

BEDFORD COUNTY PUBLIC SERVICE AUTHORITY
OPERATING POLICY MANUAL

Chapter: Wastewater System
Document Number: 6.10
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Issue (Effective) Date: August 1, 2010
Approval Date: July 16, 2010
Approved By: Executive Director

WASTEWATER LIFT STATION REQUIREMENTS

Section 1. PURPOSE

These requirements apply for any wastewater lift stations located in Bedford County that are capable of pumping 30 gallons per minute (gpm) or more, including those that the Bedford County Public Service Authority (“Authority”) will own and operate.

Section 2. GENERAL REQUIREMENTS

- A. Due to the higher operating and maintenance cost of a wastewater lift station, a gravity collection system is preferred by the Authority whenever possible. In order to consider the use of a lift station in lieu of a gravity collection system, the developer shall submit to the Authority cost estimates showing that the gravity option would exceed twice the capital construction costs of that of the wastewater lift station.
- B. The design of the lift station shall be submitted to both the Authority and DEQ for approval. The requirements shown in the document are intended to supplement those in the Sewage Collection and Treatment (SCAT) Regulations. Construction of the lift station shall not commence until written approval is granted by both the Authority and DEQ.
- C. Design calculations must be submitted with plans, showing the pump curve and system head calculations.
- D. Plans shall show the following elevations and distance (in feet) off of the wet well floor in the section view of the wet well:
 - 1. Floor elevation.
 - 2. Low Float switch location.
 - 3. All Pumps Off.
 - 4. Lag Pump Off.
 - 5. Lead Pump On.
 - 6. Lag Pump On.
 - 7. High Alarm Setting.
 - 8. High Float switch location.
 - 9. Invert in of all gravity pipes.
 - 10. Top of wet well.
- E. Bioxide may be needed, to slow the wastewater degradation, based on length of forcemain and/or detention time. This determination will be made by the Authority.

Section 3. BUILDING

- A. A secure control building shall be provided within a distance of twenty (20) feet from the edge of wet well.
- B. All electrical panels, control panels, motor starters, and generator transfer switches (if so equipped) shall be mounted inside this building.

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- C. The control building shall be a minimum of eight (8) feet wide by eight (8) feet deep; this space is dedicated to only housing electrical panels and controls. If the building also houses items other than the electrical panels and controls (i.e. a bioxide tank, generator, equipment storage, or suction lift pumps), additional space shall be allocated for these extra items.
- D. Heating and air conditioning shall be provided with a through wall package terminal air conditioner (PTAC) heat pump sized adequately for the space being heated and cooled. Ventilation shall also be provided using a louvered fan on the top of one side of the building and a mechanical louvered vent on the bottom of the other side of the building (for cross ventilation); the fan shall be operated by a Hand / Off / Auto switch, where the auto switch is controlled by a thermostat that is mounted four (4) feet off the floor.
- E. Lockset shall be mortise style lock deadbolt lock and handle, equivalent to Corbin Russwin model ML2051 BHMA 630.
- F. Interior lighting shall utilize fluorescent bulbs with electronic ballast and fixtures shall have a protective plastic lens cover. A minimum of two (2) fixtures shall be installed, with two (2) bulbs per fixture, for an eight (8) foot by eight (8) foot building; proportionately more fixtures will be required if the building is larger.

Section 4. PUMPS

- A. Submersible pumps shall be retrievable with stainless steel chain as the lifting equipment.
- B. Pumps shall have independent Variable Frequency Drives (VFD). VFD's shall be programmed to ramp up and ramp down for gradual (soft) starting and stopping.
- C. Pumps shall not have trimmed impellers; the full size impellers flow rate will be controlled with the VFD.
- D. Manufacturer shall be Hydromatic, KSB, Gorman-Rupp pumps or approved equal.

Section 5. CONTROL PANEL

- A. An Allen Bradley SLC-505 PLC is required to control the pumps and to control the alarming.
- B. An Allen Bradley Panelview 550 or greater, with an ethernet connection, is required as the display panel for the site. At a minimum, the following must be shown on the display:
 - 1. Main Screen:
 - a. Show the graphic representation of the wet well.
 - b. Show the numeric level of the wet well.
 - c. Indicate if the low float or high float is active.
 - d. Indicate if the pumps are in local hand, off, or auto mode.
 - e. Indicate if the pumps are in remote hand, off, or auto mode.
 - f. Show the current programmable level settings.

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- g. Show if the pumps are in lead or lag position, and if pump alternation is enabled.
 - h. Show current flow rate, today's total flow, and yesterday's total flow.
 - 2. Pump Control Screen (password protected):
 - a. Allow for setting the following levels:
 - i. All pumps off.
 - ii. Lag pump off.
 - iii. Lead pump on.
 - iv. Lag pump on.
 - v. High water level alarm.
 - b. Show the level setting of the high and low float switches.
 - c. Allow for selecting which pump is lead or selecting pump alternation.
 - 3. Configuration Screen (password protected):
 - a. Allow for setting the PLC clock time.
- C. Sensors and Equipment:
- 1. A sensor shall be provided on the incoming side of the VFD, monitoring the voltage and phase of the utility power. If the voltage is over or under the pump manufacturer's recommendations, if a phase of power is lost, or if there is a phase shift, this control will shut down the pumps and prevent them from running until the condition is corrected.
 - 2. An uninterruptible power supply (UPS) shall be provided to provide power backup and filtering for the PLC and any other key components (like a DC power supply for the flow meter) in the control cabinet. The UPS shall automatically reset itself (in run mode) after a loss of power where the battery is fully drained.
 - 3. A four (4) port rail mounted ethernet switch shall be provided in the cabinet to connect the PLC to the Panel view and for remote communication and computer connections.
- D. Manual Controls and Indicators:
- 1. Hand / Off / Auto Switch shall be provided for each pump.
 - a. Hand mode shall be operable even when the PLC is not operable.
 - b. Auto mode will pass the controls to the PLC.
 - c. Off shall over-ride all other controls to turn the pump off.
 - d. Switch shall be illuminated when the pump is active in either hand or auto modes.
 - 2. Push button to acknowledge all alarms.
 - 3. Push button to reset all alarms.
 - 4. Red indicator light, which flashes when there are active alarms.

Section 6. LEVEL CONTROLS

- A. The wet well level shall be monitored using a wastewater submersible pressure transducer. The transducer shall be retrievable and shall be mounted inside of a straight stilling well (no bends or deflections) of at least a four inch (4") diameter PVC.
- B. Two (2) mercury float switches are required with intrinsically safe barriers. The floats shall be mounted where they can be easily accessed for retrieval and shall be attached to a stainless steel chain to allow for adjustment. These floats are to function as redundancy and backup, in case of failure of the PLC or the level transducer, and shall function even when the PLC is inoperable.

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1. One is for high level backup and alarming. When this float is activated, all pumps shall be energized and remain energized until the low float switch is activated; in addition, it should generate an alarm when activated. This float should be located near the invert in elevation for the lowest gravity sewer pipe.
2. One is for low level backup and alarming. This float is to protect the pumps from running dry and it should generate an alarm when activated. This float should be located near the top of the motor for the submersible pump (or at least eighteen inches (18") above the end of the suction line for suction lift pumps).

Section 7. ALARMING

- A. A flashing red light and 100 decibel (dB) horn shall be mounted on the outside of the controls building, in a location that is easily visible from the nearest street and/or structure.
- B. Each alarm condition shall be programmable such that it is possible to select which alarms are handled in one of four manners: a) activates light, b) activates horn, c) sent to either SCADA or dialer, and d) disabled (bypassed). The following is a list of the minimal alarm conditions that should be generated:
 1. Low water level indication due to low float switch.
 2. High water level due to transducer setting.
 3. Very high water level indication due to high float switch.
 4. Generator in alarm.
 5. Pump moisture intrusion (one for each pump).
 6. Pump high temperature (one for each pump).
 7. Pump(s) selected on, but no flow being shown on the flow meter.
 8. Pump(s) selected on, but no flow is being detected by the check valve limit switches.
 9. High Voltage.
 10. Low Voltage.
 11. Phase loss or phase shift.
 12. Loss of communication to SCADA (if public).
- C. Remote alarming (when private) can be accomplished through an Auto Dialer.
- D. Remote alarming (when public) must be connected to the Authority's SCADA system. Communication equipment shall be determined by the Authority, depending on the site, but provided by contractor.

Section 8. MAGNETIC FLOW METER

A Magnetic Flow meter shall be provided (in valve vault for submersibles or in building for suction lift pumps), with both analog (4-20mA) and digital (pulse) outputs. Analog signal is sent to PLC to monitor instantaneous flow; digital signal is sent to PLC to monitor the totalizer. Similar to LCMag meters.

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Section 9. GENERATORS

- A. Where generators are required by the DEQ regulations, they should have remote alarming capability that is tied into the PLC as an alarm condition.
- B. Where generators are not required, an emergency portable generator connection is required, with a Crouse Hinds female connection compatible with the Authority's generator.

Section 10. WET WELL AND VALVE VAULT

- A. A retrievable stainless steel basket screen shall be provided at all locations where gravity sewer enters the wet well. The basket shall slide vertically along stainless steel guide rails. If the pump hoist cannot be used to directly, lift the basket, then a separate hoist shall be provided for the basket.
- B. Bilco style hatches shall be used to provide access inside of the wet well and valve vault. All hatches shall have integrated locking mechanisms, where padlocks can be used to restrict access.
 - 1. One large hatch shall provide access to all the pumps.
 - 2. A separate hatch shall provide access to the floats, transducer, and basket screen (unless the pump hatch can provide access to these items).
 - 3. The hatch on the valve vault shall be large enough to allow the removal of any of the equipment inside the vault, with a minimum size of 36-inches by 36-inches. The hatch shall be situated along one edge of the vault, with manhole steps installed directly below the hatch to allow access into the vault.
- C. There shall be at least one (1) vent mounted on the top of the wet well with a removable stainless steel screen on the vent.
- D. Provide an emergency pump connection on top of the valve vault, connected to the discharge side of the check valve in the valve vault. The pump connection shall be a four inch (4") quick disconnect hose fitting, such that the discharge from a portable pump can be connected to the forcemain in the event that the pumps are not working.
- E. One (1) check valve, one (1) gate valve, and one (1) diaphragm pressure gauge (located on the influent side of the check valve) shall be provided in the valve vault (submersible) or building (suction lift) for each of the discharge lines from the pumps. A ball valve shall be located between the pressure gauge and the tap to the pipe.
- F. All slide rails, chains, brackets, bolts, and other appurtenances shall be stainless steel. Galvanized and/or painted steel are not allowed.
- G. Limit switches shall be provided on all check valves. These shall be connected to the control system, to alarm if no flow is detected when the pumps are running.

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Section 11. SITE REQUIREMENTS

- A. Site shall be a minimum of 75-feet wide by 75-feet deep, unless otherwise approved by the Authority. Adequate space shall be provided on the site (and inside the fence) to allow for repair equipment and machinery (i.e. crane, trailers, etc).
- B. If the site does not border a public right-of-way, a dedicated Authority right-of-way shall be provided to the site.
- C. A W6x12 wide flange trolley beam shall be provided directly above the hoist connection point for the pumps. The beam shall be supported by at least two (2) posts, which are tall enough to allow the hoist to lift the bottom of the pump off the ground at least four (4) feet. A trolley and hoist shall be provided, to run along this trolley beam. At least twelve (12) feet of ground clear space shall be provided beside the wet well (submersibles) or building (suction lift), with the trolley beam running overhead, so that the pumps can be hoisted up and run along the trolley to where they can be loaded onto a truck.
- D. Site lighting shall consist of at least two (2) site lights:
 - 1. One pole mounted 200-watt mercury vapor light that is located as close as possible to being directly over top of the pumps in the wet well. The light shall be installed with a dusk to dawn sensor, and shall operate off a wall mounted switch that is located in the control building.
 - 2. One 200-watt mercury vapor light that is mounted above or near the door on the control building. The light shall be installed with a dusk to dawn sensor and shall operate off a wall mounted switch that is located in the control building.
- E. When a fence is installed, it shall be eight (8) feet tall with three (3) strands of barbed wire. The main driveway entry gate shall be a double swing gate of at least twenty (20) feet in width.

Section 12. OPERATION SEQUENCE

- A. A rise in the water level to the lead pump on set point turns on the pump that is currently selected as being the lead pump.
- B. A continued rise in the water level to the lag pump on set point turns on the lag pump (in addition to leaving the lead pump on).
- C. A continued rise in the water level to the high water level set point turns on the high water level alarm.
- D. A continued rise in the water level to the high water float switch locks both pumps on until the low level float switch is reached. The high float switch also initiates the very high water level alarm.
- E. When the water level drops below the high float switch, the very high level alarm signal is cancelled.

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- F. When the water level drops below the high level setpoint (from transducer), the high level alarm is cancelled.
- G. When the water level drops below the lag off set point (from transducer), the lag pump turns off. The exception to this sequence is if the high float switch has been met (in which case both pumps operate until the low float is encountered).
- H. When the water level drops “all pumps off” set point, all of the pumps are turned off.
- I. If the water level continues to drop past the “all pumps off” setpoint, due to some failure from the transducer or the PLC, all the pumps will be forced off when it hits the low float.

Section 13. REVISIONS

- A. This policy was approved and adopted by the Authority’s Board of Director on December 16, 2008.
- B. This policy was modified with the following amendment:
 - 1. July 16, 2010, effective August 1, 2010:
 - a. Made this policy to be approved by the Authority’s Executive Director, not the Authority’s Board of Directors.
 - b. Section 10.B.3 was clarified.
 - c. Section 2.A was added, to show that gravity sewer is preferred.
 - d. Section 3.D. was modified to require a heat pump for air conditioning