL By-Pass/Short Circuit Carbon Source Influent Pump Station is provided to by-pass a controlled portion of the partially pretreated DAF Cell effluent wastewater flow around the Anaerobic Lagoons in order to increase carbon source loading into the activated sludge treatment process.
- b. **One new self-priming pump is provided to pump a controlled volume and flow rate of Anaerobic Lagoon (AL) influent wastewater from the short circuit wet well located at the outlet end of Anaerobic Lagoons #1 and #2 into the new BNR System Anoxic Reactor #1.**

2. Design Assumptions

a. Wastewater Flow Rates

- 1) Maximum AL by-pass flow volume = 30% of maximum AL influent wastewater flow volume = $0.30(4.00 \text{ MGD}) = 1.20 \text{ MGD} = 833 \text{ gpm}$
- 2) Average AL by-pass flow volume = 20% of total average AL influent wastewater flow volume = $0.20(4.00 \text{ MGD}) = 0.80 \text{ MGD} = 555 \text{ gpm}$

b. Wastewater Pumping Requirements

- 1) Operation of one pump at reduced speed is required to pump the average flow rate = 555 gpm during processing shifts
- 2) Operation of one pump at reduced speed is required to pump the maximum flow rate = 833 gpm during processing shifts

c. Pump Selection

- 1) One new 50 HP, 8-inch self-priming chopper wastewater pump is provided for AL by-pass flow or AL short circuit flow pumping.
- 2) The pump is rated at 1,750 gpm @ 50 ft. head when operated at full speed.

d. Variable Speed Drives

- 1) The pump is provided with variable speed drive motor controls including automatic pump speed and pumping rate control.
- 2) Pump speed and pumping rate will be automatically controlled to maintain a set point AL by-pass flow rate and volume.

e. Flow Meter

- 1) A new magnetic flow meter will be provided to measure and totalize the pumped flow rate and daily volume.

D. Anaerobic Lagoon #1 and #2 Effluent Pump Station (New)

1. Design Assumptions

- a. Average Pumping Rate Required = 2.60 MGD = 1,800 gpm, 24 hours/day, 5 days/week

- b. Maximum Pumping Rate Required = 4.00 MGD = 2,800 gpm, 24 hours/day, 5 days/week
- c. Dry Weather Peak Pumping Rate Required = 4.00 MGD = 2,800 gpm
- d. Wet Weather Peak Pumping Rate Required = 5.00 MGD = 3,500 gpm

2. General

- a. One new Anaerobic Lagoon #1 and #2 Pump Station is provided to pump AL effluent wastewater or AL influent short circuit flow wastewater to Anaerobic Lagoon #3 or to Anoxic Reactor #1.

3. Pump Selection

- a. **Two new 50 HP, 8” self-priming chopper sewage pumps are provided to pump pretreated wastewater out of existing Anaerobic Lagoon #1 and #2 through a new 16” force main into new Anaerobic Lagoon #3 or into the new Anoxic Reactor #1.**
- b. Each pump is rated at 2.60 MGD = 1,800 gpm @ 45 feet.
- c. Operation of two pumps in parallel at reduced speed is required to pump the maximum day flow rate of 4.00 MGD = 2,800 gpm = 1,400 gpm/pump.
- d. Operation of two pumps in parallel at full speed is required to pump the maximum wet weather flow rate of 5.0 MGD = 3,500 gpm = 1,750 gpm/pump.
- e. The AL By-Pass/Short Circuit Carbon Source Influent Pump Station pump can act as an emergency stand-by to pump AL effluent to the new AL #3.

4. Variable Speed Drive Controls

- a. Each pump is provided with a variable speed drive motor controls with automatic pump speed and pumping rate control.
- b. The pumps will be normally operated to maintain a constant liquid level in AL #1 and #2.

5. Liquid Level Controls

- a. The AL #1/#2 Effluent pumps are manually started. Anaerobic Lagoon (AL) low liquid level (LLL) automatic pump shut off and alarm level controls are provided in the pump station. Pumps can also be manually operated to pump below the automatic off liquid level in order to pump down the AL.

- b. A high liquid level alarm (HLLA) is provided in the AL in order to prevent excessive liquid level in Anaerobic Lagoons #1 and #2.

6. Flow Meter

- a. **One new 16” magnetic flow meter is provided in the Anaerobic Lagoon Effluent Pump Station discharge header to accurately measure, indicate, totalize, and record the total flow rate pumped from Anaerobic Lagoons #1 and #2.**

E. Dissolved Air Flotation DAF Cell #3 For Temporary/Optional Post Treatment Of Anaerobic Lagoon Effluent (Existing)

1. General

- a. One new high capacity DAF Cell is provided to operate downstream of existing Anaerobic Lagoons #1 and #2.
- b. New DAF Cell #3 will be operated for temporary/optional post treatment of Anaerobic Lagoon #1 and #2 effluent upstream of the activated sludge treatment system.

2. Design Assumptions

- a. Wastewater Flow Rates and Volumes:

- 1) Average Day Flow (ADF) Volume = 2.60 MGD \leq 1,800 gpm
- 2) Maximum Day Flow (MDF) Volume = 4.00 MGD = 2,800 gpm, over 24 hours/day if influent pumped from existing Anaerobic Lagoon #1 and #2 for Anaerobic Lagoon post treatment in DAF Cell #3.
- 3) Wet Weather Peak Flow (PF) Volume = 5.00 MGD = 3,500 gpm pumped out of Anaerobic Lagoon #1 and #2 into DAF Cell #3 and into Anaerobic Lagoon #3.

- b. Maximum wastewater pollutant concentrations and loadings in the DAF Cell #3 influent at maximum daily influent flow rate = 4.00 MGD:

Table #7
Anaerobic Lagoon Effluent Wastewater
Pollutant Concentrations and Loadings

| Pollutant | Pollutant Concentration | | Pollutant Loading | |
|-------------|-------------------------|------------|-------------------|-------------|
| | Average | Maximum | Average | Maximum |
| BOD (total) | 1,000 mg/L | 2,000 mg/L | 33,360#/day | 66,720#/day |
| TSS | 500 mg/L | 1,000 mg/L | 16,680#/day | 33,360#/day |
| TKN | 250 mg/L | 300 mg/L | 8,340#/day | 10,000#/day |
| Ammonia-N | 150 mg/L | 250 mg/L | 5,000#/day | 8,340#/day |
| O&G | 200 mg/L | 400 mg/L | 6,672#/day | 13,344#/day |

3. DAF System Design

a. General Description

- 1) **One existing 10 ft. wide x 44 ft. long x 10 ft. liquid depth plate pack DAF Cell is provided with two new recycle flow pressurization pumps, a new air dissolving system and one pipeline flocculator to provide temporary/optional post treatment of Anaerobic Lagoon #1 and #2 effluent wastewater by chemical coagulation and flocculation and dissolved air flotation.** The effective flotation area of the DAF Cell > 2,525 ft². The free surface area of the DAF Cell = 260 ft².
- 2) One 12" diameter x 220 ft. long, 1,200 gallon volume Flocculation Tube is provided with the DAF Cell.
- 3) Two 40 HP recycle pressurization pumps each rated at 450 gpm at 208 ft. head are provided with compressed air fed into the pump discharge piping.
- 4) One Air Compressor is provided for air supply to the DAF cell air dissolving system and recycle pressurization pump discharge.

b. Design Calculations

- 1) Calculate the maximum DAF Cell solids loading rate with upstream chemical coagulation-flocculation @ 2,800 gpm = 4.00 MGD assuming a TSS removal efficiency of 80%.

$$\text{a) } \frac{[1,000 \text{ mg/L TSS}](0.80) 8.34 (4.00 \text{ MGD})}{24} \leq 1,200\#/hr$$

- 2) Calculate the required air dissolving rate for the maximum solids loading rate of 1,200#/hr, assuming an air to solids ratio = 0.01#/air/#solids in the rectangular DAF cell with polymer coagulation/flocculation.

$$\text{a) } \frac{1,200 (0.01)}{60} < 0.20\# \text{ air/min.}$$

- 3) Calculate the required air supply rate @ 90°F inlet air density @ ≤ sea level altitude ≥ .071#/ft³

$$\text{a) } \frac{0.20\#/min}{0.071} \leq 3.00 \text{ cfm}$$

- b) Use air supply rate = 1.0 cfm to 4.0 cfm = 30 to 120 liters/min.

- 4) The maximum air dissolving capacity of the DAF Cell recycle pressurization system with one 40 HP recycle pressure pump in operation = 140 liters air/min. ≥ 5.0 cfm @ 120 psi.

- 5) Calculate the pressurized flow required @ 90 psi air dissolving pressure @ wastewater temperature = 90°F max., assuming an air dissolving capacity = 0.864# air/min. @ 90 psi

$$\text{a) } QR = \frac{0.20\#/min (1000)}{0.864\# \text{ air/min}} \leq 240 \text{ gpm}$$

Two 40 HP recycle pressure pumps are provided with the DAF Cell each rated @ 450 gpm @ 208 psi. A second uninstalled pump is provided as a standby.

- 6) Calculate the maximum DAF Cell Hydraulic Surface Loading Rate

- a) Hydraulic Surface Loading Rate =

$$\frac{2,800 \text{ gpm} + 450 \text{ gpm recycle}}{2,625 \text{ ft}^2} \leq 1.25 \text{ gpm/ft}^2$$

7) Calculate the maximum DAF Solids Loading Rate =

a) Solids Loading Rate =

$$\frac{1,200\#/hr}{260\text{ ft}^2} \leq 5.0\#/ft^2/hr$$

4. DAF Sludge Production Storage and Pumping

- a. The calculated total skimmings volume produced per day in the DAF Cell #3 when operated with chemical coagulation-flocculation = 14,000# to 28,000# dry solids/day = 17,000 to 34,000 gpd after gravity decanting for approximately 10% solids concentration, assuming approximately 50% BOD removal, 80% TSS removal and 50% Oil & Grease removal and TKN removal of 30% to 50% in the DAF Cell.
- b. Solids skimmed from DAF Cell #3 will flow into a 12,000 gallon Sludge Holding Tank for gravity decanting. When DAF Cell #3 is operated for post treatment of AL effluent, the thickened solids are pumped to WAS Aerobic Digestion Basin #2 to mix and be digested with WAS prior to ultimate disposal.
- c. Two 10 HP positive displacement DAF sludge pumps are provided each rated at 200 gpm @ 60 ft. to transfer DAF sludge from the Flotation Cell Sludge Holding Tank to WAS Digestion Basin #1 or to a DAF Sludge Storage Tanker.

5. Expected DAF Cell #3 Effluent Quality if Used for Post Treatment of Anaerobic Lagoon #1 and #2 Effluent
- a. The following DAF Cell #3 effluent quality is expected if the DAF Cell is operating with a high efficiency chemical program using ferric or aluminum coagulant solution and polymer flocculant solution for chemical coagulation and flocculation in the Flocculation Tube upstream of the DAF Cell #3. The following AL post treatment effluent quality is expected to be discharged into the downstream activated sludge final treatment system:

Table #8
DAF Cell #3 Effluent Pollutant Concentrations and Loadings When Used for Post Treatment of AL #1 and AL #2 Effluent

| Pollutant | Average Concentration | Maximum Concentration |
|------------------|------------------------------|--------------------------------|
| BOD | BOD = 1,000(0.50) ≤ 500 mg/L | BOD = 2,000(0.50) ≤ 1,000 mg/L |
| TSS | TSS = 500(0.20) ≤ 100 mg/L | TSS = 1,000(0.20) ≤ 200 mg/L |
| O&G | O&G = 200(0.50) ≤ 100 mg/L | O&G = 400(0.50) ≤ 200 mg/L |
| TKN | TKN = 300(0.60) ≤ 180 mg/L | TKN = 450(0.60) ≤ 270 mg/L |

F. Chemical Feed Equipment for DAF Cell #3 Pretreatment System (Existing)

1. Bulk Coagulant Solution Storage Tank
 - a. One 10' dia. x 12' tall, 6,000 gallon volume, fiberglass double walled tank is provided for bulk storage of coagulant solution.
 - b. The bulk coagulant solution storage tank is provided with containment and has an ultrasonic level control with high and low level alarm with continuous level indicator.
2. Polymer Solution Mix Tanks
 - a. Two 10' dia. x 7' tall, 4,000 gallon volume fiberglass tanks each with 2 HP mixer are provided for make-up and storage of polymer flocculant solution.
3. Chemical Solution Pumps
 - a. Two coagulant solution pumps are provided each rated at 50 gphr @ 30 psi for dosage of coagulant solution into the wastewater flow into the DAF Cell #3 Flocculation Tube.

- b. Two polymer solution pumps are provided each rated at 90 to 900 gphr @ 40 psi for dosage of anionic flocculant solution into the wastewater flow into the DAF Cell #3 Flocculation Tube.
- c. The coagulant solution and polymer solution chemical feed pumps have variable speed drives that can be manually controlled; or, automatically controlled by flow pacing from the DAF Cell #3 influent flow meter and the chemical feed control system.

G. DAF Cell #3 Effluent Pump Station (Existing)

1. General Description

- a. If DAF Cell #3 is operated for post treatment of Anaerobic Lagoon #1 and #2 effluent, then the DAF Cell #3 Effluent Pump Station is used to pump post pretreated Anaerobic Lagoon #1 and #2 effluent wastewater discharged from the DAF Cell #3 into downstream Anaerobic Lagoon #3.

2. Design Assumptions

a. Wastewater Flow Rates, Pumping Rates and Volumes

- 1) Average wastewater flow (ADF) volume ≤ 2.20 MGD = 1,600 gpm, 7 days/week
- 2) Maximum month average wastewater flow (MMADF) volume ≤ 3.00 MGD = 2,100 gpm, 7 days/week.
- 3) Maximum daily wastewater flow (MDF) volume ≤ 4.00 MGD = 2,800 gpm
- 4) Peak wastewater flow (PF) rate = 5.00 MGD = 3,500 gpm

3. Pump Selection

- a. Three 40 HP T8 self-priming sewage pumps are provided to pump wastewater discharged to the DAF Cell #3 effluent wet well into the activated sludge treatment system.
- b. Each pump is rated at 1,750 gpm @ 45 ft.

4. Variable Speed Drive Controls

- a. Variable speed drive motor controls are provided for each pump.
- b. Pump speed and pumping rate are automatically controlled by the liquid level in the wet well.
- c. Operation of two pumps in parallel at reduced speed is required to pump the peak flow rate = 2,800 gpm = 4.00 MGD. The third pump is provided as an installed standby pump.

5. Wet Well Liquid Level Control

- a. One liquid level sensor is provided in the pump station wet well to operate the pump station pump on, pump off and high liquid level alarm controls.
- b. A control system is provided to automatically adjust the pump operating speed and the flow pumping rate to maintain the liquid level in the pump station wet well.

H. Anaerobic Lagoon #3 Effluent Pump Station (New)

1. General

- a. One new pump station is provided to pump wastewater at a controlled flow rate and volume from Anaerobic Lagoon #3 into Anoxic Reactor #1 or Nitrification Reactor #2.

2. Wastewater Flow Volume and Rates

- a. Average day wastewater flow (ADF) volume \leq 2.60 MGD, 7 days/week
- b. Maximum month average wastewater flow (MMADF) volume \leq 3.00 MGD, 7 days/week.
- c. Maximum month wastewater flow (MDF) volume \leq 4.00 MGD, 7 days/week
- d. Peak wastewater flow (PF) rate = 5.00 MGD

3. Pump Selection

- a. Equalized and pretreated wastewater can be pumped from the new Anaerobic Lagoon #3 into Anoxic Reactor #1 of the activated sludge (AS) final treatment system.

- b. **Three (3) new 40 HP, 8” self-priming suction lift pumps are provided to pump wastewater from the new Anaerobic Lagoon #3 through a new 16” force main into Anoxic Reactor #1 of the AS system.**
- c. Each pump is rated at 1,750 gpm @ 40 feet. Operation of two pumps at reduced speed is required to pump the design maximum day flow rate of 2,800 gpm = 4.0 MGD with the third pump provided as an installed standby pump.
- d. Operation of two pumps at full speed is required to pump the peak flow rate = 3,500 gpm = 5.0 MGD.

4. Variable Speed Drive Controls

- a. Each pump is provided with a variable speed drive motor controls with automatic pump speed and pumping rate control.
- b. The pumps will be normally operated to maintain a constant flow rate pumped from Anaerobic Lagoon #3 into Anoxic Reactor #1. The pumps are provided with variable speed drive motor controls which use the downstream flow meter flow measurement signal and the VFD control panel to automatically control pump operating speed to maintain a manually selected flow rate into Anoxic Reactor #1. As the liquid level in Anaerobic Lagoon #3 rises or falls and the pump head is reduced or increased, the pump speed will be automatically reduced or increased to maintain the desired flow rate.

5. Liquid Level Controls

- a. The AL pumps are manually started. Anaerobic Lagoon (AL) low liquid level (LLL) automatic pump shut off and alarm level controls are provided in the pump station. Pumps can also be manually operated to pump below the automatic off liquid level in order to pump down the AL.
- b. A high liquid level alarm (HLLA) is provided in the AL in order to prevent excessive liquid level in the Anaerobic Lagoon.

6. Flow Meter and Flow Controls

- a. **One new 14” dia. magnetic flow meter is provided in the AL Effluent Pump Station discharge line into Anoxic Reactor #1 or Nitrification Reactor #2.**
- b. The flow meter is used with the pump controls for automatic control of pump speed and pumping rate and volume from AL #3 into Anoxic Reactor #1.

- c. The flow meter has a flow indicator and totalizer provided with a downstream valve to optionally manually regulate the flow rate pumped out of AL #3 into downstream Anoxic Reactor #1.

I. Anoxic Reactor #1 (New)

1. General

- a. **One new 140 ft. dia. x 28 ft. liquid depth 3.20 MG volume above grade is provided as first stage, activated sludge Anoxic Reactor #1 to provide BOD and nitrate nitrogen removal by biological denitrification.**

2. Design Assumptions

a. Wastewater Flows

- 1) Average wastewater flow (ADF) volume ≤ 2.60 MGD, 7 days/week
- 2) Maximum month average wastewater flow (MMADF) volume ≤ 3.00 MGD, 7 days/week.
- 3) Maximum daily wastewater flow (MDF) volume ≤ 4.00 MGD
- 4) Peak wastewater flow (PF) rate = 5.00 MGD

b. Pollutant Concentrations and Loadings

- 1) The following maximum influent wastewater pollutant concentrations and loadings are assumed in the design of Anoxic Reactor #1 at the maximum day influent wastewater flow volume ≤ 4.00 MGD:

Table #9
BNR System Influent Pollutant
Concentrations and Loadings

| Pollutant | Maximum | |
|-----------|------------------------------|------------------------|
| | Concentration ⁽¹⁾ | Loading ⁽¹⁾ |
| BOD | 1,000 mg/L | 33,360#/day |
| TSS | 400 mg/L | 13,344#/day |
| TKN | 300 mg/L | 10,008#/day |
| Ammonia-N | 200 mg/L | 6,672#/day |
| FOG | 130 mg/L | 4,337#/day |
| TP | 30 mg/L | 1,000#/day |

⁽¹⁾Table #6

3. Anoxic Reactor BOD and Nitrate Removal Process Design

- a. Anoxic Reactor #1 will be operated in series as first stage anoxic activated sludge reactor for biological nitrate removal and carbonaceous BOD removal in a four stage biological nitrogen removal (BNR) system.
- b. Anoxic Reactor #1 will be used as anoxic activated sludge reactor basin for removal of carbonaceous BOD in the pretreated influent wastewater, and, for removal of nitrate nitrogen contained in the mixed liquor flow recycled from downstream Nitrification Reactor #2A.
- c. Calculate MLVSS concentration required for carbonaceous BOD removal by biological synthesis in Anoxic Reactor #1 at the minimum expected winter season design mixed liquor temperature of 15°C
 - 1) For BOD removal assuming a carbonaceous BOD removal rate of 0.40# BOD/#MLVSS at 15°C and a carbonaceous BOD removal efficiency of 80%

$$\frac{33,360\#BOD/day(0.80)}{0.40} \leq 67,000\#MLVSS @ 15^{\circ}C$$

d. Calculate MLVSS concentration required for removal of nitrate nitrogen in the mixed liquor recycled from Nitrification Reactor #2.

1) Calculate TKN concentration and loading to be nitrified assuming a 3% nitrogen uptake rate for synthesis of carbonaceous BOD; $NN = 300 \text{ mg/L} - 0.03 (1,000 \text{ mg/L}) \leq 270 \text{ mg/L}$; TKN/day to be nitrified = $(270 \text{ mg/L})(8.34)(4.00 \text{ MGD}) = 9,007 \text{ \#TKN nitrified/day}$, 7 days/week.

2) Calculate the nitrate nitrogen in recycled mixed liquor assuming 100% of TKN into Nitrification Reactor #2 is nitrified, assuming a 100% sludge recycle rate from the Final Clarifier; and assuming a maximum nitrate recycle flow rate of 400% which

$$= \frac{4Q + 1Q(RAS)}{1Q + 1Q(RAS) + 4Q} = \frac{5Q}{6Q} = 0.83 = 83\%$$
of the total flow rate that would be discharged from Nitrification Reactor #2.

$$\begin{aligned} \text{\#NO}_3\text{-N recycled} &= 0.83(9,007 \text{\#TKN nitrified/day}) \\ &= 7,476 \text{\#NO}_3\text{-N/day denitrified} \end{aligned}$$

3) For $\text{NO}_3\text{-N}$ removal assuming a denitrification rate $\geq 0.072 \text{\#NO}_3\text{-N/\#MLVSS}$ at 15°C

$$\frac{7,476 \text{\#NO}_3\text{-N/day}}{0.072} \leq 104,000 \text{\#MLVSS @ } 15^\circ\text{C}$$

;therefore, \#MLVSS for nitrate nitrogen removal governs the minimum biomass weight required and therefore the design $\text{MLVSS} = 104,000 \text{\#}$ and $\text{\#MLSS} = 104,000/0.75 \leq 139,000 \text{\#}$ assuming $\text{MLVSS/MLSS} = 0.75$

e. The maximum MLSS concentration required in Anoxic Reactor #1 is calculated as follows:

1) At anoxic basin volume = 3.20 MG

$$\text{MLSS} = \frac{139,000 \text{\#MLSS}}{(3.2 \text{ MG})(8.34)} = 5,200 \text{ mg/L} \leq 6,000 \text{ mg/L}$$

- f. Calculate the hydraulic detention time in Anoxic Reactor #1 assuming the total flow volume into the anoxic reactor = 4.00 MGD inflow volume + 1Q RAS rate + 4Q nitrate mixed liquor recycle flow rate = 4.00 MGD + 4.00 MGD (RAS) + 4.00 MGD(4) = 24.0 MGD = 16,800 gpm

$$1) \text{ HDT(min)} = \frac{3,200,000 \text{ gallons}}{16,800 \text{ gpm}} = 190 \text{ min}$$

$$= 3.2 \text{ hrs}$$

4. Anoxic Reactor #1 Mixing and Aeration Equipment Design

- a. Evaluate the mixing requirements in Anoxic Reactors #1A & #1B:

- 1) Calculate the BHP required for mixing 4,000 mg/L to 6,000 mg/L TSS concentration = 50 HP/MG using directional mix jet headers.

- 2) BHP required for mixing:

a) in Anoxic Reactor #1 = 50 HP(3.20 MG) = 160 HP < 200 HP

- b) two 200 HP jet recirculation flow pumps and two directional mix jet aeration headers are provided for tank mixing and mixed liquor solids suspension in Reactor #1.

- b. Calculate the oxygen transfer rate required in Anoxic Reactor #1 under normal operating conditions when the downstream Nitrification Reactor #2 is in service

- 1) Calculate the maximum oxygen transfer requirement for BOD synthesis assuming an oxygen demand = 0.60#O₂/#BOD and 80% BOD removal

$$\text{AOTR}_1 = \frac{0.60\#O_2/\#BOD(33,360\#BOD/\text{day})(0.80)}{24} = 667\#O_2/\text{hr (max)}$$

- 2) Calculate the maximum oxygen available in recycled nitrate for carbonaceous BOD and a removal in Anoxic Reactor #1 assuming a nitrate recycle rate of 4Q = 400%; RAS rate = 1Q = 100%; a recycled nitrate nitrogen fraction = 0.83 or 83%; and an oxygen supply of 2.86#O₂/#NO₃-N.

$$\text{AOTR}_2 = \#O_2 / \text{hr available from NO}_3\text{-N}$$

$$\text{AOTR}_2 = \frac{(9,007\#\text{TKN}/\text{day nitrified})2.86(0.83)}{24} = -891\#O_2/\text{hr (max)}$$

- 3) Calculate the maximum oxygen transfer requirement for endogenous respiration where the volume in Reactor #1 is approximately 31% of the total activated sludge volume reactor volume calculated as follows:

| Reactor | Volume | % of Total Volume |
|---------------------------|----------|-------------------|
| Anoxic Reactor #1 | 3.20 MG | 31% |
| Nitrification Reactors #2 | 3.50 MG | 34% |
| Anoxic Reactor #3 | 2.95 MG | 29% |
| Aerobic Reactor #4 | 0.55 MG | 6% |
| Total Reactor Volume | 10.20 MG | 100% |

$$AOTR_3 = \frac{(33,360 \text{ #BOD/day})(0.80 \text{ #O}_2/\text{#BOD})(0.31)}{24} = 345 \text{ #O}_2/\text{hr (max)}$$

- 4) Calculate the total amount of oxygen required in Anoxic Reactor #1:

$$\begin{aligned} AOTR_{(total)} &= AOTR_1 - AOTR_2 + AOTR_3 \\ &= 667 \text{ #O}_2/\text{hr} - 891 \text{ #O}_2/\text{hr} + 345 \text{ #O}_2/\text{hr} = 121 \text{ #O}_2/\text{hr (max)} \end{aligned}$$

- 5) Calculate the required corresponding standard oxygen transfer rate required:

$$SOTR = AOTR \left[\frac{C_{ss}}{\beta C_{sw} - DO} \alpha (1.024)^{T-20} \right]$$

$$\text{Where DO} \leq 0.30 \text{ mg/L (maximum D.O. in Reactor \#1)}$$

$$\beta = 0.90$$

$$\alpha = 0.80 \text{ @ } 3,000 \text{ to } 6,000 \text{ mg/L MLSS with subsurface jet aeration units}$$

$$1.024^{(T-20)} = 1.268 \text{ @ } T = 30^\circ\text{C}$$

$$C_w = 7.63 \text{ mg/L @ sea level, } 30^\circ\text{C @ max. mixed liquor temperature}$$

$$C_s = 9.20 \text{ mg/L @ sea level, @ } 20^\circ\text{C}$$

$$\text{Site Altitude} \leq 100 \text{ feet}$$

$$\begin{aligned} \text{Pressure Correction Factor} &\geq 0.995 \\ C_{sw} &= 7.63 \left[\frac{(0.995)(14.7) + (0.5)(0.433)(28.0)}{14.7} \right] \\ &= 7.63 \text{ mg/L}(1.407) = 10.73 \text{ mg/L} \\ C_{ss} &= 9.20 \left[\frac{14.7 + (0.5)(0.433)(28.0)}{14.7} \right] \\ &= 9.20 \text{ mg/L}(1.412) = 12.99 \text{ mg/L} \end{aligned}$$

* Reactor basin liquid depth = 28.0 ft.

$$\begin{aligned} \text{SOTR} &= \text{AOTR} \frac{12.99}{[(0.90)(10.73) - 0.3]0.80(1.268)} \\ \text{SOTR} &= 1.37(\text{AOTR}) \\ \text{SOTR} &\leq 1.40(121) \leq 200 \# \text{O}_2/\text{hr} \text{ (max)} \end{aligned}$$

6) Calculate subsurface aeration equipment air sparging requirements:

a) The oxygen available per cfm per hour @ 20°C and 1 atm

$$\begin{aligned} x &= 0.23 (0.075 \#/\text{ft}^3)(60 \text{ min/hr}) \\ &= 1.035 \# \text{O}_2/\text{cfm/hr} \end{aligned}$$

b) e = subsurface diffuser oxygen stripping or transfer efficiency at liquid depth = 28.0 ft. = 36%

$$\begin{aligned} \text{c) scfm required} &= \frac{\text{SOTR}}{(1.035)(0.36)} \\ \text{scfm} &= \frac{200 \# \text{O}_2/\text{HR}}{(1.035)(0.36)} \leq 600 \text{ scfm (max)} \end{aligned}$$

- d) The maximum blower pressure with jet nozzles installed 40" = 3.33' above the basin floor at 28.0 ft. maximum liquid depth – 3.33 ft. = 24.67 ft. jet nozzle air sparge submergence
- $$= (25.0 \text{ ft.})(0.433) + 1.00 \text{ psi} = 11.9 \text{ psi} \leq 12.0 \text{ psi including pressure loss in air supply lines and in jet nozzle diffusers}$$
- 7) Oxygen transfer in Reactor #1 can be provided by the directional jet nozzles if compressed air is supplied from the blowers to the nozzles. The jet aeration headers can be operated to provide mixing only without oxygen transfer, or, with air supply to provide mixing and oxygen transfer. Each jet header unit can be individually operated with or without aeration to supply compressed air to the jet nozzles.
- 8) Oxygen in Anoxic Reactor #1 will normally be provided by nitrate oxygen contained in the mixed liquor recycle flow pumped from the downstream Nitrification Reactor #2.
- 9) The total emergency air sparging capacity of the jet aeration mixing system in Reactor #1 is approximately 8,650 scfm providing a maximum oxygen transfer rate $\geq 2,000 \text{ #O}_2/\text{hr}$ (AOTR) with air supplied by up to 4 – 200 HP positive displacement blowers each rated at 2,400 scfm at 11.82 psi.
- 10) If Reactor #2 must be taken out of service, Reactor #1 can be operated in this emergency condition as an aerobic reactor for BOD and TKN removal if the upstream DAF Pretreatment Systems are operated with higher efficiency chemical coagulation and flocculation to reduce reactor influent BOD concentrations down to $\leq 800 \text{ mg/L}$ and TKN down to $\leq 275 \text{ mg/L}$. In the event of a shutdown of downstream Nitrification Reactor #2, the air supply blowers normally used for Reactor #2 can be operated to supply compressed air to the jet system in Reactor #1 if Reactor #1 must be operated as an aerobic nitrification reactor.

5. Expected Effluent Quality at the Maximum 7 Day Discharge Flow Volume = 3.00 MGD

- a. To insure a conservative design approach the following maximum Reactor #1 effluent pollutant concentrations and loadings are assumed for the design of downstream Nitrification Reactors #2 at the maximum day throughput flow volume of 4.00 MGD:

Table #10
Reactor #1 Effluent
Pollutant Concentrations and Loadings

| Pollutant | Maximum Concentration | Maximum Loading |
|--------------------|------------------------------|------------------------|
| BOD | 1,000(0.20) = 200 mg/L | 6,672#/day |
| TKN | 270 mg/L ⁽¹⁾ | 9,007#/day |
| NH ₃ -N | 150 mg/L ⁽²⁾ | 5,004#/day |
| TP | 25 mg/L ⁽³⁾ | 834#/day |
| O&G | 200(0.20) = 40 mg/L | 1,334#/day |

⁽¹⁾TKN = 300 mg/L – 0.03(1,000 mg/L BOD) = 270 mg/L

⁽²⁾NH₃-N will rise from 100 mg/L up to approximately 150 mg/L in the Reactors

⁽³⁾TP = 30 mg/L – 0.005(1,000 mg/L BOD) = 25.0 mg/L

J. Nitrification Reactors #2A (New) and #2B (Modification)

1. General Description

- a. **One new 152 ft. dia. x 26 ft. liquid depth, 3.50 MG volume above grade concrete tank is provided as second stage, aerobic, activated sludge Nitrification Reactor to provide TKN and ammonia removal by biological nitrification.**
- b. A portion of the outer ring of the existing Crom tank can be optionally operated to provide an additional aerobic nitrification reactor volume of up to 0.75 MG, thereby increasing the total nitrification reactor process volume to approximately 4.25 MG.
- c. Nitrification Reactor #2 can also be operated to provide complete single stage BOD and Ammonia removal in the event that Anoxic Reactor #1 must be taken out-of-service if the upstream DAF Pretreatment Systems are operated with higher efficiency chemical coagulation and flocculation to reduce reactor influent BOD concentrations down to ≤ 800 mg/L and TKN down to ≤ 275 mg/L.

2. Design Assumptions

a. Wastewater Flow

- 1) Average wastewater flow (ADF) volume \leq 2.60 MGD, 7 days/week
- 2) Maximum month average wastewater flow (MMADF) volume \leq 3.00 MGD, 7 days/week.
- 3) Maximum day wastewater flow (MDF) volume \leq 4.00 MGD
- 4) Peak wastewater flow (PF) rate = 5.00 MGD

b. Pollutant Concentrations and Loadings

- 1) Maximum influent pollutant concentrations and loadings in the Nitrification Reactor #2 influent wastewater flow volume @ 4.00 MGD:

Table #11
Nitrification Reactor #2 Influent
Pollutant Concentrations and Loadings

| Pollutant | Concentration | Maximum Loading |
|--------------------|-------------------------|------------------------|
| BOD | 200 mg/L | 6,672#/day |
| TSS (MLSS) | 4,000 to 6,000 mg/L | ----- |
| TKN | 270 mg/L ⁽¹⁾ | 9,007#/day |
| NH ₃ -N | 150 mg/L | 5,004#/day |
| TP | 25 mg/L | 834#/day |
| O&G | 40 mg/L | 1,334#/day |

⁽¹⁾NN = 300 mg/L TKN – 0.03(1,000 mg/L BOD) = 270 mg/L

3. Nitrification Reactor Process Design (Winter Conditions)

- a. Calculate MLVSS and MLSS concentrations required for BOD and ammonia removal at the expected minimum winter season design mixed liquor temperature in Reactor #2 = 15°C

- 1) For BOD removal assuming a carbonaceous BOD removal rate = 0.40#BOD/#MLVSS @ 15°C:

$$\frac{6,672\#BOD/day}{0.40} \leq 17,000\#MLVSS @ 15^\circ C$$

- 2) For TKN removal assuming a nitrification rate of 0.08#TKN/#MLVSS at 15°C:

$$\frac{9,007\#BOD/day}{0.08} \leq 113,000\#MLVSS @ 15^\circ C$$

- 3) The required MLVSS and MLSS concentrations in reactor for BOD removal and nitrification at the 15°C minimum winter season operating temperature assuming MLVSS/MLSS = 0.75

$$\frac{17,000\#+113,000\#}{(8.34)(3.50 \text{ MG})} =$$

$$\frac{130,000\#MLVSS}{(8.34)(3.50 \text{ MG})} = 4,454 \text{ mg/L MLVSS}$$

$$\frac{4,454 \text{ mg/L}}{0.75} = 5,938 \text{ mg/L MLSS}$$

$$\leq 6,000 \text{ mg/L } \pm \text{ MLSS @ } 15^\circ C$$

Assume MLSS ≤ 6,000 mg/L in Nitrification Reactors #2A and #2B during **winter season** for conservative design approach.

- 4) The required MLVSS and MLSS concentrations in reactor for BOD removal and nitrification at the 15°C minimum winter season operating temperature assuming MLVSS/MLSS = 0.75

$$\frac{17,000\#+113,000\#}{(8.34)(4.25 \text{ MG})} =$$

$$\frac{130,000\#MLVSS}{(8.34)(4.25 \text{ MG})} = 3,668 \text{ mg/L MLVSS}$$

$$\frac{3,668 \text{ mg/L}}{0.75} = 4,890 \text{ mg/L MLSS}$$

$$\leq 5,000 \text{ mg/L} \pm \text{MLSS @ } 15^{\circ}\text{C}$$

Assume MLSS \leq 5,000 mg/L in Nitrification Reactor #2 during **winter season** for conservative design approach

- 5) If the MLSS concentration in the Nitrification Reactors is 5,000 to 6,000 mg/L, then the MLSS concentration in Anoxic Reactor #1 will be approximately 5,000 to 6,000 mg/L if return sludge is pumped back into Reactor #1.

4. Nitrification Reactors #2 Process Design (Summer Conditions)

- a. Calculate MLVSS and MLSS concentrations required for BOD and ammonia removal at the expected average summer season design mixed liquor temperature in Reactor #2 = 25°C

- 1) For BOD removal assuming a carbonaceous BOD removal rate = 0.45# BOD/# MLVSS @ 25°C:

$$\frac{6,672\#\text{BOD/day}}{0.45} \leq 15,000\#\text{MLVSS @ } 25^{\circ}\text{C}$$

- 2) For TKN removal assuming a nitrification rate of 0.10 #TKN/# MLVSS at 25°C:

$$\frac{9,007\#\text{TKN/day}}{0.10} \leq 90,070\#\text{MLVSS @ } 25^{\circ}\text{C}$$

- 3) The required MLVSS and MLSS concentrations in the total reactor volume for BOD removal and nitrification at the 25°C average summer season operating temperature assuming MLVSS/MLSS = 0.75

$$\frac{15,000\# + 90,070\#}{(8.34)(3.50 \text{ MG})} =$$

$$\frac{105,070\#\text{MLVSS}}{(8.34)(3.50 \text{ MG})} = 3,600 \text{ mg/L MLVSS}$$

$$\frac{3,600 \text{ mg/L}}{0.75} = 4,800 \text{ mg/L MLSS}$$

$$\leq 5,000 \text{ mg/L} \pm \text{MLSS @ } 25^{\circ}\text{C}$$

Assume MLSS $\leq 5,000$ mg/L in Nitrification Reactor #2 during **summer season** for conservative design approach.

- 4) If the MLSS concentration in Nitrification Reactor #2 is 5,000 mg/L then the MLSS concentration in Anoxic Reactor #1 will be approximately 5,000 mg/L if return sludge is pumped back into Reactor #1.
5. Calculations indicate that the 3.50 MG minimum volume Nitrification Reactor #2 will be of adequate total volume for accomplishing the required winter season BOD and TKN (ammonia) removal. The use of subsurface jet aeration equipment in Reactor #2 will insure maximum operating temperatures in the activated sludge treatment process during the winter season. If winter season aeration basin mixed liquor temperatures cannot be maintained at approximately 15°C, then to achieve adequate TKN removal efficiency, the MLSS concentration can be increased above 6,000 mg/L and/or upstream pretreatment efficiency must be improved by increased chemical dosage in the DAF Cells to reduce the TKN loading on the downstream multi-stage activated sludge treatment system.
6. Nitrification Reactor #2 Mixing Equipment Design

a. Evaluate mixing requirements in Nitrification Reactor #2:

- 1) Calculate the BHP required for mixing a 4,000 to 6,000 mg/L MLSS concentration = 50 HP/MG using directional mix jet aeration manifold in Reactor #2:

$$\text{BHP required} = 50 \text{ HP}(3.50 \text{ MG}) = 175 \text{ HP in Reactor \#2}$$

- 2) Two new 200 HP jet recirculation pumps and six directional mix jet aeration headers are provided in the Nitrification Reactor #2 tank for suspension and mixing of mixed liquor biomass solids.

7. Nitrification Reactor #2 Aeration Equipment Design

a. Calculate the maximum oxygen transfer rate required in Nitrification Reactor #2:

- 1) Calculate the oxygen transfer requirement for BOD synthesis assuming 80% BOD removal in upstream Anoxic Reactor #1:

$$\text{AOTR}_1 = \frac{(0.60 \# \text{O}_2 / \# \text{BOD/day})(6,672 \# \text{BOD/day})}{24} = 167 \# \text{O}_2 / \text{hr (max)}$$

- 2) Calculate the oxygen transfer requirement for nitrification:

$$\text{AOTR}_2 \leq \frac{(4.57 \# \text{O}_2 / \# \text{TKN})(9,007 \# \text{TKN/day nitrified})}{24} = 1,715 \# \text{O}_2 / \text{hr (max)}$$

- 3) Calculate the oxygen transfer requirement for endogenous respiration where Nitrification Reactor #2 is approximately 44% of the total activated sludge volume:

$$AOTR_3 = \frac{(33,360 \text{ #BOD/day})(0.80 \text{ #O}_2/\text{#BOD})(0.44)}{24} = 489 \text{ #O}_2/\text{hr (max)}$$

- 4) Calculate the total maximum oxygen transfer rate required in Nitrification Reactor #2:

$$\begin{aligned} AOTR(\text{total}) &\leq AOTR_1 + AOTR_2 + AOTR_3 \\ &= 167 \text{ #O}_2/\text{hr} + 1,715 \text{ #O}_2/\text{hr} + 489 \text{ #O}_2/\text{hr} = 2,371 \text{ #O}_2/\text{hr} < 2,500 \text{ #O}_2/\text{hr (max)} \end{aligned}$$

- 5) Calculate the required corresponding maximum standard oxygen transfer rate required:

$$SOTR = AOTR \left[\frac{C_{ss}}{\beta C_{sw} - DO} \alpha (1.024)^{T-20} \right]$$

| | | |
|----------------------------|---|---|
| Where DO | ≤ | 2.0 mg/L (average DO in Reactor #2) |
| β | = | 0.95 |
| α | = | 0.85 @ 4,000 to 6,000 mg/L MLSS with subsurface slot jet aeration manifolds |
| Maximum MLSS temperatures | = | 30°C |
| 1.024 ^(T-20) | = | 1.2677 @ T = 30°C |
| C _w | = | 7.63 mg/L @ sea level, 30°C |
| C _s | = | 9.20 mg/L @ sea level, 20°C |
| Site Altitude | ≤ | 100 feet |
| Pressure Correction Factor | ≥ | 0.995 |
| C _{sw} | = | 7.63 $\left[\frac{(0.995)(14.7) + (0.5)(0.433)(26.0)}{14.7} \right]$ |
| | = | 7.63 mg/L(1.378) = 10.51 mg/L |

$$C_{ss} = 9.20 \left[\frac{14.7 + (0.5)(0.433)(26.0)}{14.7} \right]$$

$$= 9.20 \text{ mg/L}(1.383) = 12.72 \text{ mg/L}$$

* Reactor basin liquid depth = 26 ft.

$$\text{SOTR} = \text{AOTR} \frac{12.72}{[(0.95)(10.51) - 2.0]0.85(1.2677)}$$

$$\text{SOTR} = 1.48(\text{AOTR})$$

$$\text{SOTR} \leq 1.50(2,500 \# \text{O}_2/\text{hr}) \leq 3,750 \# \text{O}_2/\text{hr} \text{ (maximum)}$$

b. Calculate subsurface aeration equipment air sparging requirements:

1) The oxygen available per cfm per hour =

$$x = 0.23 (.075 \#/\text{ft}^3)(60 \text{ min/hr})$$

$$= 1.035 \# \text{O}_2/\text{cfm/hr} @ 68^\circ\text{C inlet air}$$

2) e = subsurface coarse bubble diffuser oxygen stripping or transfer efficiency at 26 ft. liquid depth = 38% in Reactor #2A

$$3) \text{ scfm required} = \frac{\text{SOTR}}{(x)(e)}$$

$$\text{scfm \#2A} = \frac{3,750 \# \text{O}_2/\text{hr}}{(1.035)(0.38)} \leq 9,600 \text{ scfm (max)}$$

4) The maximum blower pressure in Reactor #2A with jet nozzles installed 30" above the basin floor at 26.0 ft. maximum liquid depth – 2.50 ft. = 23.5 ft. jet nozzle air sparge submergence =

$$= (23.5 \text{ ft.})(0.433) + 1.30 \text{ psi} = 11.50 \text{ psi} \leq 12.0 \text{ psi including pressure drop in air supply lines and in jet nozzle diffusers}$$

- c. Oxygen transfer and mixing is provided in Nitrification Reactor #2 by operation of six directional mix subsurface jet aeration manifolds with three manifolds installed on each of the two jet aeration headers each with 110 slot jet nozzles. Flow recirculation for each jet header is provided by one 200 HP end suction sewage pump rated at 11,000 gpm at 47 ft. Each jet pump has a constant speed drive motor. The design air sparging capacity of the two jet aeration manifolds is approximately 9,600 scfm total providing a maximum total oxygen transfer rate = $2,500\#O_2/hr$ (AOTR) = $3,860\#O_2/hr$ (SOTR) with air supplied by four 200 HP positive displacement blowers each rated at approximately 2,400 scfm at 11.82 psi. A fifth 200 HP blower is provided as an installed standby.
- d. Oxygen transfer in Reactor Zone #2B of the outer ring of the existing Crom tank can be provided by operation of one or two existing 30 HP submersible pump SAMs aerator units if compressed air is supplied from the blowers to the units. The SAMs units can be operated to provide mixing only without oxygen transfer, or, with air supply to provide mixing and oxygen transfer. Each SAMs unit can be individually operated with or without aeration whether or not the dedicated blower is operated to supply compressed air to the SAMs unit. The air sparging capacity of each SAMs unit is approximately 1,400 scfm per unit provided an oxygen transfer rate $\geq 100\#O_2/hr$ (AOTR) per unit with air supplied by one dedicated 75 HP positive displacement blower rated at 1,400 scfm at 9.5 psi.

K. Nitrate Recycle Pump Station (New)

1. General

- a. A new Nitrate Recycle Pump Station is provided to recirculate mixed liquor containing nitrate nitrogen produced in Nitrification Reactor #2A back into Anoxic Reactor #1.
- b. A Nitrate Recycle Flow Volume of up to 400% of the throughput wastewater flow volume is required to achieve efficient nitrate nitrogen removal in Anoxic Reactor #1.

2. Design Assumptions

- a. Maximum 7 Day Wastewater Flow Volume = $Q_7 = 4.00$ MGD = 2,800 gpm, 24 hours/day, 7 days/week
- b. Peak Daily Wastewater Flow Volume = $Q(\max) = 5.00$ MGD = 3,500 gpm
- c. Maximum Nitrate Recycle Flow Rate = $400\% = 4Q = 4.0(4.00$ MGD) = 16.0 MGD = 11,200 gpm, 24 hours/day

3. Pump Selection

- a. Two new 30 HP, end suction pumps are provided in the Nitrate Recycle (NR) Pump Station.
- b. Each pump is rated at 5,600 gpm @ 40 ft. total head when operated at full speed.
- c. Operation of two pumps in parallel is required to provide the maximum nitrate recycle total pumping capacity required = $4Q$ (Nitrate Recycle) = $4Q = 4(4.00 \text{ MGD}) = 16 \text{ MGD} = 11,200 \text{ gpm} = 5,600 \text{ gpm/pump}$.

4. Variable Speed Drive Controls

- a. Each pump is provided with variable speed drive motor controls for control of the pumping rate back into Anoxic Reactor #1.
- b. The operator can manually select and set the desired effluent pumping rate for the flow controller to automatically control and maintain the required pump speed to provide the selected flow pumping rate measured by the downstream magnetic flow meter.

5. Discharge Flow Meter

- a. **One new 20" dia. magnetic flow meter is provided in the NR pump station discharge header to accurately measure, indicate, totalize, and allow manual control of the flow rate and volume of mixed liquor nitrate recycle flow pumped from Nitrification Reactor #2 back into Anoxic Reactor #1.**
- b. The flow meter can be used in combination with downstream flow control valve to maintain a desired set point flow rate from Nitrification Reactor #2 into Anoxic Reactor #1 in the event automatic flow control is out of service, or manual flow control is preferred.

L. Anoxic Reactor #3 (Modification)

1. General Description

- a. The outer ring of the existing Crom MLE tank will be retrofitted to function as the new third stage Anoxic Reactor #3 in the four stage BNR treatment system.
- b. A minimum of approximately 75% of the outer ring volume will be used for anoxic activated sludge treatment as a post denitrification reactor downstream of new Nitrification Reactor #2 for final nitrate nitrogen removal with optional supplemental carbon source solution dosage.

2. Design Assumptions

a. Wastewater Flow

- 1) Average wastewater flow (ADF) volume \leq 2.60 MGD, 7 days/week
- 2) Maximum month average wastewater flow (MMADF) volume \leq 3.00 MGD, 7 days/week.
- 3) Maximum day wastewater flow (MDF) volume \leq 4.00 MGD
- 4) Peak wastewater flow (PF) rate = 5.00 MGD

b. Pollutant Concentrations & Loads

- 1) Influent pollutant loadings of influent wastewater @ 4.00 MGD, 7 days/week from Nitrification Reactor #2

Table #12
Anoxic Reactor #3 Influent
Pollutant Concentrations and Loadings

| Pollutant | Concentration | Loading |
|--------------------|----------------------------------|------------------------------|
| BOD | \leq 20 mg/L | 667#/day |
| TSS (MLSS) | 4,000 to 6,000 mg/L | - |
| TKN | \leq 4 mg/L | 133#/day |
| NH ₃ -N | \leq 1 mg/L | 33#/day |
| TP | \leq 25 mg/L | 834#/day |
| NO ₃ -N | \leq 70 mg/L ⁽¹⁾⁽²⁾ | 1,751#/day ⁽¹⁾⁽²⁾ |

⁽¹⁾The design mixed liquor recycle flow rate from Nitrification Reactor #2 back to Anoxic Reactor #1 is 400% of the maximum throughput wastewater flow rate = 4Q + 100% sludge Return Rate = 1Q for a Total Recycle Rate = 5Q. This nitrate recycle flow rate will result in removal of approximately 83% of the nitrate produced in Nitrification Reactor #2 assuming that 100% of the nitrate nitrogen is produced in Reactor #2 for a conservative design. The calculated concentration of NO₃-N produced in Nitrification Reactor #2 = 300 mg/L TKN - 0.03 (1,000 mg/L BOD) = 270 mg/L NO₃-N = (4.00 MGD)(8.34)(270 mg/L NO₃-N) = 9,007#NO₃-N produced/day of which 83% is removed by denitrification in Anoxic Reactor #1 leaving 0.17(9,007#NO₃-N) = approx. 1,531#NO₃-N/day = 46 mg/L in the mixed liquor discharged to Anoxic Reactor #3.

⁽²⁾For conservative design approach assume the maximum NO₃-N concentration and loading discharged into Anoxic Reactor #3 = 46 mg/L(1.5) = 70 mg/L = 2,335#/day (including 50% safety factor)

c. Nitrate Removal Requirement

- 1) Nitrate nitrogen concentration must be in order for the final effluent total nitrogen concentration to be 15.6 mg/L including approximately ≤ 1 mg/L ammonia nitrogen and approximately 1.0 mg/L to 2.0 mg/L organic nitrogen in the final effluent TSS.

3. Anoxic Reactor #3 Nitrate Removal Process Design

- a. The Anoxic Reactor #3 zone of the outer ring of the Crom tank will have a minimum volume of approximately 2.20 MG and a maximum volume of approximately 2.95 MG. The outer ring of the existing Crom tank will be retrofitted and operated to function as third stage Anoxic Reactor #3 to provide final nitrate nitrogen removal by biological denitrification using supplemental carbon source dosage.
- b. Calculate MLVSS and MLSS concentrations required at the 2.20 MG minimum reactor volume for nitrate removal at the minimum expected winter season design mixed liquor temperature in Reactor #3 of 15°C at the design influent flow rate of 4.0 MGD when treated wastewater is discharged by gravity from Nitrification Reactor #2.
 - 1) For NO₃-N removal assuming a nitrate removal rate = $0.05 \# \text{NO}_3\text{-N} / \# \text{MLVSS}$ at 15°C using a methanol or equal organic carbon food source:

$$\frac{2,335 \# \text{NO}_3\text{-N}}{0.05} \leq 47,000 \# \text{MLVSS @ 15}^\circ\text{C}$$

- 2) The required total MLVSS and MLSS concentrations in the 2.20 MG reactor basin volume for NO₃-N removal at the 15°C winter season operating temperature assuming MLVSS/MLSS = 0.80

$$\frac{47,000 \# \text{MLVSS}}{(8.34)(2.20 \text{ MG})} = 2,562 \text{ mg/L MLVSS}$$

$$\frac{2,562 \text{ mg/L}}{0.75} = 3,415 \text{ mg/L MLSS @ 15}^\circ\text{C}$$

$$< 4,000 \text{ mg/L MLSS}$$

Assume MLSS = 4,000 mg/L to 6,000 mg/L during winter season to achieve complete nitrification and denitrification using supplemental carbon source dosage into Anoxic Reactor #3.

- c. Calculate the hydraulic detention time in Reactor #3

$$\text{HDT} = \frac{2,200,000 \text{ gallons}}{(4.00 \text{ MGD})(2.0)(694 \text{ gpm/MGD})} = 396 \text{ min} = 6.6 \text{ hours}$$

@ 100% return sludge rate from the Final Clarifier

- d. Calculations indicate that the proposed 2.20 MG to 2.95 MG volume Anoxic Reactor #3 Activated Sludge Basin is adequate for accomplishing the required winter season final stage NO₃-N removal down to an activated sludge basin temperature of 15°C. If winter season aeration basin mixed liquor temperatures cannot be maintained above 15°C, then to achieve adequate Nitrate removal efficiency, the MLSS concentration must be increased above 6,000 mg/L; and/or upstream pretreatment efficiency must be improved by increased chemical dosage in DAF Cells to reduce the TKN loading on the downstream multi-stage activated sludge treatment system.

4. Anoxic Reactor #3 Mixing Equipment Design

- a. Evaluate Mixing and Aeration requirements in Anoxic Reactor #3:

- 1) Bhp required for mixing 4,000 mg/L to 6,000 mg/L TSS concentration = 30 HP/MG using floating downpumping mixers.

$$\text{bhp required} = 30 \text{ HP/MG} (2.95 \text{ MG}) \leq 90 \text{ HP}$$

- 2) Six existing 50 HP submersible pump SAMs units will be operated without air to provide complete mixing and biomass solids suspension in Reactor #3.

5. Carbon Source Dosage Requirements

- a. Calculate the theoretical carbon source dosage requirement in Anoxic Reactor #3 assuming the maximum reactor influent NO₃-N concentration contained in the mixed liquor discharged from upstream Nitrification Reactor #3 ≤ 50 mg/L

- 1) Methanol requirement =

$$\begin{aligned} & 2.47 \text{ (NO}_3\text{-N concentration)} + \\ & 1.53 \text{ (NO}_2\text{-N concentration)} + \\ & 0.87 \text{ (DO concentration)} \end{aligned}$$

$$\begin{aligned} \text{where } \text{NO}_3\text{-N} & \leq 50 \text{ mg/L} \\ \text{NO}_2\text{-N} & \leq 1 \text{ mg/L} \\ \text{DO} & \leq 2.0 \text{ mg/L} \end{aligned}$$

2) $\text{CH}_3\text{OH} =$

$$= 2.47 (50 \text{ mg/L}) + 1.53 (1 \text{ mg/L}) + 0.87 (2.0 \text{ mg/L})$$

$$= 123.5 + 1.53 + 1.74$$

$$= 127 \text{ mg/L} < 150 \text{ mg/L}$$

3) $\# \text{CH}_3\text{OH}/\text{day}$ required \leq

$$(150 \text{ mg/L})(8.34)(4.00 \text{ MGD}) = 5,004 \#/\text{day}$$

4) @ 6.5#/gal and 600,000 mg/L BOD concentration, the calculated gpd of methanol solution required =

$$\frac{5,004 \#/\text{day}}{6.5 \#/\text{gallon}} = 769 \text{ gpd} \leq 800 \text{ gpd} \leq 35 \text{ gphr methanol solution}$$

5) assuming an alternative non-flammable carbon source (CS) solution with a BOD concentration of approximately $\geq 720,000 \text{ mg/L}$ and the CS solution weight = $11.2 \#/\text{gal}$ will be used instead of methanol, the calculated gpd of CS solution required=

$$\frac{5,004 \#/\text{day} \left(\frac{600,000}{720,000} \right)}{11.2 \#/\text{gal}} = 372 \text{ gpd} \leq 400 \text{ gpd} = 17 \text{ gphr}$$

- b. Two new carbon source (CS) solution pumps are provided each rated at 3 to 30 gphr @ 60 psi as specified in Section S.

M. Aerobic Reactor #4 (Modification)

1. General Description

- a. The center section of the outer ring of the existing Crom MLE tank will be retrofitted to function as the new fourth stage Aerobic Reactor #4 in the four stage BNR treatment system.
- b. Aerobic Reactor #4 will be used for aerobic activated sludge treatment as a polishing reactor downstream of Anoxic Reactor #3 for final BOD and ammonia nitrogen removal.

2. Design Assumptions

a. Wastewater Flow

- 1) Average wastewater flow (ADF) volume ≤ 2.60 MGD, 7 days/week
- 2) Maximum month average wastewater flow (MMADF) volume ≤ 3.00 MGD, 7 days/week.
- 3) Maximum day wastewater flow (MDF) volume ≤ 4.00 MGD
- 4) Peak wastewater flow (PF) rate = 5.00 MGD

b. Pollutant Concentrations & Loads

- 1) Influent pollutant loadings when influent wastewater @ 4.00 MGD, 7 days/week from Anoxic Reactor #3:

Table #13
Aerobic Reactor #4 Influent
Pollutant Concentrations and Loadings

| Pollutant | Pollutant Concentration | Pollutant Loadings |
|--------------------|-------------------------------------|---------------------------|
| BOD | ≤ 10 to 30 mg/L ⁽¹⁾ | $\leq 1,000$ #/day |
| TSS (MLSS) | 4,000 to 6,000 | - |
| O&G | ≤ 2.0 mg/L | 67#/day |
| NH ₃ -N | ≤ 10.0 mg/L ⁽²⁾ | 334#/day |
| NO ₂ -N | ≤ 3.0 mg/L | 100#/day |
| TP | ≤ 25.0 mg/L | 834#/day |

⁽¹⁾For conservative design approach assume the maximum BOD concentration and loading discharged into Aerobic Reactor #4 ≤ 30 mg/L = 1,000#/day

⁽²⁾For conservative design approach assume the maximum NH₃-N concentration and loading discharged into Aerobic Reactor #4 ≤ 10 mg/L = 334#/day

c. Soluble BOD Removal Requirement

- 1) Soluble BOD concentration should be reduced to approximately 2 mg/L or less.
- 2) Any ammonia nitrogen produced in upstream Anoxic Reactor #3 by the denitrification process or by cell lysing due to endogenous respiration will be reduced to ≤ 1 mg/L by nitrification in Aerobic Reactor #4.

3. Aerobic Reactor #4 BOD and Ammonia Removal Process Design

- a. The center section of the existing Crom tank will be retrofitted and operated to function as a fourth stage aerobic polishing reactor for final removal of any soluble BOD and ammonia nitrogen in the effluent of the Anoxic Reactor #3 zone by simultaneous carbonaceous BOD removal by aerobic synthesis and ammonia removal by nitrification. Aerobic Reactor #4 will have a volume of approximately 0.55 MG.
- b. Calculate MLVSS and MLSS concentrations required in the 0.55 MG reactor for BOD and ammonia removal at the minimum expected winter season design mixed liquor temperature in Reactor #4 of 15°C at the design maximum influent flow of 4.00 MGD when treated wastewater flow from Anoxic Reactor #3.

- 1) For BOD removal assuming a BOD removal rate = 0.40#BOD/#MLVSS @ 15°C:

$$\frac{1,000\#BOD/day}{0.40} \leq 2,500\#MLVSS @ 15^\circ C$$

- 2) For final ammonia removal assuming a nitrification rate = 0.06# NH₃-N/#MLVSS @ 15°C and assuming a maximum ammonia nitrogen concentration of 10 mg/L and loading in the Anoxic Reactor #3 effluent = 334#/day

$$\frac{334\#NH_3-N/day}{0.08} \leq 4,200\#MLVSS @ 15^\circ C$$

- 3) The required total MLVSS and MLSS concentrations in the 0.55 MG aeration basin volume for BOD removal and nitrification at the 15°C winter season operating temperature assuming MLVSS/MLSS = 0.75

$$\frac{2,500\# + 4,200\#}{(8.34)(0.55 \text{ MG})}$$

$$\frac{6,700\#MLVSS}{(8.34)(0.55 \text{ MG})} \leq 1,460 \text{ mg/L MLSS}$$

$$\frac{1,460 \text{ mg/L}}{0.75} \leq 2,000 \text{ mg/L MLSS @ } 15^\circ C$$

Assume MLSS \geq 2,000 mg/L during winter season for complete carbonaceous soluble BOD removal and ammonia nitrogen removal.

- c. Calculate the hydraulic detention time in Reactor #4

$$\text{HDT} = \frac{550,000 \text{ gallons}}{(4.0 \text{ MGD})(2.0)(694 \text{ gpm/MGD})} = 99 \text{ min} = 1.65 \text{ hours}$$

@ 100% return sludge rate from the Final Clarifier

- d. Calculations indicate that the proposed 0.55 MG Aerobic Reactor #4 Activated Sludge Basin is adequate volume for accomplishing the required, winter season polishing step of BOD and ammonia removal down to an activated sludge basin temperature of 15°C. The use of subsurface coarse bubble aeration equipment in the aeration basin will insure maximum operating temperatures in the aerobic activated sludge treatment process during the winter season. If winter season aeration basin mixed liquor temperatures cannot be maintained above 15°C, then to achieve adequate Ammonia removal efficiency, the MLSS concentration must be increased and/or upstream pretreatment efficiency must be improved by increased chemical dosage in DAF Cell to reduce the BOD and TKN loading on the downstream Multi-Stage Activated Sludge Treatment System.

4. Aerobic Reactor #4 Aeration and Mixing Equipment Design

- a. Evaluate Mixing and Aeration requirements in Aerobic Reactor #4:

1) Mixing Requirements

- a) cfm required for mixing 4,000 mg/L to 6,000 mg/L MLSS concentration = 20 scfm/1,000 ft³ in 550,000 gallon volume tank = 73.5 x 10³ft³

$$\text{cfm} = (73.5 \times 10^3 \text{ft}^3)(200 \text{ cfm}) = 1,500 \text{ scfm}$$

- b) a new coarse bubble diffused aeration system is provided in Reactor #4 for oxygen transfer and complete mixing, and, the air sparging capacity of the diffuser system is over 2,000 scfm with compressed air supplied by existing 125 HP positive displacement blowers each rated at 1,400 scfm @ 9.5 psi.

2) Oxygen Transfer Requirements

- a) Calculate the maximum oxygen transfer rate required in Aerobic Reactor #4 assuming excess BOD from carbon source dosage ≤ 30 mg/L = 1,000#/day and influent ammonia nitrogen loading = 250#/day

(1) oxygen demand for carbonaceous BOD synthesis @ 0.60#O₂/#BOD

$$\text{AOTR}_1 = \frac{0.60\#O_2/\#BOD(1,000\#BOD/\text{day})}{24} \leq 25\#O_2/\text{hr}$$

(2) oxygen demand for endogenous respiration occurring in Aerobic Reactor #4

(a) Total activated sludge biomass weight in Anoxic Reactor #1, Nitrification Reactor #2, Anoxic Reactor #3 and Aerobic Reactor #4

$$\text{Total reactor volume} = 3.20 \text{ MG} + 3.50 \text{ MG} + 2.95 \text{ MG} + 0.55 \text{ MG} = 10.20 \text{ MG}$$

% Total reactor volume in Aerobic Reactor #4

$$\frac{0.55 \text{ MG}}{10.20 \text{ MG}} (100) = 6\%$$

(b) The calculated endogenous oxygen demand in Aerobic Reactor #4

$$\text{AOTR}_2 = \frac{33,360 \# \text{BOD/day} (0.80) (0.06)}{24} \leq 67 \# \text{O}_2/\text{hr}$$

(3) Oxygen demand for nitrification of ammonia @ 4.57 #O₂/hr/ #NH₃-N

$$\text{AOTR}_3 = \frac{(4.57)(334 \# \text{NH}_3\text{-N/day})}{24} \leq 64 \# \text{O}_2/\text{hr}$$

(4) Calculate the total oxygen transfer requirement in Aerobic Reactor #5 for excess BOD synthesis plus endogenous respiration plus nitrification = 25 #O₂/hr + 67 #O₂/hr + 64 #O₂/hr = 156 #O₂/hr ≤ 160 #O₂/hr (AOTR)

b) Calculate the required corresponding maximum standard oxygen transfer rate required:

$$\text{SOTR} = \text{AOTR} \left[\frac{C_{ss}}{[\beta C_{SW} - \text{DO}] \alpha (1.024)^{T-20}} \right]$$

Where DO = 2.0 mg/L (average DO in Aerobic Reactor #4)

β = 0.90

α = 0.80 @ 4,000 to 6,000 mg/L MLSS with subsurface coarse bubble aeration diffusers

1.024^(T-20) = 1.126 @ maximum T = 25° C

C_w = 7.92 mg/L @ sea level, 25° C

$$C_s = 9.20 \text{ mg/L @ sea level, } 20^\circ \text{ C}$$

$$\text{Site Altitude} \leq 100 \text{ feet}$$

$$\begin{aligned} \text{Pressure} \\ \text{Correction Factor} &\geq 0.995 \end{aligned}$$

$$C_{sw} = 7.92 \left[\frac{(0.995)(14.7) + (0.5)(0.433)(20.0)}{14.7} \right]$$

$$= 7.92 \text{ mg/L}(1.290) = 10.21 \text{ mg/L}$$

$$C_{ss} = 9.20 \left[\frac{14.7 + (0.5)(0.433)(20.0)}{14.7} \right]$$

$$= 9.20 \text{ mg/L}(1.295) = 11.91 \text{ mg/L}$$

* 18.0 foot deep aeration basin with the airgrid coarse bubble diffusers installed 1.0 above the basin floor.

$$\text{SOTR} = \text{AOTR} \frac{11.91}{[(0.90)(10.21) - 2.0]0.80(1.126)}$$

$$\text{SOTR} = 1.84(\text{AOTR})$$

$$\text{SOTR} \leq 2.00(160) \leq 320 \# \text{O}_2/\text{hr}$$

c) Calculate subsurface aeration equipment air sparging requirements:

(1) The oxygen available per cfm per hour =

$$x = 0.23 (0.075 \#/\text{ft}^3)(60 \text{ min/hr})$$

$$= 1.035 \# \text{O}_2/\text{cfm/hr @ } 68^\circ \text{ inlet air}$$

(2) e = subsurface coarse bubble diffuser oxygen stripping or transfer efficiency at 20.0 average air sparge depth = 15%

$$\begin{aligned}
 (3) \text{ scfm required} &= \frac{\text{SOTR}}{(x)(e)} \\
 \text{scfm (average)} &= \frac{320\#O_2/HR}{(1.035)(0.15)} = 2,061 \text{ scfm} \\
 &\leq 2,100 \text{ scfm}
 \end{aligned}$$

(4) Max. design blower pressure with 19.0 ft. max. diffuser air sparge submergence:

$$= (19.0 \text{ ft.})(0.433) + 1.0 \text{ psi} = 9.23 \text{ psi} \leq 9.5 \text{ psi} \text{ (pressure loss plus pressure drop in air supply lines and in airgrid air diffuser sparges)}$$

- d) Oxygen transfer is provided in Aerobic Reactor #4 by a new coarse bubble diffused aeration system with 80 diffusers with a maximum air sparging capacity of 1,900 scfm and maximum oxygen transfer efficiency of approximately 200#O₂/hr.
- e) Compressed air is provided to the coarse bubble diffusers by operation of one or two existing 125 HP positive displacement blowers each rated at 1,400 scfm @ 9.5 psi.

N. Clarifier Influent Flow Splitter & Flocculation Tank (New) For Existing Clarifiers #1 & #2

1. Design Assumptions

a. Wastewater Flow

- 1) Average wastewater flow (ADF) volume ≤ 2.60 MGD, 7 days/week
- 2) Maximum month average wastewater flow (MMADF) volume ≤ 3.00 MGD, 7 days/week.
- 3) Maximum day wastewater flow (MDF) volume ≤ 4.00 MGD
- 4) Peak wastewater flow (PF) rate = 5.00 MGD
- 5) Maximum inflow rate with 100% sludge recycle rate = (4.00 MGD)(2) ≤ 8.00 MGD
- 6) Maximum inflow rate with 200% sludge recycle rate = (4.00 MGD)(3.0) ≤ 12.00 MGD

b. Mixed Liquor Suspended Solids Concentrations

1) Minimum MLSS = 4,000 mg/L

2) Maximum MLSS = 6,000 mg/L

2. General Description

a. One new clarifier influent flow splitter tank is provided to split flow into existing Final Clarifier #1 and Final Clarifier #2.

b. The flow splitter tank will function as a flocculation tank for dosage and mixing of coagulant and flocculant chemical solutions with the clarifier influent mixed liquor flow.

3. Flocculation Tank Design Calculations

a. Flocculation Tank Sizing

1) One 15.0 ft. x 15.0 ft. x 14 ft. side water depth Flocculation Tank is provided for mixing of chemical coagulant and flocculant solutions and the mixed liquor influent flow into Final Clarifiers #1 and #2.

2) Tank volume \leq 25,000 gallons

3) Calculated Hydraulic Detention Times:

a) @ 4.00 MGD maximum design flow through rate plus 100% sludge return flow rate = 8.00 MGD = 5,600 gpm total flow rate = 4.00 MGD/clarifier = 2,800 gpm/clarifier

$$\text{HDT} = \frac{25,000 \text{ gallons}}{5,600 \text{ gpm}} \geq 4.4 \text{ minutes}$$

b) @ 4.00 MGD maximum design flow through rate plus 150% sludge return flow rate = 10.00 MGD = 7,000 gpm total flow rate = 5.00 MGD/clarifier = 3,500 gpm/clarifier

$$\text{HDT} = \frac{25,000 \text{ gallons}}{7,000 \text{ gpm}} \geq 3.5 \text{ minutes}$$

4. Clarifier Influent Flow Splitting and Control

a. Two 24" outlet lines are provided for discharge of mixed liquor from the Clarifier Influent Flocculation Tank by gravity flow into the two Final Clarifiers.

- b. Each 24" outlet line has a 24" magnetic flow meter and a downstream automatic flow control valve for setting, adjusting and controlling of the wastewater flow volume into each Final Clarifier. Normally, the total clarifier influent flow volume will be equally split into the two Final Clarifiers.

O. Final Clarifiers #1 & #2 (Modification)

1. General Description

- a. The two existing clarifiers will continue to be operated in parallel for final clarification and recycle of biomass mixed liquor suspended solids settled in and removed from the mixed liquor overflow from the activated sludge treatment process.
- b. In order to improve TSS removal efficiency within the existing clarifier tanks, a new rapid suction sludge removal mechanism will be installed in each of the two Final Clarifiers.**

2. Design Assumptions

a. Wastewater Flow

- 1) Average wastewater flow (ADF) volume ≤ 2.60 MGD, 7 days/week
- 2) Maximum month average wastewater flow (MMADF) volume ≤ 3.00 MGD, 7 days/week.
- 3) Maximum day wastewater flow (MDF) volume ≤ 4.00 MGD
- 4) Peak wastewater flow (PF) rate = 5.00 MGD
- 5) Maximum influent flow rate with 100% sludge recycle rate = $(4.00 \text{ MGD})(2) \leq 8.00$ MGD
- 6) Maximum influent flow rate with 150% sludge recycle rate = $(4.00 \text{ MGD})(2.5) \leq 10.00$ MGD

b. Pollutant Concentrations and Loads

- 1) Minimum design mixed liquor solids loadings rate at the average design throughput flow rate = 4.00 MGD and with 100% sludge recycle rate @ 6,000 mg/L MLSS concentration =

$$(4.00 \text{ MGD})(6,000 \text{ mg/L})(8.34)(2.0)/24 = 16,680\#/hr.$$

- 2) Average design mixed liquor solids loadings rate at the average design throughput flow rate = 2.60 MGD and with 100% sludge recycle rate @ 5,000 mg/L MLSS concentrations =

$$(2.60 \text{ MGD})(5,000 \text{ mg/L})(8.34)(2.0)/24 = 8,688\#/hr.$$

3. Calculate Clarifier Loading Rates

- a. **The two existing 110 ft. diameter x 12.0 ft. side water depth final clarifier concrete tanks will each be retrofitted with a new rapid hydraulic suction sludge pickup mechanism, surface skimmer and scum box and continue to be operated in parallel and be used for final sedimentation of activated sludge solids.**

- b. Each 110 ft. dia. circular clarifier has an effective surface overflow diameter = 106 feet, an effective surface overflow area = 8,800 ft²; and an effective clarifier floor area = 9,498 ft²

- c. Clarifier Volume = 850,000 gallons

- d. Hydraulic Surface Loading Rates (HSLR)

$$\begin{aligned} \text{HSLR (average)} &= \frac{3,000,000 \text{ gpd}}{8,800 \text{ ft}^2(2)} \\ &\leq 170 \text{ gpd/ft}^2 \text{ @ average @ 3.00 MGD} \end{aligned}$$

$$\begin{aligned} \text{HSLR (maximum)} &= \frac{4,000,000 \text{ gpd}}{8,800 \text{ ft}^2(2)} \\ &\leq 230 \text{ gpd/ft}^2 \text{ @ maximum @ 4.00 MGD} \end{aligned}$$

- e. Maximum Solids Loading Rate (SLR) assuming an influent flow rate = 4.00 MGD and a 150% sludge recycle rate with a MLSS concentration < 6,000 mg/L

$$\text{SLR} = \frac{(4.00 \text{ MGD})(2.5)(8.34)(6,000 \text{ mg/L})}{9,498 \text{ ft}^2(2)}$$

$$\leq 27.0\#/ft^2/day \text{ @ maximum throughput flow rate} = 4.00 \text{ MGD including 150\% sludge recycle flow}$$

- f. Minimum Hydraulic Detention Time (HDT) assuming a 150% sludge recycle rate

$$\text{HDT} = \frac{(850,000 \text{ gallons})(24)(2)}{(4,000,000)(2.5)}$$

= 4.0 hours @ maximum influent flow rate = 4.00 MGD including 150% sludge recycle flow

P. Return Activated Sludge (RAS) Pump Station (New)

1. Four new 50 HP, 8-inch self-priming Return Activated Sludge (RAS) pumps are provided in the Sludge Return Pump Station for the two Final Clarifiers. Two RAS Pumps are provided for each Final Clarifier. The pumps are provided to recycle activated sludge from the Final Clarifiers to Anoxic Reactor #1 and/or Nitrification Reactor #2.
2. Each pump is rated at 1,400 gpm @ 57 feet total head which is equivalent to a maximum sludge recycle rate = 50% of the maximum design throughput flow rate = 2,800 gpm = 4.00 MGD.
3. One sludge return pump will normally be operated with each Final Clarifier at reduced speed to provide a dedicated sludge recycle rate from each Clarifier of approximately 50% of the throughput flow rate per clarifier = 2.00 MGD per pump. The third and fourth pumps are provided as an installed standbys or for increased RAS pumping rates. Four sludge return pumps operated in parallel can provide a maximum total sludge recycle rate = 2Q = 200% = 2(4.00 MGD) = 8.00 MGD = 2.00 MGD/pump = 1,400 gpm/pump.
4. **Two new 12" RAS magnetic flow meters are provided. One magnetic flow meter is provided to accurately measure, indicate and totalize the sludge recycle flow for each Final Clarifier.** The flow meter is provided with a digital flow indicator and with a downstream flow control valve to allow the sludge recycle flow from the clarifier to be throttled and controlled.

Q. Sludge Wasting Requirements (Modification)

1. Calculate the activated sludge (AS) process average F/M ratio:

$$\begin{aligned} \text{a) \#MLSS in AS process} &= (10.2 \text{ MG})(8.34)(5,000 \text{ mg/L}) \\ &= 425,340 \# \text{MLSS} \end{aligned}$$

$$\text{b) F/M} = \frac{33,360 \# \text{BOD/day}}{425,340 \# \text{MLSS}} \leq 0.078$$

2. At the expected F/M ratio of approximately 0.078#BOD/#MLSS, biosolids sludge must be wasted at a rate of approximately 0.60#TSS/#BOD applied from the activated sludge treatment system. At the design maximum 7 day BOD load of 33,360#/day approximately 20,000#/day (dry basis) of activated sludge biosolids must be wasted from the activated sludge process each day to maintain the correct MLSS concentration in the multi-stage Activated Sludge Treatment Process. Activated sludge will be wasted by being pumped from the Final Clarifier sludge return pump station to new mechanical sludge thickeners prior to discharge into existing Waste Activated Sludge Digester Basins #1 and #2 for additional aerobic digestion, gravity thickening and decanting prior to being hauled to land application sites for ultimate disposal.
3. Calculate volume of sludge produced assuming 1.0% solids in return sludge from the final clarifier:

$$\begin{aligned} \text{Sludge Volume} &= \frac{20,000\#/day}{(0.01)8.34} \\ &\leq 240,000 \text{ gpd} \end{aligned}$$

The total maximum dry weight and volume of waste sludge to be produced by the treatment system are therefore calculated to be approximately 20,000#ds/day and 150 gpm over 24 hours/day assuming a 1.0% waste sludge solids concentration.

R. Waste Activated Sludge Pump Station (New)

1. **Two new 10 HP Waste Activated Sludge (WAS) Pumps are provided in the new Sludge Return Pump Stations to pump waste activated sludge from the two Final Clarifier sludge return pump suction lines to the Waste Activated Sludge Aerobic Digester Tanks.**
2. Volume to be wasted from sludge return flow @ 10,000 mg/L minimum solids concentration = 240,000 gpd = 167 gpm, 24 hours/day.
3. Each waste sludge pump is rated at 200 gpm @ 70 feet total head.
4. The waste sludge pump will normally be manually operated to pump waste sludge flow to the Waste Activated Sludge Digesters from 12 to 24 hours/day at a flow rate ranging from 75 to 150 gpm.
5. **One new magnetic flow meter is provided in the waste sludge pump discharge line to accurately measure, indicate, and totalize the waste activated sludge flow pumped to the Waste Activated Sludge Digester Basins.** The flow meters are provided with a digital flow indicator to allow the waste sludge pumping rate to be manually controlled by adjusting the flow control valve downstream of the flow meter.

S. Tertiary Filter Influent Pump Station (New)

1. General Description

- a. One new pump station is required to transfer Final Clarifier effluent into the new Tertiary Filters.**
- b. The new Tertiary Filter (TF) Influent Pumps are located in the new TF Enclosure Building.

2. Design Assumptions

- a. Average wastewater flow (ADF) volume ≤ 2.60 MGD = 1,800 gpm, 7 days/week
- b. Maximum month average wastewater flow (MMADF) volume ≤ 3.00 MGD = 2,100 gpm, 7 days/week.
- c. Maximum day wastewater flow (MDF) volume ≤ 4.00 MGD = 2,800 gpm
- d. Peak wastewater flow (PF) rate = 5.00 MGD

3. Pump Selection

- a. Three new 40 HP, 8-inch self-priming sewage pumps are provided to pump wastewater discharged from the Final Clarifiers into the Filter Influent wet well into the new Tertiary Filter System.**
- b. Each pump is rated at 1,750 gpm @ 40 ft.

4. Variable Speed Drive Controls

- a. Variable speed drive motor controls are provided for each pump.
- b. Pump speed and pumping rate are automatically controlled by the liquid level in the wet well.
- c. Operation of two pumps in parallel at reduced speed is required to pump the maximum flow volume = 2,800 gpm = 4.00 MGD. The third pump is provided as an installed standby pump.
- d. Operation of two pumps in parallel at maximum speed is required to pump the peak flow rate = 3,500 gpm = 5.00 MGD.

5. Wet Well Liquid Level Control

- a. One liquid level sensor is provided in the pump station wet well to operate the pump station pump on, pump off and high liquid level alarm controls.
- b. A control system is provided to automatically adjust the pump operating speed and the flow pumping rate to maintain the liquid level in the pump station wet well.

T. Tertiary Filtration System (New)

1. General

- a. New deep sand bed, continuous backwash, upflow sand filters are provided for polishing final clarifier effluent for final removal of TSS, BOD and TKN.
- b. Operation of the tertiary filters will provide capability to achieve overall higher efficiency TSS and total nitrogen removal.

2. Design Assumptions

a. Wastewater Flows

- 1) Average wastewater flow (ADF) volume ≤ 2.60 MGD = 1,800 gpm, 7 days/week
- 2) Maximum month average wastewater flow (MMADF) volume ≤ 3.00 MGD = 2,100 gpm, 7 days/week.
- 3) Maximum day wastewater flow (MDF) volume ≤ 4.00 MGD = 2,800 gpm
- 4) Peak wastewater flow (PF) rate = 5.00 MGD
- 5) 24 hour, 7 day/week hydraulic flow equalization is provided upstream of the filters
- 6) Effluent from the existing Final Clarifiers will flow by gravity into the new tertiary filters

b. Wastewater Pollutant Concentrations

Table #14
Tertiary Filter Influent
Pollutant Concentrations

| Pollutant | Concentration | |
|----------------|---------------|---------|
| | Average | Maximum |
| TSS | 5 – 15 mg/L | 20 mg/L |
| BOD | 2 – 10 mg/L | 15 mg/L |
| Total Nitrogen | 5 - 8 mg/L | 10 mg/L |

3. Continuous Backwash, Upflow Deep Sand Bed Filter Design

- a. Number of filters = 9
- b. Number of modules per filter = 2
- c. Total number of filter modules = 9 filters x 2 modules = 18 modules
- d. Filter module size 7.083 ft. square = 50 ft² each; total filter bed area = 900 ft².
- e. Design filtration rates:
 - 1) With 18 filter modules in service and total filter area = 900 ft²;
 - a) @ 2.60 MGD = 1,800 gpm, the average filtration rate ≤ 2.00 gpm/ft²
 - b) @ 3.00 MGD = 2,100 gpm, the maximum filtration rate ≤ 2.40 gpm/ft²
 - c) @ 4.00 MGD = 2,800 gpm, the peak filtration rate ≤ 3.20 gpm/ft²
 - 2) With 14 filter modules in service and total filter area = 700 ft²;
 - a) @ 2.60 MGD = 1,800 gpm, the average filtration rate ≤ 2.60 gpm/ft²
 - b) @ 3.00 MGD = 2,100 gpm, the maximum filtration rate ≤ 3.00 gpm/ft²
 - c) @ 4.00 MGD = 2,800 gpm, the peak filtration rate ≤ 4.00 gpm/ft²

f. Design solids loading rates:

1) With 18 filter modules in service;

- a) @ 2.60 MGD with $TSS_i = 10$ mg/L, the solids loading rate = 12.0#/filter module/day = 0.24#/ft²/day
- b) @ 4.00 MGD with $TSS_i = 20$ mg/L, the solids loading rate = 37.3#/filter module/day = 0.84#/ft²/day

2) With 14 filter modules in service;

- a) @ 2.60 MGD with $TSS_i = 10$ mg/L, the solids loading rate = 12.0/filter module/day = 0.31#/ft²/day
- b) @ 4.00 MGD with $TSS_i = 20$ mg/L, the solids loading rate = 48#/filter module/day = 0.83#/ft²/day

g. Filter Bed Specifications

- 1) 80" deep high grade silica sand bed complying with Standard Specifications for Filtering Material (AWWA Designation B100-89).
- 2) Grain Shape, Effective Size (ES), and Uniformity Coefficient (UC)

| <u>Grain Shape</u> | <u>Effective Size</u> | <u>Uniformity Coefficient</u> |
|--------------------|-----------------------|-------------------------------|
| Sub-Angular | 1.40 mm | 1.30 to 1.60 |

The sand must conform to the conditions of above. The filter media shall predominantly be siliceous material that will resist degradation during handling and use. Crushed gravel is not acceptable. "Sub-Angular" grains are essentially sub-angular with multifaceted smooth edges. The effective size is the diameter of the tenth percentile grain (D10). The uniformity coefficient is the diameter of the sixtieth percentile grain divided by the diameter of the tenth percentile grain (D60/D10). The effective size and uniformity coefficient are determined by a dry, 10-minute automatic sieve shaker procedure on a 500-800 gram sample with U.S. Sieve Nos. 12, 14, 16, 18, 20, 30, as well as a pan.

- 3) Fines Content is defined for this size filter media as particles passing through a 30 mesh screen. Fines should not exceed by 1.5% by weight.
- 4) Specific Gravity – dry specific gravity must be greater than 2.5

- 5) Hardness – minimum 6.0 on Moh’s scale (ref. Testing and Inspection of Engineering materials; McGraw-Hill Cook Co., New York, NY; 3rd Edition; page 209)
- 6) Acid Solubility – less than 1% total loss in mass after a 30- minute immersion in an approx. 20% by wt. hydrochloric acid (HCl) solution (made by combining equal volumes of water and standard reagent grade 12.1 N (approx.) (HCl)

h. Description of Filter Operation

- 1) Influent feed is introduced into the bottom of the sand bed through a series of feed radials that are open at the bottom. As the influent flows upward through the downward moving sand bed, organic and inorganic impurities are captured by the sand. The clean, polished filtrate continues to move upward and exists at the top of the filter over the filtrate weir and out through, the effluent pipe.

i. Filter Media Cleaning and Backwashing

- 1) The filter is an upflow, deep bed, granular media filter with continuous backwash. The filter media is cleaned by a simple internal washing system that does not require backwash pumps or storage tank.
- 2) The sand bed containing captured impurities is drawn downward into the center of the filter where the airlift pipe is located. A small volume of compressed air is introduced at the bottom of the airlift, drawing the sand into the airlift pipe. The sand is scoured within the airlift pipe. The sand is scoured within the airlift pipe at an intensity of 100-150 SCFM/ft². The effectiveness of this scouring process is vastly greater than what can be expected in conventional sand filtration backwash. The scouring dislodges any solid particles attached to the sand grains.
- 3) The dirty slurry is pushed to the top of the airlift and into the reject compartment. From the reject compartment, the sand falls into the sand washer and the lighter reject solids are carried over the reject weir and out the reject pipe. As the sand cascades down through the concentric stages of the washer, it encounters a small amount of polished filtrate moving upward, driven by the difference in water level between the filtrate pool and the reject weir. The heavier, coarser sand grains fall through this small countercurrent flow while the remaining contaminants are carried back up to the reject compartment. The clean, recycled sand is deposited on the top of the sand bed where it once again begins the influent cleaning process and its eventual migration to the bottom of the filter.

j. Filter Backwash Rate

- 1) Each of the eighteen filter modules will have a continuous backwash wastewater flow rate of approximately 7 gpm to 14 gpm producing a total backwash flow rate = 126 gpm to 252 gpm.
- 2) Backwash wastewater will flow by gravity into the new Filter Reject Backwash wastewater wet well to flow by gravity to the Plant Site Pump Station #2.

k. Filter Influent Trough Skimmer

- 1) The filter influent trough is provided with an overflow baffle for manual skimming of the influent trough liquid level surface. Skimmings are discharged by gravity to recycle to the Plant Site Drain Pump Station.

U. Ultraviolet (UV) Final Effluent Disinfection System (New)

1. General Description

- a. **One new UV Contact Channel is provided for installation of an ultraviolet light contact system for final effluent disinfection.**
- b. The UV Disinfection System will include three UV Banks installed to operate in series within the concrete contact channel.
- c. Normally two UV Banks will be operated with the third bank provided as an installed standby.

2. Design Assumptions

a. Wastewater Flows

- 1) Average wastewater flow (ADF) volume ≤ 2.60 MGD = 1,800 gpm, 7 days/week
- 2) Maximum month average wastewater flow (MMADF) volume ≤ 3.00 MGD = 2,100 gpm, 7 days/week.
- 3) Maximum day wastewater flow (MDF) volume ≤ 4.00 MGD = 2,800 gpm
- 4) Peak wastewater flow (PF) rate = 5.00 MGD

b. Monthly Average Influent Pollutant Concentrations

| | | |
|-------------------|---|----------|
| TSS | ≤ | 5.0 mg/L |
| O&G | ≤ | 1.0 mg/L |
| NH ₃ N | ≤ | 1.0 mg/L |

c. Monthly Average Effluent Limitations

Fecal Coliform ≤ 200 MPN/100 ml (Monthly Average)

3. In order to comply with the fecal coliform bacteria limitations, final effluent will be disinfected by the new ultraviolet light (UV) system. The existing chlorination system will remain as a backup to the new UV system.

4. The UV contact channel structure is located in the Tertiary Filter building and has the following dimensions and volume:

a. Concrete Channel Structure

- 1) Total Length = 44 ft.
- 2) Width = 4 ft.
- 3) Depth = 5 ft.

b. UV Lamp Bank Contact Zone

- 1) Number of UV Banks = 3
- 2) UV Bank Zone Length/UV Bank = 42 ft.
- 3) UV Bank Zone Width = 24 inches
- 4) Maximum Liquid Depth = 30 inches
- 5) UV Bank Contact Zone Volume = 200 ft³ = 1,570 gallons

5. UV System Components and Design Features

a. UV Transmission = 50% minimum

b. Uniform Lamp Array - 3 Banks each with 7 Modules per Bank and 8 lamps per module providing a total of 168 UV Lamps

c. The UV system will have two Power Distribution Centers and one System Control Center.

d. The discharge end of the UV Contact Channel will be provided with one automatic level controller

e. The UV system will be provided with an Automatic Chemical/Mechanical Cleaner.

- f. Automatic Power Dose Pacing System Control will be provided.

V. Effluent Flow Meter (New)

1. One new 9" throat x 24" max. liquid depth Parshall Flume Flow Meter with a maximum flow capacity = 3,900 gpm = 5.7 MGD is provided to measure the total flow discharging from the new UV contact channel.
2. One flow indicating, recording, totalizing flow meter is provided with the Parshall Flume.

W. Waste Activated Sludge Aerobic Digestion Tanks (Existing & Modification)

1. General Description

- a. **The existing Oxidation Ditch Basin will be retrofitted into a new Waste Activated Sludge (WAS) Aerobic Digestion Tank #1 (ADT #1) for first stage aerobic digestion, gravity thickening, and decanting of WAS solids generated by the BNR treatment process.**
- b. **The two existing Sludge Storage Tanks will be retrofitted to function as Aerobic Digestion Tanks #2 and #3.** These two ADTs will normally be operated as second and third stage aerobic digesters in series with ADT #1. The WAS is normally pumped from the RAS flow into aerated Oxidation Ditch ADT #1 for first stage aerobic digestion and gravity thickening. Partially digested WAS is pumped from ADT #1 into aerated ADT #2 for second stage aerobic digestion, decanting and gravity thickening; and, then pumped into aerated ADT #3 for third stage aerobic digestion, decanting and gravity thickening.
- c. Aerobically digested WAS is pumped from ADT #2 and/or #3 to the new Screw Press System for mechanical dewatering prior to future heat drying.

2. Aerobic Digestion Tank #1 Design

- a. The existing 500 ft. long x 98 ft. wide x 8.0 ft maximum liquid depth, 3.00 MG volume below grade concrete lined oxidation ditch will be retrofitted into ADT #1 for aerobic digestion, thickening and storage of WAS.
- b. Two existing 86 ft. dia. X 9.5 ft. maximum liquid depth, 0.40 MG volume above grade concrete tanks will continue to be used for aerobic digestion, storage and gravity thickening of WAS.
- c. WAS will be pumped from the RAS suction lines of the two existing Final Clarifiers into ADT #1.

- d. Biosolids removed by the Anaerobic Lagoon Post Treatment DAF Cell #3 can be collected in a sludge storage tank and pumped to a tanker truck for hauling to off site disposal; or, optionally pumped at a low flow rate into ADT #2 for mixing and disposal with WAS.
- e. Two new 25 HP self priming rotary lobe Decant Pumps are provided drawing off clarified decant liquid from the top of ADT #1 at the end of gravity sludge thickening periods. Decant wastewater is pumped from ADT #1 into Anaerobic Lagoons #1 or #2 for recycle and disposal with treated wastewater. The second pump is provided to transfer the partially digested sludge to ADT #2 or #3.
- f. One new floating, manual operated, decant pipe is provided in ADT #2 and ADT #3 for drawing off clarified decant liquid from the surface of the ADT at the end of gravity sludge thickening periods. Decant wastewater is drained by gravity from ADT #2 and ADT #3 for recycle into the Plant Site Pump Station #2.
- g. Gravity thickened sludge will normally be pumped from the ADT #1 into ADT #2 and then into ADT #3. After aerobic digestion, decanting and gravity thickening, WAS will be pumped to the new Screw Press Sludge Dewatering System.
- h. Two new 15 HP self-priming rotary lobe sludge transfer pumps are provided to transfer sludge from ADT #2 to ADT #3 or the new Screw Press Sludge Dewatering System. The pumps can also transfer sludge from ADT #3 to the Screw Press Dewatering System.

3. Sludge Storage Tank Aeration and Mixing Equipment Design

- a. Evaluate mixing requirements in the Aerobic Digestion Tanks:
 - 1) ADT #1
 - a) Six new 60 HP AerO₂ floating surface directional mix subsurface aerator units are provided in ADT #1 for biomass mixing and oxygen transfer. The HP/MG = $6 \times 60 \text{ HP}/3.0 \text{ MG} = 120 \text{ HP/MG}$ for mixing.
 - b) Five existing 75 HP Aqua Aerobics floating surface aerators are also provided in ADT #1 for biomass sludge mixing and aeration. The HP/MG = $5 \times 75 \text{ HP}/3.0 \text{ MG} = 125 \text{ HP/MG}$.
 - 2) ADT #2 and #3
 - a) Two new 50 HP AerO₂ floating surface directional mix subsurface aerator units are provided in each of ADT #2 and ADT #3 for biomass mixing and oxygen transfer. The HP/MG = $2 \times 50 \text{ HP}/0.40 \text{ MG} = 250 \text{ HP/MG}$ for mixing.

b. Evaluate Oxygen Transfer Requirements in the ADT #1, #2 and #3:

- 1) Assume 0.25#O₂/#BOD is required in the aerobic sludge digester tanks based on the maximum BNR process BOD loading

$$\text{AOTR} = \frac{(0.25\#O_2/\#BOD)(33,360\#BOD/\text{day})}{24} = 347\#O_2/\text{hr} \leq 350\#O_2/\text{hr total}$$

- 2) Assume oxygen transfer capacity required in each ADT is calculated as follows:

$$\text{ADT \#1} = 350\#/\text{hr} \left(\frac{3.0 \text{ MG}}{3.0 \text{ MG} + 2(0.4 \text{ MG})} \right) \leq 300\#/\text{hr}$$

$$\text{ADT \#2 and \#3} = 350\#/\text{hr} \left(\frac{0.40 \text{ MG}}{3.8 \text{ MG}} \right) \leq 50\#/\text{hr}$$

4. Aeration and Mixing Equipment in ADT #1, ADT #2 and ADT #3

a. ADT #1 (old Oxidation Ditch)

- 1) Oxygen transfer capacity is provided in ADT #1 by six (6) new, 60 HP, AerO₂ floating directional mix subsurface aerators each with a floating bridge mounted 10 HP air blower rated at 440 scfm. Each AerO₂ unit provides an oxygen transfer capacity of approximately 64#O₂/hr (AOTR). The total oxygen transfer capacity provided by operation of six AerO₂ units is approximately = 385#O₂/hr (AOTR).
- 2) Additional oxygen transfer capacity can be provided by operation of up to five (5) 75 HP floating Aqua Aerobics surface aerators. Each Aqua unit provides an oxygen transfer capacity = 75#O₂/hr (AOTR). The total maximum oxygen transfer capacity provided in ADT #1 is approximately = 385#O₂/hr (6 units) + 75#O₂/hr (5 units) = 760#O₂/hr (AOTR).

b. ADT #2 and #3

- 1) Oxygen transfer capacity is provided in each of ADT #2 and ADT #3 by two new 50 HP, AerO₂ floating directional mix subsurface aerators each with a floating bridge mounted 7.5 HP air blower rated at 420 scfm. Each AerO₂ unit provides an oxygen transfer capacity of approximately 53#O₂/hr (AOTR).
- 2) The total oxygen transfer capacity provided by the operation of two AerO₂ units in the ADT is approximately 100#O₂/hr (AOTR).
- 3) The total oxygen transfer capacity provided in all three ADTs is equal to approximately 960#O₂/hr vs. the oxygen demand of approximately 375#O₂/hr (AOTR).

5. WAS Aerobic Sludge Digestion Time

- a. The total aerobic sludge digestion basin provided = 3.0 MG + 0.40 MG(2) = 3.80 MG.
- b. Calculate the approximate sludge solids detention time in the three digester basins assuming initial MLVSS/MLSS ratio = 0.80, assuming approximately 30% VSS destruction by aerobic digestion and assuming an average thickened digested sludge solids concentration = 2.0%

$$\text{Net Solids} = 20,000\#ds/day(0.80)(1 - 0.30) + 20,000\#ds/day(0.20)$$

$$= 15,200\#ds/day$$

$$\text{Net Digested Sludge Volume} = \frac{15,200\#ds/day}{(8.34)(0.02)} \leq 92,000 \text{ gallons/day}$$

- c. Sludge Retention Time for Aerobic Digestion = SRT

$$\text{SRT} = \frac{3,800,000 \text{ gallons}}{92,000 \text{ gallons/day}} = 41 \text{ days}$$

- d. The Aerobic Sludge Digestion Time will therefore be well over 40 days which should provide sufficient VSS destruction for efficient mechanical dewatering of WAS prior to heat drying.

X. Screw Press Sludge Dewatering System (New)

1. Waste Activated Sludge (WAS) Dewatering and Disposal

- a. Biosolids waste activated sludge (WAS) is pumped from the Final Clarifier Return Activated Sludge (RAS) Pump Station suction lines through a WAS force main line to the Aerobic Sludge Digestion Tanks (ADT) #1, #2 and #3. Partially aerobically digested, gravity thickened WAS is normally pumped from the ADT #3 to the new Screw Press for mechanical dewatering prior to ultimate disposal by haul off of future heat drying and land application.
- b. If the Sludge Digestion Tanks are in service so that WAS can be gravity thickened to a minimum of 2% solids concentration, the average daily liquid volume of biosolids sludge to be pumped to the new Screw Press system under normal operating conditions = approximately 100,000 gpd @ 20,000 mg/L.

- c. If the Sludge Digestion Tanks are out of service so that the WAS cannot be gravity thickened, the maximum daily liquid volume of biosolids sludge to be pumped to the Screw Press for dewatering assuming a solids concentration of approximately 1.0% in the WAS sludge pumped from the Final Clarifier RAS flow = approximately 200,000 gallons/day @ 10,000 mg/L.

2. Screw Press Design

- a. **Two new Screw Presses are provided for sludge dewatering.** The sludge inflow capacity rating of the Screw Press = 200 gpm (100 gpm per press) of the WAS sludge @ 1.0% solids concentration and 1,500#ds/hr. Operation of the Screw Presses for two shifts for approximately 12 hours/day is required to dewater the average daily sludge volume of approximately 100,000 gpd assuming a flow rate into the Screw Press of approximately 150 gpm.

- b. The calculated screw press operation times and sludge feed rate:

- 1) @ maximum WAS dry solids production rate = 20,000#ds/day assuming a maximum screw press operation time of 20 hours, the calculated press solids loading rate =

$$\frac{20,000\#ds/day}{20\text{ hrs/day}} = 1,000\#ds/hour$$

The maximum WAS liquid volume =

$$\frac{20,000\#ds/day}{(8.34)(0.01)} = 240,000\text{ gpd}$$

The maximum WAS liquid sludge feed rate to the screw press if operated 20 hours/day @ 1.0% solids concentration =

$$\frac{240,000\text{ gallons/day}}{20\text{ hrs} \times 60} = 200\text{ gpm}$$

- 2) @ average digested WAS dry solids production rate = 20,000#ds/day assuming an average screw press operation time of 12 hours/day, the calculated press solids loading rate =

$$\frac{20,000\#ds/day}{16\text{ hrs/day}} = 1,250\#ds/hour$$

The average digested WAS liquid sludge feed rate to the screw press if operated 12 hours/day @ an average of 2.0% solids concentration =

$$\frac{20,000\#ds/day}{(0.02)(8.34)} \leq 120,000\text{ gallons/day}$$

$$\frac{120,000\text{ gpd}}{16\text{ hrs/day} \times 60} \leq 125\text{ gpm}$$

3. WAS/Screw Press Sludge Feed Pumps

- a. Three new 15 HP progressive cavity sludge pumps are provided each rated at 100 gpm to pump sludge from the 4,000 gallon Screw Press Influent Tank to the Screw Press for dewatering via influent flocculation piping for polymer mixing and detention time.
- b. Three magnetic flowmeter with flow indicators and totalizers are provided in the screw press sludge feed lines to accurately measure, indicate and totalize the sludge waste flow pumped to the Screw Presses.

4. Dewatered Solids Discharge Conveyor

- a. Dewatered sludge will discharge by gravity from the Screw Press into a new conveyor auger to transfer sludge into an open top dump truck.

5. Screw Press Filtrate Recycle

- a. Filtrate wastewater discharged from the new Screw Press will drain by gravity into the Plant Site Pump Station No. 1 Wet Well to be recycled back into Anoxic Reactor #1 of the activated sludge treatment system.

6. Chemical Storage Feed Equipment for Screw Press Sludge Dewatering System

- a. For polymer flocculation of sludge being pumped into the Screw Press the following chemical feed equipment is provided:
 - 1) One Polymer Solution Preparation Unit including a Polymer Solution Mixing Chamber, Neat Polymer Metering Pump, Dilution Water Inlet and Solution Outlet Assembly and Control Panel.

- 2) One progressive cavity Neat polymer solution metering pump is provided rated at 0.5 to 5 gphr @ 40 psi to pump Neat polymer solution from drums or totes into the Polymer Mixing Chamber of the Screw Press Polymer Feed Solution Preparation Unit for dosing into the screw press sludge feed line.

7. Dewatered Sludge Volume and Water Content

- a. The estimated maximum sludge volume of approximately 240,000 gpd @ 1.0% solids concentration will be dewatered by the Screw Press to 20% or greater solids concentration depending upon sludge temperature, polymer flocculant dosage efficiency, and solids dewatering characteristics.
- b. The calculated average sludge volume and weight of dewatered WAS assuming a screw press solids capture efficiency of 97%, a dewatered sludge solids content of over 20% and an average dewatered sludge weight of 9.8#/gal = 73#/ft³ = approximately 2,000#/Yd³.

- 1) Dewatered Sludge Volume:

$$= \frac{(20,000\#ds/day)(0.97)}{(0.20)(9.8\#/gal)}$$

$$\leq 10,000 \text{ gpd} \leq 1,350 \text{ ft}^3/\text{day} \leq 50 \text{ Yd}^3/\text{day}, 5 \text{ days/week}$$

- 2) Dewatered Sludge Weight = 50 Yd³/day x 2000#/Yd³ = 100,000#/day = 50 wet tons/day, 7 days/week @ 20% dewatered solids content.

Y. Plant Site Pump Station #1 (New)

1. General

- a. One new submersible pump station and wet well is provided for pumping drainage wastewater into either Anoxic Reactor #1 or Nitrification Reactor #2.
- b. The pump station will receive drainage from the following primary sources:
 - 1) New Equipment Building floor drain
 - 2) New Chemical Building floor drain wastewater
 - 3) Screw press filtrate flow and wastewater flow
 - 4) Screw press building floor drain wastewater flow
 - 5) Miscellaneous intermittent or periodic drainage flows

2. Design Assumptions

a. Screw Press Filtrate Wastewater Flow Volume and Rates

- 1) Average flow rate ≤ 150 gpm
- 2) Peak flow rate ≤ 250 gpm

b. Total Flow Rate

- 1) Average = $150 \text{ gpm} \leq 150 \text{ gpm}$
- 2) Maximum = $250 \text{ gpm} + 150 \text{ gpm} \leq 400 \text{ gpm}$

3. Wastewater Pumping Requirements

- a. Screw Press Filtrate wastewater will be continuously discharged by gravity flow into the pump station wet well to be recycled back to Anoxic Reactor #1.
- b. Design average discharge flow rate = 150 gpm with one pump in operation at reduced speed.
- c. Design maximum discharge flow rate = 400 gpm with one pump in operation at full speed.

4. Pump Selection

- a. Two new 7.5 HP, 4" self-priming wastewater pumps are provided in the existing pump station building.
- b. Each pump is rated at 400 gpm @ 40 ft. head when operated at full speed.

5. Variable Speed Drives

- a. Each pump is provided with a variable speed drive motor controls with automatic pump speed and pumping rate control.
- b. Pump speed and pumping rate will be automatically controlled by the liquid level in the pump station wet well.
- c. Automatic Lead, Lag and Standby pump operation and sequencing is provided with high liquid level alarm and automatic pump on/off liquid levels.

Z. Plant Site Pump Station #2 (Modification)

1. General

- a. The existing Oxidation Ditch Basin Effluent Pump Station will be retrofitted into the new Plant Site Pump Station #2.
- b. The pump station will receive drainage from the following primary sources:
 - 1) Filter reject backwash wastewater
 - 2) Clarifier scum trough flush water flow
 - 3) ADT #2 and #3 Decant
 - 4) Miscellaneous intermittent or periodic drainage flows

2. Design Assumptions

- a. Filter Reject Backwash Wastewater Flow Volume and Rates
 - 1) Average flow rate = 18 filter modules x 7 gpm/filter = 126 gpm
 - 2) Peak flow rate = 18 filter modules x 14 gpm/filter = 252 gpm
- b. Clarifier Scum Flow Volume and Rates
 - 1) Average Skimmings Flow = 20 gpm/clarifier x 2 units = 40 gpm
 - 2) Maximum Skimmings Flow = 40 gpm/clarifier x 2 units = 80 gpm
- c. ADT #2 and #3 Decant Flow Volume and Rates
 - 1) Average flow rate \leq 150 gpm
 - 2) Peak flow rate \leq 250 gpm
- d. Total Flow Rate
 - 1) Average = 126 gpm + 40 gpm + 150 gpm \leq 350 gpm
 - 2) Maximum = 252 gpm + 80 gpm + 250 gpm \leq 600 gpm

3. Wastewater Pumping Requirements

- a. Design average discharge flow rate = 350 gpm with one pump in operation at reduced speed.
- b. Design maximum discharge flow rate = 600 gpm with one pump in operation at full speed.

4. Pump Selection

- a. Two new 15 HP, 4” self-priming wastewater pumps are provided in the existing pump station building.
- b. Each pump is rated at 600 gpm @ 35 ft. head when operated at full speed.

5. Variable Speed Drives

- a. Each pump is provided with a variable speed drive motor controls with automatic pump speed and pumping rate control.
- b. Pump speed and pumping rate will be automatically controlled by the liquid level in the pump station wet well.
- c. Automatic Lead, Lag and Standby pump operation and sequencing is provided with high liquid level alarm and automatic pump on/off liquid levels.

AA. Chemical Storage-Feed Equipment For Activated Sludge Process And For Nitrogen Removal (Existing And New)

1. The following equipment is provided for mixing, storage and pumping chemical solutions that are necessary for operation of the Activated Sludge Treatment System and Final Clarifiers.
 - a. For pH adjustment of mixed liquor contained in Anoxic Reactor #1 and/or Nitrification Reactor #2A to maintain the activated sludge denitrification/nitrification process mixed liquor pH between 7.2 to 8.2 units; or, for adjustment of final effluent pH above 6.0 units:
 - 1) One existing 6,100 gallon bulk storage tank will continue to be used for storage of commercially purchased 60% strength magnesium hydroxide solution. Magnesium hydroxide solution is dosed into the Reactor #2A tank to maintain mixed liquor pH above 6.8 units in the biological nitrification process.

2) Magnesium hydroxide (MgOH) liquid solution is dosed for pH control in the activated sludge BNR process.

a) Calculate the MgOH dosage rate for nitrification of 9,007# of TKN @ 4.0# alk/#TKN when biological denitrification is achieved in the Anoxic Reactors #1A, #1B & #3.

$$(1) (9,007\#TKN) \text{ nitrified/day} \times 4.0\# \text{ alk/\#TKN}$$

$$\leq 36,000\#\text{alk/day}$$

$$(2) \text{ estimated alkalinity available combined pretreated Anaerobic Lagoon effluent and DAF Cell effluent wastewater} = (600 \text{ mg/L})(8.34)(4.00 \text{ MGD}) = 20,000\#\text{/day}$$

$$(3) \text{ desired alkalinity in final effluent} = (200 \text{ mg/L})(8.34)(4.00 \text{ MGD}) = 6,672\#\text{/day} \leq 7,000\#\text{/day}$$

$$(4) \text{ CaCO}_3 \text{ alk required} =$$

$$36,000\# - 20,000 + 7,000 \leq 23,000\#\text{alk/day}$$

$$(5) \text{ Estimated MgOH dosage rate @ 4.00 MGD}$$

$$= \frac{23,000\#\text{/day}}{(8.34)(4.00 \text{ MGD})} = 689 \text{ mg/L} \leq 700 \text{ mg/L}$$

(6) @ 60% MgOH solution strength and solution weight of 12.6#/gallon and assuming approximately 12.8#alk/gal MgOH, the MgOH solution volume required per day and solution pumping rate required/hr =

$$= \frac{23,000\#\text{/day}}{12.8\#\text{alk/gal}} = 1,979 \text{ gpd} \leq 1,800 \text{ gpd} = 75 \text{ gal/hour}$$

vs. 150 gal/hr pumping capacity provided by one MgOH solution pump in operation.

b) Two new magnesium hydroxide (MgOH) solution pumps with manual variable speed drives are provided each rated at 15 - 150 gphr @ 60 psi to dose MgOH solution into the 4.00 MGD maximum design flow rate. One pump @ 150 gphr will inject MgOH at a rate of over 46,000#/day = 1,400 mg/L (dry basis) @ 4.00 MGD. The normal MgOH dosage requirement is expected to be between 55 to 75 gphr or 500 to 700 mg/L (dry basis). The second MgOH pump is provided for parallel operation, as an installed standby.

- b. The following equipment will be provided for dosage of organic Carbon Source Solution for carbonaceous BOD feed into Anoxic Reactor #3 for denitrification process control and final removal of nitrate nitrogen.
- 1) Non-Flammable carbon source (CS) solution make up and pumping equipment is provided for dosage of CS into the mixed liquor influent flow into Anoxic Reactor #3.
 - 2) Two new 5,000 gallon fiberglass bulk tanks will be provided for nonflammable organic carbon source (CS) solution storage. The carbon source solution bulk tanks will be installed in the new Chemical Equipment Building adjacent to Anoxic Reactor. Carbon source solution will be pumped into the Anoxic Reactor #3 influent line.
 - 3) Two new carbon source solution pumps with manual variable speed drives are provided each rated at 30 gphr @ 60 psi to dose organic carbon solution into the 4.00 MGD maximum design flow rate. One pump @ 17 gphr can inject 400 gpd of organic carbon source at a rate of over 5,000#CS/day > 150 mg/L @ 4.00 MGD. The normal organic carbon source dosage requirement is expected to be between 5 to 10 gphr. A second organic carbon source pump is provided for parallel operation and as an installed standby.
- c. For dosing of flocculant settling aid polymer solution into the Final Clarifier influent mixed liquor:
- 1) Two new 4,000 gallon flocculant solution mix-storage tanks each with a 2 HP mixer are provided for dosing polymer flocculant aid to the Final Clarifiers. The polymer tanks are located in the new Tertiary Filter Equipment Building located near the existing Final Clarifiers.
 - 2) Two existing polymer flocculant solution pumps with manual variable speed drives are provided for operation of the Final Clarifiers. Each flocculant solution pump is rated at 200 gphr @ 60 psi. One pump @ 167 gphr will inject flocculant solution at a rate of over 5 mg/L (dry basis) into the 4.00 MGD maximum design flow rate assuming a minimum 0.50% by weight flocculant solution strength is made up in the flocculant solution mix tanks; the normal flocculant dosage requirement is expected to be between 2 mg/L to 5 mg/L (dry basis).

BB. Expected Final Effluent Quality In Treated Wastewater Discharged Into The Existing Spray Irrigation Lagoon

After complete treatment by dissolved air flotation first stage pretreatment, anaerobic lagoon second stage pretreatment, four stage anoxic/aerobic/anoxic/aerobic activated sludge biological treatment, final clarification; tertiary filtration and disinfection, the effluent quality is expected to meet Mountaire spray irrigation operations permit requirements in effect as of the date hereof. Please note that the influent and effluent parameters set forth in this report have been developed using assumptions regarding the operation of the system that may not reflect actual operating conditions over time. Moreover, many factors can influence the ability of the wastewater treatment system to achieve target effluent parameters, including the character of production throughput, weather conditions, etc. Accordingly, no parameters can be guaranteed.

Table #15
Expected Final Effluent
Pollutant Concentrations

| Pollutant | Expected Average Final Effluent Quality | Spray Irrigation Permit Limits | |
|-------------------|---|--------------------------------|------------------|
| | | Monthly Average | Daily Maximum |
| Flow | Average: 2.60 MGD Peak: 4.00 MGD | NL | NL |
| BOD | ≤ 50 mg/L | 50 mg/L | NL |
| TSS | ≤ 50 mg/L | 50 mg/L | NL |
| Ammonia | ≤ 2 mg/L | NL | NL |
| Nitrate + Nitrite | ≤ 5 mg/L | NL | NL |
| Total Nitrogen | ≤ 10 mg/L | 15.6 mg/L | NL |
| Total Phosphorus | 20 mg/L* | NL | NL |
| Chlorides | ≤ 250 mg/L* | NL | NL |
| Sodium | ≤ 250 mg/L* | NL | NL |
| Copper | <0.0040* | NL | NL |
| Cadmium | <0.0004* | NL | NL |
| Nickel | 0.0040* | NL | NL |
| Lead | 0.0040* | NL | NL |
| Zinc | <0.0500* | NL | NL |
| pH | 5.5 - 9 | NL | NL |
| Fecal Coliform | ≤ 200 MPN/100 ml | ≤ 200 MPN/100 ml | ≤ 200 MPN/100 ml |

NL = No Limit

*Values provided by Owner

CC. DAF Pretreatment System (Future)

1. General Description

- a. The existing first stage DAF pretreatment system will be upgraded with a new DAF Cell and/or adding the capability to optionally utilize the existing DAF Cell #3 to provide redundancy and more consistent higher efficiency wastewater pretreatment upstream of the second stage Anaerobic Lagoon pretreatment system. The new DAF Cell will have a flow capacity equal to or greater than the existing Primary DAF Cell.

DD. Final Effluent Storage Pond and Pump Station (Future)

1. General Description

- a. A future Final Effluent Storage Pond will be constructed to store Final Effluent. The future Final Effluent Storage Pond will be approximately 22 MG and provided with a synthetic liner system.
- b. If the BNR System Final Clarifier Effluent or the Final Effluent from the Wastewater Treatment System is determined to be offspec, water can be diverted into the new Final Effluent Storage Pond for emergency storage. The offspec water can be pumped back at an operator set and controlled rate to the BNR System for re-treatment.
- c. A new Final Effluent Storage Pond Pump Station will be constructed to pump stored water back to the existing Spray Irrigation Fields or back to the BNR System.

2. Effluent Pumping Volumes and Flow Rates

- a. Maximum daily wastewater flow volume pumped out of the Final Effluent = 4.0 MGD = 2,800 gpm.
- b. Peak wet weather effluent pumping rate = 3,500 gpm = 5.0 MGD

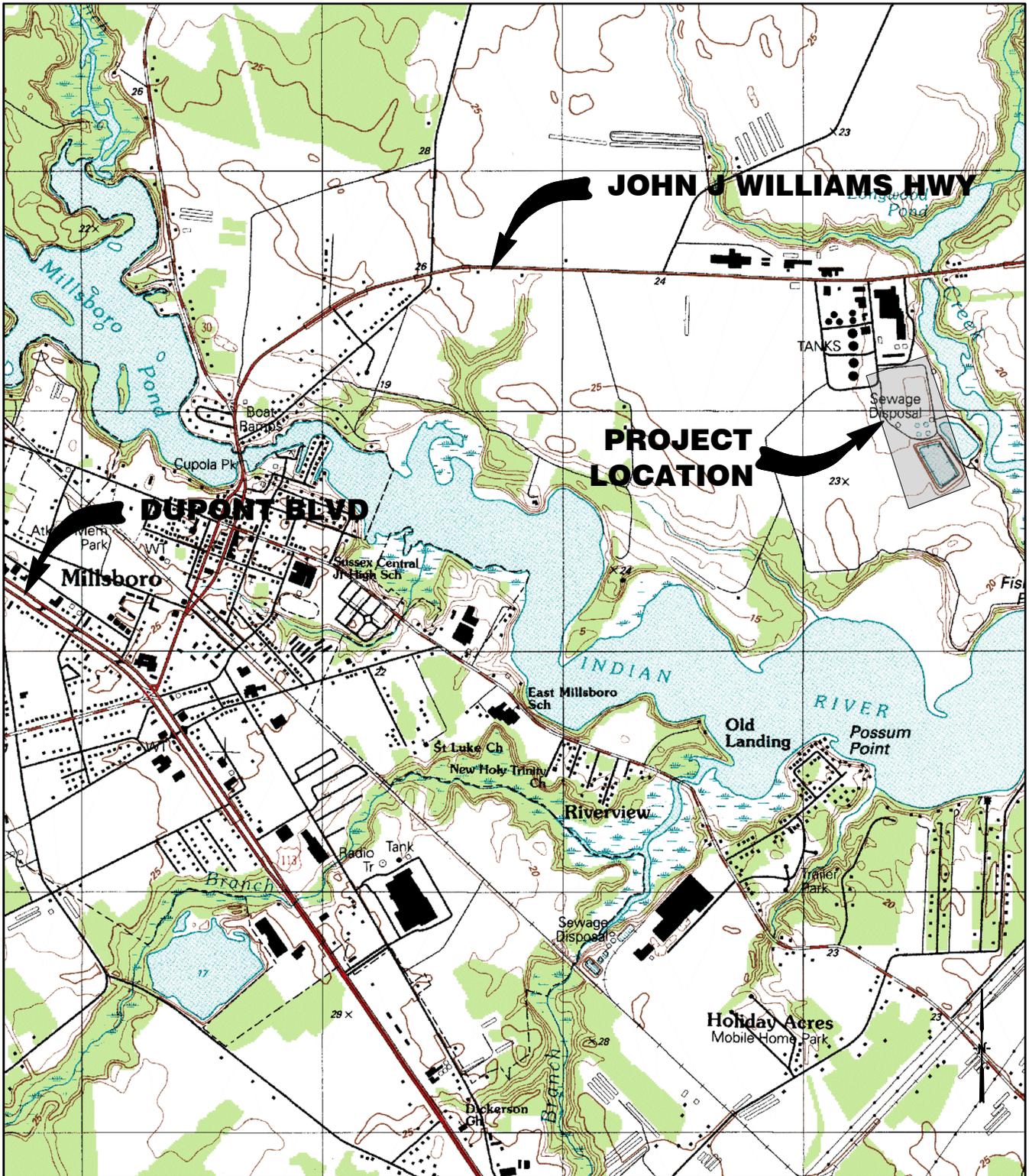
EE. Offspec Water Recycle Plan (Prepared by Mountaire Farms)

1. For Offspec water (except for ultraviolet system issues covered in EE. b.), the system is designed for various stages of handling water. Stages #1 and #2 would be place immediately after installation of the upgrade and an additional Stage #3 will be in effect with the completion of the new final effluent Lagoon.
 - a. Stage #1 would be to implement the alternate spray plan as outlined in Appendix #3 and utilize existing spray fields that have been determined to be able to receive spray irrigated effluent with higher nitrogen concentrations and /or increased hydraulic loading.

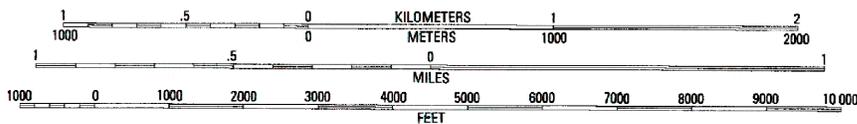
- b. Issues not handled under the Stage #1 plan design, would be handled under our Stage #2 plan. Stage #2 would involve recycling some and/or all material after the BNR System Final Clarifier back to Anaerobic Lagoon #1 for reprocessing through the wastewater system. Flow control valves in the FIPS discharge header can be operated to shut off flow to the Tertiary Filters and open the flow valve to recycle flow back into upstream Anaerobic Lagoon #1.
 - c. In the event of an issue that cannot be handled through Stage #2, we would have the option to move to a Stage #3 emergency plan. This stage would include repurposing the new Final effluent pond to an emergency Offspec water lagoon. Final effluent would be diverted from the existing 20 MG spray Irrigation Storage Lagoon to the new Final effluent pond which would be temporarily repurposed. This offspec water would be pumped back into the BNR system by a future pump station that would be installed, if needed, at a controlled rate for re-treatment in the BNR system.
2. Mountaire will have a back-up chlorination system in place in the event there are any issues with the new ultraviolet system. This would eliminate the potential of Offspec water going to spray fields.

Appendix 1

Location Map



SCALE 1:24 000



MILLSBORO, DEL.
38075-E3-TF-024

1992

DMA 5961 III SE-SERIES V832



REID ENGINEERING COMPANY, INC.

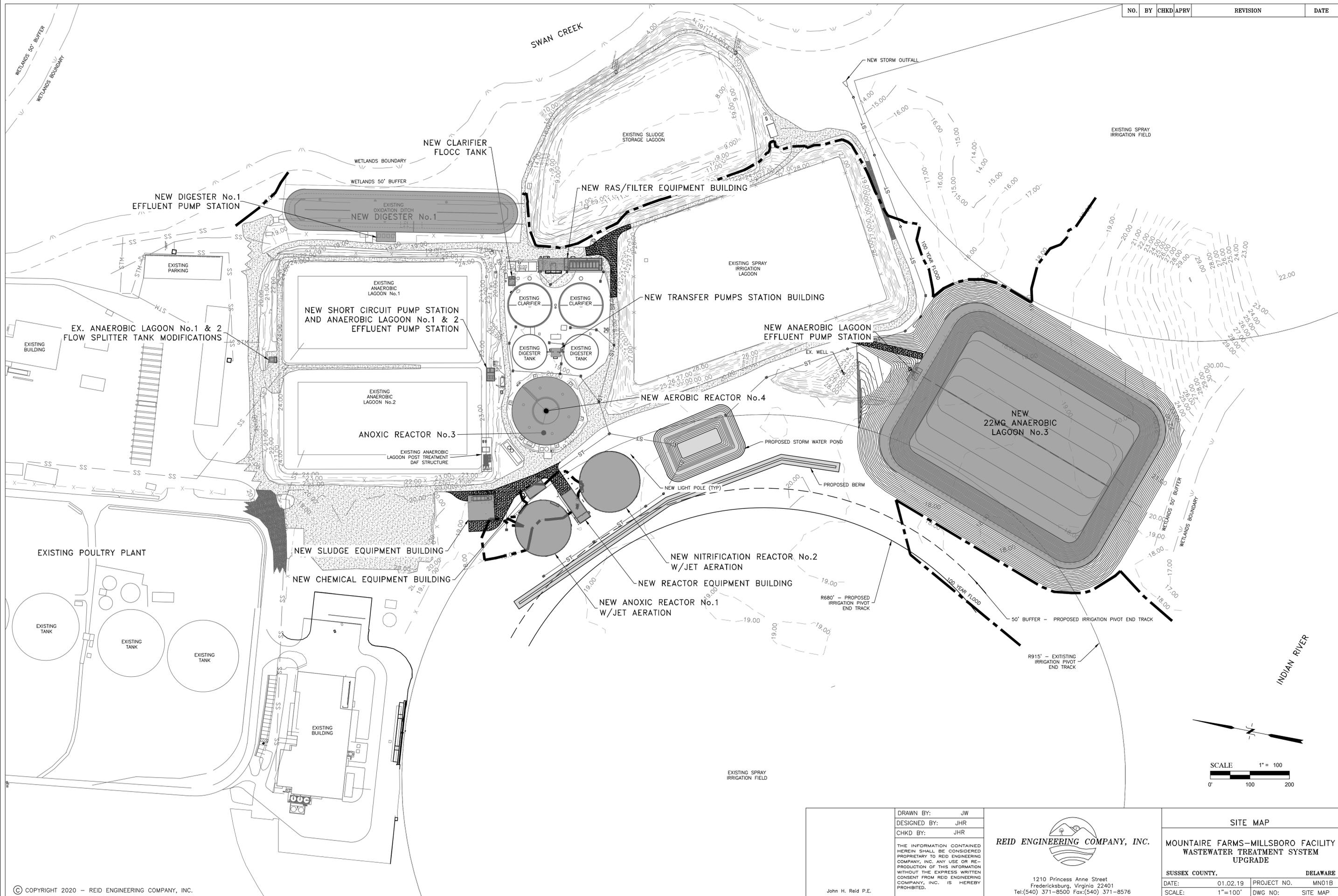
1210 Princess Anne Street
Fredericksburg, Virginia
Phone: 540-371-8500 Fax: 540-371-8576

| | |
|-----------|----------|
| Scale: | 1"=2000' |
| Date: | 12.18.18 |
| Drawn by: | BWF |
| Dwg No: | FIG.1 |

LOCATION MAP
MOUNTAIRE FARMS COMPANY
SUSSEX COUNTY, DELAWARE

Appendix 2

Site Map



DRAWN BY: JW
 DESIGNED BY: JHR
 CHKD BY: JHR
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 John H. Reid P.E.

REID ENGINEERING COMPANY, INC.

 1210 Princess Anne Street
 Fredericksburg, Virginia 22401
 Tel:(540) 371-8500 Fax:(540) 371-8576

| SITE MAP | |
|---|-------------------|
| MOUNTAIRE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | |
| SUSSEX COUNTY, DELAWARE | PROJECT NO. MNO1B |
| DATE: 01.02.19 | DWG NO: SITE MAP |
| SCALE: 1"=100' | |

Appendix 3

Nitrogen Balance and Storage Calculations



**Design Engineer Report and
Vegetative Management Plan Update
for
Spray Irrigation of Treated Wastewater**

Submitted by:

Mountaire Farms of Delaware Inc.
Millsboro Processing Complex
P.O. Box 1320
Route 24 East
Millsboro, Delaware 19966

Contributing Authors:

Duffield Associates
Dover, Delaware

Keen Consulting
Georgetown, Delaware

Earth Data Incorporated
Centreville, Maryland

February 2020

Table of Contents

| | |
|---|----|
| 1.0 Introduction | 1 |
| 2.0 Background..... | 2 |
| 3.0 Spray Specific Design Data..... | 5 |
| 4.0 Vegetative Management Plan..... | 10 |
| 5.0 Active Spreadsheet..... | 11 |
| 6.0 Spray Irrigation Contingency Plans..... | 12 |
| 7.0 Monitoring..... | 13 |

Figures and Attachments

Figure 1 - Location Map

Attachment A - Current Spray Irrigation Permit

Attachment B – Water Balance

Attachment C – Phosphorus Balance

Attachment D – Metals LLC Analysis

Attachment E – Operating History 2014-2019

Attachment F – Irrigation System Map (North and South Fields)

Attachment G – Vegetative Management Plan

Attachment H - Active Spreadsheet for Average Conditions

Attachment I - Active Spreadsheet for Increased Flow

Attachment J - Active Spreadsheet for Reduced Wetted Area

Attachment K - Active Spreadsheet for Increased Effluent Total Nitrogen

Attachment L - Active Spreadsheet for Extreme Wet Weather Events

1.0 INTRODUCTION

The following presents the 2020 Design Engineer Report and update to the Vegetative Management Plan for Spray Irrigation of Treated Wastewater at the Millsboro Processing Complex of Mountaire Farms of Delaware, Inc. (Mountaire). The original plan was prepared by George, Miles & Buhr in 2003. This plan was updated in 2019 with the assistance of Duffield Associates of Dover, Delaware; Keen Consulting of Georgetown, Delaware; and Earth Data Incorporated of Centreville, Maryland.

Mountaire owns and operates a poultry processing operation near Millsboro, Delaware. As part of this operation wastewater generated at the processing plant and support facilities is treated at an onsite wastewater treatment plant. Mountaire is upgrading the treatment plant to provide improved effluent quality. A separate Design Engineer Report prepared by Reid Engineering Inc., and hereinafter referred to as the Reid Report, describes the wastewater treatment plant upgrade. Some assumptions included herein are based on the Reid Report. Treated wastewater is irrigated on a cropland adjacent to the wastewater plant that is also part of the Millsboro complex. This document includes design and operation data for the effluent disposal system at the Millsboro plant including the effluent pumping, distribution, and irrigation systems. This document also includes crop management information typically referred to as a Vegetative or Nutrient Management Plan.

This is a guidance document intended to document the interrelationships between processing, wastewater treatment and farming operations. It also identifies critical operational concerns and provides guidance as to how processing plant, wastewater and farming operations can be best managed to provide environmentally sound land application of the treated wastewater. It is focused on the management practices for the croplands used to land apply treated wastewater through the facility's spray irrigation system.

2.0 BACKGROUND

2.1 Site History

In May 2000 Mountaire Farms of Delaware, Inc. purchased the Townsends Poultry plant located in Millsboro, Delaware. The Millsboro facility includes a poultry processing plant, a resource recovery facility, hatchery, grain handling, feed mill and associated trucking, transportation garage, farming and administrative facilities. It is located approximately 2.0 miles east of the Town of Millsboro on approximately 2,000 acres along Route 24 (Figure 1). The facility includes approximately 1,566 acres of cropland for production of cash crops using a corn-small grain-soybean-cover crop rotation system. Treated wastewater can be irrigated on 893 acres.

The facility has a long history of using its byproducts for beneficial purposes. There are several permits regulating such activities which center on the wastewater treatment plant. Examples include using the biological solids produced by the wastewater treatment processes as a soil amendment and nutrient sources to sustain crop growth; and the use of treated wastewater to irrigate the well-drained soils, helping to reduce the amount of irrigation water withdrawn from the groundwater aquifers and again supplementing the available nutrients to enhance crop production.

Originally, treated wastewater was discharged to Swan Creek. In an effort to make beneficial use of the treated wastewater and to reduce any possible environmental impacts on the Creek, the facility began to use the treated wastewater for spray irrigating crops on the lands south of Route 24 ("Centerblock" pivots) in 1978 and north of Route 24 ("WHBJ" pivots) in 1984.

Stream discharges became intermittent and as a level of comfort was developed, stream discharges became seasonal, essentially eliminating the stream discharge except during the winter months when regulatory restrictions on the land application system precluded land application.

In the 1990's, the Delaware Department of Natural Resources and Environmental Control (DNREC) worked cooperatively with the facility management to identify wet and cold weather spray fields where spray irrigation is now allowed on a year-round basis with some restrictions. This was due in part to the facility's land rich situation that allowed distribution of the wastewater across more land at relatively small application rates than was actually needed. When Mountaire Farms purchased the Millsboro Complex from Townsend Inc., Mountaire committed to eliminating the stream discharge per DNREC's request and the spray irrigation permit was modified to designate wet weather fields.

2.2 Existing Groundwater Discharge Permit Requirements

The land application of treated wastewater is regulated through the State permit system administered by DNREC's Groundwater Discharges Section. A copy of Mountaire's active spray irrigation permit (359191-04) is included as Attachment A.

Mountaire's permit contains numerous conditions and requirements for irrigation water quality, sampling, record keeping, monitoring of groundwater wells, etc. Some key elements as they relate to vegetative management and routine operational control include:

- 2.6 MGD monthly average limit on influent to the WWTP
- 2.5 inches per week maximum application rate on the spray fields
- 320 total pounds of nitrogen/acre/year maximum from all sources

In addition to these conditions, the permit also contains requirements related to buffer zones. The design and layout of the irrigation system helps ensure Mountaire's compliance with the mandated buffer requirements. As part of ongoing operation and maintenance (O & M) procedures, not less than annually Mountaire personnel inspect the irrigation facilities to confirm that the buffer zone requirements are being met. As a matter of practice Mountaire also reviews and inspects the buffers any time system stops are modified or updated, or methods of application are changed.

The buffer zone and other requirements are detailed in the State permit and are not specifically restated here. Some requirements in the Special Conditions section of the permit are very specific to the Mountaire operation and spray fields, including some exceptions to the standard requirements. This includes the aforementioned wet weather fields.

3.0 SPRAY SPECIFIC DESIGN DATA

3.1 Effluent Water Quality and Quantity

Please refer to the Reid Report for a summary of Effluent Water Quality and Quantity.

3.2 Water Balance/Determination of Design Wastewater Loading

EarthData Inc. was retained by Mountaire to complete soil infiltration testing in September and October 2019 based on a workplan approved by DNREC. The soils that make up the irrigation fields at the Millsboro complex are mostly well drained loamy sands with high percolation rates and low moisture holding capabilities. Previous soils investigations determined that infiltration rates ranged from 2.25 to 17 inches per hour. The recent testing resulted in measured infiltration rates ranging from 0.13 to 14.49 inches per hour. The overall average infiltration rate measured by EarthData was 4.02 in/hr.

The infiltration test results were used in water balance calculations to determine maximum monthly hydraulic loading rates (L_w) based on current soils conditions as shown on Attachment B. A safety factor of 7% was applied to measured rates due to variability observed during soil testing. Attachment B also includes calculation of allowable hydraulic loading based on maintaining a monthly percolate nitrogen of less than 10 mg/l during years when small grain and soybeans are grown (this condition represents the most conservative crop uptake scenario for nitrogen). As shown on Attachment B allowable loading rates based on percolate N requirements, not soil infiltration rates, are limiting at this facility. Allowable loading rates based on percolate N requirements exceed the regulatory maximum of 2.5 inches per week for every month. Loading rates can also be limited by Phosphorus or metals.

3.2 Phosphorus and Other Constituent Metal Loading Rates

Based on current soil P levels, the site's nutrient management plan recommends that effluent phosphorus be reduced to crop removal amounts. Attachment C includes calculations

of annual phosphorus loading rates based on effluent Total P concentrations ranging from 0.5 to 5.0 mg/l and irrigation rates ranging from 2.0 to 2.6 mgd. The most conservative scenario in regards to crop P uptake is based on a year in which corn is grown. Corn is preceded by a cover crop which is not harvested and therefore does not contribute to an overall P reduction through crop removal. Annual Corn phosphorus uptake based on DNREC standard values is 26.18 lb/ac/yr (Total P basis) for a yield of 150 bushels/acre. To comply with nutrient management recommendations, effluent Total P should be maintained at concentrations of 3.0 mg/l or less for effluent flows of 2.6 mgd.

Land limiting constituent calculations for metals (Cadmium, Copper, Lead, Nickel, Zinc) is provided on Attachment D. The soils ability to assimilate metals is assumed to be related to Cation Exchange Capacity (CEC), which was measured in 2018 as part of routine soil sampling. Effluent sampling completed in February, 2019 included analysis for metals. The LLC analysis for metals indicates that the site life is 186 years and that the limiting constituent is Cadmium.

3.3 Spray Irrigation Facilities, Wetted Area and Storage

Treated wastewater is discharged using 13 center pivot irrigations systems which are typically operated 24 hours per day, 7 days per week. Weather and farming do affect operations; however, irrigation downtime is mitigated because Mountaire has significant irrigation capabilities beyond the minimum requirements for their design flow. Mountaire operations staff completed an analysis of the previous five (5) years operational and weather data in August 2019. The analysis included as Attachment E, demonstrates that the irrigation systems are operated, on average from 23 to 28 days per month as summarized below.

| Month | Average Operating Days per Month |
|----------|----------------------------------|
| January | 26 |
| February | 23 |
| March | 26 |
| April | 26 |

| | |
|-----------|----|
| May | 25 |
| June | 25 |
| July | 24 |
| August | 28 |
| September | 24 |
| October | 26 |
| November | 27 |
| December | 26 |

When the wastewater treatment plant upgrade is completed, effluent will be pumped to the spray irrigation storage lagoon after the new UV disinfection process. The capacity of the storage lagoon affords the operators the flexibility to spray at specific times during the day or to skip a limited number of days as needed. A total of 21.3 million gallons operational storage is available between the lagoon high (HWL) and low water levels (LWL). The lagoon has a surface area of 5.36 acres. Mountaire plans to construct an additional storage lagoon in the future that will be at least 22 MG.

Wastewater leaves the storage lagoon via a spray irrigation pumping station that is equipped with four (4) pumps - three (3) operating pumps and one (1) standby pump. Pumping capacity with all three (3) operating pumps on is 3,300 gpm. The pumping station discharges into an irrigation main distribution system that extends throughout the fields. Valves in the pump discharge header, throughout the distribution system and at each pivot are used to select which fields will be irrigated on a daily basis. Irrigation volumes are measured by magnetic type flow meters located at each pivot. The operations staff observe metered volumes and record them daily on digital spreadsheets.

Mountaire has 893 wetted irrigation acres in 13 fields, each with its own center pivot system. The North Spray Fields (Attachment F) include the following seven fields:

Mountaire Farms of Delaware
Design Engineer Report and Vegetative Management Plan Update

| Field | Wetted Area (ac) | Design Flow (gpm) |
|---------|------------------|-------------------|
| WHBJ #1 | 54.29 | 850 |
| WHBJ #2 | 65.33 | 850 |
| WHBJ #3 | 78.00 | 780 |
| WHBJ #4 | 76.84 | 850 |
| WHBJ #5 | 64.42 | 850 |
| WHBH #6 | 72.91 | 800 |
| WHBJ #7 | 199.54 | 1750 |

The South Spray Fields (Attachment F) include the following six fields:

| Field | Wetted Area (ac) | Design Flow (gpm) |
|---------------|------------------|-------------------|
| Block 3 | 40.84 | 850 |
| Block 3A | 28.97 | 850 |
| Block 3B | 64.24 | 850 |
| Block 3C | 64.72 | 800 |
| Block 3D East | 41.56 | 850 |
| Block 3D West | 41.97 | 850 |

Note: Wetted areas shown on Attachment F for system Block 3 will change to the figures above due to anticipated irrigation pivot changes associated with the treatment plant upgrade.

The following summary of flow related design constraints is based on existing soil conditions observed during recent testing, allowable application rates based on regulatory limits, available wetted irrigation area and capabilities of the irrigation system.

- 1 Allowable flow based on soil infiltration testing -
3.9 inches per day or 94,409,032 gallons per day on 893 acres.

2. Allowable flow based on regulatory limits -
2.5 inches per week or 8,645,516 gallons per day on 893 acres
(WHBJ1, WHBJ3, WHBJ5, CB3 and CB3C have a slightly reduced rate based on recent infiltration testing.)
3. Capacity of irrigations pivots -
Northern fields (North of Route 24) – 6,730 gpm
Southern fields (South of Route 24) – 5,050 gpm
4. Pumping capability (Maximum Daily Flow) -
4,752,000 gpd or 3,300 gpm
5. WWTP average design flow –
4,000,000 gpd or 2,778 gpm
6. Irrigation average design flow -
2,600,000 gpd or 1,805 gpm

The soils at the Mountaire site have measured infiltration rates (with a large safety factor applied) much greater than the design flows, the regulatory maximum flow, and capabilities of the irrigation pumping system. The large available wetted area provides operational flexibility. Mountaire has 13 irrigation systems. Up to 3 systems are required to be operated daily to eliminate the average daily flow (irrigation) and up to 5 systems can be operated to eliminate the maximum daily flow.

4.0 Vegetative Management Plan

A copy of Mountaire's Nutrient Management Plan (NMP), prepared by Keen Consulting, is included as Attachment G. The NMP includes a discussion of crop types; crop planting sequence; anticipated crop yield; timing and application rates of commercial fertilizers; planting and harvesting timelines; cover crops; and nitrogen and phosphorus balances used for nutrient planning purposes.

5.0 Active Spreadsheet

The Active Spreadsheet included as Attachment H was completed using DNREC's standard template and includes all information required in Section 6.5.1.4.1.7.6.9 of the Regulations. The Active Spreadsheet is based on design criteria included in the preceding text or referenced documents, DNREC guidance documents and regulatory standard values. The Active Spreadsheet demonstrates that Mountaire can comply, under normal operating conditions, with a maximum monthly percolate nitrogen concentration of 10 mg/l when irrigating an average of 2.6 mgd treated effluent on 893 acres farmed on the corn-small grain-soybean-cover crop rotation system. Specific variances from normal operating conditions are discussed in Section 6.0.

6.0 Spray Irrigation-Contingency Plans

As discussed in Section 5.0 the active spreadsheet is based on design assumptions that represent average design conditions. Mountaire's operating staff are required to adjust operations as necessary to deal with irregular conditions such as farm or crop related issues, extreme weather events, off specification effluent, and temporary flow variations. For each of these scenarios, an additional active spreadsheet was created using different assumptions that represent irregular operating conditions. Each scenario is described in more detail below.

Attachment I modifies the assumption that 2.6 mgd will be applied monthly year round with no supplemental fertilization and considers an increased effluent flow of up 4.0 mgd every month with supplemental fertilization of 119 lb/ac/yr and 70 lb/ac/yr on corn and soybeans respectively.

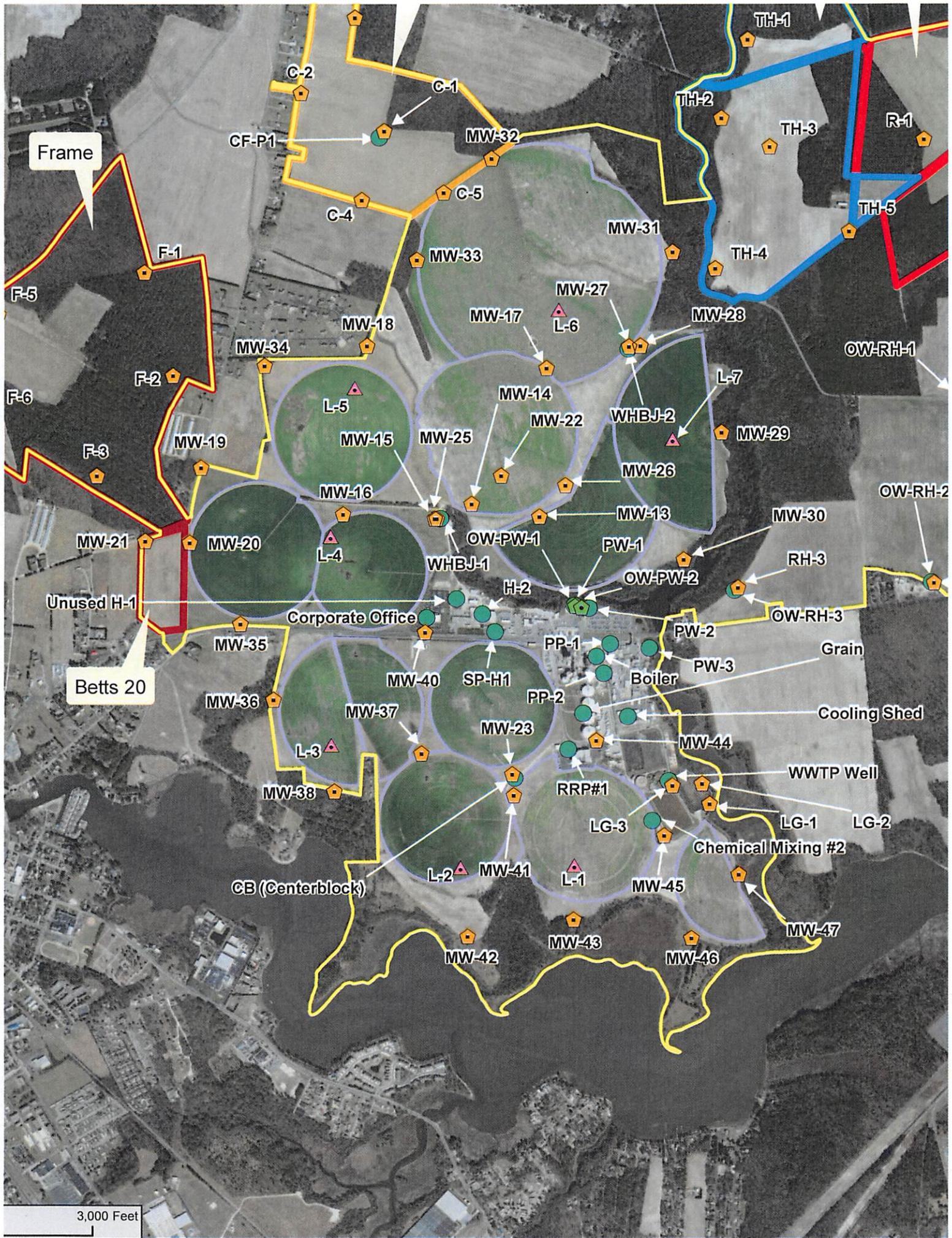
Attachment J modifies the assumption that 2.6 mgd will be applied monthly year round and considers a scenario in which the regulatory maximum 2.5 inches per week is applied every month at rates up to 4.0 mgd. This scenario also assumes that supplemental fertilization occurs at rates included on the previous scenario. As shown on Attachment J this scenario requires only 420 of the total available wetted acres and does not result in percolate nitrogen concentrations exceeding 10 mg/l. Fields WHBJ1, WHBJ3, WHBJ5, CB3 and CB3C, which had a maximum percolation rate of less than 2.5 inches per week when Earth Data performed the infiltration testing are not needed as part of the 420 acres.

Attachment K modifies the assumption that 2.6 mgd will be applied monthly year round and considers a scenario in which the effluent nitrogen concentration is as high as 14.5 mg/l and irrigated at rates up to 4.0 mgd. With abnormally high effluent, no supplemental fertilization is applied. This analysis does not result in percolate nitrogen concentrations exceeding 10 mg/l.

Finally, Attachment L is an active spreadsheet prepared on a four (4) week rather than 12 month basis. This analysis assumes that the entire irrigation system is shut down during a winter period (January) for an entire week. The analysis demonstrates the full storage volume can be eliminated over the next two weeks by irrigating up to the regulatory maximum of 2.5 inches per week without percolate nitrogen issues.

7.0 Monitoring

Part II of the existing permit included in Attachment A depicts the location of monitoring wells and lysimeters and summarizes required effluent, groundwater and soil monitoring required. Only one change to the current plan is proposed, Total Residual Chlorine will no longer be required due to installation of the UV systems.



Spray Irrigation Operations Permit

Issued by: Groundwater Discharges Section
Division of Water
Department of Natural Resources
and Environmental Control
89 Kings Highway
Dover Delaware 19901
302-739-9948

DEN Number: 359191-04
Effective Date: July 31, 2017
Expiration Date: July 30, 2022



AUTHORIZATION TO OPERATE AND MAINTAIN
UNDER THE LAWS OF THE
STATE OF DELAWARE

PERMITTEE: **Mountaire Farms of Delaware, Inc.**
P.O. Box 1320
Millsboro, Delaware 19966

FACILITY: **Mountaire Farms of Delaware, Inc.**

1. Pursuant to the provisions of 7 Del. C. §6003, **Mountaire Farms of Delaware, Inc.** is herein authorized to operate and maintain the facility known as **Mountaire Farms of Delaware, Inc.** located on Route #24, approximately 2.0 miles east of Millsboro, Sussex County, Delaware to spray irrigate treated poultry processing wastewater and treated sanitary waste to an area north of State Route #24 "WHBJ" consisting of 619 acres and to areas south of State Route #24 "Center Block System" consisting of 343 acres.
2. The effluent limitations, monitoring requirements and other permit conditions are set forth herein.

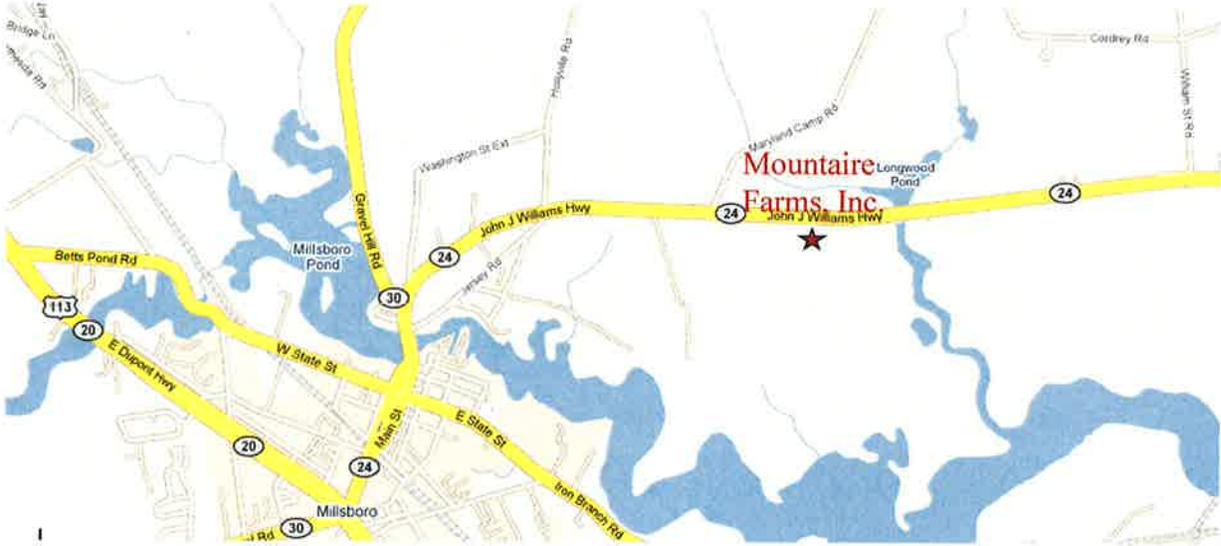


John G. "Jack" Hayes, Jr.
Environmental Program Manager
Groundwater Discharges Section
Division of Water
Delaware Department of Natural Resources
and Environmental Control



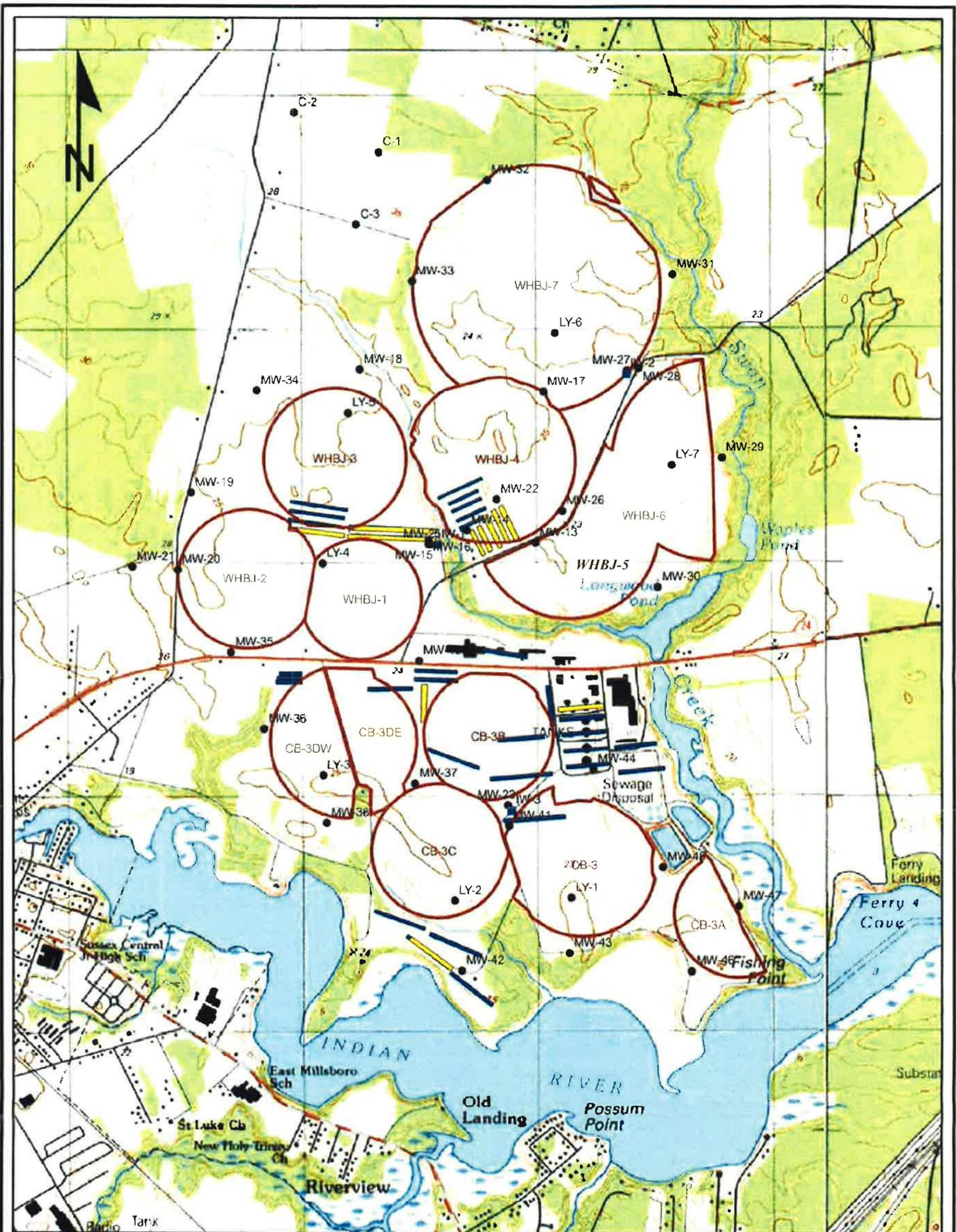
Date Signed

LOCATION MAP



SITE MAP -- Labeling of *WHBJ-5* superimposed by the GWDS

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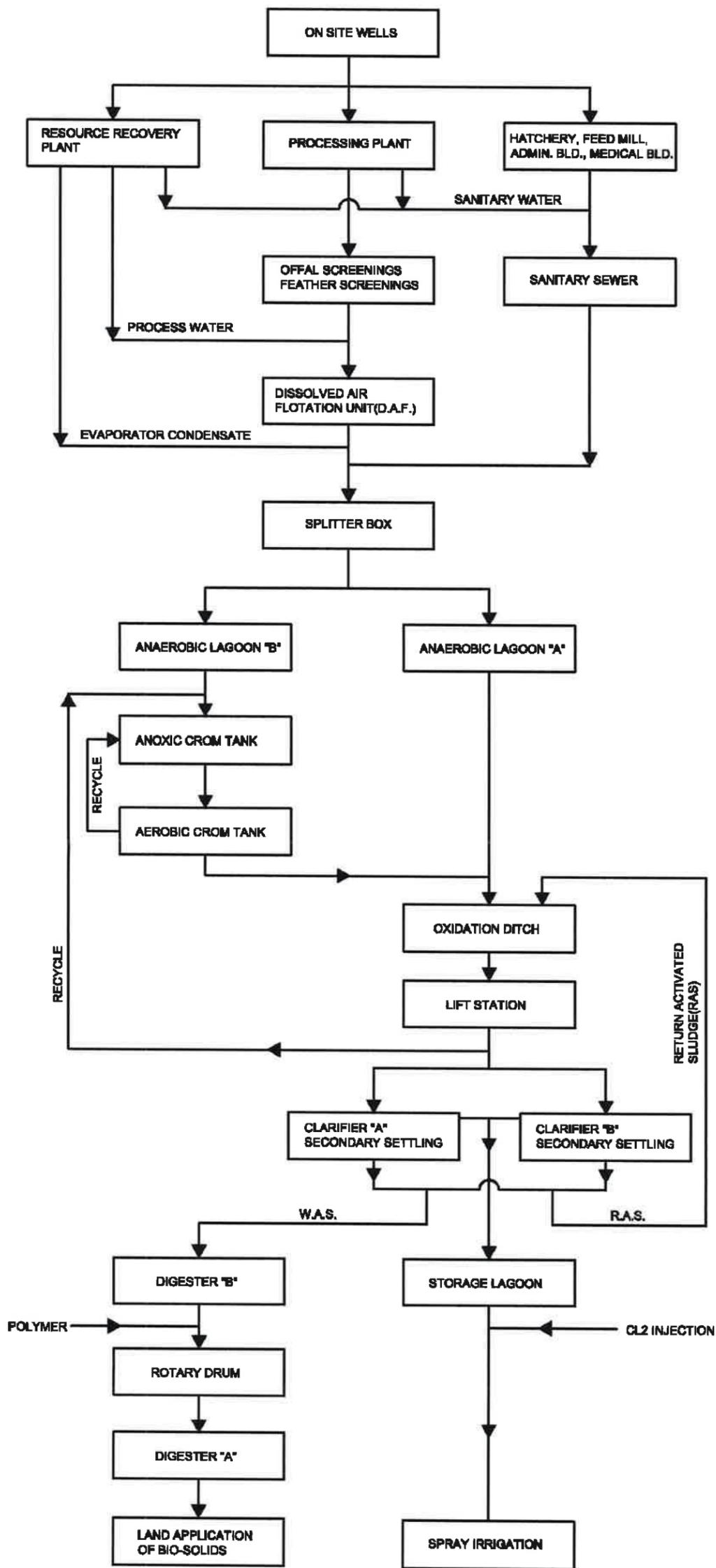


Note: Chicken houses shown in study area were digitized from 1954 and 1992 USGS 7.5 minute quadrangles for Millsboro, Delaware. All chicken houses shown have been abandoned.

| | | | |
|---|--|--|--|
| <p>Water • Land • Geospace Solutions for Tomorrow. Today.</p> | Explanation | | |
| | <ul style="list-style-type: none"> ■ Irrigation Wells ● Monitoring Points Pivot Spray Areas | <ul style="list-style-type: none"> Existing 1954 Existing 1992 | |

Figure 1: USGS 7.5 minute quadrangle map for Millsboro, Delaware showing the location and topography of the site and surrounding area (created 1954, Photorevised 1992)

PROCESS FLOW DIAGRAM



| | | | | |
|-------|----------------------------|------------------------------|--------------------------|---|
| SHEET | SCALE: N/A | WASTEWATER | DATE: 02/05/13 REV: 1 |  |
| | DRAWING # | PROCESS FLOW DIAGRAM | | |
| | LOCATION: MILLSBORO, DE | DRAWN BY: SEH REVISED BY: | | |

PART I

A. GENERAL DESCRIPTION OF OPERATION/DISCHARGES

The treatment facility is designed to treat poultry processing wastewater and sanitary waste. The treatment process includes: primary and secondary screening, dissolved air flotation (DAF), anaerobic lagoon biological treatment/equalization (2 lagoons), activated sludge biological treatment with biological nutrient reduction capability – Modified Ludzack-Ettinger (MLE), secondary clarification (2 units), sludge digestion and thickening, disinfection (chlorination) and a post treatment spray irrigation storage lagoon.

The treated effluent is spray irrigated onto approximately 928 acres. Seven center pivot spray irrigation systems are located north of State Route #24 and are designated as WHBJ Systems Nos. 1, 2, 3, 4, 5, 6, 7. And, six center pivot spray irrigation systems are located south of Route #24 and are designated as Center Block Systems Nos. 3, 3A, 3B, 3C, 3DE and 3DW.

The fields are maintained in corn, small grains (barley and wheat), and soybeans.

Approximately 542 acres are permitted for wet and cold weather use.

Spray Field Listing per 2017 Vegetative Management Plan Update Attachment D:

Spray Field Listing

| Spray Field | Irrigated Acres | Irrigated Acres by Farming Group | Tilled Acres by Farming Group | % Irrigated Acreage | Wet Weather Approved | Wet Weather Acres | 2.5 "/wk (gals) |
|---------------------|-----------------|----------------------------------|-------------------------------|---------------------|----------------------|-------------------|-------------------|
| Centerblock 3 * | 75.33 | 104.30 | 133.00 | 78.4% | Yes* | 60.00 | 5,105,294 |
| Centerblock 3A | 28.97 | | | | | - | 1,963,366 |
| Centerblock 3B | 64.24 | 170.52 | 202.00 | 84.4% | Yes | 64.24 | 4,353,698 |
| Centerblock 3C | 64.72 | | | | Yes | 64.72 | 4,386,229 |
| Centerblock 3D East | 41.56 | | | | Yes | 41.56 | 2,816,621 |
| Centerblock 3D West | 41.97 | 41.97 | 48.00 | 87.4% | Yes | 39.20 | 2,844,407 |
| WHBJ 1 | 54.29 | 119.62 | 150.00 | 79.7% | Yes | 54.29 | 3,679,363 |
| WHBJ2 | 65.33 | | | | Yes | 65.33 | 4,427,570 |
| WHBJ 3 * | 78.00 | 78.00 | 101.00 | 77.2% | Yes* | 59.00 | 5,286,246 |
| WHBJ 4 * | 76.84 | 76.84 | 101.00 | 76.1% | Yes* | 74.00 | 5,207,630 |
| WHBJ 5 | 64.42 | 137.33 | 165.00 | 83.2% | - | - | 4,365,897 |
| WHBJ6 | 72.91 | | | | - | - | 4,941,285 |
| WHBJ7 | 199.54 | 199.54 | 231.00 | 86.4% | - | - | 13,523,303 |
| | 928.12 | 928.12 | 1131.00 | 81.6% | | 542.03 | 62,900,911 |

*Portions of fields not allowed during wet/frozen weather. Area reduction estimated.

B. DOCUMENTATION

The slow rate land treatment operation shall be conducted in accordance with the following documents:

1. The State of Delaware, Department of Natural Resources and Environmental Control's Regulations Governing the Design, Installation and Operation of On-Site Wastewater Treatment and Disposal Systems, (Regulations).
2. The Operations and Management Plan submitted by Townsends Inc., during 1988.
3. The letter to Ronald E. Graeber from Metcalf and Eddy dated July 26, 1989 addressing the plan of action for the effluent disinfection system.
4. The letter to Gordon Serman from Bruce B. Bagley dated August 15, 1995 asking Townsends Inc. to address several outstanding issues.
5. The letter to Bruce B. Bagley from Robert A. Palczewski dated October 13, 1995 addressing the decreased buffer zone distance and monitoring plan.
6. A letter to Joseph Mulrooney from Bruce Stephens dated August 5, 1997 identifying wet weather irrigation fields at the Townsends treatment facility.
7. A Detail Soil Investigation for Cordrey and Frame Farms dated February 1999 submitted by Bradley Cates.
8. A report submitted by Bruce Stephens from James E. Havey dated March 23, 1999 addressing the treatment capacity of the Townsend's wastewater treatment capability and future wastewater treatment needs.
9. Plans and Specifications dated June 2, 1999 submitted by Metcalf and Eddy detailing treatment plant upgrades to increase future treatment capacities.
10. A report submitted by Gordon Serman to Doris Hamilton on August 24, 1999 identifying the wet weather spray irrigation fields.
11. A letter dated April 7, 2000 from George C. White notifying DNREC of the sale of the Townsend Facility to Mountaire Corporation.
12. A letter to Bruce B. Bagley from Jeff Smith dated November 8, 2002 providing detailed calculations on the Stormwater Improvement Project and site plan of the facility.
13. A Vegetative Management Plan for Spray Irrigation of Treated Wastewater prepared by George, Miles and Buhr, LLC dated January 31, 2003.
14. A Spray Irrigation Permit Application submitted by Mountaire Farms, Inc. on October 23, 2008.
15. The Design Development Report Addendum 2011 Wastewater Treatment Improvements submitted by CABA Associates, Inc. dated December 7, 2010.
16. Any other correspondence, documentation and/or reports related to the **Mountaire Farms of Delaware, Inc. Wastewater Treatment Facility** received and approved by the Groundwater Discharges Section and/or sent by the Groundwater Discharges Section.

C. INFLUENT LIMITATIONS

1. The monthly average influent to the wastewater treatment facility shall not exceed 2.6 million gallons per day in any calendar month calculated as Total Monthly Volume divided by the number of days in the month.

The connection of additional units or waste streams other than those indicated in the approved design documents referenced in Part I.B is prohibited without prior written approval from the Groundwater Discharges Section.

Design Treatment Capacity: 2.6 MGD Monthly Average [calculated as Total Monthly Volume divided by the number of days in the month]

D. SPRAYED EFFLUENT LIMITATIONS

During the period beginning on the effective date and lasting through the expiration date of this permit, the Permittee is authorized to discharge to the spray irrigation field(s) identified on page 1, in Part I.A, and depicted on page 3 of this permit the quantity and quality of effluent specified below and in accordance with the design documents listed in Part I.B of this permit:

1. The monthly average quantity of effluent discharged from the wastewater treatment facility to the spray fields shall not exceed 2.6 million gallons per day (MGD) calculated as Total Monthly Volume divided by the number of days in the month.
2. The average weekly quantity of effluent discharged to any portion of the spray irrigation field shall not exceed 2.5 inch per acre averaged over a 7 day rolling period.
3. The quantity of effluent discharged to any portion of the spray irrigation field shall not exceed 0.25 inch/acre/hour.
4. There shall be a minimum of a three hour rest period between applications of wastewater to the spray fields when the center pivot systems (WHBJ 4, 5, 6, Center Block 3A, 3D east and west) contact any permanent end stop. On all other spray fields, there shall be a sufficient rest period between applications to prevent field saturation and runoff from occurring in any part of the field.
5. The pH of the effluent shall not be less than 5.5 standard units nor greater than 9.0 standard units at any time.
6. The total residual chlorine concentration shall not be less than 1.0 mg/L nor more than 4.0 mg/L at any time.
7. The Chloride concentration of the effluent shall not exceed 250 mg/L on an average annual basis.
8. Design Effluent Nitrogen Concentration:

The facility has been designed for a monthly effluent Total Nitrogen concentration of 15.6 mg/L.¹

If the effluent exceeds a Total Nitrogen concentration of 19.5 mg/L [Design Value + 25%] in any calendar month, the permittee shall resample the wastewater and submit the additional analyses to the Groundwater Discharges Section. If the effluent exceeds 19.5 for over a three month period, the permittee must have the system evaluated to determine the cause and submit a revised Design Engineer Report to the Groundwater Discharges Section. If the effluent exceeds 29.3 [Design Value +50%], the Department may invoke the provisions of Part V.A.1 of this permit. [Also reference Part II.B.1.]

¹ Design Effluent Nitrogen Concentration is in accordance with Page 2 and Attachment B Page 1 and 2 of the Design Development Report Addendum 2011 Wastewater Treatment Improvements submitted by CABE Associates, Inc. dated December 7, 2010.

9. The total amount of nitrogen that may be applied to each spray field acre shall not exceed the following amounts. These amounts include supplemental fertilizers, the nitrogen supplied from the effluent, and any other source.

| Spray Field Crop Type | Nitrogen Loading Limit ² |
|--------------------------|-------------------------------------|
| Corn and Small Grain | 320 lbs/acre |
| Soybeans and Small Grain | 320 lbs/acre |

Adjustments and reductions for denitrification, ammonia volatilization, evapotranspiration and plant uptake are **not** to be factored into the annual reporting of Total Nitrogen Loading for demonstration of compliance with this limit.

If any crops are not removed from the spray irrigation fields, then the total nitrogen application rate for the field must be reduced by the amount of nitrogen that would be removed by harvesting the crop as detailed in the facility's Design Engineer Report.

The limitation of total nitrogen that can be applied to each acre may be adjusted by the Groundwater Discharges Section if it can be shown through subsequent analysis of the crop removed that the total nitrogen removed with the crop is equal to the amount applied from the effluent and additional fertilizer applications. Supplemental additions of commercial fertilizers shall be limited to amounts necessary to meet crop needs in accordance with the written recommendations of the University of Delaware Cooperative Extension Service, or a Delaware Certified Crop Advisor, for the specified crop and anticipated yield.

10. The discharge to the spray irrigation fields shall be free from material such as floating solids, sludge deposits, debris, scum, oil and grease.
11. The facility has been designed for limited public access. The treated wastewater utilized for limited public access sites must meet the following daily permissible average concentrations. The daily average concentration shall be determined by the summation of all the measured daily concentrations obtained from composite samples divided by the number of days during the calendar month when the measurements were made.
- The 5-day Biochemical Oxygen Demand (BOD₅) of the treated wastewater must not exceed 50 mg/L.
 - Disinfection of wastewaters containing domestic waste is required to yield a discharge not to exceed 200 col/100 mL Fecal Coliform.
 - The treated wastewater must not contain more than 50 mg/L of Total Suspended Solids.

| Parameter | Daily Permissible Average Concentration |
|------------------------|---|
| BOD ₅ | 50.0 mg/L |
| Fecal Coliform | 200 colonies/100 mL |
| Total Suspended Solids | 50 mg/L |

E. FACILITY CLASSIFICATION

1. A classification was performed on the permitted facility in accordance with Regulations Licensing Operators of Wastewater Facilities. The wastewater treatment system is designated as a Class IV Facility. The facility must be under the direction of a Class IV Licensed Operator in Direct Responsible Charge for the facility who is available at all times. A licensed operator, operating under the direction of the licensed operator in Direct Responsible Charge for the facility, must be available when the spray irrigation system is in operation.

² Nitrogen Loading Limit in accordance with Attachment B, Page 3 of the Design Development Report Addendum 2011 Wastewater Treatment Improvements submitted by CABE Associates, Inc. dated December 7, 2010.

F. SCHEDULE OF COMPLIANCE

1. The Permittee shall submit the information necessary and/or complete the following requirements for proper compliant operation of the spray irrigation system:
 - a. Effluent Total Nitrogen concentration:
 - i. By October 31, 2017, the Permittee must return Mountaire Farms of Delaware, Inc.'s effluent Total Nitrogen concentration to within 25% of the design value of 15.6 mg/L in accordance with the Design Development Report Addendum 2011 Wastewater Treatment Improvements submitted by CABE Associates, Inc. dated December 7, 2010.
 - ii. By August 31, 2017, the Permittee must submit to the Groundwater Discharges Section a Plan of Corrective Action. The Plan must include proposed efforts to investigate the cause of the elevated Total Nitrogen concentration in the effluent, proposed modifications to the system, and a timeline for implementing proposed modifications.
2. The Permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance by specified date. In the event of noncompliance, the notice shall include the cause of noncompliance, any remedial action taken, and the probability of meeting the next scheduled requirement.

G. BUFFER REQUIREMENTS

Buffer zones must be maintained in accordance with Section 6.3.2.3.10 of the Regulations unless otherwise specified below.

1. A buffer zone of at least 50 feet shall be maintained between the edge of the wetted field area and all highways, individual lots and property lines.
2. A buffer zone of 50 feet shall be maintained between the wetted edge of the spray field and the edge of any wetlands or any perennial lake or stream provided that the buffer zone is maintained in perennial vegetation, otherwise a buffer zone of 100 feet shall be maintained.
3. Spray irrigation of wastewater in the reduced buffer areas along Route #24 and County Road 304 shall only occur during daylight hours.

H. SLUDGE HANDLING REQUIREMENTS

In accordance with AGU 1402-5-03 and AGU 1403-5-03 issued by DNREC's Surface Water Discharges Section (302) 739-9946.

I. FACILITY SPECIFIC CONDITIONS

1. Spray irrigation is prohibited when saturated or frozen soil conditions exist, except on fields identified by the Department as "wet weather irrigation fields." No runoff of wastewater from the spray fields may enter adjacent properties, tax ditches or other water bodies. Pivot #'s CBS# 3, 3B, 3C, 3D east, 3D west (except for a portion of CBS# 3 which is adjacent to Indian River) and WHBJ 1, 2, 3 and 4 (except for portions of the WHBJ 3 and 4 spray areas along the ditch that runs west to east along these systems) have been designated as "wet weather irrigation fields."
2. If down-gradient water supply wells (public or private) are contaminated by the wastewater spray irrigation process, the permittee shall provide a free, alternative potable water supply to the affected parties.
3. The permittee shall track the wind direction to ensure that no spray drift occurs to roadways during irrigation. If wind conditions are such that spray drift could occur over roadways, then all spray irrigation activities shall cease in those fields.

4. The irrigation pump station shall be kept free from accumulated solids, debris or sludge deposits.
5. Use of the spray irrigation system for the application of pesticide products shall be conducted in accordance with approved standards for sprinkler chemigation.
6. Commercial phosphorus fertilizer applications should be limited to starter fertilizer for corn if soils tests show that it is necessary (per Jan 2015 CMR - Soils Recommendations page 9).

PART II

A. MONITORING REQUIREMENTS

During the period beginning on the effective date and lasting through the expiration date of this permit, the Permittee is authorized to discharge to spray irrigation fields identified on page 1, in Part I.A, and depicted on page 3 of this permit. Such discharge shall be monitored by the Permittee as specified herein.

Requests for monitoring modifications must be submitted to the Department's Groundwater Discharges Section in writing. Such requests must clearly state the reason for and nature of the proposed modification and, where applicable, must contain supporting scientific information, analysis, and justification. Requests will be addressed by the Department on a case by case basis.

Permittee shall initiate periodic reporting required under Part II.B.2 upon initiation of irrigation activities for all of the following monitoring requirements.

1. INFLUENT MONITORING REQUIREMENTS

Permittee shall sample combined flows resulting into the following two influent streams:

- a. From anaerobic lagoon #1 going to the oxidation ditch; and
- b. From anaerobic lagoon #2 going to the MLE.

Permittee shall submit spreadsheet summarizing combined flows resulting in the two influent streams with the Monthly DMR.

| Parameter | Unit of Measurement | Monitoring Frequency | Sample Type |
|-----------------------------|----------------------------|-----------------------------|--------------------|
| Flow | Gallons/Day | Continuous | Recorded |
| BOD ₅ | mg/L | Monthly | Grab |
| TSS | mg/L | Monthly | Grab |
| Total Nitrogen | mg/L | Monthly | Grab |
| Ammonia Nitrogen | mg/L | Monthly | Grab |
| Nitrate/Nitrite as Nitrogen | mg/L | Monthly | Grab |
| pH | S.U. | Monthly | Grab |
| Total Phosphorus | mg/L | Monthly | Grab |
| Chloride | mg/L | Monthly | Grab |

2. SPRAYED EFFLUENT MONITORING REQUIREMENTS

Samples taken in compliance with the monitoring requirements for Fecal Coliform, Oil and Grease, Total Dissolved Solids and Total Residual Chlorine shall be collected at the spray irrigation pivot. Samples taken in compliance with the monitoring requirements for pH and all composite sampling shall be at the effluent end of the clarifier.

| Parameter | Unit Measurement | Monitoring Frequency | Sample Type |
|----------------------------|------------------|----------------------|-------------|
| Ammonia Nitrogen | mg/L | Monthly | Composite |
| BOD ₅ | mg/L | Twice per month | Composite |
| Cadmium | mg/L | Annually | Composite |
| Calcium | mg/L | Annually | Composite |
| Chloride | mg/L | Quarterly | Composite |
| Copper | mg/L | Annually | Composite |
| Effluent Flow | Gal/day | Continuous | Recorded |
| Fecal Coliform | Col/100 ml | Twice per month | Grab |
| Lead | mg/L | Annually | Composite |
| Magnesium | mg/L | Annually | Composite |
| Nickel | mg/L | Annually | Composite |
| Nitrate + Nitrite Nitrogen | mg/L | Monthly | Composite |
| Oil and Grease | mg/L | Monthly | Grab |
| Organic Nitrogen | mg/L | Monthly | Calculation |
| pH | S.U. | Daily | Grab |
| Potassium | mg/L | Quarterly | Composite |
| Sodium Adsorption Ratio | N/A | Quarterly | Calculation |
| Sodium | mg/L | Quarterly | Composite |
| Total Dissolved Solids | mg/L | Quarterly | Grab |
| Total Nitrogen | mg/L | Monthly | Composite |
| Total Nitrogen Loading | lbs/acre | Monthly | Calculation |
| Total Phosphorus | mg/L | Monthly | Composite |
| Total Phosphorus Loading | lbs/acre | Monthly | Calculation |
| Total Residual Chlorine | mg/L | Daily | Grab |
| Total Suspended Solids | mg/L | Twice per month | Composite |
| Zinc | mg/L | Annually | Composite |

3. GROUNDWATER MONITORING REQUIREMENTS

Groundwater samples shall be taken from each monitoring well for the facility. Groundwater monitoring well locations are depicted on the Site Map found on Page 3 of this Permit.

Samples taken in compliance with the monitoring requirements specified shall be taken at each monitoring well in accordance with procedures approved by the Department and listed in the State of Delaware, Field Manual for Groundwater Sampling (Custer, 1988).

Groundwater monitoring results for each monitoring well shall be reported using the State of Delaware Well Identification Tag Number that is required on all wells in accordance with the Delaware Regulations Governing the Construction and Use of Wells, Section 10, A.

All field sampling logs and laboratory results for samples obtained from a well shall be identified by the DNREC ID affixed to the well.

Groundwater samples shall be tested from the following wells for the following parameters:

| Local ID | DNREC ID | Field | Local ID | DNREC ID | Field |
|----------|----------|------------|----------|----------|---------------|
| MW-13 | 243364 | WHBJ-5 | MW-31 | 70662 | WHBJ-7 |
| MW-14 | 243361 | WHBJ-4 | MW-32 | 70663 | WHBJ-7 |
| MW-15 | 243359 | WHBJ-4/5 | MW-33 | 70664 | WHBJ-7 |
| MW-16 | 243358 | WHBJ-1 | MW-34 | 70665 | WHBJ-3 |
| MW-17 | 243357 | WHBJ-4/7 | MW-35 | 70666 | WHBJ-2 |
| MW-18 | 243356 | WHBJ-3 | MW-36 | 70667 | CB-3DW CB- |
| MW-19 | 243355 | WHBJ-2 | MW-37 | 70668 | 3B/C/D |
| MW-20 | 243354 | WHBJ-2 | MW-38 | 192056 | CB-3DW |
| MW-21 | 243353 | WHBJ-2 | MW-40 | 70671 | WHBJ-1 CB- |
| MW-22 | 243362 | WHBJ-4 | MW-41 | 70672 | 3/B/C |
| MW-23 | 243365 | CB-3/B/C | MW-42 | 70673 | CB-3C |
| MW-25 | 243351 | Next to 15 | MW-43 | 70674 | CB-3 |
| MW-26 | 243363 | WHBJ-4 | MW-44 | 70675 | CB-3 |
| MW-27 | 243352 | WHBJ-7 | MW-45 | 70676 | CB-3/3A |
| MW-28 | 70659 | WHBJ-6 | MW-46 | 70677 | CB-3A |
| MW-29 | 70660 | WHBJ-6 | MW-47 | 70678 | CB-3A |
| MW-30 | 70661 | WHBJ-6 | | | |

GROUNDWATER MONITORING REQUIREMENTS (con't)

| Parameter | Unit Measurement | Measurement Frequency | Sample Type |
|-------------------------------|-------------------------|------------------------------|--------------------|
| Ammonia as Nitrogen | mg/L | Quarterly | Grab |
| Arsenic | mg/L | Quarterly | Grab |
| Chloride | mg/L | Quarterly | Grab |
| Depth to Water | hundredths of a foot | Quarterly | Field Test |
| Dissolved Oxygen | mg/L | Quarterly | Field Test |
| Fecal Coliform | Col/100mL | Quarterly | Grab |
| Nitrate + Nitrite as Nitrogen | mg/L | Quarterly | Grab |
| pH | S.U. | Quarterly | Field Test |
| Sodium | mg/L | Quarterly | Grab |
| Specific Conductance | µS/cm | Quarterly | Field Test |
| Temperature | °C | Quarterly | Field Test |
| Total Dissolved Solids | mg/L | Quarterly | Grab |
| Total Nitrogen | mg/L | Quarterly | Grab |
| Total Phosphorus | mg/L | Quarterly | Grab |

4. GROUNDWATER TABLE ELEVATION MONITORING REQUIREMENTS

N/A

5. LYSIMETER MONITORING REQUIREMENTS

Samples shall be taken from each lysimeter for the facility. Lysimeter locations are depicted on the Site Map found on Page 3 of this Permit.

Samples must be tested from the following wells for the following parameters. The constituents are listed below in highest priority first. In the event that sufficient sample volume may not be obtained to test for all parameters listed, the sample shall be tested for as many constituents possible in the following order:

| Local ID | DNREC ID | Associated Pivot | Notes |
|----------|----------|------------------|-----------------------------------|
| LY-1 | 257012 | CB-3 | Replaced well 233818 on 2/7/2017 |
| LY-2 | 257636 | CB-3C | Replaced well 233819 on 3/29/2017 |
| LY-3 | 257016 | CB-3DW | Replaced well 233820 on 2/7/2017 |
| LY-4 | 233821 | WHBJ-1 | |
| LY-5 | 233822 | WHBJ-3 | |
| LY-6 | 233823 | WHBJ-7 | |
| LY-7 | 233824 | WHBJ-6 | |

| Parameter | Unit | Measurement | |
|-------------------------------|-------------|-------------|-------------|
| | Measurement | Frequency | Sample Type |
| Total Nitrogen | mg/L | Quarterly | Grab |
| Total Phosphorus | mg/L | Quarterly | Grab |
| Nitrate + Nitrite as Nitrogen | mg/L | Quarterly | Grab |
| Ammonia as Nitrogen | mg/L | Quarterly | Grab |
| Chloride | mg/L | Quarterly | Grab |
| Sodium | mg/L | Quarterly | Grab |
| Total Dissolved Solids | mg/L | Quarterly | Grab |
| pH | S.U. | Quarterly | Field Test |
| Specific Conductance | µS/cm | Quarterly | Field Test |
| Temperature | °C | Quarterly | Field Test |

6. SOIL MONITORING REQUIREMENTS

Composite soil samples representing each soil series within the wetted spray field shall be taken separately from both soil depths of 0–12 inches and 12–24 inches. A minimum of one composite sample for each of the both aforementioned depths is required for every 20 acres of each soil series. The composite soil sampling must represent the average conditions in the sampled body of material. The discrete samples that are to be composited must be collected from the same soil horizon and depth interval.

Soil sample locations shall be plotted on a scaled drawing and labeled consistent with the sample nomenclature. Each field must also be identified so that sample results may be tracked and properly assessed for field life limiting factors.

Soil chemical testing should be in accordance with Methods of Soil Analysis published by the American Society of Agronomy, Madison, Wisconsin.

If a Compliance Monitoring Report (CMR) is required for the facility, testing for Cadmium, Nickel, Lead, Zinc and Copper should be performed approximately one year prior to permit renewal so results may be utilized by the Permittee in the CMR. Reference Part IV.A.2 of the Permit and Section 6.5.4 of the Regulations regarding CMR requirements.

| Parameter | Unit Measurement | Measurement Frequency | Sample Type |
|---|-----------------------------|---|--------------------|
| pH | S.U. | Annually | Soil Composite |
| Organic Matter | % | Annually | Soil Composite |
| Phosphorus (as P ₂ O ₅) | mg/kg | Annually | Soil Composite |
| Potassium | mg/kg | Annually | Soil Composite |
| Sodium Adsorption Ratio | meq/100g | Annually | Soil Composite |
| Arsenic | mg/kg | Once per 5 years | Soil Composite |
| Cadmium | mg/kg | Once per 5 years | Soil Composite |
| Nickel | mg/kg | Once per 5 years | Soil Composite |
| Lead | mg/kg | Once per 5 years | Soil Composite |
| Zinc | mg/kg | Once per 5 years | Soil Composite |
| Copper | mg/kg | Once per 5 years | Soil Composite |
| Cation Exchange Capacity | meq/100g | *Only if soil pH changes significantly | Soil Composite |
| Phosphorus Adsorption (Mehlich 3 acceptable) | meq/100g | **Only if soil phosphorus levels become excessive for plant growth | Soil Composite |
| Percent Base Saturation | % | *Only if soil pH changes significantly | Soil Composite |

*A significant change in soil pH is defined as a change of one or more standard units from the original value established in the Design Development Report.

** Excessive levels of soil phosphorus are defined by the Delaware Nutrient Management Commission. Soil phosphorus levels must be tested in accordance with the University of Delaware soil testing methods (Gartley, 2002). If the soil phosphorus levels become excessive, the Permittee must perform a Phosphorus Site Index (PSI) study. The results must be submitted to the Groundwater Discharges Section within 30 days of completion. Based on these, the Groundwater Discharges Section may require the Permittee to submit a plan for detailing steps to reduce the phosphorus loading rates at the site.

7. VEGETATION MONITORING

In the year prior to permit expiration, a minimum of one composite sample for each field is required upon each harvest. If a crop rotation is utilized either in alternate years or in the same year, the aforementioned requirement must be duplicated for each crop type. If a Compliance Monitoring Report (CMR) is required for the facility, testing should be performed approximately one year prior to permit renewal so results may be utilized by the Permittee in the CMR. Reference Part IV.A.2 of the Permit and Section 6.5.4 of the Regulations regarding CMR requirements.

| Parameter | Unit Measurement | Measurement Frequency | Sample Type |
|------------|---------------------------|-----------------------|----------------------|
| Yield | Bushels/acre and lbs/acre | Per harvest | Vegetation Composite |
| Nitrogen | % and lbs/acre | Per harvest | Vegetation Composite |
| Phosphorus | % and lbs/acre | Per harvest | Vegetation Composite |
| % Moisture | % | Per harvest | Vegetation Composite |

8. OPERATIONS MONITORING REQUIREMENTS

a. Spray Field Applications

| Parameter | Unit Measurement | Monitoring Frequency | Sample Type |
|------------|-------------------------------|----------------------|-------------|
| Fertilizer | lbs/acre per field/zone/pivot | Monthly | Reported |
| Fertilizer | lbs/acre per field/zone/pivot | Monthly | Reported |
| Phosphorus | lbs/acre per field/zone/pivot | Monthly | Reported |

b. Treatment System

| Parameter | Sample Location | Unit Measurement | Monitoring Frequency | Sample Type |
|---------------|-----------------|-------------------------|----------------------|-------------|
| Lagoon Levels | Lagoons | Feet of depth of lagoon | Weekly | Field Test |

9. SURFACE WATER MONITORING REQUIREMENTS

N/A

B. MONITORING SPECIFICATIONS AND REPORTING REQUIREMENTS

1. Representative Sampling

Samples and measurements taken as required in the operation permit shall be representative of the volume and nature of the monitored discharge. If there has been significant increase (> 25%) in the characterization of any one parameter of the effluent wastewater as established in the Design Engineer Report, the permittee shall resample the wastewater and submit the additional analyses to the Department. The permittee shall re-characterize the wastewater to determine if a change in treatment is required and/or if the land limiting constituent has changed. If a change in treatment is required and/or if the land limiting constituent has changed, a revised Design Engineer Report shall be submitted to the Department. After a review of these results, the Department may invoke the provisions of Part V.A.1 of this permit.

2. Reporting

Monitoring results obtained during the previous one month/quarter shall be summarized and reported on an approved monitoring report form(s) postmarked no later than the 28th day of the month following the completed reporting period. Laboratory analytical results and sampling logs must be submitted with the corresponding month's monitoring report. Signed reports/forms, laboratory analytical results, laboratory sampling logs and field data sheets shall be submitted in one complete package to the Department at the following address:

Groundwater Discharges Section
Division of Water
Department of Natural Resources and Environmental Control
89 Kings Hwy
Dover DE 19901
(302) 739-9948 Office
(302) 542-9735 Cell

3. Monitoring results reported as less than the detectible limit should be reported with the less than symbol "<" before the detection limit. The full detection limit value must be utilized in any necessary calculations. The less than symbol must be carried through the calculation. The resulting value must include any appropriate less than or greater than symbol resulting from the calculation.

4. Additional Monitoring by Permittee

If the permittee monitors any parameter at the location(s) designated herein more frequently than required, using approved analytical methods, the results shall be reported to the Department on an approved monitoring report form. Such increased frequency shall also be indicated.

5. Annual Report

The Permittee shall submit to the Department's Groundwater Discharges an Annual Report summarizing the operations, management, administration and maintenance of the facility for the calendar year. The Annual Report must be submitted to the Department's Groundwater Discharges on or before February 28th of each year. The Annual Report must include all applicable items found in Section 6.8.2.4.1.3 and Section 6.9 of the Regulations.

6. Test Procedures

Test procedures for analysis of pollutants shall conform to the applicable test procedures identified in 40 CFR, Part 136 or the most recently adopted copy of Standard Methods unless otherwise specified in this permit.

7. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the Permittee shall record the following information:

- a. The exact place, date and time of sampling and/or measurement;
- b. The person(s) who performed the sampling and/or measurement;
- c. The date(s) the analyses were performed and the time the analyses were begun;
- d. The person(s) who performed the analyses; and
- e. The results of each analysis.

8. Records Retention

All records and information resulting from the monitoring activities required by this permit or the Regulations including all records of performed analyses, calibration and maintenance of instrumentation and recording from continuous monitoring instrumentation shall be retained for five years. This period of retention shall be extended automatically during the course of any unresolved litigation regarding the regulated activity or regarding control standards applicable to the permittee or as requested by the Department.

9. Availability of Reports

All reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Department of Natural Resources and Environmental Control. Monitoring data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in 7 Del. C., §6013.

10. Operator Log

An operator log must be kept on site at all times. Each spray system section shall be numbered and referred to by number in the operator log. All records and reports shall also be kept in a bound log book on site at all times and must be made available upon request for review by the Department. This log shall, at a minimum, include the applicable items listed in Section 6.7.3 of the Regulations.

11. Quality Assurance Practices

The Permittee is required to show the validity of all monitoring data by requiring its laboratory to adhere to quality assurance practices in accordance with Section 6.8.2.4 of the Regulations.

PART III

A. OPERATIONAL REQUIREMENTS

1. Groundwater Requirements

Operation of the wastewater treatment facility and spray irrigation system shall not cause the quality of Delaware's groundwater resources to be in violation of applicable Federal or State Drinking Water Standards on an average annual basis.

2. Facilities Operation

The Permittee must properly maintain and operate all structures, pipelines, systems and equipment for collection, treatment control and monitoring which are used by the permittee to achieve compliance with the terms and conditions of the permit. Proper operation and maintenance includes, but is not limited to, effective performance based on designed facility removals; adequate funding, effective management, adequate operator staffing and training, and adequate laboratory and process controls including appropriate quality assurance procedures.

3. The spray irrigation fields shall be managed to assure at a minimum that:

- a. Spray irrigation of wastewater shall only occur on fields being prepared for planting or already planted with a crop and shall not occur on fields with crops not actively growing or on voluntary vegetation.
- b. The spray fields shall be maintained in such a manner as to prevent wastewater pooling and/or discharge of wastewater to any surface waters. Should pooled areas become evident, spraying on those areas shall be prohibited until saturated conditions no longer exist.
- c. Aerosols or nuisance odors shall not extend beyond the boundary of the spray irrigation site when treated wastewater is being applied. If odors are produced that are considered to be a public nuisance, the Permittee shall take the necessary steps to eliminate such odors. All action taken shall be reported to the Department in accordance with Part IV.A.4 of this permit.
- d. Erosion controls must be employed to prevent wastewater runoff from the spray irrigation fields. The Permittee must notify the Department immediately if any wastewater runoff occurs.
- e. The spray irrigation field's crops must be maintained in optimal condition, including any necessary weed management, reseeding, or other vegetative management practices.
- f. Effective vegetative management shall be provided such that crops harvested on the spray irrigation sites are removed from the sites.
- g. Forage crops must be harvested and removed from the irrigation field(s) at least twice a year. Crops harvested must be removed from the irrigation site within six (6) months of harvest.
- h. The wastewater must be applied in a manner such that the application is even and uniform over the irrigation area.

4. Spray irrigation is prohibited when saturated or frozen soil conditions exist except on fields identified in Part I.I.1.

5. The groundwater mound created by the added infiltration shall at no time reach within two feet of the ground surface in any section of the spray irrigation fields. Should the groundwater mound exceed this limit, the Permittee shall cease all irrigation of wastewater to the affected fields until the groundwater mound recedes to acceptable levels.

6. Connections or additions to the spray irrigation system other than those indicated on the approved plans are prohibited without prior approval from the Department's Groundwater Discharges Section.

7. Roof downspouts, foundation drains, area drains, storm sewers, combined sewers or appurtenances thereto or any sewer or device carrying storm water shall not be connected to the spray irrigation system.
8. The Permittee shall take appropriate measures to protect the spray irrigation system from damage due to sub-freezing conditions.
9. Any leaks shall be reported to the Department and repaired immediately.
10. Signs
 - a. Limited Public Access: Signs must be posted on all limited public access spray fields utilized to irrigate treated wastewater to prohibit public contact. The signs must indicate that the water being irrigated is treated wastewater. The signs must be legible. Limited public access sites must have signs posted on the perimeter every 1,000 feet, at a minimum, and at all entry points. Unlimited public access sites must have signs posted at all entry points.
 - b. Unlimited Public Access: Unlimited public access sites must have advisory signs posted at all entry points that indicate the site is spray irrigated with treated wastewater. Verbiage should include the following wording: "RECYCLED WASTEWATER – DO NOT DRINK". Alternate verbiage may be used if approved in writing by the Department.
11. Potable ground or surface water may be used for distribution system testing and irrigation to establish vegetation when sufficient treated effluent is not available.
12. Phased Systems
 - a. Once an operation permit has been issued and the wastewater flow reaches 80% of the permitted treatment capacity for the constructed phase based on a period of seven (7) consecutive days, the Permittee must submit written notification to the Department. The written notification must include a work plan for construction of the next permitted phase. The Permittee must submit a construction permit application, plans and specifications and Design Engineer Report with applicable fees if the next phase has not yet been permitted or if there are changes to the previously permitted design.
 - b. Any flow above the permitted flow for a phase shall not be allowed to be discharged to the system until construction is completed on the following phase and an operating permit has been issued or amended by the Department for the next phase.
 - c. Required documents for connecting subdivisions may be found in Section 6.5.10.3.1 of the Regulations.
13. In the event that the permittee installs new monitoring wells or replaces any existing monitoring wells, the Permittee shall submit to the Department's Groundwater Discharges Section new elevation details relative to the common benchmark previously established. Additionally, the permittee shall conduct a groundwater quality sampling program prior to initiation of wastewater disposal activities on the area incorporating the well. The sampling program shall be sufficient to establish representative groundwater quality at each well prior to initiation of the wastewater disposal activities. A minimum of three samples shall be collected at least one month apart and analyzed. A summary report detailing all analyses shall be submitted to the Department's Groundwater Discharges Section prior to initiation of wastewater disposal activities. Analyses shall include the parameters iterated in Section 6.8.1 of the Regulations.
14. The Permittee shall calibrate all flow meters in accordance with the Manufacturer's recommendations. Calibration shall include, but not be limited to influent, effluent, continuous online turbidity and chlorine residual monitors. The calibration documentation must be submitted with the Annual Report in accordance with Part II.B.5
15. The Permittee shall operate and maintain the land treatment system in accordance with the approved Operation and Maintenance Plan (O&M). A copy of the O&M must be on site at all times. The Permittee must maintain the O&M's accuracy and applicability in accordance with both their Permit and the Regulations. In the event of a discrepancy between the O&M and the Permit or Regulations, the requirements of the Permit and the Regulations would govern.

16. At least two feet of freeboard, measured vertically from the lowest point of the berm, is required for all ponds. The lowest point of the berm must be determined and marked.

The Permittee must notify the Department's Groundwater Discharges Section in writing prior to utilizing the freeboard in any lagoon or immediately upon unexpected encroachment into freeboard. In the event of encroachment into freeboard, Permittee shall contact the Groundwater Discharges Section to coordinate relief measures. In the event of an emergency, Permittee may contact the Department at the telephone numbers cited in Part II.B.2 of this permit; however, written notification must subsequently be provided within 5 days of encroachment.

17. If the facility does not treat sewage and has a storage tank that requires cleanout, and if the permittee intends to land apply material collected from the cleanout onto the spray irrigation field, the Permittee must analyze the material for nutrients and any other applicable parameters of concern as determined by the Groundwater Discharges Section Prior to tank cleanout being performed. Permittee must submit to the Groundwater Discharges Section a report including the results, the frequency and estimated volume of material to be applied, and how and where it will be applied. The report must include a mathematical analysis determining any nitrogen loading from the tank cleaning combined with nitrogen loading from wastewater application will not exceed the allowable nitrogen load.
18. Fencing is required at treatment facilities, pump stations and storage/treatment ponds. Fencing of spray fields is not required.
19. The collection and channelization of irrigated wastewater for purposes other than retreatment is prohibited.
20. Direct application of treated wastewater to drainage ditches, any water bodies, and wetlands is prohibited.

21. Emergency Repairs

Emergency repairs or the replacement of critical "like kind" components of the wastewater treatment facility necessary for the continued operation of the facility may be performed without first obtaining a construction permit from the Department.

A report must be submitted to the Department within five (5) days of completion of the emergency repairs. The report must summarize the nature of the emergency and the repairs performed. All violations must also be reported in accordance with Section 6.5.9.

22. Adverse Impact

The Permittee shall take all steps to minimize any adverse impact to the Waters of the State resulting from operation under this permit. Such steps shall include, but not be limited to, accelerated or additional monitoring as necessary to determine the nature and impact of the non-complying discharge or mitigation of such impacts.

23. Bypassing

The diversion of flow from any portion of the treatment facility's process flow (including, but not limited to, pretreatment, storage, distribution and land application) necessary to maintain compliance with the terms and conditions of this permit is prohibited unless:

- a. The bypass is unavoidable to prevent personal injury, loss of life, severe property damage, or materially adversely affect public health and/or the environment; or
- b. There are no alternatives readily available.

The Groundwater Discharges Section must be orally notified within 24 hours after such bypass; and, a written submission regarding the bypass must be submitted within five days of the Permittee's becoming aware of the bypass. Where the need for a bypass is known (or should have been known) in advance, this notification must be submitted to the Groundwater Discharges Section for approval at least ten days prior, or as soon as possible, before the date of bypass.

The treatment facility must be repaired and restored to the permitted design operations process flow.

24. Removed Substances

Solids, sludges, filter backwash or other pollutants removed in the collection, conveyance, or treatment of wastewater shall be disposed of in a manner such as to prevent any pollutant from entering the surface water or groundwater and to comply with applicable federal or state laws and regulations.

25. Power Failures

An alternative power source, which is sufficient to operate the wastewater treatment and disposal facilities, shall be available. If such alternative power source is not available, the Permittee shall halt, reduce or otherwise control production and/or all discharges upon the reduction, loss, or failure of the primary source of power to the wastewater facilities.

PART IV

A. MANAGEMENT REQUIREMENTS AND RESPONSIBILITIES

1. Initiation of Facility Operations Notification

If this permit is for initial operations following construction, the Permittee shall notify the Department in writing within 24 hours of the initiation of operations.

2. Operation Permit Re-Issuance

At least 180 days before the expiration date of this permit, the Permittee must submit an application for renewal or notify the Department of the intent to cease discharging by the expiration date. The application package for systems with a design flow $\geq 100,000$ gpd, must include a five (5) year Compliance Monitoring Report (CMR). The CMR must be in accordance with Section 6.5.4.3 of Regulations. In the event that a timely and complete application has been submitted as determined by the Department, and the Department is unable, through no fault of the Permittee, to issue a new permit before the expiration date of this permit, the terms and conditions of this permit are automatically continued and remain fully effective and enforceable until a decision is made on the new application.

3. Change in Discharge

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit.

Any anticipated facility expansions, production increases, or process modifications that will result in new, different, or increased discharges of pollutants must be reported in writing to the Department's Groundwater Discharges Section for approval. A new permit may be required.

Any other activity which would constitute cause for modification or revocation and reissuance of this permit as described in Part V.A.1 of this permit shall be reported to the Groundwater Discharges Section. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

4. Non-compliance Notification

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, including petroleum substances, into surface waters, groundwater, or onto land as soon as the Permittee has knowledge of, or should have had knowledge of, the release or discharge.

The Permittee shall report to the Groundwater Discharges Section orally within 24 hours from the time the Permittee became aware of any noncompliance that may endanger the public health or the environment by contacting the Groundwater Discharges Section at the telephone numbers cited in Part II.B.2 of this permit.

If for any reason the Permittee does not comply with, or will be unable to comply with, any effluent limitations or other conditions specified in this permit, the Permittee shall provide the Department with the following information in writing within five days of becoming aware of any actual or potential non-compliance:

- a. A description and cause of the non-compliance with any limitation or condition;
- b. The period of non-compliance including exact dates and times; or, if not yet corrected, the anticipated time the non-compliance is expected to continue; and

- c. The steps being taken or planned to reduce, eliminate and/or prevent recurrence of the non-compliant condition.

5. Facility and Construction Changes

The Permittee shall submit a written report to the Department for review and approval, of any changes to the facility or construction of the system within the following time periods:

- a. Thirty days before any planned activity, physical alteration to the permitted facility or addition to the permitted facility if that activity, alteration or addition would result in a change in information that was previously submitted to the Department;
- b. Thirty days before any anticipated change which would result in noncompliance with any permit condition or the regulations; or
- b. Immediately after the Permittee becomes aware of relevant facts omitted from, or incorrect information submitted in, a permit application or report to the Department.

6. Right of Entry

The permittee shall allow the Department entry and access, consistent with 7 Del.C. Ch. 60, to:

- a. Enter the permitted facility.
- b. Inspect any records that must be kept under the conditions of the permit.
- c. Inspect any facility, equipment, practice, or operation permitted or required by the permit.
- d. Sample or monitor for the purpose of assuring permit compliance of any substance or any parameter at the facility.

7. Permit Transferability

Permits may be transferred to a new owner or operator. The permittee must notify the Department by requesting a change of ownership of the permit before the date of transfer. The transfer must be consistent with any notarized legal documents and/or CPCN required by the Regulations. The legal documentation must be provided with the application. The application must be received 30 days before the transfer.

- a. No person shall transfer a permit from one (1) person to another unless 30 days written notice is given to the Department, indicating the transfer is agreeable to both persons, and approval of such transfer is obtained in writing from the Department, and any conditions of the approval of such transfer is obtained in writing from the Department, and any conditions of the transfer approved by the Department are complied with by the transferor and the transferee.
- b. The notice to the Department shall contain a written agreement between the transferor and the transferee, indicating the specific date of proposed transfer of permit coverage and acknowledging responsibilities of current and new permittees for compliance with and liability for the terms and conditions of this permit. The notice shall be signed by both the transferor and the transferee.

PART V

A. PROVISIONS

1. Permit Revocation

The Department may revoke a permit if, among other things, the permittee violates any permit condition, these regulations, fails to pay applicable Departmental fees, obtains the permit by misrepresentation or fails to fully disclose all relevant facts.

Except in cases of emergency, the Department shall issue a written notice of intent to revoke to the permittee prior to final revocation. Revocation shall become final within 20 days of receipt of the notice by the permittee, unless within that time the permittee requests an administrative hearing in writing.

The Department shall notify the permittee in writing of any revocation hearing at least 20 days prior to the date set for such hearing.

If the Department finds the public health, safety or welfare requires emergency action, the Department shall incorporate findings in support of such action in a written notice of emergency revocation issued to the permittee. Emergency revocation shall be effective upon receipt by the permittee. Thereafter, if requested by the permittee in writing, the Department shall provide the permittee a revocation hearing.

2. Permit Modifications/Amendments

In consultation with the permittee, the Department may modify or amend an existing permit provided that the modifications would not result in an increased impact or risk to the environment or to public health.

3. State Laws

This permit shall not be construed to preclude the institution of any legal action or relieve the Permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation.

4. Property Rights

The issuance of this permit does not convey any property rights of either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

5. Severability

The provisions of this permit are severable. If any provision of this permit, or the application of any provision of this permit, to any circumstances is held invalid; the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

6. This permit does not relieve the Permittee of complying with any applicable Federal, State or local regulations.

7. In the event that the Regulations Governing the Design, Installation and Operation of On-Site Wastewater Treatment and Disposal Systems or applicable federal regulations are revised, this permit may be opened and modified accordingly after notice and opportunity for a public hearing.

8. This permit supersedes all previous spray irrigation operation permits issued to the Permittee.

Water Balance/Determination of Design Wastewater Loading (Lw)

1. Allowable hydraulic loading based on limiting to percolate nitrogen concentration to less than 10 mg/l

| | Pr (in) | Et (in) | U (lb/mo) | f | Cn (mg/l) | Cp (mg/l) | Lwn (in) | Lw (in) | Design Lw (in) |
|-----|------------|------------|--------------|---|--------------|--------------|-------------|------------|-------------------|
| Jan | 3.0 | 0.1 | 0.3 | 0 | 10 | 9 | 27.5 | 206.4 | 27.5 |
| Feb | 3.2 | 0.1 | 2.0 | 0 | 10 | 9 | 36.5 | 185.9 | 36.5 |
| Mar | 4.1 | 0.7 | 10.4 | 0 | 10 | 9 | 76.4 | 205.9 | 76.4 |
| Apr | 3.2 | 1.8 | 22.1 | 0 | 10 | 9 | 109.8 | 201.1 | 109.8 |
| May | 3.4 | 3.3 | 22.8 | 0 | 10 | 9 | 101.0 | 209.2 | 101.0 |
| Jun | 3.6 | 4.8 | 15.1 | 0 | 10 | 9 | 55.7 | 203.7 | 55.7 |
| Jul | 3.9 | 5.5 | 30.2 | 0 | 10 | 9 | 118.7 | 210.9 | 118.7 |
| Aug | 5.3 | 4.9 | 22.7 | 0 | 10 | 9 | 103.4 | 208.9 | 103.4 |
| Sep | 3.6 | 3.6 | 7.6 | 0 | 10 | 9 | 33.3 | 202.5 | 33.3 |
| Oct | 3.5 | 1.9 | 0.0 | 0 | 10 | 9 | 14.4 | 207.7 | 14.4 |
| Nov | 3.1 | 0.9 | 0.0 | 0 | 10 | 9 | 19.8 | 200.3 | 19.8 |
| Dec | 3.6 | 0.2 | 0.0 | 0 | 10 | 9 | 30.6 | 205.9 | 30.6 |

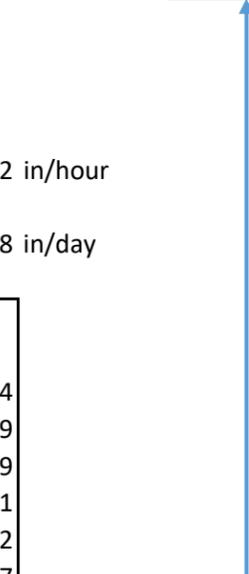
Notes and assumptions

1. Pr = Precipitation (in/mo) - from DNREC table of standard values
2. Et = Evapotranspiration (in/mo) - from DNREC table of standard values
3. U = N Uptake (lb/ac/mo) - from DNREC table based on Small Grain-Soybean year
4. f = fraction of effluent N which is denitrified or volatilized, assumed to be 0, Conservative
5. Cn = effluent N (mg/l)
6. Cp = Percolate N limit (mg/l), conservative
7. Lwn - Allowable application rate based on percolate N limit (in/mo)
8. Lw - Allowable application rate based soil hydraulic conductivity (in/mo)
9. Pw = Allowable percolation depth with safety factor applied to hydraulic conductivity measurements, (in/mo)
10. Based on infiltration testing completed by EarthData Inc., 2019

2. Allowable hydraulic loading based on soil infiltration testing

Overall average measured infiltration rate¹⁰ 4.02 in/hour
 Pw per day using a safety of 7% 6.8 in/day

| Days | Pr (in) | Et (in) | Et-Pr (in) | Pw (in) | Lw (in) | |
|------|------------|------------|---------------|------------|------------|-------|
| Jan | 31 | 3.0 | 0.1 | 2.9 | 209.25 | 206.4 |
| Feb | 28 | 3.2 | 0.1 | 3.1 | 189.00 | 185.9 |
| Mar | 31 | 4.1 | 0.7 | 3.4 | 209.25 | 205.9 |
| Apr | 30 | 3.2 | 1.8 | 1.4 | 202.50 | 201.1 |
| May | 31 | 3.4 | 3.3 | 0.1 | 209.25 | 209.2 |
| Jun | 30 | 3.6 | 4.8 | -1.2 | 202.50 | 203.7 |
| Jul | 31 | 3.9 | 5.5 | -1.6 | 209.25 | 210.9 |
| Aug | 31 | 5.3 | 4.9 | 0.4 | 209.25 | 208.9 |
| Sep | 30 | 3.6 | 3.6 | 0.0 | 202.50 | 202.5 |
| Oct | 31 | 3.5 | 1.9 | 1.6 | 209.25 | 207.7 |
| Nov | 30 | 3.1 | 0.9 | 2.2 | 202.50 | 200.3 |
| Dec | 31 | 3.6 | 0.2 | 3.4 | 209.25 | 205.9 |



Attachment C

Corn uptake 26.18 lb/ac/yr TP based 150 bu/ac yield

| 883 acres | Flow (mgd)> (mgy)> | 2 | 2.1 | 2.2 | 2.3 | 2.4 | 2.5 | 2.6 |
|-----------|-----------------------|-------|-------|-------|-------|-------|-------|-------|
| | TP | 730 | 766.5 | 803 | 839.5 | 876 | 912.5 | 949 |
| Effluent | 0.5 | 3.45 | 3.62 | 3.79 | 3.96 | 4.14 | 4.31 | 4.48 |
| P Conc | 1.0 | 6.89 | 7.24 | 7.58 | 7.93 | 8.27 | 8.62 | 8.96 |
| (mg/l) | 1.5 | 10.34 | 10.86 | 11.38 | 11.89 | 12.41 | 12.93 | 13.45 |
| | 2.0 | 13.79 | 14.48 | 15.17 | 15.86 | 16.55 | 17.24 | 17.93 |
| | 2.5 | 17.24 | 18.10 | 18.96 | 19.82 | 20.68 | 21.55 | 22.41 |
| | 3.0 | 20.68 | 21.72 | 22.75 | 23.79 | 24.82 | 25.86 | 26.89 |
| | 3.5 | 24.13 | 25.34 | 26.55 | 27.75 | 28.96 | 30.17 | 31.37 |
| | 4.0 | 27.58 | 28.96 | 30.34 | 31.72 | 33.10 | 34.47 | 35.85 |
| | 4.5 | 31.03 | 32.58 | 34.13 | 35.68 | 37.23 | 38.78 | 40.34 |
| | 5.0 | 34.47 | 36.20 | 37.92 | 39.65 | 41.37 | 43.09 | 44.82 |

Land Limiting Constuent Analysis (Metals)

Wastewater Loading Rate

949 MG/year

Area

893.63 acres

CEC (Based on 2018 data, average of all samples)

4.74 meq/100g

| Parameter | Concentration in Soils* (mg/kg) | Metal Content** (lb/acre) | Allowable Loading Level (CEC<5) (lb/acre) | Remaining Capacity (lb/acre) | Assumed Effluent Concentration (mg/L) | Lbs Applied per Acre pre Year (lbs/yr-acre) | Site Life (yrs) |
|-----------|---------------------------------|---------------------------|---|------------------------------|---------------------------------------|---|-----------------|
| Cadmium | 0.4909 | 0.984 | 4.4 | 3.42 | 0.00207 | 0.018 | 186 |
| Copper | 2.42 | 4.849 | 125.0 | 120.15 | 0.00830 | 0.074 | 1634 |
| Lead | 12.2944 | 24.635 | 500.0 | 475.36 | 0.00302 | 0.027 | 17792 |
| Nickel | 1.7070 | 3.420 | 125.0 | 121.58 | 0.00524 | 0.046 | 2618 |
| Zinc | 5.97 | 11.962 | 250.0 | 238.04 | 0.13800 | 1.222 | 195 |

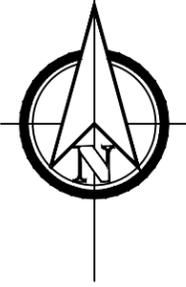
Effluent Metal Data History

| | 2017 (mg/l) | | 2018 (mg/l) | | 2019 (mg/l) | Average (mg/l) |
|---------|----------------|-----|----------------|-----|----------------|-------------------|
| Cadmium | 0.0005 | *** | 0.0005 | *** | 0.00521 | 0.00207 |
| Copper | 0.0057 | | 0.0024 | | 0.0168 | 0.00830 |
| Lead | 0.001 | *** | 0.0014 | | 0.00665 | 0.00302 |
| Nickel | 0.0069 | | 0.0033 | | 0.00553 | 0.00524 |
| Zinc | 0.227 | | 0.017 | | 0.17 | 0.13800 |

* Most recent data is used. Copper and Zinc values are from 2018. Cadmium, Lead, and Nickel are from 2017.

** Assumed soil weight per acre > 43,560 sq/ft acre x 0.5 ft x 92 lb/cu ft = 2,003,760 lbs/ac

*** Indicates measured value was below detection limit



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DRAWN BY: DAC
CHECKED BY: SHL
FILE: ###XX-XXX

**SPRAY FIELD SITE PLAN
CENTERBLOCK FIELDS 3 THRU 3D
COMPLIANCE MONITORING REPORT
MOUNTAIRE FARMS, INC.
MILLSBORO ~ SUSSEX COUNTY ~ DELAWARE**

DATE: MAY 2016

SCALE: 1" = 1000'

PROJECT NO. 10806.BE

SHEET: EXHIBIT 2



**Mountaire Farms
Millsboro, DE Facility
Nutrient Management Planning – Effluent Irrigation**

The purpose of this overview is to provide a description of the nutrient management planning and implementation activities associated with the cropland located around the Millsboro Delaware facility of Mountaire Farms. Currently there is approximately 1,566 acres of cropland under Mountaire's control. Approximately 893 acres of this cropland receives treated effluent water from the on-site poultry processing facility. This acreage receives this effluent via various center pivot irrigation systems operated by Mountaire for this specific purpose. Treated effluent is applied on a year round basis. All of these activities are performed in compliance with provisions set forth in a wastewater discharge permit issued through the Delaware Department of Natural Resources and Environmental Control (DNREC).

All of the farming practices are performed by outside entities that lease the associated cropland. Their farming practices are performed in accordance with a Nutrient Management Plan (NMP) that meets Delaware Department of Agriculture's Nutrient Management Program standards. All nutrient management activities are performed under the advice of a Delaware certified nutrient management planner and in conjunction with Mountaire to ensure adherence to permit requirements. Currently there are two enterprises that are responsible for the farming of the lands and all parties involved employ Keen Consulting, Inc. Georgetown, Delaware for the services related to these planning and implementation processes.

General Cropping Information

The cropping sequence employed on the effluent treated land is a corn/small grain/soybean/small grain (cover crop) rotation. All crops are harvested and sold to be utilized as animal feed. Crops are maintained in all of the spray irrigation fields on a year round basis with the exception being during brief transition times between harvesting and establishment of succeeding crops. Generally no-till and minimum-till methods (low soil disturbance) are employed. More intensive tillage is occasionally employed if environmental conditions necessitate. Supplemental fertilization is performed to account for nutrient needs not supplied via effluent applications. Liming of the soils is also performed in order to maintain a pH that is advantageous to proper crop growth. These activities are dictated by the NMP and utilize soil and plant tissue test results as a basis for decision making. Generally speaking a relatively equal split in the cropping mix on an annual basis is desired.



Corn

Corn is planted after the termination of the winter cover crop (wheat or barley). No-till or minimum-till planting methods are usually employed. Planting occurs in mid-April to mid-May. Supplemental fertilizer (starter, pre-plant, etc.) may be applied at this time to address any additional nutrient needs.

Approximately 4-6 weeks after crop emergence soil nitrate testing may be performed to help gauge nitrogen available for crop growth. Test results along with anticipated effluent contributions are then utilized for the purposes of a supplemental nitrogen fertilization recommendation provided through the certified planner.

Corn is harvested in September to early October. Yields generally range in the 130-175 bu/acre range with a “typical” yield being 150-165 bu/acre. Corn stover is occasionally harvested and a yield of approximately 1.9 tons/acre would be expected when this occurs.

Small Grain

Small grain (barley and wheat) is planted in late September through late October. Both barley and wheat are utilized as cover or harvestable crops dependent upon the cropping rotation in a given field for a given year. Additions of lime and potassium fertilizers as dictated by soil test results are usually performed at this time.

For small grain being taken to grain harvest, a determination of anticipated supplemental crop nitrogen needs is made in early March. This is done in a collaborative fashion between the farmers, certified consultant and Mountaire personnel. This recommendation is based upon many factors which include crop condition, yield expectations, climatic conditions and contributions from both applied and anticipated applications of effluent water.

Small grains are harvested from mid-June through early July. Barley yields range from 60-99 bu/acre with 75 bu/acre being a “typical” expected yield. Wheat yields range from 37-76 bu/acre with 50-60 bu/acre being “typical”. On occasion wheat and barley straw may also be harvested. Straw yields range from 1,800-3,600 lbs/acre with 2,400-3,000 lbs/acre being “typical”. Soybeans are planted immediately following the small grain harvest utilizing the no-till method of farming practices.

Soybeans

Soybeans are almost exclusively planted as a “double crop” following small grain harvest. Occasionally due to environmental conditions a “full season” crop of soybeans



may be utilized within the rotation. Full season soybeans would be planted in mid-May to early June. Double crop soybeans are planted in mid-June through early July.

There is generally no supplemental fertilization of soybeans beyond foliar applications of needed nutrients (minor elements) as dictated by soil and plant tissue test results and environmental conditions.

Double crop soybean yields range from 28-48 bu/acre with 40 bu/acre being “typical”. There has not been much of a full season soybean history but an anticipated slightly higher “typical” yield of 50 bu/acre would be anticipated.

Nitrogen Overview

The following table is provided as an illustration of expected crop yields and expected nitrogen uptake values.

| 20012-2016 Average Crop Yields (Treated Water Irrigated Fields) and Estimated Uptake Rates | | | | |
|---|---------------------|---------------------|---|--|
| <u>Crop</u> | <u>Yield</u> | <u>Units</u> | <u>Nitrogen Content per Unit</u> | <u>Nitrogen Uptake (lbs/acre @ Yield)</u> |
| Corn | 155 | bu/acre | 1.0 | 155 |
| Corn Stover | 1.9 | tons/acre | 18.3 | 34.8 |
| Barley | 75 | bu/acre | 1.08 | 81 |
| Barley Straw | 1.35 | tons/acre | 15.0 | 20.25 |
| Wheat | 55 | bu/acre | 1.16 | 63.8 |
| Wheat Straw | 1.35 | tons/acre | 18.0 | 24.3 |
| Cover Crop | Not Harvested | | | 40 |
| Soybeans | 40 | bu/acre | 3.75 | 150 |

Phosphorus Overview

On high phosphorus soils (>150 Fertility Index Value) Delaware nutrient management regulations require that a Phosphorus Site Index (PSI) be performed prior to any proposed applications of phosphorus. The purpose of this calculation is to provide a



rating of probability for phosphorus movement given a site's current conditions and the management techniques employed. The current PSI calculations for Mountaire result in ratings ranging from low to medium. A medium PSI rating requires that strategies be employed to reduce the amounts of phosphorus applied to a given site. It is recommended that Mountaire strive to achieve a wastewater phosphorus concentration that results in a reduction of phosphorus application that matches crop removal based on a three year cycle.

Summary

Nutrient management planning is performed on an on-going basis throughout the year. It is done as collaborative effort between the farmers, consultant and Mountaire personnel to ensure permit compliance along with the goal of achieving a successful farming outcome. At a minimum, soils analyses are performed on an annual basis (fall season) along with any needed in-season testing deemed appropriate to the given situation. Historical data along with past and anticipated environmental conditions are also significant to the nutrient management planning and implementation process. A monthly accounting of nutrient additions via effluent water along with any supplemental contributions of nitrogen and phosphorous through commercial fertilizers is kept in a collaborative manner between Keen Consulting (consultant) and Mountaire personnel.

Facility:
Field:
Date:

Mountaire Farms Inc,
All Fields
2/5/2020

ATTACHMENT H

| Design Criteria | | | | | | | | | | | | | | |
|--|----------------------|-------------|-------------|-------------|-------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|---------------|
| Parameter | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | SUM |
| 1 Treatment Capacity | 942,065,000 gal/year | | | | | | | | | | | | | |
| 2 Treatment Capacity Average Daily Flow | 2,581,000 gal/day | | | | | | | | | | | | | |
| 3 Disposal Capacity | 947,362,911 gal/year | | | | | | | | | | | | | |
| 4 Disposal Average Daily Flow | 2,595,514.82 gal/day | | | | | | | | | | | | | |
| 5 Number of Units | NA | | | | | | | | | | | | | |
| 6 Soil Perc Rate | 4.02 inches/hr | | | | | | | | | | | | | |
| 7 Maximum Allowed Infiltration Rate from Water Balance Calcs | 0.28 inches/hr | | | | | | | | | | | | | |
| 8 Total Storage Volume | 21,300,000 gallons | | | | | | | | | | | | | |
| 9 Treatment Lagoon and Storage Surface Acreage | 5.36 acres | | | | | | | | | | | | | |
| 10 Total Spray Acreage | 893.63 acres | | | | | | | | | | | | | |
| 11 Crop Type(s) | Corn | | | | | | | | | | | | | |
| 13 Treatment Capacity | | | | | | | | | | | | | | |
| 14 Influent Flow | gal/mo | 80,011,000 | 72,268,000 | 80,011,000 | 77,430,000 | 80,011,000 | 77,430,000 | 80,011,000 | 80,011,000 | 77,430,000 | 80,011,000 | 77,430,000 | 80,011,000 | 942,065,000 |
| 16 Hydraulic Spray Application | | | | | | | | | | | | | | |
| 17 Effluent Flow | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,260,530 | 80,258,430 | 77,473,664 | 80,127,438 | 80,491,305 | 77,662,875 | 80,520,415 | 77,968,254 | 80,600,000 | 947,362,911 |
| 18 | gal/acre | | | | | | | | | | | | | |
| 19 Calendar days per month | days/mo | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 |
| 20 Spray days per month | days/mo | 26 | 23 | 26 | 26 | 25 | 25 | 24 | 28 | 24 | 26 | 27 | 26 | 306 |
| 21 Spray weeks per month | week/mo | 4.4 | 4.0 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 52.1 |
| 22 Spray hydraulic application rate | in/mo | 3.3 | 3.0 | 3.3 | 3.2 | 3.3 | 3.2 | 3.3 | 3.3 | 3.2 | 3.3 | 3.2 | 3.3 | 39.0 |
| 23 Spray hydraulic application rate | in/week | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.74 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 0.75 | 9.0 |
| 24 Total Nitrogen Application | | | | | | | | | | | | | | |
| 25 Total nitrogen in spray effluent | mg/L | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | |
| 26 Total nitrogen in spray effluent | lb/acre-mo | 7.52 | 6.79 | 7.52 | 7.30 | 7.49 | 7.23 | 7.48 | 7.51 | 7.25 | 7.51 | 7.28 | 7.52 | 88 |
| 27 Total nitrogen applied as commercial fertilizer | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - |
| 28 Total nitrogen applied as biosolids | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - |
| 29 Total nitrogen due to precipitation | lb/acre-mo | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 5.0 |
| 30 Total nitrogen due to fixation | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - |
| 31 Total nitrogen applied | lb/acre-mo | 7.94 | 7.21 | 7.94 | 7.72 | 7.91 | 7.65 | 7.90 | 7.93 | 7.67 | 7.93 | 7.70 | 7.94 | 93 |
| 33 Ammonia Application | | | | | | | | | | | | | | |
| 34 Ammonia in spray effluent | mg/L | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| 35 Total ammonia application | lb/acre-mo | 0.75 | 0.68 | 0.75 | 0.73 | 0.75 | 0.72 | 0.75 | 0.75 | 0.72 | 0.75 | 0.73 | 0.75 | 8.84 |
| 37 Nitrogen Utilization | | | | | | | | | | | | | | |
| 38 Plant nitrogen uptake (see below) | | | | | | | | | | | | | | |
| 39 Summer Crop **** | lb/acre-mo | 0.00 | 0.00 | 0.00 | 3.10 | 23.25 | 40.30 | 52.70 | 32.55 | 3.10 | 0.00 | 0.00 | 0.00 | 155.0 |
| 40 Winter Cover Crop *** | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.30 | 2.28 | 0.65 | 4.2 |
| 41 Denitrification (15% of line 26) | lb/acre-mo | 1.13 | 1.02 | 1.13 | 1.10 | 1.12 | 1.08 | 1.12 | 1.13 | 1.09 | 1.13 | 1.09 | 1.13 | 13.3 |
| 42 Ammonia Volatilization (5% of line 35) | lb/acre-mo | 0.04 | 0.03 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.4 |
| 43 Total nitrogen consumed | lb/acre-mo | 1.17 | 1.05 | 1.17 | 4.23 | 24.41 | 41.42 | 53.86 | 33.71 | 4.22 | 2.46 | 3.40 | 1.82 | 172.9 |
| 45 Percolate Nitrogen Content | | | | | | | | | | | | | | |
| 46 Total nitrogen in percolate (line 31 minus line 43) | lb/acre-mo | 6.78 | 6.16 | 6.78 | 3.49 | -16.50 | -33.77 | -45.96 | -25.78 | 3.44 | 5.47 | 4.3 | 6.1 | (79.5) |
| 47 Total nitrogen in percolate | lb/mo | 6,055 | 5,506 | 6,055 | 3,120 | (14,746) | (30,178) | (41,072) | (23,040) | 3,078 | 4,888 | 3,837 | 5,475 | (71,021) |
| 49 Percolate Volume | | | | | | | | | | | | | | |
| 50 Spray Hydraulic Application (line 21) | in/mo | 3.3 | 3.0 | 3.3 | 3.2 | 3.3 | 3.2 | 3.3 | 3.3 | 3.2 | 3.3 | 3.2 | 3.3 | 39.0 |
| 51 Climatological Normal Precipitation (Exhibit K-K) | in/mo | 3.3 | 3.2 | 4.1 | 3.2 | 3.4 | 3.6 | 3.9 | 5.3 | 3.6 | 3.5 | 3.1 | 3.6 | 43.8 |
| 52 Total Hydraulic Loading | in/mo | 6.6 | 6.2 | 7.4 | 6.4 | 6.7 | 6.8 | 7.2 | 8.6 | 6.8 | 6.8 | 6.3 | 6.9 | 82.8 |
| 53 Thornwaite Potential Evapotranspiration (Exhibit J-J) | in/mo | 0.1 | 0.1 | 0.7 | 1.8 | 3.3 | 4.8 | 5.5 | 4.9 | 3.6 | 1.9 | 0.9 | 0.2 | 27.8 |
| 54 Percolate (line 52 minus line 53) | in/mo | 6.5 | 6.1 | 6.7 | 4.6 | 3.4 | 2.0 | 1.7 | 3.7 | 3.2 | 4.9 | 5.4 | 6.7 | 55.0 |
| 55 Percolate volume | gal/mo | 158,250,318 | 148,023,763 | 163,103,479 | 112,232,401 | 82,684,745 | 48,354,438 | 41,301,880 | 90,197,361 | 77,662,618 | 119,345,441 | 131,352,773 | 163,103,479 | 1,335,612,695 |
| 57 Percolate Nitrogen Concentration | | | | | | | | | | | | | | |
| 58 Total nitrogen in percolate (line 47) | lb/mo | 6,055 | 5,506 | 6,055 | 3,120 | 0 | 0 | 0 | 0 | 3,078 | 4,888 | 3,837 | 5,475 | 38,015 |
| 59 Percolate volume (line 55) | gal/mo | 158,250,318 | 148,023,763 | 163,103,479 | 112,232,401 | 82,684,745 | 48,354,438 | 41,301,880 | 90,197,361 | 77,662,618 | 119,345,441 | 131,352,773 | 163,103,479 | 1,335,612,695 |
| 60 Total nitrogen concentration in percolate | lb/MG | 38.26 | 37.20 | 37.13 | 27.80 | - | - | - | - | 39.64 | 40.96 | 29.21 | 33.57 | 28.46 |
| 61 Nitrogen concentration in percolate | mg/L | 4.6 | 4.5 | 4.5 | 3.3 | 0.0 | 0.0 | 0.0 | 0.0 | 4.8 | 4.9 | 3.5 | 4.0 | 2.8 |
| 62 STORAGE | | | | | | | | | | | | | | |
| 63 Volume Generated (line 14) | gal/mo | 80,011,000 | 72,268,000 | 80,011,000 | 77,430,000 | 80,011,000 | 77,430,000 | 80,011,000 | 80,011,000 | 77,430,000 | 80,011,000 | 77,430,000 | 80,011,000 | 942,065,000 |
| 64 Volume Irrigated (line 17) | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,260,530 | 80,258,430 | 77,473,664 | 80,127,438 | 80,491,305 | 77,662,875 | 80,520,415 | 77,968,254 | 80,600,000 | 947,362,911 |
| 65 Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K)) | gal/mo | 684,071 | 640,407 | 815,063 | 654,961 | 727,735 | 742,290 | 916,946 | 1,193,485 | 756,844 | 785,954 | 669,516 | 756,844 | 9,344,117 |

| | | | | | | | | | | | | | | | |
|----|---|--------|---------|---------|---------|-----------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|
| 66 | Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9) | gal/mo | 14,555 | 14,555 | 101,883 | 261,985 | 480,305 | 698,626 | 800,508 | 713,180 | 523,969 | 276,539 | 130,992 | 29,109 | 4,046,206 |
| 67 | Volume Stored | gal/mo | 80,516 | 93,852 | 124,180 | (437,553) | (0) | (0) | (0) | (0) | (0) | (1) | 270 | 138,735 | (0.40) |
| 68 | Cumulative Volume Stored | gal/mo | 219,521 | 313,373 | 437,553 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 270 | 139,005 | 0 |
| | P5 (in/mo) | | 4.7 | 4.4 | 5.6 | 4.5 | 5 | 5.1 | 6.3 | 8.2 | 5.2 | 5.4 | 4.6 | 5.2 | 64.2 |

Facility:

Mountaire Farms Inc,

Field:

All Fields

Date:

2/5/2020

| Design Criteria | | | | | | | | | | | | | | | | | |
|-----------------|--|--------------|-------------|-------------|-------------|-------------|------------|------------|------------|------------|-------------|-------------|-------------|-------------|---------------|--|--|
| 1 | Treatment Capacity | 942,065,000 | gal/year | | | | | | | | | | | | | | |
| 2 | Treatment Capacity Average Daily Flow | 2,581,000 | gal/day | | | | | | | | | | | | | | |
| 3 | Disposal Capacity | 947,362,911 | gal/year | | | | | | | | | | | | | | |
| 4 | Disposal Average Daily Flow | 2,595,515 | gal/day | | | | | | | | | | | | | | |
| 5 | Number of Units | NA | | | | | | | | | | | | | | | |
| 6 | Soil Perc Rate | Varies | inches/hr | | | | | | | | | | | | | | |
| 7 | Maximum Allowed Infiltration Rate from Water Balance Calcs | 0.28 | inches/hr | | | | | | | | | | | | | | |
| 8 | Total Storage Volume | 21,300,000 | gallons | | | | | | | | | | | | | | |
| 9 | Treatment Lagoon and Storage Surface Acreage | 5.36 | acres | | | | | | | | | | | | | | |
| 10 | Total Spray Acreage | 893.63 | acres | | | | | | | | | | | | | | |
| 11 | Crop Type(s) | Soybean | | | | | | | | | | | | | | | |
| 12 | Parameter | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | SUM | | |
| 13 | Treatment Capacity | | | | | | | | | | | | | | | | |
| 14 | Influent Flow | gal/mo | 80,011,000 | 72,268,000 | 80,011,000 | 77,430,000 | 80,011,000 | 77,430,000 | 80,011,000 | 80,011,000 | 77,430,000 | 80,011,000 | 77,430,000 | 80,011,000 | 942,065,000 | | |
| 15 | | | | | | | | | | | | | | | | | |
| 16 | Hydraulic Spray Application | | | | | | | | | | | | | | | | |
| 17 | Effluent Flow | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,260,530 | 80,258,430 | 77,473,664 | 80,127,438 | 80,491,305 | 77,662,875 | 80,520,415 | 77,968,254 | 80,600,000 | 947,362,911 | | |
| 18 | | gal/acre | | | | | | | | | | | | | | | |
| 19 | Calendar days per month | days/mo | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 | | |
| 20 | Spray days per month | days/mo | 26 | 23 | 26 | 26 | 25 | 25 | 24 | 28 | 24 | 26 | 27 | 26 | 306 | | |
| 21 | Spray weeks per month | week/mo | 4.4 | 4.0 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 52.14 | | |
| 22 | Spray hydraulic application rate | in/mo | 3.3 | 3.0 | 3.3 | 3.2 | 3.3 | 3.2 | 3.3 | 3.3 | 3.2 | 3.3 | 3.2 | 3.3 | 39.04 | | |
| 23 | Spray hydraulic application rate | in/week | 0.8 | 0.8 | 0.8 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.8 | 8.98 | | |
| 24 | Total Nitrogen Application | | | | | | | | | | | | | | | | |
| 25 | Total nitrogen in spray effluent | mg/L | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | | | |
| 26 | Total nitrogen in spray effluent | lb/acre-mo | 7.52 | 6.79 | 7.52 | 7.30 | 7.49 | 7.23 | 7.48 | 7.51 | 7.25 | 7.51 | 7.28 | 7.52 | 88.4 | | |
| 27 | Total nitrogen applied as commercial fertilizer | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - | | |
| 28 | Total nitrogen applied as biosolids | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - | | |
| 29 | Total nitrogen due to precipitation | lb/acre-mo | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 5.0 | | |
| 30 | Total nitrogen due to fixation | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12.00 | 24.00 | 18.00 | 6.00 | 0.00 | 0.00 | 0.00 | 60.0 | | |
| 31 | Total nitrogen applied | lb/acre-mo | 7.94 | 7.21 | 7.94 | 7.72 | 7.91 | 7.65 | 7.90 | 7.93 | 7.67 | 7.93 | 7.70 | 7.94 | 93.5 | | |
| 32 | | | | | | | | | | | | | | | | | |
| 33 | Ammonia Application | | | | | | | | | | | | | | | | |
| 34 | Ammonia in spray effluent | mg/L | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | |
| 35 | Total ammonia application | lb/acre-mo | 0.75 | 0.67 | 0.75 | 0.72 | 0.75 | 0.72 | 0.75 | 0.75 | 0.72 | 0.75 | 0.72 | 0.75 | 8.8 | | |
| 36 | | | | | | | | | | | | | | | | | |
| 37 | Nitrogen Utilization | | | | | | | | | | | | | | | | |
| 38 | Plant nitrogen uptake (see below) | | | | | | | | | | | | | | | | |
| 39 | Summer Crop **** | lb/acre-mo | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 | 60.0 | 45.0 | 15.0 | 0.0 | 0.0 | 0.0 | 150.0 | | |
| 40 | Winter Cover Crop *** | lb/acre-mo | 0.3 | 1.9 | 10.2 | 21.7 | 22.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 56.5 | | |
| 41 | Denitrification (15% of line 26) | lb/acre-mo | 1.1 | 1.0 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 13.3 | | |
| 42 | Ammonia Volatilization (5% of line 35) | lb/acre-mo | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | | |
| 43 | Total nitrogen consumed | lb/acre-mo | 1.5 | 3.0 | 11.4 | 22.8 | 23.5 | 19.1 | 37.2 | 28.2 | 10.1 | 1.2 | 1.1 | 1.2 | 160.2 | | |
| 44 | | | | | | | | | | | | | | | | | |
| 45 | Percolate Nitrogen Content | | | | | | | | | | | | | | | | |
| 46 | Total nitrogen in percolate (line 31 minus line 43) | lb/acre-mo | 6.46 | 4.25 | -3.43 | -15.10 | -15.58 | -11.47 | -29.26 | -20.23 | -2.46 | 6.77 | 6.6 | 6.8 | (66.7) | | |
| 47 | Total nitrogen in percolate | lb/mo | 5,771 | 3,796 | (3,066) | (13,494) | (13,923) | (10,250) | (26,148) | (18,080) | (2,194) | 6,050 | 5,870 | 6,056 | (59,614) | | |
| 48 | | | | | | | | | | | | | | | | | |
| 49 | Percolate Volume | | | | | | | | | | | | | | | | |
| 50 | Spray Hydraulic Application (line 21) | in/mo | 3.3 | 3.0 | 3.3 | 3.2 | 3.3 | 3.2 | 3.3 | 3.3 | 3.2 | 3.3 | 3.2 | 3.3 | 39.0 | | |
| 51 | Climatological Normal Precipitation (Exhibit K-K) | in/mo | 3.3 | 3.2 | 4.1 | 3.2 | 3.4 | 3.6 | 3.9 | 5.3 | 3.6 | 3.5 | 3.1 | 3.6 | 43.8 | | |
| 52 | Total Hydraulic Loading | in/mo | 6.6 | 6.2 | 7.4 | 6.4 | 6.7 | 6.8 | 7.2 | 8.6 | 6.8 | 6.8 | 6.3 | 6.9 | 82.8 | | |
| 53 | Thornwaite Potential Evapotranspiration (Exhibit J-J) | in/mo | 0.1 | 0.1 | 0.7 | 1.8 | 3.3 | 4.8 | 5.5 | 4.9 | 3.6 | 1.9 | 0.9 | 0.2 | 27.8 | | |
| 54 | Percolate (line 52 minus line 53) | in/mo | 6.5 | 6.1 | 6.7 | 4.6 | 3.4 | 2.0 | 1.7 | 3.7 | 3.2 | 4.9 | 5.4 | 6.7 | 55.0 | | |
| 55 | Percolate volume | gal/mo | 158,250,318 | 148,023,763 | 163,103,479 | 112,232,401 | 82,684,745 | 48,354,438 | 41,301,880 | 90,197,361 | 77,662,618 | 119,345,441 | 131,352,773 | 163,103,479 | 1,335,612,695 | | |
| 56 | | | | | | | | | | | | | | | | | |
| 57 | Percolate Nitrogen Concentration | | | | | | | | | | | | | | | | |
| 58 | Total nitrogen in percolate (line 47) | lb/mo | 5,771 | 3,796 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6,050 | 5,870 | 6,056 | 27,542.15 | | |
| 59 | Percolate volume (line 55) | gal/mo | 158,250,318 | 148,023,763 | 163,103,479 | 112,232,401 | 82,684,745 | 48,354,438 | 41,301,880 | 90,197,361 | 77,662,618 | 119,345,441 | 131,352,773 | 163,103,479 | 1,335,612,695 | | |
| 60 | Total nitrogen concentration in percolate | lb/MG | 36.47 | 25.64 | - | - | - | - | - | - | - | 50.69 | 44.69 | 37.13 | 20.62 | | |
| 61 | Nitrogen concentration in percolate | mg/L | 4.4 | 3.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.1 | 5.4 | 4.5 | 1.9 | | |
| 62 | STORAGE | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | SUM | | |
| 63 | Volume Generated (line 14) | gal/mo | 80,011,000 | 72,268,000 | 80,011,000 | 77,430,000 | 80,011,000 | 77,430,000 | 80,011,000 | 80,011,000 | 77,430,000 | 80,011,000 | 77,430,000 | 80,011,000 | 942,065,000 | | |
| 64 | Volume Irrigated (line 17) | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,260,530 | 80,258,430 | 77,473,664 | 80,127,438 | 80,491,305 | 77,662,875 | 80,520,415 | 77,968,254 | 80,600,000 | 947,362,911 | | |
| 65 | Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K*)) | gal/mo | 684,071 | 640,407 | 815,063 | 654,961 | 727,735 | 742,290 | 916,946 | 1,193,485 | 756,844 | 785,954 | 669,516 | 756,844 | 9,344,117 | | |
| 66 | Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9) | gal/mo | 14,555 | 14,555 | 101,883 | 261,985 | 480,305 | 698,626 | 800,508 | 713,180 | 523,969 | 276,539 | 130,992 | 29,109 | 4,046,206 | | |
| 67 | Volume Stored | gal/mo | 80,516 | 93,852 | 124,180 | (437,553) | (0) | 0 | (0) | 0 | 0 | (1) | 270 | 138,735 | | | |

| | | | | | | | | | | | | | | |
|----|--------------------------|--------|---------|---------|---------|---|---|---|-----|---|---|-----|-----|---------|
| 68 | Cumulative Volume Stored | gal/mo | 219,521 | 313,373 | 437,553 | 0 | 0 | 0 | (0) | 0 | 0 | (0) | 270 | 139,005 |
|----|--------------------------|--------|---------|---------|---------|---|---|---|-----|---|---|-----|-----|---------|

Facility:

Mountaire Farms Inc.

ATTACHMENT I

Field:

All Fields

Date:

2/5/2020

| Design Criteria | | | | | | | | | | | | | | |
|--|---------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------|
| Parameter | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | SUM |
| 1 Treatment Capacity | 949,000,000 | gal/year | | | | | | | | | | | | |
| 2 Treatment Capacity Average Daily Flow | 2,600,000 | gal/day | | | | | | | | | | | | |
| 3 Disposal Capacity | 1,460,000,000 | gal/year | | | | | | | | | | | | |
| 4 Disposal Average Daily Flow | 4,000,000 | gal/day | | | | | | | | | | | | |
| 5 Number of Units | NA | | | | | | | | | | | | | |
| 6 Soil Perc Rate | 4.02 | inches/hr | | | | | | | | | | | | |
| 7 Maximum Allowed Infiltration Rate from Water Balance Calcs | 0.28 | inches/hr | | | | | | | | | | | | |
| 8 Total Storage Volume | 21,300,000 | gallons | | | | | | | | | | | | |
| 9 Treatment Lagoon and Storage Surface Acreage | 5.36 | acres | | | | | | | | | | | | |
| 10 Total Spray Acreage | 893.63 | acres | | | | | | | | | | | | |
| 11 Crop Type(s) | Corn | | | | | | | | | | | | | |
| Treatment Capacity | | | | | | | | | | | | | | |
| 14 Influent Flow | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 949,000,000 |
| Hydraulic Spray Application | | | | | | | | | | | | | | |
| 17 Effluent Flow | gal/mo | 124,000,000 | 112,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 949,000,000 |
| 18 | gal/acre | | | | | | | | | | | | | |
| 19 Calendar days per month | days/mo | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 |
| 20 Spray days per month | days/mo | 26 | 23 | 26 | 26 | 25 | 25 | 24 | 28 | 24 | 26 | 27 | 26 | 306 |
| 20 Spray weeks per month | week/mo | 4.4 | 4.0 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 52.1 |
| 21 Spray hydraulic application rate | in/mo | 5.1 | 4.6 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 60.2 |
| 22 Spray hydraulic application rate | in/week | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 13.8 |
| Total Nitrogen Application | | | | | | | | | | | | | | |
| 25 Total nitrogen in spray effluent | mg/L | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | |
| 26 Total nitrogen in spray effluent | lb/acre-mo | 11.57 | 10.45 | 11.57 | 11.20 | 11.57 | 11.20 | 11.57 | 11.57 | 11.20 | 11.57 | 11.20 | 11.57 | 136 |
| 27 Total nitrogen applied as commercial fertilizer | lb/acre-mo | 0.00 | 0.00 | 0.00 | 7.00 | 24.00 | 38.00 | 50.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 119 |
| 28 Total nitrogen applied as biosolids | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - |
| 29 Total nitrogen due to precipitation | lb/acre-mo | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 5.0 |
| 30 Total nitrogen due to fixation | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - |
| 31 Total nitrogen applied | lb/acre-mo | 11.99 | 10.87 | 11.99 | 18.62 | 35.99 | 49.62 | 61.99 | 11.99 | 11.62 | 11.99 | 11.62 | 11.99 | 260 |
| Ammonia Application | | | | | | | | | | | | | | |
| 34 Ammonia in spray effluent | mg/L | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| 35 Total ammonia application | lb/acre-mo | 1.16 | 1.05 | 1.16 | 1.12 | 1.16 | 1.12 | 1.16 | 1.16 | 1.12 | 1.16 | 1.12 | 1.16 | 13.63 |
| Nitrogen Utilization | | | | | | | | | | | | | | |
| 38 Plant nitrogen uptake (see below) | | | | | | | | | | | | | | |
| 39 Summer Crop **** | lb/acre-mo | 0.00 | 0.00 | 0.00 | 3.10 | 23.25 | 40.30 | 52.70 | 32.55 | 3.10 | 0.00 | 0.00 | 0.00 | 155.0 |
| 40 Winter Cover Crop *** | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.30 | 2.28 | 0.65 | 4.2 |
| 41 Denitrification (15% of line 26) | lb/acre-mo | 1.74 | 1.57 | 1.74 | 1.68 | 1.74 | 1.68 | 1.74 | 1.74 | 1.68 | 1.74 | 1.68 | 1.74 | 20.4 |
| 42 Ammonia Volatilization (5% of line 35) | lb/acre-mo | 0.06 | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.7 |
| 43 Total nitrogen consumed | lb/acre-mo | 1.79 | 1.62 | 1.79 | 4.84 | 25.04 | 42.04 | 54.49 | 34.34 | 4.84 | 3.09 | 4.01 | 2.44 | 180.3 |
| Percolate Nitrogen Content | | | | | | | | | | | | | | |
| 46 Total nitrogen in percolate (line 31 minus line 43) | lb/acre-mo | 10.20 | 9.25 | 10.20 | 13.78 | 10.95 | 7.58 | 7.50 | -22.35 | 6.78 | 8.90 | 7.6 | 9.5 | 80.0 |
| 47 Total nitrogen in percolate | lb/mo | 9,114 | 8,268 | 9,114 | 12,317 | 9,784 | 6,777 | 6,701 | (19,974) | 6,062 | 7,952 | 6,799 | 8,533 | 71,448 |
| Percolate Volume | | | | | | | | | | | | | | |
| 50 Spray Hydraulic Application (line 21) | in/mo | 5.1 | 4.6 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 60.2 |
| 51 Climatological Normal Precipitation (Exhibit K-K) | in/mo | 3.3 | 3.2 | 4.1 | 3.2 | 3.4 | 3.6 | 3.9 | 5.3 | 3.6 | 3.5 | 3.1 | 3.6 | 43.8 |
| 52 Total Hydraulic Loading | in/mo | 8.4 | 7.8 | 9.2 | 8.1 | 8.5 | 8.5 | 9.0 | 10.4 | 8.5 | 8.6 | 8.0 | 8.7 | 104.0 |
| 53 Thornwaite Potential Evapotranspiration (Exhibit J-J) | in/mo | 0.1 | 0.1 | 0.7 | 1.8 | 3.3 | 4.8 | 5.5 | 4.9 | 3.6 | 1.9 | 0.9 | 0.2 | 27.8 |
| 54 Percolate (line 52 minus line 53) | in/mo | 8.3 | 7.7 | 8.5 | 6.3 | 5.2 | 3.7 | 3.5 | 5.5 | 4.9 | 6.7 | 7.1 | 8.5 | 76.2 |
| 55 Percolate volume | gal/mo | 201,650,174 | 187,223,633 | 206,503,335 | 153,971,733 | 126,426,170 | 90,880,633 | 85,174,297 | 133,705,912 | 119,999,602 | 162,824,881 | 173,384,379 | 206,503,335 | 1,848,248,085 |
| Percolate Nitrogen Concentration | | | | | | | | | | | | | | |
| 58 Total nitrogen in percolate (line 47) | lb/mo | 9,114 | 8,268 | 9,114 | 12,317 | 9,784 | 6,777 | 6,701 | 0 | 6,062 | 7,952 | 6,799 | 8,533 | 91,422 |
| 59 Percolate volume (line 55) | gal/mo | 201,650,174 | 187,223,633 | 206,503,335 | 153,971,733 | 126,426,170 | 90,880,633 | 85,174,297 | 133,705,912 | 119,999,602 | 162,824,881 | 173,384,379 | 206,503,335 | 1,848,248,085 |
| 60 Total nitrogen concentration in percolate | lb/MG | 45.20 | 44.16 | 44.13 | 80.00 | 77.39 | 74.57 | 78.68 | - | 50.52 | 48.84 | 39.21 | 41.32 | 49.46 |
| 61 Nitrogen concentration in percolate | mg/L | 5.4 | 5.3 | 5.3 | 9.6 | 9.3 | 8.9 | 9.4 | 0.0 | 6.1 | 5.9 | 4.7 | 5.0 | 6.2 |
| STORAGE | | | | | | | | | | | | | | |
| 62 Volume Generated (line 14) | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 949,000,000 |
| 64 Volume Irrigated (line 17) | gal/mo | 124,000,000 | 112,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 1,460,000,000 |
| 65 Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K)) | gal/mo | 684,071 | 640,407 | 815,063 | 654,961 | 727,735 | 742,290 | 916,946 | 1,193,485 | 756,844 | 785,954 | 669,516 | 756,844 | 9,344,117 |
| 66 Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9) | gal/mo | 14,555 | 14,555 | 101,883 | 261,985 | 480,305 | 698,626 | 800,508 | 713,180 | 523,969 | 276,539 | 130,992 | 29,109 | 4,046,206 |
| 67 Volume Stored | gal/mo | (42,730,484) | (38,574,148) | (42,686,820) | (41,607,023) | (43,152,570) | (41,956,336) | (43,283,562) | (42,919,695) | (41,767,125) | (42,890,586) | (41,461,476) | (42,672,265) | (505,702,089.40) |

Facility:

Mountaire Farms Inc,

Field:

All Fields

Date:

2/5/2020

| Design Criteria | | | | | | | | | | | | | | | |
|--|----------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---------------|--|
| Parameter | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | SUM | |
| Treatment Capacity | 949,000,000 gal/year | | | | | | | | | | | | | | |
| Treatment Capacity Average Daily Flow | 2,600,000 gal/day | | | | | | | | | | | | | | |
| Disposal Capacity | 949,000,000 gal/year | | | | | | | | | | | | | | |
| Disposal Average Daily Flow | 4,000,000 gal/day | | | | | | | | | | | | | | |
| Number of Units | NA | | | | | | | | | | | | | | |
| Soil Perc Rate | 4.02 inches/hr | | | | | | | | | | | | | | |
| Maximum Allowed Infiltration Rate from Water Balance Calcs | 0.28 inches/hr | | | | | | | | | | | | | | |
| Total Storage Volume | 21,300,000 gallons | | | | | | | | | | | | | | |
| Treatment Lagoon and Storage Surface Acreage | 5.36 acres | | | | | | | | | | | | | | |
| Total Spray Acreage | 893.63 acres | | | | | | | | | | | | | | |
| Crop Type(s) | Soybean | | | | | | | | | | | | | | |
| Treatment Capacity | | | | | | | | | | | | | | | |
| Influent Flow | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 949,000,000 | |
| Hydraulic Spray Application | | | | | | | | | | | | | | | |
| Effluent Flow | gal/mo | 124,000,000 | 112,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 1,460,000,000 | |
| Calendar days per month | days/mo | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 | |
| Spray days per month | days/mo | 26 | 23 | 26 | 26 | 25 | 25 | 24 | 28 | 24 | 26 | 27 | 26 | 306 | |
| Spray weeks per month | week/mo | 4.4 | 4.0 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 52.14 | |
| Spray hydraulic application rate | in/mo | 5.1 | 4.6 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 60.17 | |
| Spray hydraulic application rate | in/week | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 13.85 | |
| Total Nitrogen Application | | | | | | | | | | | | | | | |
| Total nitrogen in spray effluent | mg/L | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | | |
| Total nitrogen in spray effluent | lb/acre-mo | 11.57 | 10.45 | 11.57 | 11.20 | 11.57 | 11.20 | 11.57 | 11.57 | 11.20 | 11.57 | 11.20 | 11.57 | 136.3 | |
| Total nitrogen applied as commercial fertilizer | lb/acre-mo | 0.00 | 0.00 | 0.00 | 7.00 | 23.00 | 13.00 | 27.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 70.0 | |
| Total nitrogen applied as biosolids | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - | |
| Total nitrogen due to precipitation | lb/acre-mo | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 5.0 | |
| Total nitrogen due to fixation | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12.00 | 24.00 | 18.00 | 6.00 | 0.00 | 0.00 | 0.00 | 60.0 | |
| Total nitrogen applied | lb/acre-mo | 11.99 | 10.87 | 11.99 | 18.62 | 34.99 | 24.62 | 38.99 | 11.99 | 11.62 | 11.99 | 11.62 | 11.99 | 211.3 | |
| Ammonia Application | | | | | | | | | | | | | | | |
| Ammonia in spray effluent | mg/L | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | |
| Total ammonia application | lb/acre-mo | 0.75 | 0.68 | 0.75 | 0.73 | 0.75 | 0.73 | 0.75 | 0.75 | 0.73 | 0.75 | 0.73 | 0.75 | 8.9 | |
| Nitrogen Utilization | | | | | | | | | | | | | | | |
| Plant nitrogen uptake (see below) | | | | | | | | | | | | | | | |
| Summer Crop **** | lb/acre-mo | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 | 60.0 | 45.0 | 15.0 | 0.0 | 0.0 | 0.0 | 150.0 | |
| Winter Cover Crop *** | lb/acre-mo | 0.3 | 1.9 | 10.2 | 21.7 | 22.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 56.5 | |
| Denitrification (15% of line 26) | lb/acre-mo | 1.7 | 1.6 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 | 20.4 | |
| Ammonia Volatilization (5% of line 35) | lb/acre-mo | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | |
| Total nitrogen consumed | lb/acre-mo | 2.1 | 3.5 | 12.0 | 23.4 | 24.1 | 19.7 | 37.8 | 28.8 | 10.7 | 1.8 | 1.7 | 1.8 | 167.3 | |
| Percolate Nitrogen Content | | | | | | | | | | | | | | | |
| Total nitrogen in percolate (line 31 minus line 43) | lb/acre-mo | 9.90 | 7.36 | 0.01 | -4.79 | 10.89 | 4.90 | 1.22 | -16.78 | 0.90 | 10.22 | 9.9 | 10.2 | 44.0 | |
| Total nitrogen in percolate | lb/mo | 8,847 | 6,574 | 10 | (4,280) | 9,731 | 4,381 | 1,089 | (14,996) | 807 | 9,132 | 8,850 | 9,132 | 39,278 | |
| Percolate Volume | | | | | | | | | | | | | | | |
| Spray Hydraulic Application (line 21) | in/mo | 5.1 | 4.6 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 60.2 | |
| Climatological Normal Precipitation (Exhibit K-K) | in/mo | 3.3 | 3.2 | 4.1 | 3.2 | 3.4 | 3.6 | 3.9 | 5.3 | 3.6 | 3.5 | 3.1 | 3.6 | 43.8 | |
| Total Hydraulic Loading | in/mo | 8.4 | 7.8 | 9.2 | 8.1 | 8.5 | 8.5 | 9.0 | 10.4 | 8.5 | 8.6 | 8.0 | 8.7 | 104.0 | |
| Thornwaite Potential Evapotranspiration (Exhibit J-J) | in/mo | 0.1 | 0.1 | 0.7 | 1.8 | 3.3 | 4.8 | 5.5 | 4.9 | 3.6 | 1.9 | 0.9 | 0.2 | 27.8 | |
| Percolate (line 52 minus line 53) | in/mo | 8.3 | 7.7 | 8.5 | 6.3 | 5.2 | 3.7 | 3.5 | 5.5 | 4.9 | 6.7 | 7.1 | 8.5 | 76.2 | |
| Percolate volume | gal/mo | 201,650,174 | 187,223,633 | 206,503,335 | 153,971,733 | 126,426,170 | 90,880,633 | 85,174,297 | 133,705,912 | 119,999,602 | 162,824,881 | 173,384,379 | 206,503,335 | 1,848,248,085 | |
| Percolate Nitrogen Concentration | | | | | | | | | | | | | | | |
| Total nitrogen in percolate (line 47) | lb/mo | 8,847 | 6,574 | 10 | 0 | 9,731 | 4,381 | 1,089 | 0 | 807 | 9,132 | 8,850 | 9,132 | 58,553.48 | |
| Percolate volume (line 55) | gal/mo | 201,650,174 | 187,223,633 | 206,503,335 | 153,971,733 | 126,426,170 | 90,880,633 | 85,174,297 | 133,705,912 | 119,999,602 | 162,824,881 | 173,384,379 | 206,503,335 | 1,848,248,085 | |
| Total nitrogen concentration in percolate | lb/MG | 43.87 | 35.11 | 0.05 | - | 76.97 | 48.21 | 12.79 | - | 6.72 | 56.09 | 51.04 | 44.22 | 31.68 | |
| Nitrogen concentration in percolate | mg/L | 5.3 | 4.2 | 0.0 | 0.0 | 9.2 | 5.8 | 1.5 | 0.0 | 0.8 | 6.7 | 6.1 | 5.3 | 3.7 | |

| 62 | STORAGE | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | SUM |
|----|--|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------|
| 63 | Volume Generated (line 14) | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 949,000,000 |
| 64 | Volume Irrigated (line 17) | gal/mo | 124,000,000 | 112,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 1,460,000,000 |
| 65 | Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K*)) | gal/mo | 684,071 | 640,407 | 815,063 | 654,961 | 727,735 | 742,290 | 916,946 | 1,193,485 | 756,844 | 785,954 | 669,516 | 756,844 | 9,344,117 |
| 66 | Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9) | gal/mo | 14,555 | 14,555 | 101,883 | 261,985 | 480,305 | 698,626 | 800,508 | 713,180 | 523,969 | 276,539 | 130,992 | 29,109 | 4,046,206 |
| 67 | Volume Stored | gal/mo | (42,730,484) | (38,574,148) | (42,686,820) | (41,607,023) | (43,152,570) | (41,956,336) | (43,283,562) | (42,919,695) | (41,767,125) | (42,890,586) | (41,461,476) | (42,672,265) | (505,702,089.40) |
| 68 | Cumulative Volume Stored | gal/mo | | | | | | | | | | | | (42,672,265) | |

Facility:

Mountaire Farms Inc.

ATTACHMENT J

Field:

All Fields

Date:

2/5/2020

| Design Criteria | | | |
|-----------------|--|---------------|-----------|
| 1 | Treatment Capacity | 949,000,000 | gal/year |
| 2 | Treatment Capacity Average Daily Flow | 2,600,000 | gal/day |
| 3 | Disposal Capacity | 1,460,000,000 | gal/year |
| 4 | Disposal Average Daily Flow | 4,000,000 | gal/day |
| 5 | Number of Units | NA | |
| 6 | Soil Perc Rate | 4.02 | inches/hr |
| 7 | Maximum Allowed Infiltration Rate from Water Balance Calcs | 0.28 | inches/hr |
| 8 | Total Storage Volume | 21,300,000 | gallons |
| 9 | Treatment Lagoon and Storage Surface Acreage | 5.36 | acres |
| 10 | Total Spray Acreage | 420 | acres |
| 11 | Crop Type(s) | | Corn |

Note: fields WHBJ-1, WHBJ-3, WHBJ-5, CB-3, and CB-3C all have maximum percolation rates less than 2.5 in/wk and are not included in this Total Spray Acreage

| Parameter | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | SUM |
|---|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------|------------------|
| Treatment Capacity | | | | | | | | | | | | | | |
| Influent Flow | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 949,000,000 |
| Hydraulic Spray Application | | | | | | | | | | | | | | |
| Effluent Flow | gal/mo | 124,000,000 | 112,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 72,900,000 | 949,000,000 |
| Calendar days per month | days/mo | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 |
| Spray days per month | days/mo | 26 | 23 | 26 | 26 | 25 | 25 | 24 | 28 | 24 | 26 | 27 | 26 | 306 |
| Spray weeks per month | week/mo | 4.4 | 4.0 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 52.1 |
| Spray hydraulic application rate | in/mo | 10.9 | 9.8 | 10.9 | 10.5 | 10.9 | 10.5 | 10.9 | 10.9 | 10.5 | 10.9 | 10.5 | 6.4 | 123.5 |
| Spray hydraulic application rate | in/week | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 1.4 | 28.4 |
| Total Nitrogen Application | | | | | | | | | | | | | | |
| Total nitrogen in spray effluent | mg/L | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | |
| Total nitrogen in spray effluent | lb/acre-mo | 24.62 | 22.24 | 24.62 | 23.83 | 24.62 | 23.83 | 24.62 | 24.62 | 23.83 | 24.62 | 23.83 | 14.48 | 280 |
| Total nitrogen applied as commercial fertilizer | lb/acre-mo | 0.00 | 0.00 | 0.00 | 7.00 | 24.00 | 38.00 | 50.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 119 |
| Total nitrogen applied as biosolids | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - |
| Total nitrogen due to precipitation | lb/acre-mo | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 5.0 |
| Total nitrogen due to fixation | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - |
| Total nitrogen applied | lb/acre-mo | 25.04 | 22.66 | 25.04 | 31.25 | 49.04 | 62.25 | 75.04 | 25.04 | 24.25 | 25.04 | 24.25 | 14.90 | 404 |
| Ammonia Application | | | | | | | | | | | | | | |
| Ammonia in spray effluent | mg/L | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Total ammonia application | lb/acre-mo | 2.46 | 2.22 | 2.46 | 2.38 | 2.46 | 2.38 | 2.46 | 2.46 | 2.38 | 2.46 | 2.38 | 1.45 | 27.98 |
| Nitrogen Utilization | | | | | | | | | | | | | | |
| Plant nitrogen uptake (see below) | | | | | | | | | | | | | | |
| Summer Crop **** | lb/acre-mo | 0.00 | 0.00 | 0.00 | 3.10 | 23.25 | 40.30 | 52.70 | 32.55 | 3.10 | 0.00 | 0.00 | 0.00 | 155.0 |
| Winter Cover Crop *** | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.30 | 2.28 | 0.65 | 4.2 |
| Denitrification (15% of line 26) | lb/acre-mo | 3.69 | 3.34 | 3.69 | 3.57 | 3.69 | 3.57 | 3.69 | 3.69 | 3.57 | 3.69 | 3.57 | 2.17 | 42.0 |
| Ammonia Volatilization (5% of line 35) | lb/acre-mo | 0.12 | 0.11 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.07 | 1.4 |
| Total nitrogen consumed | lb/acre-mo | 3.82 | 3.45 | 3.82 | 6.79 | 27.07 | 43.99 | 56.52 | 36.37 | 6.79 | 5.12 | 5.97 | 2.89 | 202.6 |
| Percolate Nitrogen Content | | | | | | | | | | | | | | |
| Total nitrogen in percolate (line 31 minus line 43) | lb/acre-mo | 21.23 | 19.21 | 21.23 | 24.46 | 21.98 | 18.26 | 18.53 | -11.32 | 17.46 | 19.93 | 18.3 | 12.0 | 201.2 |
| Total nitrogen in percolate | lb/mo | 8,915 | 8,069 | 8,915 | 10,271 | 9,230 | 7,667 | 7,781 | (4,756) | 7,331 | 8,369 | 7,678 | 5,041 | 84,512 |
| Percolate Volume | | | | | | | | | | | | | | |
| Spray Hydraulic Application (line 21) | in/mo | 10.9 | 9.8 | 10.9 | 10.5 | 10.9 | 10.5 | 10.9 | 10.9 | 10.5 | 10.9 | 10.5 | 6.4 | 123.5 |
| Climatological Normal Precipitation (Exhibit K-K) | in/mo | 3.3 | 3.2 | 4.1 | 3.2 | 3.4 | 3.6 | 3.9 | 5.3 | 3.6 | 3.5 | 3.1 | 3.6 | 43.8 |
| Total Hydraulic Loading | in/mo | 14.2 | 13.0 | 15.0 | 13.7 | 14.3 | 14.1 | 14.8 | 16.2 | 14.1 | 14.4 | 13.6 | 10.0 | 167.3 |
| Thornwaite Potential Evapotranspiration (Exhibit J-J) | in/mo | 0.1 | 0.1 | 0.7 | 1.8 | 3.3 | 4.8 | 5.5 | 4.9 | 3.6 | 1.9 | 0.9 | 0.2 | 27.8 |
| Percolate (line 52 minus line 53) | in/mo | 14.1 | 12.9 | 14.3 | 11.9 | 11.0 | 9.3 | 9.3 | 11.3 | 10.5 | 12.5 | 12.7 | 9.8 | 139.5 |
| Percolate volume | gal/mo | 160,494,834 | 147,354,397 | 162,775,787 | 135,966,272 | 125,140,065 | 106,313,885 | 105,751,967 | 128,561,495 | 119,999,602 | 142,247,211 | 145,090,083 | 111,675,956 | 1,591,371,554 |
| Percolate Nitrogen Concentration | | | | | | | | | | | | | | |
| Total nitrogen in percolate (line 47) | lb/mo | 8,915 | 8,069 | 8,915 | 10,271 | 9,230.052 | 7,667 | 7,781 | 0 | 7,331 | 8,369 | 7,678 | 5,041 | 89,268 |
| Percolate volume (line 55) | gal/mo | 160,494,834 | 147,354,397 | 162,775,787 | 135,966,272 | 125,140,065 | 106,313,885 | 105,751,967 | 128,561,495 | 119,999,602 | 142,247,211 | 145,090,083 | 111,675,956 | 1,591,371,554 |
| Total nitrogen concentration in percolate | lb/MG | 55.55 | 54.76 | 54.77 | 75.54 | 73.76 | 72.12 | 73.58 | - | 61.09 | 58.83 | 52.92 | 45.14 | 56.09 |
| Nitrogen concentration in percolate | mg/L | 6.7 | 6.6 | 6.6 | 9.1 | 8.8 | 8.6 | 8.8 | 0.0 | 7.3 | 7.1 | 6.3 | 5.4 | 6.8 |
| STORAGE | | | | | | | | | | | | | | |
| Volume Generated (line 14) | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 949,000,000 |
| Volume Irrigated (line 17) | gal/mo | 124,000,000 | 112,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 72,900,000 | 1,408,900,000 |
| Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K)) | gal/mo | 684,071 | 640,407 | 815,063 | 654,961 | 727,735 | 742,290 | 916,946 | 1,193,485 | 756,844 | 785,954 | 669,516 | 756,844 | 9,344,117 |
| Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9) | gal/mo | 14,555 | 14,555 | 101,883 | 261,985 | 480,305 | 698,626 | 800,508 | 713,180 | 523,969 | 276,539 | 130,992 | 29,109 | 4,046,206 |
| Volume Stored | gal/mo | (42,730,484) | (38,574,148) | (42,686,820) | (41,607,023) | (43,152,570) | (41,956,336) | (43,283,562) | (42,919,695) | (41,767,125) | (42,890,586) | (41,461,476) | 8,427,735 | (454,602,089.40) |

| | | | | | | | | | | | | | |
|----|--------------------------|--------|---------------|---------------|---------------|---------------|--|--|--|--|--------------|--------------|--------------|
| 68 | Cumulative Volume Stored | gal/mo | (118,654,810) | (157,228,958) | (199,915,778) | (241,522,801) | | | | | (42,890,586) | (84,352,062) | (75,924,327) |
|----|--------------------------|--------|---------------|---------------|---------------|---------------|--|--|--|--|--------------|--------------|--------------|

Facility:

Mountaire Farms Inc,

Field:

All Fields

Date:

2/5/2020

| Design Criteria | | | |
|-----------------|--|-------------|-----------|
| 1 | Treatment Capacity | 949,000,000 | gal/year |
| 2 | Treatment Capacity Average Daily Flow | 2,600,000 | gal/day |
| 3 | Disposal Capacity | 949,000,000 | gal/year |
| 4 | Disposal Average Daily Flow | 4,000,000 | gal/day |
| 5 | Number of Units | NA | |
| 6 | Soil Perc Rate | 4.02 | inches/hr |
| 7 | Maximum Allowed Infiltration Rate from Water Balance Calcs | 0.28 | inches/hr |
| 8 | Total Storage Volume | 21,300,000 | gallons |
| 9 | Treatment Lagoon and Storage Surface Acreage | 5.36 | acres |
| 10 | Total Spray Acreage | 420 | acres |
| 11 | Crop Type(s) | Soybean | |

Note: Fields WHBJ-1, WHBJ-3, WHBJ-5, CB-3, and CB-3C all have maximum percolation rates less than 2.5 in/wk and were not included in this Total Spray Acreage.

| 12 | Parameter | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | SUM |
|----|---|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---------------|
| 13 | Treatment Capacity | | | | | | | | | | | | | | |
| 14 | Influent Flow | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 949,000,000 |
| 15 | | | | | | | | | | | | | | | |
| 16 | Hydraulic Spray Application | | | | | | | | | | | | | | |
| 17 | Effluent Flow | gal/mo | 124,000,000 | 112,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 72,900,000 | 1,408,900,000 |
| 18 | | gal/acre | | | | | | | | | | | | | |
| 19 | Calendar days per month | days/mo | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 |
| 20 | Spray days per month | days/mo | 26 | 23 | 26 | 26 | 25 | 25 | 24 | 28 | 24 | 26 | 27 | 26 | 306 |
| | Spray weeks per month | week/mo | 4.4 | 4.0 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 52.14 |
| 21 | Spray hydraulic application rate | in/mo | 10.9 | 9.8 | 10.9 | 10.5 | 10.9 | 10.5 | 10.9 | 10.9 | 10.5 | 10.9 | 10.5 | 6.4 | 123.54 |
| 22 | Spray hydraulic application rate | in/week | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 1.4 | 28.45 |
| 23 | | | | | | | | | | | | | | | |
| 24 | Total Nitrogen Application | | | | | | | | | | | | | | |
| 25 | Total nitrogen in spray effluent | mg/L | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 | |
| 26 | Total nitrogen in spray effluent | lb/acre-mo | 24.62 | 22.24 | 24.62 | 23.83 | 24.62 | 23.83 | 24.62 | 24.62 | 23.83 | 24.62 | 23.83 | 14.48 | 279.8 |
| 27 | Total nitrogen applied as commercial fertilizer | lb/acre-mo | 0.00 | 0.00 | 0.00 | 7.00 | 23.00 | 13.00 | 27.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 70.0 |
| 28 | Total nitrogen applied as biosolids | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - |
| 29 | Total nitrogen due to precipitation | lb/acre-mo | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 5.0 |
| 30 | Total nitrogen due to fixation | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12.00 | 24.00 | 18.00 | 6.00 | 0.00 | 0.00 | 0.00 | 60.0 |
| 31 | Total nitrogen applied | lb/acre-mo | 25.04 | 22.66 | 25.04 | 31.25 | 48.04 | 37.25 | 52.04 | 25.04 | 24.25 | 25.04 | 24.25 | 14.90 | 354.8 |
| 32 | | | | | | | | | | | | | | | |
| 33 | Ammonia Application | | | | | | | | | | | | | | |
| 34 | Ammonia in spray effluent | mg/L | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| 35 | Total ammonia application | lb/acre-mo | 1.60 | 1.45 | 1.60 | 1.55 | 1.60 | 1.55 | 1.60 | 1.60 | 1.55 | 1.60 | 1.55 | 1.60 | 18.8 |
| 36 | | | | | | | | | | | | | | | |
| 37 | Nitrogen Utilization | | | | | | | | | | | | | | |
| 38 | Plant nitrogen uptake (see below) | | | | | | | | | | | | | | |
| 39 | Summer Crop **** | lb/acre-mo | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 | 60.0 | 45.0 | 15.0 | 0.0 | 0.0 | 0.0 | 150.0 |
| 40 | Winter Cover Crop *** | lb/acre-mo | 0.3 | 1.9 | 10.2 | 21.7 | 22.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 56.5 |
| 41 | Denitrification (15% of line 26) | lb/acre-mo | 3.7 | 3.3 | 3.7 | 3.6 | 3.7 | 3.6 | 3.7 | 3.7 | 3.6 | 3.7 | 3.6 | 2.2 | 42.0 |
| 42 | Ammonia Volatilization (5% of line 35) | lb/acre-mo | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.9 |
| 43 | Total nitrogen consumed | lb/acre-mo | 4.1 | 5.3 | 14.0 | 25.3 | 26.1 | 21.7 | 39.8 | 30.8 | 12.7 | 3.8 | 3.7 | 2.3 | 189.4 |
| 44 | | | | | | | | | | | | | | | |
| 45 | Percolate Nitrogen Content | | | | | | | | | | | | | | |
| 46 | Total nitrogen in percolate (line 31 minus line 43) | lb/acre-mo | 20.95 | 17.34 | 11.06 | 5.90 | 21.94 | 15.60 | 12.27 | -5.73 | 11.60 | 21.27 | 20.6 | 12.6 | 165.4 |
| 47 | Total nitrogen in percolate | lb/mo | 8,799 | 7,282 | 4,646 | 2,480 | 9,215 | 6,551 | 5,153 | (2,407) | 4,871 | 8,933 | 8,651 | 5,311 | 69,484 |
| 48 | | | | | | | | | | | | | | | |
| 49 | Percolate Volume | | | | | | | | | | | | | | |
| 50 | Spray Hydraulic Application (line 21) | in/mo | 10.9 | 9.8 | 10.9 | 10.5 | 10.9 | 10.5 | 10.9 | 10.9 | 10.5 | 10.9 | 10.5 | 6.4 | 123.5 |
| 51 | Climatological Normal Precipitation (Exhibit K-K) | in/mo | 3.3 | 3.2 | 4.1 | 3.2 | 3.4 | 3.6 | 3.9 | 5.3 | 3.6 | 3.5 | 3.1 | 3.6 | 43.8 |
| 52 | Total Hydraulic Loading | in/mo | 14.2 | 13.0 | 15.0 | 13.7 | 14.3 | 14.1 | 14.8 | 16.2 | 14.1 | 14.4 | 13.6 | 10.0 | 167.3 |
| 53 | Thornwaite Potential Evapotranspiration (Exhibit J-J) | in/mo | 0.1 | 0.1 | 0.7 | 1.8 | 3.3 | 4.8 | 5.5 | 4.9 | 3.6 | 1.9 | 0.9 | 0.2 | 27.8 |
| 54 | Percolate (line 52 minus line 53) | in/mo | 14.1 | 12.9 | 14.3 | 11.9 | 11.0 | 9.3 | 9.3 | 11.3 | 10.5 | 12.5 | 12.7 | 9.8 | 139.5 |
| 55 | Percolate volume | gal/mo | 160,494,834 | 147,354,397 | 162,775,787 | 135,966,272 | 125,140,065 | 106,313,885 | 105,751,967 | 128,561,495 | 119,999,602 | 142,247,211 | 145,090,083 | 111,675,956 | 1,591,371,554 |
| 56 | | | | | | | | | | | | | | | |
| 57 | Percolate Nitrogen Concentration | | | | | | | | | | | | | | |
| 58 | Total nitrogen in percolate (line 47) | lb/mo | 8,799 | 7,282 | 4,646 | 2,480 | 9,215 | 6,551 | 5,153 | 0 | 4,871 | 8,933 | 8,651 | 5,311 | 71,890.38 |
| 59 | Percolate volume (line 55) | gal/mo | 160,494,834 | 147,354,397 | 162,775,787 | 135,966,272 | 125,140,065 | 106,313,885 | 105,751,967 | 128,561,495 | 119,999,602 | 142,247,211 | 145,090,083 | 111,675,956 | 1,591,371,554 |
| 60 | Total nitrogen concentration in percolate | lb/MG | 54.83 | 49.42 | 28.54 | 18.24 | 73.63 | 61.62 | 48.73 | - | 40.59 | 62.80 | 59.62 | 47.55 | 45.18 |
| 61 | Nitrogen concentration in percolate | mg/L | 6.6 | 5.9 | 3.4 | 2.2 | 8.8 | 7.4 | 5.8 | 0.0 | 4.9 | 7.5 | 7.1 | 5.7 | 5.5 |

| 62 | STORAGE | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | SUM |
|----|--|--------|---------------|---------------|---------------|---------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|------------------|
| 63 | Volume Generated (line 14) | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 949,000,000 |
| 64 | Volume Irrigated (line 17) | gal/mo | 124,000,000 | 112,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 72,900,000 | 1,408,900,000 |
| 65 | Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K*)) | gal/mo | 684,071 | 640,407 | 815,063 | 654,961 | 727,735 | 742,290 | 916,946 | 1,193,485 | 756,844 | 785,954 | 669,516 | 756,844 | 9,344,117 |
| 66 | Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9) | gal/mo | 14,555 | 14,555 | 101,883 | 261,985 | 480,305 | 698,626 | 800,508 | 713,180 | 523,969 | 276,539 | 130,992 | 29,109 | 4,046,206 |
| 67 | Volume Stored | gal/mo | (42,730,484) | (38,574,148) | (42,686,820) | (41,607,023) | (43,152,570) | (41,956,336) | (43,283,562) | (42,919,695) | (41,767,125) | (42,890,586) | (41,461,476) | 8,427,735 | (454,602,089.40) |
| 68 | Cumulative Volume Stored | gal/mo | (118,654,810) | (157,228,958) | (199,915,778) | (241,522,801) | | | | | | (42,890,586) | (84,352,062) | (75,924,327) | |

ATTACHMENT K

Facility: Mountaire Farms Inc,
Field: All Fields
Date: 2/5/2020

| Design Criteria | | | | | | | | | | | | | | | |
|-----------------|---|---------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---------------|
| 1 | Treatment Capacity | 949,000,000 | gal/year | | | | | | | | | | | | |
| 2 | Treatment Capacity Average Daily Flow | 2,600,000 | gal/day | | | | | | | | | | | | |
| 3 | Disposal Capacity | 1,460,000,000 | gal/year | | | | | | | | | | | | |
| 4 | Disposal Average Daily Flow | 4,000,000 | gal/day | | | | | | | | | | | | |
| 5 | Number of Units | NA | | | | | | | | | | | | | |
| 6 | Soil Perc Rate | 4.02 | inches/hr | | | | | | | | | | | | |
| 7 | Maximum Allowed Infiltration Rate from Water | 0.28 | inches/hr | | | | | | | | | | | | |
| 8 | Balance Calcs | | | | | | | | | | | | | | |
| 9 | Total Storage Volume | 21,300,000 | gallons | | | | | | | | | | | | |
| 10 | Treatment Lagoon and Storage Surface | 5.36 | acres | | | | | | | | | | | | |
| 11 | Total Spray Acreage | 893.63 | acres | | | | | | | | | | | | |
| 12 | Crop Type(s) | Corn | | | | | | | | | | | | | |
| 13 | Parameter | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | SUM |
| 14 | Treatment Capacity | | | | | | | | | | | | | | |
| 15 | Influent Flow | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 949,000,000 |
| 16 | Hydraulic Spray Application | | | | | | | | | | | | | | |
| 17 | Effluent Flow | gal/mo | 124,000,000 | 112,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 949,000,000 |
| 18 | | gal/acre | | | | | | | | | | | | | |
| 19 | Calendar days per month | days/mo | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 |
| 20 | Spray days per month | days/mo | 26 | 23 | 26 | 26 | 25 | 25 | 24 | 28 | 24 | 26 | 27 | 26 | 306 |
| 21 | Spray weeks per month | week/mo | 4.4 | 4.0 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 52.1 |
| 22 | Spray hydraulic application rate | in/mo | 5.1 | 4.6 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 60.2 |
| 23 | Spray hydraulic application rate | in/week | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 13.8 |
| 24 | Total Nitrogen Application | | | | | | | | | | | | | | |
| 25 | Total nitrogen in spray effluent | mg/L | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | |
| 26 | Total nitrogen in spray effluent | lb/acre-mo | 16.78 | 15.16 | 16.78 | 16.24 | 16.78 | 16.24 | 16.78 | 16.78 | 16.24 | 16.78 | 16.24 | 16.78 | 198 |
| 27 | Total nitrogen applied as commercial fertilizer | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - |
| 28 | Total nitrogen applied as biosolids | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - |
| 29 | Total nitrogen due to precipitation | lb/acre-mo | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 5.0 |
| 30 | Total nitrogen due to fixation | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - |
| 31 | Total nitrogen applied | lb/acre-mo | 17.20 | 15.58 | 17.20 | 16.66 | 17.20 | 16.66 | 17.20 | 17.20 | 16.66 | 17.20 | 16.66 | 17.20 | 203 |
| 32 | | | | | | | | | | | | | | | |
| 33 | Ammonia Application | | | | | | | | | | | | | | |
| 34 | Ammonia in spray effluent | mg/L | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| 35 | Total ammonia application | lb/acre-mo | 1.16 | 1.05 | 1.16 | 1.12 | 1.16 | 1.12 | 1.16 | 1.16 | 1.12 | 1.16 | 1.12 | 1.16 | 13.63 |
| 36 | | | | | | | | | | | | | | | |
| 37 | Nitrogen Utilization | | | | | | | | | | | | | | |
| 38 | Plant nitrogen uptake (see below) | | | | | | | | | | | | | | |
| 39 | Summer Crop **** | lb/acre-mo | 0.00 | 0.00 | 0.00 | 3.10 | 23.25 | 40.30 | 52.70 | 32.55 | 3.10 | 0.00 | 0.00 | 0.00 | 155.0 |
| 40 | Winter Cover Crop *** | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.30 | 2.28 | 0.65 | 4.2 |
| 41 | Denitrification (15% of line 26) | lb/acre-mo | 2.52 | 2.27 | 2.52 | 2.44 | 2.52 | 2.44 | 2.52 | 2.52 | 2.44 | 2.52 | 2.44 | 2.52 | 29.6 |
| 42 | Ammonia Volatilization (5% of line 35) | lb/acre-mo | 0.06 | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.7 |
| 43 | Total nitrogen consumed | lb/acre-mo | 2.57 | 2.33 | 2.57 | 5.59 | 25.82 | 42.79 | 55.27 | 35.12 | 5.59 | 3.87 | 4.77 | 3.22 | 189.5 |
| 44 | | | | | | | | | | | | | | | |
| 45 | Percolate Nitrogen Content | | | | | | | | | | | | | | |
| 46 | Total nitrogen in percolate (line 31 minus line 43) | lb/acre-mo | 14.63 | 13.25 | 14.63 | 11.07 | -8.62 | -26.13 | -38.07 | -17.92 | 11.07 | 13.33 | 11.9 | 14.0 | 13.1 |
| 47 | Total nitrogen in percolate | lb/mo | 13,070 | 11,841 | 13,070 | 9,890 | (7,707) | (23,353) | (34,025) | (16,018) | 9,890 | 11,908 | 10,627 | 12,489 | 11,681 |
| 48 | | | | | | | | | | | | | | | |
| 49 | Percolate Volume | | | | | | | | | | | | | | |
| 50 | Spray Hydraulic Application (line 21) | in/mo | 5.1 | 4.6 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 60.2 |
| 51 | Climatological Normal Precipitation (Exhibit K-K) | in/mo | 3.3 | 3.2 | 4.1 | 3.2 | 3.4 | 3.6 | 3.9 | 5.3 | 3.6 | 3.5 | 3.1 | 3.6 | 43.8 |
| 52 | Total Hydraulic Loading | in/mo | 8.4 | 7.8 | 9.2 | 8.1 | 8.5 | 8.5 | 9.0 | 10.4 | 8.5 | 8.6 | 8.0 | 8.7 | 104.0 |
| 53 | Thornwaite Potential Evapotranspiration (Exhibit J-J) | in/mo | 0.1 | 0.1 | 0.7 | 1.8 | 3.3 | 4.8 | 5.5 | 4.9 | 3.6 | 1.9 | 0.9 | 0.2 | 27.8 |
| 54 | Percolate (line 52 minus line 53) | in/mo | 8.3 | 7.7 | 8.5 | 6.3 | 5.2 | 3.7 | 3.5 | 5.5 | 4.9 | 6.7 | 7.1 | 8.5 | 76.2 |
| 55 | Percolate volume | gal/mo | 201,650,174 | 187,223,633 | 206,503,335 | 153,971,733 | 126,426,170 | 90,880,633 | 85,174,297 | 133,705,912 | 119,999,602 | 162,824,881 | 173,384,379 | 206,503,335 | 1,848,248,085 |
| 56 | | | | | | | | | | | | | | | |
| 57 | Percolate Nitrogen Concentration | | | | | | | | | | | | | | |
| 58 | Total nitrogen in percolate (line 47) | lb/mo | 13,070 | 11,841 | 13,070 | 9,890 | 0 | 0 | 0 | 0 | 9,890 | 11,908 | 10,627 | 12,489 | 92,784 |
| 59 | Percolate volume (line 55) | gal/mo | 201,650,174 | 187,223,633 | 206,503,335 | 153,971,733 | 126,426,170 | 90,880,633 | 85,174,297 | 133,705,912 | 119,999,602 | 162,824,881 | 173,384,379 | 206,503,335 | 1,848,248,085 |

Facility:

Mountaire Farms Inc.

Field:

All Fields

Date:

2/5/2020

| Design Criteria | | | | | | | | | | | | | | | |
|---|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|---------------|
| 1 | Treatment Capacity | 949,000,000 | gal/year | | | | | | | | | | | | |
| 2 | Treatment Capacity Average Daily Flow | 2,600,000 | gal/day | | | | | | | | | | | | |
| 3 | Disposal Capacity | 949,000,000 | gal/year | | | | | | | | | | | | |
| 4 | Disposal Average Daily Flow | 4,000,000 | gal/day | | | | | | | | | | | | |
| 5 | Number of Units | NA | | | | | | | | | | | | | |
| 6 | Soil Perc Rate | 4.02 | inches/hr | | | | | | | | | | | | |
| 7 | Maximum Allowed Infiltration Rate from Water | 0.28 | inches/hr | | | | | | | | | | | | |
| 8 | Balance Calcs | | | | | | | | | | | | | | |
| 9 | Total Storage Volume | 21,300,000 | gallons | | | | | | | | | | | | |
| 10 | Treatment Lagoon and Storage Surface Acreage | 5.36 | acres | | | | | | | | | | | | |
| 11 | Total Spray Acreage | 893.63 | acres | | | | | | | | | | | | |
| 12 | Crop Type(s) | | Soybean | | | | | | | | | | | | |
| 13 | Parameter | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | SUM |
| Treatment Capacity | | | | | | | | | | | | | | | |
| 14 | Influent Flow | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 949,000,000 |
| Hydraulic Spray Application | | | | | | | | | | | | | | | |
| 17 | Effluent Flow | gal/mo | 124,000,000 | 112,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 1,460,000,000 |
| 19 | Calendar days per month | days/mo | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 |
| 20 | Spray days per month | days/mo | 26 | 23 | 26 | 26 | 25 | 25 | 24 | 28 | 24 | 26 | 27 | 26 | 306 |
| 21 | Spray weeks per month | week/mo | 4.4 | 4.0 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 4.4 | 4.3 | 4.4 | 4.3 | 4.4 | 52.14 |
| 21 | Spray hydraulic application rate | in/mo | 5.1 | 4.6 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 60.17 |
| 22 | Spray hydraulic application rate | in/week | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 13.85 |
| Total Nitrogen Application | | | | | | | | | | | | | | | |
| 25 | Total nitrogen in spray effluent | mg/L | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | 14.50 | |
| 26 | Total nitrogen in spray effluent | lb/acre-mo | 16.78 | 15.16 | 16.78 | 16.24 | 16.78 | 16.24 | 16.78 | 16.78 | 16.24 | 16.78 | 16.24 | 16.78 | 197.6 |
| 27 | Total nitrogen applied as commercial fertilizer | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - |
| 28 | Total nitrogen applied as biosolids | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | - |
| 29 | Total nitrogen due to precipitation | lb/acre-mo | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 | 5.0 |
| 30 | Total nitrogen due to fixation | lb/acre-mo | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12.00 | 24.00 | 18.00 | 6.00 | 0.00 | 0.00 | 0.00 | 60.0 |
| 31 | Total nitrogen applied | lb/acre-mo | 17.20 | 15.58 | 17.20 | 16.66 | 17.20 | 16.66 | 17.20 | 17.20 | 16.66 | 17.20 | 16.66 | 17.20 | 202.6 |
| Ammonia Application | | | | | | | | | | | | | | | |
| 34 | Ammonia in spray effluent | mg/L | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| 35 | Total ammonia application | lb/acre-mo | 0.75 | 0.68 | 0.75 | 0.73 | 0.75 | 0.73 | 0.75 | 0.75 | 0.73 | 0.75 | 0.73 | 0.75 | 8.9 |
| Nitrogen Utilization | | | | | | | | | | | | | | | |
| 38 | Plant nitrogen uptake (see below) | | | | | | | | | | | | | | |
| 39 | Summer Crop **** | lb/acre-mo | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 | 60.0 | 45.0 | 15.0 | 0.0 | 0.0 | 0.0 | 150.0 |
| 40 | Winter Cover Crop *** | lb/acre-mo | 0.3 | 1.9 | 10.2 | 21.7 | 22.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 56.5 |
| 41 | Denitrification (15% of line 26) | lb/acre-mo | 2.5 | 2.3 | 2.5 | 2.4 | 2.5 | 2.4 | 2.5 | 2.5 | 2.4 | 2.5 | 2.4 | 2.5 | 29.6 |
| 42 | Ammonia Volatilization (5% of line 35) | lb/acre-mo | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 |
| 43 | Total nitrogen consumed | lb/acre-mo | 2.9 | 4.2 | 12.8 | 24.2 | 24.9 | 20.5 | 38.6 | 29.6 | 11.5 | 2.6 | 2.5 | 2.6 | 176.5 |
| Percolate Nitrogen Content | | | | | | | | | | | | | | | |
| 46 | Total nitrogen in percolate (line 31 minus line 43) | lb/acre-mo | 14.33 | 11.35 | 4.44 | -7.51 | -7.68 | -3.81 | -21.35 | -12.35 | 5.19 | 14.65 | 14.2 | 14.6 | 26.1 |
| 47 | Total nitrogen in percolate | lb/mo | 12,803 | 10,147 | 3,966 | (6,707) | (6,867) | (3,408) | (19,083) | (11,040) | 4,635 | 13,088 | 12,678 | 13,088 | 23,299 |
| Percolate Volume | | | | | | | | | | | | | | | |
| 50 | Spray Hydraulic Application (line 21) | in/mo | 5.1 | 4.6 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 5.1 | 4.9 | 5.1 | 4.9 | 5.1 | 60.2 |
| 51 | Climatological Normal Precipitation (Exhibit K-K) | in/mo | 3.3 | 3.2 | 4.1 | 3.2 | 3.4 | 3.6 | 3.9 | 5.3 | 3.6 | 3.5 | 3.1 | 3.6 | 43.8 |
| 52 | Total Hydraulic Loading | in/mo | 8.4 | 7.8 | 9.2 | 8.1 | 8.5 | 8.5 | 9.0 | 10.4 | 8.5 | 8.6 | 8.0 | 8.7 | 104.0 |
| 53 | Thornwaite Potential Evapotranspiration (Exhibit J-J) | in/mo | 0.1 | 0.1 | 0.7 | 1.8 | 3.3 | 4.8 | 5.5 | 4.9 | 3.6 | 1.9 | 0.9 | 0.2 | 27.8 |
| 54 | Percolate (line 52 minus line 53) | in/mo | 8.3 | 7.7 | 8.5 | 6.3 | 5.2 | 3.7 | 3.5 | 5.5 | 4.9 | 6.7 | 7.1 | 8.5 | 76.2 |
| 55 | Percolate volume | gal/mo | 201,650,174 | 187,223,633 | 206,503,335 | 153,971,733 | 126,426,170 | 90,880,633 | 85,174,297 | 133,705,912 | 119,999,602 | 162,824,881 | 173,384,379 | 206,503,335 | 1,848,248,085 |
| Percolate Nitrogen Concentration | | | | | | | | | | | | | | | |
| 58 | Total nitrogen in percolate (line 47) | lb/mo | 12,803 | 10,147 | 3,966 | 0 | 0 | 0 | 0 | 0 | 4,635 | 13,088 | 12,678 | 13,088 | 70,403.44 |
| 59 | Percolate volume (line 55) | gal/mo | 201,650,174 | 187,223,633 | 206,503,335 | 153,971,733 | 126,426,170 | 90,880,633 | 85,174,297 | 133,705,912 | 119,999,602 | 162,824,881 | 173,384,379 | 206,503,335 | 1,848,248,085 |
| 60 | Total nitrogen concentration in percolate | lb/MG | 63.49 | 54.20 | 19.20 | - | - | - | - | - | 38.63 | 80.38 | 73.12 | 63.38 | 38.09 |
| 61 | Nitrogen concentration in percolate | mg/L | 7.6 | 6.5 | 2.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4.6 | 9.6 | 8.8 | 7.6 | 3.9 |
| STORAGE | | | | | | | | | | | | | | | |
| 62 | Volume Generated (line 14) | gal/mo | 80,600,000 | 72,800,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 80,600,000 | 78,000,000 | 80,600,000 | 78,000,000 | 80,600,000 | 949,000,000 |
| 64 | Volume Irrigated (line 17) | gal/mo | 124,000,000 | 112,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 120,000,000 | 124,000,000 | 1,460,000,000 |

Facility:

Field:

Date:

11/11/2019

| Design Criteria | | | | | | | | | | | | | | | SUM | | |
|---|---------------------|------------|------------|--------------|--------------|--------|-----|-----|-----|-----|------|-----|-----|-----|--------------|-------------|-----|
| Parameter | Units | Jan/Week 1 | Jan/Week 2 | Jan/Week 3 | Jan/Week 4 | | | | | | | | | | | SUM | |
| 1 Treatment Capacity | 72,800,000 gal/year | | | | | | | | | | | | | | | | |
| 2 Treatment Capacity Average Daily Flow | 2,600,000 gal/day | | | | | | | | | | | | | | | | |
| 3 Disposal Capacity | 72,800,000 gal/year | | | | | | | | | | | | | | | | |
| 4 Disposal Average Daily Flow | 2,600,000 gal/day | | | | | | | | | | | | | | | | |
| 5 Number of Units | | | | | | | | | | | | | | | | | |
| 6 Soil Perc Rate | inches/hr | | | | | | | | | | | | | | | | |
| 7 Maximum Allowed Infiltration Rate from Water Balance Calcs | inches/hr | | | | | | | | | | | | | | | | |
| 8 Total Storage Volume | 21300000 gallons | | | | | | | | | | | | | | | | |
| 9 Treatment Lagoon and Storage Surface Acreage | 5.36 acres | | | | | | | | | | | | | | | | |
| 10 Total Spray Acreage | 460 acres | | | | | | | | | | | | | | | | |
| 11 Crop Type(s) | Corn | | | | | | | | | | | | | | | | |
| Treatment Capacity | | | | | | | | | | | | | | | | | |
| 14 Influent Flow | gal/wk | 20,150,000 | 20,150,000 | 20,150,000 | 20,150,000 | | | | | | | | | | | 80,600,000 | |
| Hydraulic Spray Application | | | | | | | | | | | | | | | | | |
| 17 Effluent Flow | gal/wk | 20,146,361 | - | 30,634,580 | 30,634,580 | | | | | | | | | | | 80,600,000 | |
| 18 | gal/acre | | | | | | | | | | | | | | | | |
| 19 Calendar days per week | days/wk | 7 | 7 | 7 | 7 | | | | | | | | | | | 28 | |
| 20 Spray days per week | days/wk | 7 | 0 | 7 | 7 | | | | | | | | | | | 21 | |
| 21 Spray weeks per month | week/mo | | | | | | | | | | | | | 0.0 | | | |
| 21 Spray hydraulic application rate | in/wk | 1.6 | 0.0 | 2.5 | 2.5 | | | | | | | | | | | 6.5 | |
| 22 | | | | | | | | | | | | | | 0.0 | | | |
| Total Nitrogen Application | | | | | | | | | | | | | | | | | |
| 25 Total nitrogen in spray effluent | mg/L | 10.00 | 10.00 | 10.00 | 10.00 | | | | | | | | | | | | |
| 26 Total nitrogen in spray effluent | lb/acre-wk | 3.65 | 0.00 | 5.55 | 5.55 | | | | | | | | | | | 15 | |
| 27 Total nitrogen applied as commercial fertilizer | lb/acre-wk | 0.00 | 0.00 | 0.00 | 0.00 | | | | | | | | | | | - | |
| 28 Total nitrogen applied as biosolids | lb/acre-wk | 0.00 | 0.00 | 0.00 | 0.00 | | | | | | | | | | | - | |
| 29 Total nitrogen due to precipitation | lb/acre-wk | 0.42 | 0.42 | 0.42 | 0.42 | | | | | | | | | | | 1.7 | |
| 30 Total nitrogen due to fixation | lb/acre-wk | 0.00 | 0.00 | 0.00 | 0.00 | | | | | | | | | | | - | |
| 31 Total nitrogen applied | lb/acre-wk | 4.07 | 0.42 | 5.97 | 5.97 | | | | | | | | | | | 16 | |
| Ammonia Application | | | | | | | | | | | | | | | | | |
| 34 Ammonia in spray effluent | mg/L | 1.00 | 1.00 | 1.00 | 1.00 | | | | | | | | | | | | |
| 35 Total ammonia application | lb/acre-wk | 0.37 | 0.00 | 0.56 | 0.56 | | | | | | | | | | | 1.48 | |
| Nitrogen Utilization | | | | | | | | | | | | | | | | | |
| 38 Plant nitrogen uptake (see below) | | | | | | | | | | | | | | | | | |
| 39 Summer Crop **** | lb/acre-wk | 0.00 | 0.00 | 0.00 | 0.00 | | | | | | | | | | | 0.0 | |
| 40 Winter Cover Crop *** | lb/acre-wk | 0.00 | 0.00 | 0.00 | 0.00 | | | | | | | | | | | 0.0 | |
| 41 Denitrification (15% of line 26) | lb/acre-wk | 0.55 | 0.00 | 0.83 | 0.83 | | | | | | | | | | | 2.2 | |
| 42 Ammonia Volatilization (5% of line 35) | lb/acre-wk | 0.02 | 0.00 | 0.03 | 0.03 | | | | | | | | | | | 0.1 | |
| 43 Total nitrogen consumed | lb/acre-wk | 0.57 | 0.00 | 0.86 | 0.86 | | | | | | | | | | | 2.3 | |
| Percolate Nitrogen Content | | | | | | | | | | | | | | | | | |
| 46 Total nitrogen in percolate (line 31 minus line 43) | lb/acre-wk | 3.51 | 0.42 | 5.11 | 5.11 | | | | | | | | | | | 14.2 | |
| 47 Total nitrogen in percolate | lb/wk | 1,613 | 193 | 2,352 | 2,352 | | | | | | | | | | | 6,510 | |
| Percolate Volume | | | | | | | | | | | | | | | | | |
| 50 Spray Hydraulic Application (line 21) | in/wk | 1.6 | 0.0 | 2.5 | 2.5 | | | | | | | | | | | 6.5 | |
| 51 Climatological Normal Precipitation (Exhibit K-K) | in/wk | 0.8250 | 0.825 | 0.825 | 0.825 | | | | | | | | | | | 3.3 | |
| 52 Total Hydraulic Loading | in/wk | 2.4 | 0.8 | 3.3 | 3.3 | | | | | | | | | | | 9.8 | |
| 53 Thornwaite Potential Evapotranspiration (Exhibit J-J) | in/wk | 0.025 | 0.0250 | 0.0250 | 0.0250 | | | | | | | | | | | 0.1 | |
| 54 Percolate (line 52 minus line 53) | in/wk | 2.4 | 0.8 | 3.3 | 3.3 | | | | | | | | | | | 9.7 | |
| 55 Percolate volume | gal/wk | 30,140,739 | 9,992,746 | 40,629,808 | 40,629,808 | | | | | | | | | | | 121,393,100 | |
| Percolate Nitrogen Concentration | | | | | | | | | | | | | | | | | |
| 58 Total nitrogen in percolate (line 47) | lb/wk | 1,613 | 193 | 2,352 | 2,352 | | | | | | | | | | | 6,510 | |
| 59 Percolate volume (line 55) | gal/wk | 30,140,739 | 9,992,746 | 40,629,808 | 40,629,808 | | | | | | | | | | | 121,393,100 | |
| 60 Total nitrogen concentration in percolate | lb/MG | 53.51 | 19.33 | 57.89 | 57.89 | | | | | | | | | | | 53.63 | |
| 61 Nitrogen concentration in percolate | mg/L | 6.4 | 2.3 | 6.9 | 6.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.9 |
| STORAGE | | | Week 1 | Week 2 | Week 3 | Week 4 | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | SUM | | |
| 62 Volume Generated (line 14) | gal/wk | 20,150,000 | 20,150,000 | 20,150,000 | 20,150,000 | - | - | - | - | - | - | - | - | - | 80,600,000 | | |
| 64 Volume Irrigated (line 17) | gal/wk | 20,146,361 | - | 30,634,580 | 30,634,580 | - | - | - | - | - | - | - | - | - | 81,415,521 | | |
| 65 Volume added from Precipitation to system on all treatment and storage lagoons (calculated using line 9 and the 5-Year Return Period Monthly Precipitation (Exhibit K-K*)) | gal/wk | - | 684,064 | - | - | | | | | | | | | | 684,064 | | |
| 66 Volume lost due to Evaporation from system from all treatment and storage lagoons (calculated using line 9) | gal/wk | 3,639 | 3,639 | 3,639 | 3,639 | - | - | - | - | - | - | - | - | - | 14,555 | | |
| 67 Volume Stored | gal/wk | (0) | 20,830,425 | (10,488,219) | (10,488,219) | - | - | - | - | - | - | - | - | - | (146,012.42) | | |
| 68 Cumulative Volume Stored | gal/wk | 138,735 | 20,969,160 | 10,480,941 | (7,277) | | | | | | | | | | | | |

P5 (in/wk)

4.7

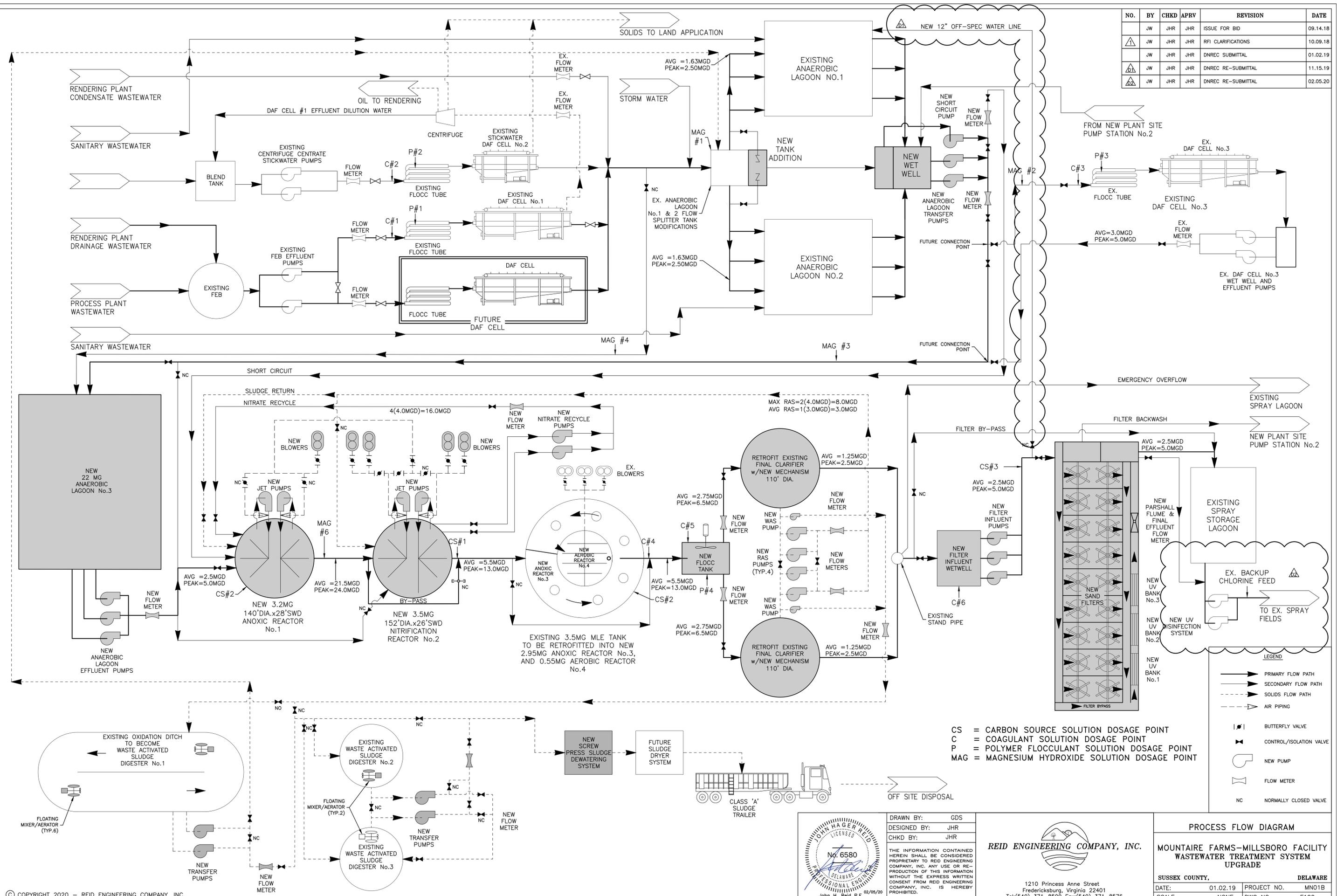
4.7

Week 1 Cumulative volume represents stored effluent from previous December as shown on Attachment H

Appendix 4

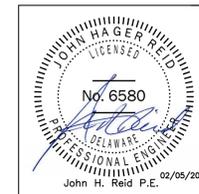
Flow Diagram

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| | JW | JHR | JHR | ISSUE FOR BID | 09.14.18 |
| | JW | JHR | JHR | RFI CLARIFICATIONS | 10.09.18 |
| | JW | JHR | JHR | DNREC SUBMITTAL | 01.02.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 11.15.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |



CS = CARBON SOURCE SOLUTION DOSAGE POINT
 C = COAGULANT SOLUTION DOSAGE POINT
 P = POLYMER FLOCCULANT SOLUTION DOSAGE POINT
 MAG = MAGNESIUM HYDROXIDE SOLUTION DOSAGE POINT

- LEGEND**
- PRIMARY FLOW PATH
 - SECONDARY FLOW PATH
 - SOLIDS FLOW PATH
 - - - AIR PIPING
 - |/| BUTTERFLY VALVE
 - ▶ CONTROL/ISOLATION VALVE
 - ⊕ NEW PUMP
 - ⊕ FLOW METER
 - NC NORMALLY CLOSED VALVE



DRAWN BY: GDS
 DESIGNED BY: JHR
 CHKD BY: JHR

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 Fredericksburg, Virginia 22401
 Tel:(540) 371-8500 Fax:(540) 371-8576

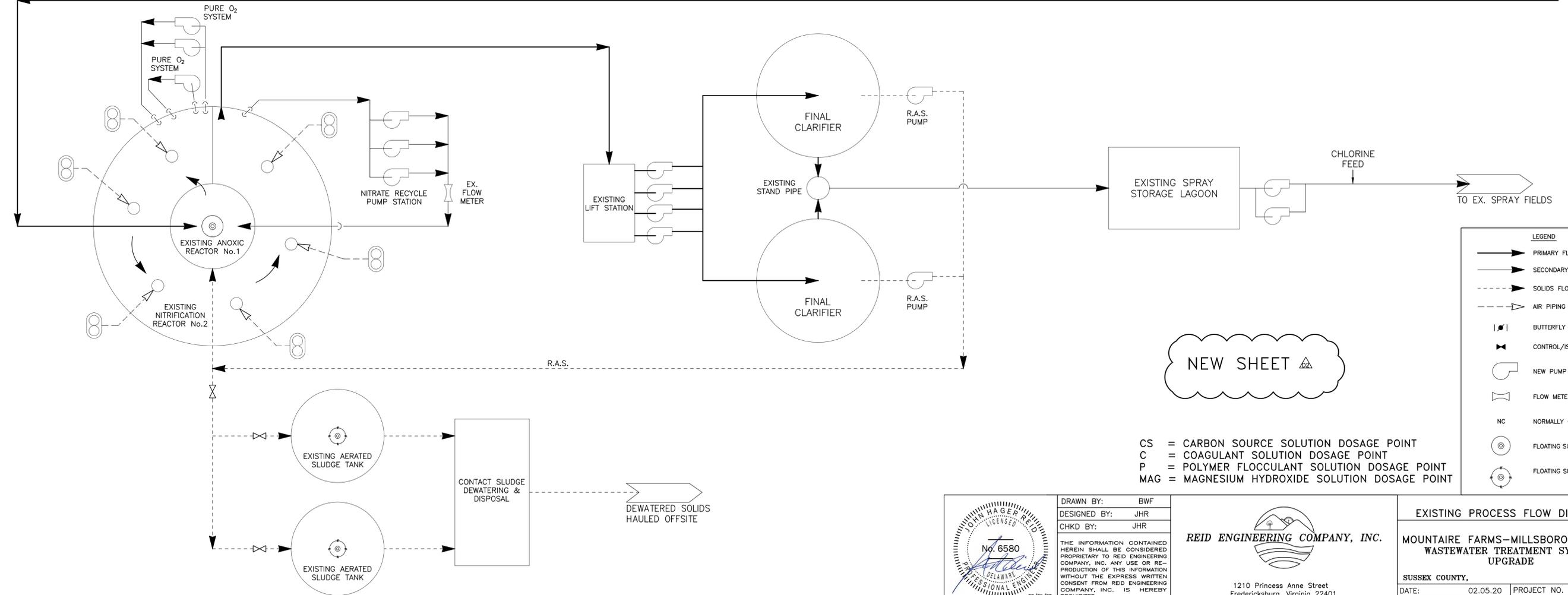
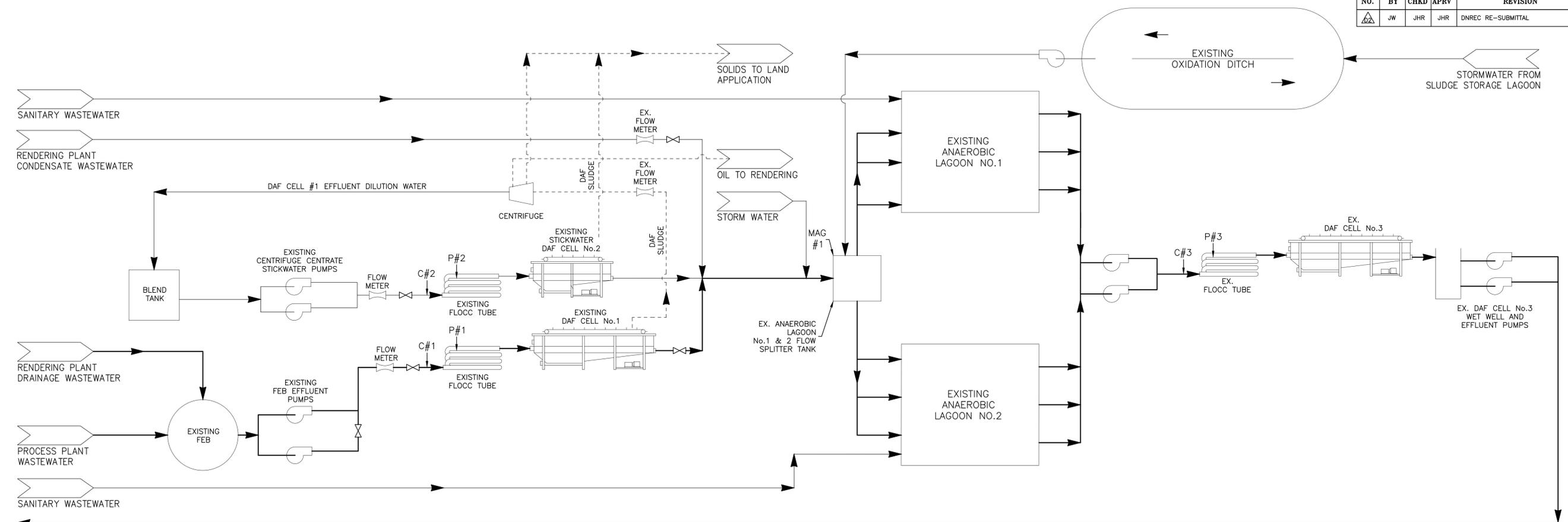
PROCESS FLOW DIAGRAM

MOUNTAINE FARM-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE

SUSSEX COUNTY, DELAWARE

DATE: 01.02.19 PROJECT NO. MN01B
 SCALE: NONE DWG NO: F100

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| Δ2 | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |

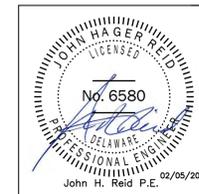


LEGEND

- PRIMARY FLOW PATH
- SECONDARY FLOW PATH
- - - SOLIDS FLOW PATH
- - - AIR PIPING
- | / | BUTTERFLY VALVE
- ✕ CONTROL/ISOLATION VALVE
- ☪ NEW PUMP
- ◊ FLOW METER
- NC NORMALLY CLOSED VALVE
- ⊙ FLOATING SURFACE MIXER
- ⊙ FLOATING SURFACE AERATOR

CS = CARBON SOURCE SOLUTION DOSAGE POINT
 C = COAGULANT SOLUTION DOSAGE POINT
 P = POLYMER FLOCCULANT SOLUTION DOSAGE POINT
 MAG = MAGNESIUM HYDROXIDE SOLUTION DOSAGE POINT

NEW SHEET Δ



DRAWN BY: BWF
 DESIGNED BY: JHR
 CHKD BY: JHR

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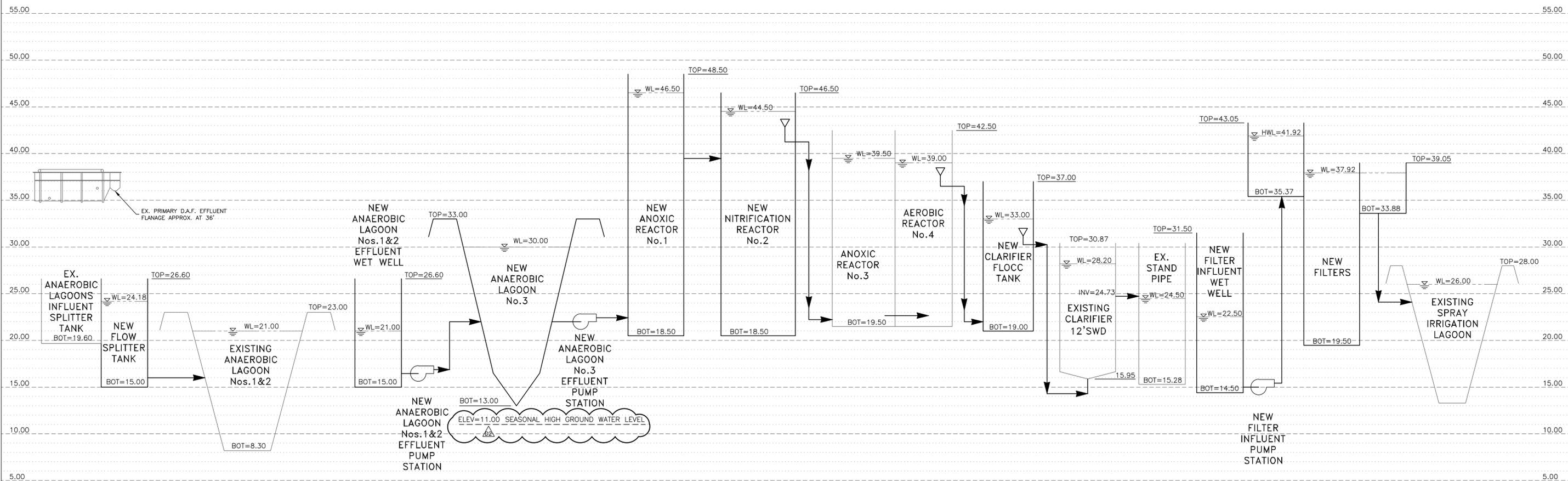
1210 Princess Anne Street
 Fredericksburg, Virginia 22401
 Tel:(540) 371-8500 Fax:(540) 371-8576

| EXISTING PROCESS FLOW DIAGRAM | |
|--|----------------------------------|
| MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | |
| SUSSEX COUNTY, DELAWARE | DATE: 02.05.20 PROJECT NO. MN01B |
| SCALE: NONE | DWG NO: F100A |

Appendix 5

Hydraulic Profile

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| | JW | JHR | JHR | ISSUE FOR BID | 09.14.18 |
| | JW | JHR | JHR | DNREC SUBMITTAL | 01.02.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 11.15.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |



DRAWN BY: JW
DESIGNED BY: JHR
CHKD BY: JHR

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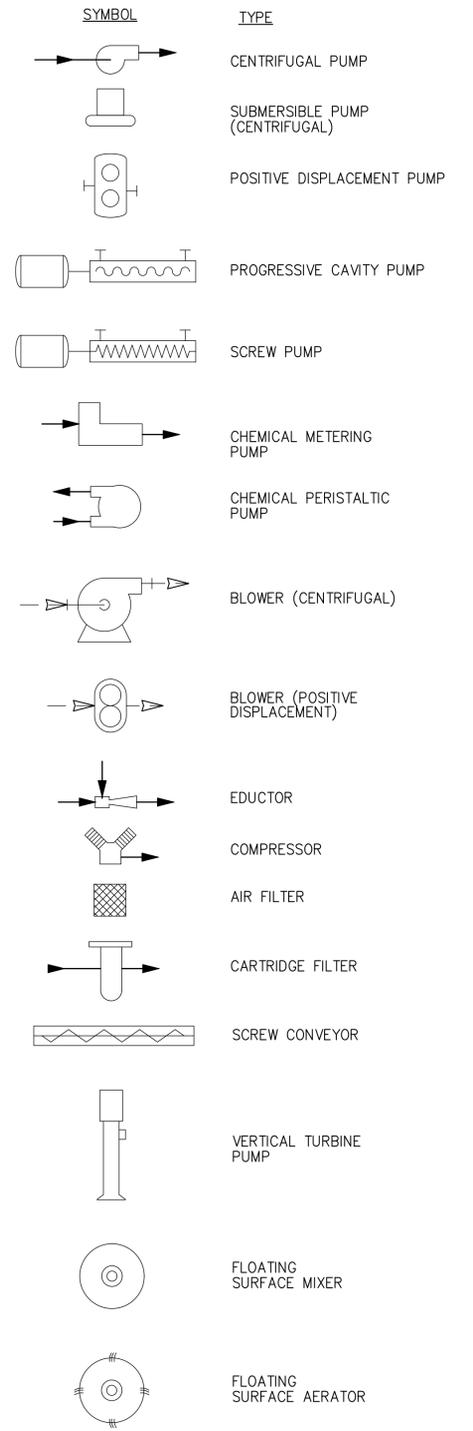
| HYDRAULIC PROFILE | | | |
|--|----------|-------------------------|-------|
| MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | | SUSSEX COUNTY, DELAWARE | |
| DATE: | 01.02.19 | PROJECT NO. | MN01B |
| SCALE: | NONE | DWG NO: | F101 |

Appendix 6

P&IDs

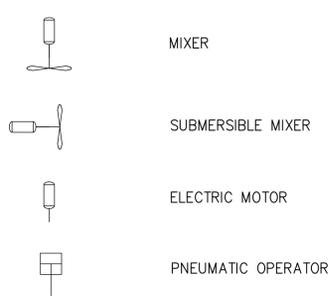
| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| | JW | JHR | JHR | ISSUE FOR BID | 09.14.18 |
| | JW | JHR | JHR | DNREC SUBMITTAL | 01.02.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 11.15.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |

EQUIPMENT SYMBOLS



EQUIPMENT TYPES

| TYPE | SYMBOL |
|--------------------------|--------|
| AUGER | AU |
| BLOWER | B |
| COMPRESSOR | C |
| CONVEYOR | CVR |
| CENTRIFUGAL FAN | CF |
| DISSOLVED AIR FLOATATION | DAF |
| AERATOR/DIFFUSER | D |
| FILTER | F |
| GRIT SEPARATION | G |
| HOIST | H |
| LAGOON | LA |
| MOTOR | M |
| MIXER | MXR |
| PUMP | P |
| MECHANICAL SCREEN | S |
| SURFACE MIXER | SM |
| SURFACE AREATOR | SA |
| SKIMMER | SK |
| TANK | TK |
| WET WELL | T |
| UV DISINFECTION UNIT | U |

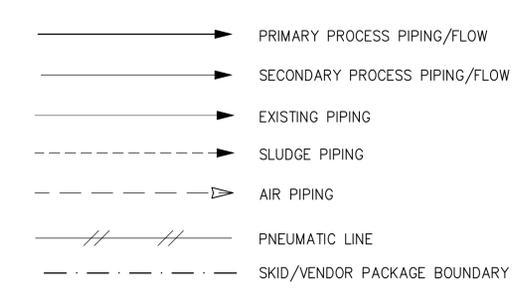


VALVE SYMBOLS

| DESIGNATION | SYMBOL | TYPE |
|-------------|----------|---|
| VA | [Symbol] | GATE |
| VB | [Symbol] | BALL |
| VC | [Symbol] | CHECK |
| VD | [Symbol] | DIAPHRAGM |
| VG | [Symbol] | GLOBE |
| VK | [Symbol] | KNIFE GATE |
| VN | [Symbol] | NEEDLE |
| VO | [Symbol] | PINCH |
| VP | [Symbol] | PLUG |
| VY | [Symbol] | BUTTERFLY |
| TW | [Symbol] | 3 WAY |
| VL | [Symbol] | ANGLE |
| VT | [Symbol] | TELESCOPING |
| HB | [Symbol] | HOSE BIBS |
| YH | [Symbol] | FREEZE PROOF YARD HYDRANT |
| MUD | [Symbol] | MUD (DRAIN) |
| PSV | [Symbol] | PRESSURE RELIEF OR SAFETY |
| PSV | [Symbol] | VACUUM RELIEF OR SAFETY |
| PSV | [Symbol] | COMBINATION RELIEF OR SAFETY |
| PCV | [Symbol] | SELF CONTAINED PRESSURE CONTROL |
| PCV | [Symbol] | SELF CONTAINED BACK PRESSURE CONTROL |
| ARV | [Symbol] | AIR RELEASE VALVE SOLENOID VALVE |
| SOV | [Symbol] | TWO-WAY THREE-WAY SOLENOID VALVE. (ARROW DIRECTION SHOWS DE-ENERGIZED FLOW DIRECTION) |
| SOV | [Symbol] | SOLENOID ACTUATOR (W/MANUAL OVERRIDE) |

NOTE: VALVES ARE THE SAME SIZE AND SPECIFICATION AS THE LINE THEY ARE IN UNLESS STATED OTHERWISE ON THE DRAWING.

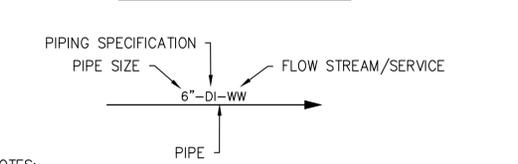
P & ID LINE LEGEND



INTERFACE SYMBOLS



PIPING IDENTIFICATION



- NOTES:
1. FLOW STREAM AND PIPING SPECIFICATIONS ARE SOMETIMES OMITTED.
 2. PIPE SIZE IS IN INCHES.
 3. SEE SHEET D100 FOR ADDITIONAL PIPE MATERIAL SPECIFICATION REQUIREMENTS.

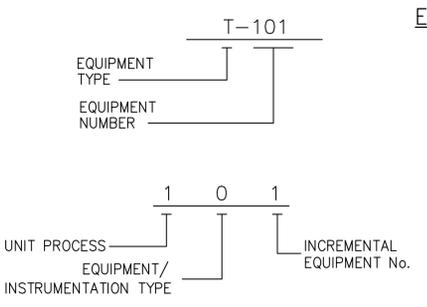
PIPE MATERIAL IDENTIFICATION

| | |
|-------|--------------------------|
| DI | DUCTILE IRON |
| CS | CARBON STEEL |
| PVC | PVC |
| CPVC | CPVC |
| SS316 | STAINLESS STEEL SCH. 316 |
| SS304 | STAINLESS STEEL SCH. 304 |

FLOW STREAM IDENTIFICATION

| | |
|-----|-------------------------|
| BA | BLOWER AIR |
| CA | COMPRESSED AIR |
| CD | CONDENSATE |
| CO | CLEAN OUT |
| DR | DRAINS |
| HCL | HYPOCHLORITE |
| NG | NATURAL GAS |
| NR | NITRATE RECYCLE |
| RAS | RETURN ACTIVATED SLUDGE |
| SC | SCREENINGS |
| SD | DAF SOLIDS |
| ST | STORMWATER |
| STM | STEAM |
| VT | VENT |
| WW | PROCESS WASTEWATER |
| WAS | WASTE ACTIVATED SLUDGE |
| W | POTABLE WATER |

EQUIPMENT IDENTIFICATION

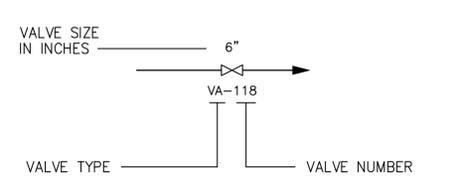


EQUIPMENT INSTRUMENTATION TYPE

| | |
|---|--|
| 0 | TANKS |
| 1 | PUMPS |
| 2 | BLOWERS |
| 3 | MIXERS |
| 4 | AERATORS |
| 5 | OTHER |
| 6 | OTHER |
| 7 | OTHER |
| 8 | FLOW METER |
| 9 | INSTRUMENTATION (DO, PH, ORP, LEVEL, ETC.) |

VALVE IDENTIFICATION

(IF DIFFERENT FROM PIPE SPECIFICATION)



PIPING & PIPING EQUIPMENT SYMBOLS

| OPTIONAL DESIGNATION | SYMBOL | TYPE |
|----------------------|----------|--------------------------|
| NONE | [Symbol] | CAP/PLUG |
| NONE | [Symbol] | BLIND FLANGE |
| NONE | [Symbol] | FLANGED CONNECTION |
| NONE | [Symbol] | UNION |
| NONE | [Symbol] | CONCENTRIC REDUCER |
| NONE | [Symbol] | ECCENTRIC REDUCER |
| EJ | [Symbol] | EXPANSION JOINT |
| ST | [Symbol] | STRAINER |
| BFP | [Symbol] | BACKFLOW PREVENTER |
| FLC | [Symbol] | FLEXIBLE CONNECTION |
| NZ | [Symbol] | SPRAY NOZZLE |
| QCH | [Symbol] | HOSE COUPLING |
| QCU | [Symbol] | QUICK COUPLING |
| SM | [Symbol] | STATIC MIXER |
| DF | [Symbol] | DIFFUSER (FINE BUBBLE) |
| DC | [Symbol] | DIFFUSER (COARSE BUBBLE) |
| CAL | [Symbol] | CALIBRATION COLUMN |



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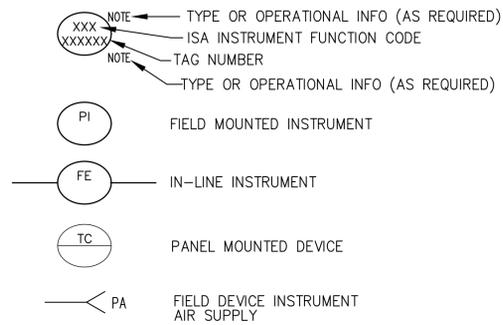
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 1210 Princess Anne Street
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| P&ID SYMBOLS | |
|--|-------------------|
| MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | |
| SUSSEX COUNTY, DELAWARE | |
| DATE: 01.02.19 | PROJECT NO. MN01B |
| SCALE: NONE | DWG NO: F200 |

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| | JW | JHR | JHR | ISSUE FOR BID | 09.14.18 |
| | JW | JHR | JHR | DNREC SUBMITTAL | 01.02.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 11.15.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |

INSTRUMENT IDENTIFICATION

EXAMPLE SYMBOLS



INSTRUMENTATION FUNCTION DESIGNATORS

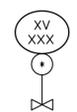
| | |
|--------|--------------------------------|
| ACK | ACKNOWLEDGE |
| AM | AUTO-MANUAL |
| AUTO | AUTOMATIC |
| C | CLOSED |
| DISC | DISCONNECT SWITCH |
| DIFF | DIFFERENTIAL |
| ES | EMERGENCY STOP (SAFETY SWITCH) |
| ETM | ELAPSED TIME METER |
| F | FAST |
| FR | FORWARD-REVERSE |
| FS | FAST-SLOW |
| FSLOS | FAST-SLOW-LOCKOUT STOP |
| FTC | FAIL TO CLOSE |
| FTO | FAIL TO OPEN |
| HA | HAND-AUTO |
| HOA | HAND-OFF-AUTO |
| LCP | LOCATE CONTROL PANEL |
| L/B/P | LOCAL/BYPASS/AUTO |
| L/L | LEAD/LAG |
| L/L/LL | LEAD/LAG/LAG-LAG |
| LOC | LOCAL |
| LOR | LOCAL-OFF-REMOTE |
| LOS | LOCKOUT STOP |
| LR | LOCAL-REMOTE |
| LRA | LOCAL-REMOTE-AUTO |
| MA | MANUAL-AUTO |
| MAN | MAN |
| O | OPEN |
| OC | OPEN-CLOSE |
| OL | OVERLOAD |
| OO | ON-OFF |
| OPER | OPERATE |
| OSC | OPEN-STOP-CLOSE |
| RDY | READY |
| REM | REMOTE |
| RUN | RUN |
| S | SLOW |
| SEQ | SEQUENCER |
| SIL | SILENCE |
| SLOS | START-LOCKOUT STOP |
| SP | STOP |
| SR | STOP RESET |
| SS | START-STOP |
| ST | START |
| SWF | SEAL WATER FAIL |

GENERAL ABBREVIATIONS

| | |
|--------|--|
| AC | ALTERNATING CURRENT |
| AVE | AVERAGE |
| BOD | BIOCHEMICAL OXYGEN DEMAND |
| BOT | BOTTOM |
| BOP | BOTTOM OF PIPE |
| CISP | CAST IRON SOIL PIPE |
| CL | CENTERLINE |
| Ø | DIAMETER |
| DC | DIRECT CURRENT |
| DO | DISSOLVED OXYGEN |
| DWG | DRAWING |
| E | EAST |
| EL | ELEVATION |
| EX | EXISTING |
| FLG | FLANGE |
| FT | FOOT, FEET |
| GALV | GALVANIZED |
| IMH | INFLUENT MANHOLE |
| IN | INCH(S) |
| IPS | INFLUENT PUMP STATION |
| INV | INVERT |
| MAX | MAXIMUM |
| MCC | MOTOR CONTROL CENTER |
| MFG | MANUFACTURER |
| MGD | MILLION GALLONS PER DAY |
| MG/L | MILLIGRAMS PER LITER |
| MH | MANHOLE |
| MIN | MINIMUM |
| MJ | MECHANICAL JOINT |
| N | TORQUE, NORTH |
| NO | NUMBER |
| NPT | AMERICAN NATIONAL STANDARD TAPER THREAD PIPE |
| ORP | OXIDATION REDUCTION POTENTIAL |
| pH | HYDROGEN ION CONCENTRATION |
| PE | PLAIN END |
| PLC(S) | PLACE OR PLACES |
| PS | PIPE SLEEVE |
| SCH | SCHEDULE |
| STL | STEEL |
| T | TURBIDITY |
| TSS | TOTAL SUSPENDED SOLIDS |
| TYP | TYPICAL |
| VFD | VARIABLE FREQUENCY DRIVE |
| WP | WALL PIPE |
| Z | SHEAR |

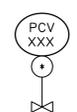
AUTOMATIC VALVE SYMBOLS

OPEN-CLOSE VALVES



XXX = VALVE TAG NUMBER
SEE DRAWING F200 FOR VALVE SYMBOLS
* = ACTUATOR TYPE
M = ELECTRIC MOTOR
P = PNEUMATIC

MODULATING VALVES



XXX = VALVE TAG NUMBER
SEE ABOVE FOR ACTUATOR TYPE
SEE DRAWING F200 FOR VALVE SYMBOLS

PCV = PRESSURE CONTROL VALVE
FCV = FLOW CONTROL VALVE
LCV = LEVEL CONTROL VALVE
TCV = TEMPERATURE CONTROL VALVE

PRIMARY ELEMENT SYMBOLS



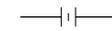
FLUME



WEIR (FIXED)



VENTURI FLOW TUBE



ORIFICE PLATE



ROTAMETER



INLINE FLOWMETER
M=MAGNETIC P=PROPELLOR
T=TURBINE U=ULTRASONIC
V=VORTEX

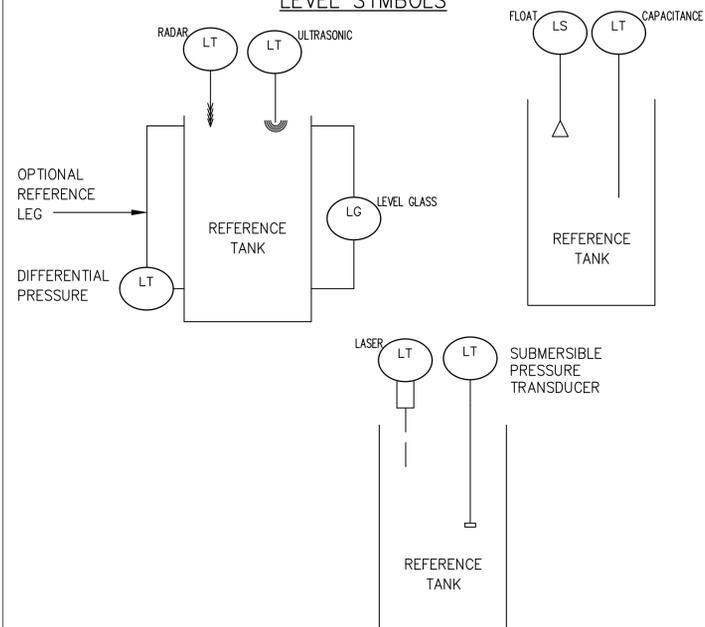
INSTRUMENT IDENTIFICATION TABLE - ISA STANDARDS

| LETTER | FIRST LETTER | | SUCCEEDING LETTERS | | |
|--------|------------------------------------|---------------------|-----------------------------|--|------------------------|
| | MEASURED OR INITIATING VARIABLE | MODIFIER | READOUT OR PASSIVE FUNCTION | OUTPUT FUNCTION | MODIFIER |
| A | ANALYSIS | | ALARM | | |
| B | BURNER, COMBUSTION | | USER'S CHOICE | USER'S CHOICE | USER'S CHOICE |
| C | CONDUCTIVITY | | | CONTROL | |
| D | DENSITY (MASS) OR SPECIFIC GRAVITY | DIFFERENTIAL | | | |
| E | VOLTAGE | | SENSOR (PRIMARY ELEMENT) | | |
| F | FLOW RATE | RATIO (FRACTION) | | | |
| G | GAGING (DIMENSIONAL) | | GLASS, VIEWING DEVICE | | |
| H | HAND (MANUALLY INITIATED) | | | | HIGH (OPENED) |
| I | CURRENT (ELECTRICAL) | | INDICATE | | |
| J | POWER | SCAN | | | |
| K | TIME, TIME SCHEDULE | | | CONTROL STATION | |
| L | LEVEL | | LIGHT (PILOT) | | LOW (CLOSED) |
| M | MOISTURE OR HUMIDITY | | | | MIDDLE OR INTERMEDIATE |
| N | ON/OFF | | USER'S CHOICE | USER'S CHOICE | USER'S CHOICE |
| O | USER'S CHOICE | | ORIFICE, RESTRICTION | | |
| P | PRESSURE, VACUUM | | POINT (TEST) CONNECTION | | |
| Q | QUANTITY OR EVENT | INTEGRATE, TOTALIZE | | | |
| R | RADIOACTIVITY | | RECORD | | |
| S | SPEED, FREQUENCY | SAFETY | | | SWITCH |
| T | TEMPERATURE | | | TRANSMIT | |
| U | MULTIVARIABLE | | MULTIFUNCTION | | MULTIFUNCTION |
| V | VIBRATION | | | VALVE, DAMPER, LOUVER | |
| W | WEIGHT, FORCE | | WELL | | |
| X | UNCLASSIFIED | | UNCLASSIFIED | | UNCLASSIFIED |
| Y | USER'S CHOICE | | | RELAY, COMPUTE, CONVERT | |
| Z | POSITION | | | DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT | |

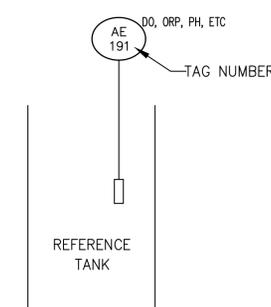
GATE SYMBOLS

| OPTIONAL DESIGNATION | ELEVATION | PLAN | TYPE |
|----------------------|-----------|------|-------------------------|
| GD | | | STOP |
| GS | | | SUBMERGED OPENING SLIDE |
| GS | | | OPEN TOP SLIDE |
| GS | | | WEIR |

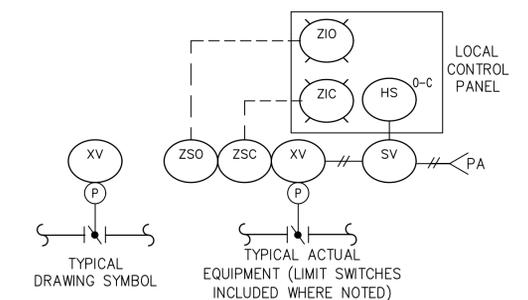
LEVEL SYMBOLS



ANALYSIS INSTRUMENT SYMBOLS



AIR OPERATED OPEN-CLOSE VALVES



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CHKD BY: J.H.R.

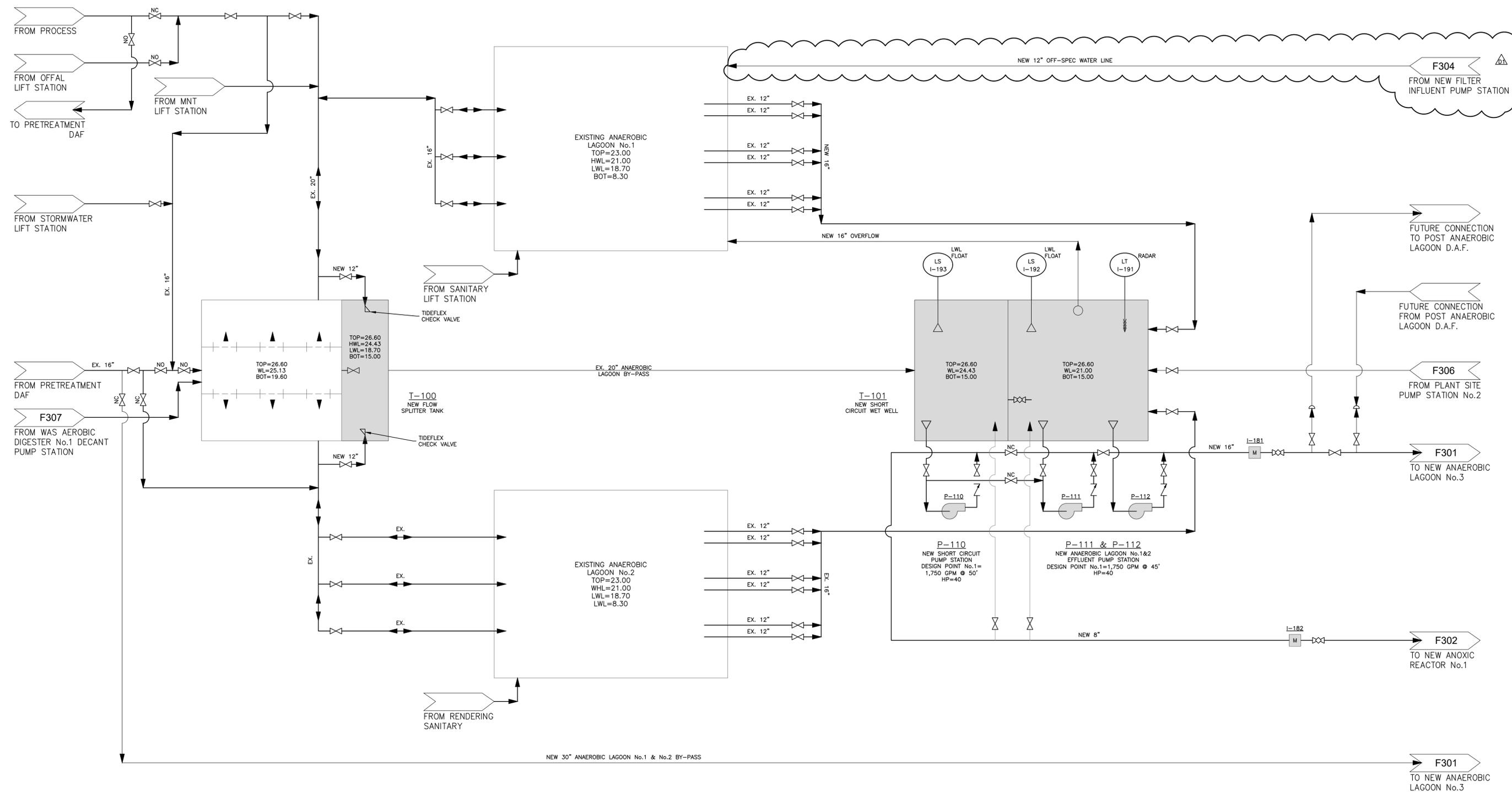
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| P&ID SYMBOLS | |
|--|-------------------|
| MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | |
| SUSSEX COUNTY, DELAWARE | |
| DATE: 01.02.19 | PROJECT NO. MNO1B |
| SCALE: NONE | DWG NO: F201 |

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| | JW | JHR | JHR | ISSUE FOR BID | 09.14.18 |
| | JW | JHR | JHR | DNREC SUBMITTAL | 01.02.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 11.15.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |



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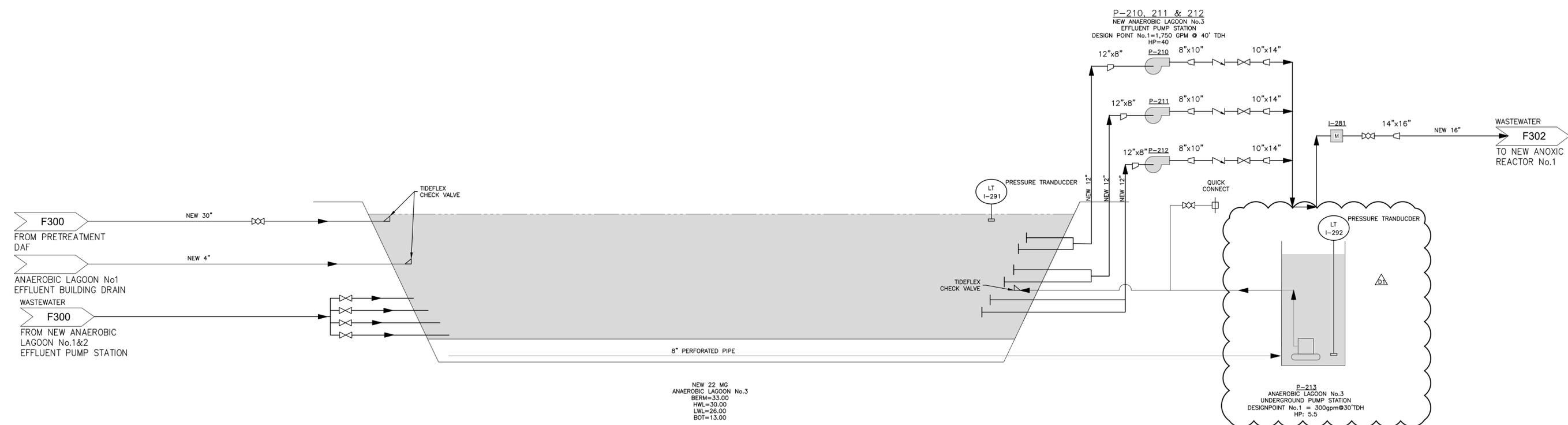
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| EX. ANAEROBIC LAGOON No.1 & 2 P&ID | |
|--|-------------------|
| MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | |
| SUSSEX COUNTY, DELAWARE | |
| DATE: 01.02.19 | PROJECT NO. MN01B |
| SCALE: NONE | DWG NO: F300 |

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| | JW | JHR | JHR | ISSUE FOR BID | 09.14.18 |
| | JW | JHR | JHR | DNREC SUBMITTAL | 01.02.19 |
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| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |



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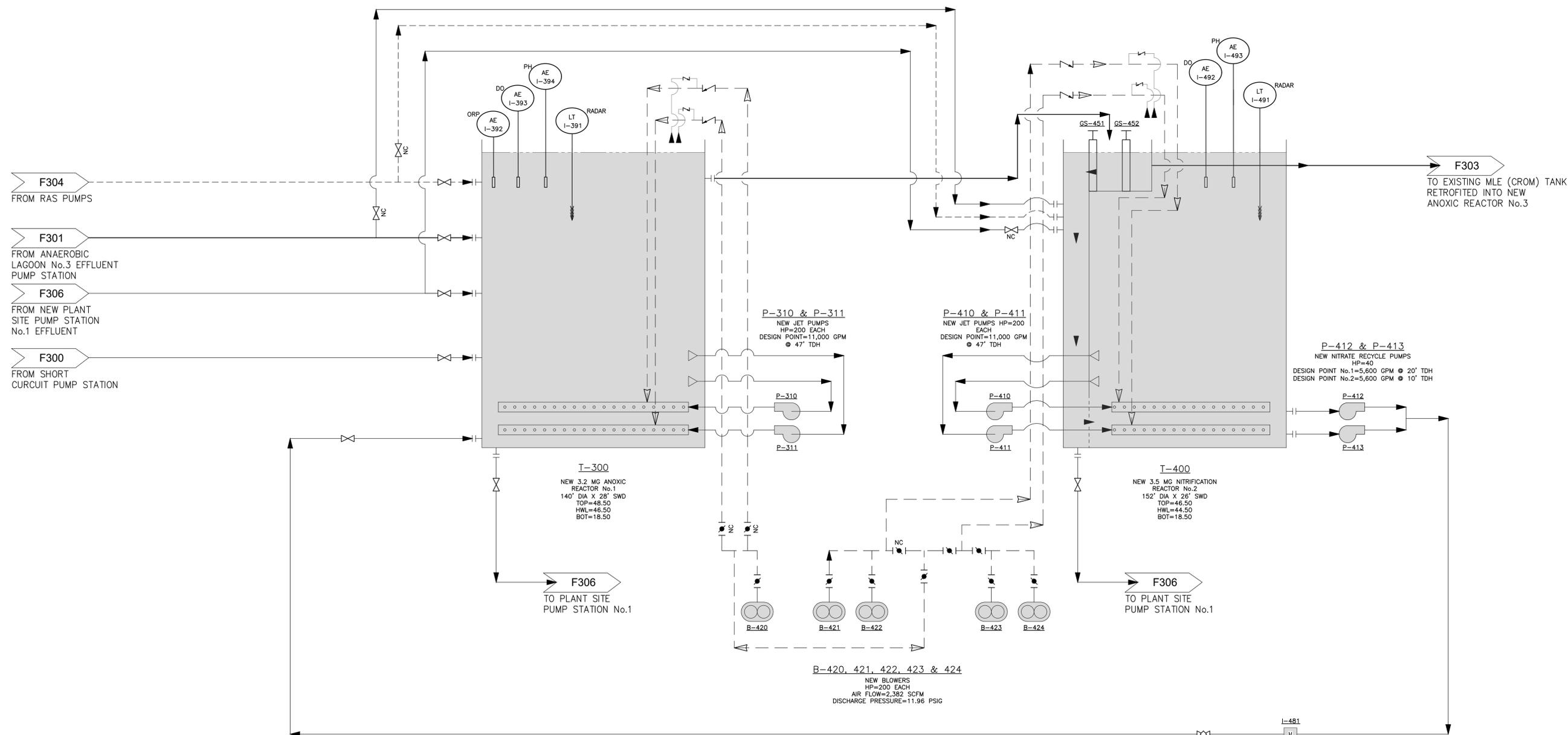
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| | |
|--|-------------------|
| NEW ANAEROBIC LAGOON No.3 P&ID | |
| MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | |
| SUSSEX COUNTY, | DELAWARE |
| DATE: 01.02.19 | PROJECT NO. MNO1B |
| SCALE: NONE | DWG NO: F301 |

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| | JW | JHR | JHR | ISSUE FOR BID | 09.14.18 |
| | JW | JHR | JHR | DNREC SUBMITTAL | 01.02.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 11.15.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |



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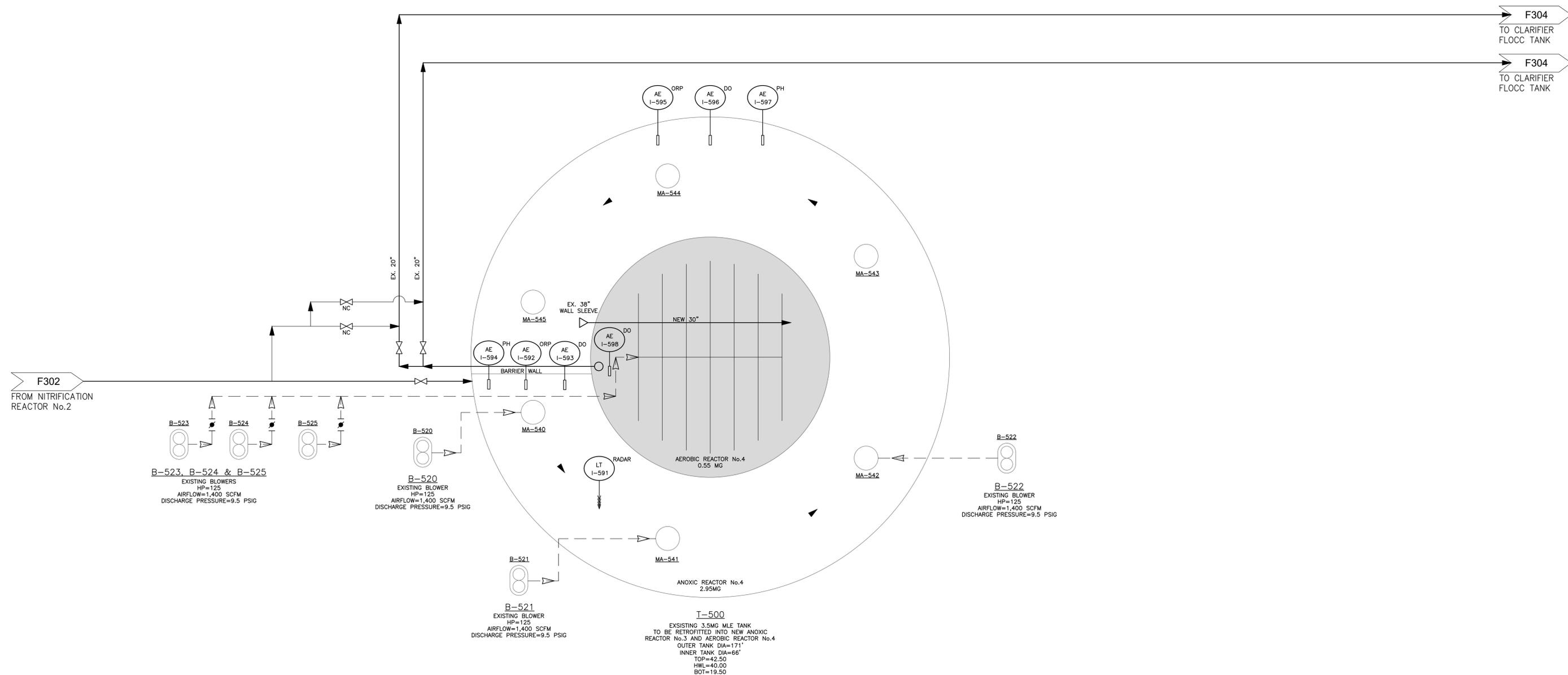
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| NEW REACTOR No.1 & No.2 P&ID | |
|--|-------------------|
| MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | |
| SUSSEX COUNTY, DELAWARE | |
| DATE: 01.02.19 | PROJECT NO. MN01B |
| SCALE: NONE | DWG NO: F302 |

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| | JW | JHR | JHR | ISSUE FOR BID | 09.14.18 |
| | JW | JHR | JHR | DNREC SUBMITTAL | 01.02.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 11.15.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |



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CHKD BY: J.H.R.

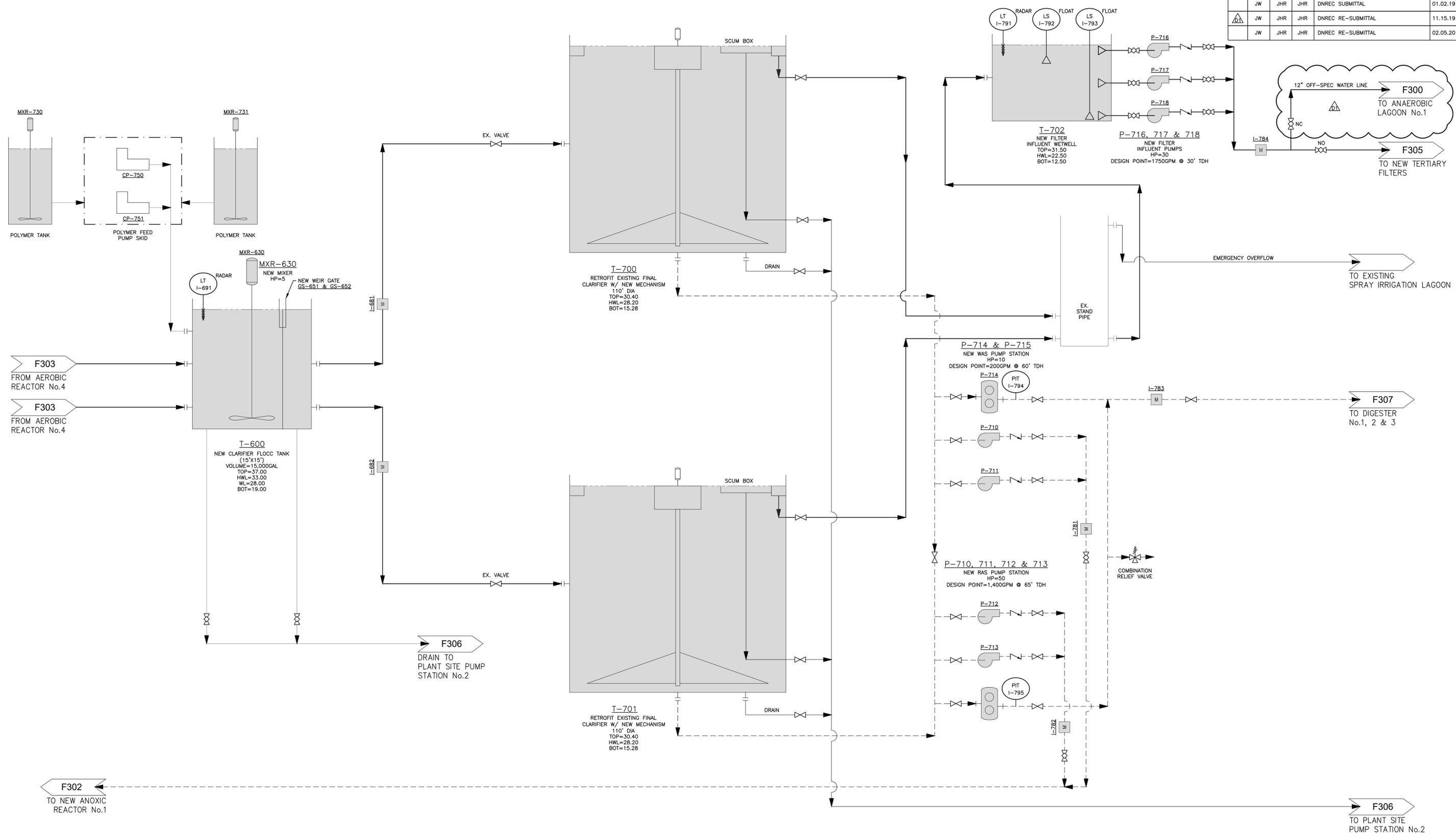
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| EX. MLE TANK NEW REACTOR No.3 & No.4 P&ID | |
|--|-------------------|
| MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | |
| SUSSEX COUNTY, | DELAWARE |
| DATE: 01.02.19 | PROJECT NO. MN01B |
| SCALE: NONE | DWG NO: F303 |

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| | JW | JHR | JHR | ISSUE FOR BID | 09.14.18 |
| | JW | JHR | JHR | DNREC SUBMITTAL | 01.02.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 11.15.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |

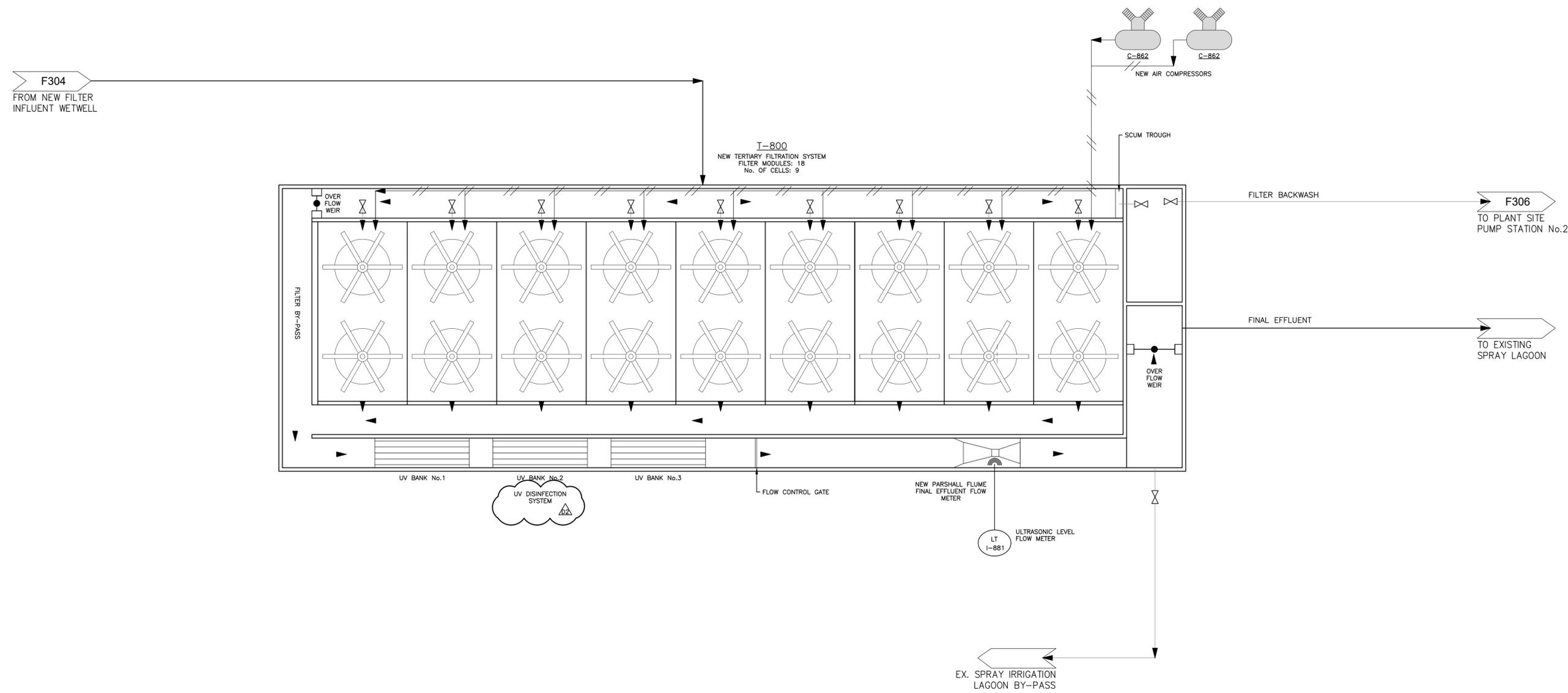


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| FINAL CLARIFIERS P&ID | | | |
|--|----------|-------------------------|-------|
| MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | | SUSSEX COUNTY, DELAWARE | |
| DATE: | 01.02.19 | PROJECT NO. | MN01B |
| SCALE: | NONE | DWG NO: | F304 |

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| | JW | JHR | JHR | ISSUE FOR BID | 09.14.18 |
| | JW | JHR | JHR | DNREC SUBMITTAL | 01.02.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 11.15.19 |
| △ | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |



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DESIGNED BY: J.H.R.
CHKD BY: J.H.R.

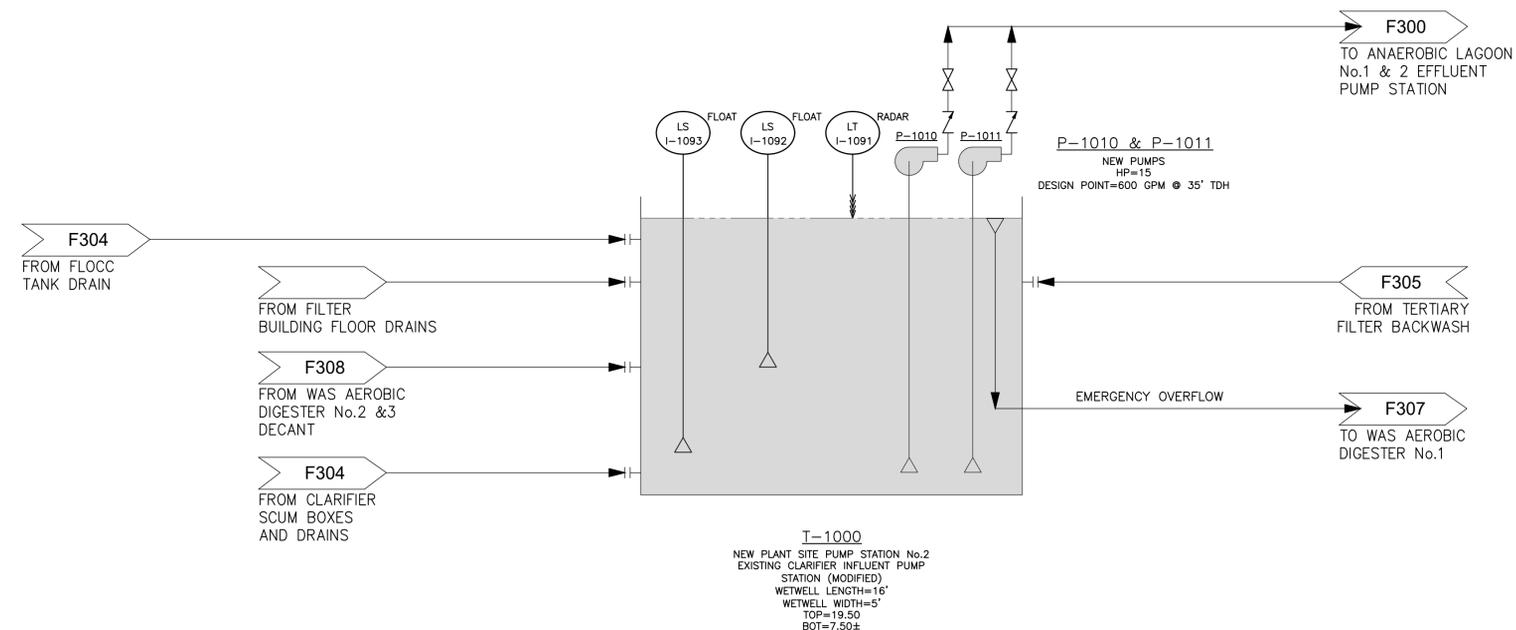
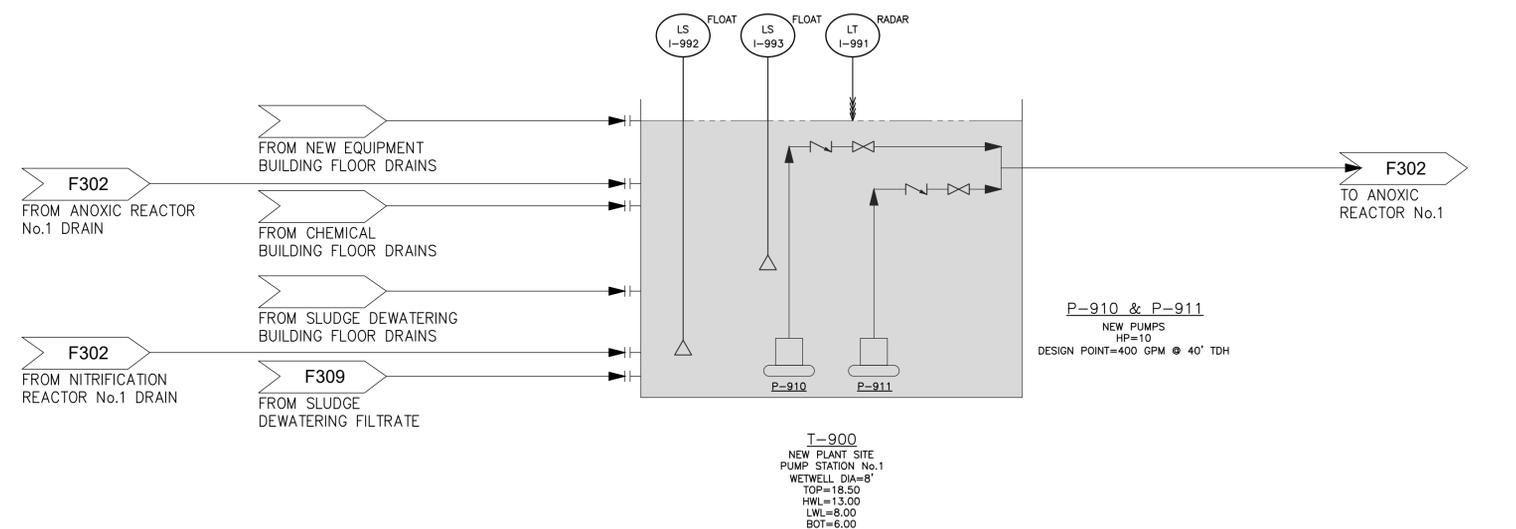
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Tel:(540) 371-8500 Fax:(540) 371-8576

| NEW SAND FILTERS P&ID | |
|--|-------------------|
| MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | |
| SUSSEX COUNTY, DELAWARE | |
| DATE: 01.02.19 | PROJECT NO. MN01B |
| SCALE: NONE | DWG NO: F305 |

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| | JW | JHR | JHR | ISSUE FOR BID | 09.14.18 |
| | JW | JHR | JHR | DNREC SUBMITTAL | 01.02.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 11.15.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |



DRAWN BY: S.B.A.
 DESIGNED BY: J.H.R.
 CHKD BY: J.H.R.

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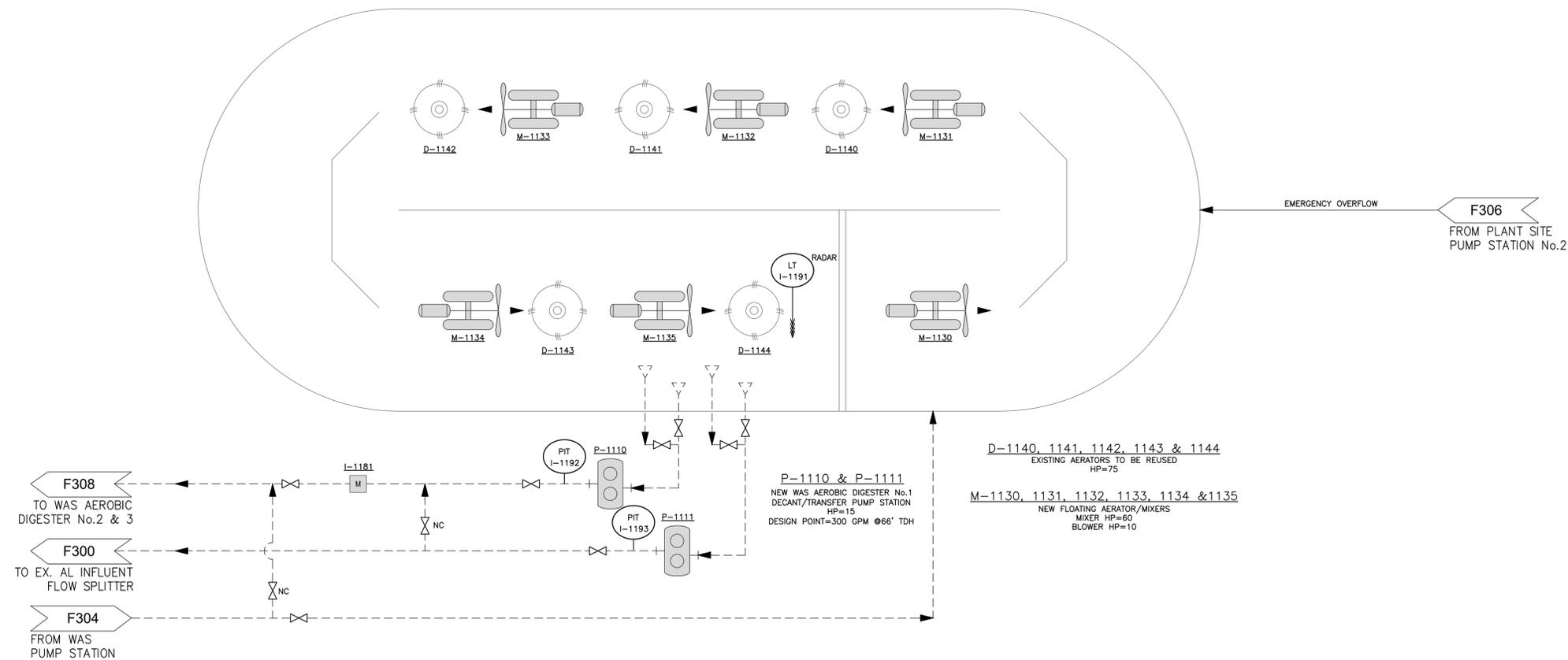
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| NEW PLANT SITE PUMP STATIONS No.1 & No.2 P&ID | |
|--|-------------------|
| MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | |
| SUSSEX COUNTY, DELAWARE | |
| DATE: 01.02.19 | PROJECT NO. MN01B |
| SCALE: NONE | DWG NO: F306 |

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| | JW | JHR | JHR | ISSUE FOR BID | 09.14.18 |
| | JW | JHR | JHR | DNREC SUBMITTAL | 01.02.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 11.15.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |

T-1100
 EXISTING WASTE ACTIVATED
 SLUDGE DIGESTER No.1
 VOLUME=3MG
 NOMINAL LENGTH=500'
 NOMINAL WIDTH=98'
 NOMINAL DEPTH=8'
 TOP=17.70
 HWL=15.70
 LWL=13.70
 BOT=7.70



DRAWN BY: S.B.A.
 DESIGNED BY: J.H.R.
 CHKD BY: J.H.R.

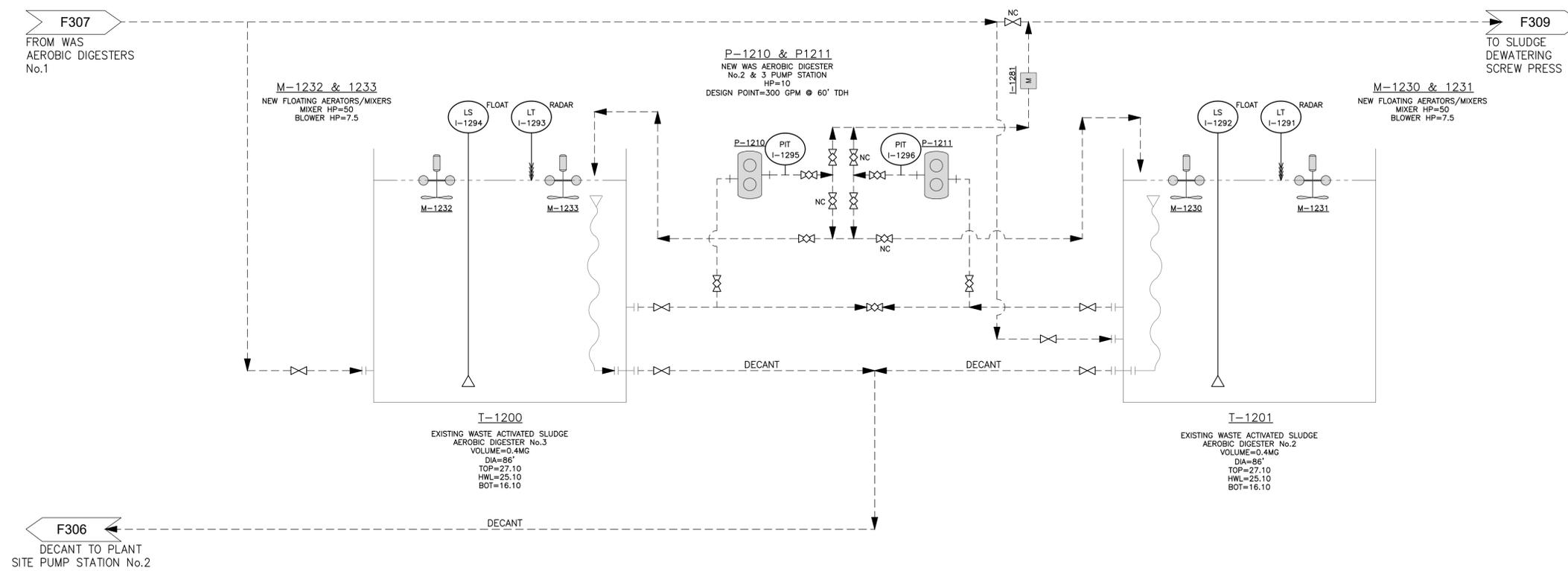
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| EXISTING WASTE ACTIVATED SLUDGE AEROBIC DIGESTER No.1 P&ID | |
|--|-------------------|
| MOUNTAIRE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | |
| SUSSEX COUNTY, | DELAWARE |
| DATE: 01.02.19 | PROJECT NO. MN01B |
| SCALE: NONE | DWG NO: F307 |

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| | JW | JHR | JHR | ISSUE FOR BID | 09.14.18 |
| | JW | JHR | JHR | DNREC SUBMITTAL | 01.02.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 11.15.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |



DRAWN BY: S.B.A.
 DESIGNED BY: J.H.R.
 CHKD BY: J.H.R.

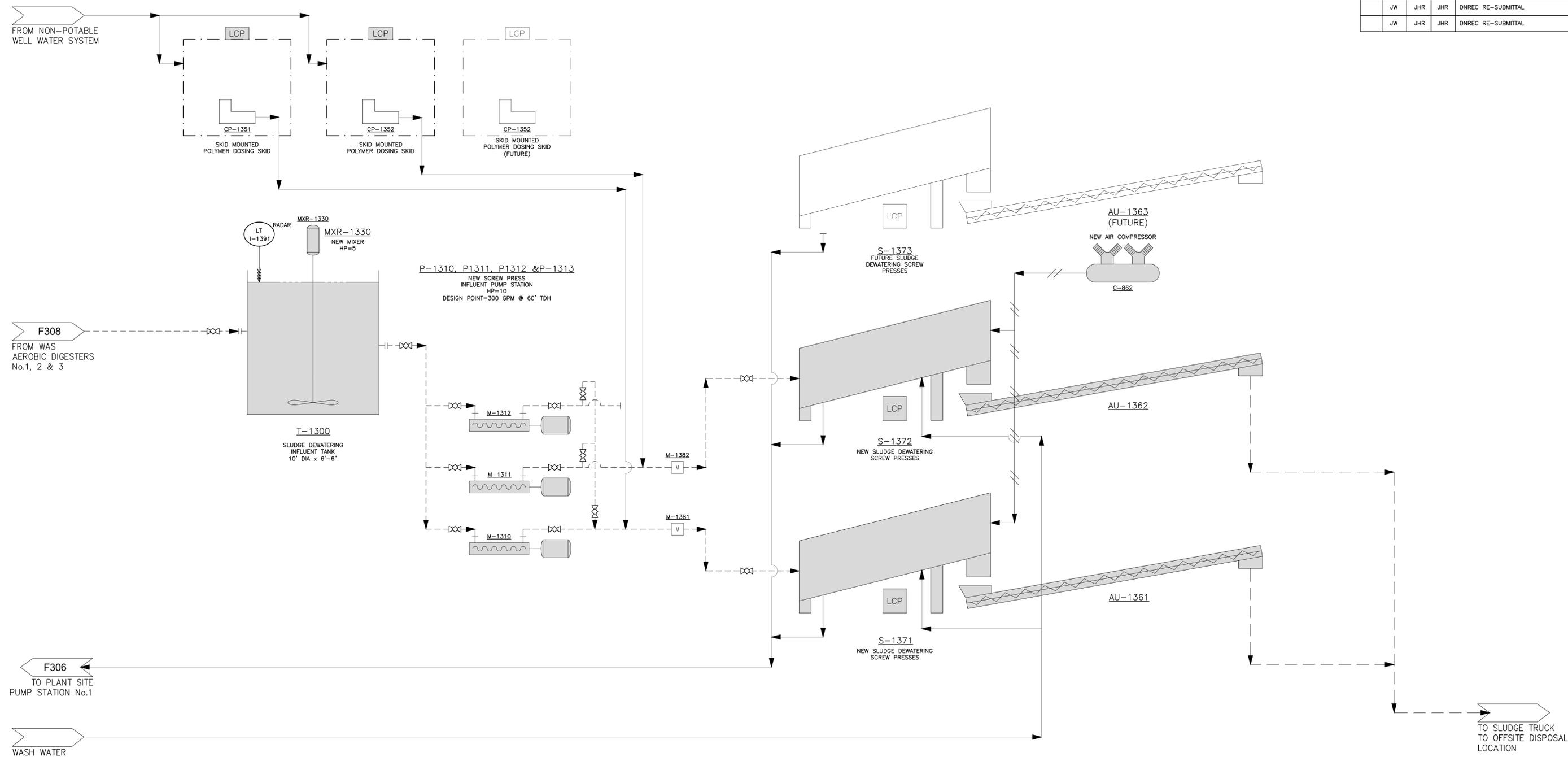
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| | |
|--|-------------------|
| WASTE ACTIVATED SLUDGE AEROBIC DIGESTER No.2 & 3 P&ID | |
| MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | |
| SUSSEX COUNTY, DELAWARE | |
| DATE: 01.02.19 | PROJECT NO. MNO1B |
| SCALE: NONE | DWG NO: F308 |

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|----|------|------|--------------------|----------|
| | JW | JHR | JHR | ISSUE FOR BID | 09.14.18 |
| | JW | JHR | JHR | DNREC SUBMITTAL | 01.02.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 11.15.19 |
| | JW | JHR | JHR | DNREC RE-SUBMITTAL | 02.05.20 |



NOTE:
THE LOCALE CONTROL PANEL LCP SHALL
BE LOCATED IN THE ELECTRICAL ROOM



DRAWN BY: S.B.A.
DESIGNED BY: J.H.R.
CHKD BY: J.H.R.

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| NEW SLUDGE DEWATERING SCREW PRESS P&ID | |
|--|-------------------|
| MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | |
| SUSSEX COUNTY, DELAWARE | |
| DATE: 01.02.19 | PROJECT NO. MN01B |
| SCALE: NONE | DWG NO: F309 |

Appendix 7

Controls and Integration

Mountaire Farms of Delaware, Inc.
Millsboro Facility
Sussex County, DE
Wastewater Treatment System Upgrade

Control Logic Outline

Notes:

1. The Control Logic Outline is provided as a guide for the General Contractor and the Integrator to serve as a general guide of the design intent for the functionality of the specified equipment.
2. The Control Logic Outline shall be reviewed by each Bidder and any discrepancies between the Drawings, Technical Specifications and the Control Logic Outline shall be brought to the Engineers attention immediately.
3. Equipment specific alarms, warnings, and protections are not included in the following list. The General Contractor (GC)/Integrator shall be responsible for reviewing and coordinating all equipment specific features for inclusion in the system controls. This Control Logic Outline is a general list of the operational control scheme. The Contractor/Integrator shall provide revisions/additions to this outline to be included in the Contractor/Integrator prepared Control Logic Outline.
4. Audio/Visual Alarms are to activate for specified alarms within the PLC control as well as specified alarms outside of the PLC control (i.e. PLC is not functioning or the equipment is being operated at the MCC)

Control Logic:

1. Short Circuit Pump Station

- A. The Primary operation of the short circuit pump station is to pump pretreated wastewater that by-passes the Anaerobic Lagoons No. 1 and 2, directly to the Anoxic Reactor No. 1 to provide sufficient BOD for denitrification. The Alternative mode of operation is for the Short Circuit Pump to operate in parallel with the Anaerobic Lagoon No. 1 & 2 Effluent Pumps (P-111 &112) in the event one of the pumps is not operational. In the alternative mode the Short Circuit Pump will pump directly to the Anaerobic Lagoon No. 3.
- B. Equipment
 - 1) Pump - P-110
- C. Associated Equipment
 - 1) Flow Meter - I-181 (Alternate Instrumentation)
 - 2) Flow Meter - I-182 (Primary Instrumentation)
 - 3) Level Float – I-192 (Alternate Instrumentation)
 - 4) Level Float - I-193 (Primary Instrumentation)

D. MCC Controls

- 1) Manually operate, On/Off, pumps
- 2) Control Speed
- 3) Prevent pump from operating at LWL - Level Float I-193
- 4) Auto

E. PLC Controls

- 1) Manual Control
 - a. Manually operate, On/Off, pumps
 - b. Control Speed
 - c. Pump Off at LWL
- 2) Automatic Control - Normal Operation:
 - a. Primary operation is for the pump to pump from the Short Circuit Pump Station wet well to the Anoxic Reactor No. 1.
 - b. Adjust pump speed to maintain operator set discharge flow rate (Flow Meter I-182)
 - c. Pump Off at LWL (I-193)
- 3) Automatic Control - Alternative Operation:
 - a. Alternative operation is for the pump to pump from the Anaerobic Lagoon No. 1 & 2 Effluent Pump Station wet well to the Post Anaerobic Lagoon DAF and/or the Anaerobic Lagoon No. 3.
 - b. Adjust pump speed to maintain operator set liquid level
 - c. Pump Off at LWL (I-192)

F. HMI

- 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each pump
 - b. Flow rate, gpm (Flow Meter I-182)
 - c. Pump operating Hz
- 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each pump
 - b. Flow volume pumped the previous day (Flow Meter I-182)
- 3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
 - a. Adjust pump discharge flow rate.
 - b. Select Primary or Alternate operation.

G. Alarms

- 1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic

Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

2. Anaerobic Lagoon No. 1 & 2 Effluent Pump Station

A. Equipment

- 1) Pump - P-111
- 2) Pump - P-112

B. Associated Equipment

- 1) Flow Meter - I-181 (Primary Instrumentation)
- 2) Flow Meter - I-182 (Alternate Instrumentation)
- 3) Level Sensor – I-191 (Primary Instrumentation)
- 4) Level Float (LWL) – I-192 (Primary Instrumentation)
- 5) Level Float (LWL) - I-193 (Alternate Instrumentation)

C. MCC Controls

- 1) Manually operate, On/Off, pumps
- 2) Control Speed
- 3) Prevent pump from operating at LWL - Level Float I-192
- 4) Auto

D. PLC Controls

- 1) Manual Control
 - a. Manually operate, On/Off, pumps
 - b. Control Speed
 - c. Pump Off at LWL
- 2) Automatic Control - Normal Operation:
 - a. Primary operation is for the pump to pump from the Anaerobic Lagoon No. 1 & 2 Effluent Pump Station wet well to the Post Anaerobic Lagoon DAF and/or the Adjust pump speed to maintain operator set discharge flow rate.
 - b. Adjust pump speed to maintain operator set discharge flow rate (Flow Meter I-181)
 - c. Pump Off at LWL (I-191 and I-192)
 - d. Prevent pumps from operating at LWL (minimum safe operating level for the pumps) (I-191 and I-192)
- 3) Automatic Control - Alternative Surface Overflow Operation:
 - a. Alternate operation is for the Pump P-111 to pump from the Short Circuit Pump Station wet well to the Anoxic Reactor No. 1.
 - b. Adjust pump speed to maintain operator set discharge flow rate (Flow Meter I-182)

c. Pump Off at LWL (I-193)

E. Pump Alternation

- 1) The alternation of the lead pump shall be capable of being based on operational run time
- 2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.

F. HMI

- 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each pump
 - b. Flow rate, gpm (Flow Meter I-181)
 - c. Pump operating Hz
 - d. Liquid Level in the wet well (Level Sensor I-191)
- 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each pump
 - b. Flow volume pumped the previous day (Flow Meter I-181)
- 3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
 - a. Select lead pump
 - b. Disengage the automatic alternation of pumps
 - c. Adjust pump discharge flow rate.

G. Alarms

- 1) High Water Alarm (I-191)
- 2) Low Water Alarm (I-191)
- 3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

3. Existing Post DAF No. 3 Post Anaerobic Lagoon DAF Pump Station

A. Equipment

- 1) Existing Pump 1
- 2) Existing Pump 2

B. Associated Equipment

- 1) Existing Flow Meter
- 2) Existing Level Sensor

- C. MCC Controls
 - 1) Manually operate, On/Off, pumps
 - 2) Control Speed
 - 3) Prevent pump from operating at LWL
 - 4) Auto
- D. PLC Controls
 - 1) Manual Control
 - a. Manually operate, On/Off, pumps
 - b. Control Speed
 - c. Pump Off at LWL
 - 2) Automatic Control:
 - a. Adjust pump speed to maintain operator set liquid level in the wet well.
 - b. Prevent pump from operating at LWL.
- E. Pump Alternation
 - 1) The alternation of the lead pump shall be capable of being based on operational run time
 - 2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.
- F. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each pump
 - b. Flow rate, gpm
 - c. Pump operating Hz
 - d. Liquid Level in wet well
 - 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each pump
 - b. Flow volume pumped the previous day
 - 3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
 - a. Select lead pump
 - b. Disengage the automatic alternation of pumps
 - c. Adjust pump discharge flow rate.
- G. Alarms
 - 1) High Water Alarm
 - 2) Low Water Alarm

- 3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

4. Anaerobic Lagoon No. 3 Effluent Pump Station

A. Equipment

- 1) Pump – P-210
- 2) Pump – P-211
- 3) Pump – P-212

B. Associated Equipment

- 1) Flow Meter – I-281
- 2) Level Sensor – I-291

C. MCC Controls

- 1) Manually operate, On/Off, pumps
- 2) Control Speed
- 3) Prevent pump from operating at LWL (I-291)
- 4) Auto

D. PLC Controls

- 1) Manual Control
 - a. Manually operate, On/Off, pumps
 - b. Control Speed
 - c. Pump Off at LWL (I-291)
- 2) Automatic Control:
 - a. Adjust pump speed to maintain operator set discharge flow rate (I-281)
 - b. Two pumps on at full speed at Anaerobic Lagoon HHWL (I-291)
 - c. Prevent pump from operating at LWL (I-291)

E. Pump Alternation

- 1) The alternation of the lead pump shall be capable of being based on operational run time
- 2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.

F. HMI

- 1) At a minimum, the following shall be displayed on the HMI Screen:

- a. Operational status of each pump
 - b. Flow rate, gpm (I-281)
 - c. Pump operating Hz
 - d. Liquid Level in the Anaerobic Lagoon No. 3 (I-291)
- 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each pump
 - b. Flow volume pumped the previous day (I-281)
 - 3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
 - a. Select lead pump
 - b. Disengage the automatic alternation of pumps
 - c. Adjust pump discharge flow rate.
- G. Alarms
- 1) High High Water Alarm
 - 2) High Water Alarm
 - 3) Low Water Alarm
 - 4) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

5. Anoxic Reactor No. 1 Jet System Pumps

- A. Equipment
 - 1) Pump – P-310
 - 2) Pump – P-311
- B. Associated Equipment
 - 1) Level Sensor – I-391
- C. MCC Controls
 - 1) Manually operate, On/Off, pumps
 - 2) Prevent pump from operating at LWL (I-391)
 - 3) Auto
- D. PLC Controls
 - 1) Manual Control
 - a. Manually operate, On/Off, pumps
 - b. Pump Off at LWL (I-391)

E. HMI

- 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each pump
 - b. Pump operating Hz
 - c. Liquid Level in the Anoxic Reactor No. 1 (I-391)
- 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each pump

F. Alarms

- 1) High Water Alarm
- 2) Low Water Alarm
- 3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

6. Anoxic Reactor No. 1 – Process Instrumentation

A. Equipment

- 1) Level Sensor – I-391
- 2) ORP Sensor – I-392
- 3) D.O. Sensor – I-393
- 4) pH Sensor – I-394

B. HMI

- 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Anoxic Reactor No. 1 liquid level
 - b. Display ORP level
 - c. Display D.O. level
 - d. Display pH level
- 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Record ORP trend data
 - b. Record D.O. trend data
 - c. Record pH trend data

C. Alarms

- 1) High Water Level (HWL) Alarm
- 2) Low Water Level (LWL) Alarm

7. Nitrification Reactor No. 2 Influent Slide Gates

- A. Equipment
 - 1) Weir Gate – GS-451
 - 2) Weir Gate – GS-452
- B. MCC Controls
 - 1) Adjust weir gate position
- C. PLC
 - 1) Manual Controls
 - a. Adjust weir gate position
- D. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Position of each weir gate
- E. Alarms
 - 1) Alarm if both weir gates are simultaneously closed

8. Nitrification Reactor No. 2 – Jet System Pumps

- A. Equipment
 - 1) Pump – P-410
 - 2) Pump – P-411
- B. Associated Equipment
 - 1) Level Sensor – I-491
- C. MCC Controls
 - 1) Manually operate, On/Off, pumps
 - 2) Adjust pump operating speed
 - 3) Prevent pump from operating at LWL (I-491)
 - 4) Auto
- D. PLC Controls
 - 1) Manual Control
 - a. Manually operate, On/Off, pumps
 - b. Adjust pump operating speed
 - c. Pump Off at LWL (I-491)
- E. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each pump

- b. Pump operating Hz
 - c. Liquid Level in the Nitrification Reactor No. 2 (I-491)
 - 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each pump
- F. Alarms
 - 1) High Water Alarm
 - 2) Low Water Alarm
 - 3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

9. Nitrification Reactor No. 2 – Jet System Blowers

- A. Normal operation is for the Nitrification Reactor No. 2 to be operated as a completely mixed aerobic reactor (jet mixing with aeration) and the Anoxic Reactor No. 1 to be operated at a completely mixed anoxic condition (jet mixing without aeration). Alternate Operation: the Anoxic Reactor will act as the single aerobic reactor and the Nitrification Reactor No. 2 will be offline; therefore, the blowers will provide air flow to the Anoxic Reactor No. 1 jet system
- B. Equipment
 - 1) Blower – B-420
 - 2) Blower – B-421
 - 3) Blower – B-422
 - 4) Blower – B-423
 - 5) Blower – B-424
- C. Associated Equipment
 - 1) D.O. Sensor – I-492
 - 2) D.O. Sensor – I-393
 - 3) Pump – P-310
 - 4) Pump – P-311
 - 5) Pump – P-410
 - 6) Pump – P-411
- D. MCC Controls
 - 1) Manually operate, On/Off, blowers
 - 2) Control blower speed
 - 3) Auto

E. PLC Controls

1) Manual Controls

- a. Manually operate, On/Off, blowers
- b. Adjust blower speed
- c. Select Normal or Alternate Operation Mode
 - i. During Normal Operation Mode of using the Nitrification Reactor No. 2 as the aerobic reactor: Prevent Blower B-420, B-421, B-422, B-423, and B-424 from operating when the Nitrification Reactor No. 2 jet pumps are not operating. Must be able to override the lock out in order to perform backflush and to operate if one of the jet pumps or reactors is out of service
 - ii. During Alternate Operation Mode of using the Anoxic Reactor No. 1 as an aerobic reactor: Prevent Blower B-420, B-421, B-422, B-523, and B-524 from operating when the Anoxic Reactor No. 1 jet pumps are not operating. Must be able to override the lock out in order to perform backflush.

2) Automatic Controls

- a. Select Normal or Alternate Operation Mode
 - i. Normal Operation: Automatically adjust speed to maintain operate specified D.O. in the Nitrification Reactor #2 (Normal Operation). During Normal Operation the D.O. in the Anoxic Reactor No. 1 will not have any control of the blower's operation.
 - ii. Alternate Operation: Automatically adjust speed to maintain operator specified D.O. in the Anoxic Reactor #1 (Alternative Operation when Anoxic Reactor is being operated as the aerobic reactor)
 - iii. During Normal Operation Mode of using the Nitrification Reactor No. 2 as the aerobic reactor: Prevent Blower B-420, B-421, B-422, B-423, and B-424 from operating when the Nitrification Reactor No. 2 jet pumps are not operating. Must be able to override the lock out in order to perform backflush and to operate if one of the jet pumps or reactors is out of service
 - iv. During Alternate Operation Mode of using the Anoxic Reactor No. 1 as an aerobic reactor: Prevent Blower B-420, B-421, B-422, B-523, and B-524 from operating when the Anoxic Reactor No. 1 jet pumps are not operating. Must be able to override the lock out in order to perform backflush.
- b. Turn additional blowers (non-lead blower) On/Off to maintain set D.O. Level
 - i. The GC/Integrator/Equipment Manufacturer shall propose a blower control sequencing that prevents blowers from frequently cycling on and off.

3) Blower Alternation

- a. The alternation of the lead blower shall be capable of being based on operational run time
- b. All blowers shall alternate as lead blower. All blowers to maintain approximately equivalent run times.

- c. The alternation of the lead blower shall be capable of being based on a set time and day of the week.

F. HMI

- 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each blower
 - b. D.O. (I-393 & I-492)
 - c. Blower operating Hz
- 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each blower
 - b. D.O. trend data for both reactors
- 3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
 - a. D.O. set point in each reactor
 - b. Manually select lead blower
 - c. Disengage the automatic alternation of pumps
 - d. Override the blower lockout in order to operate the blowers without the jet system pumps operating in order to backflush the system.

G. Alarms

- 1) The Contractor/Integrator shall be responsible for identifying all available alarms on the existing equipment and the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

10. Nitrification Reactor No. 2 – Process Instrumentation

A. Equipment

- 1) Level Sensor – I-491
- 2) D.O. Sensor – I-492
- 3) pH Sensor – I-493

B. HMI

- 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Nitrification Reactor No. 2 liquid level
 - b. Display D.O. level
 - c. Display pH level
- 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Record D.O. trend data

- b. Record pH trend data
- C. Alarms
 - 1) High Water Level (HWL) Alarm
 - 2) Low Water Level (LWL) Alarm

11. Nitrate Recycle Pump Station

- A. Equipment
 - 1) Pump – P-412
 - 2) Pump – P-413
- B. Associated Equipment
 - 1) Flow Meter – I-481
 - 2) Level Sensor – I-391
 - 3) Level Sensor – I-491
- C. MCC Controls
 - 1) Manually operate, On/Off, pumps
 - 2) Adjust pump operating speed
 - 3) Prevent pump from operating at Nitrification Reactor No. 2 LWL (I-491)
 - 4) Prevent pump from operating at Anoxic Reactor No. 1 HWL (I-391)
 - 5) Auto
- D. PLC Controls
 - 1) Manual Control
 - a. Manually operate, On/Off, pumps
 - b. Adjust pump operating speed
 - c. Prevent pump from operating at Nitrification Reactor No. 2 LWL (I-491)
 - d. Prevent pump from operating at Anoxic Reactor No. 1 HWL (I-391)
 - 2) Automatic Control
 - a. Adjust pump speed to maintain operator set discharge flow rate (I-481)
 - i. NOTE: Normally two pumps will operate to maintain the required Nitrate Recycle flow rate.
 - b. Prevent pump from operating at Nitrification Reactor No. 2 LWL (I-491)
 - c. Prevent pump from operating at Anoxic Reactor No. 1 HWL (I-391)
- E. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each pump

- b. Flow rate, gpm (I-481)
 - c. Pump operating Hz
 - 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each pump
 - b. Flow volume pumped the previous day (I-481)
 - 3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
 - a. Adjust pump discharge flow rate.
- F. Alarms
 - 1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

12. Anoxic Reactor No. 3 Existing Blowers

- A. Equipment
 - 1) Ex. Blower B-520
 - 2) Ex. Blower B-521
 - 3) Ex. Blower B-522
- B. MCC Controls
 - 1) Existing
- C. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each Blower
 - b. Blower operating Hz
- D. Alarms
 - 1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

13. Anoxic Reactor No. 3 Existing Mixers (SAM Units)

- A. Equipment
 - 1) Ex. SAM Unit – MA-540
 - 2) Ex. SAM Unit – MA-541

- 3) Ex. SAM Unit – MA-542
 - 4) Ex. SAM Unit – MA-543
 - 5) Ex. SAM Unit – MA-544
 - 6) Ex. SAM Unit – MA-545
- B. MCC Controls
- 1) Existing
- C. HMI
- 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each SAM Unit
 - b. Pump operating Hz
- D. Alarms
- 1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

14. Anoxic Reactor No. 3 – Process Instrumentation

- A. Equipment
- 1) Level Sensor – I-591
 - 2) ORP Sensor – I-592
 - 3) D.O. Sensor – I-593
 - 4) pH Sensor – I-594
 - 5) ORP Sensor – I-595
 - 6) D.O. Sensor – I-596
 - 7) pH Sensor – I-597
- B. HMI
- 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Anoxic Reactor No. 3 liquid level
 - b. Display ORP level
 - c. Display D.O. level
 - d. Display pH level
 - 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Record ORP trend data
 - b. Record D.O. trend data

- c. Record pH trend data
- C. Alarms
 - 1) High Water Level (HWL) Alarm
 - 2) Low Water Level (LWL) Alarm

15. Aerobic Reactor No. 4 Existing Blowers

- A. Equipment
 - 1) Ex. Blower B-523
 - 2) Ex. Blower B-524
 - 3) Ex. Blower B-525
- B. MCC Controls
 - 1) Existing
- C. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each Blower
 - b. Blower operating Hz
- D. Alarms
 - 1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

16. Aerobic Reactor No. 4 – Process Integration

- A. Equipment
 - 1) D.O. Sensor – I-598
- B. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Display D.O. level
 - 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Record D.O. trend data

17. Clarifier Flocc Tank – Mixer

- A. Equipment
 - 1) Vertical Shaft Mixer – MXR-630
- B. Associated Equipment
 - 1) Level Sensor – I-691

- C. MCC Controls
 - 1) Manually operate, On/Off, Mixer
 - 2) Control mixer speed
 - 3) Auto
- D. PLC Controls
 - 1) Manual Controls
 - a. Manually operate, On/Off, mixer
 - b. Adjust mixer speed
 - 2) Automatic Controls
 - a. Adjust mixer speed based on liquid level
- E. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of Mixer
 - b. Mixer operating Hz
 - c. Liquid Level in the Clarifier Flocc Tank (I-691)
 - 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for the mixer
- F. Alarms
 - 1) High Water Alarm
 - 2) Low Water Alarm
 - 3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

18. Clarifier Flocc Tank Weir Gates

- A. Equipment
 - 1) Weir Gate – GS-651
 - 2) Weir Gate – GS-652
- B. Associated Equipment
 - 1) Flow Meter – I-681
 - 2) Flow Meter – I-682
- C. MCC Controls
 - 1) Adjust weir gate position

- 2) Auto
- D. PLC
 - 1) Manual Controls
 - a. Adjust weir gate position
 - 2) Automatic Controls
 - a. Adjust weir gate position to maintain operator set flow rate
- E. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Position of each weir gate

19. Filter Influent Pump Station

- A. Equipment
 - 1) Pump – P-716
 - 2) Pump – P-717
 - 3) Pump – P-718
- B. Associated Equipment
 - 1) Flow Meter – I-784
 - 2) Level Sensor – I-791
 - 3) Level Float HWL – I-792
 - 4) Level Float LWL – I-793
- C. MCC Controls
 - 1) Manually operate, On/Off, pumps
 - 2) Adjust pump speed
 - 3) Prevent pump from operating at LWL - Level Float I-793
 - 4) Pump on at HWL – Level Float I-792
 - 5) Auto
- D. PLC Controls
 - 1) Manual Control
 - a. Manually operate, On/Off, pumps
 - b. Adjust pump speed
 - c. Pump Off at LWL
 - 2) Automatic Control
 - a. Adjust pump speed to maintain operator set liquid level in the wet well.
 - b. Pumps on at full speed at HWL

- c. Pump Off at LWL
- E. Pump Alternation
 - 1) The alternation of the lead pump shall be capable of being based on operational run time
 - 2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.
- F. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each pump
 - b. Flow rate, gpm (Flow Meter I-784)
 - c. Pump operating Hz
 - d. Liquid level in the wet well
 - 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each pump
 - b. Flow volume pumped the previous day (Flow Meter I-784)
 - 3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
 - a. Select lead pump
 - b. Disengage the automatic alternation of pumps
- G. Alarms
 - 1) High Water Level Alarm
 - 2) Low Water Level Alarm
 - 3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

20. Return Activated Sludge (RAS) Pump Station

- A. Equipment
 - 1) Pump – P-710
 - 2) Pump – P-711
 - 3) Pump – P-712
 - 4) Pump – P-713
- B. Associated Equipment
 - 1) Flow Meter – I-781

- 2) Flow Meter – I-782
 - 3) Level Sensor – I-391
- C. MCC Controls
- 1) Manually operate, On/Off, pumps
 - 2) Adjust pump speed
 - 3) Auto
- D. PLC Controls
- 1) Manual Control
 - a. Manually operate, On/Off, pumps
 - b. Adjust pump speed
 - c. Pump Off at HWL in Anoxic Reactor No. 1 (I-391)
 - 2) Automatic Control:
 - a. Adjust pump (P-710 & 711) speed to maintain operator set discharge flow rate (I-781)
 - b. Adjust pump (P-712 & 713) speed to maintain operator set discharge flow rate (I-782)
 - c. Pump Off at HWL in Anoxic Reactor No. 1 (I-391)
- E. Pump Alternation
- 1) The alternation of the lead pump shall be capable of being based on operational run time
 - 2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.
- F. HMI
- 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each pump
 - b. Flow rate, gpm (I-781)
 - c. Flow rate, gpm (I-782)
 - d. Pump operating Hz
 - 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each pump
 - b. Flow volume pumped the previous day (I-781)
 - c. Flow volume pumped the previous day (I-782)
 - 3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
 - a. Select lead pump

- b. Disengage the automatic alternation of pumps
- c. Adjust pump discharge flow rate.

G. Alarms

- 1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

21. Waste Activated Sludge (WAS) Pump Station

A. Equipment

- 1) Pump – P-714
- 2) Pump – P-715

B. Associated Equipment

- 1) Flow Meter – I-783
- 2) Pressure Sensor – I-794
- 3) Pressure Sensor – I-795

C. MCC Controls

- 1) Manually operate, On/Off, pumps
- 2) Adjust pump speed
- 3) Auto

D. PLC Controls

- 1) Manual Control
 - a. Manually operate, On/Off, pumps
 - b. Adjust pump speed
 - c. Prevent pump from operating at high discharge pressure
- 2) Automatic Control
 - a. Adjust pump speed to maintain operate set discharge flow rate.
 - b. Prevent pump from operating at high discharge pressure

E. HMI

- 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each pump
 - b. Flow rate, gpm (I-783)
 - c. Pump operating Hz
 - d. Pump discharge pressure

- 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each pump
 - b. Flow volume pumped the previous day (I-783)
- 3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
 - a. Select lead pump
 - b. Adjust pump discharge flow rate.

F. Alarms

- 1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

22. Tertiary Sand Filters

- A. Local Control Panel
- B. The Contractor/Integrator shall be responsible for identifying all available alarms and I/Os on the equipment to be provided and recommend alarm functionality and I/Os in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

23. UV Disinfection System

- A. Local Control Panel
- B. The Contractor/Integrator shall be responsible for identifying all available alarms and I/Os on the equipment to be provided and recommend alarm functionality and I/Os in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

24. Final Effluent Flow Meter

- A. Equipment
 - 1) Flow Meter – I-881
- B. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Flow rate, gpm (I-881)
 - 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Flow volume pumped the previous day (I-881)

25. Plant Site Pump Station No. 1

- A. Equipment
 - 1) Pump – P-910
 - 2) Pump – P-911
- B. Associated Equipment
 - 1) Level Sensor – I-991
 - 2) Level Float – I-992
 - 3) Level Float – I-993
- C. MCC Controls
 - 1) Manually operate, On/Off, pumps
 - 2) Control Speed
 - 3) Alarm and prevent pump from operating at LWL - Level Float I-992
 - 4) Alarm and Pump On at full speed at HWL – Level Float I-993
 - 5) Auto
- D. PLC Controls
 - 1) Manual Control
 - a. Manually operate, On/Off, pumps
 - b. Control Speed
 - c. Pump Off at LWL
 - d. Alarm at HWL
 - 2) Automatic Control
 - a. Adjust pump speed to maintain set liquid level
 - b. Pump off at LWL
 - c. Lead pump on
 - d. Lag pump on
 - e. Alarm at HWL
- E. Pump Alternation
 - 1) The alternation of the lead pump shall be capable of being based on operational run time
 - 2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.
- F. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each pump
 - b. Pump operating Hz

- c. Liquid Level in the wet well (Level Sensor I-991)
 - 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each pump
 - 3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
 - a. Select lead pump
 - b. Disengage the automatic alternation of pumps
 - c. Adjust set liquid levels
- G. Alarms
- 1) High Water Alarm (I-992) Audible Visual
 - 2) Low Water Alarm (I-993) Audible Visual
 - 3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

26. Plant Site Pump Station No. 2

- A. Equipment
 - 1) Pump – P-1010
 - 2) Pump – P-1011
- B. Associated Equipment
 - 1) Level Sensor – I-1091
 - 2) Level Float – I-1092
 - 3) Level Float – I-1093
- C. MCC Controls
 - 1) Manually operate, On/Off, pumps
 - 2) Control Speed
 - 3) Alarm and prevent pump from operating at LWL - Level Float I-1092
 - 4) Alarm and Pump On at full speed at HWL – Level Float I-1093
 - 5) Auto
- D. PLC Controls
 - 1) Manual Control
 - a. Manually operate, On/Off, pumps
 - b. Control Speed
 - c. Pump Off at LWL

- d. Alarm at HWL
- 2) Automatic Control
 - a. Adjust pump speed to maintain set liquid level
 - b. Pump off at LWL
 - c. Lead pump on
 - d. Lag pump on
 - e. Alarm at HWL
- E. Pump Alternation
 - 1) The alternation of the lead pump shall be capable of being based on operational run time
 - 2) The alternation of the lead pump shall be capable of being based on a set time and day of the week.
- F. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each pump
 - b. Pump operating Hz
 - c. Liquid Level in the wet well (Level Sensor I-1091)
 - 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each pump
 - 3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
 - a. Select lead pump
 - b. Disengage the automatic alternation of pumps
 - c. Adjust set liquid levels
- G. Alarms
 - 1) High Water Alarm (I-1092) Audible Visual
 - 2) Low Water Alarm (I-1093) Audible Visual
 - 3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

27. Waste Activated Sludge Aerobic Digester No. 1 – Mixers

- A. Equipment
 - 1) Mixer – M-1130 (with Blower)

- 2) Mixer – M-1131 (with Blower)
 - 3) Mixer – M-1132 (with Blower)
 - 4) Mixer – M-1133 (with Blower)
 - 5) Mixer – M-1134 (with Blower)
 - 6) Mixer – M-1135 (with Blower)
- B. MCC Controls
- 1) Manually operate, On/Off, pumps
 - 2) Auto
- C. PLC Controls
- 1) Manual Control
 - a. Manually operate, On/Off, pumps
- D. HMI
- 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each mixer
 - b. Operational status of each mixer's blower
 - 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each mixer and mixer blower
- E. Alarms
- 1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

28. Waste Activated Sludge Aerobic Digester No. 1 – Existing Aerators

- A. Equipment
- 1) Aerator – D-1140
 - 2) Aerator – D-1141
 - 3) Aerator – D-1142
 - 4) Aerator – D-1143
 - 5) Aerator – D-1144
- B. MCC Controls
- 1) Manually operate, On/Off, pumps
 - 2) Auto
- C. PLC Controls

- 1) Manual Control
 - a. Manually operate, On/Off, pumps
- D. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each Aerator
 - 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each Aerator
- E. Alarms
 - 1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

29. Waste Activated Sludge Aerobic Digester No. 1 Pump Station

- A. Equipment
 - 1) Pump – P-1110
 - 2) Pump – P-1111
- B. Associated Equipment
 - 1) Flow Meter – I-1181
 - 2) Level Sensor – I-1191
 - 3) Pressure Sensor – I-1192
 - 4) Pressure Sensor – I-1193
- C. MCC Controls
 - 1) Manually operate, On/Off, pumps
 - 2) Adjust pump speed
 - 3) Auto
- D. PLC Controls
 - 1) Manual Control
 - a. Manually operate, On/Off, pumps
 - b. Adjust pump speed
 - c. Prevent pump from operating at high discharge pressure
 - 2) Automatic Control
 - a. Adjust pump speed to maintain operate set discharge flow rate.
 - b. Prevent pump from operating at high discharge pressure

E. HMI

- 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of each pump
 - b. Flow rate, gpm (I-1181)
 - c. Pump operating Hz
 - d. Pump discharge pressure
 - e. Digester liquid level
- 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each pump
 - b. Flow volume pumped the previous day (I-1181)
- 3) At a minimum, the operator shall be able to adjust the following from the HMI screen:
 - a. Adjust pump discharge flow rate.

F. Alarms

- 1) HWL Alarm
- 2) LWL Alarm
- 3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

30. Waste Activated Sludge Aerobic Digester No. 2 & 3 – Mixers

A. Equipment

- 1) Mixer – M-1230 (with Blower)
- 2) Mixer – M-1231 (with Blower)
- 3) Mixer – M-1232 (with Blower)
- 4) Mixer – M-1233 (with Blower)

B. MCC Controls

- 1) Manually operate, On/Off, pumps
- 2) Auto

C. PLC Controls

- 1) Manual Control
 - a. Manually operate, On/Off, pumps

D. HMI

- 1) At a minimum, the following shall be displayed on the HMI Screen:

- a. Operational status of each mixer
 - b. Operational status of each mixer's blower
- 2) At a minimum, the following data shall be maintained in the PLC:
 - a. Run time data for each mixer and mixer blower
- E. Alarms
 - 1) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

31. Waste Activated Sludge Aerobic Digester No. 2 & 3 Transfer Pump Station

- A. Equipment
 - 1) Pump – P-1210
 - 2) Pump – P-1211
- B. Associated Equipment
 - 1) Flow Meter – I-1281
 - 2) Level Sensor – I-1291
 - 3) Level Float – I-1292
 - 4) Level Sensor – I-1293
 - 5) Level Float – I-1294
 - 6) Pressure Sensor – I-1295
 - 7) Pressure Sensor – I-1296
 - 8) Level Sensor – I-1391 (Sludge Dewatering Influent Tank)
- C. MCC Controls
 - 1) Manually operate, On/Off, pumps
 - 2) Adjust pump speed
 - 3) Prevent pump from operating at LWL (floats)
 - 4) Auto
- D. PLC Controls
 - 1) Manual Control
 - a. Manually operate, On/Off, pumps
 - b. Adjust pump speed
 - c. Prevent pump from operating at high discharge pressure

- d. Prevent pump from operating at LWL in the digester (based on associated level sensor)
- e. Prevent pump from operating at HWL (I-1391) when the pump is pumping to the Sludge Dewatering Influent Tank

2) Automatic Control

- a. Adjust pump speed to maintain operate set discharge flow rate when transferring between digesters
- b. Automatically adjust pump speed to maintain set liquid level (I-1391) in the Sludge Dewatering Influent Tank when pumping to the Sludge Dewatering Influent Tank
- c. Prevent pump from operating at high discharge pressure
- d. Prevent pump from operating at LWL in the digester (based on associated level sensor)
- e. Prevent pump from operating at HWL (I-1391) when the pump is pumping to the Sludge Dewatering Influent Tank

E. HMI

1) At a minimum, the following shall be displayed on the HMI Screen:

- a. Operational status of each pump
- b. Flow rate, gpm (I-1281)
- c. Pump operating Hz
- d. Pump discharge pressure
- e. Digester liquid levels
- f. Liquid level of Sludge Dewatering Influent Tank

2) At a minimum, the following data shall be maintained in the PLC:

- a. Run time data for each pump
- b. Flow volume pumped the previous day (I-1281)

3) At a minimum, the operator shall be able to adjust the following from the HMI screen:

- a. Identify which tank each pump is pumping from for level control
- b. Identify to which tank each pump is pumping for level control (Digester #2, Digester #3 or Sludge Dewatering Influent Tank)
- c. Adjust pump discharge flow rate.

F. Alarms

- 1) HWL Alarm
- 2) LWL Alarm
- 3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment

critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

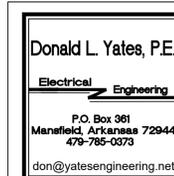
32. Sludge Dewatering Influent Tank

- A. Equipment
 - 1) Mixer – MXR-1330
 - 2) Level Sensor – I-1391
- B. MCC Controls
 - 1) Manually operate, On/Off, mixer
 - 2) Adjust mixer speed
- C. PLC Controls
 - 1) Manual Control
 - a. Manually operate, On/Off, mixer
 - b. Adjust mixer speed
- D. HMI
 - 1) At a minimum, the following shall be displayed on the HMI Screen:
 - a. Operational status of the mixer
 - b. Liquid level of the Sludge Dewatering Influent Tank
- E. Alarms
 - 1) HWL Alarm
 - 2) LWL Alarm
 - 3) The Contractor/Integrator shall be responsible for identifying all available alarms on the equipment to be provided and recommend alarm functionality in their Control Logic Outline. In general, all available alarms shall be communicated to the PLC. Equipment critical alarms that are intended by the manufacturer to alter the operation of the equipment (i.e. shut down) shall also be directly connected to the MCC as well as the PLC.

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|-----|------|------|------------------------|----------|
| | DLY | DLY | DLY | ISSUED FOR BID | 9/14/18 |
| | DLY | DLY | DLY | POST BID CONFORMED SET | 12/4/18 |
| | DLY | DLY | DLY | DNREC SUBMISSION | 1/2/19 |
| | DLY | DLY | DLY | DNREC RE-SUBMITTAL | 11/15/19 |
| | DLY | DLY | DLY | DNREC RE-SUBMITTAL | 2/5/20 |

| EQUIP # | EQUIPMENT NAME | HP | VFD Y/N | MCC OR LCP | VOLTS/PHASE | PLC CONTROL INFORMATION | | ASSOCIATED EQUIPMENT INSTRUMENTATION AND PROTECTION DEVICES | COMMENTS |
|---------|---|-----|---------|------------|-------------|-------------------------------------|--|--|---|
| | | | | | | HAND | AUTO | | |
| P-110 | Short Circuit Pump Station - Pump #1 | 50 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set discharge flow rate, Pump off at LWL. | Flow Meter I-182 Level Float I-193 | |
| P-111 | Anaerobic Lagoon 1 & 2 Eff. PS - Pump #1 | 50 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set liquid level, HWL Alarm, pump shut off at LWL. | Radar Level Sensor I-191 Level Float I-192 Flow Meter I-181 | |
| P-112 | Anaerobic Lagoon 1 & 2 Eff. PS - Pump #2 | 50 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set liquid level, HWL Alarm, pump shut off at LWL. | Radar Level Sensor I-191 Level Float I-192 Flow Meter I-181 | |
| P-210 | Anaerobic Lagoon 3 Eff. PS - Pump #1 | 40 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set discharge flow rate, HWL Alarm, pump shut off at LWL. | Pressure Transducer Level Sensor I-291 Flow Meter I-281 | |
| P-211 | Anaerobic Lagoon 3 Eff. PS - Pump #2 | 40 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set discharge flow rate, HWL Alarm, pump shut off at LWL. | Pressure Transducer Level Sensor I-291 Flow Meter I-281 | |
| P-212 | Anaerobic Lagoon 3 Eff. PS - Pump #3 | 40 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set discharge flow rate, HWL Alarm, pump shut off at LWL. | Pressure Transducer Level Sensor I-291 Flow Meter I-281 | |
| P-213 | Anaerobic Lagoon 3 Underdrain Pump | 5.5 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control, alarm when operating. | Pressure Transducer Level Sensor I-292 | |
| P-310 | Anoxic Reactor #1 - Jet Pump #1 | 200 | N | MCC | 460/3 | On, off, auto, manual speed control | On, off, manual speed control | | |
| P-311 | Anoxic Reactor #2 - Jet Pump #2 | 200 | N | MCC | 460/3 | On, off, auto, manual speed control | On, off, manual speed control | | |
| P-410 | Nitrification Reactor #2 - Jet Pump #1 | 200 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, manual speed control | | |
| P-411 | Nitrification Reactor #2 - Jet Pump #2 | 200 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, manual speed control | | |
| B-420 | Nitrification Reactor #2 - Blower #1 | 200 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control and on/off control to maintain set D.O. ; Operator select which D.O. probe provides operational control information, blower lockout when pump is not operating. | D.O. Sensor I-492 D.O. Sensor I-393 (Emergency Operation Only) | The blower shall be prevented from operating when the jet pump is not operational, however there must be a manual override for allowing the blower to operate without the jet pump operating. |
| B-421 | Nitrification Reactor #2 - Blower #2 | 200 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control and on/off control to maintain set D.O. ; Operator select which D.O. probe provides operational control information, blower lockout when pump is not operating. | D.O. Sensor I-492 D.O. Sensor I-393 (Emergency Operation Only) | The blower shall be prevented from operating when the jet pump is not operational, however there must be a manual override for allowing the blower to operate without the jet pump operating. |
| B-422 | Nitrification Reactor #2 - Blower #3 | 200 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control and on/off control to maintain set D.O. ; Operator select which D.O. probe provides operational control information, blower lockout when pump is not operating. | D.O. Sensor I-492 D.O. Sensor I-393 (Emergency Operation Only) | The blower shall be prevented from operating when the jet pump is not operational, however there must be a manual override for allowing the blower to operate without the jet pump operating. |
| B-423 | Nitrification Reactor #2 - Blower #4 | 200 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control and on/off control to maintain set D.O. ; Operator select which D.O. probe provides operational control information, blower lockout when pump is not operating. | D.O. Sensor I-492 D.O. Sensor I-393 (Emergency Operation Only) | The blower shall be prevented from operating when the jet pump is not operational, however there must be a manual override for allowing the blower to operate without the jet pump operating. |
| B-424 | Nitrification Reactor #2 - Blower #5 | 200 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control and on/off control to maintain set D.O. ; Operator select which D.O. probe provides operational control information, blower lockout when pump is not operating. | D.O. Sensor I-492 D.O. Sensor I-393 (Emergency Operation Only) | The blower shall be prevented from operating when the jet pump is not operational, however there must be a manual override for allowing the blower to operate without the jet pump operating. |
| P-412 | Nitrate Recycle Pump Station - Pump #1 | 40 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set discharge flow rate | Flow Meter I- 481 | |
| P-413 | Nitrate Recycle Pump Station - Pump #2 | 40 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set discharge flow rate | Flow Meter I-481 | |
| GS-451 | Nitrification Reactor Slide Gate #1 | | | MCC | 460/3 | Forward, Reverse, Auto | Manual Forward, Reverse | | Open and Closed Limit Switches Position feed back I/O |
| GS-452 | Nitrification Reactor Slide Gate #2 | | | MCC | 460/3 | Forward, Reverse, Auto | Manual Forward, Reverse | | Open and Closed Limit Switches Position feed back I/O |
| MXR-630 | Clarifier Inf. Flocc Tank Mixer | 5 | Y | MCC | 460/3 | On, off, auto | On, off, manual speed control | | |
| GS-651 | Flocc Tank Weir Gate #1 | | | | | Forward, Reverse, Auto | Manual Forward, Reverse | | Open and Closed Limit Switches Position feed back I/O |
| GS-652 | Flocc Tank Weir Gate #2 | | | | | Forward, Reverse, Auto | Manual Forward, Reverse | | Open and Closed Limit Switches Position feed back I/O |
| 631 | Clarifier #1 - Mechanism | 0.5 | N | MCC | 460/3 | | | | |
| 632 | Clarifier #2 - Mechanism | 0.5 | N | MCC | 460/3 | | | | |
| P-716 | Filter Influent Pump Station - Pump #1 | 30 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set liquid level, HWL, pump on and alarm, LWL, pump off and alarm. | Radar Level Sensor I-791 Level Float I-792 Level Float I-793 | |
| P-717 | Filter Influent Pump Station - Pump #2 | 30 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set liquid level, HWL, pump on and alarm, LWL, pump off and alarm. | Radar Level Sensor I-791 Level Float I-792 Level Float I-793 | |
| P-718 | Filter Influent Pump Station - Pump #3 | 30 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set liquid level, HWL, pump on and alarm, LWL, pump off and alarm. | Radar Level Sensor I-791 Level Float I-792 Level Float I-793 | |
| MXR-730 | Polymer Tank Mixer | 2 | Y | MCC | 460/3 | On, off, manual speed control | On, off, manual speed control | | |
| MXR-731 | Polymer Tank Mixer | 2 | Y | MCC | 460/3 | On, off, manual speed control | On, off, manual speed control | | |
| CP-750 | Polymer Feed Pump Skid - Pump #1 | 0.5 | Y | LCP | 120/1 | | | | |
| CP-751 | Polymer Feed Pump Skid - Pump #2 | 0.5 | Y | LCP | 120/1 | | | | |
| P-810 | Filter Backwash Pump Station - Pump #1 - (Future) | 15 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set liquid level, HWL, Alarm, pump shut off at LWL. | Radar Level Sensor I- Level Float I- Level Float I- | |
| P-811 | Filter Backwash Pump Station - Pump #2 - (Future) | 15 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set liquid level, HWL, Alarm, pump shut off at LWL. | Radar Level Sensor I- Level Float I- Level Float I- | |
| P-710 | RAS Pump Station - Pump #1 | 50 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set discharge flow rate | Flow Meter I-781 | |
| P-711 | RAS Pump Station - Pump #2 | 50 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set discharge flow rate | Flow Meter I-781 | |
| P-712 | RAS Pump Station - Pump #3 | 50 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set discharge flow rate | Flow Meter I-782 | |
| P-713 | RAS Pump Station - Pump #4 | 50 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set discharge flow rate | Flow Meter I-782 | |
| P-714 | WAS Pump Station - Pump #1 | 10 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set discharge flow rate, Pump Off at High Discharge Pressure | Flow Meter I-783 Pressure Sensor I-794 | |
| P-715 | WAS Pump Station - Pump #2 | 10 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set discharge flow rate, Pump Off at High Discharge Pressure | Flow Meter I-783 Pressure Sensor I-795 | |
| C-861 | Filter Air Compressor #1 | 20 | | | | | | | See Compressor Cut Sheet |
| C-862 | Filter Air Compressor #2 | 20 | | | | | | | See Compressor Cut Sheet |
| C-883 | Filter Air Compressor Air Drier #1 | | | | | | | | See Cut Sheet for Power Requirements |
| C-884 | Filter Air Compressor Air Drier #2 | | | | | | | | See Cut Sheet for Power Requirements |
| U-871 | UV Disinfection System Bank #1 | | | | | | | | |
| U-872 | UV Disinfection System Bank #2 | | | | | | | | |
| U-873 | UV Disinfection System Bank #3 | | | | | | | | |
| P-910 | Plant Site PS #1 - Pump #1 | 20 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set liquid level, HWL, pump on and alarm, LWL, pump off and alarm. | Radar Level Sensor I-991 Level Float I-992 Level Float I-993 | |
| P-911 | Plant Site PS #1 - Pump #2 | 20 | Y | MCC | 460/3 | On, off, auto, manual speed control | On, off, automatic speed control to maintain set liquid level, HWL, pump on and alarm, LWL, pump off and alarm. | Radar Level Sensor I-991 Level Float I-992 Level Float I-993 | |

EQUIPMENT SCHEDULE



DRAWN BY: DLY
DESIGNED BY: DLY
CHKD BY: DLY
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| EQUIPMENT SCHEDULE | | | |
|--|----------|-------------|-------|
| MOUNTAINE FARMS--MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | | | |
| SUSSEX COUNTY, | | DELAWARE | |
| DATE: | 11/15/19 | PROJECT NO. | MN01B |
| SCALE: | AS SHOWN | DWG NO.: | E607 |

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|-----|------|------|----------------|----------|
| | DLY | DLY | DLY | ISSUED FOR BID | 9/14/18 |
| 3 | DLY | DLY | DLY | REVISION 3 | 10/22/18 |

| | | | | |
|-----|-----|-----|------------------------|----------|
| DLY | DLY | DLY | POST BID CONFORMED SET | 12/4/18 |
| DLY | DLY | DLY | DNREC SUBMISSION | 1/2/19 |
| DLY | DLY | DLY | DNREC RE-SUBMITTAL | 11/15/19 |
| DLY | DLY | DLY | DNREC RE-SUBMITTAL | 2/5/20 |

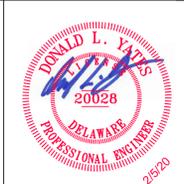
| EQUIP # | EQUIPMENT NAME | HP | VFD Y/N | MCC OR LCP | VOLTS/PHASE | PLC CONTROL INFORMATION | | ASSOCIATED EQUIPMENT INSTRUMENTATION AND PROTECTION DEVICES | COMMENTS |
|----------|--|-------------|-------------------|------------|-------------------------|-------------------------------------|---|---|---|
| | | | | | | HAND | AUTO | | |
| P-1011 | Plant Site PS #2 - Pump #2 | 15 | Y | MCC | 460/3 | On, off, auto; manual speed control | On, off, automatic speed control to maintain set liquid level, HVL pump on and alarm, LWL pump off and alarm | Radar Level Sensor I-1091 Level Float I-1092 Level Float I-1093 | |
| P-1110 | WAS Aerobic Digester #1 Decant/Transfer PS - Pump #1 | 25 | Y | MCC | 460/3 | On, off, auto; manual speed control | On, off, automatic speed control to maintain set pump rate, pump off at LWL in Digester #1, Pump off at High Discharge Pressure To Digester #2 & #3: On, off, automatic speed control to maintain set liquid level in the Screw Press Influent Tank, pump off at LWL in Digester #1, pump off at HVL in the Screw Press Influent Tank, Pump off at High Discharge Pressure To Screw Press Influent Tank: Alternative automatic speed control to maintain set liquid level in the Screw Press Influent Tank, pump off at LWL in Digester #1, pump off at HVL in the Screw Press Influent Tank, Pump off at High Discharge Pressure | Radar Level Sensor I-1191 Radar Level Sensor I-1391 Flow Meter I-1181 Pressure Transducer I-1192 | |
| P-1111 | WAS Aerobic Digester #1 Decant/Transfer PS - Pump #2 | 25 | Y | MCC | 460/3 | On, off, auto; manual speed control | On, off, automatic speed control to maintain set pump rate, pump off at LWL in Digester #1, Pump off at High Discharge Pressure To Digester #2 & #3: On, off, automatic speed control to maintain set liquid level in the Screw Press Influent Tank, pump off at LWL in Digester #1, pump off at HVL in the Screw Press Influent Tank, Pump off at High Discharge Pressure To Screw Press Influent Tank: Alternative automatic speed control to maintain set liquid level in the Screw Press Influent Tank, pump off at LWL in Digester #1, pump off at HVL in the Screw Press Influent Tank, Pump off at High Discharge Pressure | Radar Level Sensor I-1191 Radar Level Sensor I-1391 Flow Meter I-1181 Pressure Transducer I-1193 | |
| 1120 | Chemical Feed - Carbon Source Pump #1 | | | | 120 V | | | | |
| 1121 | Chemical Feed - Carbon Source Pump #2 | | | | 120 V | | | | |
| 1122 | Chemical Feed - Mag Pump #1 | 1 | | | 230/460, 3 Ph | | | | |
| 1123 | Chemical Feed - Mag Pump #2 | 1 | | | 230/460, 3 Ph | | | | |
| | Mag Tank #1 Mixer | 2 | | | 230/460, 3 Ph | | | | |
| | Mag Tank #2 Mixer | 2 | | | 230/460, 3 Ph | | | | |
| | Reuse Water Pump Station - Pump #1 - (Future) | | Y | MCC | 460/3 | On, off, auto; manual speed control | On, off, automatic speed control to maintain set liquid level, HVL Alarm, pump shut off at LWL | Radar Level Sensor I- Level Float I- Level Float I- | |
| | Reuse Water Pump Station - Pump #2 - (Future) | | Y | MCC | 460/3 | On, off, auto; manual speed control | On, off, automatic speed control to maintain set liquid level, HVL Alarm, pump shut off at LWL | Radar Level Sensor I- Level Float I- Level Float I- | |
| M-1130 | Digester #1 - Mixer #1 - Mixer Motor | 60.0 | N | MCC | 60 030/460, 3 Ph | | | | |
| B-1130 | Digester #1 - Mixer #1 - Blower Motor | 10.0 | N | MCC | 10 030/460, 3 Ph | | | | |
| M-1131 | Digester #1 - Mixer #2 - Mixer Motor | 60.0 | N | MCC | 60 030/460, 3 Ph | | | | |
| B-1131 | Digester #1 - Mixer #2 - Blower Motor | 10.0 | N | MCC | 10 030/460, 3 Ph | | | | |
| M-1132 | Digester #1 - Mixer #3 - Mixer Motor | 60.0 | N | MCC | 60 030/460, 3 Ph | | | | |
| B-1132 | Digester #1 - Mixer #3 - Blower Motor | 10.0 | N | MCC | 10 030/460, 3 Ph | | | | |
| M-1133 | Digester #1 - Mixer #4 - Mixer Motor | 60.0 | N | MCC | 60 030/460, 3 Ph | | | | |
| B-1133 | Digester #1 - Mixer #4 - Blower Motor | 10.0 | N | MCC | 10 030/460, 3 Ph | | | | |
| M-1134 | Digester #1 - Mixer #5 - Mixer Motor | 60.0 | N | MCC | 60 030/460, 3 Ph | | | | |
| B-1134 | Digester #1 - Mixer #5 - Blower Motor | 10.0 | N | MCC | 10 030/460, 3 Ph | | | | |
| M-1135 | Digester #1 - Mixer #6 - Mixer Motor | 60.0 | N | MCC | 60 030/460, 3 Ph | | | | |
| B-1135 | Digester #1 - Mixer #6 - Blower Motor | 10.0 | N | MCC | 10 030/460, 3 Ph | | | | |
| M-1230 | Digester #2 - Mixer #1 - Mixer Motor | 50.0 | N | MCC | 50 030/460, 3 Ph | | | | |
| B-1230 | Digester #2 - Mixer #1 - Blower Motor | 7.5 | N | MCC | 7.530/460, 3 Ph | | | | |
| M-1231 | Digester #2 - Mixer #2 - Mixer Motor | 50.0 | N | MCC | 50 030/460, 3 Ph | | | | |
| B-1231 | Digester #2 - Mixer #2 - Blower Motor | 7.5 | N | MCC | 7.530/460, 3 Ph | | | | |
| M-1232 | Digester #3 - Mixer #1 - Mixer Motor | 50.0 | N | MCC | 50 030/460, 3 Ph | | | | |
| B-1232 | Digester #3 - Mixer #1 - Blower Motor | 7.5 | N | MCC | 7.530/460, 3 Ph | | | | |
| M-1233 | Digester #3 - Mixer #2 - Mixer Motor | 50.0 | N | MCC | 50 030/460, 3 Ph | | | | |
| B-1233 | Digester #3 - Mixer #2 - Blower Motor | 7.5 | N | MCC | 7.530/460, 3 Ph | | | | |
| P-1210 | Digester #2 & #3 Pump Station Pump #1 | 15 | Y | MCC | 460 / 3 | On, off, auto; manual speed control | Transfer Between Digesters: Pump off at LWL in tank pumping "from", pump off at HVL in tank pumping "to", Pump off at High Discharge Pressure To Screw Press Influent Tank: automatic speed control to maintain liquid level in the screw press influent tank, pump off at LWL in tank pumping "from", pump off at HVL in tank pumping "to", Pump off at High Discharge Pressure | Radar Level Sensor I-1191 Level Float I-1192 Radar Level Sensor I-1291 Level Float I-1292 Radar Level Sensor I-1391 Pressure Transducer I-1295 | |
| P-1211 | Digester #2 & #3 Pump Station Pump #2 | 15 | Y | MCC | 460 / 3 | On, off, auto; manual speed control | Transfer Between Digesters: Pump off at LWL in tank pumping "from", pump off at HVL in tank pumping "to", Pump off at High Discharge Pressure To Screw Press Influent Tank: automatic speed control to maintain liquid level in the screw press influent tank, pump off at LWL in tank pumping "from", pump off at HVL in tank pumping "to", Pump off at High Discharge Pressure | Radar Level Sensor I-1191 Level Float I-1192 Radar Level Sensor I-1291 Level Float I-1292 Radar Level Sensor I-1391 Pressure Transducer I-1296 | |
| | Digester #2 & #3 Pump Station Building Sump Pump | 0.25 | | | 120 V | | | | |
| P-1310 | Screw Press Influent Pump Station Pump #1 | 5 or 7.5 HP | Y | MCC / LCP | Approx 5 HP30/460, 3 Ph | On, off, auto; manual speed control | On, off, speed controlled based on input from the Dewater Screw Press LCP. Pump off at LWL in Sludge Dewatering Influent Tank, Pump off at High Discharge Pressure | Radar Level Sensor I-1391 Dewatering Screw Press LCP Flow Meter I-1381 Pressure Transducer I-1392 | |
| P-1311 | Screw Press Influent Pump Station Pump #2 | 5 or 7.5 HP | Y | MCC / LCP | Approx 5 HP30/460, 3 Ph | On, off, auto; manual speed control | On, off, speed controlled based on input from the Dewater Screw Press LCP. Pump off at LWL in Sludge Dewatering Influent Tank, Pump off at High Discharge Pressure | Radar Level Sensor I-1391 Dewatering Screw Press LCP Flow Meter I-1382 Pressure Transducer I-1393 | |
| P-1312 | Screw Press Influent Pump Station Pump #3 | 5 or 7.5 HP | Y | MCC / LCP | Approx 5 HP30/460, 3 Ph | On, off, auto; manual speed control | On, off, speed controlled based on input from the Dewater Screw Press LCP. Pump off at LWL in Sludge Dewatering Influent Tank, Pump off at High Discharge Pressure | Radar Level Sensor I-1391 Dewatering Screw Press LCP Flow Meter I-1383 Pressure Transducer I-1394 | |
| MXR-1330 | Sludge Dewatering Influent Tank Mixer | 5 | Y | MCC | 530/460, 3 Ph | On, off, manual speed control | | | |
| S-1371 | Dewatering Screw Press #1 - Motor | 5 | Y | MCC | 230/460 V, 3 PH | | | | The Manufacturer will provide a LCP for control only. |
| | Screw Press #1 - Spray Wash | 0.25 | Reversing Starter | MCC | | | | | Attached to Screw Press #1 |
| S-1372 | Dewatering Screw Press #2 - Motor | 5 | Y | MCC | 230/460 V, 3 PH | | | | The Manufacturer will provide a LCP for control only. |
| | Screw Press #2 - Spray Wash | 0.25 | Reversing Starter | MCC | | | | | Attached to Screw Press #2 |

PERMANENT MAGNET MOTOR, COORDINATE WITH MCC SUPPLIER

PERMANENT MAGNET MOTOR, COORDINATE WITH MCC SUPPLIER

EQUIPMENT SCHEDULE (CONTINUED)

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don@yatesengineering.net



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DESIGNED BY: DLY
CHKD BY: DLY
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Tel: (540) 371-8500 Fax: (540) 371-8576

| EQUIPMENT SCHEDULE | | | |
|--|----------|-------------------|--|
| MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE | | | |
| SUSSEX COUNTY, DELAWARE | | PROJECT NO. MN01B | |
| DATE: 11/15/19 | AS SHOWN | DWG NO: E608 | |

| NO. | BY | CHKD | APRV | REVISION | DATE |
|-----|-----|------|------|------------------------|----------|
| | DLY | DLY | DLY | ISSUED FOR BID | 9/14/18 |
| | DLY | DLY | DLY | POST BID CONFORMED SET | 12/4/18 |
| | DLY | DLY | DLY | DNREC SUBMISSION | 1/2/19 |
| | DLY | DLY | DLY | DNREC RE-SUBMITTAL | 11/15/19 |
| | DLY | DLY | DLY | DNREC RE-SUBMITTAL | 2/5/20 |

| EQUIP # | EQUIPMENT NAME | HP | VFD Y/N | MCC OR LCP | VOLTS/PHASE | PLC CONTROL INFORMATION | | ASSOCIATED EQUIPMENT INSTRUMENTATION AND PROTECTION DEVICES | COMMENTS |
|---------|--|------|-----------------------|------------|-------------|-------------------------|------|---|--|
| | | | | | | HAND | AUTO | | |
| | Screw Press #3 - Spray Wash (Future) | 0.25 | Reversing Starter | MCC | | | | | Attached to Screw Press #3 |
| AU-1361 | Screw Press Sludge Cake Auger #1 | 2 | Non-reversing starter | MCC | | | | | |
| AU-1362 | Screw Press Sludge Cake Auger #2 | 2 | Non-reversing starter | MCC | | | | | |
| AU-1363 | Screw Press Sludge Cake Auger #3 (Future) | 2 | Non-reversing starter | MCC | | | | | |
| AU-1364 | Sludge Cake Transfer Auger (Future) | 2 | Non-reversing starter | MCC | | | | | To be located above the sludge cake truck in the future. |
| CP-1351 | Chemical Feed - Screw Press Polymer Skid #1 | 0.5 | | LCP | 120 / 1 | | | Dewatering Screw Press LCP | I believe this LCP needs to communicate with the Screw Press LCP |
| CP-1352 | Chemical Feed - Screw Press Polymer Skid #2 | 0.5 | | LCP | 120 / 1 | | | Dewatering Screw Press LCP | I believe this LCP needs to communicate with the Screw Press LCP |
| CP-1353 | Chemical Feed - Screw Press Polymer Skid #3 (Future) | 0.5 | | LCP | 120 / 1 | | | Dewatering Screw Press LCP | I believe this LCP needs to communicate with the Screw Press LCP |
| C-1354 | Dewatering Screw Press System Air Compressor | 2 | | | 120 / 1 | | | | NEED LOCATION, NEED HP |

EQUIPMENT SCHEDULE (CONTINUED)

| EQUIP # | INSTRUMENTATION | REMOTE READOUT Y/N | LOCATION | COMMENTS |
|----------------------------|--------------------------------------|--------------------|-------------------------------------|--|
| New Instrumentation | | | | |
| I-181 | Magnetic Flow Meter | Y | AL #1 & #2 Effluent Pump Station | |
| I-182 | Magnetic Flow Meter | Y | Short Circuit Pump Station | |
| I-191 | Radar Level Sensor | Y | AL #1 & #2 Eff. PS Wet Well | |
| I-192 | Level Float | | AL #1 & #2 Eff. PS Wet Well | |
| I-193 | Level Float | | Short Circuit PS Wet Well | |
| I-193 | Level Float | | Short Circuit PS Wet Well | |
| I-281 | Magnetic Flow Meter | Y | AL #3 Effluent Pump Station | |
| I-291 | Pressure Transducer Level Sensor | Y | AL #3 Effluent Pump Station | |
| I-292 | Pressure Transducer Level Sensor | Y | AL #3 Underdrain Pump Station | |
| I-391 | Radar Level Sensor | Y | Anoxic Reactor #1 | |
| I-392 | ORP Sensor | Y | Anoxic Reactor #1 | |
| I-393 | D.O. Sensor | Y | Anoxic Reactor #1 | |
| I-394 | pH Sensor | Y | Anoxic Reactor #1 | |
| I-481 | Magnetic Flow Meter | Y | Nitrate Recycle Pump Station | |
| I-491 | Radar Level Sensor | Y | Nitrification Reactor #2 | |
| I-492 | D.O. Sensor | Y | Nitrification Reactor #2 | |
| I-493 | pH Sensor | Y | Nitrification Reactor #2 | |
| I-591 | Radar Level Sensor | Y | Anoxic Reactor #3 | |
| I-592 | ORP Sensor | Y | Anoxic Reactor #3 | |
| I-593 | D.O. Sensor | Y | Anoxic Reactor #3 | |
| I-594 | pH Sensor | Y | Anoxic Reactor #3 | |
| I-595 | ORP Sensor | Y | Anoxic Reactor #3 | |
| I-596 | D.O. Sensor | Y | Anoxic Reactor #3 | |
| I-597 | pH Sensor | Y | Anoxic Reactor #3 | |
| I-598 | D.O. Sensor | Y | Aerobic Reactor #4 | |
| I-681 | Magnetic Flow Meter | Y | Clarifier Flocc Tank | |
| I-682 | Magnetic Flow Meter | Y | Clarifier Flocc Tank | |
| I-691 | Radar Level Sensor | Y | Clarifier Flocc Tank | |
| I-781 | Magnetic Flow Meter | Y | RAS Pump Station | |
| I-782 | Magnetic Flow Meter | Y | RAS Pump Station | |
| I-783 | Magnetic Flow Meter | Y | WAS Pump Station | |
| I-784 | Magnetic Flow Meter | Y | Filter Influent Pump Station | |
| I-791 | Radar Level Sensor | Y | Filter Influent Pump Station | |
| I-792 | Level Float | | Filter Influent Pump Station | |
| I-793 | Level Float | | Filter Influent Pump Station | |
| I-794 | Pressor Sensor | Y | WAS PS Pump #1 | Prevent high discharge pressure |
| I-795 | Pressor Sensor | Y | WAS PS Pump #2 | Prevent high discharge pressure |
| I-891 | Ultrasonic Level Sensor - Flow Meter | Y | Final Effluent Parshall Flume | |
| I-890 | Magnetic Flow Meter (Future) | Y | Filter Backwas Wastewater PS | FUTURE? |
| I-891 | Radar Level Sensor (Future) | Y | Filter Backwas Wastewater PS | FUTURE? |
| I-892 | Level Float (Future) | | Filter Backwas Wastewater PS | FUTURE? |
| I-893 | Level Float (Future) | | Filter Backwas Wastewater PS | FUTURE? |
| I-991 | Radar Level Sensor | Y | New Plant Site PS #1 | |
| I-992 | Level Float | | New Plant Site PS #1 | |
| I-993 | Level Float | | New Plant Site PS #1 | |
| I-1091 | Radar Level Sensor | Y | Plant Site Pump Station #2 | |
| I-1092 | Level Float | | Plant Site Pump Station #2 | |
| I-1093 | Level Float | | Plant Site Pump Station #2 | |
| I-1181 | Magnetic Flow Meter | Y | WAS Aerobic Digester #1 Transfer PS | |
| I-1191 | Radar Level Sensor | Y | WAS Aerobic Digester #1 PS | |
| I-1192 | Pressor Sensor | Y | WAS Aerobic Digester #1 PS | Prevent high discharge pressure |
| I-1193 | Pressor Sensor | Y | WAS Aerobic Digester #1 PS | Prevent high discharge pressure |
| I-1281 | Magnetic Flow Meter | Y | WAS Aerobic Digester #2 & #3 PS | |
| I-1291 | Radar Level Sensor | Y | WAS Aerobic Digester #2 | |
| I-1292 | Level Float | | WAS Aerobic Digester #2 | |
| I-1293 | Radar Level Sensor | Y | WAS Aerobic Digester #3 | |
| I-1294 | Level Float | | WAS Aerobic Digester #3 | |
| I-1295 | Pressure Sensor | Y | WAS Aerobic Digester #2 & #3 PS | Prevent high discharge pressure |
| I-1296 | Pressure Sensor | Y | WAS Aerobic Digester #2 & #3 PS | Prevent high discharge pressure |
| I-1381 | Magnetic Flow Meter | Y | Screw Press Influent | Functions as part of the Sludge Dewatering System and Controls |
| I-1382 | Magnetic Flow Meter | Y | Screw Press Influent | Functions as part of the Sludge Dewatering System and Controls |
| I-1383 | Magnetic Flow Meter | Y | Screw Press Influent | Functions as part of the Sludge Dewatering System and Controls |
| I-1391 | Radar Level Sensor | Y | Screw Press Feed Tank | |
| I-1392 | Pressure Sensor | Y | Screw Press Feed PS | Prevent high discharge pressure |
| I-1393 | Pressure Sensor | Y | Screw Press Feed PS | Prevent high discharge pressure |
| I-1394 | Pressure Sensor (Future) | Y | Screw Press Feed PS | Prevent high discharge pressure |

INSTRUMENTATION SCHEDULE

| EQUIP # | EXISTING EQUIPMENT NAME | EXISTING HP | EX. VFD Y/N | MCC OR LCP | VOLTS/PHASE | EXISTING CONTROL INFORMATION | COMMENTS |
|---------|---|-------------|-------------|------------|-------------|------------------------------|----------------------|
| | Anaerobic Lagoon 1 & 2 Eff. PS Pump #1 | | | | | | To Be Removed |
| | Anaerobic Lagoon 1 & 2 Eff. PS Pump #2 | | | | | | To Be Removed |
| MA-540 | Crom Tank SAM Unit #1 | 50 | | | | | To Remain in Use |
| MA-541 | Crom Tank SAM Unit #2 | 50 | | | | | To Remain in Use |
| MA-542 | Crom Tank SAM Unit #3 | 50 | | | | | To Remain in Use |
| MA-543 | Crom Tank SAM Unit #4 | 50 | | | | | To Remain in Use |
| MA-544 | Crom Tank SAM Unit #5 | 50 | | | | | To Remain in Use |
| MA-545 | Crom Tank SAM Unit #6 | 50 | | | | | To Remain in Use |
| B-520 | Crom Tank Blower #1 | 125 | | | | | To Remain |
| B-521 | Crom Tank Blower #2 | 125 | | | | | To Remain |
| B-522 | Crom Tank Blower #3 | 125 | | | | | To Remain / Not Used |
| B-523 | Crom Tank Blower #4 | 125 | | | | | To Remain |
| B-524 | Crom Tank Blower #5 | 125 | | | | | To Remain |
| B-525 | Crom Tank Blower #6 | 125 | | | | | To Remain |
| | Clarifier #1 Mechanism | | | | | | To Be Replaced |
| | Clarifier #2 Mechanism | | | | | | To Be Replaced |
| | Clarifier Influent Pump Station - Pump #1 | | | | | | To Be Removed |
| | Clarifier Influent Pump Station - Pump #2 | | | | | | To Be Removed |
| D-1140 | Oxidation Ditch - Floating Aerator #1 | 75 | | | | | To Be Re-positioned |
| D-1141 | Oxidation Ditch - Floating Aerator #2 | 75 | | | | | To Be Re-positioned |
| D-1142 | Oxidation Ditch - Floating Aerator #3 | 75 | | | | | To Be Re-positioned |
| D-1143 | Oxidation Ditch - Floating Aerator #4 | 75 | | | | | To Be Re-positioned |
| D-1144 | Oxidation Ditch - Floating Aerator #5 | 75 | | | | | To Be Re-positioned |
| | Oxidation Ditch - Floating Aerator #6 | 75 | | | | | To Be Removed |
| | Oxidation Ditch - Floating Aerator #7 | 75 | | | | | To Be Removed |
| | Oxidation Ditch - Floating Aerator #8 | 75 | | | | | To Be Removed |
| | Oxidation Ditch - Floating Aerator #9 | 75 | | | | | To Be Removed |
| | Oxidation Ditch - Floating Aerator #10 | 75 | | | | | To Be Removed |

EXISTING EQUIPMENT SCHEDULE

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EQUIPMENT SCHEDULES, INSTRUMENTATION SCHEDULE

MOUNTAINE FARMS-MILLSBORO FACILITY WASTEWATER TREATMENT SYSTEM UPGRADE

SUSSEX COUNTY, DELAWARE

DATE: 11/15/19 PROJECT NO. MN01B
 SCALE: AS SHOWN DWG NO: E609