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**Coastal Community Convinced  
About Vacuum Sewers**

# Coastal Community Convinced about Vacuum Sewers

The answer to a sewage treatment master plan.

By Steve Gibbs

**T**he relationship between cost and value is usually predictable. The quality of a product or service typically increases with the price. You get what you pay for, as the old saying goes.

Fripp Island, SC, recently had the experience of paying less, but getting more. The small, gated community just northeast of Hilton Head installed a

state-of-the-art vacuum sewer system and saved \$1.6 million. The new system is extremely efficient, requires little maintenance, and it has eliminated the threat of septic tanks contaminating shell fishing in the area. That's a real bargain for Fripp Island taxpayers.

"We had no experience with vacuum sewer technology when we went into this project, so we were very skeptical,"

said Ernie Wilson, manager of the Fripp Island Public Service District. "But we have been very pleased with the results now that the system is in service. I would recommend vacuum sewers to anyone with circumstances like ours."

## Save the Shell Fish

Only two years ago Fripp Island faced a significant environmental problem.



*Vacuum sewer technology is a cost-effective solution for communities with flat topography, sandy soil, and a high water table, like Fripp Island, SC.*

Many of the homes on the island were served by leaky, ineffective septic tanks that were allowing untreated sewage to pollute groundwater and local shell fishing areas. The community also had inherited an inadequate sewage treatment facility and conveyance system from a land developer. Poor soil conditions resulted in county and state officials prohibiting septic tanks on a number of properties. Growth was at a standstill and public safety was at risk.

Recognizing the need for a sewage treatment master plan, the Fripp Island Public Service District authorized the engineering firm of Hussy, Gay, Bell and DeYoung (HGBD, [www.hgbd.com](http://www.hgbd.com)) to study the problem and recommend solutions. The engineers came back with three alternatives: a gravity system, a pressure system using grinder pumps, and vacuum sewer technology.

Like many seaside communities, Fripp Island has flat topography, sandy soil, and a water table that is only a few feet below the surface. These circumstances can make gravity sewer installation expensive. This is especially true on Fripp Island, an exclusive gated community with high property values. The flat landscape meant that multiple lift stations would need to transport wastewater from neighborhoods to the treatment plant. Trenches for gravity flow collection lines must be deep to achieve the necessary "fall," and the high groundwater would likely mean dewatering, trench boxes, and other construction expenses.

"We quickly discovered that gravity sewers were going to be expensive," Wilson noted. "They also would create a lot of disruption to our roads and utilities because of all the deep trenches that would be needed."

According to the initial studies, a gravity sewer system on Fripp Island would cost at least \$5 million, and that price did not include the land needed to build the lift stations.

The expense of gravity sewers led the engineers to look closely at other alternatives. A grinder pump system would be less expensive, but still cost nearly \$4 million. The cost for vacuum sewers was \$3.4 million. The engineers did a 20-year life cycle analysis that took into

account not only capital costs, but annual operation and maintenance costs, as well. Their conclusion: the clear choice was vacuum sewer technology.

"Our research led us to recommend vacuum sewers because of the circumstances on the island," said Hoyt DeShazo, project representative for HGBD. "The big selling point for the client was the cost of installation and the fact that the system would require only one vacuum station, rather than multiple lift stations."

## Learning the Ropes

The first hurdle, according to Wilson, was learning how to install vacuum sewers. A field service team from AIRVAC, Inc. ([www.airvac.com](http://www.airvac.com)), the company chosen for the job, came to Fripp Island to provide on-the-scene advice and consultation. AIRVAC is a leader in vacuum sewer technology with more than 30 years of experience and more than 250

systems in operation in the U.S. alone.

The Fripp Island engineers learned that connecting homes and businesses to vacuum sewers is simple and no different than connecting to a gravity sewer. The individual lateral connections from the customer utilize gravity flow. The wastewater is collected in a "valve pit" that is buried near the street. The valve pit holds the wastewater until it reaches a predetermined level, usually about ten gal. A pneumatic vacuum valve then opens and the wastewater enters the collection line. No electricity is required for the valve to open.

In Fripp Island's case, a single vacuum station maintains vacuum pressure within all of the collection lines that will serve about 770 homes in the area. Wastewater in the line is propelled at high speeds, usually about 15 to 18 feet per second. This high velocity flow scours the line and keeps it free of debris and grease buildup.



*Vacuum sewers are typically buried in shallow trenches, so contractors can use smaller excavation equipment and there is less soil displacement, allowing streets to remain open.*



*AIRVAC components are lightweight yet extremely durable; workmen can install most of the components by hand.*

Because the collection lines in a vacuum system do not require gravity to transport the wastewater, but rather can be installed in a saw-tooth fashion, the lines can be buried at much shallower depths. This saves time, money, and inconvenience.

“There are a lot of installation advantages with vacuum sewers over gravity sewers,” explained Mike Donovan of Taylor Construction, the company that laid the vacuum lines in Fripp Island. “We used Schedule 40 PVC pipes in trenches that were usually about two and a half to six feet deep. That’s nothing compared to gravity lines, which would have required trenches 16 to 20 feet deep. My crew was myself and three other guys. We laid all the lines on Fripp Island.”

Donovan also noted the benefits of using smaller equipment. “We used a small John Deere excavator with rubber tracks and a bucket that was three feet wide. We were able to easily work around other utilities and there was very little traffic disruption. We laid the pipe in by hand and there were no manholes to install. The work was faster and safer than laying gravity sewer lines.”

## Zone Coverage

Fripp Island was divided into four zones with a main collection line for each zone. The collection lines are connected to a single central vacuum station, and from there to the treatment facility. Construction and installation of the vacuum station went smoothly, as the local engineers were assisted by field service personnel from AIRVAC.

“The AIRVAC team spent a week with us when we were installing the collection lines and another week when we put in the vacuum station,” explained



*Vacuum sewer stations provide a clean, odor-free working environment, and because vacuum sewers are a closed system, workmen never come in contact with raw sewage.*

Wilson. "It turned out to be very easy. We only have one vacuum station, so the system is very easy to monitor and to maintain. You check a few gauges every day and change the oil in the pumps regularly. That's about it."

Oceanfront communities like Fripp Island are subjected to hurricanes and fierce storms from time to time, so they sometimes lose electrical power. The Fripp Island vacuum station is equipped with a backup generator that will keep the sewer system operational even during power outages.

"We recently had a storm knock out the power so we had to use the back-up generator for about six hours," noted Wilson. "It's very valuable to the community to maintain sewer service during power outages. It's one less thing the

public utility's staff has to worry about."

## Completely Convinced

The installation of Fripp Island's vacuum sewer system created little disruption for the residents of the island. There was no loss of service during installation, no interference with emergency services, and little inconvenience to island residents. The system has been easy to maintain and Fripp Island Public Service District officials anticipate great performance for many years to come.

"We spoke with a public works supervisor in Florida who worked in a city with a much larger vacuum system than ours," said Wilson. "His experience with vacuum sewers convinced us that vacuum sewers would work for us. I think we made a good decision. Vacuum sew-

ers cost less to install and they are easy to maintain. We're very pleased with the system."

Fripp Island's vacuum sewer provides several important benefits to the community aside from just sewer conveyance. The new sewer protects the environment, for both the shell fishermen and those who enjoy recreational water sports. It also protects property values. Homeowners replaced ineffective septic tanks with a modern sewer system that is environmentally friendly, quiet, non-disruptive, and easy to maintain. From every standpoint, Fripp Island got excellent value for its sewer investment.

*Mr. Gibbs has written about public works and infrastructure for more than 20 years. His articles have appeared in dozens of national publications.*



## Quick and Easy Repairs

There are two common misconceptions about vacuum sewers: that a leak in a vacuum line will cause the entire system to fail, and that vacuum line repairs are difficult. Both are inaccurate.

A directional drilling device installing cable pierced through the side of a PVC vacuum line. The loss of vacuum alerted operators at the vacuum station that the line had been compromised.



Workmen accidentally hit a Fripp Island vacuum sewer collection line dead center when installing cable.

The location of the problem was quickly identified and a crew was dispatched to the site. First, they isolated the leak by shutting off nearby division valves that are located within the piping network, then they excavated the line. The excavation was easy because the line was buried only four feet



Repairing the damage was relatively simple, as the shallow depth of the line made access easy. A full-circle clamp was applied and the line was back in service in less than an hour.

deep.

"We uncovered the line and put a full-circle clamp on the pipe. We had it repaired and back in service in less than an hour," said Ernie Wilson of the Fripp Island Public Service Department. "I don't think homeowners were aware there was even a problem because there was never a loss of service."

The ability to quickly isolate a leak and easily access the vacuum collection lines makes most repair work simple and non-disruptive, another reason why public works directors appreciate vacuum sewer technology.