



WASTEWATER LIFT STATION
DESIGN STANDARDS

April 9, 2025

I. GENERAL

1) Introduction

The wastewater lift station design standards outline the City of Snohomish (City) design requirements for public and private wastewater lift stations. Upgrades or modifications to existing wastewater lift stations shall comply with these standards to the extent practical. The wastewater lift station design standards include design criteria and Standard Drawings.

The City of Snohomish reserves the right to modify or waive any design standard. Any deviations from these design standards will require written justification to and the approval of the City of Snohomish prior to construction or permit issuance. The City may require a cost-benefit analysis to compare deeper gravity systems with proposed lift stations. Building Permit(s) and all applicable, required Permits must be submitted for the municipal lift station.

A pre-design meeting is required with the City to determine the design parameters, including tributary area, and design period.

2) List of Abbreviations:

AKART	All Known Available and Reasonable Technology
ASPP	Accidental Spill Preventions Plan
BMPs	Best Management Practices
BOD	Biochemical Oxygen Demand
CC&Rs	Covenants, Codes and Restrictions
CFR	Code of Federal Regulations
COD	Chemical Oxygen Demand
CSO	Combined Sewer Overflow
DIPRA	Ductile Iron Pipe Research Association
DOE	Department of Ecology
DOH	Department of Health
EPA	U.S. Environmental Protection Agency
FEMA	Floodplain Emergency Management Administration
FOG	Fats, Oils, and Grease
GPD	Gallons per Day
GPM	Gallons per Minute
HDPE	High Density Polyethylene
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Fire Code
L	Liter
L&I	Labor and Industries
LEL	Lower Explosive Limit
LPI	Lightning Protection Institute
Mg	Milligrams
mg/L	Milligrams per Liter

MGD	Million Gallons per Day
NEC	National Electric Code
NFPA	National Fire Protection Association
NPDES	National Pollutant Discharge Elimination System
NPSHA	Net Positive Suction Head Available
NPSHR	Net Positive Suction Head Required
NPT	National Pipe Thread
NSCIU	Nonsignificant Categorical Industrial User
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
POTW	Publicly Owned Treatment Works
PVC	Polyvinyl Chloride
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
SIC	Standard Industrial Classifications
SIU	Significant Industrial User
SMC	Snohomish Municipal Code
SSO	Sanitary Sewer Overflow
SWDA	Solid Waste Disposal Act (42 USC 6901, et seq.)
TSS	Total Suspended Solids
UGA	Urban Growth Area
USC	United States Code
WEF	Water Environment Federation
WTS	Water Technical Sheets

3) Applicable Regulations and References

Wastewater lift stations, at a minimum, shall conform to this document, SMC, and the Washington State Department of Ecology Criteria for Sewage Works Design (Orange Book). Other regulations governing facilities and construction shall be adhered to, including regulations published by OSHA, L&I, NFPA, NEC, IFC, IBC, Washington State Uniform Plumbing Code (UPC), and others as applicable and amended by Washington State and City of Snohomish.

Reference documents include the current editions of Design of Wastewater and Storm water Pumping Station, Manual of Practice FD-4 by WEF, Handbook of PVC Pipe Design and Construction by PVC Pipe Association, Handbook of Polyethylene Pipe by Plastic Pipe Institute (PPI), Ductile Iron Pipe Design Manual published by Ductile Iron Pipe Research Associations (DIPRA), Recommended Standards For Wastewater Facilities (Ten State Standards), and Washington State Department of Transportation (WSDOT).

II. DESIGN CRITERIA

1) Design Flow

Wastewater lift stations shall be designed to accommodate the projected peak hour flow rate. The design flow rate for the wastewater lift stations shall consider current and projected peak flow rates and wastewater composition.

a) Planning Period/Growth Rate

Wastewater lift stations shall, at minimum, be designed to accommodate a 50-year planning period for the major components including the wet well volume, force main, and pump station electrical requirements, instrumentation, and piping. Initially, the pumps furnished shall be designed to satisfy flows projected to occur over a 20-year planning period. No portion of the conveyance system may be counted towards required wet well volumes. Appropriate growth rates utilized for the planning period shall be submitted and approved by the City.

b) Existing and Projected Flows

Wastewater lift stations shall be designed to pump the flow for existing, planned, and future developments in conjunction with planned improvements per the current City's Comprehensive Plan, General Sewer Plan, and Capital Improvement Program.

Zoning and land uses shall determine population density for determining residential flows. Commercial flows shall be analyzed on a case-by-cases basis dependent on number of employees, business hours, nature of use and operations, effluent constituents, discharge schedule, water consumption, flow data, and other pertinent information to classify quantity and quality of the wastewater discharge. A peaking factor per the Orange Book shall be applied to the average daily per capita flow and includes coverage for inflow and infiltration (I&I) from combined sewer and storm areas. High groundwater, older systems, and/or illicit connections shall be considered in the flow quantity when present.

The contributory wastewater basin shall be the topographic basin for the area based on minimum gravity sewer slope design per the Orange Book and may include areas outside the City limits as determined by the City on a case-by-case basis. Both developed and undeveloped properties shall be included. Flow contributions outside the City limits within the Urban Growth Area (UGA) shall be determined by using the City's proposed population densities through zoning and land use applications in combination with the City of Snohomish's occupancy wastewater rates.

c) Composition

Wastewater composition can vary widely depending upon the proportion of design flow generated by non-domestic users. Non-domestic user wastewater composition shall be supplied to the City during permit review. Adequate consideration and necessary provisions shall be taken to ensure that wastewater lift station equipment and materials are suitable for the anticipated composition and quantity of non-domestic wastewater. SMC 15.08 contains the Prohibited Discharge Standards.

2) Downstream Impacts

The applicant shall determine the adequacy of the existing sanitary sewer system to accommodate the proposed development from the point of connection to a major sanitary sewer interceptor. Normally the capacity can be determined based on the developed area contributing to the existing facility. The following shall be addressed in the sewerage report to substantiate the design of the system:

- Area of project and adjacent areas.
- Tributary areas outside project.
- Jurisdiction(s) of project, adjacent areas, and tributary areas.
- Contours for existing and proposed elevations at two (2) feet intervals. LIDAR data may be used for offsite basin analysis.
- Zoning and land uses used to predict flows.
- Any non-domestic waste being introduced into the sewer system such as industrial process waste, cooling waters, etc. and the types of pretreatment devices to be provided.
- Calculations showing predicted average and peak flows at major junction points including flow from areas outside the project parcel(s).
- Line layout, pipe size, slope, material, and fittings.
- Cumulative volumetric flow if slug loads are present.
- Special facilities such as hospitals, schools, military uses, etc.
- Sources of major flow within the project boundary.
- Engineering design calculations to size wet well, pumps, and force main.
- Public vs. private piping with associated rights-of-way and/or easements.

The design report shall include a detailed analysis of the impacts on any downstream wastewater lift station caused by the increased flow rates generated by the proposed wastewater lift station. The potential need for downstream improvements will be identified during the pre-application permit or land use permit phase for the project. The cost for required modifications or upgrades to any downstream lift stations shall be borne by the applicant. These impacts include lift stations directly receiving discharge from other lift stations via force mains and indirectly from lift stations through gravity conveyance downstream of the respective force main discharge.

3) Site Selection

Site selection is dependent on several factors, including but not limited to topography, access, floodplain and/or shoreline proximity, land use, aesthetics and noise, odor concerns, existing and proposed conflicts, ownership, and overflow potential and impact to the environment. All the following factors shall be considered when selecting the lift station site:

a) Topography

Gravity sewer designs set by both project proposed and existing topography tributary to

wastewater lift stations dictate site selection. Adjacent drainage areas potentially served by the wastewater lift station via minimum gravity standard sewer slopes must also be considered. Wastewater lift station site selection shall also be compatible with suitable site access, proposed grading, and setbacks as recommended by the Project Geotechnical Engineer and outside of critical areas.

b) Access

Access for a Vactor truck, personnel trucks, and maintenance equipment shall be provided to all wastewater lift stations. All wastewater lift stations shall be sited to allow access by all-weather surface roads capable of accommodating a WB-50 design vehicle.

c) Floodplain

Wastewater lift stations shall be sited to remain operational and permit access if constructed within floodplain designations of FEMA and the National Flood Insurance Program.

Wastewater lift stations shall be sited to remain operational and permit access if constructed within floodplains, which includes the minimum 100-year floodplain designations of FEMA and the National Flood Insurance Program.

Lift station top slab, wet well rim(s), and valve vault lid elevations shall be constructed above the 100-year return frequency flood with all portions below utilizing flood proofing meeting SMC 14.270. The access road shall be constructed above the flood plain elevation.

d) Land Use

Lift station sites shall conform to land use regulations for which the property is zoned and adhere to setbacks required under such zoning. Approved variances may be required for situations not adhering to the City of Snohomish Land Use Code.

e) Aesthetics and Noise

Natural screening of the site should be a primary element of site selection wherever possible. Where pump stations are sited in proximity to developed areas, predominant wind direction for potential odor dispersion and building aspects such as generator exhaust and noise and ventilation fan noises shall be considered and minimized. Equipment shall be designed for noise reduction below 85 decibels and in compliance with SMC 8.16 Public Disturbance Noise. Similarly, building setbacks shall be considered to provide minimal impact to neighboring properties. Landscape screening may be required as directed by the City of Snohomish.

f) Odors

The Engineer shall assess the effect of odor on adjacent land uses, residents, and workers at the facility. Every effort shall be made in site selection to reduce potential odor pollution.

Wind direction, duration, and intensity are all important considerations that must be evaluated.

g) Conflicts

Lift stations, when located adjacent to high-speed roads, heavily traveled roads or in areas otherwise susceptible to vehicular impact shall be designed with impact mitigation devices to protect the lift station equipment from errant vehicles. Bollards may only be used in low-speed areas. Adequate overhead clearance shall be provided over the entire wastewater lift station site so that maintenance equipment does not interfere with overhead utilities or structures. In general wastewater lift stations should not be sited where existing overhead interferences exist.

h) Ownership

Wastewater lift stations shall be constructed to the City of Snohomish's standards. Lift stations shall be owned and maintained by the City.

i) Environmental Protection

Lift stations shall be designed to not allow sewage overflow from the facility. Secondary power, containment, additional storage, etc. shall be provided as backup measures in the event of power, pump, or other failure.

4) Site Improvements

Wastewater lift stations must be designed and constructed with the necessary site improvements to ensure adequate and reasonable access, security, drainage, and maintainability per the following requirements:

a) Access Road

All paved surfaces at the lift station site shall be designed for the expected vehicular and equipment loadings but shall not have a structural section of less than four (4) inches of asphalt and six (6) inches of base as specified in Section 3 – Streets of the Engineering Standards Manual. Grades shall not exceed 10% to allow fire emergency service access to the lift station per the current IFC. The wet well shall be located so that it is directly accessible to a 35-foot Vactor type truck with the nose of the vehicle over the wet well without impacting the structure. Access design provisions shall be made for a turnaround with 25-foot minimum radii and swept-path analysis conducted if deemed necessary by the City. Parking shall be accommodated adjacent to the lift station for maintenance staff.

Site grades and/or walls must be adequate to accommodate low-hanging hose reels on vactor trucks. If wet wells, valve vaults, or other facilities will be driven over, then the lids shall be rated for HS-25 loading. No portions of lift stations shall not be located within the traffic way of streets and alleys.

b) Perimeter Fence and Gates

All wastewater lift stations must have a minimum six (6) feet high perimeter fence surrounding the lift station site designed to discourage unauthorized access. Fencing shall be designed for high winds and materials shall be submitted to Public Works for review and approval. A three (3) feet wide man-gate as well as double eight (8) feet wide (16 feet total) swinging gates shall be provided at minimum for access to the site. All gates must be capable of achieving fully open position, including sliding gates. All posts shall be steel installed in concrete. The Public Works Department will install all locks.

c) Potable Water

A potable water service with 5/8" water meter with reduced pressure backflow assembly shall be provided for the facility. The reduced pressure backflow assembly shall be contained either inside the municipal lift station structure or outside in a freeze protection enclosure such as a Hot Box ® or approved equal.

d) Grading

Site shall be graded to prevent local ponding and to provide positive drainage away from structures. The site shall be graded to not create a low point in relation to the adjoining properties. Storm runoff from the lift station site shall be designed in compliance with SMC Title 15 and shall be included in the overall project stormwater management design. Cross-connection of stormwater with the lift station collection/discharge is not permitted.

e) Landscaping

Landscape design and materials shall meet the same requirements for landscaping as required by the conditions of approval for the project as determined by Department of Planning and Development Services. Any landscaping trees within five (5) feet of hardscape or utilities shall have a root barrier installed.

f) Dry Utilities

Transformers, junction boxes, conduit, gas service piping, meters, and all other dry utility appurtenances shall be designed to not conflict with pump station operations and shall be shown on the site plan.

5) Hydraulics

Wastewater lift stations shall be designed to satisfy the hydraulic conditions of the proposed facility including future planned improvements to the force main, lift station, and/or future lift stations. The friction head shall be determined as accurately as possible considering all pipe major and minor losses, and other sources of flow in the force main for a range of flow rates to bracket the calculated peak flow rate contributory to the lift station. System curves

shall be generated to include the required head dependent on minimum and maximum flow rate scenarios. Static elevations may change dependent on downstream conditions.

Pump curves shall be shown for individual and combined simultaneous pump operations and shall be provided from the specific pump manufacturer. Separate curves for different speeds in RPMs stemming from variable frequency drives (VFDs) shall be provided. Efficiency, power, and net positive suction head shall be included in the pump curve diagrams.

The design calculations shall be submitted in the preliminary design report along with all design assumptions, limitations, and restrictions. The Engineer shall include in the calculations the net positive suction head available (NPSHA) as well as the net positive suction head required (NPSHR) to assure cavitation will not occur. The duty point(s), operating range, motor speeds, impeller diameter, and system elevations shall be identified.

6) Force Main

a) Size and Velocity

The force main shall be sized to produce a fluid velocity of no less than two (2) feet per second and no more than eight (8) feet per second; the minimum force main size is four (4) inches. Potential for expansion of the lift station through the planning horizon shall be considered when sizing the force main or a second force main shall be laid if target velocities cannot be met for the short term.

b) Horizontal Location

Force mains shall be located within the public rights-of-way or in appropriate public utility easements. Clearances from structures shall be ten (10) feet minimum. The horizontal deflection shall adhere to no more than half of the manufacturer's recommendation. The horizontal location of the force main shall be identified with buried tracer wire and dig tape. The location of stub-outs with valves shall be identified with carsonite utility marker posts. Reaction blocking shall be utilized at each horizontal fitting via thrust blocks or restrained joints/fittings when soil is undisturbed or cannot provide bearing or installed in fill. The force main shall be anchored within the pump station. Force main slopes over 20% will require slope anchors. As-builts shall be submitted and consist of surveyed points traced along the installed tracer wire alignment per the Washington State Plane NAD 83 datum.

c) Materials

All pipe utilized for force mains shall be high density polyethylene (HDPE) material meeting AWWA C901/906, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714, and PPI Listed Material (TR-4) PE 4710.

d) Profile

Force mains shall have a minimum depth of cover of four (4) feet as measured from the

proposed finish grade to the top of pipe. A continuous upward slope from the lift station to the discharge point if feasible. If a high point cannot be avoided, and as allowed by the City, a wastewater air release and air/vacuum valve shall be installed in vaults at each high point as determined by the City. At major low points a manually controlled drain valve shall be installed in a manhole to allow for cleaning and/or draining. The vertical deflection shall adhere to no more than half of the manufacturer's recommendation.

e) Separation Distance

Sanitary sewer force mains paralleling water mains shall have a minimum horizontal separation of ten (10) feet and vertical separation of 1.5-feet (18-inches) measured edge to edge.

Unusual conditions where parallel water and sewer mains must be placed closer than ten (10) feet or perpendicular crossings less than 1.5-feet shall adhere to the design and construction requirements of the Orange Book and DOH Design Manual.

f) Appurtenances

i) Air and Vacuum Release Valves

Air and vacuum release valves shall be specifically designed for wastewater service and be sized per the manufacturer's recommendations. Air and vacuum release valves shall be required at profile highpoints as determined by the City.

Air release and air/vacuum release valves shall be manufactured by Val-Matic ® or approved equal.

ii) Drain Valves

Maintenance connections at major force main low points shall consist of drain valves installed to dewater and to remove buildup of solids. Drain valves will be placed on a case-by-case basis as determined by the City.

iii) Isolation Valves

Isolation valves shall be installed at all main stubs, on each leg of tee and cross fittings, and every 500-feet of force main and as determined by the City. Tracer wire shall be installed and shall connect to each valve box for tracing.

Isolation valves shall be plug valves manufactured by DeZURIK ® or approved equal.

iv) Check Valves

Check valves downstream of the lift station may be required as determined by the

City Engineer on a case-by-case basis.

v) Additional Appurtenances

The City may require additional appurtenances for lift stations and force mains on a case-by-case basis.

g) Surge Analysis

Hydraulic surges and transients shall be considered for the lift station, force main, and appurtenances when required by the City. The modulus of elasticity of the pipe material shall be considered when evaluating water hammer effects and cyclic loadings.

At a minimum the following design items should be addressed in the surge analysis:

- Transient pressures due to water hammer and the effect on the entire system.
- Cyclic loading of the force main.
- Investigation of the pipeline profile and HGL to determine the possibility of water column separation and/or cavitation.
- Reverse rotation characteristics of the pumps.
- Shut-off characteristics of all proposed pump control valves, including check valves.
- Substantiation for the use of surge control valves and other surge protection devices, when necessary, listing recommended size and computed discharge pressures.
- Significant grade changes along the force main alignment.
- Length of force main.
- Dead ends.
- Scenarios when velocities exceed four (4) feet per second.

The surge analysis shall also evaluate the following operational scenarios:

- Normal operation with pump starts and stops.
- Power outage while pumps running.
- Rapid changes in demand.
- Closing/opening of isolation valve(s).
- Closing air release valve(s).
- Pipe rupture.
- Failure of surge protection facilities.

The potential impact of water hammer shall be evaluated with special consideration given to cyclic loadings that are inherent in wastewater force mains. All elements of the piping system must be designed to withstand the maximum water hammer in addition to the static head and cyclic loading. A safety factor of 1.5 shall be used when determining the adequacy of all piping system components regarding withstanding system pressure. The City require software modeling on a case-by-case basis.

h) Force Main Termination

Exposed walls of a structure required at the junction of force mains and gravity sewers must be constructed or protected with acid resistant materials. Raven ® lining or approved equal shall be used. This applies to all surfaces exposed to the atmosphere above the wastewater. The flow transition from the force main to the gravity sewer shall be smooth and non-turbulent with alignment horizontal and invert elevation no greater than one (1) foot above the receiving manhole flow line.

7) Wet Well

Wet wells shall be considered a hazardous environment, classified as NEC Class I, Division I for explosive gases. Wet wells shall be designed and constructed to be as hazard free as possible, and corrosion-resistant materials shall be used throughout. All materials and equipment used in wet wells shall meet NEC Class I, Division I standards (NFPA 820). No junction boxes shall be installed in the wet well.

Personnel entering the wet well shall meet the requirements of the current State Department of Labor and Industry confined space regulations, contained in Chapter 296-809 WAC. Danger signs shall be posted on site to reflect the permit-required confined space.

a) Structure

Wet wells shall be constructed of precast reinforced concrete and shall be circular. The minimum inside diameter shall be 72-inches and larger diameters may be required on a case-by-case basis. Wet wells that are installed below the groundwater table shall be adequately designed to prevent flotation without the use of hydrostatic pressure relief valves and buoyancy calculations shall be included in the design submittal.

Wet well depth and associated volume shall be as required to accommodate the influent sewer, provide for adequate pump suction pipe submergence as recommended by the pump manufacturer, and to provide adequate storage to prevent the excessive cycling of pumps. The governing equation per the Orange Book is Volume, $V = tQ/4$ where the desired timing between pump cycles is approximately ten (10) minutes for six (6) starts per hour and Q is the peak flow rate of the pump in GPM.

The required wet well working volume shall be calculated to optimize pump operation to meet peak hour flow and efficient pump cycles. The design engineer shall consider the diurnal nature of wastewater flow as well as the pump manufacturer's recommendations regarding pump start frequency when determining the wet well volume. Every effort will be made to prevent wastewater in the wet well from becoming septic.

Primary high-water alarm shall be set to wet well influent invert. A redundant high water alarm float shall be installed six (6) inches above the primary high-water alarm. A primary low-water alarm shall be installed one (1) foot above the pump manufacture's lowest suction elevation. Minimum elevation difference between remaining control elevations for on/off

shall be one (1) foot.

b) Interior Linings and Waterproofing

Wet well interior walls and ceiling shall be lined with a material that is suitable for immersion wastewater service. The lining shall be completely resistant to hydrogen sulfide and sulfuric acid. The liner shall be easily cleanable and sufficiently durable so that it can be washed with a high-pressure water hose and is light in color. Materials used for interior liners shall be subject to the approval of the City of Snohomish prior to installation and shall be Raven ® or approved equal.

Wet wells that are anticipated to be below the groundwater table shall also have a waterproofing system installed on the exterior of the wet well. Regardless of the elevation of the water table, all joints in the concrete and all penetrations through the concrete shall be grouted with non-shrink grout on both sides of the joint or penetration.

c) Access

Wet well access for personnel shall be through a 24-inch manhole frame and cover; the manhole cover shall be hinged. A pre-cast flat eccentric top slab shall be used to connect access to the wet well structure. The access location shall be located outside the lift station structure. The wet well and access shall be positioned so that a truck mounted crane can lift equipment out of the wet well vertically. A polypropylene ladder is required in the wet well with all support members and hardware being stainless steel.

d) Floor Slopes

Wet wells shall have sloping sides to form a trench or hopper at the bottom of the wet well in all areas outside of the dedicated sump. Slopes shall be approximately one (1) horizontal to one (1) vertical (45-degrees) at minimum.

e) Level Control System

Wet well liquid levels shall be measured and controlled by pressure transducers.

f) Piping

All piping penetrations through the wet well shall utilize waterproof seals such as Kor-N-Seal® or approved equal. Suction piping shall be stainless steel material and shall be four (4) inches diameter minimum. All piping supports shall be stainless steel material.

Ventilation piping shall be provided to the wet well for future connection to an odor scrubber as needed. The pipe shall be initially capped within the wet well. Drain lines from the pump's drain valves and air lines from the pump's air release shall be routed to the wet well for discharge. Discharge from municipal lift station structure interior and valve vault drains shall also be piped to the wet well.

g) Grease and Grit

The City may require a chemical additive system to soften grease on a case-by-case basis. Larger pump stations will require grit removal with bar racks, screens, etc.

8) Valve Vault

A precast concrete vault shall be installed underground adjacent to the wet well and municipal structure. The vault shall house a plug isolation valve downstream of the meter followed by piping with associated supports and plug isolation valves for the re-circulation line and the bypass line. The bypass line shall be piped to three (3) feet minimum above grade with a horizontal cam lock connection. Ventilation shall be provided from and connected to the municipal structure for inflow and a pipe shall be provided to atmosphere for outflow. A sump and pump shall be provided in the vault to accommodate drainage and shall discharge to the wet well. Grout shall be applied to the bottom of the wet well to provide a 2% minimum slope towards the sump. Lighting and GFCI outlets shall be provided inside the valve vault.

A polypropylene ladder is required for personnel access with all support members and hardware being stainless steel. Access shall be through a vault hatch with two (2) minimum panels to provide access to both personal and for raising/lowering piping equipment; one of the panels shall be located directly over the ladder access.

9) Pump System

Pumps shall be manufactured by Gorman-Rupp with belt drive motors. No alternatives for manufacturing will be accepted. Impellers shall be the Eradicator ® type from Gorman Rupp. A written warranty from the pumping system manufacturer is required for five (5) years minimum.

Wastewater pumps shall be self-priming centrifugal non-clog solids handling pumps designed specifically for handling raw, unscreened domestic sanitary wastewater and shall be able to pass a minimum three (3) inch diameter solid. All wastewater pumps shall rotate clockwise as viewed from the motor end. Pump motors shall operate on 460 volts, three (3) phase, 60 Hz electrical service. Self-priming centrifugal pump lift stations shall be located at grade. Self-priming centrifugal wastewater pumps shall be specifically designed for continuous operation in air. The City may require other pump materials, appurtenances, and/or impeller alternatives to suit a particular application.

All wastewater lift stations shall have multiple pumps. Wastewater lift stations shall be capable of delivering the design flow rate with the largest pump out of service and with a single pump running. Wastewater lift station design shall permit individual pump maintenance while maintaining the station in operation. Pumping operation shall alternate pumps with each run cycle.

Suction and discharge piping must be supported rigidly at or near the pump connections. Supports shall be designed and placed to avoid vibration. Manufacturer's pre-built pump package shall include drain valves for each pump, air release valves to facilitate pump draining, and external swing-arm check valves installed horizontally downstream the pump. Suction and discharge pressure gauge kits are required for each pump.

a) Valves

Each wastewater pump shall have isolation valves to permit the removal or maintenance of the pumps and check valves without affecting the operation of remaining pumps. Isolation valves shall be non-lubricated plug valves manufactured by DeZURIK ® or approved equal. Plug valves shall be 100% port opening. Four (4) to six (6) inch plug valves shall be quarter turn to open. Larger plug valves shall have geared operators with hand wheels. Plug valves shall be positioned so that when closed, the valve body is isolated from the actively flowing portion of the piping system. Plug valves shall be installed horizontally and be oriented so that the valve is not operated from the top, but instead the side.

b) Bypass Pumping

Wastewater lift stations shall have additional pipe, valves, fittings, and other appurtenances as necessary to permit bypassing of the lift station pumps. The provisions include isolation plug valves and quick connect cam lock fitting upon a standpipe adjacent to the wet well enabling the temporary pump to discharge directly into the existing force main. A normally closed valve for bypass pumping shall be located in the underground vault adjacent to the wet well

c) Recirculation Piping

Every lift station shall have provisions for re-circulating the influent back into the wet well for the purpose of draining the force main for maintenance or emergencies. A normally closed plug isolation valve shall be located in the underground valve vault adjacent to the wet well to allow influent when the valve is opened.

d) Flow Metering

Magnetic flow meter shall be manufactured by Krohn ® or approved equal and shall be downstream of all pumps prior to force main discharge and located inside the lift station structure. Flow metering shall be included in the SCADA system. Installation of the meter shall be as recommended by the meter manufacturer. At minimum, the flow meter shall include magnetic measurement rods that can be removed and replaced without dismantling the meter.

e) Materials

All pipe material within the lift station structure shall be ductile iron class 53 lined with

Protecto 401. Restraining fittings shall utilize flanges and mega lugs; restrained pipe joints may utilize Field Lok Gaskets® or approved equivalent and MEGALUGS ® or approved equivalent. Pipe supports shall be steel material and placed as needed.

10) Wastewater Lift Station Structure

A municipal structure is required to house the outlet side of the suction pipe, the pumps with associated check valves and air/vacuum release valves, flow meter, and the inlet side of the discharge force main. Prefabricated fiberglass enclosures, NEMA enclosures located outside, or similar housing will not be permitted. The structure will contain the electrical, instrumentation, and communication equipment along with all other necessary operational furnishings.

Architectural design of the municipal structure to blend in with the proposed development is encouraged. Outside portions of the structure not enclosed in security fencing may be utilized as a bus stop for public school children, benches, or other similar facilities. The Department of Planning and Development Services (PDS) may have additional requirements based on the type of development and location.

Structure Interior

A building permit and all other applicable, required permits shall be submitted to the City for the municipal lift station structure. The structure interior shall contain the following items as minimum:

a) Layout

Five (5) feet minimum shall be provided as clearance between any portion of the pumping, electrical, and instrumentation systems and the structure's walls for the purpose of providing maintenance space for staff.

b) Sanitary Sewer

- Concrete slab with floor drains.
- A floor drain shall be installed in the middle of the pump package and adjacent to facilitate drainage during maintenance and draining.
- Handwashing station.
- Emergency eyewash station.

c) Potable Water

- Handwashing station.
- Emergency eyewash station with carbon filter; wall mounted is not permitted.
- Hose bib for washing interior slab and equipment.

d) Ventilation & Temperature

Pump stations shall be provided with a separate ventilating system and shall be sized per the International Mechanical Code as amended by Washington State per WAC 51-52.

Temperature shall be regulated to ensure the operating equipment's manufacturer's specifications are not exceeded. The Washington State Energy code shall be adhered to in the structure design for heating and cooling.

Electric unit heaters shall be provided to maintain a minimum temperature of 55 degrees Fahrenheit in the pump stations. Heating systems shall provide adequate temperature for maintenance personnel in cold weather and protection from freezing. Air conditioning via fans shall be provided to maintain a maximum temperature of 90 degrees Fahrenheit; motorized dampers with louvers shall be utilized. Both heating and cooling ventilation shall have manual switches and thermostat for automatic operation.

All electrical equipment shall come equipped with internal cooling systems.

e) Lighting

- Wall or ceiling mounted LEDs for adequate lighting during non-daylight hours.
- Both automatic and manual switches for non-emergency lighting.
- Emergency lighting adjacent to door.
- All electrical cabinets shall come equipped with internal lighting.

f) Electrical

- Door intrusion switch.
- All non-lighting and non-intrusion wall switches to be GFCI.
- 120 volt, 1-phase GFCI receptacles shall be provided within the pump station building.

g) Equipment & Instrumentation

- Pumps, motors, check valves, air/release valves, isolation plug valves, and flow meter.
- Main control center (MCC) and disconnecting switches – Siemens.
- Variable Frequency Drives (VFDs) - PowerFlex
- Programmable logic control (PLC) – Allen Bradley.
- Operator Interface Unit – Allen-Bradley PanelView Plus.

h) Access

Personnel access to the municipal structure shall be via lockable standard door. Oversized large double doors shall be provided to facilitate removal and installation of pumping equipment. Security electronic card readers shall be coordinated with the city and installed in

addition to standard locks.

All check valves, isolation valves, and other equipment that requires operations shall have adequate personnel access. Scaffolding, stairs, ladders, etc. may be required to facilitate access to equipment for operation.

i) Structural

A structural beam monorail with crane shall be provided above and in line with the pumps for removal and installation of pumping equipment. A structural professional engineer shall provide stamped plans and calculations for the rail design as part of the building permit submittal to the City for the municipal lift station structure. The structure exterior shall contain the following items as minimum:

Potable Water:

- Hose bib.
- Frost hydrant.

Security:

- Siren horn alarm for unauthorized entry, fire, and failure of pump/power/generator.
- Sign with emergency number for public to call.
- Sign with address and designated as sanitary sewer lift station.

Lighting:

- Building mounted wall packs with adjustable reflector and upward oriented.
- Exterior lights shall be provided to adequately light the equipment area. The lights shall be appropriately shielded to prevent “spillage” on to neighboring properties. Exterior lift station lighting shall be fitted with day/night sensors for automatic on-off operation and shall also be fitted with manual on-off switches.
- Lighting shall be provided over the wet well.

Electrical:

- GFCI duplex outdoor weatherproof outlets shall be provided.
- Security surveillance video camera.

Communications:

- An antenna for radio communications with the City’s SCADA system is required on top of the structure.

11) Emergency Station Operation

To ensure that utility power or equipment failures do not cause sewer system overflows, provisions to maintain wastewater pump station including standby power shall be made.

A diesel engine emergency electric generator shall be provided for all wastewater lift

stations. The unit shall be sized to allow simultaneous starts and operation of the required pumps in addition to the auxiliary loads, and to start lag pumps while the lead pump is running with a maximum voltage dip of 20%. An automatic transfer switch shall be provided to switch to emergency power on a power failure or a drop in any phase voltage to 70 percent of line voltage.

Diesel engine powered generators require a fully automatic 3-phase resistance element 2-step load bank rated at 50% of the generator KW rating. The load bank shall be energized when the generator load is less than 50% and de-energized when the load is above 50%. An aboveground double containment fuel tank shall be provided for diesel fuel. The generator shall be housed outside in a weatherproof enclosure. The fuel tank shall be the smallest available size to give a 24-hour fuel supply at full load for the generator size provided and shall be equipped with a thermostatically controlled immersion heater. The generator shall meet the City of Snohomish sound requirements as delineated in Title 8 of the SMC. Generator shall be manufactured by Cummins.

12) Electrical & Instrumentation

a) Power Requirement

The electric service shall be 480 volts three (3) Phase. The service shall be sized to allow all station fixtures, equipment, and all pumps to operate together including future lift station, pumps, and/or force main improvements. Snohomish County Public Utility District (PUD) is the City's electric provider.

All switches, breakers and wires shall be clearly marked or labeled. Standard control panel layout shall be provided with the following section of panels:

- Power company metering and main breakers.
- Automatic transfer switch.
- Circuit breakers and starters for unit heaters, portable pump, main wastewater pumps, fans, compressors, etc.
- Flow recorder and pump controls including cycle counters and running time clocks.

b) Control Panel

PLC operation buttons shall include hand/off/auto for pumps, overload resets, and float control reset, and indicators for pumps running, alarm status, and float control activation.

13) Telemetry

a) Remote Terminal Units

Remote terminal units (RTUs) shall be as specified for lift stations and provided by the developer. The City will provide the Engineer with information on how the existing control

master system screen displays are to be updated, and what reports, if any, need to be updated by information received from the additional RTUs, current manufacturers and model numbers of equipment and existing software in use by the City. All equipment and software must be compatible with the City's existing SCADA system. The telemetry system shall have a battery backup with 2 hours reserve.

For reference, the City has utilized Process Solutions to assist with designing the pump station instrumentation.

b) RF Path Study

An RF path study may be required to verify communications reliability. The City utilizes VIPER radio systems.

A 950 MHz radio will be used to transmit signals between the RTUs and the City's control center. Where spread spectrum radio cannot be used, a communication method shall be determined in consultation with the City of Snohomish.

III. DESIGN, CONTRACT DOCUMENTS AND CONSTRUCTION

1) Preliminary Design Report

The preliminary engineering report will include, at a minimum, the description of design criteria to be utilized, preliminary flow computations, design calculations, calculated system curves, water hammer (surge) protection analysis/recommendation, identification of right-of-way requirements, number of property owners involved, listing of permit requirements, geotechnical investigation and cost estimate based on unit costs for major elements of work. A separate cost estimate shall be submitted for a gravity-only design.

In addition, the following design criteria shall be developed:

- Site Development
- Structural Design
- Architectural Design
- Hydraulic Analysis
- Mechanical Design
- Electrical Design
- Instrumentation and Process Control
- Corrosion Control
- Odor Control
- Noise Control

2) Commissioning and Acceptance

Prior to wastewater lift station acceptance by the City of Snohomish a thorough inspection and operational check of the station is required. The Engineer shall submit a proposed start-up check

list to the City prior to the completion of construction. The start-up shall include:

- Confirm static and dynamic pressures.
- Confirm all alarms, remote control capability and reporting functions.
- Calibration of level controls.
- Confirm operation of lift station under auxiliary power.

Once the start-up procedure is finalized the start-up will be scheduled. The following are required to be present at the start-up:

- The engineer in responsible charge of the lift station design.
- The electrical and instrumentation engineer.
- The mechanical engineer.
- The general contractor superintendent.
- A representative from the electrical contractor.
- A representative from the instrumentation contractor.
- A representative from the mechanical contractor.
- The pump manufacturer's representative.
- A representative from the City of Snohomish Sewer Maintenance Division.
- A representative from the City of Snohomish Engineering Division.

The installation of mechanical and electrical equipment in accordance with these design standards requires, upon completion and prior to final inspection, testing to ensure the standards are met and to maintain quality control. Pump testing to include pumping rate and pressure for each pump and combination thereof, electrical testing procedures which apply to all electrical equipment, and load bank testing procedures which apply to all standby generators shall be provided. The wastewater lift station will not be accepted by the City of Snohomish until all components are evaluated individually and as a complete system. If one component fails it shall be repaired or replaced and re-tested. Once the individual component is operating properly the entire system shall be re-tested to assure the system as a whole is operating properly.

Flow tests shall be conducted that allow each pump to cycle ten (10) times. The test shall be run so that the pumps cycle continuously as if in permanent operation. While conducting the test flow rates shall be recorded through the use of the flow meter; the meter shall be calibrated prior to testing. The discharge pressures from each pump shall also be recorded during the test.

The force main shall be hydro pressure tested at 50% above the design pressure or 200 psi, whichever is greater; the test shall last 15 minutes without any pressure loss between valves.

Ground resistance testing shall be performed for ground systems using the fall of potential method. Ground resistance test services shall be provided by a fully trained and equipped testing company; testing by the contractor will not be accepted. The test shall be complete enough to be conclusive and to ensure proper operation. This shall be certified in test reports submitted to the Engineer. Test shall be nondestructive, and procedures used shall be approved by the Engineer. Generally testing shall comply with current NFPA 70, National Electric Code (NEC).

3) Documentation

Prior to acceptance of the lift station the contractor shall deliver to the City electronic PDF and/or CAD DWGS copies of the following:

- Record drawings for all components of the lift station.
- As-built control schematics.
- As-built wiring diagrams.
- Pump specifications, test data, and manufacturers O&M manuals.
- Generator equipment data and manuals.
- Mechanical and electrical component lists.
- Warranty documents.
- Contact information for all warranties and equipment manufacturers.

4) Warranty

All sanitary sewer lift stations shall include a two-year warranty against defects in workmanship and materials. The two-year period shall begin once the City has made final acceptance. Items that require repair under the two-year warranty period shall be covered under an additional two-year warranty after the repair is made.

Any warranty claim shall be acknowledged by the responsible party and course of action determined within one (1) week of the initial notification.

5) Instruction of City Personnel

City personnel shall receive training from factory authorized representatives of the major equipment to include, but not necessarily limited to, the pumps, pump controls, generator, and facility operation. The training shall be performed prior to acceptance of the lift station by the City and prior to permit final.