Wastewater Monitoring Solutions

Introduction

Wastewater lift stations and pump stations are critical pieces of infrastructure that nobody thinks or cares about until they don't work. If they fail and overflow, then they get a lot of attention and none of it good. This includes angry property owners and managers as well as hefty environmental agency fines. Proper monitoring and maintenance of wastewater lift stations and pump stations is critical.

Wastewater lift stations and wastewater pump stations are very similar in concept and operation, but differ in the type of pumps and piping that are required.

Lift stations are used to lift sewage to a higher level so that it can flow through sloped underground pipes using gravity until it gets to the next station. Digging trenches to slope pipes from homes all the way to a treatment plant is prohibitively expensive. So large wells are built periodically through the system to collect the wastewater. Pumps at the bottom of the wells lift the sewage to discharge pipes near the surface so that it can flow downhill to the next station. The sewage can go through several wastewater lift stations on its way to a treatment plant with the stations getting larger closer to the plant to handle the aggregated volume of the smaller stations further out.

A wastewater pump station transports sewage by pumping it through a pressurized pipe until it reaches a point where it can flow downhill through sloped pipes using gravity or until it reaches a treatment plant. They differ from wastewater lift stations in that the wastewater pump station moves the sewage some distance horizontally as well as vertically.

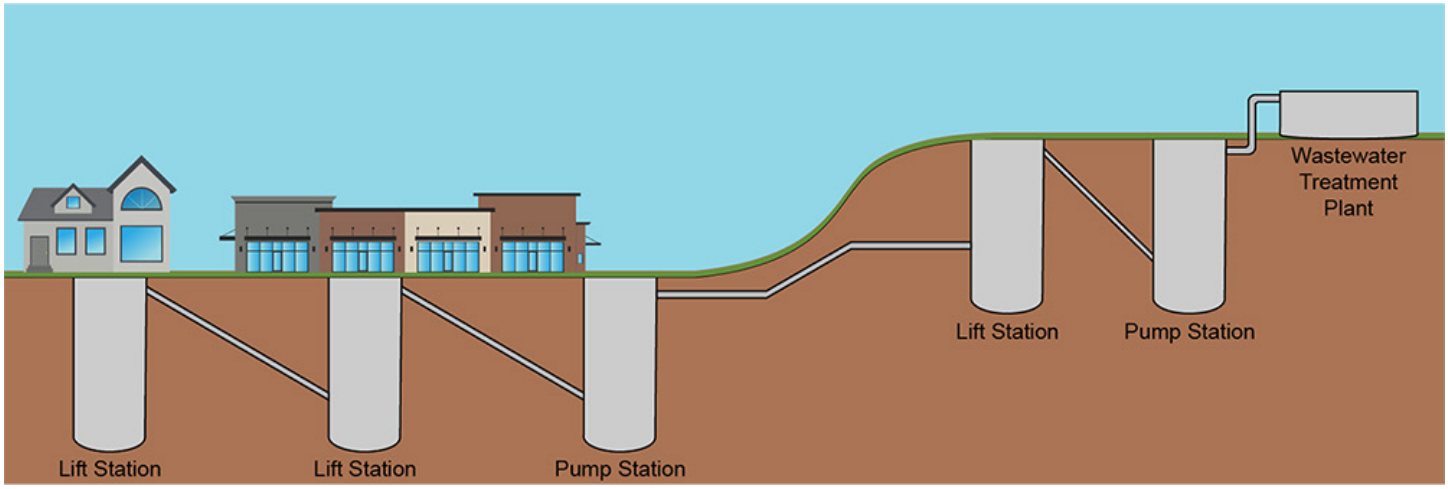

Figure 1: Wastewater Lift Stations and Wastewater Pump Stations

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How Do Wastewater Lift and Pump Stations Work?

The most common type of wastewater station is called a wet well. This is a pit that holds wastewater until it reaches a threshold level where there is enough wastewater to pump out. The level is detected by simple float switches. As the wastewater level rises, it turns on a float switch. Simple control logic in a panel controls the pumps. When the lead float switch turns on, one pump is activated until the off float switch turns off. If the lag float switch turns on, the second pump is activated. If the high level float switch turns on, then a red light is turned on and a horn sounds indicating an issue that needs to be addressed.

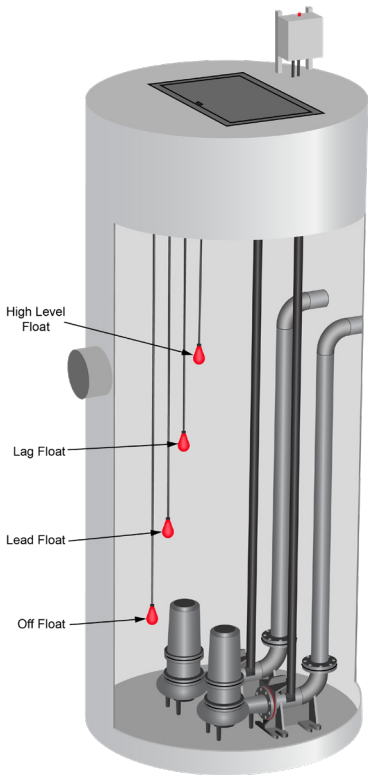


Figure 2: Wastewater Lift Station

Wastewater pump stations operate in a similar fashion, but the pumps generally need to be more powerful to push the wastewater further and the piping needs to be stronger to handle the pressurized sewage. Wastewater pump stations are typically used when the source is in a low-lying area, when the wastewater must be moved uphill, or when the cost of digging trenches for sloping pipes is higher than the cost of installing a pump station.

Wastewater Station Monitoring and Maintenance

Routine servicing of the pumps, motors and float switches is important to ensure their good operation. Remote monitoring of the stations catches issues before they become serious problems. This includes recording the float switch activations to ensure the pumps are turning on and off correctly and that the station is keeping up with the volume of water. Monitoring the motor currents can show that they are operating correctly or that something is wearing out or a pump is clogged. Monitoring power to the station can detect interruptions, noise or other conditions that could impact the electronics and motors.

The key is that the service provider responsible for the maintenance of the station is informed of a problem well before an overflow event. This gives them time to service the station and correct any issues before it becomes a serious problem.

Wastewater Station Monitoring Solutions

SCADA systems have been used to monitor wastewater lift stations for decades. However, these are typically older systems using dedicated radios that drive up cost. As the Internet of Things (IoT) has exploded over recent years, the cost of technology to connect Things to the Internet has plummeted while becoming easier to use and deploy.

The Nexcomm Systems LiftPoint System is a complete hardware, software, and cloud services solution for monitoring and controlling wastewater lift stations and pump stations.

This is a fully integrated system. Gone are the days of trying to connect disparate sensors and monitors to PLCs and then to get that to communicate with an expensive, single source, proprietary SCADA radio. There is simply one box with wires that land on the terminals inside the panel.

Furthermore, with thorough national cellular coverage, most lift stations and pump stations will not need special antennas or antenna alignment. Remote and rural stations may need extra attention, but most stations become plug-and-play. The LiftPoint System reduces both hardware costs as well as installation costs.

We offer multiple hardware options depending on the complexity of the station and the level of information desired, as well as a complete cloud service with reporting and alerting built in.

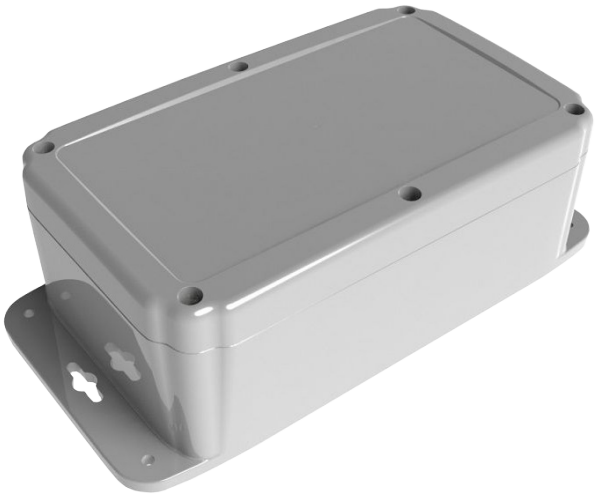
The LiftPoint Light

The LiftPoint Light is the most basic entry. It monitors the ON / OFF state of four floats, monitors two CTs for motor current, and has two 4 to 20mA analog sensor inputs. The data is sent to the Nexcomm Systems cloud services using the new CAT-M1 cellular technology. Integrated battery backup keeps the LiftPoint Light alive in the event of power loss to the station so that it can report the condition. This is designed for basic monitoring of small stations with up to two pumps. This device has allowed our customers to reduce the cost of large municipal deployments by millions of dollars compared to traditional SCADA systems.

LiftPoint Light	Specifications
	• 110VAC Input Power • 4 AC Inputs; 110V • 2 Analog Inputs, 4 to 20mA • 2 Current Transformer (CT) Inputs, 1V • CAT-M1 Cellular Modem • GPS Positioning Services • Integrated Battery Backup • IP68 Polycarbonate Enclosure with Mounting Flanges

The LiftPoint

The LiftPoint is the full-featured option to monitor all major functions of a wastewater lift station. It has sixteen 110V digital inputs, two 12V digital inputs, three CT inputs, one 4 to 20mA input, and one Dallas 1-Wire channel for digital sensors. It also has some control capabilities with RS-485 and Ethernet for communications to PLCs or controllers. Three relays and ten current sink outputs can control non-critical functions, such as activating or deactivating the horn or light. Integrated battery backup keeps the LiftPoint alive in the event of power loss to the station so that it can report the condition.

LiftPoint	Specifications
	• 110VAC or 12VDC • 3 card slots • 16 AC Inputs • 3 double throw relay outputs • 1 RS-485 Channel • 2 RS-232 Channels • 10 Digital Sinks • 4 Analog Inputs (1x 4-20mA, 3x 4-20mA or 1V CT) • 1 10/100 Ethernet Connection • 1 Dallas 1-Wire Channel • Wi-Fi b/g/n • CAT-1 Cellular Modem • GPS Positioning Services • Integrated Battery Backup • IP68 Polycarbonate Enclosure with Mounting Flanges

The Nexus Panel

The Nexus Panel is a great solution for more advanced stations with electronic drives or Variable Frequency Drives (VFDs). It has an RS-485 port to communicate with the drives over Modbus and one or four Ethernet ports to communicate with Modbus TCP or straight Ethernet. It can be populated with different cards that enable different features. A four port Ethernet card connects to multiple devices through Ethernet. Cards are also available that have CT inputs, analog inputs and digital on / off inputs for sensors. It is designed to be mounted on DIN rail inside the station panel, so installation is very simple.

Nexus Panel	Specifications
	• 9-36VDC • 2 card slots • 1 USB Port • 1 RS-485 Channel • 1 Digital Input; 1 Output • Bluetooth, Thread Enabled • Wi-Fi b/g/n • GPS • DIN Rail Mount Enclosure • 4.50 x 3.50 x 1.25 Inches With Ethernet Card • 4-Port 10/100 Ethernet Switch With RTD/CT Card • 1 10/100 Ethernet Port • 3 PT100 RTD Analog Inputs • 4 Analog Inputs (1x 4-20mA, 3x 4-20mA or 1V) • 2 36V Digital / Pulse Inputs • 1 Digital Output Current Sinks With I/O Card • 1 10/100 Ethernet Port • Six 4-20mA Analog • Four digital on / off inputs, 0 to 36V • Two current transformer inputs, 1V analog • Five digital output current sinks, up to 300mA

Wastewater Lift Station Monitoring Cloud Services

The Nexcomm Systems Cloud Services offer intuitive visualization of the wastewater lift station. It also generates email and SMS text message alerts in the event of fault conditions. The alerts are configurable as well as who gets them on what days and at what times. The system records service and maintenance reports entered in by field personnel and generates monthly reports for property owners, managers and agencies.

The LiftPoint system offers a simple solution for wastewater lift station monitoring at a cost that is far below traditional SCADA systems. Contact us to discuss how this innovative solution can solve your needs.

Figure 3: LiftPoint Cloud Services

What do you get for your money?

The LiftPoint system has several features that offer advantages over traditional SCADA systems.

- **Station Health Insight**

  Current Transformers (CTs) can be added to monitor the current of the motors and provide insight into their health. This can include wear on bearings as well as clogged pumps. Analog sensors can be included to provide more insight, such as flow, temperature, pressure and so forth. Some motors and pumps have signal lines that can be monitored, such as leak detection.

- **Store Station Maintenance Records**

  Technicians can enter maintenance information for a specific station when they do field work. This can include a list of what was checked as well as a text field for entering any notes or points of concern. All of this is saved with the date and technician ID with the rest of the data for that station. It can then be automatically pulled into a monthly report that can be sent to the station owner.

- **Cellular Connectivity is Included**

  The LiftPoint hardware includes cellular modems and SIM cards for the largest cellular service providers. The latest generation modems offer better performance and no configuration is required. Software updates and data plans are included.

- **Integrated Security**

  The connection between the device and the Cloud services is secured with Microsoft Azure technology. Without getting deep into the topic, each device has a unique key to encrypt the

data and log into the Azure system. This system is maintained at the highest level of security by Microsoft and is updated with the latest industry best practices.

- **Robust Hardware**

  The LiftPoint and LiftPoint Light have outdoor rated polycarbonate enclosures with mounting flanges that let them be easily attached to the panel or Unistrut. They are 110VAC compatible, so wires can be connected directly to the panel without any special connectors or adapters. Split core current transformers can be snapped around the power lines to the motors, making installation very simple. 4 to 20mA inputs allow the connection of additional sensors, such as flow, level, temperature, and pressure sensors.

  A connectorized flying lead option is available. This allows the panel to be pre-wired for monitoring with a weather-proof bulkhead connector on the bottom of the panel. The monitoring hardware can be installed later with a matching cable and connector. Mount the box, plug in the connector and done.

- **Integrated Cloud Services**

  The cloud services offer many options, including

  - Over-the-air (OTA) updates pushed out to all units from the cloud (do not have to physically touch any of the devices)
  - Device provisioning services; link a specific box to a specific station and specific customer for billing and reporting
  - Secure connections using Microsoft Azure
  - Login system with user levels to control access and read / write privileges
  - Trouble shooting and support
  - Tools to assist with billing customers. Reports with data usage, performance metrics, alert history, and maintenance records for each station can be automatically generated. This provides justification to the customer for the service they are paying for.
  - Visualizations, graphs and reports on the web that can be accessed from anywhere at any time.
  - The highest level offers control capabilities with the ability to activate relays or current sink outputs to control equipment at the station.
  - Branding options to look like your website

- **Integration with Existing SCADA Systems**

  Municipalities with existing SCADA systems can still use the LiftPoint System. An independent cellular router can be connected to SCADA servers and feed the data into the existing system. This completely bypasses IT departments and their security concerns, providing an independent link for the wastewater infrastructure that is completely disconnected from any other systems in the municipality.

System Levels

The LiftPoint Monitoring System has three levels to meet the needs and budget of different projects.

Basic Monitoring

- Monitoring and status of devices on an independent system
- Device provisioning services
- Over the air updates
- Link security from the device to the cloud
- Trouble shooting and support
- Device usage records to support billing

Monitoring and Reporting

- Everything in Basic Monitoring
- Graphs, charts and visualizations on the web
- Alarms and alerts through text message and email
- Maintenance records per device
- Usage, maintenance, and operation reports per device

Remote Control

- Everything in Monitoring and Reporting
- Send control commands to the devices

Contact us to discuss the project and which devices are the best fit for specific installations.

About Nexcomm Systems

Connectivity solutions for the IoT and beyond

Nexcomm Systems provides the complete solution for connecting devices to the cloud for monitoring and control. We offer wired and wireless sensor hubs, cellular gateways and airtime, as well as cloud services for provisioning devices, data storage, visualizations, and reports. With systems tailored to different applications, environments and price points, we are a one-stop shop for remote monitoring and control.

Connect, Monitor, Control