APPENDIX B
PROCESS NARRATIVE

North End Sewage Treatment Plant (NEWPCC) Hauled Liquid Waste Facility – Phase II Upgrade Process Controls Narrative

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DEFINITIONS

There are a number of abbreviations, terminologies and acronyms used throughout the document. These are defined below:

COW: City of Winnipeg

DCS: Distributed Control System – Existing programmable control system in the North End Sewage Treatment Plant

H2S: Hydrogen sulfide, a toxic gas.

HC: Hydrocarbon, molecules which can create an explosive atmosphere when in concentrations between the LEL (Lower Explosive Limit) and the UEL (Upper Explosive Limit).

HW: Hauled Wastewater.

HWB1: Hauled Wastewater Building No. 1.

HWB2: Hauled Wastewater Building No. 2.

HWC: Hauled Wastewater Building programmable controller.

HWC1: Controller located in Hauled Wastewater Building 1 used to monitor and control various aspects of the hauled wastewater receiving facilities and access to receiving Lane #1, Lane #2. It is part of the central control system, connected to the plant DCS network and OWS via Modbus TCP protocol.

HWC2: Controller located in Hauled Wastewater Building 2 used to monitor and control various aspects of the hauled wastewater receiving facilities and access to receiving Lane #3, Lane #4. It is part of the central control system, connected to the plant DCS network and OWS via Modbus TCP protocol.

HWIC1: Hauled Wastewater Industrial Computer 1 in HWB1. The computer is linked to the pedestal displays in Lane 1 and is also connected to the plant communication network. The industrial computer logs and time stamps events related to Lane 1 of the receiving facility and also creates transaction records.

HWIC2: Hauled Wastewater Industrial Computer 2 in HWB1. The computer is linked to the pedestal displays in Lane 2 and is also connected to the plant communication network. The industrial computer logs and time stamps events related to Lane 2 of the receiving facility and also creates transaction records.

HWIC3: Hauled Wastewater Industrial Computer 3 in HWB2. The computer is linked to the pedestal displays in Lane 3 and is also connected to the plant communication network. The industrial computer logs and time stamps events related to Lane 3 of the receiving facility and also creates transaction records.

HWIC4: Hauled Wastewater Industrial Computer 4 in HWB2. The computer is linked to the pedestal displays in Lane 4 and is also connected to the plant communication network. The industrial computer logs and time stamps events related to Lane 4 of the receiving facility **including hauled wastewater and leachate**, and also creates transaction records.

HWCP1: Control panel located in Hauled Wastewater Building #1. Panel contains the HWC1, input and output cards, communication hardware, and HWIC1 and HWIC2.

HWCP2: Control panel located in a Hauled Wastewater Building #2. Panel contains the HWC2, input and output cards, communication hardware, and HWIC3 and HWIC4.

HMI: Human machine interface. HWCP1, HWCP2, and LCP each contain an HMI.

LC: Leachate Sampling Building programmable controller, part of the central control system, connected to the plant DCS network, OWS, and HMI via Modbus TCP protocol. Controller used to monitor and control various aspects of the leachate receiving facilities and access to receiving Lane #4.

LCP: Control panel located in the Leachate Sampling Building. Panel contains the LC, input and output cards, and communication hardware.

OWS: Operator workstation computer interface located in the main digester control room.

In Service/Out of Service: Available modes for equipment used in the process control system such as control valves, pumps, gates etc. The equipment can be manually switched between modes at the OWS. If there is an equipment failure, that piece of equipment will be automatically placed in the Out of Service mode and will require the operator to place the system back to In Service mode at the OWS once the fail condition has been reset.

Automatic Mode: Equipment is under control of the control system and will respond to various changes in the process environment.

Manual Mode: Equipment is under manual control – changes to equipment state can be made at the OWS. The system will not automatically respond to changes in the process environment. This situation should be avoided when possible, and equipment left in Automatic Mode.

1.0 HAULED WASTEWATER RECEIVING SYSTEM

1.1 SYSTEM DESCRIPTION

The Hauled Wastewater Receiving System includes 3 dedicated receiving lanes and 1 lane that is shared with the Leachate Receiving System. Lanes 1 and 2 are served by Hauled Wastewater Building 1. Hauled wastewater from Lane 3 is directed to Hauled Wastewater Building 2. Lane 4 can be used to dump hauled wastewater if a truck arrives and there is no leachate truck currently in Lane 4. This lane's primary purpose is to be a leachate receiving lane. Hauled wastewater received in Lane 4 is directed to Hauled Wastewater Building 2.

Hauled wastewater is dumped into the receiving manhole, and flows by gravity into the holding tank. The wastewater is allowed to collect in the holding tank until the tank is 1/3 full, at which point the automated discharge valve opens to empty the holding tank into the gravity system that drains into the facility main interceptor sewer. The tank is allowed to reach 1/3 full prior to allowing the hauled wastewater into the interceptor sewer so that hydrocarbons can be detected prior to being introduced into the facility's treatment process. If hydrocarbons are detected, the tank discharge valve will be locked shut and the offending truck operator will be required to transfer the holding tank contents back into the truck via a cam-lock connection provided for this purpose at the exterior of the building.

As the hauled wastewater passes through the influent piping upstream of the holding tank, an automatic sampler inside the Hauled Wastewater Building takes a series of samples from the load and stores them for subsequent testing. In addition, a flow meter measures the volume of wastewater and records the total volume of each load.

A flushing water assembly provides flushing water to help maintain clear and unobstructed wastewater piping. Flushing water is injected at three separate locations at specific times in the truck dump sequence and at regularly scheduled off-peak hours: in the influent pipe upstream of the flowmeter, at the head of the holding tank, and in the holding tank discharge pipe upstream of the discharge valve.

A table summarizing the key Hauled Wastewater Receiving System equipment and its associated tag numbers follows. Where similar equipment is located in various locations, the Lane 1 tag and location is provided first, followed by the other lanes' equipment.

EQUIPMENT	FUNCTION/DESCRIPTION	TAG NUMBER	LOCATION
Entrance gate	Automatic barrier allowing access to trucks when the lane is open	XZ-Y800 XZ-Y810 XZ-Y830 XZ-Y840	Lane 1 entrance Lane 2 entrance Lane 3 entrance Lane 4 entrance
Receiving manhole	Accept hauled wastewater from truck	MH 1 MH 2 MH 4 MH 7	Lane 1 Lane 2 Lane 3 Lane 4
Flow meter	Measure and record volume dumped into Holding Tank for each truck load	FE-Y113 FE-Y123 FE-X123 FE-X113	HWB1 Lane 1 HWB1 Lane 2 HWB2 Lane 3 HWB2 Lane 4
Automatic sampler	Take samples from each load passing through Holding Tank and store them in the attached refrigerator	S-Y910 S-Y920 S-Y930 S-Y940	HWB1 Lane 1 HWB1 Lane 2 HWB2 Lane 3 HWB2 Lane 4
Level instrument	Measure level in each Holding Tank	LE-Y111 LE-Y121 LE-X121 LE-X111	HWB1 Lane 1 HWB1 Lane 2 HWB2 Lane 3 HWB2 Lane 4
Flushing water flow meter	Measure the flow rate and volumes of flushing water used by the hauled wastewater and leachate receiving buildings	FE-Y114	Located in the Sludge Dewatering building
Influent pipe flush valve	Allow flushing water into Holding Tank influent piping upstream of the flow meter	XV-Y781 XV-Y791 XV-Y784 XV-Y794	HWB1 Lane 1 HWB1 Lane 2 HWB2 Lane 3 HWB2 Lane 4
Holding tank flush valve	Allow flushing water into the upper end of Holding Tank	XV-Y782 XV-Y792 XV-Y785 XV-Y795	HWB1 Lane 1 HWB1 Lane 2 HWB2 Lane 3 HWB2 Lane 4

EQUIPMENT	FUNCTION/DESCRIPTION	TAG NUMBER	LOCATION
Holding tank discharge flush valve	Allow flushing water into Holding Tank discharge piping / discharge valve	XV-Y783 XV-Y793 XV-Y786 XV-Y796	HWB1 Lane 1 HWB1 Lane 2 HWB2 Lane 3 HWB2 Lane 4
Holding tank discharge valve	Keep contaminated loads from entering treatment process	XV-Y211 XV-Y221 XV-Y231 XV-Y241	HWB1 Lane 1 HWB1 Lane 2 HWB2 Lane 3 HWB2 Lane 4
Hydrocarbon sensor	Detect presence of hydrocarbon gases within Holding Tank	AE-Y114 AE-Y124 AE-Y133 AE-Y143	HWB1 Lane 1 HWB1 Lane 2 HWB2 Lane 3 HWB2 Lane 4
Exit gate	Automatic barrier allowing trucks to exit lane after dumping their load provided no hydrocarbon gases are detected	XZ-Y805 XZ-Y815 XZ-Y835 XZ-Y845	Lane 1 exit Lane 2 exit Lane 3 exit Lane 4 exit
Lane exit signage	Two color traffic control display (red/green) signaling to trucks whether they may or may not exit the lane.	XL-Y805 XL-Y815 XL-Y835 XL-Y845	Lane 1 exit Lane 2 exit Lane 3 exit Lane 4 exit
Leachate flushing valve (manual)	Allows for flushing of the Leachate piping and flow meter.	HV-X950	Leachate Sampling Building (LSB)

Following is a listing of the Hauled Wastewater Receiving System P&ID drawings:

1-0101Y-A0001-001 Sheet 6 of 20 HWB1 Receiving Manholes and Holding Tanks

1-0101Y-A0002-001 Sheet 7 of 20 HWB1 Miscellaneous Systems

1-0101Y-A0005-001 Sheet 8 of 20 HWB1 Heating Pump P-Y640

1-0101Y-A0008-001 Sheet 9 of 20 HWB2 Receiving Manholes and Holding Tanks

1-0101Y-A0009-001 Sheet 10 of 20 HWB2 Wastewater Effluent

1-0101Y-A0010-001 Sheet 11 of 20 HWB2 Miscellaneous Systems

1-0101Y-A0011-001 Sheet 12 of 20 HWB1 Heating Pump P-X640

1.1.1 GATE ACCESS CONTROL

Four lanes designated Lane No.1, Lane No.2, Lane No.3, and Lane No.4 are available to receive hauled wastewater from authorized wastewater haulers. Lane control is accomplished by access stations c/w touch screen displays and number keypad interfaces for the haulers to enter a PIN code, and entrance gates (XZ-Y800, XZ-Y810, XZ-Y830, XZ-Y840) and exit gates (XZ-Y805, XZ-Y815, XZ-Y835, XZ-Y845) with in-ground vehicle proximity sensors. Security video monitoring is in place at the entrance and exit of each lane to visually monitor and record vehicle arrivals and departures. The lane entrance camera views the haulers as they interact with the access keypads and as they discharge their wastewater, and give a view of the lane exit gates and lane exit signage (XL-805, XL-815, XL-835, XL-845).
Various messages will be displayed on the HMI pedestal at the entrance to each lane to provide feedback to the truck haulers. The messages are indicated in the following table and will be referred to by their corresponding message ID in the remainder of this document.

Message ID	Message Wording
<Bad Quality>	Out of Service
1	Lane open. Please enter access code.
11	Accepted. Please proceed to receiving manhole.
21	Lane Occupied. Please wait.
31	Lane temporarily down for cleaning.
41	Out of Service
51	Holding Tank Hydrocarbon Contamination! LANE CLOSED!

The display will normally show one of the valid messages corresponding to the state as detected by the HWC. In the case of a communication error between the HWC and the HWIC the <Bad Quality> message will be displayed and the lane will be locked out from accepting future access code entries until communication is restored and a valid message can then be displayed. Additionally, the display will go dark (or sleep mode) after an adjustable time delay, this will require the hauler to touch the screen to activate the system and restore a valid message.

1.1.2 RECEIVING MANHOLES & HOLDING TANKS

Each lane contains a receiving manhole (MH-1 in Lane 1, MH-2 in Lane 2, MH-4 in Lane 3, and MH-7 in Lane 4) designed to accept hauled wastewater from trucks. The wastewater is conveyed through a gravity piping system to a corresponding holding tank within one of the

Hauled Wastewater Buildings, designated Holding Tanks No.1, No.2, No.3, or No.4, respectively. Flowmeters on each pipe (FE-Y113, FE-Y123, FE-X123, FE-X113) allow for flow/volume monitoring to the tanks while sampling stations allow COW staff to test and monitor the contents of the incoming wastewater. In addition, hydrocarbon sensors in each holding tank (AE-Y114, AE-Y124, AE-Y133, AE-Y143) continuously analyze the ambient tank air for hydrocarbon concentrations. Level sensors (LE-Y111, LE-Y121, LE-X121, LE-X111) monitor the liquid level in each holding tank. Collected wastewater from each holding tank discharges through a 300 mm diameter IPS Type 316L Schedule 10 stainless steel effluent pipe into the facility main interceptor sewer via MH-3 (for Lanes 1 and 2), MH-3A (for Lane 3), and MH-6 (for Lane 4). Flow discharge through each pipe is controlled by an electric actuated valve.

1.1.3 SAMPLING SYSTEM

Automatic samplers (S-Y910, S-Y920, S-Y930, S-Y940 for lanes 1, 2, 3, and 4) are located adjacent to each flowmeter (FE-Y113, FE-Y123, FE-X123, FE-X113) on the 250 mm diameter pipe from the receiving manholes to the holding tanks. The sampling stations use Hach AS950 refrigerated automatic samplers to draw a 25 cc sample from the pipe continuously during the discharge period. The samplers are capable of operating in two ways: composite sampling and individual sampling.

Composite sampling consists of collecting a daily composite sample to aid in process control. The sampler is fitted with 10 liter composite sample collection vessel mounted inside a refrigerator with a top-side port hole to allow for a polyethylene sample transport tube between the sampler and sample collection vessel.

Individual sampling requires replacing the composite sample collection vessel in the refrigerator with a sample collection carousel consisting of 24 – one liter polyethylene sample containers. The PLC monitors flow in the pipe and only triggers a sample when there is flow in the pipe, preventing the sampler from operating if there is a temporary interruption in flow. Individual hauler collected samples are deposited into their respective container located inside a refrigerator. After 24 loads of hauled wastewater are sampled, the operator or laboratory personnel must remove the sample bottles and replace them with new bottles, or sampling of future loads will be disabled until the sampler carousel is emptied.

A 50 mm ball valve with cap and chain is located downstream of the automatic samplers to allow manual samples to be drawn from the influent pipe.

The hauled wastewater facility will be run almost exclusively utilizing the individual sampling method.

1.1.4 FLUSHING SYSTEM

Flushing water to the two Hauled Wastewater Buildings and the Leachate Sampling Building is sourced from the existing flushing water system located in the Sludge Dewatering Building. A

flow meter (FE-Y114) within the Sludge Dewatering Building allows flow/volume monitoring of all truck haul receiving facilities combined.

The flushing system allows flushing at three distinct points in each Hauled Wastewater Building and one location in the Leachate Sampling Building. Within the Hauled Wastewater Buildings, flushing capability is available upstream of each influent flow meter (XV-Y781, XV-Y791, XV-Y784, XV-Y794), at the upper end of each tank (XV-Y782, XV-Y792, XV-Y785, XV-Y795), and at each tank's discharge valve to clear the valve of debris (XV-Y783, XV-Y793, XV-Y786, XV-Y796). The Leachate Sampling Building has a flushing water connection upstream of the leachate influent flow meter.
The hauled wastewater discharge valve operation and flushing sequence in between successive truck dumps is as follows:

- Tank discharge valve (XV-Y211, XV-Y221, XV-Y231, XV-Y241) to be closed prior to truck being allowed to enter the lane.

- Assuming no LEL's are detected, when the holding tank reaches 1/3 full, open the tank discharge valve.

- If LEL's are detected by the combustible gas analyzer (AE-Y114, AE-Y124, AE-Y133, AE-Y143), the tank discharge valve (XV-Y211, XV-Y221, XV-Y231, XV-Y241) will remain closed and no flushing operations will be initiated. An alarm is triggered and the hauler will be required to drain the contents of the holding tank back into the truck via the truck's vacuum pump and a separate camlock connection point above grade at the HW building.

- Once a truck has finished discharging, as determined by a sustained "no flow" measurement by the tank influent flow meter (FE-Y113, FE-Y123, FE-X123, FE-X113) (operator adjustable) for a period of 20s (adjustable), and the holding tank having reached a level of 1/3 full (operator adjustable), initiate flushing of the influent piping and flow meter for 20 seconds (operator adjustable). A predetermined volume (operator adjustable) is subtracted from the truck's volume total to account for the flushing water volume through the flow meter. Note that the flushing sequence will not be initiated for small loads that do not fill the holding tank to 1/3 capacity.

- When the holding tank empties as measured by the tank level instrument (LE-Y111, LE-Y121, LE-X121, LE-X111), open the discharge flushing valve (XV-Y783, XV-Y793, XV-Y786, XV-Y796) to flush water through the tank discharge valve (XV-Y211, XV-Y221, XV-Y231, XV-Y241).

- When the truck triggers the exit gate (XZ-Y805, XZ-Y815, XZ-Y835, XZ-Y845) proximity loop, close the tank discharge valve. The tank discharge flushing valve is commanded to close 30 seconds after the 300ø tank discharge valve starts to close (operator adjustable).

- Allow the subsequent truck access into the lane when the tank discharge valve has completely closed.

The frequency of the above flushing sequence is operator adjustable (one flush for every *nn* discharges), so that the flushing operation need not be performed for every load, depending on the needs of the City.

In addition to the above flushing sequence intended for regular use after every hauled wastewater load, an additional "large flush" will be preprogrammed to occur at regular intervals (at a selectable time every *nn* days). This interval will be operator adjustable, but initially set to occur every night during off-peak hours. The "large flush" procedure entails:

- Confirm the tank discharge valve (XV-Y211, XV-Y221, XV-Y231, XV-Y241) is closed.
- Initiate flushing of the influent piping and flow meter for 30 seconds (operator adjustable). Influent flush valve is signaled to close after being fully open for the 30 seconds.
- After the influent pipe has been flushed for 30 seconds, initiate filling of the tank via the flushing water supply valve (XV-Y782, XV-Y792, XV-Y785, XV-Y795) at the upper end of the tank.
- When the tank level is measured over 75% full (operator adjustable), for a period of 10 s (operator adjustable), close the flushing water supply valve to the upper end of the tank and open the holding tank discharge valve (XV-Y211, XV-Y221, XV-Y231, XV-Y241).
- Once the measured holding tank level drops below a setpoint, initiate flushing of the holding tank discharge valve via the discharge flushing valve (XV-Y783, XV-Y793, XV-Y786, XV-Y796) and spray nozzle. The discharge flushing valve shall remain open for an operator selectable period of time after the valve close command has been issued. This will initially be set to 30 seconds.
    - If the tank discharge valve closes before the discharge flushing valve, then the discharge flushing valve is signaled to close.
- The tank discharge valve (XV-Y211, XV-Y221, XV-Y231, XV-Y241) closes when the tank has emptied.
- The proposed control narrative will complete the "large flush" for each holding tank in sequence, allowing one tank's flushing sequence to complete before initiating the flushing sequence of the next tank. In general, only one large flushing water valve will be open at any given time, to limit pressure drops in the flushing water system.
- If any of the four holding tanks is in the midst of a large flush cycle at 7:00 am, Monday to Friday, that flushing cycle and any remaining large flush cycles in the queue are aborted. The large flush cycle for the holding tank with the previously aborted cycle is reinitiated that night and the sequence continues for the other 3 hauled wastewater tanks.

All electrically actuated valves on each discharge system are capable of modulating so that the valves can be used to limit flushing water flow for the sake of existing connected systems. These will initially be set to either fully open or closed, but the exact operational parameters of these valves will be determined during commissioning.

The ability to flush the Leachate Sampling Building influent piping is provided by a manually actuated valve (HV-X950). Flushing of this system is done on a periodic basis as part of regular maintenance or on an as needed basis. A check valve on the flushing water line helps prevent any foam that may develop in the leachate piping from entering the flushing water piping.

1.2 LANE NO.1 CONTROLS NARRATIVE

1.2.1 HAULED WASTEWATER RECEIVING & ACCESS CONTROL SYSTEM

The following is a sequence of operation for hauler trucks utilizing Lane No.1:

- Truck pulls up to entrance gate (XZ-Y800) and observes message display on touchscreen. Message display will read one of the messages indicated in the Table in Section 1.1.1. The PIN keypad will only accept keypad inputs when the lane is empty and in a normal (non-fault) status. Once the lane clears and Tank Discharge Valve (XV-Y211) is closed, the message display shows Message ID#1 and the driver enters the access code on the keypad. If the access code is accepted message display changes to message ID #11 and the Entrance Gate opens. When the truck clears the entrance gate (XZ-800) proximity loop, the gate closes.

- The control system records a time stamped event for truck ID, and sampler carousel position. Truck proceeds to Receiving Manhole No.1. The Entrance gate closes and message display changes to message ID #21.

- Hauler begins dumping hauled wastewater into Receiving Manhole No.1. The Holding Tank Discharge Valve (XV-Y211) remains closed during this process.

- Wastewater begins collecting in Receiving Manhole No.1 and flowing into Holding Tank No.1. Hydrocarbon Sensor (AE/AIT-Y112) continuously monitors for HC gas in the holding tank. Refer to section 1.2.2 for sequence of operation during hydrocarbon detection alarm. HWC1 begins totalizing wastewater volume flowing through the pipe into the holding tank as sensed by Flowmeter (FE-Y113).

- The Level instrument (LE-Y111) monitors level in Holding Tank No.1. When holding tank level reaches 1/3 full (operator selectable setpoint) and no HC are detected, Tank Discharge Valve (XV-Y211) opens and wastewater begins flowing from Holding Tank No.1 to Receiving Manhole No.3 and on to the facility main interceptor sewer. For cases where hauler truck wastewater volume is insufficient to fill holding tank 1/3 full, Tank Discharge Valve (XV-Y211) opens when the truck exits the lane as detected by the exit gate (XZ-Y800) proximity loop. The valve does not open when the truck triggers the exit gate proximity loop if the valve already opened during the dump due to the holding tank reaching 1/3 full.

- Once Holding Tank 1 reaches 1/3 full, the flushing sequence becomes active and will trigger based on the following control narrative.

- Influent Flush Valve (XV-Y781) opens if Flowmeter (FE/FIT-Y113) registers a stoppage in flow ("no flow" initially set to flow of 2 L/s or less, but operator adjustable) that lasts for 20 s

(operator adjustable). Once fully opened, this valve remains open for 20 seconds before returning to its closed position (operator adjustable).

- When Level Sensor (LE-Y111) reads a level of 100 mm or less (operator adjustable) for a period of 10 s (operator adjustable), Tank Discharge Flush Valve (Y783-XV) opens to begin flushing Tank Discharge Valve (XV-Y211) of debris.

- The Hauler completes the discharge and proceeds to exit gate (XZ-Y805) where 2-state message display (XL-Y805) will by default be indicating a green "↑"arrow. The truck is permitted to exit the gate which is normally open, via an Open command from the PLC. When the truck crosses exit gate (XZ-805) proximity loop, the control system receives a signal and the flow totals, sampler carousel position and time of departure are recorded.

- With the truck having triggered the exit gate (XZ-Y805) proximity loop, once LE/LIT-Y111 reads Holding Tank 1 being empty, Tank Discharge Valve (XV-Y211) begins to close while Tank Discharge Flushing Valve (XV-Y783) remains open to flush the valve.

- Tank Discharge Flush Valve (XV-Y783) closes 30 seconds (adjustable) after the command to close Tank Discharge Valve (XV-Y211) is initiated.

- If the "no flow" condition at the flowmeter (FE-Y113) remains for 30 minutes (operator adjustable) and the exit loop is not triggered a message "Vehicle still present in Lane 1 30 minutes after discharge stopped" is generated on the HMI and at the OWS to notify operators and the Tank Discharge Flushing Valve (XV-Y783) closes.

- A transaction is created based on the data recorded as the truck entered the dumping facility and the data recorded as the truck left the facility. If the sampler (S-Y910) carousel position at the start of the transaction and at the end of the transaction does not match, the system will record the transaction and include a "Sampler Carousel Mismatch" flag.

- System resets and Lane No.1 is now ready to receive another truck. Entrance gate message display changes to Message ID #1 and the process is repeated.

1.2.2 HYDROCARBON ALARM SYSTEM

Hydrocarbon Sensor (AE-Y114) continuously monitors for HC gas concentrations (%LEL) in Holding Tank No.1. Upon detection of hydrocarbon gas at 25% LEL, the following sequence of operation is initiated:

- Alarm is generated by the HWC1 which activates panel buzzer (XA1-Y725) on the HWCP1. The alarm is annunciated at the HMI and the OWS. Operator may silence buzzer from reset pushbutton (HS-Y725) on panel, from the HMI, or from the OWS.

- Outdoor alarm beacon (QA-Y726) located on the Hauled Wastewater Building 1 side facing Lane 1 activates and lane exit signage (XL-Y805) illuminates a flashing red "X".
- Entrance gate (XZ-Y800) and exit gate (XZ-Y805) lock closed.
- Entrance gate industrial monitor message display changes to Message ID #51. In addition, monitor will display operator's telephone number.
- Holding Tank No.1 Discharge Valve (XV-Y211) closes (or remains closed).
- Wastewater hauler is responsible for retrieving and removing the contaminated wastewater from the receiving manhole and holding tank.
- Lane No.1 remains locked down until the manhole and holding tank are empty (FE-Y113 reads no flow for 30 s (adjustable) and tank level sensor (LE-Y111) reads empty for 30 s (adjustable)), the hydrocarbon alarm clears, and a COW operator manually resets the system through the system interface at the OWS or HMI. The control system closes the transaction and records the transaction as a rejected load due to Hydrocarbon detection.

1.2.3 SAMPLING SYSTEM

Automatic sampler (S-Y910) located adjacent to flowmeter (FE-Y113) on the 250 mm diameter pipe from Receiving Manhole No.1 to Holding Tank No.1 is intended to operate primarily as an individual sampling station. HWC1 monitors and controls the following signals:

- Initiate sample digital pulse output command;
- Sampler in "Auto" digital input;
- Sampler "Loss of Power" digital input;
- Rotate sampler carousel digital output command;
- Sampler carousel rotated one bottle position (15o) digital input
- Sampler carousel home position (360^{o}) digital input.
- Sampler system carousel reset pushbutton.
- Missed sample
- Purge failure
- Jammed distributor

The following is a sequence of operation for the sampler system:

- Operators ensure sufficient individual sample collection containers are available in the refrigerator, system is set to "Individual" operation mode in the OWS and sampler manual isolation valve (HV-Y911) is open.

- Sampling operation initiates from wastewater flow detection by flowmeter (FE-Y113) greater than 8 L/s (adjustable) for a period of at least 10 s (operator adjustable).

- The PLC signals the sampler to collect 25cc samples periodically during wastewater discharge. Sampling frequency set by operator selectable timer setpoint located in the sampler control panel, initially set at 6 seconds. Based on the 25cc sample size, and the one liter sample container the system will not allow more than 40 samples/truck. This will be achieved through a time based formula, time/sample * 40 samples = total time sampler enabled. The sampler will be set up to sample once every 6 seconds, therefore the sampler will be enabled for 6 x 40 = 240 seconds as a maximum.

- Upon completion of wastewater discharge the truck will exit the lane and is detected by exit gate proximity (ZX-Y805), this will signal the transaction to be completed and the HWC1 signals the carousel to rotate one position to the next empty container.

- The HWC generates notice when carousel has rotated through 24 sampler bottles and no empty containers are available. A message indicating "Lane #1 sampler carousel full" is generated at the OWS and HMI. The operator must remove full bottles from carousel, replace with empty ones and reset system from manual reset pushbutton on HWCP or OWS. Unavailability of containers does not inhibit normal operation of the rest of the hauled wastewater receiving system.

- The control system monitors the position of the sampler carousel and provides an alarm and warning e-mail when the carousel is at position 20 of 24, indicating "Hauled Wastewater Lane #1 Sampler Carousel nearly full – please clean carousel"

- The carousel cleaning procedure will be to press the stop button on the control panel near the carousel. The button will illuminate, indicating that the carousel and sampler have been locked out and that it is safe to clean out the used bottles from the carousel.

- At this point the display at the entrance pedestal will read Message ID#31.

- The City staff will then be required to remove all used containers from the sampling carousel and possibly clean the sampler. Once the sampling carousel has been cleaned and new containers inserted, the staff will be required to pull out the stop button. This will signal the HWC to move the sampling carousel to the home position and also will change the entrance pedestal display to read message ID#1.

- HWC1 monitors the sampler (S-Y910) for fault conditions which indicate that the sampler is Out of Service.
    - After a command from the PLC to advance the carousel position, the PLC monitors for a successful "rotated one bottle position" signal. If this is not received within 45s (adjustable) a fault message "Lane #1 (S-Y910) sampler carousel rotation failed to complete within timer" is annunciated on the HMI and on the OWS.
    - The sampler is also monitored for "Not in Auto" condition, "Loss of Power" condition, "Missed Sample" signal, "Purge Failure" signal, and "Jammed Distributor" signal. On the occurrence of a fault, the fault type is displayed on the HMI and the OWS.
    - The command to initiate a sample is inhibited while a fault condition exists.
    - A truck carrying out a discharge is allowed to finish and leave the lane but Message ID#41 is displayed at the entrance gate and no trucks are permitted to enter the lane.
    - When all faults are cleared the system resumes normal operation.

1.2.4 LANE INTERLOCKS AND LOCKOUT CONDITIONS

The control system monitors various conditions of the equipment used in the Hauled Wastewater receiving lane to generate lane lockout conditions as noted below:

- Holding tank level transmitter (LE-Y111) Failure
- Holding tank high level alarm (LSH-Y111)
- Flow Meter (FE/FIT-Y113) Fault
- Holding Tank Discharge Valve (XV-Y211) not in Auto Mode
- Holding Tank Discharge Valve (XV-Y211) Not in Service
- Building Sump Pit High Level Alarm (LSH-Y560)
- Building Flood Alarm (LH-Y700)
- Sampler (S-Y910) not in Auto Mode
- Sampler (S-Y910) Not In Service
- Communication error between HWC1 and HWIC1.

In addition to locking out the lane in any of the above conditions, the pedestal display at the lane entrance gate will read message ID #41 and "Please call 204-XXX-XXXX for instructions". The phone number in the message will be defined by the City of Winnipeg. The HMI and OWS will display the relevant alarm message.

1.2.5 LANE TEST MODE

Maintenance staff will have a test mode access code. This will trigger a mode in HWC1 that will operate the lane controls as if a truck hauler was using the lane, with the exception that the sampler will not be initiated. The system will simulate a flow of 80L/s for four minutes and record events and transaction creation will proceed as if the system were operating normally.

1.3 LANE NO.2, 3, AND 4 HAULED WASTEWATER CONTROLS NARRATIVE

1.3.1 HAULED WASTEWATER RECEIVING & ACCESS CONTROL SYSTEM

The control narrative for all lanes receiving hauled wastewater is similar. The following table of equivalency can be used in conjunction with the control narrative for Lane 1 to understand the control narrative for the other lanes. There is a separate control narrative for Lane 4 when that lane is being used by a leachate hauler.

TABLE 1.3.1.1 - LANE CROSS REFERENCES

	LANE 1 HAULED WASTEWATER	LANE 2 HAULED WASTEWATER	LANE 3 HAULED WASTEWATER	LANE 4 HAULED WASTEWATER
Entrance Gate	XZ-Y800	XZ-Y810	XZ-Y830	XZ-Y840
Receiving Manhole	MH-1	MH-2	MH-4	MH-7
Receiving Tank	Holding Tank 1	Holding Tank 2	Holding Tank 3	Holding Tank 4
Flowmeter	FE/FIT-Y113	FE/FIT-Y123	FE/FIT-X123	FE/FIT-X113
Automatic Sampler	S-Y910	S-Y920	S-Y930	S-Y940
Tank Hydrocarbon Sensor	AE/AIT-Y114	AE/AIT-Y124	AE/AIT-Y133	AE/AIT-Y143
Tank Liquid Level Sensor	LE/LIT-Y111	LE/LIT-Y121	LE/LIT-X121	LE/LIT-X111
Effluent Discharge Destination	MH-3	MH-3	MH-3A	MH-6
Tank Discharge Valve	XV-Y211	XV-Y221	XV-Y231	XV-Y241
Flushing Water Flowmeter	FE/FIT-Y114	FE/FIT-Y114	FE/FIT-Y114	FE/FIT-Y114
Influent Flush Valve	Y781-XV	Y791-XV	Y784-XV	Y794-XV
Tank Flush Valve	Y782-XV	Y792-XV	Y785-XV	Y795-XV
Tank Discharge Flush Valve	Y783-XV	Y793-XV	Y786-XV	Y796-XV
Exit Gate	XZ-Y805	XZ-Y815	XZ-Y835	XZ-Y845
Control Panel Buzzer	Y725-XA1	Y725-XA1	Y730-XA1	Y730-XA1
Buzzer Reset Pushbutton	HS-Y725	HS-Y725	HS-Y730	HS-Y730
Outdoor LEL Alarm Beacon	QA-Y726	QA-Y727	QA-Y728	QA-Y729
Sampler Isolation Valve	Y911-HV	Y921-HV	X921-HV	X911-HV
Sump Pit High Level Alarm	LSH-Y560	LSH-Y560	LSH-Y561	LSH-Y561
Building Flood Alarm	LH-Y700	LH-Y700	LH-Y710	LH-Y710
Outdoor H2S Alarm Beacon	QA-Y725	QA-Y725	QA-Y730	QA-Y730
H2S Sensor	AE-Y900	AE-Y900	AE-Y901	AE-Y901

1.4 HAULED WASTEWATER BUILDING HVAC SYSTEMS

1.4.1 HVAC SYSTEMS

Snow/Ice Melt control for existing Pad-1 for MH-1 and existing Pad-2 for MH-2 shall be upgraded.

For the snow melt system, existing Pad-1 and Pad-2 shall be controlled as one pad. A new slab instrument for measuring temperatures at the slabs and the presence of snow/ice will be provided for each pad (TE1-Y640 and TE2-Y640). The existing 3-way control valve (TV-Y640) shall be replaced with a unit compatible with the PLC system. Existing pump (P-Y640) shall be retained but re-wired to be controlled by HWCP1. The pump will be enabled when outside air

temperature is between 2°C and -15°C (adjustable). On a call for melting from the snow/ice sensor or manual activation, the slab temperature ramp up will start and slowly drive up to the slab temperature setpoint 3°C (adjustable). Slab temperature ramp up shall be based on rate of temperature increase per unit time to prevent concrete slab thermal shock. Control valve (TV-Y640) shall modulate to maintain slab ramp-up schedule.

Alarms will be generated when any of the following conditions occur:

- The pump P-Y640 is at fault or overload
- The slab temperature is beyond two (2) degrees above its set point
- Snow /Ice detector feedback exceeds a preset time three (3) hours (adjustable)
- The glycol water return temperature from either pad is greater than two (2) degrees (adjustable) from the slab temperature

Snow/Ice Melt control for existing Pad-3 for MH-4 and new Pad-4 for MH-7 shall be upgraded.

For the snow melt system, existing Pad-3 and new Pad-4 shall be controlled as one pad. A new temperature sensor and snow/ice sensor will be provided for each pad (TE1-Y660 and TE2-Y660). Existing controls for the 3-way control valve (TV-Y660) shall be replaced with an actuator compatible with the PLC system. Existing pump P-X640 shall be retained but re-wired to be controlled by HWCP2. The pump will be enabled when outside air temperature is between 2°C and -15°C (adjustable). On a call for melting from the snow/ice sensor or manual activation, the slab temperature ramp up will start and slowly drive up to the slab temperature setpoint 3°C (adjustable). Slab temperature ramp up shall be based on rate of temperature increase per unit time to prevent concrete slab thermal shock. Control valve (TV-Y660) shall modulate to maintain slab ramp-up schedule.

Alarms will be generated when any of the following conditions occur:

- The pump P-Y660 is at fault or overload
- The slab temperature is beyond two (2) degrees above its set point
- Snow /Ice detector feedback exceeds a preset time three (3) hours (adjustable)
- The glycol water return temperature from either pad is greater than two (2) degrees (adjustable) from the slab temperature

2.0 LEACHATE RECEIVING SYSTEM

2.1 SYSTEM DESCRIPTION

The Leachate Receiving System includes 1 receiving lane (Lane 4) that is shared with the Hauled Wastewater Receiving System. Leachate from Lane 4 is dumped through a discharge hose which is directly connected to the Leachate Sampling Building receiving piping. A leachate truck will only be allowed into the lane if there is not another truck currently occupying Lane 4. This lane's primary purpose is to be a leachate receiving lane.

Leachate flows by gravity through the Leachate Sampling Building piping directly into the underground facility main interceptor sewer. There is no holding tank or valve to control flow from the truck.

As the leachate passes through the influent piping inside the Leachate Sampling Building, an automatic sampler takes a series of samples from the load and stores them for subsequent testing. In addition, a flow meter measures the volume of leachate and records the total volume of each load.

There is a single flushing water connection inside the Leachate Sampling Building, upstream of the flow meter. The valve controlling flushing water flow is manually controlled from within the building. Flushing water can be allowed into the leachate receiving piping to flush away foam as required and as part of regular maintenance.

A table summarizing the key Leachate Receiving System equipment and its associated tag numbers follows.

EQUIPMENT	FUNCTION/DESCRIPTION	TAG NUMBER	LOCATION
Entrance gate	Automatic barrier allowing access to trucks when the lane is open	XZ-Y840	Lane 4
Flow meter	Measure and record volume of leachate for each truck load	FE-X151	Leachate Sampling Building

EQUIPMENT	FUNCTION/DESCRIPTION	TAG NUMBER	LOCATION
Automatic sampler	Take samples from each load and store them in the attached refrigerator	S-X950	Leachate Sampling Building
Exit gate	Automatic barrier allowing trucks to exit lane after dumping their load	XZ-Y845	Lane 4
Hydrogen Sulphide (H2S) sensor	Monitors ambient air in the building for high levels of toxic hydrogen sulphide	AE-X951	LSB
Combustible hydrocarbon sensor	Monitors ambient air in the building for high levels of combustible hydrocarbons	AE-X952	LSB
Supply fan	HVAC - Supplies ventilation air	F-X691	LSB
Supply fan motorized damper	HVAC - seals fan opening when not running	M-X691	LSB
Exhaust fan	HVAC - Exhausts air	F-X692	LSB
Exhaust fan motorized damper	HVAC - seals fan opening when not operating	M-X692	LSB
Duct heater	HVAC - tempers supply air	DH-X693	LSB
Duct heater	HVAC - tempers supply air	DH-X694	LSB
Unit heater	HVAC - building heating	UH-X603	LSB

EQUIPMENT	FUNCTION/DESCRIPTION	TAG NUMBER	LOCATION
Low temperature switch	HVAC - building protection	TSL-X630	LSB

The following is the Leachate System P&ID drawing:

1-0101X-A0009-001 Sheet 13 of 20 LSB Leachate Sampling Building P&ID

2.1.1 GATE ACCESS CONTROL

One lane designated Lane No.4 is available to receive hauled leachate from authorized leachate haulers. Access to the lane is controlled by a set of entrance and exit barrier gates c/w keypads and proximity sensors. Security video cameras have been installed for monitoring. Various messages will be displayed on the HMI pedestal at the entrance to Lane 4 to provide feedback to the truck haulers. The messages are indicated in the following table and will be referred to by their corresponding message ID in the remainder of this document.

Message ID	Message Wording
<Bad Quality>	Out of Service
1	Lane open. Please enter access code.
11	Accepted. Please proceed to hauled wastewater receiving manhole.
12	Accepted. Please proceed to leachate receiving hose.
21	Lane Occupied. Please wait.
31	Lane temporarily down for cleaning.
41	Lane Out of Service for Hauled Wastewater receiving.
42	Lane Out of Service for Leachate receiving.
43	Lane Out of Service for Hauled Wastewater and Leachate receiving.
51	Holding Tank Hydrocarbon Contamination! LANE CLOSED!

The display will normally show one of the valid messages corresponding to the state as detected by HWC2. In the case of a communication error between HWC2 and the HWIC4, the <Bad Quality> message will be displayed and the lane will be locked out from accepting future access code entries until communication is restored and a valid message can then be displayed. Additionally, the display will go dark (or sleep mode) after an adjustable time delay, this will require the hauler to touch the screen to activate the system and restore a valid message.

2.1.2 RECEIVING APPARATUS

Lane No.4 contains one receiving hose designed to accept hauled leachate from trucks and convey it through a gravity flow based piping system through the Leachate Sampling Building to the main interceptor sewer downstream of MH-6. A flowmeter (FE-X151) allows for flow/volume monitoring while a sampling station (S-X950) allows COW staff to test and monitor the contents of the incoming leachate.

2.1.3 SAMPLING SYSTEM

An automatic sampler (S-X950) is located adjacent to the flowmeter (FE-X151) on the 150 mm diameter pipe within the Leachate Sampling Building. The sampling station uses a Hach AS950 refrigerated automatic sampler to draw a 25 cc sample from the pipe at regular intervals during a truck's discharge period. The sampler (S-X950) is capable of operating in two ways: composite sampling and individual sampling.

Composite sampling consists of collecting a daily composite sample to aid in process control. The sampler is fitted with a 10 liter composite sample collection vessel mounted inside a refrigerator with a top-side port hole to allow for a polyethylene sample transport tube between the sampler and sample collection vessel.

Individual sampling requires replacing the composite sample collection vessel in the refrigerator with a sample collection carousel vessel consisting of 24 – one liter polyethylene sample containers. The system is interlocked so that the Leachate Control Panel (LCP) will only signal the sampler to initiate a sample when there is flow in the pipe, as measured by the flowmeter (FE-X151), preventing the sampler from operating if there is a temporary interruption in flow through the main pipe. Individual hauler collected samples are deposited into their respective container located inside a refrigerator. After 24 loads of hauled leachate are sampled, the operator or laboratory personnel must remove the sample bottles and replace them with new bottles, or sampling of future loads will be disabled until the sampler carousel is emptied. See the control narrative in the following sections for discussion of sampler faults, interlocks, and annunciation.

A 25 mm ball valve with cap and chain is located downstream of the automatic sampler to allow manual samples to be drawn from the influent pipe.

The leachate facility will be run almost exclusively utilizing the individual sampling method.

2.1.4 FLUSHING SYSTEM

The leachate receiving piping has a single flushing water connection located within the Leachate Sampling Building. The flushing process is manually initiated by personnel inside the Leachate Sampling Building. Flushing water introduced into the system flows into the 300ø gravity line and on to the main interceptor sewer.

2.2 RECEIVING HOSE CONTROLS NARRATIVE

2.2.1 LEACHATE RECEIVING & GATE ACCESS CONTROL SYSTEM

The following is a sequence of operation for leachate hauler trucks arriving at Lane 4.

- Truck pulls up to entrance gate (XZ-Y840) and observes message display on industrial monitor. Message display will read message ID#1.
- If all interlocks are satisfied (refer to 2.2.3), the system will accept the hauler's access code.
- The HWPIC4 computer will read the entered code and determine whether it is a valid leachate hauler code, a valid wastewater hauler code, or an invalid code. HWPIC4 will signal one relay (R1) to close if it is a valid wastewater hauler, and another relay (R2) to close if it is a valid leachate hauler. HWCP2 and LCP monitor the relays.
    - If it is an invalid code, the message display indicates "Invalid PIN number. To reach an operator dial (204) XXX-XXXX." for 4 seconds before reverting to Message ID#1 and awaiting a new code entry attempt.
    - If it is a valid wastewater code, controls occur as per the Hauled Wastewater Receiving System control narrative above.
    - If it is a valid leachate code, controls occur as follows.
- Use of a valid leachate access code causes Holding Tank No. 4 Tank Discharge Valve (XV-Y241) to be locked in the closed position until the leachate truck triggers the exit gate proximity loop. If Flowmeter FE -X113 detects flow into Holding Tank No. 4 while a leachate truck is in the lane, an alarm is triggered. Message "Lane 4 leachate truck - flow detected to Hauled Wastewater Tank 4" on the HMI and OWS. Entrance and exit gates (XZ-Y840 and XZ-Y845) lock in the closed position and Lane 4 exit signage (XL-Y845) to flash red.
- The entrance gate (XZ-Y840) opens. Truck proceeds into the dumping area and the entrance gate closes. The message display shows Message ID #21.
- The driver connects the 150ø flexible hose to the truck discharge. The cam-lock connection to the truck should be approximately located over MH-7 so that any spillage can drain away. The small amount of spilled leachate will collect in Hauled Wastewater Building 2 Tank 4, to be mixed and passed through with the next hauled wastewater truck to use that lane. Under no circumstances is a leachate truck to dump directly into MH 7.
- The control system records a time stamped event for truck ID, and sampler carousel position.

- Hauler begins dumping leachate through the flexible hose and Leachate Sampling Building. Leachate flows straight through to the facility main interceptor sewer downstream of MH-6.
- LC begins totalizing leachate volume flowing through pipe as sensed by Flowmeter FE-X151.
- The sampling system (S-X950) takes samples as described below.
- Hauler completes dumping load and proceeds to exit gate Y845 where 2-state message display will by default be indicating a green "↑" arrow. The truck is permitted to exit the normally open gate signaling the control system that the flow totals, sampler carousel position and time of departure can be recorded.
- A transaction is created based on the data recorded as the truck entered the dumping facility and the data recorded as the truck left the facility. Transaction data includes time of truck entry into lane, position of the automatic sampler carousel, load volume, and time of truck exit from lane. If the sampler carousel position at the start of the transaction and at the end of the transaction does not match, the system will record the transaction and include a "Sampler Carousel Mismatch" flag.

2.2.2 SAMPLING SYSTEM

Automatic sampler S-X950 located adjacent to flowmeter FE-X151 on the 150 mm diameter pipe through the Leachate Sampling Building is intended to operate primarily as an individual sampling station. LC monitors and controls the following signals:

- Initiate sample digital pulse output command
- Sampler in "Auto" digital input
- Sampler "Loss of Power" digital input
- Rotate sampler carousel digital output command
- Sampler carousel rotated one bottle position (15^{o}) digital input
- Sampler carousel home position (360^{o}) digital input
- Sampler system carousel reset pushbutton
- Missed sample
- Purge failure
- Jammed distributor

The following is a sequence of operation for the sampler system:

- Operators ensure sufficient individual sample collection containers are available in the refrigerator, system is set to "Individual" operation mode in the OWS and sampler manual isolation valve X951-HV is open.

- Sampling operation initiates from leachate flow detection by flowmeter FE-Y151. A flow greater than 6 L/s (adjustable) for a period of 10 s (adjustable)

- Sampler collects 25cc samples at regular intervals during leachate discharge. The sampling frequency is operator selectable and set by timer setpoint located in the sampler control panel. Based on the 25cc sample size, and the one liter sample container, the system will not allow more than 40 samples/truck. This will be achieved through a time based formula: sampling interval * 40 samples = total time sampler enabled. The sampler will be initially set up to sample once every 10 seconds, therefore the sampler will be enabled for 10 x 40 = 400 seconds as a maximum.

- Upon completion of leachate discharge the truck will exit the lane. The exit gate (XZ-Y845) loop sensor will detect when the truck is gone. This will signal the transaction to be completed and LC signals carousel to rotate one position to the next empty container.

- LC generates notice when carousel has rotated through 24 sampler bottles and no empty containers are available. A message indicating "Lane #4 leachate sampler carousel full" is generated at the OWS and HMI. The operator must remove full bottles from carousel, replace with empty ones and reset system from manual reset pushbutton on LC. Unavailability of containers does not inhibit normal operation of the rest of the leachate receiving system.

- The control system monitors the position of the sampler carousel and provides an alarm warning e-mail when the carousel is at position 20 of 24, indicating "Lane #4 leachate Sampler Carousel nearly full – please clean carousel"

- The carousel cleaning procedure will be to press the red stop button on the control panel near the carousel. The button will illuminate, indicating that the carousel and sampler have been locked out and that it is safe to clean out the used bottles from the carousel. Message ID 31 will display on the HMI pedestal at the entrance to Lane 4 and leachate trucks will not be permitted to enter the lane until the cleaning procedure is completed. Hauled wastewater trucks will still be free to enter Lane 4 and dump into MH 7.

- The City staff will then be required to remove all used containers from the sampling carousel and possibly clean the sampler. Once the sampling carousel has been cleaned and new containers inserted, the staff will be required to pull out the stop button. This will signal the LC to move the sampling carousel to the home position and also will make Lane No. 4 leachate available for use.

2.2.3 LANE NO. 4 INTERLOCKS AND LOCKOUT CONDITIONS

The control system monitors various conditions of the equipment used in the Leachate receiving lane to generate lane lockout conditions as noted below.

- Flowmeter FE-X151 Fault
- Sampler X950 not in Auto Mode
- Sampler X950 Not in Service
- Building Flood Alarm X710-LH

In one (or more) of these conditions, the lane is locked out for further leachate deliveries and the message display shows Message ID 42. These lockouts do not affect the ability of wastewater haulers to dump into Holding Tank No. 4 through MH-7. If there is a lock out condition present in the Lane 4 hauled wastewater receiving system at the same time as there is a lockout in the Lane 4 leachate receiving system, the message display shows Message ID 43 and no traffic can enter the lane.

2.3 LEACHATE SAMPLING BUILDING HVAC, HC AND MISC SYSTEMS

2.3.1 HVAC SYSTEM

The supply fan (F-X691) and the exhaust fan (F-X692) work in tandem to provide ventilation for the building. When the building is occupied, a manual override timer must be triggered to start the fans. The timer maximum setting will be 1 hour. Fans will also start on command from the PLC in the event of manual override at the HMI or OWS, or on high H_2S level (AE-X951) or high LEL level (AE-X952) in the space. A low temperature low limit switch (TSL-X630) will shut the fans down when room temperature is below low-limit setpoint of 12°C (adjustable). The low temp shut down is overriden by high H2S or high LEL.

Fan start sequence begins by opening intake and exhaust motorized dampers (M-X691 and M-X692). When dampers are fully open, damper end switches will trigger power to the fans. Damper shall close when the fan is not running.

Differential pressure sensors will monitor the pressure difference across the filter to monitor the filter loading condition.

Two electric duct heaters (DH-X693 and DH-X694) in series will control the temperature of outside air being supplied to the building. They have packaged air flow sensors, air temperature sensors and modulating control. The first duct heater will automatically turn on when there is proof of air flow and the temperature of incoming air is below 13°C (adjustable). It will modulate to maintain a discharge temperature of 13°C (adjustable). The second duct heater will be controlled (when

there is air flow through the duct heater) as Stage 1 from a programmable two stage heating thermostat. The unit heater (UH-X603) will be controlled as Stage 2. In the event where the outside air temperature is above the first duct heater temperature setpoint, heat will only be provided by the second duct heater (Stage 1).

The electric unit heater will provide heating as controlled by Stage 2 of a wall mounted programmable thermostat. The thermostat will cycle the unit heater on and off to meet room temperature setpoint. Room thermostat setpoint will have a default setting of 17°C (adjustable). The thermostat will have the ability for a manual override of room temperature setpoint. When the thermostat programming reaches the next timing stage, it will revert back to the default programming for room temperature. Note that when the ventilation system is off, the unit heater will be the sole source of heating for the space.

Alarms will be generated when any of the following conditions occur:

- Supply fan (F-X691) has an overload or fault
- Exhaust fan (F-X692) has an overload or fault
- The filter pressure differential is greater than 74 Pa (adjustable) setpoint
- The room temperature (TSL-X630) is below the low limit setpoint of 10°C (adjustable)

2.3.2 COMBUSTIBLE HYDROCARBON SENSING SYSTEM

The Ambient Hydrocarbon Alarm (AE-X952) carries out the following sequence.

If hydrocarbon (HC) levels rise above 5% LEL (adjustable) for a period of 60 s (adjustable), a warning will be annunciated at the HMI and at the OWS and ventilation will operate.

If HC levels rise above 10% LEL (adjustable) for a period of 60 s (adjustable), an alarm will be annunciated at the HMI and at the OWS, and the local LEL beacon over the entrance to the building door will light.

When ambient levels fall below 2% LEL (adjustable) for a period of 1 hour (adjustable), the ventilation returns to normal operation and warnings and alarms are cleared. They are logged on the DCS alarm screen.

2.3.3 MISCELLANEOUS BUILDING SYSTEMS

In addition to the status signals and alarms detailed in the previous sections, a few other miscellaneous building system signals are also brought into the LC as signals:

- Building Low Temperature Alarm (TSL-X630)

- Building Flood Alarm (X710-LH)
- Building Intrusion Alarm (X720-XA)

The Low Temperature, Flood, and Intrusion alarms are annunciated locally on the HMI and remotely on the OWS and are logged on the OWS alarm log.

3.0 OTHER SYSTEMS

3.1 AMBIENT H2S ANALYZERS

One H2S analyzer will be installed in Hauled Wastewater Building 1, one in HWB2, and one in the new Leachate Sampling Building. As H2S gas is heavier than air, the sensors will be located appx 600 mm above floor level.

If H2S levels rise above 5 ppm (adjustable) for a period of 60 s (adjustable), a warning will be annunciated at the HMI and at the OWS and ventilation will be operated at maximum.

TABLE 3.1.1 - H2S SENSOR CROSS REFERENCES

Area	Analyzer	Beacon	Ventilation
HWB1	AE/AIT-Y900	QA-Y725	Y650-MNH
HWB2	AE/AIT-Y901	QA-Y730	X650-MNH
LSB	AE/AIT-X900	X951-QA	F-X691 & F-X692

If H2S levels rise above 10 ppm (adjustable) for a period of 60 s (adjustable), an alarm will be annunciated at the HMI and at the OWS, and the local beacon over the entrance to the building door will light.

When ambient levels fall below 2.5 ppm (adjustable) for a period of 1 hour (adjustable), the ventilation rates return to normal and warnings and alarms are cleared. They are logged in the DCS alarm screen.

4.0 EQUIPMENT SOFT AUTOMATIC/MANUAL MODES

4.1 TWO POSITION AUTOMATIC CONTROL VALVES

Two position control valves will have Automatic and Manual modes available on the OWS. For normal automatic operation the valves should be in automatic mode. The operator can switch to manual mode at the OWS. This will not cause the valve to move. Once the valve has been placed in manual mode, the operator can open or close the valve via software pushbuttons on the screen. The open/close buttons are interlocked in the controller to be deactivated in automatic mode.

4.2 MODULATING AUTOMATIC CONTROL VALVES

Modulating control valves will have Automatic and Manual modes available on the OWS. For normal automatic operation the valves should be in automatic mode. The operator can switch to manual mode at the OWS. This will not cause the valve to move, rather it will hold its current position as the manual setpoint. Once the valve has been placed in manual mode, the operator can change valve position via numeric entry on the screen. The manual position setpoint is interlocked in the controller to be deactivated in automatic mode.

4.3 ENTRANCE CONTROL GATES

Entrance control gates will have Automatic and Manual modes available on the OWS and HMI. For normal automatic operation the gates should be in automatic mode. The operator can switch to manual mode at the OWS or HMI. This will not cause gate to change state. Once the gate has been placed in manual mode, the operator can open the gate via software pushbutton. The gate will automatically close when the proximity loop beneath the gate has been activated, then cleared. The manual open control is interlocked in the controller to be deactivated in automatic mode.

4.4 EXIT CONTROL GATES

Exit control gates will have Automatic and Manual modes available on the OWS and HMI. For normal automatic operation the gates should be in automatic mode. The operator can switch to manual mode at the OWS and HMI. This will not cause gate to change state. Once the gate has been placed in manual mode, the operator can open the gate via software pushbutton. The gate will automatically close when the proximity loop beneath the gate has been activated, then cleared. The manual open control is interlocked in the controller to be deactivated in automatic mode.