City of Anacortes

Sewage Pump Station Design Standards

General

1. The WWTP Manager shall approve the final design.
2. Sewage pump station and force main shall meet applicable design criteria presented in the Criteria for Sewage Works Design, Washington State Department of Ecology (August 2008).
3. Design, along with supporting sewage flow and hydraulic calculations, shall be submitted to the City of Anacortes for approval stamped and signed by a professional engineer licensed in the State of Washington. All electrical drawings shall be stamped and signed by a professional electrical engineer licensed in the State of Washington.
4. Pump station shall be located outside of the travel lane and shoulder of roadways.
5. Clear access for a service vehicle to park off of the road to perform pump removal and station maintenance.
6. Easement agreement for unobstructed access to the pump station for installation, operation and maintenance of the facility.
7. Pump stations with long force mains may require odor control.
8. Prior to the construction of any sewage pumping station there shall be a pre-construction meeting. All applicable trades shall be represented.
9. The general contractor shall provide submittals for all materials used to the City for review.

Pump and Wet Well

10. Minimum wet well size for standard design 3” solids pass pumps is 8’ in diameter.
11. Wet Well hatches shall be the LW Products Safe-Hatch system, H-20 rated equipped with protective grating.
12. Flygt or Fairbanks Morse submersible pumps, two each, each one sized to handle all of the flow, pumps shall be equipped with three phase 480-volt electric motors. Deviation from this standard shall be at the Wastewater Treatment Plant Manager’s approval.
13. The pumps shall be in the manufacturer’s preferred operating range. This range shall be indicated on the selected pump curve. The pumps shall be as close as possible to the best efficiency point of the pump curve, using the lowest horsepower motor that can be found to perform the required pump rate. The plant manager must approve the selected pumps.
14. Provide two complete rebuild kits for the pumps.
15. Pump removal system shall be stainless steel pipe guide rails, cable guides shall not be considered.
16. Each pump shall be attached to a 316 stainless steel shackle and lifting chain with a shock load rating appropriate for the selected pump. The chain shall be suspended from a stainless steel hook located in the opening of the hatch.
17. Provide a large stainless steel hook inside of the hatch opening to hang the pump electrical cable on, one for each pump.

18. The minimum acceptable pump operating range shall be three feet. This range shall fall entirely below the well influent line. The engineer shall demonstrate that the pump system will not exceed the maximum rated motor starts per hour.
19. A submersible level transmitter, Contegra, Endress & Hauser or equivalent, providing an intrinsically safe 4-20 mA output shall be installed in the wetwell.
20. A non-mercury float type level switch shall be installed as a high level backup redundant controller.
21. The bottom of the wetwell shall be sloped to provide a sump configuration at the pump inlet. The well shall be equipped with a Flygt TOPS system pump basin (see Flygt section 8-20.2) when Flygt pumps are used.
22. The wet well influent line shall be equipped with a stainless steel influent baffle.
23. All hardware and other basic mechanical parts (not including piping and valves) internal to the wet well and valve vault shall be 316 stainless steel, including the level transducer/float hanger, anchor bolts, cable grip systems etc.
24. The anchoring system shall be Hilti HIT HY 150, or equal, epoxy in place anchor bolts. Expansion anchors shall not be used.
25. All vault penetrations shall be cut with a core hole saw. All below grade vault penetrations shall be sealed with elastomeric annular space seals with 316 stainless steel hardware, Thunderline Link Seal or equal. All joints and seams in the wetwell and other vaults shall incorporate a watertight seal.
26. All piping internal to the wet well shall be coated for corrosion protection with a glass flake epoxy coating, vinyl ester coating or other equivalent durable coating as approved by the Wastewater Treatment Plant Manager. Surface preparation and coating application shall be done according to manufacturer's specifications.
27. It is not permissible to penetrate the wet well with a force main from another pump station. When another pump station is to be connected it shall pass through a transition to gravity manhole before entering a pump station wet well.
28. The hydraulic capacity of the pump station or known or anticipated wet well conditions may require that the influent sewage must pass through a raw sewage grinder. The City of Anacortes Wastewater Treatment Plant Manager shall determine if a grinder is required. If a grinder is required it shall be a Muffin Monster model manufactured by JWC Corporation or equivalent as approved by the Wastewater Treatment Plant Manager
29. When required, the grinder shall be mounted on a factory-made frame assembly fabricated in 304 stainless steel provided by the grinder manufacturer.
30. The grinder control panel shall be fabricated by the grinder manufacturer.
31. The grinder shall be attached to a 316 stainless steel shackle and lifting chain with a shock load rating appropriate for the grinder.
32. The City of Anacortes Wastewater Treatment Plant Manager shall approve the design of the grinder installation.

Valve Vault

33. All valves shall be enclosed in an external valve vault.
34. Check valves shall be Flygt or equal ball check valves.
35. Isolation valves shall be Dezurik non restricting 100% port eccentric plug valves with square operating nut.
36. Parallel to the pipeline all flanges to be at least one foot from the vault walls. All flanges are to be minimum one foot from the floor of the vault. Perpendicular to the pipeline all valve bodies or flanges to be no less than eighteen inches from the vault walls.

37. Pipe supports shall be hot dip galvanized.
38. The valve vault shall drain to the pump station wet well. When gravity drainage is used a “P” trap shall protect the vault. When gravity drainage is not possible the valve vault shall incorporate a sump pump discharging to the wet well. Sump pump or gravity drainage line shall be equipped with a Tideflex all rubber check valve, Red Valve Co. or equal.
39. The minimum inside height of the vault shall be four feet.
40. Plug valves shall be accessible for operation through the hatch, or shall be equipped with a valve stem riser to the surface.
41. Provide an operating wrench for the valves.
42. Valve Vault hatches shall be the LW Products Safe-Hatch system, H-20 rated.
43. All hardware and other basic mechanical parts (not including piping and valves) internal to the wet well and valve vault shall be 316 stainless steel, including float hangers, anchor bolts, cable grip systems etc.
44. All vault penetrations shall be cut with a core hole saw. All vault penetrations below grade shall be sealed with elastomeric annular space seals, Thunderline Link Seal or equal.
45. The anchoring system shall be Hilti HIT HY 150, or equal, epoxy in place anchor bolts.
46. All piping internal to the valve vault shall be coated for corrosion protection with a glass flake epoxy coating, vinyl ester coating or other equivalent durable coating as approved by the Wastewater Treatment Plant Manager. Surface preparation and coating application shall be done according to manufacturer’s specifications.

Force Main

47. The force main shall be constructed of ductile iron, C900 PVC or fuse-welded HDPE pipe.
48. The force main shall be installed on a continuous grade that provides gravity drainage throughout. Relief from this requirement requires pre-authorization from the WWTP Manager.
49. When two force main systems are connected together, the connection point shall be in a vault. Each force main shall be equipped with an isolation valve.
50. When two force main systems are connected together the two pumping stations shall be coordinated to not operate simultaneously through additional programming and SCADA integration. Relief from this requirement shall be only be on very small systems and at the discretion of the WWTP manager.
51. When required, air release shall be ARI Flow Control Accessories Model S-020 Style valve 2” valve, stainless steel or reinforced nylon body, when required combination air/vacuum release valves shall be A. R. I. Flow Control Accessories Model D-020 Style 2” valve, reinforced nylon body.
52. Long force main runs require installation of valve vaults and isolation valves along the force main for future maintenance.

Basic Electrical

53. The contractor shall furnish short-circuit and protective device coordination study as prepared by a qualified Electrical Engineering Service.
54. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in the current version of NFPA 70E -*Standard for Electrical Safety in the Workplace*. The arc flash hazard analysis shall be performed according to the IEEE Standard 1584 – 2018, the IEEE *Guide for Performing Arc-Flash Hazard Calculations*. The Arc-Flash rating shall be posted on the enclosure,
55. All electrical enclosures, except the explosion proof enclosure, shall be Hoffman Watershed 4x, or equal stainless steel enclosures.

56. All conduit exiting the wet well or valve vault shall be PVC coated (both inside and outside) galvanized rigid steel conduit.
57. All conduits entering the wet well shall extend to the hatch opening and shall be attached to the wet well cover on a stainless steel unistrut stand off no more than 12” below the cover of the wet well.
58. Minimum conduit size shall be one inch.
59. No conduit shall be more than one half full of conductor(s).
60. Separate electrical conduits shall be installed for each pump. A separate conduit shall be supplied for the level control float. A separate conduit shall be supplied for the level transducer. The level transducer conduit shall run directly to the control panel. All other conduits shall exit the wet well and run directly to an explosion proof enclosure.
61. The explosion proof enclosure shall be located above grade if possible, if installed below grade it shall be in a vault. The enclosure shall be manufactured by the Appleton Corp. model AJBEW and shall be powder coated inside and out, equipped with a stainless steel hinge kit and quad lead bolts.
62. The explosion proof enclosure shall be equipped with an explosion proof space heater to prevent condensation.
63. The explosion proof enclosure below grade vault shall drain to the wet well. The drain line shall enter the wet well and elbow down ninety degrees. The drain shall be equipped with a Tideflex all rubber check valve, Red Valve Co. or equal. When gravity drainage is not possible the vault shall incorporate a sump pump discharging to the wet well. Sump pump or gravity drainage line shall be equipped with a Tideflex all rubber check valve, Red Valve Co. or equal.
64. LW Products incorporated shall manufacture the explosion proof enclosure below grade vault cover.
65. All wires entering and exiting the enclosure shall land on terminal strips.
66. Intrinsically safe wiring shall be in a separate zone in the explosion proof enclosure.
67. All conduit seal-offs shall be located just below the control panel or as specified by the electrical engineer.
68. All hardware, unistrut, anchor bolts etc. shall be 316 stainless steel.
69. The anchoring system shall be Hilti HIT HY 150, or equal.

Pump Station Control Panel

70. The Pump Station Control Panel shall be manufactured by a systems integrator approved by the City of Anacortes.
71. If the pump station controls are housed in an exterior panel the enclosure shall be a Hoffman Watershed panel constructed in 316 stainless steel.
72. The pump station shall be controlled by a ControlLogix programmable logic controller manufactured by the Allen Bradley Corporation.
73. The engine generator transfer switch shall be included in the control panel.
74. The flow meter transmitter shall be included in the control panel enclosure (or inside of a building).
75. The control panel and all other electrical enclosures shall be mounted on stainless steel feet or stainless steel unistrut; all hardware and other basic electrical parts shall be 316 stainless steel.
76. The level transducer and the high level float shall be attached to a 316 stainless steel chain dedicated for this purpose.
77. The control panel will communicate by cellular modem and fiber optic telemetry to the Wastewater Treatment Plant.
78. Programming is required at the Wastewater Treatment Plant to incorporate the new pump station into the telemetry and SCADA system.

Flow Meter

79. All pump stations shall include flow monitoring using a Foxboro or Endress & Hauser magnetic type flow meter installed according to manufacturer's specifications.
80. The flow meter shall be placed in a separate vault. All below grade vault penetrations and joints shall be properly sealed; the vault shall drain to the wet well.
81. The meter shall be explosion proof and submersible. The flow signal shall be reported to the WWTP. The flow meter transmitter shall be included in the control panel enclosure.

Pump Control System

82. If the pump controls are housed in an exterior panel the enclosure shall be a Hoffman Watershed panel constructed in 316 stainless steel.
83. The pump control system shall be manufactured by a systems integrator approved by the City of Anacortes.
84. The primary control system shall be an Allen Bradley ControlLogix PLC. The PLC will be programmed with the following wet well and other operator adjustable control points:
    a. Abnormal Low Level Alarm
    b. Low Level Pump off
    c. Lead Pump Start Level
    d. Lag Pump Start Level
    e. Abnormal High Level
    f. Long On Time Alarm for either pump
    g. Long Off Time Alarm for either pump
85. The PLC interface shall be an Allen Bradley Panelview Plus 7 color touch screen graphic terminal.
86. The primary wet well level control shall be a Contegra, Endress & Hauser or equivalent pressure transducer. The manufacturers' supplied cable shall be ordered long enough to reach the control panel enclosure. No wiring splice will be permitted in this cable.
87. Pump Hand Off Auto switches and press to test pilot lights shall be installed on the face of control panel.
88. Pump run alternation
    a. Normal operation will be for pumps to automatically alternate operation
    b. Switch mounted on control panel will permit either pump to be placed in lead pump position
89. The control system shall be equipped with a redundant back up controller.
    a. The redundant system shall operate completely independent from the PLC system. If the PLC or pressure transducer system fails to run the pumps for any reason the redundant system shall call the lead pump to run.
    b. The redundant system shall be initiated by the wet well high float.
    c. Upon activation of the float the selected pump shall run for a predetermined amount of time set on an adjustable time delay relay. The time delay relay shall be an Allen Bradley cat no. HRQN2HU25. The initial setting shall be the amount of time it takes for a pump to draw the wet well down from the level of the float to the normal off level.
90. The control system shall be powered by a UPS that shall provide power for no less than four hours.
91. The control system shall prevent the pumps from operating in the event of a loss of any phase of electrical power.
92. When located in an external enclosure:
    a. The control panel enclosure shall be equipped with a thermostatically controlled heater
    b. The control panel enclosure shall be equipped with a thermostatically controlled ventilation fan.

93. The pump station shall communicate via cellular modem and fiber telemetry to the WWTP. Cell modem shall be a Sierra Wireless Cellular 4G/LTE Ethernet Modem. A Transition Networks SGFEB1040-130 Ethernet Media Converter, shall be used for fiber communication.
94. The PLC shall provide the following indications to the WWTP:
    a. Pump hours for each pump, last 24 hours and accumulated
    b. Pump cycles for each pump, last 24 hours and accumulated
    c. Pump run indication, each pump
    d. Current cycle on-time, each pump
    e. Current cycle off-time, each pump
    f. Station flow from the flow meter, instantaneous and totalized
    g. Wet well level
    h. Normal power available
    i. Generator power available
    j. Transfer switch position
    k. Generator hours, last 24 and total
    l. Pump failure alarm (pump called to run and no pump running), each pump
    m. Pump seal fail alarm, each pump
    n. Pump motor overtemp alarm, each pump
    o. Pump HOA switch position, each pump
    p. Long on time alarm, each pump
    q. Long off time alarm, each pump
    r. Amp draw, each pump
    s. Abnormal level alarms
    t. High level float alarm
    u. Pump station operating on redundant controller
    v. Intrusion alarm
    w. Generator common failure alarm
    x. Generator low fuel tank level alarm
    y. Power failure/loss of phase
95. All operator adjustable controls shall be accessible on the WWTP SCADA system computers.
96. Communication failure alarm, with a communication failure alarm disable function and adjustable delay settings at the WWTP.
97. Additional programming is required at the WWTP SCADA system to integrate the pump station into the plant graphic displays and reporting system.
98. Hardware installation and integration into the City's fiber network at the Library is required.

Engine Generator and Transfer Switch

99. All pump stations are required to be equipped with a stand-by emergency generator and transfer switch.
100. The generator transfer switch shall be an ASCO Series 7000 automatic transfer switch, with exercise clock.
101. The emergency generator shall be a diesel-powered engine generator, Cummins Onan or Caterpillar, sized or equipped as follows:
    a. Sized to run both pumps at the same time; one pump may delay start.
    b. The maximum starting voltage dip shall be 20%. The electrical engineer shall submit the design specifications for the engine generator.
    c. Silenced sufficiently to meet City of Anacortes and Washington State noise limit requirements.
    d. Fuel tank sized to provide 24 hours of operation at full load. The fuel tank shall also be equipped with a low fuel level alarm. The fuel tank shall have secondary containment basin.
    e. The oil and coolant drains shall be extended beyond the generator framework and shall be equipped with a ball valve.
    f. Mounted on seismic spring isolators.

g. Engine emergency shutdown is to be controlled by a minimum of:
   - low coolant level
   - low oil pressure
   - high coolant temperature

h. A 120V, 100 watt space heater is to be installed in the alternator. The space heater shall turn off when generator is operating.
i. The engine shall incorporate a coolant heating system.
j. Generator control panel must provide alarms for fault conditions; general fault shall be provided to the telemetry system.
k. Include batteries and charging system
l. Cummins coastal enclosure (aluminum, stainless steel) or equal
m. Include a 5 year warranty period.