

ce NEWS

for the business of civil engineering



WASTEWATER ALTERNATIVE FOR COASTAL CONDITIONS

Modeling water
quality impacts of
stormwater runoff

Public-Private Partnerships:
What's old is new again

Wastewater alternative for coastal conditions

Vacuum technology provides five benefits for a barrier island community.

By Christopher S. Garrett, P.E.

Project

Holden Beach, N.C.,
wastewater collection system

Civil engineer

URS Corporation

Product application

In this coastal area, an AIRVAC vacuum wastewater collection system offers installation and operation advantages compared with gravity systems.



Two public works projects are alike. However, there are certain profiles that are repeated, especially in similar geographic areas. For example, oceanside communities with flat topography, sandy soil, and high groundwater are a recurring situation along the coast in North Carolina. These conditions present significant problems when designing wastewater collection systems. Gravity systems, in these circumstances, are especially difficult to install because of the issues associated with deep trenching and dewatering. The water table in many seaside areas is only 3 or 4 feet below grade. Installing large gravity-flow lines may require trenches that are 15 feet deep. It is a costly, dangerous, and disruptive combination of factors.

Experience has taught us that vacuum sewer technology is an excellent alternative to gravity systems in these conditions. The characteristics of vacuum technology eliminate many of the issues that make the installation of gravity sewers expensive and disruptive in these seaside communities. For a variety of reasons, vacuum sewer technologies such as AIRVAC are now recommended for projects such as the one recently completed in Holden Beach, N.C.

Holden Beach is located on one of the barrier islands along the Atlantic Coast. It has all of the region's geographic characteristics — sandy soil, high groundwater, and flat terrain.

Holden Beach had its four vacuum stations built below grade in watertight vaults, which provides an aesthetic benefit and protects the system from storm surges.

The community is primarily a resort location populated with vacation homes and rental properties. Real estate values are very high and available space is at a premium.

Having studied and designed several sewer systems in coastal areas similar to Holden Beach, we can usually point to five specific areas where vacuum technology is superior to gravity systems. Almost every time we see circumstances such as Holden Beach, we immediately think “vacuum” because of the following benefits:

Installation ease — In flat topography with high groundwater, vacuum sewers are much easier and faster to install than gravity sewers. Vacuum collection lines are often smaller than gravity lines. They are typically about 4, 6, 8, and 10 inches in diameter and made of SDR 21 or Schedule 40 PVC pipes. These small, lightweight pipes can be installed with small equipment. Because of the sawtooth profile, the lines can be buried in shallower trenches, typically 4 to 6 feet deep. This typically means less digging, less dewatering, and fewer

construction-related restoration issues.

Installation progress can be much faster, too. In Holden Beach, installation crews estimated that they were laying as much as 200 linear feet per day. A gravity sanitary sewer installation would have probably accomplished less than 100 feet per day because of localized conditions.

Perhaps even more important, the design called for only four vacuum stations to serve approximately 3,000 connections. A gravity system would have needed about 15 pumping stations. Considering the property values in Holden Beach, this was an important cost-saving factor. It was also a quality-of-life factor that was valued by the town.

Operations and maintenance — Vacuum systems are easy to maintain. Most vacuum system functions can be monitored at the vacuum stations. If there is ever a loss of vacuum pressure in the collection lines, the problem can be isolated quickly and repaired easily. Remember, the lines are typically only 4 to 6 feet deep, so excavation is not difficult. Vacuum lines require no cleaning because the velocity of the flow in the pipes scours the lines and helps prevent buildups and clogs. And, because vacuum sewers are closed systems (no infiltration or exfiltration), they are not required to have periodic video inspections as is common with gravity sewers.

Operations and maintenance personnel also appreciate the fact that they seldom, if ever, contact raw sewage.

In the case of Holden Beach, AIRVAC provided training and brought in field service technicians to answer questions and provide advice. The company also conducted plumber workshops, advising local plumbers on the correct way to connect a residence to the AIRVAC system.

Storm survivability — Similar to most communities along the Atlantic Coast, Holden Beach is subject to hurricanes and storm damage. When electrical power is lost or when there is a storm surge, a conventional gravity sanitary sewer is often knocked out of commission, leading to sanitary sewer overflows. A vacuum system, on the other hand, can be designed and operated to lessen the calamity of a tropical event.

In the case of Holden Beach, the four vacuum stations are built below grade in watertight vaults. Not only is this an aesthetic benefit (no vacuum stations to block the beautiful sea views), it also protects the system from storm surges. And because it is a closed system, stormwater and sand can't

Vacuum stations provide a clean, safe environment for system operation and monitoring.



PROJECT CASE STUDY ►



Lightweight, vacuum collection lines, typically 4 inches to 10 inches in diameter, can be buried in trenches only about 4 to 6 feet deep.



Frank Bland, AIRVAC regional manager (left), and Bart Sanders, AIRVAC field representative (right), explain how a vacuum valve pit works to Steve Wheeler, Holden Beach town manager (center).

infiltrate and clog the lines or overwhelm the treatment facility. With regard to electrical power, the individual valve pits that connect the homes to the system operate by pneumatic pressure — no electricity is required. Vacuum stations are kept operational by using portable generators.

Green issues — Some of the factors that led Holden Beach to examine a new wastewater collection system were the problems associated with septic tanks and failing drain fields. Regardless of the sewer technology selected, the town saw removing the onsite systems as a step toward a cleaner environment.

The new vacuum sewer system in Holden Beach supports the town's goal of environmental stewardship by providing a closed system that is much less prone to sanitary sewer overflows when compared with a conventional gravity sanitary system. In particular, elimination of infiltration and inflow makes vacuum sewer technology attractive to coastal communities.

Value of experience — Objectivity is essential in engineering. We look at every situation individually and make recommendations only after careful analysis and consultation. But experience is important, as well. Vacuum technology is proven effective for conditions such as those in Holden Beach. It saves time and money and provides an effective sewer-collection process that is easy to maintain and durable.

When the conditions are right, vacuum sewers are the logical choice for sewage conveyance. ■

Christopher S. Garrett, P.E., is a vice president at URS Corporation. He has been involved with many vacuum system designs in the Mid-Atlantic region since the 1990s.

www.airvac.com