

# THE CITY OF HOLLAND BOARD OF PUBLIC WORKS (BPW)

## SPECIFICATIONS FOR WASTEWATER LIFT STATIONS

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### PART 1 - GENERAL

#### 1.1 INTRODUCTION

This document outlines the design requirements for public wastewater lift stations. Upgrades or modifications to existing wastewater lift stations shall meet these standards to the extent practical.

These standards are intended to guide in the design of wastewater lift stations. The Holland Board of Public Works (BPW) reserves the right to modify or waive any design standard for a particular application. Any deviations from these design standards will require justification to and the approval of the BPW.

#### 1.2 ABBREVIATIONS

- A. 10 State Standards – *Recommended Standards for Wastewater Facilities* by the Great Lakes-Upper Mississippi River Board of State and Provincial Health and Environmental Managers
- B. AASHTO – American Association of State Highway and Transportation Officials
- C. ACI – American Concrete Institute
- D. AWWA – American Water Works Association
- E. ANSI – American National Standards Institute
- F. ASTM – American Society for Testing and Materials
- G. BPW – Holland Board of Public Works
- H. IEEE – Institute of Electrical and Electronics Engineers
- I. LPI – Lightning Protection Institute
- J. MDEQ – Michigan Department of Environmental Quality
- K. MIOSHA – Michigan Occupational Safety and Health Administration
- L. NEC – National Electric Code
- M. NFPA – National Fire Protection Association
- N. NPSHA – Net Positive Suction Head Available
- O. NPSHR – Net Positive Suction Head Required
- P. OSHA – Occupational Safety and Health Administration
- Q. SCADA – Supervisory Control and Data Acquisition
- R. TDH – Total Dynamic Head
- S. UL – Underwriters Laboratories

#### 1.3 APPLICABLE REGULATIONS

Wastewater lift stations must satisfy the regulations of all agencies having jurisdiction. Wastewater lift stations, at a minimum, shall conform to this document and the most current edition of *Recommended Standards for Wastewater Facilities* (10 State Standards). Other regulations governing facilities and construction shall be adhered to, including regulations published by MDEQ, OSHA, MIOSHA, NFPA, NEC and others as applicable.

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### PART 2 - DESIGN CRITERIA

#### 2.1 STATION DEPTH

Wastewater lift station depth shall be dictated by the depth of the existing and proposed sanitary sewer collection system which it is intended to serve. The collection system depth shall be as necessary to accommodate basement services on homes with 8-foot basement ceiling height.

#### 2.2 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.

- A. Lift Station Planning Period/Sizing: Wastewater lift stations shall be designed to accommodate ultimate build-out density of the service area for the major components including the wet well, pump station layout and force main. Appropriate growth rates utilized for the planning period shall be submitted to the BPW for review and approval.
- B. Pump Planning Period/Sizing: Pumps shall be designed to satisfy flows projected to occur over a 20 year planning period. Appropriate growth rates utilized for the planning period shall be submitted to the BPW for review and approval.
- C. Average Day Flow Rates:
  1. Existing Residential Development: Historical flow data shall be used where available. Where not available, average day flows shall be determined by multiplying the service area population by the per capita flow requirements of Ten State Standards (100 gal/cap/d). Service area population shall be estimated by use of house count and the latest census estimates for average population per household.
  2. Future Residential Development: Average day flows shall be determined by multiplying the projected service area population by the per capita flow requirements of Ten State Standards (100 gal/cap/d). Service area population shall be estimated by use of proposed development density (i.e. homes per acre) and the latest census estimates for average population per household.
  3. Existing Non-Residential Development: Historical flow data shall be used where available. Where not available, average day flows shall be determined based on an inventory of existing customers and appropriate estimates of flow for each. Calculations and basis for non-residential development estimates shall be submitted to the BPW for review and approval.
  4. Future Non-Residential Development: Average day flows shall be determined by use of projected development type/density and appropriate estimates of flow. Calculations and basis for non-residential development estimates shall be submitted to the BPW for review and approval.

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- D. Peak Hour Flow Rates: Shall be calculated using the methodology outlined in Chapter 10 of Ten State Standards.
- E. Wastewater Composition: Can vary widely depending upon the proportion of design flow generated by non-domestic users. Non-domestic user wastewater composition shall be investigated. Adequate consideration and necessary provisions shall be taken to ensure that lift station equipment and materials are suitable for the anticipated composition of wastewater.

### 2.3 HYDRAULICS

- A. Total Dynamic Head (TDH): TDH calculations shall be prepared and submitted to the BPW for review. The calculations shall include friction head losses determined as accurately as possible by taking into account all pipe and minor losses. Friction coefficients used in calculations shall be in accordance with the requirements of Chapter 40 of Ten State Standards. Calculations shall include pump/system curves for individual and combined simultaneous pump operation. The pump/system curve calculations may be performed utilizing any accepted hydraulic equation.
- B. Net Positive Suction Head - A net positive suction head available (NPSHA) analysis for the pumps shall be prepared and submitted to the BPW for review. The NPSHA shall be calculated for the expected design flows and shall exceed the pump manufacturer's Net Positive Suction Head Required (NPSHR) requirements by an added margin of safety of not less than 5 feet.
- C. Water Hammer – Water hammer (surge) analysis of the force main and lift station shall be performed during the design of the station. Water hammer shall be evaluated for normal operating conditions as well as for a power outage when pump(s) are running condition. All elements of the piping system must be designed to withstand the surges experienced under the maximum water hammer condition.
- D. Hydraulic Submittals: The TDH, NPSHA and Water Hammer calculations shall be submitted to the BPW along with all design assumptions, limitations and restrictions for review and approval.

### 2.4 SITING

- A. Topography/Floodplain: Wastewater lift stations shall be sited to remain operational and permit access during a 100-year frequency storm/flood.
- B. Land Use/Zoning: 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 are required for situations not adhering to the zoning regulations
- C. Aesthetics and Noise: Where lift stations are to be located in close proximity to developed areas; setbacks and noise attenuation shall be considered.

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- D. Odors: Every effort shall be made in site selection to reduce potential odor pollution. To this effect, wind direction, duration and intensity are all important considerations that should be evaluated during the siting process.
- E. Protection from Vehicles: Lift stations located on intersections, curves, high speed roads or any other areas susceptible to vehicular impact shall be designed with mitigation devices to protect the lift stations and appurtenant equipment from errant vehicles.
- F. Access: Lift stations shall be sited to allow access by all-weather surface roads capable of accommodating an AASHTO WB-40 design vehicle.
- G. Overhead Clearance: Adequate overhead clearance shall be provided over the site so that maintenance equipment will not interfere with any existing or future overhead utilities or structures. To this effect, lift stations should not be sited where existing overhead interferences exist.

### 2.5 SITE IMPROVEMENTS

- A. Grading: Site grading shall be designed to provide positive drainage away from the structures and to prevent ponding on the site.
- B. Access Drive:
  - 1. Lift stations shall be designed and constructed with adequate access for maintenance vehicles including Vector trucks.
  - 2. Access shall be provided so that the wet well is directly accessible to the BPW's Vector truck with the nose of the vehicle over the wet well.
  - 3. Whenever possible, provisions shall be made for egress from the site into traffic nose first.
  - 4. The access drive shall be a paved surface designed for the expected vehicular and equipment loadings at the site. Exceptions can be made for porous pavement as long as structure loading requirements are met and the surface is all weather and can accommodate snow removal operations. A location to deposit snow shall also be taken into consideration.
- C. Landscaping: Lift station sites shall be screened as appropriate for the surrounding development using landscaping designed to complement the existing/proposed vegetation in the surrounding area.

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- D. Perimeter Fence: All self-priming centrifugal lift stations shall have a minimum 6 foot high perimeter fence surrounding the lift station site to discourage unauthorized access. Submersible stations may also require fencing but this shall be on a case-by-case basis as determined by the BPW. Double 8 foot wide (16 foot total) swinging gates or a single 16 foot wide sliding gate shall be provided for access to all fenced sites.
- E. Potable Water: Stations shall be provided with potable water service for pump seal water (where applicable) and for cleaning. Sites shall be provided with a frost free yard hydrant for the purposes of cleaning. All potable water services shall be metered and shall contain a suitable and testable backflow preventer.

### 2.6 WASTEWATER LIFT STATION TYPE

- A. General: The type of lift station to be provided shall be determined by the required pump motor horsepower. Generally the type of station to be constructed shall be determined from the following table.

STATION TYPE	MAXIMUM HORSEPOWER
Submersible/Grinder	5 HP
<b>Self-Priming Centrifugal</b>	<b>No Restrictions</b>

- B. Lift stations may be either custom built-in-place or engineered package systems.

### 2.7 PUMPING EQUIPMENT

- A. General: Wastewater pumps shall be centrifugal non-clog solids handling pumps designed specifically for handling raw, unscreened domestic wastewater.
- B. Number of Pumps: Lift stations shall be designed to deliver the peak hour design flow rate with the largest pump out of service (N-1 condition). To this effect, the minimum number of pumps per station shall be two.
- C. Pump Efficiency:
  - 1. Every effort shall be made to select pumps that operate at their Best Efficiency Point (BEP).
  - 2. Minimum pump efficiency shall be 65%. Any variance from this requirement shall require BPW approval.
  - 3. Peak and average flows shall be considered when selecting the appropriate pump.
- D. Pump Motor:

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1. Efficiency: Electric motors shall be in compliance with the NEMA Premium Efficiency specification.
2. Motor Starters: Motors greater than 10 HP in size shall be provided with soft start/soft stop starters or variable frequency drives.

### E. Submersible Pumps:

1. General: Pumping equipment in the wet well must meet the requirements of the NEC Code for Class 1, Group D, Division 1 areas.
2. Guide Rails: Submersible pumps shall be equipped with guide rails and cable for installing and servicing the pump. The rails, cable and all associated hardware shall be Type 316 Stainless Steel.
3. Discharge Elbow: Submersible pumps shall be readily removable and replaceable without dewatering the wet well or disconnecting any piping in the wet well. As such, pumps shall be supplied with discharge seal and elbow assemblies for usage in removing the pumps from the wet well via the guide rail system. Flanged discharge assemblies are prohibited.
4. Impellers: Shall consist of cast iron or ductile iron and shall be capable of passing 3-inch solids. Usage of grinder or chopper pumps in lieu of the 3-inch solids requirement will be subject to review and approval of the BPW.
5. Pump Volute and Motor Housing: Shall be of cast iron construction. Fasteners and hardware shall be Stainless Steel.
6. Mechanical Seals: Shall consist of Tungsten Carbide.
7. Leak Detection: Pumps shall be fitted with leakage sensors for detecting the presence of water in the oil and/or stator housing.
8. Thermal Switch: A thermal switch shall be provided on the motor to protect the pump from running dry. Reset shall be automatic when motor is cool.

### F. Self-Priming Centrifugal Pumps:

1. General: Pumps shall be self-priming, vertical, non-clog, centrifugal sewage pumps.
2. Motor: Shall be Totally Enclosed, Fan Cooled (TEFC).
3. Impellers: Shall consist of cast iron or ductile iron and shall be capable of passing 3-inch solids.
4. Pump Volute and Motor Housing: Shall be of cast iron construction.

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5. Mechanical Seals: Shall consist of Tungsten Carbide.

### 2.8 APPROACH MANHOLE

- A. General: A 60-inch (minimum) diameter approach manhole shall be constructed upstream of all wet wells. The approach manhole shall be located on the lift station site and shall serve as a common point of connection for all sanitary sewer pipes tributary to the pump station. A single pipe shall extend from the approach manhole to the wet well.
- B. Isolation Valve: The pipe from the approach manhole to the wet well shall be provided with a valve that will allow for isolation of the wet well for maintenance. The valve can be either a sluice gate provided in the approach manhole or a buried resilient wedge gate valve on the pipeline.

### 2.9 COMMINUTOR/SCREENING

- A. General: Comminutors or basket screens may be required on a case by case basis. Determination of need for such equipment shall be based on evaluation of existing and future potential for problems with rags and/or other solids at the station. Where a comminutor or basket screen is required, usage of grinder or chopper pumps may be used in lieu of this equipment if approved by the BPW.
- B. Comminutors: Shall be installed on the influent to the wet well or on the suction lines to the pumps. Comminutors placed on suction lines shall be placed on the pump side of the suction line isolation valve to allow for removal for maintenance. Comminutors placed on the influent to the wet well shall be equipped with Type 316 Stainless Steel frame and rail system to allow for removal for maintenance.
- C. Basket Screens: Shall be installed on the influent to the wet well and shall be fabricated of Type 316 Stainless Steel. Screen shall be provided with electrically operated derrick for removal of screen for cleaning.

### 2.10 WET WELL

- A. General: 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.
- B. Sizing:

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1. Working Volume: The required wet well working volume shall be calculated based on the diurnal range of design flows (i.e. minimum hour flow thru peak hour flow) and the manufacturer's recommendations regarding pump start frequency.
2. Wet Well Diameter: Minimum inside diameter shall be 5 feet, however, actual size shall be determined based on considerations such as pump configuration, working volume and access.
3. Retention Time: Every effort shall be made to prevent wastewater in the wet well from becoming septic.
4. Adjustability: The wet well shall contain adequate vertical room for level sensing adjustments above and below the design levels.
5. Sizing Submittals: The wet well working volume calculations including calculations of the cycle times at minimum, average and peak hour flows shall be submitted to the BPW along with all design assumptions, limitations and restrictions for review and approval.

### C. Structure:

1. Material: Whenever practical wet wells shall be precast reinforced concrete structures. If required volume dictates the usage of a cast in place structure it shall be designed and constructed in accordance with the most current edition of *ACI 350 – Code Requirements for Environmental Engineering Concrete Structures and Commentary*.
2. Interior Lining: Wet well interior walls and ceiling shall be lined with a material that is completely resistant to hydrogen sulfide and sulfuric acid and is suitable for immersion in wastewater. The lining shall also be easily cleanable and sufficiently durable so that it can be washed with a high pressure water hose. Proposed liner materials shall be subject to review and approval of the BPW prior to installation.
3. Exterior Waterproofing: Wet well below grade surfaces shall have a waterproofing system installed on them. Additionally, all joints in the concrete shall be grouted with non-shrink grout on both sides of the joint.
4. Buoyancy/Flotation: Wet wells installed below the groundwater table shall be adequately designed to prevent flotation without the use of hydrostatic pressure relief valves.
5. Access: Wet wells shall be provided with a lockable heavy duty aluminum odor control hatch sized and located appropriately for access and servicing of equipment. Hatch shall come equipped with hinged and lockable fall protection system supplied by hatch manufacturer.

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6. Floor Slope/Fillets: Wet wells shall be provided with fillets at the bottom of the structure to effectively form a hopper around the inlet piping to the pumps. Fillets should be arranged to minimize the flat portion of the floor and square corners should be avoided.
7. Service Landings: When utilized in wet wells, intermediate landings shall be supplied with hand rails fabricated of aluminum, stainless steel or other approved corrosion resistant materials. All associated hardware shall be stainless steel.

### 2.11 DRY WELL (SELF PRIMING CENTRIFUGAL STATIONS)

- A. General: Stations may be engineered packaged pump stations where the design parameters permit the use of a factory built pump station.
- B. Structure:
  1. Packaged Pump Stations: Packaged stations utilizing structural steel "cans" are acceptable. Steel thickness shall be designed appropriately for site conditions (i.e. depth, water table, etc.) but in no case shall be less than 1/4" for dry well walls, 1/4" for entrance tube walls, and 3/8" for top and bottom heads. Station interior and exterior shall be protected with an epoxy coating for corrosion protection.
    - a. Entrance Cover: Shall be waterproof and corrosion resistant, with lock. Cover shall also be provided with a means of opening the cover from inside tube if cover is locked.
    - b. Fall Protection: Entrance tube shall be provided with intermediate landings for fall protection.
  2. Custom Built-in Place: Shall be concrete designed in accordance with the most current requirements of ACI. Below grade surfaces shall have a waterproofing system installed on them.
  3. Buoyancy/Flotation: Dry wells installed below the ground water table shall be adequately designed to prevent flotation without the use of hydrostatic pressure relief valves.
- C. Air Vent: Mechanical ventilation shall be provided for dry wells in accordance with all applicable codes. The duct for the ventilation system shall be fabricated from corrosion-resistant material, extended to above grade, outlet turned down, and with insect screen in outlet.
- D. Cathodic Protection: Stations utilizing steel "cans" shall be installed with appropriately designed impressed current cathodic protection systems.

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- E. Sump Pump: Dry wells shall have a float-controlled submersible sump pump located in a sump. Discharge from the pump shall be to the wet well and the discharge piping shall include dual check valves to protect the dry well from backflow from the wet well. Discharge in the wet well shall be above the maximum high water level.
- F. Float Switch: Dry wells shall be equipped with a float switch located just above floor level that will trigger an alarm notifying that the station is flooded. Float switch shall be normally closed.

### 2.12 VALVE VAULTS (SUBMERSIBLE STATIONS)

- A. Structure:
  - 1. Material: Vaults may be precast reinforced or cast in place concrete structures and shall extend 6-inches above grade.
  - 2. Exterior Waterproofing: Vault below grade surfaces shall have a waterproofing system installed on them. Additionally, 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.
  - 3. Buoyancy/Flotation: Vaults installed below the groundwater table shall be adequately designed to prevent flotation without the use of hydrostatic pressure relief valves.
  - 4. Access: Vaults shall be provided with a lockable heavy duty aluminum hatch with spring-doors sized and located appropriately for access and servicing of equipment. Hatch shall come equipped with hinged and lockable fall protection system supplied by hatch manufacturer.
- B. Sump Pump: Vaults shall have a float-controlled submersible sump pump located in a sump. The sump and pump shall be designed to handle anticipated maximum seepage and infiltration into the structure. Discharge from the pump shall be to the wet well and the discharge piping shall include dual check valves to protect the vault from backflow from the wet well. Discharge in the wet well shall be above the maximum high water level.

### 2.13 STATION PIPING

- A. General: All station piping described in this section shall be contained in a dry well (self-priming centrifugal stations) or valve vault (submersible stations) for general usage and maintenance by BPW staff.
  - 1. Materials: All station pipe and fittings shall be pressure class Ductile Iron. Wherever possible, piping in station shall be grooved end for ease of maintenance.

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- B. Suction Piping (Self Priming Centrifugal Stations):
1. General: Individual suction pipes shall be required for each pump and shall be designed with a gradual slope from the opening upward to the pump.
  2. Air and Turbulence Prevention: Suction piping shall be designed and installed to not permit the accumulation of air in the piping or induce excessive turbulence in the pump suction area. To this effect, long radius suction piping bends shall be used whenever possible and eccentric reducers shall be used where pipe size change is needed. Eccentric reducers shall be installed with the flat side up to prevent formation of air pockets.
  3. Size and Velocity: Generally the piping shall be sized to produce a fluid velocity of three (3) to six (6) feet per second (fps) at ultimate development. Velocity may be as low as two and a half (2.5) fps for initial development.
- C. Valves:
1. Check Valves: Each pump shall have a check valve with external swing arm. Check valves must be installed horizontally.
  2. Pump Isolation Valves: Each pump shall have isolation valves on the suction and discharge piping placed to permit the removal or maintenance of pumps and check valves without affecting the operation of remaining pumps. Valves shall be 100% port opening eccentric plug valves and shall utilize worm gear actuators with hand wheels and position indicators.
- D. Pressure Gauges: Pressure gauges shall be supplied on the suction and discharge mains to/from each pump. Gauge connection ports shall be stainless steel construction and must include a stainless steel spring return ball valve for isolation of the pressure gauges for maintenance or replacement.

### 2.14 FORCEMAIN

- A. Materials: All pipe utilized for force mains shall be pressure rated pipe. Acceptable materials are Ductile Iron (polyethylene encased), High-Density Polyethylene (HDPE) and Polyvinyl Chloride (PVC).
- B. Size and Velocity: Generally the piping shall be sized to produce a fluid velocity of three (3) to six (6) feet per second (fps) at ultimate development. Velocity may be as low as two and a half (2.5) fps for initial development.
- C. Horizontal Location: Force mains shall be located within public rights-of-way and/or in dedicated utility easements. Appropriate clearances between other utilities shall be provided for as specified in Ten States Standards.
- D. Vertical Location:

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1. Minimum Depth: Force mains shall be covered with sufficient earth or other insulation to prevent freezing. To this effect, a minimum depth of cover of 5 feet as measured from the proposed grade to the top of pipe shall be maintained.
  2. Isolation Distance: Appropriate clearances between other utilities shall be provided for as specified in Ten States Standards.
  3. Slope: Force main shall be laid at a continuous upward slope from the lift station to the discharge point to prevent formation of air pockets in the line. In the event that a high point cannot be avoided, and as allowed by the BPW, a wastewater air release and air/vacuum valve shall be installed in a vault at the high point.
- E. Station Isolation Valve: A buried valve shall be installed on the force main directly outside of the dry well/valve vault for usage in isolating the entire station. Isolation valve shall be a resilient wedge gate valve.
- F. Fittings: To the extent possible, bends and tees shall be minimized in the design and installation of the force main. Where bends are necessary, multiple 45-degree or less bends should be utilized in lieu of 90-degree bends. Similarly, wyes shall be used in lieu of tees at any intersection points.
- G. Tracer Wire: Force main shall be provided with tracer wire in accordance with the BPW's specification for Underground Utility Conductivity and Continuity.
- H. Termination: Force mains shall transition into a gravity sewer line within the termination manhole in a manner that minimizes agitation of the sewage. The crowns of the force main and outlet gravity line shall match where possible, with bench grouting installed to direct flow into the outlet with a minimal change in the gravity flow angle. A drop connection per Detail FM-1 shall be utilized where matching the crowns is not possible due to elevation differential between the force main and gravity sewer line
- I. Termination Manhole: Interior walls and ceiling of manhole that force main discharges into shall be lined with a material that is completely resistant to hydrogen sulfide and sulfuric acid. The lining shall also be easily cleanable and sufficiently durable so that it can be washed with a high pressure water hose. Proposed liner materials shall be subject to review and approval of the BPW prior to installation.

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### J. Appurtenances:

1. General: All appurtenant structures (air release vaults, clean-out vaults, etc.) shall require sufficient access considerations for BPW maintenance staff and required equipment to service and maintain them.
2. Air Release and Air/Vacuum Release Valves: Force main shall be laid in a manner to minimize the number of peaks and valleys along the profile in order to limit the accumulation of gases. Where it is not economically feasible to lay the force mains in a manner to avoid peaks, air release and air/vacuum release valves shall be installed to purge air from the system. Air release and air/vacuum release valves shall be specifically designed for wastewater service and shall be sized per the manufacturer's recommendations. The valves shall be installed in buried vaults for access by maintenance staff and shall be provided with a manually controlled isolation valve between the air release and air/vacuum valve and the force main.
3. Cleaning Considerations:
  - a. Clean-Outs: Double or single clean-outs may be required at low points of the force main at the discretion of the BPW.
  - b. Drain: When required by the BPW, the force main shall include dewatering connections at major force main low points. Drains generally include a resilient wedge gate valve installed on a tee and drain piping to an existing sewer manhole or separate manhole that can then be pumped out by BPW maintenance personnel.

### 2.15 EMERGENCY BYPASS PIPING

- A. General: An emergency pump connection shall be provided at all lift stations. Connection shall be sized according to station and header pipe size, and shall consist of a tee, resilient wedge gate valve and adapter flange with "quick disconnect" male fitting with dust cap. The bypass pump connection shall be located downstream of the station isolation valve.

### 2.16 COATINGS AND PAINTING:

- A. General: All exposed construction materials and equipment except those constructed from stainless steel, aluminum and fiberglass shall be protected with appropriate coating systems. Factory applied finishes are acceptable as long as they conform to color standards and any damaged coatings are repaired in field.
- B. Manufacturer: Coating systems shall be as manufactured by Tnemec, Sherwin Williams or alternately approved manufacturer of superior durability coatings.

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- C. Color: Above grade structures shall be painted brown. Pipes valves and fittings shall be in accordance with the standards outlined in Chapter 50 of Ten State Standards.
- D. Approval: All paint and coating systems shall be reviewed and approved by the BPW.

### 2.17 ELECTRICAL

- A. Electrical Service: Shall be 480 volt, 3 phase, 60 Hz unless otherwise approved by BPW.
- B. Lift Station Control Panels:
  - 1. General: Shall be enclosed in NEMA 4X enclosure panels.
  - 2. Layout and Spacing: Shall be sufficient to allow for device removal and maintenance without disassembly of adjacent devices. Additionally, ample panel gutter space (sides, top, and bottom) shall be provided for training wires and cables.
  - 3. Sizing: Panels shall be sized to suit the physical dimensions required for components and heat requirements of components mounted within. Panels shall be provided with a minimum 20 percent back panel space for future considerations.
  - 4. All enclosures shall be equipped with an interior, 15 Amp, GFCI duplex receptacle and interior fluorescent lighting. A switch shall be provided to control the lighting.
- C. Convenience Receptacles: 120 volt, single phase receptacles shall be provided within dry wells and at least one GFCI duplex outdoor weatherproof convenience outlet shall be provided above grade for usage by maintenance staff.
- D. Lightning and Surge Protection:
  - 1. The station shall be provided with lightning protection in accordance with the latest editions of NFPA 780 and LPI-175.
  - 2. Transient voltage surge suppressors (TVSS) shall be provided on service entrance(s), feeders and branch circuits. Materials and work shall comply with the latest editions of ANSI/IEEE C62.41 and UL 1449.
- E. Emergency Power Requirements:
  - 1. General: Lift stations shall be required to provide one of the following means of onsite emergency power.

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- a. Emergency Generator(s): The generator(s) shall be fueled by natural gas unless otherwise approved by the BPW and shall be provided with automatic transfer switches supplied by the generator manufacturer. The generator(s) shall have a minimum of 4-foot clearance for operation and maintenance and shall be provided with a sound attenuation package suitable for usage in residential areas.
    - i. Sizing: Generators shall be sized to allow simultaneous starts and operation of all installed and/or planned pumps in addition to station auxiliary loads. In order to provide some room for future growth at the station, generators shall at a minimum be sized based on pumps utilizing motors one size larger than those proposed/installed. For example, if the pumps in the associated lift station utilize 7.5 horsepower (hp) pumps, the generator shall be sized based on 10 hp pumps.
  - b. Dual Electrical Feeds: The two electrical feeds shall be provided from two independent electrical substations and shall be completely physically separated including not sharing the same pole(s). The station also needs to be provided with the capability of fully automatic switch over between the two electrical feeds to assure continuous service.
2. Alternate Justification: The requirement for onsite emergency power supply may be waved by the BPW if demonstration can be provided that the station has at least 2 hours of emergency storage available in the wet well and collection system (without causing back-ups or overflows) under design peak hour flow conditions. Demonstration must be shown that the system will have sufficient storage under initial and ultimate peak hour flow conditions.
- a. Portable Generator Connection: Stations approved for installation without on-site back-up power shall be provided with a quick connection and manual transfer switch for usage with the BPW's emergency generators.

### 2.18 STATION CONTROLS, INSTRUMENTATION AND MONITORING

#### A. Level Control and Monitoring:

1. General: All stations shall be designed for local and remote control of pump operation.
2. Self Priming Centrifugal Stations: Shall use a continuously run bubbler system with two compressors which alternate on timer controls.
  - a. Local Control: Shall be via pressure switches installed on the bubbler system to sense level in the wet well



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### Required Alarm Conditions

Alarm Condition	Station Type	
	Self-Priming Centrifugal	Submersible
Power Fail	X	X
Dry Well Flooded	X	
High Wet Well Level (initiated by both primary level control system and back-up float)	X	X
Low Air Pressure Alarm	X	
PLC Communications Failure	X	X
Compressor Motor Alarm (for each compressor)	X	
Pump Motor Alarm (for each pump)	X	X
Pressure Transmitter Failure		X
All Pumps On Alarm	X	X
Station Inactive	X	X
Pumps Running More Than 15 Minutes	X	X
Low Wet Well Alarm	X	X
On Back-up Power	X	X
UPS Failure	X	X
PLC Battery Needs Replacement	X	X
Not in Auto (i.e. in manual)	X	X
Crew on Site	X	X
Emergency	X	X
Intruder Alert	X	X

### 2.19 COMMISSIONING AND ACCEPTANCE:

- A. Start-up & Testing: Prior to acceptance by the BPW a thorough inspection and operational check of the station is required. The start-up testing shall include, but not be limited to: 1) Pump performance testing to verify pumping rate and pressure for each pump and combination thereof; 2) Electrical testing; 3) Load bank testing (for onsite generators); 4) Confirmation of all alarms; 5) Confirmation of local control capabilities; 6) confirmation of remote control capabilities; and 7) Confirmation of operation under auxiliary power.
  1. Correction: Repair or replace all faulty operating components and repeat test until acceptable.
- B. Documentation: Prior to acceptance of the lift station three hard copies and one electronic copy of the following shall be provided to the BPW:

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1. Record Drawings for all components of the lift station
  2. Record Drawings of control schematics
  3. Record Drawings of wiring diagrams
  4. Pump Station O&M Manuals
  5. Pump specifications and test data
  6. Generator equipment data and manuals
  7. Contact information for all warranties
- C. Training: Prior to acceptance, BPW personnel shall receive training from factory authorized representatives of the major equipment including but not necessarily limited to the pumps, pump controls and generator.

### **2.20 WARRANTY:**

- A. General: All sanitary sewer lift stations shall include a one-year warranty against defects in workmanship and materials. The one-year time frame shall begin once the BPW has made final acceptance of the station(s). Items that require repair under the one year warranty period shall be covered under an additional one year warranty after the repair is made.