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SECTION 2.9 – LIFT STATIONS

2.9.1 INITIAL CONSIDERATIONS

Extension of sanitary servicing, by means other than gravity flow sewer mains, is to be considered only in cases where economically insurmountable constraints cannot be resolved thereby dictating a requirement for a wastewater pumping station. This must be justified through the Preliminary Design Report for the development area. This section applies only to pre-packaged wet well duplex lift stations where pumping requirements are less than 100 hp (2500 lbs).

Wet wells are to be Flygt duplex pumping systems. A Flygt pre-packaged station with Flygt N, CP series pumps or newer and Barski Industries tank, or approved equivalent, is to be used for all lift stations unless wet well or pump capacity dictates dry well / wet well configured design. When a grinder is not installed on the inflow pipe to the wet well, A Flygt F series pump, or equivalent, is to be installed.

A stand-alone building will be required should the size of the pumps or the need for a standby generator and fuel tank warrant it, or if requested by the Engineer.

The building is to include all controls, have water service provided and should be located as close as possible to the wet well (where applicable). Interior wall finishes for lift station buildings are to be fire treated plywood with application of white paint.

The City of Whitehorse will exercise discretion regarding provisions of Lift Station Buildings on a case by case basis. These provisions include but are not limited post-disaster criteria, accommodation for removal of pumps, and the requirement for pressure level transmitters.

2.9.1.1 STANDARDIZATION

The City encourages consistency and standardization in the design and construction of wastewater pumping stations by the requirements of Flygt equipment unless otherwise approved herein.

This standardization is intended to promote designs that facilitate economical construction and operation and increased reliability. Standardization in equipment and controls will reduce the inventory of spare parts, allow for interchangeability, and promote safe and efficient operation and maintenance

2.9.1.2 STAGING OF WASTEWATER PUMPING FACILITIES

Where warranted, due to economic considerations or to accommodate extended periods of development of the contributing area, the provision of pumping capacity and/or the construction of a wastewater pumping station may be staged appropriately.

Where such staging is proposed, all stages are to be defined and related to the anticipated development scenario for the contributing area. A plan of action is to be established as part of the initial design to define the process for the implementation of future stages. The plan should consider continuity of service, the responsibility and financial arrangements for future stage implementation and the most cost-effective method for implementing the capacity changes.

A modular approach to the arrangement of structural components and/or pumping units may facilitate staging and this should be reviewed as part of the design.

Design and construction criteria for pumping stations anticipated to be required for limited periods will not be relaxed.

2.9.2 DETAILED DESIGN REPORT REQUIREMENTS

The basis for detailed design of wastewater pumping stations will be defined in the Preliminary Design Report. In support of the detailed design for a wastewater pumping station, a summary report should be prepared. This report is to address the following items:

- A brief description of the project and purpose;
- The justification for a wastewater pumping facility;
- Design period (30 years or maximum development potential);
- Area serviced;
- Population densities and ultimate total population;
- Commercial and industrial contributing areas and consideration for industrial effluent;
- Projected average, peak and minimum daily dry weather flow including allowance for infiltration, related to anticipated development staging;
- Landscaping requirements to meet adjacent development;
- Assessment of power factor and installation of PF correction where design PF<0.9;
- Provision of domestic water service and building plumbing system;
- Station security, including cameras;
- Infiltration and extraneous flow allowance;
- Design flow rates proposed;
- Number, type, capacity and motor power of the proposed pumping units;
- Forcemain design basis;
- System head curves, including head computations for the pumping system;
- Sewage detention times in the wet well and forcemain under various operating conditions (cycle time assessment is to be provided on design and record drawings);SCADA connection/modification requirements;
- Radio and mast for SCADA communications if fiber is not available;
- Heating and Ventilation requirements;
- Odor control measures;

- Emergency backup systems, including overflow provision and a standby power generator, to address mechanical, electrical or operator failures or catastrophic events;
- Environmental considerations and impacts;
- Station location, considerations and accessibility; and
- Staging provisions.

2.9.3 DESIGN REQUIREMENTS SPECIFIC TO PRE-PACKAGED LIFT STATIONS

All pre-packaged stations are to have the following features:

- Vertical Main chamber made of Fibreglass Reinforced Plastic (FRP) with filament wound shell section and external reinforced ribs integral to base;
- Side mounted valve chamber;
- All FRP reinforced base with molded corners capable of handling full water tables;
- Smooth molded interior with sanitary white finish for ease of cleaning;
- All external surfaces are to be forest green gel-coat with UV inhibitors;
- All tank bolting hardware is to be Type 304 stainless steel minimum;
- 50 mm approved insulation on outside of tank to 3000 mm below grade, inside tank roof and inside hatch;
- FRP discharge piping that is rated at 1380 KPa (200 psi) with a gel coated white exterior;
- All aluminum lid and hatch covers with stainless steel hardware for hinges and lock pins;
- Lid and hatch covers are to include an intrusion switch;
- Hold down and lifting lugs made of mild steel coated with coal tar epoxy filament wound into the bottom and top ribs respectively;
- Flanged FRP inlet nozzles rated at 350 KPa (50 psi);
- Flanged FRP forcemain nozzle rated at 1380 KPa (200 psi);
- Vent including one inlet with down-comer pipe and a gooseneck outlet on the station top all in FRP;
- 3-50 mm threaded electrical connections;
- Galvanized guide rails;
- Full, corrosion resistant intermediate platform;
- Full ladder made of aluminum, stainless steel or FRP capable of holding 200 Kg;
- Grab handle or safety post for ladder;
- Guide rails in galvanized or stainless steel;

- Installation of lifting davit sockets;
- FRP stilling tube for transducers;
- Dexon blower heater and adapter flange c/w down comer pipe;
- Explosion proof 100W light operated from control panel;
- Explosion proof, “quick connect” plugs on pump electrical wires;
- Flygt T.O.P. tapered base system (1500 mm to 2600 mm diameter tanks);
- Flygt flush valves are to be utilized where ever possible;
- Air release valve;
- Emergency suction or pump out line to top of station;
- Winch assembly;
- Pump lifting chain and shackle;
- Sufficient lifting lugs to secure station to concrete base; and
- 19 mm insulated and heat traced water service where available with approved backflow assembly.

Only equipment essential for the operation of the pump station is to be located in the wet well. Where possible all switches and electrical equipment is to be located in the control panel.

Three complete sets of Engineer sealed drawings are to be submitted for City review prior to station configuration approval. The drawings are to provide detail of all major construction elements and a list of all equipment furnished.

A Geotechnical Engineer is to approve foundation design, anchoring bolts, concrete ballast, excavation, and backfill.

2.9.4 EXTERNAL CONNECTION CONSIDERATIONS

2.9.4.1 WASTE WATER INLET SEWER

Only one sewer connection is to be provided into a wet well to convey sewage from the contributing collection system.

If more than one sewer enters the site or is required to be connected to the pumping station, a collection manhole is to be provided as a junction point for all incoming sewers. Appropriate stubs are to be provided for future connections. Only a single connection is to be made from the collection manhole to the wet well of the pumping station.

2.9.4.2 OVERFLOW CONNECTIONS TO SANITARY SEWER SYSTEMS

In anticipation of the potential operational failure of a wastewater pumping facility and its backup provisions, the feasibility of providing a gravity overflow is to be evaluated. The elevation and hydraulic

capacity of overflow connections are to be optimized to minimize the risk of basement flooding due to sanitary system backup.

Provision of an overflow connection to an adjacent or downstream sanitary sewer system is required whenever it is feasible. The connection should be from a manhole outside the station to permit the overflow to bypass the pumping station. If this is not possible, then overflow from the pumping station wet well will be permitted.

2.9.5 WET WELL CONSIDERATIONS

2.9.5.1 SIZING

Wet wells are to be of adequate size to suit equipment space, operator access requirements, and active volume considerations. 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, and priming requirements and vortex control.

Wet wells must be sized small enough to minimize total retention time, the time sewage is held in the wet well, and any rising forcemain, and yet be large enough to control the frequency of pump starts. The maximum retention time in the wet well should not exceed 30 minutes for the design minimum flow rate anticipated when the contributing area is fully developed. Depending on the activity level of the Sewage, Flygt may recommend an alternative retention time based on the station cycle times. The Engineer must approve any variation of retention times. It is desirable to have a wet well with sufficient active volume so that all sewage within the discharge forcemain will be replaced during one pumping cycle, especially of sags exist in the forcemain profile.

Wet wells should be sized large enough to maximize pump life by decreasing the frequency of pump starts. However, in the interest of limiting excessive detention time, wastewater pumping stations will inherently be subject to relatively high frequencies of switching cycles.

Exceeding a frequency of 15 starts per hour for motors of above 30 kW increases the cost of switchgear and motor maintenance and the reliability and life of the machinery and electric components will decrease. Accordingly, sufficient storage between switching levels should be provided to limit the number of pump starts, normally to 6 per hour with pump alternation and 10 per hour with the standby pump inoperative. The Manufacturer's recommendations with regard to the allowable frequency of pump starts for the specific size and type of motor are to be satisfied.

Inlet mains are not to be utilized for wet well storage. The inlet to the station is to be above the normal high level operating point.

2.9.5.2 SHAPE AND BENCHING

Wet wells are to be arranged and benched to limit dead spaces where solids can accumulate and to provide smooth, uniform, and unobstructed flow to the pump suction influence zones. Wet well floors should have a minimum slope of 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.

The cross-sectional area and shape of the wet well above the benching is to be constant or increasing from the bottom towards the top.

Suction elbows, baffle plates, vortex breakers, or drop tubes are to be provided as required to prevent vortex from occurring.

2.9.6 PUMPS

2.9.6.1 PUMPING CAPACITY REQUIREMENTS

Pumping equipment is to be selected with capacity in excess of the maximum expected flow as determined by established engineering practice. In all cases, the design capacity flow rate for a wastewater pumping station is to exceed the expected maximum flow rate determined for the development.

A minimum of two pumps is required for each pumping station with a third spare pump.

2.9.6.2 PUMP SELECTION CONSIDERATION

Wet well installed 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. Where possible, quick cable disconnects are to be installed for ease of pump removal for servicing.

Pumps are to be designed to handle raw sewage and pump impellers are to be of a non-clog design. Where specialized requirements are required, a grinder impeller may be considered.

Pumps are to be selected which provide optimum efficiencies at actual operating points. At any operating condition on the characteristic curve of the pump, the pump should not exceed the power rating of a motor.

Flush valves to the wet well are to be provided for aeration and suspension of grit and solids in wet well.

Pumps selected should be the product of a manufacturer with lengthy experience in the design and manufacture of pumps for raw sewage service.

2.9.6.3 PUMP ELECTRIAL REQUIREMENTS

Where ever possible, main pump motors are to operate on 600 volt, 3-phase power. All wet well installed pumps are to have approved explosion proof plugs for pump disconnection within the wet well without personnel entering the wet well.

2.9.7 PIPING REQUIREMENTS

The minimum diameter for all pump suction and discharge piping is to be 100 mm nominal. Piping is to 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.

All piping within wastewater pumping stations is to be corrosion resistant material. All flanged bolting in wet well areas is to be stainless steel. Buried pipe under the facility and within the excavation is to be a minimum of standard wall welded steel, with yellow jacket exterior and cement or epoxy interior; or galvanized pipe with polyken tape wrapped exterior.

Corrosion potential is to be assessed and cathodic protection installed where required.

The pressure rating for piping within the station is to suit the service requirement; however the minimum rating is to be 900 KPa.

2.9.8 VALVE REQUIREMENTS

2.9.8.1 CHECK VALVES

A check valve is to be installed on the discharge line between each pump and isolation valve.

A check valve is to be installed after the bypass tee connection shutoff valve to prevent backflow to any connected auxiliary pump. This valve may be mounted vertically if necessary.

Ball checks are to be avoided unless otherwise approved. If ball checks are approved for installation, they are to be installed complete with a drain cock.

Check valves are to be supplied with external levers and spring and limit switches to indicate and prove valve opening on wet well / dry well configured stations.

2.9.8.2 ISOLATION VALVES

Shutoff valves are to be included on the discharge lines from each pump between the pump check valve and the discharge header. This will permit isolation of each pumping unit and check valve for removal or repair.

A forcemain isolation valve is to be included on the main discharge pipe where it connects to the discharge forcemain leaving the facility, to isolate the forcemain from the pump station.

Isolation valves are to be plug valve style.

2.9.8.3 BYPASS PROVISIONS

A tee-connection with a shutoff valve on the branch is to 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. The unconnected end of the tee connection must be oriented to face toward an access hatch or entryway to facilitate the connection of the auxiliary pump discharge or outlet line.

2.9.9 STATION CONTROL, SCADA AND ALARM HANDLING

2.9.9.1 INSTRUMENTATION

Allen Bradley or Micrologix controllers are to be utilized for station control. Primary level control is to be an atmospherically compensated pressure transducer, radar or ultra-sonic - subject to approval. The control panel is to be CompactLogix model 1769-L33ER HMI and is to have the following features:

- EEMAC 4 enclosure or equivalent
- Fusible type main disconnect switch mechanically interlocked with the inner door
- Factory applied R10 insulation in outside applications;
- Thermostatically controlled Strip heater in outside applications;
- Internal, switched lighting;
- All wiring is to be numbered as identified on shop drawings;
- All wiring is to be connected to terminal blocks;
- All wiring is to be bundled in channeling;
- Locking mechanism; and
- 120 volt, 15 amp duplex receptacle and 240 volt, 30 amp receptacle

Stations are to have graphic display control interface or SCADA / HMI terminal as approved by the City.

All control systems are to have un-interruptible power supply capable of powering the control systems for 2 hours. All control systems are to be protected by transient voltage surge suppression.

The control panel must be located so that it cannot be flooded under any foreseeable circumstances. All drywells are to be equipped with flood sensors and alarms.

Pumps are to be controlled so that Lead pump is cycled after each pump operation.

All stations with backup power are to have power monitoring equipment installed and appropriate Robonic or otherwise approved transfer switch.

As backup for high and low station operation, Flygt bulb controlled low voltage relay logic is to be provided.

All Flygt pre-packaged stations are to have flow calculated by the controller based on pumping and station inflow rates.

All pumps are to have mechanical analogue read out for pump run hours.

Standard instruction sensors are to be magnetic (non-mechanical) in consideration of frost build-up, unless otherwise approved.

2.9.9.2 SCADA

SCADA requirements are outlined in Appendix 2.A.

The use of dial up modem, wireless or fiber lines for communication to the City's central SCADA is to be approved by the City.

All City approved station status points are to be entered into the Allen Bradley or controller and transmitted to the City's central SCADA system.

Approved modifications for graphical screens, control, data logging, report generation and O&M manuals are to be made to the City's SCADA system.

2.9.9.3 ALARM HANDLING

All City approved station process alarms are to be inputted into the Allen Bradley controller and transmitted to the City's central SCADA system. Approved modifications are to be made to the City's SCADA to represent process alarms.

Intrusion alarms are to consist of a DSC panel, model number PC 1616 or PC 1832, complete with full message keypad model number PK5500. The preferred phone line is a Centrex line. For stations that do not have emergency back-up flyght bulbs (i.e.: booster stations and recirculation stations) a DSC TL 260 communicator with a connection to the City network (instead of a phone line) is required.

Modifications to represent the station are to be made to the City's Patriot central alarm system.

Each pump, where applicable, is to monitor pump motor leakage, overload, and overheating.

2.9.9.4 PRESSURE GAUGES

Gauges should be a compound pressure/vacuum type, equipped with a diaphragm seal and isolation valves. Gauges provided for the discharge should be liquid-filled with a maximum range of appropriately twice the working pressure.

2.9.10 SITE REQUIREMENTS

2.9.10.1 PROXIMITY TO OTHER LAND USES

Special consideration should be given to the location of wastewater pumping stations relative to existing or proposed adjacent development, in order to minimize the facilities aesthetic impact in terms of visibility, odour, and noise. The location of wastewater pumping stations in the immediate proximity of school sites and playgrounds should be avoided if possible. Safety and security measures are to be given special consideration in such cases.

2.9.10.2 VEHICLE ACCESS

When lift station is adjacent to developed areas, a 4.5 (minimum) wide paved road is to be provided into the site, with extensions as appropriate to provide maintenance vehicle access for removal or delivery of

other station equipment. Paved space should also be provided for parking of maintenance staff and service vehicles. For lift stations not adjacent to developed areas, gravel surfaces may be acceptable.

2.9.10.3 PEDESTRIAN ACCESS

Pedestrian access is to be provided from the parking area to the Lift Station.

2.9.10.4 FENCING

All above ground pumping stations are to be fenced. The fence is to have an opening gate for entry of vehicles and equipment. The gate is to be lockable to prevent unauthorized entry. Fences are to typically be zinc coated industrial grade steel chain link (security type) and be of 1.83 m overall height complete with three-strand barbed wire overhang. Architectural fences providing a similar level of security may be considered where dictated by aesthetic considerations. Fencing must be durable and maintenance free.

2.9.10.5 SITE GRADING

Pumping stations are to be located outside of the limits of any area subject to surface ponding or inundation by surface flow during major runoff events so that they are accessible in all weather conditions. The pumping station site is to be adequately graded so that it drains freely away from the facility and no ponding of water will occur adjacent to buildings, entrances or around electrical transformers. Site elevations are to be established such that the facility is not subject to flooding due to runoff flows or ponding under any conditions of rainfall or runoff from snowmelt.

2.9.10.6 LANDSCAPING

At the minimum, pumping station sites are to be landscaped with grass or provided with a low maintenance ground cover material. Where the proximity to public land use dictates a need for additional landscaping measures to conceal the facility, or to enhance its appearance, these must be part of the facility design and construction. These measures will, with appropriate irrigation systems, include appropriate planting of trees and shrubbery or architectural treatments of structures.

If a station building is required, water service is to be provided if available.

For further City of Whitehorse Landscaping requirements, refer to Sections 2.8 and 3.22 of this manual.

2.9.11 MAINTENANCE AND OPERATIONAL PROVISIONS

2.9.11.1 OPERATING, MAINTENANCE AND SERVICE MANUAL

As part of the responsibility for the design of a wastewater pumping station, the design Engineer is to prepare and provide an Operating Maintenance and Service Manual for the facility.

An example outline of the Table of Contents for an O & M manual is shown below. All sections are to include a Title Page and Table of Contents.

This outline is to be used as a guideline:

1. CITY OPERATOR'S FOLDER

(Contractor to develop sections as indicated. City to develop the remaining sections. Contractor is to provide tabs for all sections.)

1.1 City Operator's Record of Changes (equipment, programming, software, or upgrades)

1.2 Emergency information (listing)

1.3 System Maintenance description and checklist (by Contractor)

1.4 Software changes or upgrades listing

1.5 Alarm listing

1.6 Programming printouts and scripting

1.7 Key data (i.e. set-points, passwords, IP addresses, telephone numbers)

2. SAFETY

2.1 Hazard Assessment (by Contractor)

3. PROJECT DESCRIPTION

3.1 Site sketch (by Contractor)

3.2 Project sketch (by Contractor)

3.3 System Introduction (by Contractor)

3.4 System Description and Operation (by Contractor)

3.5 SCADA-ready features (by Contractor)

4. CONTRACT INFORMATION

4.1 List of Suppliers (by Contractor)

4.2 Software license and other licenses (by Contractor)

4.3 Warranty, Certification & Construction Completion Certificate (by Contractor)

4.4 Permits and Inspectors Reports (by Contractor)

4.5 Distribution of manual copies (by Contractor)

5. COMPONENT INFORMATION

(Description, Manufacturer's information, Manuals & Drawings)

5.1 Control panel (by Contractor)

5.2 Controller (by Contractor)

5.3 Calibration Instructions and initial calibration record

5.4 Pumps, Motors and Impellers (by Contractor)

5.5 Pump curves (by Contractor)

5.6 Level Transducer & Bulb Type Regulators (by Contractor)

5.7 Heaters (by Contractor)

5.8 Security Alarm System (by Contractor)

5.9 Chain Hoist (by Contractor)

5.10 Electrical Cabinet (by Contractor)

5.11 Electrical components (by Contractor)

5.11.1 TVSS

5.11.2 Programmable controller

5.11.3 Controller user guide

5.11.4 Modem

5.11.5 Alarms and security panel

5.11.6 Site security

5.11.7 Telephone line(s)

5.11.8 Alarm dialer and alarm

6. SUPPLIER'S SHOP DRAWINGS

6.1 Pre-fabricated Lift Station Shop Drawing (by Contractor)

6.2 Lift Station Details (by Contractor)

6.3 Lift Station Power & Telephone Servicing (by Contractor)

6.4 Control Panel Wiring Diagrams (by Contractor)

7. RECORD DRAWINGS AND CONSTRUCTION PHOTOS

(Full-size A1 drawings required - folded into plastic pockets)

7.1 Site and Utility plan (by Contractor)

7.2 Electrical plan (by Contractor)

7.3 Construction Photos (color) (by Contractor)

8. USB COPY

(in plastic pockets)

8.1 Electronic Record of the Manual and drawing attachments (by Contractor)

8.2 Programming scripting and scripting commentary listing (by Contractor)

8.3 Software provided or necessary (by Contractor)

8.4 Component supplied digital files (by Contractor)

Three copies of the manual are to be provided prior to the issuance of a construction completion (CCC). When completion of a finalized manual prior to CCC is not feasible, then to facilitate the timely transfer of operational responsibility, the Engineer may accept an interim form of the operation maintenance and service manual at CCC. The Developer is to provide the completed final version of the manual prior to approval of final acceptance certificate for the improvement.

The manual is to include:

- The Engineer's design operational protocol;

- Complete set of Equipment manufacturer's operation, maintenance service and repair instructions;
- All warranty certificates;
- A complete parts list for all mechanical and electrical equipment, including all control diagrams and schematics with wires individually numbered and identified;
- Test results and calibration of all equipment from commissioning and testing conducted by professional Engineers for the Developer prior to application for a construction completion certificate;

O & M manuals are to be assembled in 210 mm x 275 mm capacity, expanding spine catalogue binders complete with plated piano hinges, bound in heavy blue fabric, with hot stamped white lettering on front and spine. A sufficient number of volumes are to be provided for to allow each binder to hold system data while in full closed position (not expanded). A sample of art work and fabric colour is to be provided to the Engineer before having binders constructed.

In addition to the hard cover binder, a USB drive containing the entire O&M Manual in .pdf format is required.

2.9.11.2 PUMP AND EQUIPMENT REMOVAL

Provisions are to be made in the piping for removal of all valves and equipment. Appropriately located vent and drain valves are to be provided to permit drainage of all piping to facilitate valve and equipment removal. Permanent hoist equipment and access hatches are to be provided to permit removal and replacement of any piece of station equipment requiring routine maintenance or replacement

As an alternative in specific cases, appropriate vehicle access and adequate access hatches may be provided to allow the use of exterior mobile cranes. "Safe hatches" are to be used where required.

For wet well pump installations, the provision and arrangement of lifting equipment is to be such that the necessity for personnel to enter the wet well for removal of equipment is minimized.

Lifting equipment should have sufficient capacity to handle the heaviest load anticipated, including the allowance for dynamic forces due to load shifting. The capacity of all lifting equipment is to be clearly posted. Eyebolts in the walls and/or ceilings are to be provided for rigging chain hoists or come-alongs.

2.9.11.3 ACCESS INTO STATION STRUCTURES

Suitable and safe means of access are to be provided to all equipment requiring inspection of maintenance and to the wet wall for inspection and cleaning.

Stairways and ladders are to comply with the requirements of Occupational Health and Safety. All stairs are to be of a non-skid type.

Access into wet wells is to be from the outside and not through buildings or dry wells.

Doors and access hatches are to have suitable locking devices.

For all entry hatches, non-protruding extension ladders are to be provided, which must be located far enough away from the walls to be able to be pulled up through the access opening and extended to a height of at least 1.0 m above the roof.

Access hatches covers for all roof openings to wet or dry wells must be sealed or have sufficient overhang to prevent rainwater inflow. Odor tight aluminum hatch covers should be used. Fall arrest anchors are to be installed where required.

2.9.11.4 OPERATIONAL RELIABILITY/ EMERGENCY BACKUP PROVISIONS

The design of wastewater pumping facilities must identify and anticipate all events that affect the functioning of the facility. Provisions must be made to mitigate the consequences of failure of the facility by any mode, to prevent property damage, the endangerment of public health or environmental damage.

In cases where redundant electric power supply or overflow connections is not feasible, provision of on-site installed emergency standby power equipment installed in a building is required.

2.9.11.5 LIGHTING

Adequate lighting is to be provided for the entire facility. Emergency backup lighting and wet well lighting is to be provided. Switching is to be outside the wet well where feasible.

Wet well lighting should be arranged to be indirect (from outside of the well) and maintainable without entering the wet well whenever feasible.

Exterior lights are to be provided to illuminate all building entrance areas, entrance hatches, and outside equipment access locations. Lighting at building entrance areas are to be movement activated for security.

2.9.11.6 VENTILATION

Forced mechanical ventilation is required at all wastewater facilities. Suitable equipment is to be installed to provide for continuous ventilation at a rate of six air changes per hour (at low water) in each of the wet well areas. Completely separate systems are required for each.

Generator ventilation and cooling is to maximize recirculation and use minimum outside air in consideration of cold weather operation.

Fresh air, heated and thermostatically controlled, is to be forced into each area at a point 150 mm above the high water level in wet wells and exhausted at higher levels. In pits over 4.5 m deep, multiple inlets and outlets are desirable.

Subject to City approval, provisions for connection of portable ventilation equipment may be included as an alternative to continuous ventilation for the wet well only. The Engineer will supply details of the connection requirement on request.

Consideration should be given to provision of an automatic control to increase ventilation rates to 20 to 30 air changes per hour, interlocked to turn on with light switches, in addition to the continuous ventilation requirements.

Provision is to be made to detect and actuate an alarm if the ventilation system should fail. A local alarm indicator is to be provided and is to be noticeable prior to station entry without being noticeable to the public. Provision should be made for transmission of the alarm through the telemetry system to the 2-Mile Hill SCADA Central System.

Provision is to be made for ventilation of wet wells using portable ventilation equipment, in case of failure of the built-in system. This provision is to consist of a 200 mm diameter standpipe extending from inside the wet well to a flanged connection on the exterior of the facility.

The end of the standpipe is to be located to permit discharge of air through the standpipe to a point 150 mm above the normal high operating level of the wet well.

All dry wells and architecturally enclosed spaces connected to a wet well are to be equipped with gas detection sensors with visual & auditory alarm capability connected to the SCADA system.

2.9.11.7 HEATING

High-efficiency furnaces or boilers are to be installed complete with heat recovery units to recover waste heat from exhausted air.

The entire facility is to be designed for energy conservation and in compliance with the National Energy Code of Canada the City of Whitehorse Building and Plumbing Bylaw.