

4.5 WASTEWATER LIFT STATIONS

4.5.1 General

The information in this section is intended for use in both urban and rural applications. Gravity systems are the preferred method for wastewater conveyance. Alternative designs using lift stations and forcemains will only be considered if the constraints associated with a gravity system cannot be resolved. Justification for alternative drainage designs must be provided within ASP/ACP documents for the proposed development area. Strathcona County reserves the right to request any level of detail needed to justify the consideration of these systems.

This document was developed to outline the minimum design requirements to build a wastewater lift station for Strathcona County. Recognizing that each lift station operates uniquely, it is the responsibility of the Design Engineer to ascertain that the minimum standards are met and that additional considerations are taken into account for the station to operate as intended.

4.5.1.1 Design Criteria

- (i) General design information should include, but is not limited to, the following:
 - Location and accessibility
 - Service area
 - Average and peak dry weather flows
 - Average and peak wet weather flows
 - Design pump discharge rates
 - Wet well storage capacity
 - Transient pressure analysis
 - Forcemain surge protection devices and valving
 - Wastewater detention times
 - Odour control methods
 - Solids management
 - Staging requirements
 - Operation and maintenance issues
 - Geotechnical requirements
 - Landscaping and Screening requirements
 - Cost estimates
- (ii) Strathcona County servicing standards for design flows are to be followed (refer to [VOL. 1 SEC. 4.2, WASTEWATER COLLECTION SYSTEM, SUB-SECTION 4.2.1](#)), including an analysis of upstream gravity sewer flow and capacity of the trunk sewer system downstream of the lift station discharge to ensure adequate capacity is available in the trunk sewer.
- (iii) Stations are to be designed to provide a 50-year service life. Design must include provisions for dealing with failure of the facility to prevent property damage, environmental damage, and endangerment of public health.
- (iv) Station design must include provisions for upsizing based on development without impacting station operation. Where staging of a lift station is required due to extended periods of development for the contributing area, consideration is to be given to wet well

isolation, temporary pumping, and initial versus final forcemain sizing. Scour velocities in the forcemain must be maintained for all stages of development. Consideration is to be given to sizing the electrical utility service and standby generator for the ultimate requirements of the station. Refer to [SUB-SECTION 4.5.8.2 OF THIS SECTION](#) for more information on standby power requirements.

- (v) Station design must also consider odour generation and mitigation. Odour control requirements are to be discussed with Strathcona County during station design. Mitigation requirements will be reviewed on a case-by-case basis.
- (vi) Landscaping and Screening requirements to be reviewed at each specific site.
- (vii) Station design and configuration shall be in accordance Alberta Environment and Parks Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems, and the design shall be completed by a Licensed Engineer.
- (viii) At time of detailed design, the County will determine if an Air Quality Monitoring System (AQMS) will be required near the lift station. If required, monitoring equipment is to be included with the lift station construction.

4.5.1.2 Configuration

- (i) Wastewater lift stations shall be configured with a wet well/dry well arrangement, with the pumps and valving located within the dry well. Wet well submersible lift stations will be reviewed on a case-by-case basis and should only be considered where the pump motors are less than 75 kW in size and the station invert is less than 8.0 m below grade unless otherwise approved by Strathcona County.
- (ii) All stations require a building for housing electrical and control equipment. The building shall also include provision for a desk, tool storage, and a unisex washroom. Heating and ventilation equipment shall be located within the building or in the dry well. Access to the dry well and wet well areas shall be from separate outside doors.
- (iii) Where renovation of an existing lift station is required, all costs for the removal and disposal of demolished goods shall be included in the contract price. Strathcona County shall have the first right of refusal to salvage any items from the station. The Consultant shall provide a suggested sequence of construction for review by Strathcona County prior to tendering work. Temporary power, temporary pumping, demolition of existing infrastructure, and construction of new infrastructure is to be included. All items related to temporary pumping and temporary power shall be included in the tender documents for pricing by the Contractor.

4.5.2 Civil

4.5.2.1 Location Considerations

- (i) Land Uses
 - For all new development, the land use for a lift station must be a PUL. Lift stations located within the development shall consider proposed adjacent development with respect to visibility, odour, and noise. Lift stations should not be located on school sites or in parks. Additional safety and security measures are required if located on school sites or in parks, to be reviewed and approved by Strathcona County.

- (ii) Floodproofing
 - Lift stations shall be located and designed to remain in operation during all storm events without flooding and must remain accessible in all weather conditions. The main building floor shall be a minimum of 300 mm above the 1:100-year flood elevation of any adjacent waterbody or overland drainage route. All surface drainage shall be designed to be directed away from wastewater manholes and minimize inflow and infiltration into the wastewater system.
- (iii) Site Access
 - Site access and parking areas shall be paved and designed to HS-20 vehicle loading level. Gravel access may be considered in some rural locations with prior approval of Strathcona County. Site access shall be designed in accordance with [VOL. 1 SEC. 4.1, ROADS](#) or [VOL. 1 SEC. 5.1, RURAL TRANSPORTATION](#), as applicable. The minimum width for site access is 6.0 m. Parking area shall have space for two (2) half-ton size vehicles, one (1) tandem axle vehicle similar to a vacuum truck, and a confined space entry (CSE) trailer.
 - A minimum of 4.0 m gravel space around the station shall be provided. A turnaround space on-site designed for a tandem axle vehicle shall be provided if the station is located on a major arterial road to prevent backing vehicles out into traffic. A turning movement diagram must be submitted displaying that vehicles can maneuver around the site without difficulty. This diagram is to be submitted with the detailed design drawings.
- (iv) Building Access
 - Bollards shall be installed on the door apron to protect against damage from vehicles backing into the building. The bollards shall not inhibit vehicle access to the doors for equipment removal. Doors and access hatches shall have suitable locking devices in accordance with the current Strathcona County standards (contact the Strathcona County Representative for more information). All external access hatches shall be padlockable, and all padlocks supplied shall be keyed to suit Strathcona County Operations security key system.
- (v) Site Grading and Drainage
 - Site grading and stormwater management plans shall be provided with the detailed design. The site shall be graded to provide no less than a 2% slope away from the building for surface water drainage and to prevent ponding/icing problems. All slopes and berms must be accessible for mowing at a 4:1 slope. Roof drains and downspouts shall be designed to prevent drainage onto sidewalks or designated walkways, and to carry water a minimum of 1.5 m from the foundation.

4.5.2.2 Site Security

- (i) A chain link security fence shall be installed around the perimeter of the station site. The fence must be a minimum of 1.8 m high and include a 1.0 m wide man-gate and a 4.8 m wide manual sliding gate for access. The gate is to be large enough to permit access of a 10.7 m vacuum truck. Where the use of a slide gate is not practical, a double swing gate may be provided with approval from Strathcona County. All swing gates must swing open all the way and have provision for chains and locks. All gates shall be padlocked and supplied padlocks shall be keyed to suit Strathcona County Operations security key

system. All posts must be set in concrete. All gates must be designed to be self-supporting and designed for winter operation. Refer to [VOL. 1 SEC. 6, OPEN SPACE STANDARDS, SUB-SECTION 6.10](#) for additional fencing requirements.

- (ii) All building signs shall include the Strathcona County logo, and station name. Refer to the most recent edition of the Strathcona County Visual Identity Guide for building sign requirements (contact the Strathcona County Representative for more information).
- (iii) Appropriate signage must be affixed on the fence that details the following information:
 - Building address
 - Strathcona County Utilities contact number or a contact number for the operating group for private lift stations
 - A “No Trespassing” statement

4.5.3 Lift Station Building

4.5.3.1 General

- (i) Exterior walls shall be split-faced concrete block with an air space, insulation, and a structural concrete block wall. Alternatively, a wood frame building with concrete siding may be considered with approval of Strathcona County. The building shall be insulated with an R-30 factor for walls and an R-40 factor for roofs, or in accordance with the most recent edition of the National Energy Code of Canada for Buildings, whichever is more stringent.
- (ii) Lift stations shall have a peaked roof. The roof shall be standing seam metal roofing with a minimum 25-year service life as per the manufacturer's specifications. A wooden truss roof structure and ceiling is preferred, but other roofing systems may be acceptable with approval from Strathcona County.
- (iii) The building exterior elevations should be designed to blend with the surrounding community's aesthetics and align with Strathcona County's preferred colour scheme.
- (iv) Roof penetrations should be avoided where possible and venting penetrations shall be made through walls as codes and regulations permit. Self-shedding roofs should not be sloped toward the side of a building with an access point. If this is not possible, all entrances on the downward slope side of self-shedding roofs shall have awnings to protect individuals accessing the facility. Roof access hatches and engineered tie-off points for fall protection shall be incorporated into the design of all roofs.
- (v) Door openings shall be large enough (width and height) as practical to accommodate the largest piece of equipment, including installation and extraction, while minimizing the disassembly required onsite. Doors shall be heavy-duty tamper resistant insulated hollow metal doors complete with high-quality door seals, where one double door leaf is pinned at the top and bottom. Doors shall be located so that open doors do not impede access walkways. Exterior lock hardware shall meet the current requirements of Strathcona County Operations (contact the Strathcona County representative for more information).
- (vi) The dry well shall be provided with a double door wide enough to facilitate pump removal. Bollards shall be installed inside the building to protect floor hatches if designed for vehicle entry. The wet well access space, wet well platform and wet well sump must be separated from all other areas complete with a gas-tight barrier and separate entrances from outside.

- (vii) The generator room shall be independent from the electrical room. The wet well access space shall be covered but can be enclosed or open to the outside. If enclosed, a permanent ventilation system is required for purging the space at a rate of 30 air changes per hour prior to entering. Access to the space must have sufficient height and width to accommodate a vacuum truck hose.
- (viii) The lift station shall be designed to include the following areas:
 - Wet well
 - Wet well access
 - Wet well platform
 - Dry well
 - Dry well access
 - Electrical room
 - Washroom
 - Meter platform (wet well only stations)
 - Generator room (for generators over 300 kW). Generators less than 300 kW can be located remote from the building in an insulated sound attenuated enclosure.
- (ix) Access hatch covers for all wet wells and dry wells must be gasketed (sealed) to prevent rainwater inflow and to contain odour. Odour-tight stainless hatch covers should be used. All doors shall have concrete entrance pads flush with the bottom of the door and be equipped with appropriate weather stripping.

4.5.3.2 Interior

- (i) Provisions in the design of the lift station shall be made to securely store site-specific spare parts and provide operational storage. Wall space shall be provided for lockout board station, broom, mop and squeegee.
- (ii) All heating and ventilation equipment and valves shall be housed in the building.
- (iii) Interior walls should be constructed from concrete block and are to be painted white. Alternatively, wood frame partitions may be used with metal liner panels. Concrete floors shall be treated with Sika Floor 261 system or approved equivalent. Colour is to be Agate Grey. All floor and walkway surfaces shall be sloped to a point of drainage.
- (iv) Permanent hoist equipment shall be provided to allow for the removal and/or replacement of the sewage pumps, macerator (if equipped), and any other station equipment. The capacity of all lifting equipment is to be clearly posted on the equipment, including the beam, hoist, and hook. Lifting equipment in wet wells shall be designed for additional loading caused by rags and solids in addition to bare equipment weight. Eyebolts in the walls and ceilings are to be provided for rigging chain hoists or come-alongs.
- (v) All monorails, hoists, and cranes to be designed, tested and commissioned in accordance with the most recent edition of CSA B167, Overhead cranes, gantry cranes, monorails, hoists, and jib cranes. All design, testing and commissioning tasks are the responsibility of the Developer.
- (vi) For wet well pump installations, the arrangement of lifting equipment is to minimize the necessity for entry into the wet well. An electric hoist with a manual gear driven trolley is required. A manual hoist is acceptable for applications where anticipated operation is less than once per year. The hoisting equipment shall be designed to load directly onto service vehicles unless otherwise approved by Strathcona County. Under select circumstances,

the use of exterior mobile cranes may be required but the design must allow for sufficient vehicle access and access hatch accessibility.

- (vii) Fall protection and safety retrieval equipment shall be provided. Approved fall protection and safety retrieval equipment must be in accordance with the most recent versions of Alberta's OHS Act, Code and Regulation. Fall protection products shall be DBI-SALA, or approved equivalent, and must meet the current standards of Strathcona County Operations (contact the Strathcona County Representative for more information). No platforms or ladders used shall become a hindrance for retrieval operations from the wet well.
- (viii) Fall protection must be provided for entry into confined/restricted spaces and areas where tie-off is required. Ladder cages are not permitted. Removable guard rails shall be provided around all hatches, with a swing gate on one (1) side designed to meet the current requirements of Alberta's OHS Act, Code and Regulation. A safety retrieval plan is required, authenticated by a Licensed Engineer. Details of engineered connections are to be included in the record drawings.

4.5.4 Wet Well

4.5.4.1 General

- (i) Wet wells should be sized to minimize total retention time in the wet well and have sufficient capacity to maintain the frequency of pump starts within manufacturer's recommendations. The maximum retention time in the wet well shall not exceed 30 minutes for the design minimum flow rate anticipated once the station's contributing area has been fully developed.
- (ii) Total retention time in the wet well and forcemain is to be kept to a minimum, typically less than four (4) hours, to avoid anaerobic fermentation and the odorous, hazardous and corrosive gases that may be produced. Provisions must be made to control anaerobic conditions where the total retention time is greater than four (4) hours.
- (iii) It is desirable to have a wet well with sufficient active volume so that all sewage within the discharge forcemain is replaced during each pumping cycle, particularly when sags are present in the forcemain profile.
- (iv) Wet wells shall have a single connection point from the collection area. A collection/bypass pumping manhole shall be provided immediately upstream of the lift station with an isolation gate or valve provided on the connection to the wet well to allow for wet well isolation and temporary pumping. Appropriate stubs are to be provided for future connections to the collection area. The access covers on collection manholes or bypass pumping manholes shall have 900 mm diameter vault covers or 900 mm square hatches.
- (v) Dead spaces in wet wells shall be limited through benching and arrangement to provide a smooth, uniform and unobstructed flow to the pump suction influence zones and minimize areas where solids may accumulate. Wet well floors shall have a slope of at least 1:1 to a hopper-type bottom. The horizontal area of the hopper bottom should be no larger than necessary for the proper installation of the pump or suction pipe.
- (vi) Wet wells shall have ladder access. Ladder materials shall be suitable for the environment.

4.5.4.2 Structural

- (i) Corrosion considerations for wet wells:
 - All bolts, nuts and other fasteners used in wet well areas shall be 316L stainless steel, and all supports, brackets, gratings, ladders and other structures shall be of corrosion resistant materials.
 - Stainless steel doors or hatches are recommended for access to wet wells. Installation of electrical equipment and wiring within the wet well is to be avoided whenever it is not essential.
 - Use stainless steel lifting chains in wet wells. Systems where the chain is not required to stay in the sewage are preferred.
- (ii) Wet wells shall have a platform located above the sewer inlet to allow access to the wet well for inspection, repairs and maintenance. Platform grating shall have removable sections to allow for the removal and servicing of wet well equipment and cleaning. Cut-outs in platform shall include sections for level bulbs, level sensor (refer to [SUB-SECTION 4.5.8.9 OF THIS SECTION](#) for more information on level measurement requirements), vacuum truck hose access for clean-out of sump, and equipment removal as required. The platform shall also provide for the ability to wash down wet wells. Cut-outs are to be covered with a removable or hinged section if the hole is a tripping hazard or large enough to step into.
- (iii) Stairs, ladders and platforms are to be constructed from fiber-reinforced polymer (FRP) material with stainless steel fasteners. Wet well surface shall receive an epoxy or polyurethane coating specifically designed to protect concrete from the deleterious effects of sewage.
- (iv) Buoyant forces for the empty wet well shall be considered during the design. Buoyancy during a 1:100-year flood event should be used for design, if applicable. The Consultant shall indicate the considered design conditions and factor of safety on contract documents.
- (v) All subsurface structures shall be sulphate-resistant cast-in-place concrete with appropriate additives to protect against water seepage. Steel wet wells are not acceptable. Use of FRP and other non-metallic wet well requires approval from Strathcona County. The interior of the wet well shall be coated with a corrosion resistant coating, and the exterior of the wet well shall have the appropriate waterproofing to ensure that there is no infiltration into the wet well. A hydrostatic test in accordance with ACI350.1, Specification for Tightness Testing of Environmental Engineering Concrete Containment Structures, shall be completed for the wet well after internal coating is complete and before external waterproofing and backfilling.

4.5.4.3 Process

- (i) Avoid turbulence and excessive entrainment of air where the gravity sewer enters the wet well to minimize odour generation and to prevent entrained air from reducing pump performance or causing loss of prime. Provisions necessary to address this may include drop tubes inside wet wells of small facilities or grade adjustments. A drop manhole upstream from the pumping station may be used to lower the elevation of the inlet to the station. Inlet sewers shall not enter the wet well at an elevation lower than the normal high-water level for the design capacity flow rate. Operating levels within the wet well must not surcharge the incoming gravity sewer under normal operation.

- (ii) The shutoff equipment (isolation gate/valve) shall be of a type and material suitable for raw sewage service. The installation of shutoff devices within the wet well is not recommended unless there is no alternative. If they are necessary, the detailed design must incorporate methods of operating them without wet well entry.
- (iii) To minimize dead storage volume, the depth from the "pump-off" level to the floor of the wet well should be kept to an acceptable minimum. The required depth will be dictated by suction pipe inlet conditions, pump manufacturer's requirements for submergence or cooling, net positive suction head, priming requirements, and vortex control. Suction elbows, baffle plates, vortex breakers, or drop tubes are to be provided as required.
- (iv) Macerators are required at stations with high expectations of ragging and pump plugging. Stations with mostly residential flow may not require a macerator. Strathcona County will review this requirement on a case-by-case basis.
- (v) All appurtenances (e.g. meters, valves, etc.) within the lift station require ID tags that are referenced within the Operations and Maintenance Manual.

4.5.5 Dry Well

4.5.5.1 General

- (i) The dry well layout shall be such that all equipment and valves are easily accessible. There shall be a minimum of 1.0 m horizontal clearance on two (2) sides and 1.0 m vertical clearance. Vertical clearance between monorail and floor shall take into consideration height of future equipment, truck bed and hoist. Sufficient clearance room shall be provided around piping to allow access to flange bolts and a laydown area next to equipment.

4.5.5.2 Structural

- (i) Hatches are required in floors to facilitate removal of equipment and materials from spaces below ground floor level. Hatches shall be flush design, and no hatch appurtenances shall protrude above the finished floor. Hatches shall have a latch that securely fixes the device closed. Hatch openings in the electrical room and operating room shall have a secondary safety grate that is closable separate from the main hatch. Hatches shall be made of stainless steel and shall be designed to withstand the loads they are likely to encounter during their service life in the lift station, such as supporting a macerator. Removeable guard rails with safety gates to be provided around each hatch.
- (ii) The dry well shall be equipped with stairs and safety landings regardless of the space classification, including minimum 2100 mm headroom. Stairways shall be sized to allow for emergency services to attend to and remove stricken personnel from the space serviced by the stairway.

4.5.6 Process Mechanical

4.5.6.1 Pumps

- (i) Forcemains
 - Forcemains from lift stations should be constructed with HDPE piping. PVC piping is acceptable as an alternative. Forcemains should be designed to minimize high and low points along the profile. Where intermediate high points cannot be avoided, air

release/vacuum valves must be installed in a manhole for maintenance. All piping in the manholes shall be 316L stainless steel. Piping exiting the manhole shall be Schedule 40 316L stainless steel for the first 3.0 m. Piping material can be reviewed and an approved alternative by Strathcona County may be accepted.

- Forcemains should have a design velocity between 0.75 m/s and 2.5 m/s. Forcemains are to be installed in accordance with [VOL. 2 SEC. 501, INSTALLATION OF SEWERS](#).

(ii) Pumping Requirements

- Pump starts should be normally limited to six (6) per hour with pump alternation and 10 per hour with the standby pump inoperative. Pump selection shall be coordinated with wet well design so that pump starts are within manufacturer's recommendations.
- Pump selection considerations include:
 - Submersible pumps are preferred for all situations (wet or dry mounted). Where dry wells could become flooded, design of the cables, seals, connectors, electronic controls, etc., should allow dry mounted pumps to operate under water. Pumps are to be removable and replaceable without dewatering the wet well or requiring personnel to enter the wet well. All pumps in a pumping station should be identical and interchangeable.
 - Pump impellers shall be of a non-clog design and be capable of passing spherical solids of 75 mm diameter.
 - Pumps are to be selected to provide optimum efficiencies at actual operating points. The power rating of a motor shall not be exceeded by the pump at any operating condition on the characteristic curve of the pump.
 - Selected pumps shall be locally serviceable. Pumps selected should be the product of a manufacturer with more than 15 years of experience in the design and manufacture of pumps for raw sewage service.
 - Hydraulic Institute published calculation procedures with empirical factors should be used to facilitate design and selection of pumps to avoid cavitation.
 - Pumping system to include an automated system to recirculate flow from the pump discharge to the wet well for a fixed duration, designed to control the accumulation of grease, scum and re-suspended solids.
 - Pumping instrumentation should include seal leak and high temperature alarms.
 - Variable frequency drive (VFD) wiring should include 4-20mA analog signal outputs to the programmable logic controller (PLC) to show pump speed and current used.
 - Soft Starts should show current used.
- Pumping equipment shall be selected with capacity in excess of the maximum expected flow as determined by established engineering practice. In all cases, the design flow rate for a wastewater pumping station with one (1) pump out of service shall exceed the expected peak wet weather design flow.
- A minimum of two (2) installed pumps shall be provided for each pumping station. A third pump shall be provided as a shelf spare for pumps less than or equal to 5 HP. A wet well bypass piping system shall be provided for pumping stations with pumps greater than 5 HP.

- Where only two (2) installed pumping units are provided, they and the shelf spare pump (if applicable) shall all be of the same pumping capacity. Each unit, operating independently, shall be capable of pumping at the design capacity flow rate for the station under design service conditions.
- Where three (3) or more pumping units are provided, they shall have pumping capacity such that with the largest unit out of service, the remaining units operating in parallel are capable of pumping at the design capacity flow rate for the station under design service conditions.
- Main pump motors shall operate on 600 V, 60 Hz 3-phase, 3-wire power. Composite power and control connections shall include a plugin style disconnect. Disconnect shall be of a two (2) motion design and be arc-flash resistant rated.
- Pumps shall have variable frequency drives (VFDs) or soft starters. Where pumps are variable speed, the drives shall be equipped with appropriately sized harmonic power filters. Harmonics mitigation must be included with the design of the electrical systems when VFDs are used. Constant speed pumps under 40 kW can be started across the line. Pumps larger than 40 kW should have soft starters. Drives and soft starters shall be complete with pilot lights (run, fault), hour meters, amp meter and Hand-Off-Auto switch.
- Pumps are to be connected such that when any pump is removed for service, the remaining pump or pumps will remain operational.
- Dry wells must be equipped with a sump and sump pump to deal with leakage or seepage (also refer to [SUB-SECTION 4.5.8.9 OF THIS SECTION](#) for flood detection requirements). The sump pump is to discharge to the wet well, at a point above the maximum high-water level. A check valve and isolation valve downstream of the check valve shall be provided in the discharge pipe to preclude backflow of wastewater into the sump.
- Sump pumps should be of the appropriate size and capacity to handle common solids and must be capable of draining the sump that it is designed for. The connection from sump to wet well must also be high enough to allow pump out of the dry well into the wet well for the condition where the dry well is flooded.

4.5.6.2 Pipes, Valves, and Fittings.

- (i) Two (2) or more pumps shall be connected in a parallel arrangement to a common header. The header shall be located within a control building or dry well, such that all isolation and check valves are accessible for operation and maintenance. Each pump shall have its own individual intake and/or suction connection to the wet well.
- (ii) Piping requirements:
 - Minimum size of piping: The minimum diameter for all pump suction and discharge piping shall be 100 mm nominal. Piping should be sized such that flow velocity will not exceed 1.8 m/s in suction piping or 3.5 m/s in the discharge header within the pumping station. Flow velocities should not be less than 0.75 m/s, to maintain solids in suspension. Discharge piping should be as large as possible while maintaining this minimum velocity for scouring.
 - Piping materials: All piping within wastewater pumping stations shall be corrosion resistant material. All piping within the wet well shall be 316L stainless steel and

welded. Bolted flanges can be used, but only as an alternative if accessible and approved by Strathcona County.

- Pressure rating for piping: The pressure rating for piping within the station shall suit the service requirement. The minimum pressure rating shall be 900 kPa.
- Buried pipe under the facility and within the excavation shall be a minimum of Schedule 40 316L stainless steel. Where chloride levels within the soils are at levels that preclude the use of stainless steel piping, epoxy coated steel may be used with approval from Strathcona County.
- Buried piping connections to the station structure shall accommodate vertical movement between the piping and structure. Flexibility to be added by including a plain end coupling 1.0 m from the structure and a second transition coupling located on undisturbed ground or a minimum of 3.0 m from the structure. Couplings shall be restrained style where possible. Where the pipe size does not allow for a restrained coupling, an AWWA restraint harness and designed thrust blocking must be installed. Couplings to be Robar, or approved equivalent.
- Locate buried piping in locations that allow for excavation and repair without impacting the building superstructure or other site infrastructure such as fencing.

(iii) Valve requirements:

- A check valve shall be installed on the discharge line between each pump and the header isolation valve. Check valves should be mounted in a vertical position and be of the ball check type.
- Isolation valves shall be included on the discharge lines from each pump between the pump check valve and the discharge header within the dry well. Isolation valves shall also be included on the suction side of the pump to permit isolation of each pumping unit and check valve for removal or repair. Full port ball or plug valves are to be used.
- Bleed valves shall be installed between the pump discharge and the check valve, and between the check valve and the isolation valve. An air release valve shall be installed on the highest point of the discharge header.
- A forcemain isolation valve shall be included on the main discharge pipe where it connects to the discharge forcemain before leaving the facility, to isolate the forcemain from the station.
- Valves shall be easily accessible for operation and maintenance.
- Air release or combination air release air vacuum valves shall be installed on high points. Drain and vent connections to be piped back to the wet well.
- Combination Air Release and Vacuum Valves shall have four (4) functions of uninterrupted discharge of air/gas, unrestricted vacuum break and pipeline surge protection in a single chamber. Valve shall be anti-surge and anti-shock air release and vacuum break valves. The large orifice shall allow air to escape during pipeline filling and allow air intake during pipeline draining. The small orifice shall release air accumulations after the pipeline is filled, under pressure and in operation. The valve shall be equipped with an integral surge alleviation mechanism that automatically dampens surge pressures due to rapid air discharge or the subsequent rejoining of separated water columns.
- County preference is for Ventomat RBXc Air Release Valve, or an approved equivalent.

- (iv) A tee-connection with a shutoff valve on the branch shall be provided on the main discharge pipe within each pumping station, upstream from the forcemain isolation valve. The arrangement is to allow for either bypassing of the station using auxiliary pumping equipment or bypassing the forcemain and pumping to an alternative outlet line or truck. The unconnected end of the tee-connection shall be oriented to face toward an access hatch or entryway to facilitate the connection of the auxiliary pump discharge or outlet line.
- (v) Provisions shall be made in the piping for removal of all valves and equipment. Appropriately located vent and drain valves shall be provided to permit drainage of all piping to facilitate valve and equipment removal.

4.5.7 Building Mechanical

4.5.7.1 Ventilation

- (i) Separate ventilation systems shall be provided to all rooms as required by applicable regulations and building codes, including but not limited to space electrical classification. A general requirement of the heating, ventilation and air conditioning (HVAC) system is that it must return to service automatically following a power interruption.
- (ii) Suitable equipment shall be installed to provide for continuous ventilation at a minimum rate of six (6) air changes per hour in the wet well and six (6) air changes per hour in the dry well. Signage shall be installed on the exterior of the building identifying any entry procedures such as, "Operate ventilation system for 15 minutes prior to entry. Ventilation must be in service when space is occupied." Wording to be modified as required for actual system installed.
- (iii) Heating and cooling air exchanges in combination with HVAC systems shall minimize heat loss and maximize energy efficiency of heating and cooling systems.
- (iv) Fresh air, heated and thermostatically controlled, shall be forced into each area at a point 150 mm above the floor in dry pits and 150 mm above the high-water level in wet wells, and exhausted at higher levels. Wet wells with a depth greater than 4.5 m should consider multiple inlets and outlets in the design.
- (v) Mechanical dampers, louvers, ventilation, and exhausts shall be arranged to minimize the impact to neighbouring properties. Noise from HVAC shall not exceed 55 db(A) as measured at the property line.
- (vi) Fresh air intakes, louvers, dampers and discharges shall have screening or filtering installed to prevent the introduction of insects, vermin, pollen and any other dust/debris that may affect cleanliness of the station and/or sensitive electrical equipment. Filters to be removable to allow for replacement.
- (vii) Unit heaters must be located to facilitate regular servicing. Units may be gas or electric and must meet the area classification of the space in which they are located. Preference for gas heaters to aid in reducing greenhouse gas emissions.

4.5.7.2 Plumbing

- (i) A 50 mm diameter potable water service shall be supplied to the lift station. The primary isolation valve shall be installed where the water service enters the building. The water service must rise above the main floor (above flood level), where it will be split into separate service water and potable water services. A reduced pressure backflow preventor must be installed on both services. The use of backflow preventors requires a variance from Alberta

Environment and Parks (AEP). Developer/Consultant to obtain variance in writing prior to construction.

- (ii) Each station shall include a washroom unless otherwise approved by Strathcona County. The washroom as a minimum must contain a low flow water closet, lavatory and mop sink. A point of use electric hot water heater shall be provided for the lavatory in the washroom.
- (iii) Service water is to be supplied to both the wet well platform and the dry well with a 25 mm diameter hose bib, local check valve, and a wall mounted hose hanger. A pressure sustaining valve may be required in areas of low average day flow due to risk of dropping pressure too quickly in the distribution main. Piping within the dry well can be copper, piping in wet well area shall be 316L stainless steel. Provide dielectric unions at pipe material transitions.

4.5.7.3 Fixed Gas Monitoring

- (i) A fixed gas monitoring system is required for each station. The complete system, including analyzers, relays, beacons, buzzer, and calibration gas, shall be supplied by a single vendor. All fixed gas monitoring equipment shall be easily accessible for calibration and maintenance. Signage shall be included on the building exterior identifying the lighting and the associated monitored condition.
- (ii) Sensors include:
 - Hydrogen Sulfide (H₂S): Two (2) H₂S sensors shall be mounted low in the dry well near the bottom and close to the pumps. A third sensor shall be installed in the wet well at the platform level. A blue beacon shall activate at H₂S levels exceeding 5 ppm from any of the sensors. An audible horn must simultaneously sound for the dry well sensors and meet 110 dB at 1.0 m depth and 100 dB at 3.0 m depth. Wet well sensors are for monitoring only.
 - Low Explosive Limit (LEL): An LEL sensor shall be installed high in the wet well (just under the floor). A red strobe on the exterior of the building shall activate at 5% of LEL.
- (iii) Gas sensors in the wet well and dry well shall connect to analyzers in the wet well access space and dry well, respectively. These analyzers shall relay the level of gas detected, status, and type of alarms back to the PLC with information displayed on the Supervisory Control and Data Acquisition (SCADA) screen. The gas detection system shall contain:
 - Stainless steel construction;
 - Two (2) mod bus outputs;
 - Relay state (latch alarm / non-latch warn);
 - CSA approval;
 - H₂S sensors (0-100 ppm) – refer to [SUB-SECTION 4.5.7.3\(ii\) OF THIS SECTION](#) for more details;
 - One (1) combustible gas sensor (0-100%);
 - One (1) LEL methane sensor (0-5%) – refer to [SUB-SECTION 4.5.7.3\(ii\) OF THIS SECTION](#) for more details;
 - Red beacon;
 - Blue beacon; and
 - Buzzer.

4.5.8 Electrical, Instrumentation, and Controls

4.5.8.1 General

- (i) The facility electrical system shall meet the most recent version of the Canadian Electrical Code.
- (ii) The Developer shall ascertain from the electric utility the nature of the available power supply and make all necessary arrangements for connection. Power quality must be addressed and, where necessary, the proper voltage/lightening arrestors and harmonic distortion filters must be effectively incorporated into the electrical system.
- (iii) 3-phase power shall be used with each phase monitored using a 3-phase monitor with light emitting diode (LED) visual indication and report to the SCADA system. The location of electrical switchgear and similar equipment shall be such that it is not subject to flooding. The required voltage for lift station pumping gear is 600 VAC, with 240 VAC and 120 VAC for the stepped down voltages.
- (iv) Installation of electrical equipment and wiring within the wet well is to be avoided whenever it is not essential. Wet wells shall be classified as Class 1 Zone 2 with continuous ventilation of 12 air changes per hour. Dry wells are to be designed with continuous ventilation of six (6) air changes per hour to allow for area classification to be de-rated to unclassified.

4.5.8.2 Standby Power

- (i) Standby power shall be provided at each facility in the form of a generator. The generator shall be sized for the total connected load of the station and shall be capable of starting and operating all connected equipment. Generators should be diesel with enough capacity to run the generator at full load for a minimum of 24 hours. Natural gas generators are to be avoided and require approval from Strathcona County. The maximum size of natural gas generator that will be considered is 150 kW. Generators smaller than 300 kW may be placed outside on a concrete slab with an insulated sound attenuating enclosure. Generators larger than 300 kW shall be placed within the station in a separate room.
- (ii) Design, installation, operation, maintenance, and testing of emergency generators and associated equipment for providing backup power supply shall conform to CSA C282, Emergency electrical power supply for buildings. Other requirements include the following:
 - A double wall fuel storage tank shall be located under any diesel generator inside the building with sufficient fuel to run the generator at full load for 24 hours.
 - Generator shall be equipped with louver controls (fresh air, outside vent and re-circulate) and automatic transfer switch. Generator shall be sized to accommodate future loads according to the pumping capacity staging plan.
 - Generator shall be designed to power the full building loads and all duty pumps running concurrently. The fuel tank must have both a manual fuel indicator on the tank, and a fuel indicator that is connected to the lift station control system that can alarm at a pre-set low level.
 - The generator power transfer switch shall be designed to automatically power the facility when line power is lost, and automatically return to line power once it returns.
 - There shall be an exterior mounted lockable fuel fill panel, complete with indicator lights that annunciate at least four-point fuel levels within the fuel tank and an audible

level indication. The fuel fill cabinet shall be located to allow for a fuel truck to park within 5.0 m of the cabinet. A sidewalk or parking lot area shall be available to access the cabinet.

- Generator exhaust silencer shall be "Hospital Grade" where generator engine exhaust noise is abated by no less than 40 dB(A). The noise level from the generator engine shall not exceed 104 dB(A) when measured 1.0 m from the generator engine inside the building. The noise generated by the lift station when measured at the property lines shall not contravene the Strathcona County Noise Control Bylaw 66-99 and amendments thereto.

4.5.8.3 Lighting

- (i) Adequate lighting shall be provided throughout the entire structure to ensure the safe operation and maintenance of the complete facility. All lighting shall be LED.
- (ii) Exterior lighting requirements include:
 - Adequate exterior lighting shall be designed and installed in accordance with the Strathcona County Light Efficient Community Policy SER-009-038 and any amendments thereto, and should be designed so as to not create a nuisance to the surrounding area.
 - Exterior lighting is to be complete with photocells. A manual/automatic switch bypassing the photocell is to be installed in an accessible vicinity and located on the contactor for manual control of the exterior lighting.
 - Exterior lighting shall be provided on all four (4) sides of the building and operate with photocells. Lights by building entrance areas shall come on when dark; all other lighting to come on at night with motion detection. All lights shall be supplemented with manual switches inside building.
- (iii) Other lighting requirements include:
 - Lighting in the wet well shall be explosion proof.
 - The wet well and dry well design lighting level shall be 1,000 lux. Lights must return to on quickly.
 - Fixtures must be installed above the normal high-water level, and accessible for service.
 - Emergency backup lighting shall be provided. Emergency backup wall packs shall be connected to their respective room's lighting circuit. Emergency lighting shall plug into receptacles mounted for an emergency light pack.
 - A red pilot light shall be placed at the entrance to the station complete with a push test button. Light must turn on when ventilation fails. Place 'Ventilation Fail' label above light.
 - All lighting shall be accessible for maintenance without scaffolding or removal of other equipment.
- (iv) Cables and wires shall be labeled at all junctions, junction boxes and terminal boxes. Labeling shall be referenced on drawings.

4.5.8.4 Wiring

- (i) Low voltage Class II type wiring (security systems, data lines, etc.) shall have proper protection and support. This includes conduit, conventional raceway, basket raceway or properly spaced hook raceway.
- (ii) All discrete electrical components (pumps, motors, machines, heaters, etc.) shall have adequate breaker and/or disconnect installation so as to allow for positive, lockable isolation as well as local disconnects to enable isolation without having to take the majority of other services down to repair small components.
- (iii) The minimum standard for receptacles is 20-amp, T-prong style. The minimum building wiring gauge is American Wire Gauge (AWG) #12.
- (iv) All electrical switches, breakers, and outlets shall be numbered and easily traceable from panel to end service. All switches and receptacles, including exterior receptacles, are to be identified via a weatherproof label with the circuit supplied and panel it originates from, including panel and circuit identifier. Junction boxes shall be labeled with their voltage and panel origin. Cabinets must have a lamacoid plaque mechanically fixed to their doors with either rivets or screws.
- (v) All panel schedules are to be typed and located within the panel. Electronic files capable of modification are to be forwarded to Strathcona County. Motor Control Centre (MCC) and lighting panels shall be equipped with minimum 20% spare capacity.
- (vi) Pump power and control cable shall have plugin style disconnect located above the highest anticipated flood elevation in the dry well but remain accessible. Junction boxes may be located below the flood elevation if National Electric Manufacturer Association (NEMA) Enclosures Type 6P are used. Power and control cables between the pump and the junction box shall be easily removable and replaceable when the pump is removed and replaced for service. Hardwire Emergency Shutoff buttons shall be directly adjacent to each pump. Plugs style connectors to be full load rated disconnect with arc fault protection.
- (vii) 120 V receptacles shall be provided as a minimum at the following locations:
 - Generator room
 - Electrical room
 - Dry well
 - Wet well (explosion proof)
 - Outside building by doors

4.5.8.5 Instrumentation and Controls

- (i) All lift stations shall have instrumentation and control systems that allow the station to run unattended and are fully integrated and compatible with Strathcona County's existing central control system. PLCs/HMIs (Human Machine Interfaces) are to match the current standard for Strathcona County Operations (contact the Strathcona County Representative for more information). SCADA communication should be via ADSL/fiber internet or cellular. Radio and cellular communications may be used with approval of Strathcona County.
- (ii) All instruments, control systems (PLCs and HMIs), wiring, PLC software, and accessories are to be supplied and installed by the Developer. Strathcona County will provide the programming for the PLCs and HMIs.

- (iii) A detailed control philosophy is required in addition to the Operations and Maintenance Manual. Control philosophy shall be approved by Strathcona County as part of the design process. Operator site training shall be provided following commissioning. Strathcona County will be responsible for PLC and HMI programming unless otherwise advised by Strathcona County. Developer's Contractor to provide assistance during commissioning with implementation of the program.
- (iv) The nature of the instrumentation and control systems will vary depending on the size, type, and function of the station and shall be decided during discussions between the Developer and Strathcona County.
- (v) All instruments, sensors and mechanical float switches to be installed in a wet well or limited access area shall be, wherever possible, accessible and removable without entering the wet well or limited access area. All instruments that have local indication, or that require access for programming, should be installed at eye level. All instruments and electrical or control panels that require occasional access must be readily accessible for maintenance and programming.
- (vi) All powered instruments are to have separate fuses. All fuses to be labelled.
- (vii) All instruments and control systems (PLCs and HMIs) shall be electrically protected by a surge control system and powered by an uninterruptible power supply (UPS). All communication equipment to have data line surge protection. UPS systems shall have an external bypass switch to allow for maintenance without interrupting power.
- (viii) All local controls systems to utilize a local historian to prevent loss of data. Local historians to offload data to the master storage facility twice daily if a master facility exists.
- (ix) Dedicated data lines and UPS power are to be provided in the area where such Building Management System/Building Automation System (BMS/BAS) and network switch systems are located.
- (x) Transmitter displays should be remotely located on the main level of the operating room or electrical room as applicable. All cables to have a tag at the instrument and junction box identifying the instrument. Laminated labels to be on both ends of all wires inside the PLC, junction box or instrument terminals.

4.5.8.6 Alarms

- (i) A monitored security system shall be provided for each building. The security system shall be connected to the internet, have a card reader at each main door, heat detectors in each space, control panel, door contacts, and UPS backup. The security system shall be designed and provided by Strathcona County's preferred security vendor.
- (ii) Operational alarm requirements are as follows:
 - Wet well high-level and low-level alarm switches using mechanical float switches to provide backup to the ultrasonic level measurement – refer to [SUB-SECTION 4.5.8.9 OF THIS SECTION](#) for more information on level measurement requirements.
 - Dry well flooding alarm – refer to [SUB-SECTION 4.5.8.9 OF THIS SECTION](#) for more information on level measurement requirements.
 - Pump failure alarm.
 - Pump auto/hand/off indicator.
 - Main power failure alarm.

- Standby generator alarms status and alarms – refer to [SUB-SECTION 4.5.8.2\(ii\) OF THIS SECTION](#) for more information.
 - Building HVAC alarms and controls. Provision shall be made to detect and actuate an alarm if the ventilation system should fail or if a low temperature in the station is detected.
 - Discharge Pressure to have high and low pressure alarms.
- (iii) All alarms are to be locally indicated. Instrumentation shall be telemetered by means of digital signals to a remote location determined by Strathcona County. The telemetry system shall have a battery-powered backup supply to allow the system to operate for at least four (4) hours after a power failure.
- 4.5.8.7 Flow Measurement
- (i) Flow measurement shall be with magnetic flow meters. Flow meters should be installed on each pump discharge in dry well installations. Should include a digital pulse for totalizing flow and an analog 4-20 mA signal for flow rate.
 - (ii) Flow measurement to be reviewed and designed to accommodate for measurement of wet well.
- 4.5.8.8 Pressure Indication
- (i) Pressure indicators and transmitters shall meet the following requirements:
 - 25 mm or 1" pipe taps, 1" ball valves with shut off valves suitable for quick connect pressure gauges shall be provided on each pump suction and discharge. The location of these taps shall be such that the locations are suitable and easily accessible and shall be isolated from the sewage by a flushable isolation ring.
 - Gauges provided for discharge lines shall be liquid filled with a maximum range of at least twice the operating pressure. Gauges shall be stainless steel with dual units of kPa/psi. Pressure gauges shall have a snubber installed.
- 4.5.8.9 Level Measurement
- (i) Level measurement shall meet the following requirements:
 - Ultrasonic level instrument is required. Level control instruments shall be installed so that they can be activated or removed from the wet well platform for testing and servicing (refer to [SUB-SECTION 4.5.4.2\(ii\) OF THIS SECTION](#) for more information on platform requirements). Water level control sensing devices should be located so that performance is not unduly affected by turbulent flows entering the well or by the turbulent suction of the pumps and so that cables do not get tangled. Submersible level elements shall be installed in stilling wells to mitigate sensor anomalies. Level elements require intrinsic safety, either through design or intrinsically safe barriers mounted in non-hazardous rated environments. Level transmitters shall be installed in non-hazardous rated areas.
 - A pressure level transducer is acceptable in place of an ultrasonic sensor where foaming is expected in the sewage and with approval from Strathcona County.
 - Two (2) backup level bulbs are required. Each level bulb is to be installed such that it can be removed from the wet well platform level for cleaning and servicing. All level bulbs installed in hazardous rated areas are required to have internal intrinsic safety

or be connected to intrinsically safe barriers. The redundant level control bulbs are to be connected to a supplemental pump control system that will automatically take over control of the pumps should the lift station main level controller fail. High High level shall run all pumps and Low Low level shall stop all pumps automatically.

- The dry well sump shall be equipped with a flood detection level bulb that is connected to the PLC and SCADA system for annunciation.
- Level instruments shall be terminated in junction boxes located above the wet well sump in an area above the flood zone and connected to intrinsically safe interfaces. A minimum of 100 mm is required between each level set point.
- Refer to [SUB-SECTION 4.5.8.6 OF THIS SECTION](#) for more information on alarm requirements.