ATTACHMENT C.4

WOODARD &CURRAN

# ENGINEERING REPORT

## Basis of Design for Wastewater Treatment Upgrades and Permit Modification

Permit No. ST0003861

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COMMITMENT & INTEGRITY DRIVE RESULTS

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# ENGINEERING CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in a manner consistent with that degree of care and skill ordinarily exercised by members of the same profession currently practicing under similar circumstances. I further certify that the proposed wastewater treatment system defined in this document and all attachments was designed to properly treat the waste stream characteristics, as defined in these documents, from Draper Valley Farms Facility located at 1000 Jason Lane in Mount Vernon, Washington. The proposed system is designed to operate within the standards and limits as required by the Washington State Department of Ecology's sewer use ordinance and other applicable local and federal pretreatment standards. The information submitted in these documents is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for willful violations.

| | | |
|---|---|---|
| Patrick J. Cyr | | 3/1/2021 |
| (Print) | (Sign) | Date |

# FACILITY MANAGEMENT AND OPERATIONS CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for willful violations.

Perdue will own, operate, and maintain the proposed system upgrades described in this document after construction.

*Perdue Vice President of Operations*

Matt Junkel 3/3/21

(Print) (Sign) Date

# EXECUTIVE SUMMARY

The Design Basis Engineering Report (DB) will be used to determine the optimal scope for the wastewater treatment system upgrade project and to take the design beyond the preliminary 30% design phase into detailed design based on approved project scope. The report will also be used to provide information to support the application to the Washington State Department of Ecology (Ecology) for renewal and modification of the Facility's Industrial Pretreatment Permit Number ST0003861. The DB will develop the project scope as approved after completion of the 30% preliminary design phase. The DB defines engineering scope to facilitate a basis to carry on the detailed engineering design while providing early permitting documentation to support critical path activities. Key drawings and figures such as site and piping layout plans, Schematics/PFDs, mass balance, and hydraulic profile are included with the report.

The Project consists of wastewater treatment system upgrades including new treatment processes to the adjoining Perdue Draper Valley Farms (DVF) chicken processing facility located in Mount Vernon, Washington. At this stage of scope development, alternatives are evaluated, and the best single option is selected as the DB.

The new treatment system will be added to the existing wastewater treatment plant (WWTP). It will include Moving Bed Bioreactor (MBBR) biological treatment followed by Dissolved Air Flotation (DAF) with additional processes for storing and transferring biological solids. The new treatment system is required to meet process wastewater discharge requirements for pH, 5-day Biochemical Oxygen Demand (BOD), total Suspended Solids (TSS), and treated process effluent flow monitoring.

Major components to be included in the project include:

- Utilization of the existing process wastewater equalization tank (FEB) and primary DAF system for primary treatment;
- Addition of a primary DAF effluent pH adjustment tank;
- Addition of flow monitoring and a control valving to split primary DAF effluent flow between the discharge and the new MBBR system;
- Addition of aerobic biological treatment via MBBR to increase treatment capacity for BOD;
- Addition of a secondary DAF to remove biological solids from the MBBR effluent; and
- Addition of a biological solids tank and pumping system to store and transfer the secondary DAF float for offsite disposal.
- The system will also include better monitoring and control for pH adjustment and organic load management for the primary DAF effluent.
- Addition of a small building for climate-controlled storage of new treatment chemicals and operator work space.

The wastewater treatment plant (WWTP) upgrade will utilize the flow and load equalization of the existing WWTP along with oil & grease (O&G) and TSS treatment. The proposed MBBR and Secondary DAF will biologically remove soluble organics and remove biological solids from the MBBR effluent. The new system will provide a combined treated effluent water, comprised of treated effluent from the primary DAF and treated effluent from the new MBBR system, to meet the site's permit limits for discharge to the Mount Vernon Publicly Owned Treatment Works (POTW). The remaining sections of this BOD document provide the details related to the scope and definition of each new unit process and supporting component included in the new WWTP.

# 1. BACKGROUND

## 1.1 Site Description

The Perdue Draper Valley Farms facility (DVF) is located at 1000 Jason Lane approximately 0.7 miles southwest of the intersection of Riverside Drive and East College Way. The industrial activity at the facility is the slaughter and further processing of chicken portions. This includes slaughtering live birds, cutting and packaging operations, and sanitation activities. The facility processes approximately 80,000 live chickens per day and produces approximately 425,000 pounds of processed chicken per day. It is believed that the original facility was constructed in 1972. The industrial activity at the site has been the same since the facility was constructed. The facility discharges process wastewater and sanitary wastewater to the City of Mount Vernon sewer system under Ecology Permit Number ST-0003861. The permit expires on August 31, 2021.

## 1.2 Purpose and Objectives

The DVF facility processes both standard and organic chickens. In addition to wastewater organics originating from chicken meat processing, the facility utilizes peracetic acid sanitizer and citric acid for microbial intervention processing steps. Increases in the use of these chemicals has increased effluent soluble BOD, which is not removed by the existing dissolved air flotation (DAF) process. Future Food and Drug Administration (FDA) requirements could force changes in the types and amounts of microbial intervention chemicals used, and these changes may further impact the soluble BOD in the wastewater. The facility discharges its wastewater to the local Publicly Owned Treatment Works (POTW) and is under legal and regulatory pressure to reduce effluent BOD and better manage effluent pH due to exceedances and excursions that have occurred over the past few years.

The wastewater generated at DVF contains levels of contaminants that are regulated by Sewer Use Ordinance issued by Ecology. Ecology requires that DVF design, construct, operate, and maintain a wastewater pretreatment system capable of pretreating the waste stream to the parameters set forth in Permit Number ST-0003861. This document has been prepared in accordance with the City of Mount Vernon and Ecology guidelines.

The objectives of this report are to:

- Explain plant wastewater loadings and changes in process chemical usage.
- Provide background and justification for the proposed increase in the effluent BOD limit from 1,430 pounds per day (ppd) to 1,620 ppd.
- Demonstrate compliance with the new proposed BOD limit and existing requirements of Ecology Permit Number ST-0003861 through the WWTP upgrades.
- Determine the optimal scope for the WWTP upgrade project and establish a design basis to carry the project beyond the preliminary 30% design phase into detailed design.
- Provide a supplementary Engineering Report as required by Ecology to support the submittal of the "Application for State Waste Discharge Permit to Discharge Industrial Wastewater to a Publicly-Owned Treatment Works (POTW)" for permit renewal and modification. Refer to Appendix B for a crosswalk with the report requirements specified in WAC 173-240 and where each requirement is addressed in this report.

## 1.3 Regulatory Requirements

DVF discharges pretreated process wastewater to the Mount Vernon POTW. The existing and anticipated discharge limits are listed in Table 1-1.

**Table 1-1: Discharge Limitations**

| Parameter | Units | Maximum Consecutive 3-day Average | Daily Maximum | Monitoring Frequency | Sample Type |
|---|---|---|---|---|---|
| Flow | gpd | 760,000 | - | Daily meter reading | Continuous metering |
| $BOD_5$ | ppd | 1,620[1] | - | Daily | Flow-proportional composite |
| TSS | ppd | 825 | - | Daily | Flow-proportional composite |
| O&G | mg/L | - | 100 | Quarterly | Grab |
| pH | s.u. | 6.2 (min.) – 11.0 (max.) | | Continuous | Continuous metering |

Notes:
$BOD_5$ = 5-day biochemical oxygen demand
TSS = total suspended solids
O&G = oil and grease
gpd = gallons per day
ppd = pounds per day
mg/L = milligrams per liter of wastewater
s.u. = standard pH units
"-" = no limit or not applicable
[1] The city of Mount Vernon POTW has approved a limit increase from 1,430 ppd to 1,620 ppd.

## 1.4 Compliance Discussion

The facility is not consistently compliant with its permitted discharge limitations. The existing wastewater treatment system consists of equalization and primary solids separation via dissolved air floatation (DAF), and these processes do not remove soluble BOD or provide adequate pH control. Soluble BOD loading has increased since the primary treatment system was last upgraded. This loading is primarily driven by FDA requirements for chemical usage for microbial interventions to prevent product contamination. The chemicals currently used and required include peracetic acid and citric acid, and these have introduced increasing amounts of soluble BOD to the wastewater.

This report describes wastewater treatment plant upgrades that, when implemented, can achieve 100% compliance with the permit limits by removing soluble BOD and improving pH control. The ability to achieve 100% compliance is supported by desktop modeling and analysis, results from similar installations, and scientific evidence from literature that is described in subsequent sections of this report.

# 2. PLANT PROCESS DESCRIPTION (EXISTING)

## 2.1 Existing Wastewater Sources and Quantities

The DVF facility is divided into three process drain areas. The first is the processing or live bird offloading, hanging, and slaughter operations. The second is the processing or the eviscerating operation, chilling, cutting, and packaging operations. The third includes the exterior dock and unloading areas. The first processing area contains a series of floor drains that collect the wastewater from slaughtering and cleaning activities. From these drains, the waste stream flows by gravity through a 12-inch main feather trunk line into the offal room, where it is conveyed by gravity through an internally fed rotating feather screen that removes feathers, debris, meat particles, and large solid material. The second processing area contains floor drains that collect wastewater from the viscera, cutting, packaging, and cleaning activities. These drains convey wastewater by gravity through a 12-inch main meat trunk line into the offal room, where it is conveyed by gravity through another internally fed rotating meat screen that removes meat particles, debris, and large solids. The exterior dock areas include the live bird unloading and hanging operation, feather, viscera, and sludge byproduct truck loading, and wet dock loading and unloading. These areas, along with the existing wastewater treatment area, have a series of drains and catch basins that collect stormwater, drippings, and waste generated from cleaning and convey the mixture to the equalization tank for treatment.

The existing wastewater sources originate from and drain to the three process wastewater drain systems described above. The wastewater contains suspended solids (TSS), Oil and Grease (O&G), particulate and soluble Biochemical Oxygen Demand (BOD), and Chemical Oxygen Demand (COD). The wastewater constituents are introduced by chicken and chicken part processing and the microbial intervention chemicals required by FDA. Table 2-1 summarizes the average and 95$^{th}$ percentile values for the facility wastewater based on 2019 process control sampling data. The 95$^{th}$ percentile loadings were calculated using the 95$^{th}$ percentile concentrations and average flow. This summary is representative of wastewater treated through the existing primary wastewater treatment system prior to discharge to the sanitary sewer.

**Table 2-1: Process Wastewater (Primary DAF Influent) Characterization**

| Parameter | | Data Points | Average | 95$^{th}$ Percentile |
|---|---|---|---|---|
| Flow | MGD | 332 | 0.315 | 0.461 |
| pH | s.u. | - | Approximate Range: 4.5 to 5.5 | |
| TSS | mg/L | 6 | 689 | 962 |
| | ppd | | 1,813 | 2,531 |
| Total COD | mg/L | 24 | 2,700 | 5,219 |
| | ppd | | 7,103 | 13,729 |
| Soluble COD | mg/L | - | 897 | 1,733 |
| | ppd | | 2,360 | 4,562 |
| Total BOD | mg/L | 33 | 2,163 | 3,014 |
| | ppd | | 5,691 | 7,928 |
| Soluble BOD | mg/L | 20 | 624 | 842 |
| | ppd | | 1,642 | 2,215 |
| FOG | mg/L | 6 | 557 | 725 |

The facility typically runs for 16 hours per day, 5 to 6 days per week, 52 weeks per year. Wastewater flows typically peak at the beginning of cleaning operations when scalders and other batch tanks are drained. Although the peak flows occur during clean up, most of the daily wastewater flow is generated during the killing and viscera operations. Typically, two thirds of the flow occur during plant processing operations. The average wastewater pretreatment influent flow and 95th percentile influent flow that correspond to the data in Table 2-1 are 315,000 gpd and 461,000 gpd, respectively, as based on city water meter data, which is the flow currently approved and used for discharge permit monitoring and reporting.

It should be noted that in addition to process wastewater, the facility water balance includes sanitary wastewater, non-contact cooling water, boiler blowdown, evaporative losses, and water loss through the finished product and primary DAF sludge. These quantities are estimated in Table 2-2 and represent approximately 4-5% of the average plant influent flow. At the time these estimates were made, for DVF's 2015 permit renewal, the average plant influent was reported to be 0.486 MGD.

**Table 2-2: Other Wastewater Sources and Water Loss**

| Parameter | | Average | Maximum | Method of Disposal or Discharge Outlet |
|---|---|---|---|---|
| Non-Contact Cooling Water and Boiler Blowdown | MGD | 0.008 | 0.016 | Primary WWTP |
| Sanitary wastewater | MGD | 0.006 | 0.014 | Sanitary sewer |
| Evaporative losses | MGD | 0.008 | 0.012 | Evaporation to Atmosphere |
| Water in finished product | MGD | 0.004 | 0.006 | Product |
| Water in Primary DAF Sludge | MGD | 0.003 | 0.005 | Hauled offsite for anaerobic digestion |

The non-contact cooling water and boiler blowdown combines with the process wastewater for treatment in the primary WWTP prior to discharge to the sanitary sewer. The site sanitary or domestic waste sewer has a separate tie in to the City of Mount Vernon sewer system which is located downstream of the treated process water tie in and compliance point. The primary DAF sludge is hauled offsite by a licensed hauler and permitted end user for anaerobic digestion.

## 2.2 Existing Pretreatment System

### 2.2.1 Primary Screening

The existing primary treatment system includes screening for feathers, meat, bones, and other debris generated during processing. This occurs in the two internally fed rotary drum screens mentioned in Section 2.1. Each of these he screens are gravity fed and include 0.03-inch openings. They are sized to process surge flows of up to 500 gpm each. The meat and feather screening byproducts are conveyed by separate screw augers to separate byproduct trailers located adjacent to the offal room.

### 2.2.2 Offal Wet Well and Transfer Pumps

Screened wastewater flows by gravity to a 2,000-gallon wet well located to the east of the screens. Wastewater is pumped from the wet well by two Gorman-Rupp GP-6 centrifugal pumps in duty/spare configuration. Both pumps can run if needed during peak flow conditions. The pump discharge includes a recirculation line back to the wet well to limit frequent stops and starts.

### 2.2.3 Equalization Tank and DAF Feed Pumps

The Offal Wet Well Transfer Pumps convey wastewater from the wet well to an aboveground 75,000-gallon working volume equalization tank. The tank is 24'7" in diameter and 23'7" high. The tank is constructed of stainless steel and located outside adjacent to the south wall of the processing plant. The tank includes a coarse bubble diffuser manifold and a blower for mixing. An ultrasonic level indicator performs continuous tank level measurements and alerts the operators if the tank reaches the high-level set point. In the event of a tank overflow, an overflow pipe directs the flow back to the offal wet well. The equalization tank improves the consistency of the wastewater flow and characteristics fed to the primary DAF. Two T-4 Gorman-Rupp 500 gpm pumps in a duty/standby configuration are used to pump the equalized wastewater to the primary DAF flocculation chamber, which is installed inside the offal building against the southeast wall.

### 2.2.4 Primary DAF

The Primary DAF is sized to process 800 gpm. Main components include the main floatation chamber, a smaller flocculation chamber, and two Edur multiphase centrifugal pumps. Each pump is rated for 100 gpm at 100 PSI with 44 liters per minute of air delivery.

Wastewater first enters the flocculation chamber, where ferric chloride and cationic polymer are automatically injected to aid in solids coagulation and flocculation. Wastewater flows from the flocculation chamber into the DAF tank, where the release of hydraulic pressure causes the solids to float to the surface. These floated solids are skimmed by a rotating paddle skimmer and then transferred to the sludge holding tank. DAF float (sludge) is pumped from the sludge holding tank to a closed top tanker located adjacent to the feather and meat trailers. The sludge is hauled offsite by a licensed hauler and permitted end user.

DAF effluent water is monitored for pH and turbidity. Effluent overflows into the Primary DAF Effluent Trough where it is injected with sodium hydroxide to increase pH and satisfy the discharge range, and then it is discharged to the sewer. Sodium hypochlorite is occasionally injected into the Primary DAF Effluent Trough to provide a small amount of chemical polishing for soluble BOD when high loadings occur. The primary treatment system is typically shut down between Saturdays at 8 AM through Mondays at 4 AM following facility shutdowns. When the treatment process restarts, DAF effluent is recirculated to the equalization tank via the secondary screen tank until flows and turbidity readings stabilize.

The DAF operation effectively removes the TSS, O&G, and particulate BOD. Analysis of primary influent data (Table 2-1) and DAF effluent data (Table 3-1) shows that TSS and O&G are reduced to levels well below the permitted discharge limits. The DAF also removes most of the particulate BOD in the wastewater; however, the DAF is not an effective technology for removing soluble organic BOD and COD. The proposed wastewater upgrades are designed to reduce soluble organic contamination in the wastewater discharge.

### 2.2.5 Chemical Usage

Table 2-3 lists primary wastewater treatment chemicals and usage rates.

**Table 2-3: Primary Treatment Chemical Usage**

| Chemical | Usage Rate (gpd) |
|---|---|
| 50% Sodium hydroxide | 150 |
| Cationic polymer | 26.5 |
| Ferric chloride | 200 |
| Sodium hypochlorite | 50 |

## 2.3 Stormwater Runoff Requirements

Stormwater that falls on site buildings and parking lots surrounding the site is collected and conveyed to the stormwater system and discharged to the permitted outfall location per Industrial Stormwater General Permit WAR000552. This stormwater includes runoff from the main parking areas, building roof drains, and rear storage areas. Stormwater that encounters the exterior dock areas, byproduct truck loading, wet dock loading and unloading, and the wastewater treatment area is contained by curbing and site grading and collected in a series of drains and catch basins. This stormwater is conveyed to a sump where it is pumped to the equalization tank for treatment in the primary DAF. All proposed WWTP upgrades will be located within this existing curbed and graded containment area. Site resurfacing and stormwater conveyance improvements were implemented in 2017. Those improvements are not addressed herein.

## 2.4 Existing Pretreatment Permit and Receiving POTW

Perdue and the City of Mount Vernon have discussed increasing the facility's effluent BOD limit from a three-day moving average of 1,430 ppd to 1,620 ppd. The City has indicated that the POTW has available capacity to treat the additional BOD loading. The City of Mount Vernon Wastewater Treatment Plant discharges treated wastewater to the Skagit River under National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit No. WA0024074. The permit lists the design criteria for the plant, including the maximum month design flow and the maximum month BOD and TSS loadings. The permit specifies that if the flow or waste load into the system reaches 85% of any one of the design criteria for three consecutive months, or if the plant is projected to reach its design capacity within five years, the permittee must submit a plan and schedule to Ecology for maintaining treatment capacity.

An analysis of publicly available monthly Discharge Monitoring Report (DMR) data for October 2018 through September 2020 was conducted to compare influent loadings at the POTW with the action levels defined in the NPDES permit. The maximum monthly flow, BOD load, and TSS load were each calculated from the data set. Table 2-4 shows a comparison of the maximum monthly DMR values, design criteria, and capacity action threshold (85% of design). The percent of design capacity currently utilized and available capacity up to the 85% threshold are listed. The current maximum month values are well below the 85% action threshold. The proposed BOD limit increase of 190 ppd represents approximately 5.5% of the remaining BOD capacity (4,238 ppd) and is expected to have minimal impact on the POTW. Because the nature of the discharge remains unchanged, there will be no impact to the POTW's use or disposal of municipal biosolids.

**Table 2-4: Mount Vernon POTW Capacity Summary**

| Parameter | Units | Influent Design Criteria | Capacity Action Threshold (85% of design value) | Oct. 2018 – Sept. 2020 Max. Month Value | % of Design | Available Capacity (up to 85% Threshold) |
|---|---|---|---|---|---|---|
| Max. Month Flow | MGD | 15 | 12.75 | 6.33 | 42 | 6.42 |
| Max. Month BOD | ppd | 17,300 | 14,705 | 10,468 | 61 | 4,238 |
| Max. Month TSS | ppd | 18,300 | 15,555 | 10,272 | 56 | 5,283 |

Sources: The State of Washington Department of Ecology Water Quality and Reporting Information System (PARIS) and NPDES Waste Discharge Permit No. WA0024074

# 3. WWTP UPGRADES (PROPOSED)

## 3.1 General Discussion

This section details recent changes in plant process chemical usage, resulting impacts on wastewater loadings, and proposed upgrades to the treatment system. Proposed upgrades will address soluble BOD treatment to demonstrate compliance with the new proposed BOD limit and the existing requirements of Ecology Permit Number ST-0003861. The proposed upgrades include an MBBR and a secondary DAF that will process a side stream of the existing DAF effluent. Secondary DAF effluent will be combined with Primary DAF effluent that bypasses the new treatment processes. The BOD of the combined effluents will remain below the discharge limits listed in Table 1-1.

## 3.2 Existing Effluent Data

Table 3-1 provides a summary of the primary DAF effluent DMR and process control data collected in 2019. This data characterizes the future MBBR influent. 2019 was selected as the baseline data set because BOD levels were generally higher than what was observed in 2020 due to the amount of peracetic acid used, the type of peracetic acid chemistry, and the citric acid use for microbial interventions. The 2019 data is considered "worst case" for design and provides flexibility for Perdue if there is a future need to change the chemical selection or usage rates for microbial intervention chemicals to maintain compliance with FDA requirements.

**Table 3-1: Process Wastewater (Primary DAF Effluent) 2019 Baseline Data**

| Parameter | | Data Points | Average | 95th Percentile |
|---|---|---|---|---|
| Flow | MGD | 332 | 0.315 | 0.461 |
| pH | s.u. | 331 | Range: 4.8 to 10.1 | |
| TSS | mg/L | 331 | 41 | 101 |
| | ppd | | 109 | 267 |
| Total COD | mg/L | 238 | 718 | 1,033 |
| | ppd | | 1,890 | 2,718 |
| Soluble COD | mg/L | - | 718 | 1,033 |
| | ppd | | 1,890[1] | 2,718 |
| Total BOD | mg/L | 331 | 385 | 680 |
| | ppd | | 1,015 | 1,791 |
| Soluble BOD | mg/L | 8 | 385 | 556 |
| | ppd | | 1,015[1] | 1,462 |
| Peracetic Acid | mg/L | 35 | 8.6 | 22.5 |
| | ppd | | 23 | 59 |
| O&G | mg/L | 9 | 3 | 6 |

[1] Primary DAF effluent soluble BOD results are based on a limited sample set of eight results which were paired with total BOD results collected on the same days. The soluble BOD results consistently exceeded the total BOD in these samples. Theoretically, soluble BOD cannot be higher than total BOD; therefore, the soluble to total BOD ratio was assumed to be 1 for the purposes of this analysis. Limitations in the analytical measurements are likely the cause for this discrepancy. Soluble COD was estimated by multiplying the total COD results by the soluble BOD to total BOD ratio of 1.

The primary DAF effluent average and 95th percentile values for flow, pH, BOD, and TSS represent all DMR data for 2019. COD was collected for internal process control purposes. O&G values were calculated from nine samples collected between March and October 2019. Mass loading in ppd or concentrations in mg/L were calculated for each constituent using the formula mass loading (ppd) = concentration (mg/L) x average flow (MGD) x 8.345. Peracetic acid (PAA) average and 95th percentile values were calculated using 35 data points collected between May and July 2019.

DAF effluent soluble BOD average and 95th percentile values were calculated using eight data points collected between July and October 2019. Soluble COD was estimated by multiplying total COD by the soluble BOD to total BOD ratio. The limited sampling results for soluble BOD indicate that the majority, if not all, particulate BOD present in the wastewater is removed by the primary DAF.

## 3.3 Microbial Interventions and Associated Chemical Use

Chemicals used for microbial intervention during processing operations such as sprays and dip tanks include peracetic acid sanitizer and citric acid. The typical pH range of these chemicals is 4.5 to 5.5 s.u., and they are major sources of acidity and soluble BOD and COD in the wastewater. Table 3-2 outlines the average and peak (maximum) usage rates of peracetic acid and citric acid sanitizer during 2019 and the anticipated future usage rates. The anticipated future usage rates have been considered in the design basis for the wastewater treatment upgrades presented in Section 3-83.4.

**Table 3-2: Chemical Use Rates for Microbial Intervention Chemicals**

| | 25% Peracetic Acid Sanitizer (gpd)* | | 50% Citric Acid (gpd)* | |
|---|---|---|---|---|
| | *Average* | *Maximum* | *Average* | *Maximum* |
| 2019 Baseline | 97 | 219 | 57 | - |
| Future Design Basis | 140 | 250 | 65 | 90 |

*Or equivalent formulation.

Table 3-3 shows the equivalent soluble BOD and soluble COD for each chemical. PAA calculations are based on the acetic acid content of a 25% PAA formulation which is estimated to be a minimum of 45% acetic acid by weight. Acetic acid has a COD value of 1.07 lb. per lb. of chemical and a BOD value of 0.7 lb. per lb. of acetic acid COD. While PAA is a strong oxidant, by the time it leaves the Primary DAF the majority of PAA is dissociated into acetic acid and hydrogen peroxide due to a combination of contact with chicken, oxidation by wastewater organics, increased temperatures, and increased pH conditions. Citric acid is readily biodegradable in aerobic biological treatment systems. 50% citric acid has a BOD of 0.528 lb. per lb. chemical and a COD of 0.728 lb. per lb. of chemical.

**Table 3-3: Future BOD and COD Loading from Microbial Intervention Chemicals**

| | Density (lb/gal) | Lb. BOD / gal. of Chemical | Lb. COD / gal. of Chemical | Soluble BOD Loading (ppd) | | Soluble COD Loading (ppd) | |
|---|---|---|---|---|---|---|---|
| | | | | *Average* | *Maximum* | *Average* | *Maximum* |
| 25% Peracetic Acid* | 9.44 | 3.18 | 4.54 | 445 | 795 | 636 | 1,136 |
| 50% Citric Acid* | 10.33 | 5.45 | 7.52 | 355 | 491 | 489 | 677 |

*Or equivalent formulation.

## 3.4 Design Criteria

### 3.4.1 Influent Flows and Loads

Table 3-4 outlines the design basis data for the proposed WWTP upgrade. The design basis incorporates the 2019 DMR and process control data as a baseline. Adjustments were made to the data to account for possible future increases in chemical usage or changes in the types of chemicals used, and to account for future effluent flow monitoring and allow for flexibility in future processing operations. These adjustments were based on the following system attributes:

- The measured Primary DAF effluent flow is expected to be approximately 5% lower than the total plant influent currently measured by the city potable water meter. The reasons for this are discussed in Section 2.1. This reduction was further confirmed by preliminary effluent flow data collected at the plant. The WWTP upgrades will include a new flowmeter for direct monitoring of the treated process water effluent.

- The projected future increases in PAA and citric acid usage discussed in Section 3.3 are expected to result in increases of 129 ppd in the average BOD load and 147 ppd in the peak BOD load ($95^{th}$ percentile) as compared to the 2019 baseline.

- Projected future increases in PAA and citric acid usage are expected to result in increases of 160 ppd in the average COD load and 195 ppd in the peak COD load ($95^{th}$ percentile) as compared to the 2019 baseline.

- The instantaneous peak design flow is 850 gpm based on the existing pump capacities. This flow would be a rare and short-lived occurrence.

**Table 3-4: WWTP Upgrade Design Basis (Primary DAF Effluent)**

| Parameter | Units | Future Average | Future Peak ($95^{th}$ Percentile) |
|---|---|---|---|
| Flow | MGD | 0.300 | 0.438 |
| pH | S.U. | Range: 4.8 to 10.1 Average: 7.0 | |
| Temperature | ºF | Range: 50 to 90 Average: 75 | |
| Total Suspended Solids (TSS) | mg/L | 41 | 101 |
| | ppd | 103 | 253 |
| Total COD | mg/L | 820 | 1,165 |
| | ppd | 2,050 | 2,913 |
| Soluble COD | mg/L | 820 | 1,165 |
| | ppd | 2,050 | 2,913 |
| Total BOD | mg/L | 457 | 775 |
| | ppd | 1,144 | 1,938 |
| Soluble BOD | mg/L | 437 | 621 |
| | ppd | 1,093 | 1,552 |
| Oil & Grease | mg/L | < 10 | |

### 3.4.2 Treatment Performance Criteria

The treatment performance criteria for the WWTP are to meet or exceed the existing discharge limits included in upgrade are the facility Table 3-5.

**Table 3-5: Treatment Performance Criteria**

| Parameter | Units | Maximum Consecutive 3-day Average | Daily Maximum |
|---|---|---|---|
| $BOD_5$ | ppd | < 1,620[1] | - |
| TSS | ppd | < 825 | - |
| O&G | mg/L | - | < 100 |
| pH | s.u. | 6.2 (min.) – 11.0 (max.) | |

[1] The City of Mount Vernon POTW has approved a limit increase from 1,430 ppd to 1,620 ppd.

## 3.5 Treatment Alternatives Discussion

Several wastewater treatment upgrade alternatives were considered by Perdue to achieve consistent compliance with the discharge limits. The proposed upgrade, which consists of an MBBR and a secondary DAF to treat a portion of effluent from the site's existing primary DAF, was selected as the preferred option because it offers the ideal balance of treatment performance, footprint, flexibility for future operations and expansion, cost, and operability. The preferred option meets the requirement to provide all known, available, and reasonable methods of treatment (AKART). This conclusion is supported by the following comparison of the preferred option to other treatment systems designed to address the type of pollutant loading found at DVF.

Table 3-6 provides a high-level summary of the advantages and disadvantages of the compliance measures and treatment technologies considered for DVF.

**Table 3-6: Compliance Alternatives Comparison**

| Process | Advantages | Disadvantages |
|---|---|---|
| MBBR and Secondary DAF Treatment<br>(Optimized treatment expansion design to meet discharge limits)<br>**SELECTED** | • Effluent meets discharge limits<br>• Proven technology for food processing wastewater treatment including poultry processing<br>• Operators familiar with technology<br>• Offers moderate additional capacity for future expansion of flows and loads<br>• Optimized system sizing allows for compliance while minimizing capital and O&M costs and footprint as compared to full-flow treatment | • Moderate footprint<br>• Moderate O&M cost<br>• Moderate capital cost |
| MBBR and Secondary DAF Treatment of the Full Flow | • Effluent meets discharge limits<br>• Proven treatment technology for food processing wastewater treatment<br>• Proven treatment technology within Perdue<br>• Offers high additional capacity for future expansion of flows and loads<br>• Operators familiar with technology | • Large footprint – would eliminate site area that is needed for processing plant upgrades<br>• Higher O&M cost<br>• Higher capital cost |
| Increased Equalization Capacity for Load Leveling of Primary DAF Effluent to the City POTW | • Could achieve discharge limits but would require a 7-day moving average BOD limit<br>• No new treatment technology is introduced | • Modification of the permit limit from a 3-day average to a 7-day average is not possible<br>• Large footprint – a much larger EQ tank would be required<br>• Substantial monitoring and sampling effort required to size tank |
| Advanced oxidation process using Ozone or Electrochemical Oxidation Technology | • Effluent meets discharge limits<br>• Moderate footprint | • High capital cost<br>• High O&M cost<br>• Operators unfamiliar with technology<br>• Safety upgrades required for ozone |

## 3.6 Mass Balance and Process Calculations

Mass balances were developed to show the anticipated treatment performance for average and peak loading conditions. The discharge limits allow for some flexibility in the proposed treatment. As shown in the design basis (Table 3-4), the average BOD loading in the Primary DAF effluent (1,144 ppd) is less than the proposed discharge limit of 1,620 ppd; however, the BOD loading under peak (95$^{th}$ percentile) conditions is 1,938 ppd. Secondary treatment will be required to remove a minimum of 318 ppd of BOD about 5% of the time. The proposed MBBR and Secondary DAF treatment system will provide biological treatment for a portion of the Primary DAF effluent. The flow proportion sent through secondary treatment will be set on a daily basis by the operator based on COD sampling results performed onsite. The operating bounds for Primary DAF effluent that will undergo secondary treatment have been defined by the average and peak design conditions. The mass balance tables are included on the Process Flow Diagram (PFD) for the proposed upgrades. The PFD is included in Appendix A.

- Under average loading conditions or below, the MBBR and Secondary DAF will treat up to 80% of the flow leaving the Primary DAF or 240,000 gpd. Under this condition the system will be hydraulicly limited by the secondary DAF, which is sized to handle up to 180 gpm. The anticipated treatment performance and design assumptions at this condition are:
  - 915 ppd BOD loading to the MBBR
  - Minimum COD removal of 60%
  - Minimum BOD removal of 80%
  - Minimum TSS removal of 80%
  - Biomass yield of 0.51 g VSS per g per g COD removed
  - VSS/TSS Ratio = 0.85
  - Secondary DAF float solids concentration of 4%
- Under peak loading conditions the MBBR and Secondary DAF will treat up to 55% of the flow leaving the Primary DAF or 165,000 gpd. Under this condition the system will be limited by the organic treatment capacity in the MBBR. The anticipated treatment performance at this condition is:
  - 1,066 ppd BOD loading to the MBBR
  - Minimum COD removal of 60%
  - Minimum BOD removal of 70%
  - Minimum TSS removal of 80%
  - Biomass yield of 0.51 g VSS per g per g COD removed
  - VSS/TSS Ratio = 0.85
  - Secondary DAF float solids concentration of 4%

The MBBR will treat similar organic loading under both conditions. The treatment system will be designed to produce a combined Primary and Secondary DAF effluent for discharge that exceeds the effluent limitations under these circumstances. Perdue will have the ability to direct more flow to the MBBR if necessary, to compensate for higher loading coming from the primary DAF effluent wastewater up to the hydraulic capacity of the secondary DAF.

## 3.7 Process Description

The proposed WWTP upgrades will be designed and built to service wastewater flow from processed chicken production at the facility. The design basis, including expected influent characteristics and flows to the upgrades, are described in Section 3.4. The upgraded WWTP effluent discharged to the Mount Vernon POTW must meet discharge permit limits described in Section 3.4.2.

The proposed upgrades will be installed downstream of the existing DAF. Key components of the WWTP upgrades are listed below. Each component is shown in the drawings provided in Appendix A. Detailed descriptions are provided in Sections 3.7 and 3.8 below, including:

- Primary DAF Effluent pH Adjustment System
- MBBR System
- Secondary DAF
- Effluent Handling
- Secondary Sludge Handling

### 3.7.1 Overall Process Flow Description

Process Flow Diagrams depicting the process equipment and process flow are presented in Appendix A. General arrangement drawings depicting the treatment system layout are also provided in Appendix A. Proposed plant upgrades include the addition of Primary DAF effluent neutralization, aerobic wastewater treatment by an MBBR, biological solids separation through a Secondary DAF, effluent handling, and sludge handling. The general treatment process flow is explained below.

Process wastewater will be treated through the existing WWTP as described in Section 2.2. Effluent from the existing Primary DAF will flow via gravity to the proposed Primary DAF Effluent pH Adjustment Tank (TK-10301), where mixing and pH neutralization via sodium hydroxide or ferric chloride addition will occur. The Primary DAF Effluent Trough will be modified to convey effluent flow to the proposed pH Adjustment Tank. in this tank. Primary DAF Effluent Pumps (P-10301A & B) will be used to transfer neutralized process wastewater from the Primary DAF Effluent pH Adjustment Tank to the MBBR (TK-10401), the Combined Effluent Tank (T-10501), or back to the existing Secondary Screen Tank. Process wastewater with an out of spec pH will be directed to the existing screen tank. If the pH is in compliance with discharge limits, the process wastewater flow will be split between the MBBR and the Combined Effluent Tank via flow setpoints.

The process wastewater BOD will be consumed by aerobic bacteria in the MBBR (TK-10401) and create activated sludge. Wastewater and the suspended activated sludge will flow by gravity into the Secondary DAF (DAF-10501). Secondary DAF effluent will flow to the Combined Effluent Tank via gravity. Treated effluent will be pumped from the Combined Effluent Tank to the sewer via the Combined Effluent Pumps. DAF float will be conveyed to the Secondary DAF Sludge Tank (TK-10601).

A detailed description of each unit process in the proposed WWTP upgrades are presented below.

## 3.8 Treatment Unit Sizing

### 3.8.1 Modifications to the Existing Primary DAF

Minimal modifications will be made to the existing treatment system. A new 10-inch diameter pipe flange and control valve will be added to the south end of the Primary DAF Effluent Trough to allow wastewater to flow by gravity to the DAF Effluent pH Adjustment Tank. A control valve will be added to the existing trough outlet on the north side of the Trough to direct effluent to the existing Secondary Screen Tank. This valve will allow wastewater to flow back to the EQ Tank via the Secondary Screen Tank if the Primary DAF effluent turbidity is out of spec.

### 3.8.2 Primary DAF Effluent pH Adjustment System

The Primary DAF Effluent pH Adjustment Tank will be required to provide pH neutralization of primary DAF effluent prior to further treatment through the MBBR or discharge to the sewer. The pH Adjustment Tank will be sized for a minimum retention time of 12 minutes at the peak design flow of 500 gpm; therefore, the tank volume will be 6,000 gallons. The tank side water depth will be limited to about 6 feet to allow for gravity overflow from the Primary DAF Effluent Trough to the pH Adjustment Tank. The tank will be an open top, cylindrical tank constructed of HDPE with approximate dimensions of a 14-foot diameter by 8-foot height. The tank will be operated with 2 feet of freeboard.

A vertical turbine mixer with a 3 HP motor will be used to agitate the contents of the pH Adjustment Tank. pH will be measured via two in-tank pH sensors. Sodium hydroxide (50%) and ferric chloride (40%) will be added to the tank as necessary to adjust pH. The pH of the Primary DAF effluent is typically low; thus, it is expected that only sodium hydroxide addition will be required to raise the pH. Ferric chloride will be routed to the tank to act as an acid in the event that the pH needs to be reduced. The existing facility uses ferric chloride, so it is already onsite and available for use. The tank will contain two redundant pH sensors.

Primary DAF Effluent Transfer Pumps will convey process wastewater from the pH Adjustment Tank to the MBBR, Combined Effluent Tank, or the Secondary Screen Tank. The Primary DAF Effluent Transfer Pumps will be end-suction centrifugal pumps with a capacity of 500 gpm at 34 feet total dynamic head (TDH). The pumps will be operated with variable frequency drives (VFDs) and will be controlled by the pH Adjustment Tank level. A constant level setpoint is maintained in the tank.

Wastewater with a pH outside of the specified range as measured by the in-tank pH sensors will be automatically diverted to the Secondary Screen Tank. Wastewater with a pH within the desired operating range and compliant with City discharge requirements will be pumped either to the MBBR or the Combined Effluent Tank. The flow rate directed to the MBBR will be an operator adjustable set point to be set as needed based on COD sample results of the Primary DAF effluent. COD test results will be correlated to BOD using the typical BOD to COD ratio for the wastewater. The historical ratio is 0.5 to 0.6. The COD results, coupled with flowrate data, will be used to set the portion of flow directed to the MBBR to ensure sufficient BOD removal to maintain compliance with effluent BOD limits.

### 3.8.3 Moving Bed Bioreactor (MBBR)

A portion of the process wastewater, up to 80% of flow under average loading conditions and as low as 55% under peak loading conditions, will be pumped from the Primary DAF Effluent pH Adjustment Tank to the MBBR. The MBBR will provide BOD reduction through aerobic biological treatment. The MBBR will consist of a tank (bioreactor) filled with media and aerated using aeration blowers. The media (biofilm carriers) will provide the required fixed film surface area to facilitate and support the growth of aerobic bacteria. The aeration blowers will supply aeration air to the tank through a coarse bubble aeration grid to provide the required concentration of dissolved oxygen to support aerobic bacteria growth to treat the incoming BOD. Aeration blowers will also provide media suspension and agitation to facilitate adequate contact with wastewater and the biomass on the carriers. Aerobic bacteria will biologically oxidize BOD through cellular functions and yield activated sludge. The capability to add nitrogen and phosphorus will be provided to ensure adequate nutrients for cell growth. A supplemental carbon source will be available to add to the MBBR tank over the weekend to maintain cell growth during periods of low to no process wastewater flow. The MBBR tank discharge will be equipped with a sieve that will allow wastewater and suspended solids to pass through and retain the biofilm carriers in the MBBR tank. MBBR effluent will flow via gravity to the Secondary DAF.

The MBBR tank will be a field erected, open top, carbon steel tank with approximate dimensions of 16-foot diameter by 32-foot height. The working volume of the tank will be approximately 36,000 gallons with a side water depth of 28 feet. The proposed media fill fraction is 57% of the reactor volume with 83 $m^3$ of media. An MBBR fixed film surface area of about 53,950 $m^2$ will be provided by 650 $m^2/m^3$ carriers; therefore, the design peak Surface Area Loading Rate

(SALR) for the peak BOD loading of 1,066 ppd is 9 g BOD/ $m^2$/d. This loading rate is representative of average SALR for normal rate MBBR rectors based on literature values[1].

The design BOD removal of the MBBR is oxygen transfer limited. The proposed design currently contains two MBBR Aeration Blowers operating in a duty/duty-assist configuration. The aeration blowers are described in more detail in Section 3.8.4.

The maximum hydraulic capacity through the MBBR will be limited by the hydraulic capacity of the Secondary DAF. The Secondary DAF will be sized for a flow of 180 gpm, which is adequate for processing both average and peak design conditions. As noted in Section 3.8.2, the flow rate directed to the MBBR is an operator adjusted set point that can be changed as needed based on Primary DAF effluent COD measurements collected during the day. The existing primary treatment system shuts down when the processing operations shut down. Shutdowns typically last from Saturdays at 8 AM through Mondays at 4 AM. The MBBR tank will not receive process wastewater flow during this period, therefore a supplemental carbon source (glycerin or chicken blood) can be added to feed the aerobic bacteria, keeping the biological solids healthy and activated over the weekend. When the treatment process restarts the MBBR will be able to provide the designed BOD removal.

Dissolved oxygen (DO) concentration, pH, and foam level will be monitored in the MBBR Tank. The MBBR Aeration Blowers will be controlled by the DO to target a set point of 2.0 mg/L. The defoamer injection will be triggered by a foam level alarm. The injection rate will be set by the operator and controlled by a timer that will cycle the metering pump on and off until the alarm clears. If after three consecutive feeding cycles the foam has not dissipated, then an alarm will be activated notifying the operator to investigate the issue and to consider increasing the defoamer addition rate and re-start the feed cycle. The target average dosage of defoamer is 10 mg/L and the peak dosage is 50 mg/L based on the MBBR reactor size.

### 3.8.4 Aeration

The MBBR tank will require aeration to supply oxygen to oxidize the BOD and to mix and suspend the biofilm carriers in the tank. The MBBR system will have two MBBR Aeration Blowers, one duty and one duty/assist. The blowers will be 40 HP rotary lobe, positive displacement blowers, each with a capacity of 270 scfm at 12.5 psig. The blowers will be operated on VFDs controlled by the DO of the MBBR Tank. The aeration air will be supplied to the MBBR tank through a 304 stainless steel coarse bubble diffused aeration grid located approximately 12 inches from the bottom of the tank.

As described in Section 3.8.3, the MBBR BOD removal will be oxygen limited. One blower will be required to be online and the other blower will be on standby under average design conditions. Both blowers will operate during peak loading conditions. If BOD loading increases in the future to a point where two blowers are required under normal operating conditions, then both aeration blowers will serve as duty blowers and a future standby blower will be installed to serve as an online spare. Two blowers at 100% air flow can transfer up to 1,374 ppd of oxygen used for BOD treatment.

### 3.8.5 Secondary DAF

The Secondary DAF will separate suspended solids from the MBBR effluent prior to discharge to the Combined Effluent Tank to maintain compliance with TSS discharge limits. The Secondary DAF will be sized to process up to 180 gpm at a TSS loading of less than 2,500 mg/L and it will be constructed of polypropylene. High molecular weight cationic polymer will be added to flocculate the secondary sludge. The specific cationic polymer will be determined during

[1] SALR for Normal Rate Biofilm Reactors from *Biofilm Reactors* Published by the Water Environment Federation in 2010. WEF Manual of Practice No. 35. 2010.

detailed design and verified during start-up. The capability to add ferric chloride as a coagulant to the Secondary DAF will be built into the design, however, coagulation of secondary sludge is not expected during normal operation. Flocculated secondary sludge will be floated using dissolved air injection and skimmed off the surface of the DAF tank.

Polymer will be injected into the DAF influent box through flow-paced dosing. A dissolved air pump will recirculate DAF effluent to the DAF influent box. The pump will dissolve compressed air into the recirculated flow and generate 5-to-12-micron diameter bubbles at high saturation efficiencies. The micro air bubbles will adhere to the flocculated solids in the DAF and float the solids to the surface of the Secondary DAF tank. Treated Secondary DAF effluent will flow from the effluent box to the Combined Effluent Tank via gravity.

Floated solids will be periodically skimmed from the top into the sludge hopper by a skimming rake. The skimming rake will operate on a timer. The Secondary DAF Sludge Transfer Pumps will transfer sludge from the hopper at regular intervals. The pumps will also transfer settled sludge from the bottom cones of the DAF to the Secondary DAF Sludge Tank to capture any dense solids that settled out in the DAF. This transfer will be manually performed by the operators as needed to prevent the build-up of solids in the bottom of the DAF. The Secondary DAF will be shut down when there is no process wastewater flow, typically from Saturday at 8 AM until Monday morning at 4 AM.

### 3.8.6 Effluent Monitoring and Handling

Secondary DAF effluent will combine with neutralized Primary DAF effluent in the Combined Effluent Tank. The Combined Effluent Tank will be sized for a minimum retention time of five minutes at the peak design flow of 500 gpm; therefore, the tank volume will be 2,900 gallons. The tank height will be limited to 8 feet to allow for gravity overflow from the Secondary DAF effluent box to the Combine Effluent Tank. The tank will be an open top, cylindrical tank constructed of HDPE with approximate dimensions of a 9-foot diameter by 8-foot height. The tank will be operated with 2 feet of freeboard.

Effluent will be pumped from the Combined Effluent Tank to the city sewer via the Combined Effluent Pumps. The Combined Effluent Pumps will be duty/duty-assist, end-suction centrifugal pumps, each with a capacity of 500 gpm at 20 feet TDH. The pumps will be operated with VFDs and will be controlled by the Combined Effluent Tank level. A constant level setpoint will be maintained in the tank.

Effluent monitoring for pH and flow will be conducted with a pH meter and a flow meter installed on the discharge line of the Combined Effluent Tank. These meters will be located to provide continuous, accurate pH and flow effluent measurements for permit compliance. Effluent flow from the Combined Effluent Tank will be piped and tied into the existing city sewer discharge point. Effluent will flow from this point to the existing Wastewater Sampling Manhole. Compliance sampling will continue to be conducted as it has in the past at the existing Wastewater Sampling Manhole. The proposed upgrades have been designed to maintain compliance with discharge permit limits shown in Section 3.4.2.

### 3.8.7 Sludge Handling

Secondary activated sludge will be produced in the MBBR. Excess sludge will slough off the biofilm carriers and be discharged with the MBBR effluent to the Secondary DAF. Secondary waste activated sludge will be thickened to 4% dry solids in the Secondary DAF and this thickened sludge will be pumped to the Secondary DAF Sludge Tank via the Secondary DAF Sludge Transfer Pumps. Under average MBBR loading, about 2,000 GPD of 4% Secondary DAF Sludge will be generated.

The Secondary DAF Sludge Transfer Pumps will be air-operated diaphragm pumps sized for 50 gpm each. Two pumps will be provided for redundancy. These transfer pumps will be configured to pump Secondary DAF float to the Secondary DAF Sludge Tank, and to transfer sludge from the Secondary DAF Sludge Tank to the Primary DAF Sludge Tanker. The pumps will transfer DAF float to the Secondary DAF Sludge Tank automatically as controlled by a high-level switch in the DAF sludge hopper. The operators will manually configure the pumps to transfer sludge from the Secondary DAF Sludge Tank to the Primary Sludge Tanker. An operator will be present for the duration of the transfer to the Tanker, and they will set the Secondary DAF Sludge Transfer Pumps back to automatic operation after the transfer is complete.

The Secondary DAF Sludge Tank will be a 6,000-gallon, closed top, cone bottom tank constructed of HDPE. This tank will be sized for a 3-day retention time to store peak MBBR solids generation conditions. Secondary sludge will be transferred to the existing Primary DAF Sludge Tanker, which is a closed top tanker located next to the feather and meat trailers, at a minimum of once every three days. The sludge will be hauled offsite by a licensed hauler and permitted end user. Perdue plans to dispose of the Secondary DAF sludge with the existing stream of Primary DAF sludge. The material is currently hauled offsite for anaerobic digestion at a licensed third-party treatment facility.

### 3.8.8 Chemical Feed Systems

Chemical feed systems will include sodium hydroxide, phosphoric acid, urea, food grade defoamer, a supplemental carbon source, ferric chloride, and cationic polymer. Sodium hydroxide and ferric chloride already exist onsite and will be used to neutralize pH in the Primary DAF Effluent. Phosphoric acid and urea will be new chemical nutrients that will be used to supplement nutrients in the wastewater to support bacterial growth in the aerobic treatment system. Defoamer will be used in the MBBR system to prevent/minimize foaming. Polymer will be used to thicken the secondary sludge processed through the Secondary DAF. There will be an option to add ferric chloride as a coagulant to the Secondary DAF, however ferric chloride is not expected to be needed. A summary of expected chemical usage rates is provided in the table below.

**Table 3-7: Proposed Chemical Storage and Usage Rates[1]**

| Chemical | Storage Container | Maximum Volume Stored Onsite | Usage Rate (gpd) |
|---|---|---|---|
| Urea (50%)[2] | 55-gallon drums | 110 gal | 16 to 37 |
| Phosphoric Acid (75%)[3] | 55-gallon drums | 110 gal | 2 to 6 |
| Defoamer (100%) | 55-gallon drums | 110 gal | 2 to 11 |
| Neat Cationic Polymer | 55-gallon drums | 110 gal | 8 to 12 |
| Supplemental Carbon[4] | 55-gallon drums | 110 gal | 7 |

[1]Sodium hydroxide and ferric chloride usage rates are not expected to change as a result of the upgrades. The existing usage rates can be found in Section 2-5.
[2] Urea addition rate is based on a nutrient demand of 5 lb. nitrogen per 100 lb. BOD
[3] Phosphoric acid addition rate is based on a nutrient demand ratio of 1 lb. phosphorus per 100 lb. BOD.
[4]Supplemental carbon is available over the weekend to feed the biomass when there is no process wastewater flow.

Sodium hydroxide and ferric chloride are currently used in the existing WWTP. Sodium hydroxide is currently added to the existing Primary DAF Effluent Trough for pH adjustment. Additional sodium hydroxide will be added to the Primary DAF Effluent pH Adjustment Tank as needed for supplemental pH adjustment. The proposed modifications will allow for pH trimming in the Primary DAF Effluent pH Adjustment Tank. The existing sodium hydroxide usage rate is not expected to change as a result of these upgrades.

Ferric chloride is currently used as a coagulant in the Primary DAF. The proposed upgrades will include provisions to add ferric chloride to the Primary DAF Effluent pH Adjustment Tank for pH trimming and to the Secondary DAF as a coagulant. The existing ferric chloride usage rate is not expected to change as a result of these upgrades because the Primary DAF effluent is acidic, and coagulation is not expected to be required to thicken sludge in the Secondary DAF. Proposed ferric chloride feed pumps will match the existing ferric chloride feed pumps used onsite.

All other proposed chemical feed systems will be designed to provide the maximum daily chemical usage. All chemical storage drums will be housed on secondary containment pallets and located to allow access for chemical deliveries and protection against severe weather conditions.

### 3.8.9 Location of WWTP Upgrades

Limited footprint is available for the proposed WWTP Upgrades at the existing facility. Multiple options were evaluated to select the site for the proposed WWTP upgrades. The selected site is shown on the General Arrangement drawings provided in Appendix A. This location has been selected for the following reasons:

- The site is within close proximity to the existing WWTP, which offers the following benefits:
    - Minimized proposed piping runs.
    - Easy management of secondary sludge. Existing infrastructure for primary sludge disposal can be used for the secondary sludge.
    - The effluent can be discharged to the existing city sewer. The existing Wastewater Sampling Manhole can continue to be used for compliance sampling.
- The site is located within a contained area. Stormwater improvements will not be required due to the WWTP upgrades.
- The site is not restricted by other limitations such as:
    - Footprint needs for future projects, such as the receiving area upgrades.
    - It is not located within 150 feet from the property boundary or Kulshan Creek.

The selected site is suitable for the proposed WWTP upgrades. This location also minimizes the impact on truck traffic and waste disposal. The orientation of the existing feather and blood trailer, offal trailer, and Primary DAF Sludge Trailer will be rotated 90 degrees as shown on the general arrangement drawing. Bollards will be installed around the proposed equipment to protect it from truck traffic.

## 3.9 Additional Design Considerations

The additional details on the site/civil, structural, mechanical, electrical, and instrumentation and controls design will be provided to Ecology in subsequent submittals as the design progresses. All components will be designed in accordance with the latest editions of relevant federal, state, and local standards.

## 3.10 Implementation Schedule

An estimated implementation schedule for the WWTP upgrades is defined in Table 3-8. The anticipated project timeline is 70 weeks following the completion of the 30% design and approval from Ecology to move forward with the proposed upgrades.

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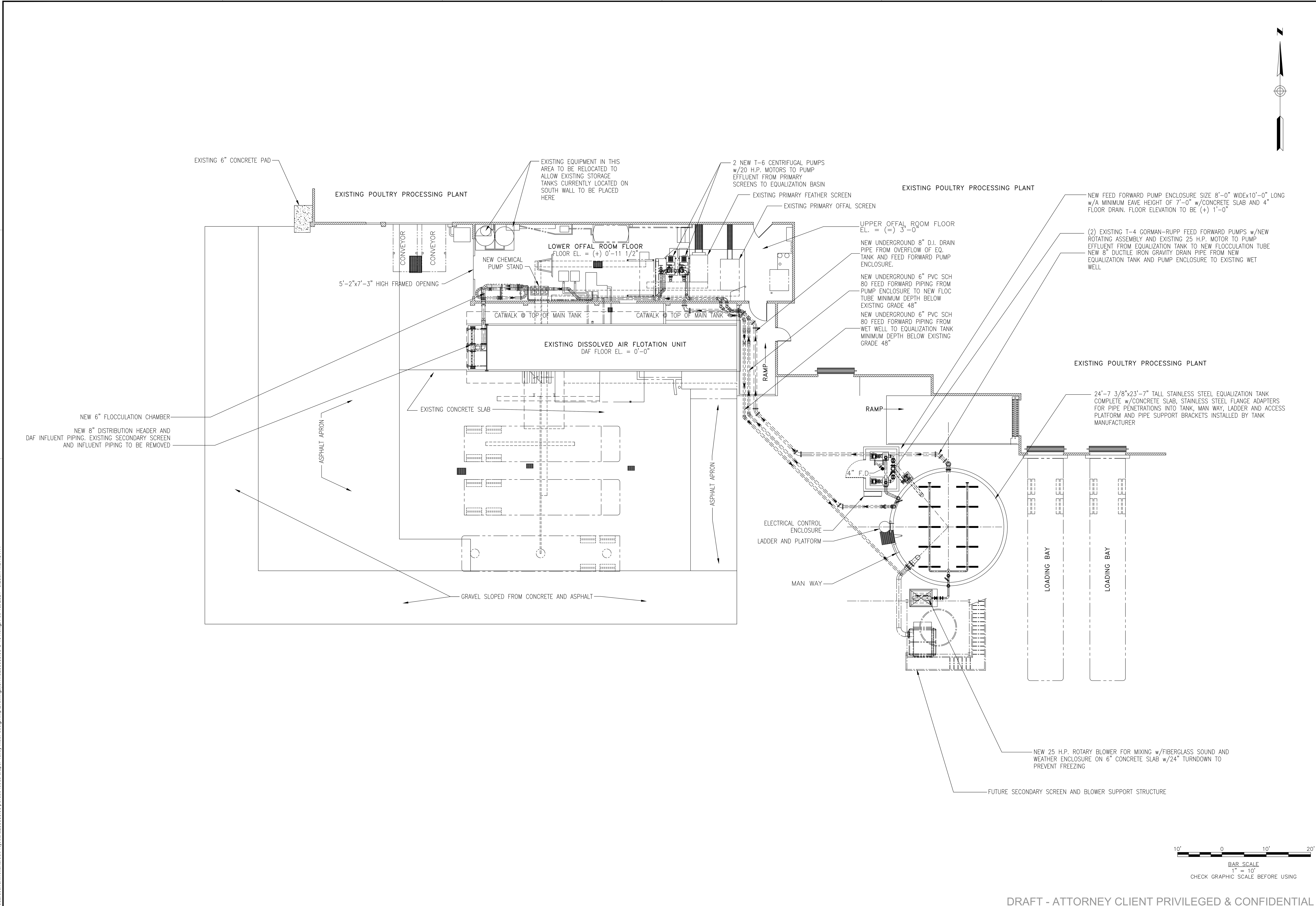
## Table 3-8 Implementation Schedule (Months)

| | Major Project Phases | Phase Duration (Months) | Total (Months) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Detailed Design (90% Design Packages):<br>- Specifications<br>- Construction Drawings<br>- Contracts | 6 | 6 | | | | | | | | | | | | | | | | |
| 2 | Equipment Procurement and Delivery to Site | 4 | 9 | | | | | | | | | | | | | | | | |
| 3 | Installation | 4 | 13 | | | | | | | | | | | | | | | | |
| 4 | Commissioning, Startup, and Operator Training | 3 | 16 | | | | | | | | | | | | | | | | |

# APPENDIX A: DRAWINGS

ATTACHMENT C.4

22x34 SHEET 1:1




DRAFT - ATTORNEY CLIENT PRIVILEGED & CONFIDENTIAL

\\woodardcurran.net\shared\Projects\0233685.00 perdue foods draper valley mbbr design\wip\Drawings\Civil\0233685.00-C-101.dwg, Feb 10, 2021 - 9:28am MBROWN


WOODARD & CURRAN
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800.446.5518 | www.woodardcurran.com
COMMITMENT & INTEGRITY DRIVE RESULTS




| REV | DESCRIPTION | DATE |
|---|---|---|

DESIGNED BY: RC/MBM
DRAWN BY: MB
CHECKED BY: RC
0233685.00-C-101.dwg

# EXISTING CONDITIONS SITE PLAN

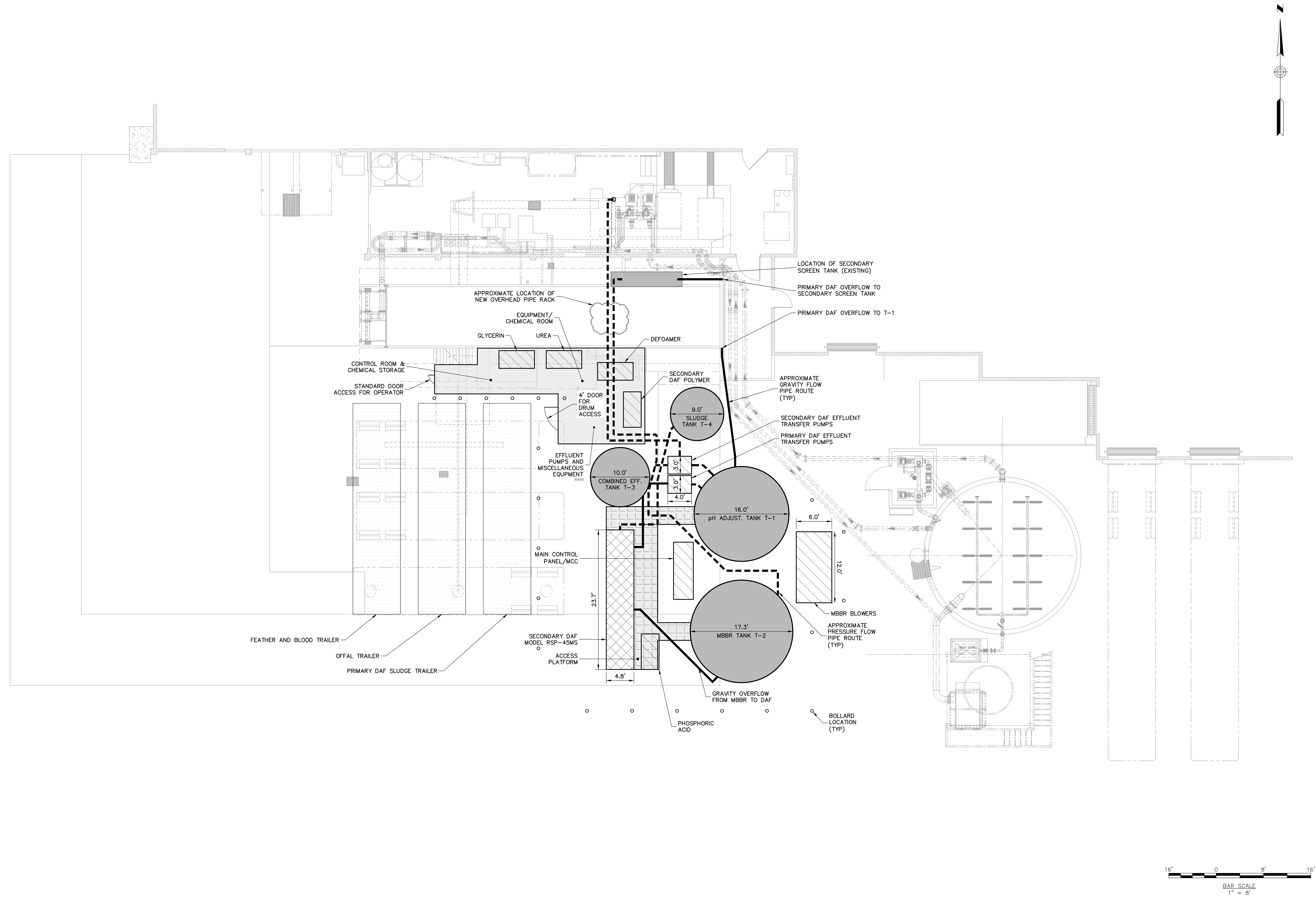
PERDUE DRAPER VALLEY FARMS
MOUNT VERNON, WASHINGTON

30% DESIGN WWTP UPGRADE

JOB NO: 233685.00
DATE: XXX
SCALE: AS SHOWN
SHEET: 3 OF XXX

C-101

22x34 SHEET 1:1

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| REV | DESCRIPTION | DATE |
|---|---|---|
| | | |

DESIGNED BY: MBM/MB CHECKED BY: BC/MBM
DRAWN BY: MN 0233685.00-C-102.dwg

# GENERAL ARRANGEMENT

PERDUE DRAPER VALLEY FARMS
MOUNT VERNON, WASHINGTON

30% DESIGN WWTP UPGRADE

| | |
|---|---|
| JOB NO: | 233685.00 |
| DATE: | 2021 |
| SCALE: | NA |
| SHEET: | 4 OF XXX |

C-102

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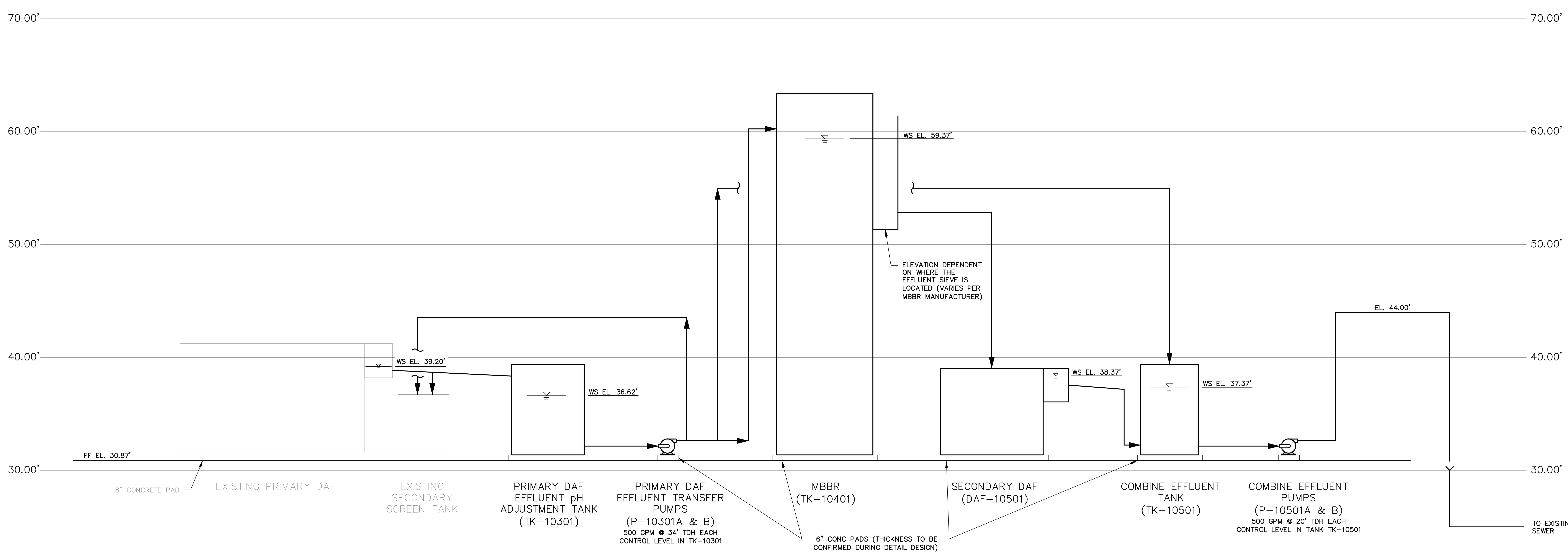
22x34 SHEET
1:1




HYDRAULIC PROFILE OF WWTP UPGRADES

NOT FOR CONSTRUCTION

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COMMITMENT & INTEGRITY DRIVE RESULTS



REV | DESCRIPTION | DATE

DESIGNED BY: XXX
DRAWN BY: XXX
CHECKED BY: XXX
P-101.dwg

# HYDRAULIC PROFILE

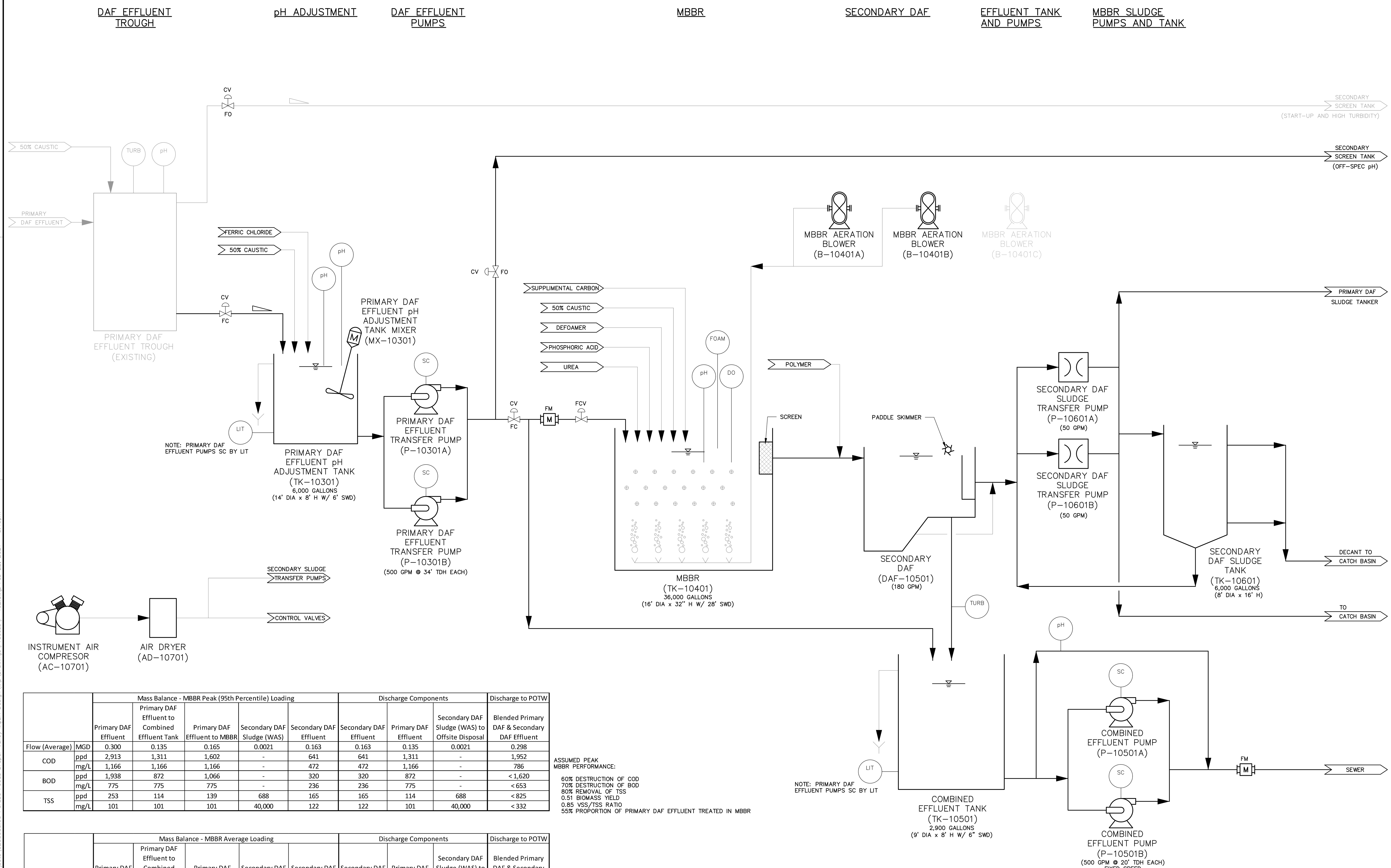
PERDUE DRAPER VALLEY FARMS
MOUNT VERNON, WASHINGTON

30% DESIGN WWTP UPGRADE

JOB NO: 233685.00
DATE: 2021
SCALE: NA
SHEET: ---- OF XXX

P-101

22x34 SHEET
1:1




| | | Mass Balance - MBBR Peak (95th Percentile) Loading | | | | | Discharge Components | | | Discharge to POTW |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Primary DAF Effluent | Primary DAF Effluent to Combined Effluent Tank | Primary DAF Effluent to MBBR | Secondary DAF Sludge (WAS) | Secondary DAF Effluent | Secondary DAF Effluent | Primary DAF Effluent | Secondary DAF Sludge (WAS) to Offsite Disposal | Blended Primary DAF & Secondary DAF Effluent |
| Flow (Average) | MGD | 0.300 | 0.135 | 0.165 | 0.0021 | 0.163 | 0.163 | 0.135 | 0.0021 | 0.298 |
| COD | ppd | 2,913 | 1,311 | 1,602 | - | 641 | 641 | 1,311 | - | 1,952 |
| | mg/L | 1,166 | 1,166 | 1,166 | - | 472 | 472 | 1,166 | - | 786 |
| BOD | ppd | 1,938 | 872 | 1,066 | - | 320 | 320 | 872 | - | < 1,620 |
| | mg/L | 775 | 775 | 775 | - | 236 | 236 | 775 | - | < 653 |
| TSS | ppd | 253 | 114 | 139 | 688 | 165 | 165 | 114 | 688 | < 825 |
| | mg/L | 101 | 101 | 101 | 40,000 | 122 | 122 | 101 | 40,000 | < 332 |

ASSUMED PEAK
MBBR PERFORMANCE:

60% DESTRUCTION OF COD
70% DESTRUCTION OF BOD
80% REMOVAL OF TSS
0.51 BIOMASS YIELD
0.85 VSS/TSS RATIO
55% PROPORTION OF PRIMARY DAF EFFLUENT TREATED IN MBBR

| | | Mass Balance - MBBR Average Loading | | | | | Discharge Components | | | Discharge to POTW |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Primary DAF Effluent | Primary DAF Effluent to Combined Effluent Tank | Primary DAF Effluent to MBBR | Secondary DAF Sludge (WAS) | Secondary DAF Effluent | Secondary DAF Effluent | Primary DAF Effluent | Secondary DAF Sludge (WAS) to Offsite Disposal | Blended Primary DAF & Secondary DAF Effluent |
| Flow (Average) | MGD | 0.300 | 0.060 | 0.240 | 0.0020 | 0.238 | 0.238 | 0.060 | 0.0020 | 0.298 |
| COD | ppd | 2,050 | 410 | 1,640 | - | 656 | 656 | 410 | - | 1,066 |
| | mg/L | 820 | 820 | 820 | - | 331 | 331 | 820 | - | 429 |
| BOD | ppd | 1,144 | 229 | 915 | - | 183 | 183 | 229 | - | < 1,620 |
| | mg/L | 458 | 458 | 458 | - | 92 | 92 | 458 | - | < 652 |
| TSS | ppd | 103 | 21 | 83 | 657 | 148 | 148 | 21 | 657 | < 825 |
| | mg/L | 41 | 41 | 41 | 40,000 | 75 | 75 | 41 | 40,000 | < 332 |

ASSUMED AVERAGE
MBBR PERFORMANCE:

60% DESTRUCTION OF COD
80% DESTRUCTION OF BOD
80% REMOVAL OF TSS
0.51 BIOMASS YIELD
0.85 VSS/TSS RATIO
80% PROPORTION OF PRIMARY DAF EFFLUENT TREATED IN MBBR

NOT FOR CONSTRUCTION

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Canton, Massachusetts 02021
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COMMITMENT & INTEGRITY DRIVE RESULTS



REV | DESCRIPTION | DATE
DESIGNED BY: XXX | CHECKED BY: XXX
DRAWN BY: XXX | P-102.dwg

# PROCESS FLOW DIAGRAM MBBR AND SECONDARY DAF

PERDUE DRAPER VALLEY FARMS
MOUNT VERNON, WASHINGTON

30% DESIGN WWTP UPGRADE

JOB NO: 233685.00
DATE: 2021
SCALE: NA
SHEET: ---- OF XXX

P-102

# APPENDIX B: CROSSWALK WITH WAC 173-240-130 REQUIREMENTS

| WAC 173-240-130 | Summary of Requirement | Section in Engineering Report |
|---|---|---|
| a | Type of industry or business | 1.1 |
| b | The kind and quantity of finished product | 1.1 |
| c | The quantity and quality of water used by the industry and a description of how it is consumed or disposed of | 2.1 |
| d | The amount and kind of chemicals used in the treatment process | 2.2.5 (existing)<br>3.8.8 (proposed) |
| e | The basic design data and sizing calculations of the treatment units | 3.6 & 3.8 |
| f | A discussion of the suitability of the proposed site for the facility | 3.8.9 |
| g | A description of the treatment process and operation, including a flow diagram | 3.1 – 3.8 & Appendix A |
| h | All necessary maps and layout sketches | Appendix A |
| i | Provisions for bypass | 3.8.2 |
| j | Physical provision for oil and hazardous material spill control or accidental discharge prevention or both | 2.3 |
| k | Results to be expected from the treatment process including the predicted wastewater characteristics, as shown in the waste discharge permit, where applicable | 3.6 & Appendix A |
| l | A description of the receiving water, location of the point of discharge, applicable water quality standards, and how water quality standards will be met outside of any applicable dilution zone; | Not Applicable |
| m | Detailed outfall analysis | Not Applicable |
| n | The relationship to existing treatment facilities if any | 1.2 & 1.3 |
| o | Where discharge is to a municipal sewerage system, a discussion of that system's ability to transport and treat the proposed industrial waste discharge without exceeding the municipality's allocated industrial capacity. Also, a discussion on the effects of the proposed industrial discharge on the use or disposal of municipal sludge; | 2.4 |
| p | Where discharge is through land application, including seepage lagoons, irrigation, and subsurface disposal, a geohydrologic evaluation is required. | Not Applicable |
| q | A statement expressing sound engineering justification through the use of pilot plant data, results from other similar installations, or scientific evidence from the literature, or both, that the effluent results from the proposed facility will meet applicable permit effluent limitations or pretreatment standards or both | 1.4 |

| WAC 173-240-130 | Summary of Requirement | Section in Engineering Report |
|---|---|---|
| r | A discussion of the method of final sludge disposal selected and any alternatives considered with reasons for rejection | 3.8.7 |
| s | A statement regarding who will own, operate, and maintain the system after construction; | Facility Management and Operations Certification |
| t | A statement regarding compliance with any state or local water quality management plan or any plan adopted under the Federal Water Pollution Control Act as amended | Not Applicable |
| u | Provisions for any committed future plans | 3.4.1 |
| v | A discussion of the various alternatives evaluated, if any, and reasons they are unacceptable | 3.5 |
| w | A timetable for final design and construction | 3.10 |
| x | A statement regarding compliance with the State Environmental Policy Act (SEPA) and the National Environmental Policy Act (NEPA), if applicable | Not Applicable |
| y | Additional items to be included in an engineering report for a solid waste leachate treatment | Not Applicable |

ATTACHMENT C.4

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