



TABLE OF CONTENTS

TABLE OF CONTENTS.....	1
INTRODUCTION.....	1
INTENT OF THE STANDARDS.....	1
SANITARY LIFT STATION DESIGN CRITERIA.....	2
1.0 GENERAL SPECIFICATIONS.....	2
1.1 PUMPS.....	2
1.2 KIOSK	2
1.3 PIPING/VALVE CHAMBER	3
1.4 VENTILATION.....	4
1.5 LIFT STATION TANK.....	4
1.6 EQUIPMENT	4
1.7 EMERGENCY BACKUP GENERATOR.....	5
1.8 WARRANTY.....	6
1.9 WATER CONNECTION.....	6
1.10 SITE FENCING	6
2.0 LIFT STATION ELECTRICAL DESIGN STANDARDS	6
2.1 STANDARD LIFT STATION ELECTRICAL SPECIFICATION.....	6
2.2 USER INTERFACE	7
2.3 VFD STATION SUPPLEMENTARY SPECIFICATION	8
2.4 ENTRY AND ALARM TEST MODE.....	8
3.0 CITY SCADA SYSTEM.....	9
4.0 COMMUNICATIONS BETWEEN SCADA AND LIFT STATION	10
1.0 GENERAL.....	11
2.0 PRODUCTS	12
3.0 EXECUTION	18



INTRODUCTION

The use of sanitary lift stations is generally discouraged and the City must approve any proposal for a lift station prior to submission of any engineered drawings for a lift station. Lift stations are considered a "special case" and are to be designed by a qualified professional. The following will form the general design requirements for duplex lift stations categorized as small to mid-sized lift stations. For stations larger than 50 l/s, or that require more than two pumps, authorization must be obtained from the City on a case by case basis, and the following standards may not fully apply.

Unless documentation provided by the City of Courtenay along with a specific request for tender or request for proposal states specifically that a provision set forth has been waived, all provisions are to be satisfied.

The requirements set forth in these standards are minimum requirements that shall be applied universally by all parties performing services for and/or providing equipment to the City of Courtenay. This includes, but is not limited to, all component parts that may form part of package systems.

This document is part of a series of standards and as such should not be viewed in isolation of all other City of Courtenay associated standards which may modify and/or clarify the requirements set forth within this document.

The City of Courtenay may, on a case-by-case basis, and at the City's sole discretion, approve deviations from these standards.

INTENT OF THE STANDARDS

The Design Criteria are intended to provide direction to the Applicant and their Engineer on the elements required to be considered in the design of sanitary lift stations. It is intended to be used in conjunction with the MMCD Design Guideline Manual and the City of Courtenay Subdivision and Development Servicing Bylaw Schedule 1.

The Supplementary Specifications are intended to provide direction to the Applicant and their Engineer on the specifications that must be incorporated into building servicing contracts for the installation of new sanitary lift stations. The Supplementary Specifications are to be used in conjunction with the City of Courtenay Subdivision and Development Services Bylaw Schedule 2 and Schedule 3 and the Master Municipal Construction Document (MMCD).



SANITARY LIFT STATION DESIGN CRITERIA

1.0 GENERAL SPECIFICATIONS

1.1 Pumps

- (a) All sanitary lift stations shall be designed with a minimum of two pumps, each capable of handling the Peak Wet Weather Flows independent of the other. The pump that is furthest away from the inlet shall be supplied with a 4901 flush valve.
- (b) Each pump must be:
- capable of passing solids up to 75 mm in size;
 - equipped with hour meters;
 - easily removed for maintenance;
 - constructed to operate on a voltage based on HP rating as shown on the table below:

Pump Size	Approved Voltages
Less than 5HP	Single phase 240V / Three phase 208V
5HP – 10HP	Three phase 208V / Three phase 600V
Larger than 10 HP	Three phase 600V

- (c) Motor cables, power cables, etc. shall be continuous from the lift station to the kiosk. Cables are not to be spliced. Only one power cable is allowed in one conduit.

1.2 Kiosk

All auxiliary equipment and control panels shall be mounted in a secure lockable kiosk adjacent to the station. The kiosk shall be located not less than 1.2 metres and not more than 3 metres from the station lid, with the controls section of the kiosk facing the wet well and facing north (where practical to do so.). The kiosk shall be founded on a concrete foundation, and should be made from powder coated aluminum, with a standard green finish. All kiosks shall be supplied with a rubber gasket between the aluminum kiosk and the concrete to prevent water leakage into the kiosk.

The electrical Kiosk shall be CSA Type 3R rated and fabricated from marine grade aluminum in accordance with the following Ministry of Transportation and Infrastructure Kiosk Specifications:

- General Material Requirements: 402.3.1
- Connecting Hardware 402.3.2
- Fabrication Mechanical Requirements, General Requirements 402.4.1
- Welding 402.4.2
- Door Gaskets 402.4.4
- Kiosk Environmental Requirements, General 402.4.8.1
- Kiosk Fan and Heater Thermostat 402.4.8.5
- Kiosk Finish 402.6
- Electrical Kiosk shall be powder coated "Fence Post Green".



- Plan Pouch 402.9

The kiosk shall be fabricated with sufficient bracing to form a structure capable of withstanding transportation, wind, snow and ice loading. The kiosk manufacturer is responsible for obtaining structural and seismic certification from a professional engineer registered with Engineers and Geoscientists BC. Structural certification shall include recommendations for fastening methods.

The kiosk shall contain separate compartments for:

- pump control;
- service entrance and distribution; and
- fan and duct section, complete with isolated cable junction chamber vented to the atmosphere.

The kiosk shall be designed to contain:

- all control and telemetry equipment within the pump control compartment;
- an electrical service entrance that is complete with required appurtenances and components shall be arranged in a manner acceptable to B.C. Hydro;
- all power distribution equipment in the service entrance and distribution section, with exception to a 120/240 or 120/208V electrical panel which shall be mounted within the pump control compartment;
- an extra 120 volt receptacle within the pump control and service entrance/distribution sections;
- an automatic transfer switch in the service entrance and distribution section;
- a manual transfer switch in the service entrance and distribution section;
- a receptacle for mobile backup generator on the exterior of the kiosk;
- intrusion and fault alarm keypad and panel, keypad to be accessible, with equipment mounted within the pump control compartment;
- exterior lighting mounted to an overhead pole capable of illuminating the area around the tank lid to WorksafeBC required standards;
- a heater within each of the pump control and service entrance/distribution sections; and
- a digital clock.

The fan and duct section shall be isolated from the pump control and service entrance/distribution sections by means of a continuous weld.

1.3 Piping/Valve Chamber

All piping within the wet well shall be stainless steel or approved equivalent, and all stations shall feature an external separate valve chamber for valves and flow measurement equipment. The valve chamber can be either fiberglass or pre-cast concrete with suitable lockable lids with lift assist mechanisms as required.

Each pump discharge shall have a ball check valve or lever type swing check valve.



Each pump discharge shall have a plug valve installed downstream of the check valves.

Drain to be provided at floor elevation and floor to be sloped to convey inflow of water or sewage toward drain inlet. The drain shall include a backwater valve and p-trap to prevent sewage and gas from entering the piping/valve chamber.

1.4 Ventilation

Ventilation at each station is to be by forced air using a fixed speed fan that runs continuously. The minimum ventilation rate is to be 12 air changes per hour or higher if required for safety considerations. The fan shall be located in the kiosk and be sealed to the inlet blower line. The blower shall indicate failure on the control panel.

Each station shall have a minimum of one vent stack, and shall have odour control installed. As a minimum, the vent stack shall be equipped with an activated carbon filter capable of conveying the required air flow rate without excessive pressure loss: Calgon SweetVent or equal.

1.5 Lift Station Tank

The lift station tank to be of fiberglass construction.

Wet wells shall be designed with the following features:

- Include a benched bottom to direct all solids into the pump suction;
- Include surface access with a lockable, waterproof fiberglass or aluminum cover. Access hatches must include hydraulic assist and safe hatch;
- Provide access that is 200 mm to 500 mm above the finished grade to prevent vehicles from riding overtop of the structure;
- Contain aluminum (or fiberglass) ladder mounted so it does not interfere with the removal and installation of the pumps, etc. The ladder shall be designed to extend and lock least 1.0 metre above the tank access. Ladders mounts to be structurally sufficient to prevent puncturing of the tank wall, where mechanical fasteners are to be used, the wall shall be reinforced to provide sufficient capacity for the type and size of fastener. Integrated fiberglass ladders shall be fixed mounted to the fiberglass wall with appropriate reinforcing of the fiberglass as specified by the manufacturer;
- Contain a platform above the high water level float to permit wet well access wherever the total depth from ground level to wet well floor exceeds 2.4 metres;
- Include 1 base and davit complete with hand operated winch capable of lifting the pumps clear of the lift station (as per the City's Approved Products List);
- Include 1 base and davit for confined space entry. (as per the City's Approved Products List);
- Contain explosion proof lighting capable of illuminating the interior of the tank.

1.6 Equipment

All equipment must be CSA Approved and Work Safe BC compliant.



1.7 Emergency Backup Generator

All sewage lift stations shall be equipped with an emergency backup generator unless otherwise approved by the City. The generator transfer switch shall be of the automatic type. The generator shall be diesel fueled unless otherwise approved by the City. Diesel fuel tanks shall be base tanks integrated into generator unit by OEM, shall include double wall containment, and shall be sized to run the generator for at least 24 hrs continuously at 100% load. The concrete base to install the generator shall be provided with a spill containment structure to capture any spillage. The generator shall have a 1.2m clearance all around, and it shall be provided with a noise control package. Noise Control Package Specification for Generator shall be residential rated. Sound attenuation includes enclosure and exhaust muffler package. Sound attenuation system performance shall result in measured sound levels not to exceed 65 dB @ 10.7 metres. Design Engineer shall perform a load analysis with the sequence of motor starting in order to know the motor starting loads and the motor running loads. Such electric load calculations must be done in kVA units to account additional loads due to low power factor. The generator shall have a motor starting kVA capacity to limit the voltage dip to no more than 15% for any motor starting conditions. Such generator load analysis must be included in the engineering report. The generator manufacturer must be pre-approved by the City prior to design of the backup system.

The generator shall also come equipped with a permanently-mounted resistive load bank, with a full load that equals +/- 80% of the generator unit's full load capacity. The load bank shall also include the following specifications:

- Duty Cycle: Rated for continuous operation.
- Load Steps: 5, 10, 10, 25, 50, 100 KW
- Cooling System: integral with generator cooling system
- Sound dampening: integral with generator muffling system
- Operator Controls: Control Panel housed in a NEMA-type wall mount enclosure including:
 - Main Power ON/OFF Switch, Power ON Indicator, and Master Load ON/OFF Switch.
 - Load selection shall be provided by individual industrial lever-type toggle switches for on/off application of resistive load segments, one provided for each load step.
 - Auto Load Dump Circuit: A remote load dump circuit is provided as part of the load bank control circuit.
- Provisions shall be provided to trip the load bank off-line from a normally closed set of auxiliary contacts from an automatic transfer switch or other device. In the event of a utility failure, all load is removed.

Automatic Load Controller: Automatic Load step controller that maintains a minimum load on the generator set. The controller shall monitor the connected downstream loads and will automatically add or subtract load steps in response to overall load changes as to maintain a minimum load level on the generator set.



1.8 Warranty

All lift station components shall be warranted in accordance with the manufacturer's warranty, and such warranty shall be explicitly stated in a warranty statement (section) provided with the Operations and Maintenance Manuals submitted upon acceptance of the Lift Station by the City.

1.9 Water Connection

A 50 mm water service connection for cleaning purposes must be provided at the site. The service must include a dry standpipe and appropriate cross-connection control devices located in an above ground heated lockable cabinet. The connection shall also include an on/off ball valve and a 38mm quick connect cam-lock fitting. Cross-connection control devices must be designed to be compliant with CSA standard B64.10-11 (Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers). RP backflow device shall be located in an above ground kiosk.

1.10 Site Fencing

1.8m black epoxy coated perimeter fencing is to be provided.

2.0 LIFT STATION ELECTRICAL DESIGN STANDARDS

2.1 Standard Lift Station Electrical Specification

All lift stations shall include at a minimum the following features and capabilities:

Manual pump controls	It shall be possible to set each pump into manual (Hand) mode. When in the manual mode the control of the pump shall be independent of (and unaffected by) the actions (or absence) of the controller or fail-safe pump control relays.
Motor type and starting	All pumps 10hp or larger require soft starting devices or are to be speed controlled via Variable Frequency Drives.
Controller	The station controller shall conform to the City of Courtenay Approved Products List.
Float Switches	Each station shall be supplied with a high level and low level float switch. These shall be either an ITT Flygt float level tree type (mercury) or an acceptable alternative as Approved by the City and CSA certified. Guides must be used for all float levels. The low level float is to be set at a level just above the pump intake. The high level float is to be set at a level no higher than the obvert of the lowest inlet pipe.



Fail Safe Operation	The high level float shall trigger operation of pumps, the operation of which shall be independent of the main station controller. The pump operation shall be wired to cease on either activation of the low level float or time-out of a timer relay. During normal operation the high level float will not be activated.
Level monitoring	Wet well levels shall be monitored using an ultrasonic sensor or pressure transducer connected as an analog input to the control unit. This level is to be used for pump control and shall be reported to the central monitoring station.
Programmable operation	Pump start and stop levels are to be programmable and set through the local pump controller HMI and via SCADA.
Pump supervision	Pumps shall be monitored, as a minimum, for stator over temperature faults, seal leakage and over current condition.
Flow rate	Flow rate data is to be reported by flow monitoring device.
Intrusion alarm for kiosk or building	Access to the electrical controls is to be monitored by a contact switch, and an alarm condition shall be generated when the contact is broken.
Receptacle for plug in of standby generator	Each station, including those which include local generator, shall be equipped with a receptacle for plug-in of City standby generator, mounted on the exterior of the building or kiosk within a lockable NEMA-4X enclosure (padlock provided by the City).
Alarms	<p>The following alarms shall be generated and reported by the alarm system by way of a dedicated telephone connection. The alarms shall also be connected to the lift station controller to allow for annunciation through the City's SCADA system</p> <ul style="list-style-type: none">• Intrusion Alarm• Loss of Power• High level alarm• Low level alarm• Pump monitoring alarms (leakage, high temperature)• Generator Faults (if generator installed)• Breaker tripped• Float switch failure
UPS backup for controller and communications system	A UPS standby power system is required. The UPS must provide power to the controller for at least one hour in the event of a power outage.

2.2 User Interface

The user interface in a typical lift system consists of manual controls for emergency and maintenance purposes, and an electronic interface directly to the controller.



Manual Controls

The operator interface at this level shall be kept to a minimum. Auto/Off/Manual selectors for each pump are to be provided. These controls shall function independently of the controller. When in placed in manual mode the appropriate pump shall start. When placed in the Off condition the pump shall not start regardless of input from the controller. In Auto mode the pump is controlled by the controller. Pump run time meters shall be installed for each pump.

Status lamps are required as follows:

- One lamp indicating kiosk power
- One status lamp for each pump indicating pump run condition
- One status lamp for each pump indicating a failure condition

Controller Interface

Each station shall also include a station control Human-Machine-Interface (HMI), mounted in the door of the control cabinet. This control keypad is used to view and reset alarm status, and to configure the operation of the station. The HMI shall conform to the City of Courtenay Approved Products List, and shall integrate directly with the station controller.

2.3 VFD Station Supplementary Specification

All lift stations involving VFDs shall include the features and capabilities outlined above plus the following features and capabilities:

VFD	A solid state variable frequency drive, sized for the motors associated with the project, with inline load filters. Xylem ACS550 or similar.
VFD Manual Mode	The VFD shall be programmed to run the pump at an appropriate default speed in manual mode (when started).
VFD controller connection	Connection to the VFD is by analog output from the controller.
VFD output monitoring	The controller shall monitor and make use of the speed output, and current outputs of each VFD. These shall be made available to the monitoring system.

2.4 Entry and Alarm Test Mode

Each pumping station panel will have a key lock access to the control cabinet. A momentary spring-to-centre rotary selector switch shall be provided to switch to select between Test & Normal mode of operation. In Test mode the system shall behave as follows:

When momentarily switched to the "Test" position all normal alarms from the station will be acknowledged and disabled for 30 minutes, and a local "Test Mode" pilot light will illuminate.



In addition, a test alarm shall be triggered which will be treated as a low priority alarm at the SCADA system.

The station controller begins a phased monitoring of the situation, as described in the following table.

Phase	Description	
1	The input is activated by the test mode selector switch. Result: Work time begins (25 minutes).	
2	The input has been activated longer than the Work time. Result: Common alarm outputs are activated. Warning time begins. (5 minutes)	
3	Personnel acknowledge their presence within the Warning time. Result: Work time is restarted. Common alarm outputs are set to passive.	No acknowledge is received within the Warning time. Result: Personnel alarm is generated.
4	The selector switch is momentarily placed in the "Normal" position, or the kiosk/station door is closed. Result: "Test Mode" pilot light extinguishes and station alarming returns to normal.	

3.0 CITY SCADA SYSTEM

City of Courtenay sewage pumping stations are to be compatible with a central monitoring system, planned for some future date. This section is provided to explain the requirements on all new lift stations in order to ensure compatibility with the planned SCADA system.

Key features of the planned SCADA system are planned to include:

- real time information regarding the status of stations throughout the municipality in order to efficiently respond to faults and other issues as they arise;
- limited remote control capability of the stations, which in certain cases may avoid the need for a site visit;
- historical information and other data that will assist with proactive maintenance activities; and
- historical information and other data that can be used to make informed decisions guiding future infrastructure development.



4.0 COMMUNICATIONS BETWEEN SCADA AND LIFT STATION

Stations constructed pre SCADA system shall support the future installation of communications equipment. Sufficient space is to be provided in the kiosk for a lockable louvred/ventilated box that will contain transmitter/receiver and networking equipment. In addition, a 100mm underground communications conduit shall be stubbed out from the kiosk/building foundation to allow for a future installation of antenna.



CONSTRUCTION SUPPLEMENTARY SPECIFICATIONS

- | | | | | |
|-----|------------------------------|----|--|------------------|
| 1.0 | GENERAL | .1 | This section refers to those portions of the Work that are unique to the supply and installation of prefabricated submersible sewage lift stations. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein. | |
| 1.1 | Related Work | .1 | Electrical | Division 26 |
| | | .2 | Concrete Reinforcement | Section 03 20 01 |
| | | .3 | Cast-in-Place Concrete | Section 03 30 53 |
| | | .4 | Aggregates and Granular Materials | Section 31 05 17 |
| | | .5 | Excavating, Trenching, and Backfilling | Section 31 23 01 |
| | | .6 | Sanitary Sewers | Section 33 30 01 |
| | | .7 | Sewage Force mains | Section 33 34 01 |
| 1.2 | Shop Drawing and Data Sheets | .1 | Before fabrication, the supplier shall submit shop drawings to the City for review. The submission shall include data sheets for all equipment to be ordered, along with a full drawing package for the electrical kiosk (external kiosk, internal layouts, wiring and controls diagrams) | |
| | | .2 | Lift station structural drawings, stamped by a Professional Engineer registered in British Columbia, shall be provided for the fibreglass wet well, the reinforced concrete base, the electrical kiosk enclosure and the anchoring systems for the generator, electrical kiosk and wet well. | |
| 1.3 | Requests for Approved Equals | .1 | Any requests for approved equal shall contain sufficient documentation regarding the service organization which is available to back up the tendered pumping units. In particular, the service organization shall: <ul style="list-style-type: none">• have been in existence a sufficient length of time to have established a reputation which can be backed up with references;• have a number of qualified employees whose major commitment is to carry out service calls; and• have a well-equipped local maintenance shop. | |
| | | .2 | The Contractor shall also be prepared to demonstrate the availability of commonly required spare parts. If these are not kept in stock locally, the anticipated delivery period must be clearly indicated in the Form of Tender. | |



- 1.4 Commissioning Plan .1 A commissioning plan should be provided to the City for review 2 weeks in advance of the scheduled commissioning.
- 2.0 PRODUCTS
- 2.1 Structure .1 Chamber:
- .1 The main chamber shall contain the pumps and associated equipment and shall be a vertical cylinder.
 - .2 The shell shall be constructed of Fibreglass Reinforced Plastic (FRP) and shall provide sufficient rigidity to resist deflection during installation and to resist pump loads and vibrations.
 - .3 The main chamber shall be reinforced with external reinforcing rings.
 - .4 Four (4) lifting "eyes" adequate for the entire weight of the completed station, including all installed equipment, shall be provided.
 - .5 Where inflow, discharge and ventilation lines, pass through the tank wall, the wall shall be reinforced.
 - .6 The connecting flanges shall be ANSI B-16.1, Class 125, unless shown otherwise on drawings.
 - .7 Color of the fibreglass interior shall be sanitary white. The exterior shall be dark green.
 - .8 Hold down lugs, complete with hold down bolts, shall be provided with sufficient strength to anchor the lift station to the reinforced concrete base, preventing flotation.
 - .9 The wet well shall be smooth and free of projections and pockets which could impede flow and collect sediment.
 - .10 An aluminum access ladder shall be provided as per Work Safe BC requirements. After installation of the complete lift station, all equipment shall be capable of servicing from the upper chamber.
 - .11 Electrical connection points shall be provided for the pump motors, light, and float conduits.



.2 Physical Properties of FRP Fabrication:

- .1 The material of all tanks shipped shall meet the following minimum requirements:

<u>Property at 73° F.</u>	<u>ASTM Test</u>	<u>Value</u>
Tensile Strength	D638	8,000 - 16,000 psi
Compressive Strength	D695	14,000 - 27,000 psi
Flexural Strength	D790	16,000 - 30,000 psi
Flexural Modulus	D790	1.0 x 10 ⁶ psi
Hardness (average)	D790	Barcol 40

- .2 Fiberglass tank to be helically filament wound utilizing chemically inert ISO resins. The laminate shall contain at least 60% and not over 70% glass by weight. All FRP work shall meet or exceed the following standards:

C.G.S.B.	41-GP-22
A.S.T.M.	3299 and 2563-2.4
A.S.T.M.	D883-69

- .3 The maximum load rating permitted on the top of the tank must be posted on a plaque on the inside of the lid. The plaque must clearly visible when the lid is open.

.3 Construction

- .1 Laminates shall be dense, without voids, dry spots, foreign inclusions, air bubbles, pinholes, or delamination and shall not be cracked or crazed. Such deficiencies shall be removed by grinding and replaced with hand laid matt and roving exceeding the amount removed. The fabricated unit shall have a smooth white inner surface and shall have a dimensional tolerance of plus or minus 6mm from design dimensions.
- .2 Bonded joints shall be made by wrapping with strips of fibreglass mat soaked in resin. The wrap material shall be at least as thick as the heaviest plastic section joined, and it shall extend to either side of the joint a sufficient distance to make the joint at least as strong as the pieces joined. Interior joints shall be coloured white to match the interior surfaces; exterior joints shall be of the same colour as the exterior surface.



- .3 The inside surfaces of bonded joints shall be sealed with one layer of mat and then coated with resin to a minimum of 2.5mm thick.
- .4 All exposed interior and exterior surfaces shall have sufficient resin coating 0.51mm minimum thickness, to avoid exposure of glass fibres.
- .5 To prevent "flowing" of the final resin coat, it shall be bonded by using "Veil" glass fibre.
- .6 All cut edges and drilled holes shall be coated with resin so that no glass fibres are exposed and voids filled.
- .7 Structural elements having edges exposed shall be reinforced with chopped strand glass mat.
- .8 The minimum tank wall thickness shall be 16mm and shall be externally reinforced to resist soil, bearing, hydraulic, and handling loads, both internal and external. Wall thickness to be increased as required to resist loading.
- .9 The resin used shall be a commercial grade and shall be evaluated by test of previous service to be acceptable for use in domestic sewage applications and suitable for installation underground throughout Canada.
- .10 Ultraviolet light inhibitors to be used on all external surface in accordance with resin manufacturer's instructions.

2.2 Submersible Sewage
Pumps

- .1 Pumps to be equipped with ANSI discharge flange. Pumps shall be a centrifugal, submersible, non-clog, bottom suction, capable of passing a 76mm solid. Pumps and motors shall incorporate the following:

Impeller: Cast iron.

Volute/Motor Frame: Cast iron, close coupled to seal chamber. Volute to be equipped with quick discharge nozzle to provide an automatic rapid and leakproof gravity lock type connection or disconnection from the fixed elbow. Sliding guide brackets to slide along guide rails.

Shaft: Stainless Steel.

Seals: Double mechanical seals (tungsten carbide to carbide upper and tungsten carbide to tungsten carbide lower).



Bearings: Anti-friction suitable for a minimum bearing life of 50,000 hours B10 life under operating conditions.

Fluid Operating Temp.: 0°C to 20°C.

Fluid Specific Gravity: 1.0

Fluid Type: Domestic Sewage

Fasteners: Stainless Steel (ASTM TYPE 316).

- .2 Motors shall be CSA approved submersible squirrel cage induction type with Class F insulation and non-hydroscopic windings. Service factor shall be 1.0. Use EEMAC Design B. If higher starting torque is required for the equipment loading, use EEMAC Design C.

Pump motors shall come equipped with means of communicating seal leaks and over-temperature conditions.

- .3 Power cables shall be factory-sealed into the motors and flush valve. They shall be of a type of construction acceptable to the electrical inspector. Cables shall be of sufficient length to reach the Control Kiosk without splices.

Power cables shall be equipped with a disconnect switch located inside the wet well, complete with lockout. Disconnect switches to be Meltric Decontactors or approved equal.

- .4 The pump motor nameplates shall be mounted in the Kiosk or Panel.

- .5 Pumps shall be painted with epoxy and equipped with sacrificial zinc anodes to provide corrosion protection.

- .6 Pump P2 to be equipped with Flygt Model 4901 Mix Flush Valve or approved equal.

- .7 Contractor shall supply the following spare equipment:

- one (1) impeller
- one (1) spare pump

2.3 Fixed Discharge
Connection

- .1 Fixed discharge elbow, quick disconnect type, with steel soleplate, lower guide rail holder and drilled for anchor bolts.



2.4	Lifting Chains	.1	Lifting chains to be Grade 80 Accoloy A8 material, rated with a working load of 1900 kg and shall be NAR approved for overhead lifting, finish to be galvanized. Chain length to be sufficient to connect between pump and chain hoist.
2.5	Guide Rail Assembly	.1	Schedule 40 galvanized steel pipe c/w upper guide bar holder.
		.2	All fittings and connectors to be galvanized.
2.6	Ventilation Duct Work & Fan	.1	Inlet duct shall be provided for air blown into the lift station and a vent shall release exhaust air.
2.7	Lighting Fixture	.1	The wet well light shall be an explosion-proof, wall-mounted, LED fixture suitable for Class 1 locations, complete with globe and guard, RAB Type EB 123 or equal. Switch by General Contractor.
2.8	External Piping	.1	As per the Contract Drawings.
2.9	Internal Piping	.1	Sewage piping shall be stainless steel.
2.10	Plug Valves	.1	Plug Valve, c/w lever. Flanges to ANSI B-16.1, Class 125.
2.11	Check Valves	.1	Ball check valve. Flanges to ANSI B-16.1, Class 125.
2.12	Level Regulators	.1	Provide five ENM-10 Flygt level regulators to stop both pumps, start lead pump, start standby pump, high level alarm, low level alarm for 24 volt operation, each with sufficient cable suitable for the installation.
		.2	Provide one aluminum liquid level hanger, with wall bracket mount and flat switch conductor hooks for excess cable. Hanger shall also provide threaded strain-relief squeeze connectors for each level regulator.
2.13	Bolts	.1	All bolts, including those for the check valve and plug valve, shall be ASTM Type 316 Stainless Steel.
2.14	Access Covers	.1	Access covers shall be designed to allow removal of the pumps from the stations without removing or damaging other equipment.
		.2	Each cover shall be hinged and include hydraulic assist for easy opening with less than 225 N lifting force and shall be provided with a padlock hasp with a box enclosure to prevent vandalizing of the lock.



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|---------------------------|----|---|
| | .3 | A brass padlock shall will be installed by the City at the developer's cost. |
| | .4 | Each cover shall be provided with a positive means of locking open. |
| | .5 | Safe-Hatch (or approved equal) shall be included to provide fall through protection. |
| 2.15 Air Release Valve | .1 | Air release valve to be 50mm diameter NPT inlet, cast iron body, bronze mechanism and seat, stainless steel lever pins and float, designed for sewage, rated at 1MPa. Provide shut-off valve and back flushing facilities including blow-off valves and 3 metre long back flush hose. Equip valve and hose with quick disconnect couplings. |
| 2.16 Floor Gratings | .1 | Fibreglass or Borden Type B aluminium Size No. 6 suitable for a bearing load of 5 kN/m ² , or 200 kg plus dead weight of one pump whichever is greater. |
| 2.17 Miscellaneous Metals | .1 | Aluminium: to ASTM 655. |
| | .2 | conforming to CSA G40.2-M1977; Type W with yield strength of 300 MPa, shop primed. |
| | .3 | stainless steel ASTM Type A316 Stainless Steel unless otherwise noted. |
| | .4 | Miscellaneous metalwork, including brackets, nuts and bolts, cables, turnbuckles, and eye bolts shall be stainless steel or aluminium. Sharp edges and weld splatter shall be removed prior to installation. |
| 2.18 Pressure Gauge | .1 | GIC #6211, liquid 100 mm diameter pressure gauge c/w snubber and isolating valve. |
| 2.19 Hydrostatic Tests | .1 | Pressure piping within the FRP wet well and valve chamber shall be hydrostatically tested to a pressure no less than 1.5 x the shut off pressure of the lift station pumps. The test pressure shall be held for a period of not less than two (2) hours, with no leakage permitted. |

Sewage forcemains external to the lift station shall be tested in accordance with Section 33 34 01 – Sewage Forcemains.

Should any test disclose leakage greater than that specified above, the Supplier shall locate and repair the defect and retest



			the section to ensure that the leakage is within the allowable limits.
2.20	Concrete Base and Anchoring System	.1	The reinforced concrete wet well base and anchoring system shall be designed to prevent uplift of the fibreglass lift station assuming that the surrounding soil is flooded to finished ground elevation and that the station is empty. A minimum safety factor of 1.5 against uplift shall be used in the design of the base and anchoring system.
2.21	Power Supply and Controls	.1	As per Division 26.
3.0	EXECUTION		
3.1	Excavation and Backfilling	.1	To requirements of Section 31 23 01 Excavation, Trenching and Backfilling.
		.2	Start backfilling only after the concrete has acquired a suitable degree of strength and only after obtaining written permission from the Contract Administrator. No backfilling of walls shall take place before the slabs have been cast and have reached a minimum of 75% design strength.
		.3	Use only the approved portion of the excavated material and other approved imported granular fill.
		.4	Deposit backfill in layers not exceeding 150mm thickness, and compact to obtain 95% of Standard Proctor Density or otherwise indicated on the Contract Documents.
		.5	Keep heavy compacting equipment away from structure by at least 1.5 metres. This portion shall be compacted using hand operated tampers.
		.6	Make all fills and embankments to elevations, contours, and slopes shown on the drawings.
		.7	Grade top layer carefully to smooth regular surface, with a minimum thickness of 100mm of topsoil, when indicated on the drawings.
		.8	Allow for any settlement which may occur in order that the finished fills or embankments will be to the final grades as shown on the drawings.



- .9 Excavate and remove all materials whatever their nature and condition to depths and dimensions necessary for the construction of the structure and piping to the limits shown on the drawings.
 - .10 Furnish all equipment for construction, temporary supports including shoring, bracing, cribs, coffer dams, etc. and for de-watering.
 - .11 Install and operate an adequate de-watering system for construction of the structures in the dry.
 - .12 All equipment used for de-watering and excavation shall be of a suitable and rugged type to assure continuous operation.
 - .13 Make special provisions to relieve the water pressure and prevent flotation or damage to parts of the works in case of accidental stoppage of de-watering equipment.
 - .14 Where over excavation is required, fill with specified sub-base or lean concrete unless otherwise indicated in the Contract Documents.
 - .15 Stockpile excavated granular material meeting backfill specification designated by the Contract Administrator. Save for re-use.
 - .16 Notify the Contract Administrator for inspection and approval after the excavation is completed.
 - .17 Do not place any concrete until the Contract Administrator has approved the depth of excavation and the character of the foundation material.
- 3.2 External Piping .1 To requirements of Sections 31 23 01 - Excavating, Trenching and Backfilling, Section 33 30 01 - Sanitary Sewers, and Section 33 34 01 - Sewage Forcemains.
- 3.3 Concrete Work .1 To Section 03 30 53 - Cast-in-Place Concrete and Section 03 20 01 - Concrete Reinforcement.
- 3.4 Electrical .1 To Division 26.
- 3.5 Piping Installation .1 Pipe shall be adequately supported on adjustable pipe saddle supports or from pie hangers or brackets during construction and completion to prevent abnormal stresses being imposed on items of equipment such as pump flanges.



- .2 Valves shall be installed in accordance with the manufacturer's recommendations.
 - .3 Before installing bolted connections, pipe ends, and gaskets shall be absolutely clean. Gaskets shall be lubricated with soapy water and bolts with thread lubricant. Bolts shall be tightened progressively by the crossover method and not in rotation around the joint. Bolts shall be torqued to the manufacturer's requirements. Wrenches used for tightening bolts shall be in good condition and properly sized to prevent rounding of nuts and bolt heads.
 - .4 During all stages of construction, piping shall be protected from damage from any cause. Openings in the piping system shall be securely covered, capped, or plugged to prevent collection of dirt, debris, or other extraneous matter during the entire construction.
 - .5 Damaged work shall be removed and replaced with new material to the satisfaction of the City.
- 3.6 Pumps and Accessories
- .1 Locate discharge elbows on the sump floor at exact locations required so that guide rails which connect from them to the access frame will be in perfect alignment.
 - .2 Firmly anchor discharge elbows to the floor at their proper location.
 - .3 Install guide rails.
 - .4 Lower pumps on guide rail system until contact is made with discharge elbows. Ensure that system functions to give leaktight connection.
- 3.7 Start-Up
- .1 Lift station shall be completed, including work of other sections, before start-up.
 - .2 Start-up of equipment to take place in the presence of a trained representative of the Equipment Supplier and City. Copies of final operating and maintenance manuals shall be provided to the City at least two (2) weeks in advance of start-up.
 - .3 Set level and align all equipment to the complete satisfaction of the City.
 - .4 Carefully check the operation and controls of the equipment.



- .5 Notify the City when the operation and controls of the equipment are satisfactory.
- .6 Provide the necessary facilities for the City to check the operation of the equipment.
- .7 The Contractor shall make provisions for adequate supply of water to the wet well and forcemain for testing purposes. Testing will include checking performance of all pumps, floats, and controls. At minimum the following tests will be conducted.
 - .1 Pump Condition - i.e. pump body, impeller running free, quick disconnect connection, cable connections, gaskets and oil level.
 - .2 Wet Well Condition - i.e. pump sliding free on guide rails, pump cable with sufficient slack, floats suitably positioned and will not snarl, no cable splices or junction box in the wet well, well clean.
 - .3 Control Panel Condition - i.e. components including motor overloads correctly rated for the pumps. Record over-load settings on schematic, date and sign.
 - .4 Start-Up Operation - i.e. supply voltage suitable, pump rotation correct, operation of pumps - by float switches - HOA selectors - lead pump selector - overloads isolate associated control, alarm float.
 - .5 Pump Load Checks - ie. load current on all phases for single and parallel pump operation, supply voltage under load. Confirm pumping rate and operating head.
 - .6 Alarm panel test to confirm all zones are correctly configured and operational.
- .8 Liaise with the Contract Administrator to ensure that the Design Engineer, the City, the Contractor, and the Equipment Supplier are present for the start-up and testing program.
- .9 The City will not take over operation and maintenance of any equipment until the work of all related sections has been completed in the area in which the equipment is located and all equipment has operated in its intended manner to the satisfaction of the City.



- .10 Cost of any temporary power costs for the start-up procedure shall be the responsibility of the Contractor.
- 3.8 Protection
 - .1 Protect the work and material of all other sections from damage and make good all damage thus caused, to the satisfaction of the City.
 - .2 Be responsible for work and equipment until finally inspected, tested, and accepted, protect work against theft, injury, or damage, and carefully store material and equipment received on site which are not immediately installed. Close open ends of work with temporary covers and plugs during construction to prevent entry of obstructing materials.
- 3.9 Cleaning
 - .1 Any dirt rubbish, or grease on walls, floors, or fixtures for which the Contractor is responsible must be removed and the premises left in first class condition in every respect.
 - .2 De-water station wet well and remove all dirt and grit from bottom of station.
- 3.10 Maintenance Manuals
 - .1 Supply three copies of hard backed bound manuals with all the information required for maintenance, operation, parts catalogue and lubrication.

The following information shall be included in the manual:

- .1 Table of contents.
 - .2 As constructed shop drawings.
 - .3 Equipment, layout drawings.
 - .4 Electrical, control, and alarm wiring diagrams.
 - .5 Normal and emergency operating instructions for all equipment.
 - .6 Maintenance instructions for all equipment.
 - .7 Safe work procedure for confined space entry into the wet well and valve chamber (to be prepared by a Qualified Professional).
 - .8 Equipment data sheets.
 - .9 Certified head/capacity curves for pumps.
 - .10 Equipment part lists.
 - .2 Each section shall be separated from the preceding section with a plasticized divider with a tab denoting contents of the section.
 - .3 Review all of these instructions with the City representatives before the commencement of the maintenance period.



General catalogues will not be accepted and bulletins must deal specifically with the equipment provided.