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Pangnirtung Wastewater Treatment Plant – Design Brief- FINAL

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1 Introduction

1.1 General

The following design brief summarizes the design parameters that were utilized for the optimization of a wastewater treatment plant that services the Hamlet of Pangnirtung. The current system, constructed in 2003, was originally designed utilizing a Rotating Biological Contactor (RBC) process. This process did not work well resulting in the system being converted to an activated sludge system to try and improve the operation. The activated sludge system did not prove to be capable of consistently providing a good level of treatment; the system requires further optimization.

The Hamlet is a small community on Baffin Island in Nunavut with a combination of challenges with respect to wastewater treatment. All wastewater is trucked resulting in 24 hours of flow arriving at the plant in approximately 8 hours. On occasion, a days' worth of hauling may be missed (e.g., bad weather) resulting in a larger-than-normal flow day shortly thereafter. The Hamlet requires a system that is simple to operate while being reliable and compact.

1.2 Community Description

Pangnirtung is located on Baffin Island at N66°08.82' and W65°42.07' on the south shore of the Pangnirtung Fiord. Pangnirtung has a reported population of 1425. The Hamlet is primarily residential in nature with a few businesses (lodges, grocery stores, etc.), schools and a fish processing plant (Pangnirtung Fisheries). Both fresh water and the wastewater are transported by trucks to and from the various buildings – there is no piped system within the community.

1.3 Project Scope

The basis of the project was to "optimize" the existing wastewater treatment plant by working with the existing infrastructure providing sufficient changes to enable proper operation. Upon examining the wastewater characteristics and applying the appropriate treatment principles to properly treat the wastewater, it became evident that the existing process was undersized.

A Pre-Design Report prepared for this project examined several process options that could be used to replace the existing system. Due to its compact nature, the recommended membrane bioreactor (MBR) process will provide a good-quality effluent in a relatively small footprint. It will be necessary to expand the building envelope in order to house the necessary equipment.

2 Design Criteria and Background Data

2.1 Service Conditions

Due to the location of the Hamlet, weather and remoteness present the biggest challenges for the wastewater treatment system both in terms of design and operation. These factors create periods of time when the community cannot be accessed from the outside for deliveries of supplies. This poses a challenge for wastewater treatment whereby sufficient storage must be provided for stockpiling of spare parts/equipment and consumable products such as chemicals.

2.1.1 Existing Facilities

The existing wastewater treatment facility is approximately 10 years old. The building and its infrastructure appear to be in reasonably good shape. Some electrical equipment was replaced two years ago due to corrosion issues. Improvements to the ventilation system have reduced the possibility of similar corrosion issues re-occurring.

The current treatment train consists of the following processes:

- Truck receiving station;
- Manual (coarse) bar screen
- Raw wastewater sump c/w submersible pumps;
- Drum screen (fine) and screenings compactor;
- Screened wastewater sump c/w submersible pumps;
- Equalization (EQ) Tank, 189 m^3 total volume, nominal working volume of 138 m^3;
- Feed pumps;
- Twin aeration basins;
- Twin secondary clarifiers;
- Sludge recycle/waste pumps;
- Aerobic sludge digester; and,
- Sludge dewatering.

The effluent is discharged (without disinfection) at the edge of the ocean above the high tide limit.

The building services include a twin oil-fired boiler system (heat) and a back-up generator. Office/laboratory space was included in the mezzanine space (last upgrade) over the dewatering area.

2.1.2 Design Flows

The design flows for the wastewater treatment system were developed based on the population to be served over a 20-year design period.

Design flows (based on design year 2034) are:

- Average Daily Flow: 290 m^3/d
- Peak Daily Flow: 360 m^3/d

- Peak Hourly Flow: 7.8 L/s

2.2 Wastewater Characteristics

The wastewater characteristics for design of the wastewater treatment facility were developed as part of the pre-design report. In summary, the design characteristics on a concentration basis are significantly higher than typical municipal wastewater due to the reduced per-capita water use. The wastewater characteristics that have been developed for design are presented in Table 2.1.

Table 2.1 - Recommended Influent Wastewater Characteristics for Design

Parameter	Unit	Influent	Effluent Limits
Carbonaceous BOD_5 Concentration	mg/L	1000	80
Total Suspended Solids (TSS)	mg/L	1070	70
Total Kjeldahl Nitrogen (TKN)	mg/L	250	
Total Phosphorous (TP)	mg/L	40	

3 WWTP Design Considerations

3.1 Wastewater Treatment

In general, the wastewater treatment system upgrade includes the addition of a packaged membrane bioreactor system with aeration and anoxic biological treatment tanks to provide the bulk of the treatment (replacing the existing activated sludge system). A number of additional processes and process units will be required to form a complete wastewater treatment system for the Hamlet. The following paragraphs provide a description of each of these processes and provide a description of how each unit fits into the overall treatment system (also refer to the P400-series of drawings in Appendix A for the Process Flow Diagrams, and the Process and Instrumentation Diagrams (P&IDs)).

3.1.1 Screening

Preliminary treatment consists of coarse and fine screening. Coarse screening consists of a manually-cleaned bar screen with openings in the order of 12 mm. All wastewater initially flows through this screen and into the first of two wastewater sumps. The wastewater is then pumped through a drum screen with a screen element having 3 mm openings. The screened wastewater then flows to a second sump where it is pumped to the Equalization Tank.

Screened material collected from the drum screen is washed, compacted and dewatered prior to being discharged into a bagging collection system. Screened material from the coarse screen is collected in a separate lined bin. All screenings are ultimately disposed of in the solid waste landfill site.

The existing drum screen appears to be in good working order and will be incorporated into the design of the upgraded system. Conversations with the membrane supplier (GE Water & Process Technologies) have indicated that the screen needs to be retrofitted with a new drum with smaller openings (2 mm). Discussions with the equipment supplier indicate that a new drum can be provided with smaller screen openings for this unit. Replacement of only the drum would represent a significant cost savings over having to purchase an entirely new screening unit.

3.1.2 Pumping

The proposed new treatment system is an upgrade of the existing facility whereby a large portion of the biological process will be replaced. However, the upgraded design is based on utilizing as much of the preliminary treatment (also referred to as the system head works) processes as possible. This will include the use of existing sumps and pumps where possible. A review of the existing pumps was completed during the detailed design phase and determined that the performance capabilities (and current condition/projected service life) for the existing pumps will be adequate for the upgraded facility.

Pumping of the raw wastewater is required to first move the raw wastewater from the initial receiving sump (via a duplex submersible pump system) through the drum screen. A second duplex submersible pump system then transports the wastewater from the screening area to the Equalization Tank. These two sets of duplex pumps are located in sumps located in the floor in the existing screening/dewatering room.

From the equalization tank, raw wastewater will be fed to the biological treatment system using duplex, centrifugal, end-suction pumps that will be installed on a concrete housekeeping pad on the building floor near the equalization tank. These pumps will be controlled by variable frequency drives to allow for steady inflow to the biological system (anoxic tank). These pumps will be designed for continuous duty operation to allow for consistent inflow to the biological system over 24 hours. Pumps will be of the closecoupled design (as opposed to belt-driven) and will be supplied as a complete package pre-installed with the motor on a common steel base.

A duplex pump system will be required to extract permeate (treated effluent) from the membrane system. These pumps will both operate as duty pumps with one pump dedicated to each membrane tank. Provision will be made within the permeate piping to allow for each pump to service both tanks in the event of a pump failure. These pumps will be supplied by the membrane equipment supplier as part of a packaged skid-mounted assembly and will be rotary lobe pumps with VFD control to allow for precise flow control.

Additional duplex pumps will be required to provide a constant recycle of mixed liquor suspended solids (MLSS) from the membrane tank to the anoxic tank. The discharge piping from these pumps will be configured to allow for a portion of the recycle MLSS to be diverted to the sludge storage tank for wasting. A hose pump will be utilized to transfer sludge from the storage tank to the dewatering system and will be operated/controlled by an integral speed control system. The recycle pumps (centrifugal, end-suction pumps) will be supplied by the membrane equipment supplier. The recycle pumps will be equipped with VFD control to allow variation of the recycle flow rate.

3.1.3 Equalization

The existing Equalization (EQ) Tank will be incorporated into the upgraded system to absorb the peak flows associated with the trucking of wastewater over an 8-hour period. The EQ tank provides attenuation within the system to help promote a steady delivery of flow and organic loading to the downstream biological treatment system. Sharp spikes in either flow or organic load can lead to instability and reduced treatment performance within any biological system and an EQ tank helps to minimize these potential impacts. The existing EQ Tank has a total volume of approximately 189 m^3; the usable volume is in the order of 138 m^3.

The EQ Tank is constructed of bolted steel, gasketed panels and appears to be in good condition. The tank is enclosed and vented to the exterior of the building. Previously screened wastewater will be pumped from this tank to the MBR system. The tank will generally operate at its lowest level in order to have containment volume available when needed. This tank is equipped with a diffused aeration system that can be used to prevent the tank contents from going septic and causing odours.

3.1.4 Membrane Bioreactor (MBR)

The Membrane Bioreactor (MBR) will provide the majority of the wastewater treatment. The biological treatment system consists of three main zones, identified as the anoxic tank, the aeration tank and the membrane tanks. The anoxic tank is the first zone in the process and consists of a mixed tank with relatively low levels of dissolved oxygen (DO). Bacteria in the presence of low oxygen levels are able to perform biological nitrogen removal (which also can reduce the amount of chemical required for alkalinity addition). The aeration tank follows the anoxic tank and it is here that most of the biological treatment occurs within the system. The aeration tank operates at a higher DO concentration allowing the aerobic bacteria to consume the organic material in the wastewater, eliminating most of the influent BOD_5 concentration. It is in the aeration tank that the ammonia nitrogen is converted to nitrates and nitrites (through the process of nitrification) thereby reducing the potential for ammonia toxicity within the receiving waters (Pangnirtung Fiord) at the point of the effluent discharge. Due to the size of the aerobic and anoxic tanks, and to minimize floor space requirements, the anoxic tank will be located in the center of the aerobic tank; both tanks will be covered. The mixed liquor from the aeration tank flows to the membrane tanks.

Some organic removal continues within the membrane tanks but the primary purpose is to house the submerged membranes that provide virtually 100% removal of TSS from the effluent. Dual membrane tanks will be provided to allow for one tank to be out of service for periodic membrane cleaning as required without a need to stop flow to the system. The membrane tanks will be skid-mounted packaged systems.

The MBR system is supplied as a packaged treatment system by a single supplier and includes a number of key equipment items including pumps, aeration blowers, mixers, chemical feed systems, instrumentation, and controls. Many of the components are supplied as skid-mounted, packaged assemblies complete with piping, valves, and instrumentation pre-installed. This will help reduce the cost and complexity of the installation of this equipment and also allow for more efficient use of space within the plant.

3.1.5 Ultraviolet (UV) Disinfection

A final step in the treatment process is UV disinfection for deactivation of pathogens within the effluent discharged from the membrane system. The UV system is a stainless steel channel bolted to a concrete housekeeping pad on the building floor. The stainless steel channel will house the UV light bulbs that perform the pathogen deactivation. The UV system will be supplied as a complete unit including an outlet weir to maintain a minimum level of treated effluent in the channel. This minimum level ensures that the bulbs are always submerged even under low flow conditions. The UV system will include provision in the piping configuration, including valves, to allow for bypass of the system if maintenance is required. An additional advantage of the high quality effluent produced from the membrane system is that the effluent has a high UV transmittance which can allow for the use of a smaller UV system to achieve the same effectiveness.

3.1.6 Residuals Management

Due to the continuous growth of active biomass in the biological portions of the treatment system, production of waste activated sludge (WAS) from any biological treatment system is inevitable. An existing aerobic sludge digester will be used as a waste sludge storage tank to retain the waste sludge prior to dewatering. This allows for the operator to thicken the WAS and periodically direct WAS to the dewatering operation at convenient times. Dewatering is required to reduce the overall volume of waste sludge sent for disposal. There are many different operations available for dewatering, but given the remoteness of the Hamlet and the inherent challenges of sourcing spare parts, a simple but effective option is to handle the waste sludge using GeoTubes®. A GeoTube® is constructed from geomembrane fibers as a large enclosed tube. The sludge is pumped into the tube until the tube is full. The flow of sludge is then stopped allowing the tube to relax and the water in the sludge naturally leave through the permeable membrane. This process is repeated until the GeoTube® is full of dewatered solids.

The GeoTube® will be housed in a trailer in an enclosed room of the treatment plant adjacent to the raw wastewater sumps and screening. The water draining from the GeoTube® (identified as filtrate) will be directed from the trailer to the screened wastewater sump and recycled back to the EQ tank. The sludge will collect in the GeoTube® until such time as it is full, then the trailer would be removed from the plant, hauled to the landfill site, emptied of the GeoTube® and returned to have a new GeoTube® installed. A filled GeoTube® would be in the order of 2.5m wide by 7m long, and weigh in the order of 20 tonnes. Preliminary calculations indicate that the treatment system would fill up to 2 to 3 units per month in the early years, increasing to 4 units per month as the population increases through to 2034.

3.1.7 Chemical Systems

Various chemical systems will be required for the proper operation of the plant. The MBR system will require cleaning chemicals to keep the membranes functioning properly. The membranes can be fouled by both organic and inorganic material. The membranes operate by having the water pass from the outside to the inside of the membrane structures. Generally, organic fouling can be addressed by continuously mechanical cleaning methods such as applying an air scour over the face of the membranes and, on a regular basis, apply a back-pulsing (reversing the flow of effluent) or relaxing the membranes (halt the permeate pumps) while the air scour continues. The exact method and combination of operations associated with mechanical cleaning vary depending on the type of membrane used. This removes the majority of the organic build-up during normal operation. Over time, however, the organic build-up is such that the regular cleaning method becomes ineffective.

Organic fouling that cannot be removed by mechanical means can be effectively reversed through chemical cleaning with a chlorine compound, usually sodium hypochlorite. A solution of sodium hypochlorite is introduced into the effluent side of the membranes and allowed to drain through the membranes from the inside out dislodging the organic growth. A weak acid (e.g., citric acid) is similarly introduced into the membranes to remove inorganic material (e.g., scale). The chemical cleaning, for both organic and inorganic fouling, should be a relatively infrequent event – 1 to 2 times per year for each.

The chemical cleaning systems will consist of metering pumps, piping and valving mounted on a panel. The cleaning chemicals would be shipped in a concentrated liquid form or as a powder so a dilution tank (with a mixer) will be required for each system. The chemical dosing system for membrane cleaning will be supplied by the membrane equipment supplier as a packaged, skid-mounted system.

A chemical (polymer) feed system consisting of metering pumps, piping and valving will also be required for the dewatering system. The polymer would be shipped in liquid form. Further dilution will be necessary before the polymer is used in the dewatering system; final effluent will be used for the dilution water.

An additional consideration for this plant will be chemical addition to the biological treatment system for alkalinity control. Aerobic treatment systems generally undergo a process called nitrification in the presence of sufficient ammonia-nitrogen (from the raw wastewater) and oxygen (from the aeration blowers). This process consumes alkalinity which can leave the system vulnerable to an alkalinity deficiency. Having sufficient alkalinity in the system is critical for buffering in the biological reaction tanks to maintain a neutral pH balance required for proper system operation. The addition of a denitrification step (anoxic zone) provides recovery of roughly half of the alkalinity lost through nitrification. However, in some cases, chemical addition such as soda ash or sodium bicarbonate is required to maintain proper alkalinity levels in the biological system. Preliminary investigation for this facility indicates that alkalinity chemical addition will be required.

3.2 Process Support Requirements

The additional equipment that is proposed for the upgraded Pangnirtung wastewater treatment plant includes:

- Laboratory Equipment – Laboratory equipment will include all necessary glassware, testing apparatus, chemicals, etc., to perform the tests required for proper monitoring of the treatment system.
- Safety Shower – eyewash and safety shower in case of chemical exposure
- Chemical storage appropriate for storing chemicals in a cool, dark and dry location.

3.3 Instrumentation and Control

The existing wastewater treatment system is comprised of three control systems: one for each air handler and one for the process. Modifications will be made to the process PLC to accommodate the new treatment equipment. The programming of the PLC would be done using RS Logix software and the Operator interface programming would be done with Allen Bradley Factory Talk View Studio Software that is not proprietary in nature.

The following is a preliminary list of functions that the wastewater treatment PLC will control; some of these instruments are already connected to the process PLC:

- Flow measurement (inlet of plant, plant effluent and waste sludge);
- Operation of the raw wastewater pumps feeding the MBR system;
- Monitoring the MBR system for status/alarms;
- Various "FAULT" and "STATUS" indications for auxiliary equipment:
  - Pumps (Circulation and Chemical Feed)
  - Diesel Generator
  - Boilers
  - HVAC

3.4 Controls Narrative for Wastewater Treatment System

The following is a preliminary list of functions that the wastewater treatment PLC would control:

- On/off and speed control for all pumps based on online flow and/or level instrumentation
- On/off and speed control for all blowers based on online flow and/or dissolved oxygen (DO) instrumentation
- Chemical metering for pH adjustment
- Timing of back-pulse operations within the membrane tanks
- Clean-in-place routines for periodic membrane cleaning including chemical metering
- Control of waste sludge flow to waste sludge storage tank

The following is the proposed preliminary instrumentation required for the wastewater treatment plant (existing instrumentation will be used if possible):

- Level indicating transmitters for all tanks and sumps
- Flow transmitters for raw influent, permeate (effluent), recycle sludge, and waste sludge
- Dissolved oxygen instrumentation for aeration, anoxic, membrane, EQ, and sludge storage tanks
- Trans-membrane pressure transmitter for each membrane tank
- Online temperature monitoring for aeration tank
- Various faults and alarms based on set-points for instrumentation listed above.

3.5 Building Space Requirements

A new structure will be required to house some components of the wastewater treatment process. The addition will become an integral part of the existing building (i.e., the building envelope will be increased to enclose the additional space required).

At present, the addition size has been set at 463 m^2 (20.4m X 22.7m). The addition will house some components of the wastewater treatment system as well as sludge dewatering.

Drawing A601-1 in Appendix A illustrates the building layout.

3.5.1 Building Design Criteria

3.5.1.1 BUILDING SYSTEMS

.1 Reference Codes and Standards

Design will be in accordance with requirements of following standards and to requirements of local authority having jurisdiction. Where conflict occurs, the most stringent shall apply.

- National Building Code of Canada 2010 edition, errata, revisions and supplements.
- CSA-A23.1-09/A23.2-09, Concrete Material and Methods of Concrete Construction / Methods of Test for Concrete.
- CSA-A23.3-04 (R2010), Design of Concrete Structures.
- CSA-S16-09, Limit States Design of Steel Structures.
- CSA-S136-07, North American Specification for the Design of Cold Formed Steel Structural Members.

.2 Structural Loading

Design loads will be in accordance with the 2010 edition of the National Building Code of Canada (NBCC) for Pangnirtung. The Importance Category = 'Post-Disaster', per Table 4.1.2.1.

- Snow and rain (1/50):
    - S_s = 3.9 kPa.
    - S_r = 0.2 kPa.
- Wind:
    - $q_{1/10}$ = 1.00 kPa
    - $q_{1/50}$ = 1.20 kPa
- Seismic:
    - S_a (0.2) = 0.438
    - S_a (0.5) = 0.216
    - S_a (1.0) = 0.096
    - S_a (2.0) = 0.031
    - PGA = 0.240

.3 Foundations

The building foundation design will be carried out in accordance with the geotechnical report recommendations. The foundation will be a cast-in-place concrete mat with rigid insulation, granular base and thermosyphon system.

.4 Structure

The building structure addition will be a steel pre-engineered building system which is well suited and commonly used in the north. The framing will consist of steel rigid frames spanning the narrow dimension of the building which will support cold formed roof purlins, liner, insulation and metal roofing. The wall structure will consist of horizontal cold formed girts, liner, insulation and exterior metal cladding.

The lateral load resisting system will consist of rigid frames along with X-braced end walls for loads parallel to the building narrow dimension, and X-braced sidewalls for loads parallel to the building long dimension.

.5 Building Envelope

The building envelope will consist of the following:

- Walls:
  - Pre-finished metal cladding.
  - Air barrier.
  - RSI 4.4 minimum semi-rigid insulation.
  - Thermal sub-girts.
  - Structural cold formed girts.
  - Interior vapour barrier/metal liner.
- Roof:
  - Standing seam metal roof cladding.
  - Thermal support clips.
  - Air barrier.
  - RSI 7.0 minimum semi-rigid insulation.
  - Structural cold formed purlins.
  - Interior vapour barrier/metal liner.

3.6 Building and Site Services

3.6.1 Fire Protection

Fire Protection will be in conformance with the National Fire Code 2005 and conform to NFPA 820 "Standard for Fire Protection in Wastewater Treatment and Collection Facilities", 2012, with the exception of sprinklers.

Due to the limited availability of Fire Protection Water in the vicinity of the building the building will not be sprinklered. Water supply will be provided by the local fire department for fire suppression.

The building will be divided off into two areas:

1. The classified area is as designated under the Liquid Stream Treatment Process Requirements as a Class 1, Div 2 area. This area houses the raw wastewater sumps and screening and is located in the existing building. Fire Extinguishers and a Combustible Gas Detector will be required. The area will be physically separated and sealed from the unclassified area.

2. The unclassified area will be as designated under the Liquid Stream Treatment Process Requirements and will include the remainder of the building. Fire Extinguishers and a Fire Alarm System will be included. The area will be physically separated and sealed from the classified area. A combustible gas detector was added in the dewatering area to increase ventilation rates in both the dewatering area and process area in the event the gas detector limits are exceeded.

3.6.2 Plumbing

Any additional plumbing will be in conformance with The National Plumbing Code of Canada 2005.

An emergency eyewash/shower combination with tempered water will be added as a safety measure for personnel working with chemicals.

3.6.3 Heating

Existing heat is provided by two sectional cast iron boilers pumping through a duplex pumping system to unit heaters and two air handling units located throughout the existing plant. A third boiler has been added in what was previously the generator room to account for the additional heat loads. The boiler system has been sized to provide redundancy of one boiler. An additional circulating pump has been added. The existing fuel oil day tank has been used for the new boiler and a larger double wall outdoor tank installed to replace the existing tank. The outdoor tank location has been changed to allow for the construction of the building addition. The new diesel generator has its own day tank and duplex fuel transfer pumping system.

The use of water-to-air heat pumps for capturing heat from the process waste stream to use as building heat was reviewed. The high cost of electricity for operating the heat pumps does not make this an economically viable option.

Heat for the new dewatering area is provided by 2 hydronic unit heaters operating off stand-alone thermostats.

Heat for the new process area is provided by a combination of hydronic unit heaters and an air handling unit complete with hydronic coil. Unit heaters are operated off stand-alone thermostats.

3.6.4 Ventilation

Areas will be ventilated in accordance with the National Building Code, ASHRAE 62-2007 "Guidelines for Acceptable Indoor Air Quality", and NFPA 820.

Ventilation Process Area: The space will be continuously ventilating at the rate of 0.5 outdoor air changes per hour (ACH) normally with a turnover rate of 3 ACH. Ventilation rate will increase to 0.8 outdoor ACH during occupancy of the dewatering area to account for a higher exhaust rate in the dewatering area. Ventilation will increase to 1.5 outdoor ACH (50% outdoor air in the air handling unit) in the event of gas being sensed in the dewatering area. The air handling was limited to 50% outdoor air to prevent freezing of the hydronic heating coil. Supply air is heated by a hydronic heating coil. All controls are tied to the process PLC and the system powered by both normal and back-up power sources. The use of modulating dampers permits accurate flow setting which will be verified by a balancing contractor. Air handling unit supply air temperature is controlled and monitored digitally.

Ventilation Dewatering Area: The Dewatering Area is ventilated at a rate of three (3) air changes per hour continuously. Combustible gas detection and Hydrogen Sulfide gas detection is used to monitor air quality. Ventilation rate is increased to 6 ACH if gas is detected or the room is occupied.

Ventilation in Generator and New Boiler Room: The new boiler room is provided with its own supply fan and dampers to provide combustion air and cooling. The new generator room utilizes its cooling fan and dampers to provide combustion air and room cooling.

3.6.5 Building Electrical Services

3.6.5.1. POWER DISTRIBUTION

An existing 600 volt service entrance is fed from the local utility (Nunavut Power Corporation). This service entrance will not be large enough to power both the existing and the new loads. A new 400 amp service entrance will be installed including a new service-rated disconnect, new metering and a new grounding system. This service entrance will feed a new 600 volt, 400 amp panel board. This new panel will feed all of the new 600 volt loads, a new 45 KVA transformer as well as the two existing panels. The new 45 KVA transformer will be used to feed a new 120/208 volt distribution panel.

Currently a 90 KW generator and an automatic transfer switch are installed to provide power to the wastewater treatment facility in the event of a utility power failure. With the addition to both the waste water treatment process and the addition to the building it was determined that this generator would not be large enough to provide standby power. As a result this generator will be removed and will be replaced with a new 200 KW generator as well as a new 400 amp transfer switch.

Variable frequency drives will be installed on 600 volt motors where possible in order to improve control functionality as well as energy efficiency. In order to reduce cost, the variable frequency drives will be wall mounted. Each variable frequency drive will be equipped with a line side reactor in order to minimize the harmonics that are placed back on to a relatively small electrical system. Local motor disconnects will be installed, where feasible, to make motor maintenance as simple as possible.

3.6.5.2. LIGHTING & BUILDING SERVICES

The new 120/208 volt distribution panel will be used to feed all of the lighting and building services in the expanded portion of the building. All new 120/208 volt miscellaneous building, mechanical and process loads will be fed from this new panel. Standard building services such as switches and receptacles will be included in this design.

The interior lighting for the expanded portion of the building will be included in this design (including the design of emergency lighting). Site lighting will be upgraded for the existing building and new site lighting will be included in the design for the expanded portion. Exit lighting for the expansion will be included in the design and exit lighting in the existing portion will be upgraded where it has become necessary due to the expansion.

3.6.5.3. SCADA & CONTROLS

Several PLC panels are installed in the plant. These are used for process control and monitoring. The MicroLogix 1500 PLC that is currently being used for process control will be replaced with a compact logix controller. I/O cards will be added as necessary to incorporate all new I/O connections. The Allen Bradley PanelView 300 graphic terminal will be modified to display the new equipment. Remote alarming will be used to provide off-site operators with both critical and non-critical alarms from each station. The MicroLogix 1500 PLC that is currently being used for control of the mechanical building services will be replaced with a Compact Logix controller. New I/O modules will be added as necessary to accommodate the new mechanical equipment required for the building expansion. The existing PanelView 300 will be removed along with all of the lights and switches that are currently in the panel door. All of this control will be accomplished via a new PanelView 12.1". Due to a lack of space in this panel a new small panel will be added to be used as an I/O wiring box.

Appendix A: Drawings

Drawing A601-1: Floor Plan

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