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Meeting The Flow of the Open Road

*Crazy D's truck stop has installed the
largest flood-dosed trench system ever
permitted in the state of Indiana.*

BY DENNIS F. HALLAHAN AND CHRISTOPHER LIMCACO



The Crazy D's Truck Stop is a 24-hour gas station in Plymouth, IN, complete with restaurant, bathroom, and shower facilities. Since its early days of operation, the stop has been plagued by septic system problems. In fact, it has gone through three onsite wastewater treatment systems, all of which have failed.

The initial system consisted of a field-constructed, 12,000-gallon, three-compartment, concrete septic tank and gravity absorption field. The second project added two 1,500-gallon dosing tanks and a new pressure-lateral absorption field, which failed almost immediately after installation. The third attempt included installation of a new, constructed wetland system and a new pressure-lateral field. Because of the high-strength restaurant waste and a lack of proper operation and maintenance, this last system failed within just two years of its installation.

In all three cases, the primary problem was that the systems were simply unable to handle the high-strength wastes at the facility, mainly from the restaurant, which produces high levels of fat, grease, and oils. In addition, the lack of an adequate operation and maintenance program expedited the inevitable failure of the previously installed constructed wetland and absorption fields.

“Plan D”

sidebar

After the three failures, Crazy D's had toyed with the idea of abandoning its existing onsite treatment system and becoming centralized. The thinking was to install new pumping facilities that would pump the wastewater to the city of Plymouth's wastewater collection system. However, because of the high costs associated with this option—combined with the fact that the city did not want the extra wastewater—replacing the existing failed system appeared to be the smarter choice.

Crazy D's site development engineer discovered Algaewheel Inc., of Indianapolis, creators of the BACPAC wastewater treatment system. A turnkey service company providing design, permitting, manufacturing, construction, and operation and maintenance of onsite decentralized wastewater systems, Algaewheel was contracted to handle the design, permitting, and installation at Crazy D's. Christopher Limcaco, president of Algaewheel, evaluated the design flow, environmental and waste strength issues, and needs at Crazy D's, as well as the past operations and maintenance issues in creating the new onsite system. The Indiana State Department of Health and the Marshall County Health Department assisted to ensure that any new system design would meet state and local requirements and obtain quick approval.

The previously installed disposal fields and other site constraints required Algaewheel to install the disposal field site in a remote location. Traditional pipe-and-trench, a pressure-dosed field, and chamber technology were all evaluated as options for the absorption field. The logistics and costs associated with transporting fill and installing a traditional pipe-and-trench field or a pressure-dosed field tipped the scale toward chambers in this case.

“Stone and pipe were not an option for this system, because they are too timely to install and costly to transport,” said Limcaco. “Transporting the gravel alone over the field would have caused excessive compaction and reduced the potential life of the field. The lighter weight of the chamber units eliminated the compaction concern.”

The BACPAC Lowdown

Although the BACPAC wastewater treatment system is relatively new to the wastewater market and was first released only last year, Algaewheel has actually been designing and testing the system since 1995. As of now there are three systems in use, two of these at commercial sites—one of them Crazy D's—and at one municipal wastewater site in Whitestown, IN.

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What's innovative about BACPAC is that although it utilizes bacteriological filtration like other systems, it also uses solar energy through photosynthesis. "It actually runs on about 50% solar energy," elaborates Limcaco. "Solar energy makes the algae, then the algae combined with the bacteria is what breaks down the waste. By utilizing algae, not only are we utilizing solar energy, but it makes the system more efficient because of the symbiotic relationship between algae and bacteria."

In addition, BACPAC is self-cleaning, making it much less likely to clog than most other systems. It's also pre-engineered and pre-manufactured, meaning it's not built on the customer's site. This saves a lot of time in terms of installation. It's also modularized, so it can be easily expanded.

A Design For Success

In addition to replacing Crazy D's existing wetland system with BACPAC, the old pressure-distribution absorption field was replaced with a new Quick4 absorption field. Manufactured by Infiltrator Systems Inc., of Old Saybrook, CT, the Quick4 Chambers added to the ease of installation. "We were able to install 100 feet of chambers in 15 minutes!" says Limcaco. "Speed of installation was critical to this project because the entire current system at Crazy D's had to be shut down during installation and the owner was forced to pump and haul until the new system was completed." To date, the new flood-dosed system at Crazy D's is the largest system of its kind permitted in the state of Indiana.



Even though extreme weather conditions made construction difficult, the project was completed quickly and within budget.

three existing 1,500-gallon grease traps that were left in place. The waste then mixes with wastewater from the restrooms and moves to an equalization tank where it can be stored during high flow and then pumped to a d-box. The existing 12,000-gallon septic tank was converted to an equalization tank for this part of the process, and the existing septic tank effluent pump station was converted to a raw sewage pump station. This was accomplished by replacing the existing pumps with new raw sewage pumps and redirecting the force main from the constructed wetland to seven new BACPAC treatment units.

The d-box distributes the flow equally to the seven units, where sewage is treated before entering seven new 2,000-gallon septic tanks. Each BACPAC sits on top of its own septic tank, and all components of the system run in parallel. These units include an aerated, rotating-media filter component designed to promote algal and bacterial growth and incorporate a heterogeneous bacterial mixed liquor for a more complete nutrient removal.

A Time To Settle

The effluent from the BACPAC tanks flows into the settling tanks. There, the algae enhance the settling of solids. Anaerobic digestion of the algae and bacteria in the settling tanks effectively converts the captured nitrogen into nitrogen gas and locks phosphorus into the inert sediments at the bottom of the tank. These nutrients are effectively captured at this phase of the system. While total suspended solids in the effluent from the settling tanks are generally low, an effluent filter assembly was added as a precaution to further protect the disposal fields.

Although the previous wastewater systems had been intended to handle fats, oils, and grease, the levels at Crazy D's were just too high for their designs. In other words, it wasn't the systems themselves that failed; they simply weren't a good match for the job at hand.

"Any kind of media filters are susceptible to clogging as soon as you get high solids, grease, and fat into them," begins Limcaco. "The pores of the media will clog. Our system is designed to handle those solids. It aerates the water and uses bacteria and algae to break down the waste. The BACPAC rotates itself through the water and also cleans itself off, so it doesn't get clogged like a recirculating media or others might."

The Path of Effluent

The system was designed for a peak daily flow of 7,000 gallons per day. The restaurant generates the majority of the flow. From the restaurant, the wastewater travels to



Quick4 chambers were delivered to Crazy D's remote location in a pickup truck and installed in 100-foot rows.



From here the effluent enters a dosing tank, which feeds four separate disposal fields containing 2,000 Quick4 Standard Chambers. The Quick4 chambers selected for Crazy D's represent a dramatic evolution in the advancement of dispersal-field technology. Their 4-foot individual lengths and MultiPort End Caps allow for optimal design solutions, while their unique contouring capability offers maximum installation flexibility. They are also lightweight, which makes them easy to deliver and install in remote locations.

The soil types throughout the absorption field site varied considerably. The most restrictive soil type required that a 0.3 loading rate be used for sizing the absorption field.

The four separate disposal fields were laid out based on regulatory design criteria. Each field consists of four separate banks of five laterals, with each lateral being 100 feet long.

Four main pressure lines from the existing dosing tank dispense the treated effluent to the new fields via four primary concrete d-boxes. Each of the four primary d-boxes then distributes flow to four secondary d-boxes, which in turn distribute flow to the laterals in each field. A total of twenty concrete d-boxes were used on this project. The system is designed to dose each field once per day.

"This was the most cost-effective and easy-to-install absorption treatment system I've ever designed," said Limcaco. "Based on this experience, I plan to use Infiltrator chambers more often from now on."

Overcoming the Weather

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"The system we designed was not only the right choice because of the effectiveness of each of the technologies incorporated, but it could also be installed quickly," adds Limcaco. Installation for this project, however, did prove to be unusually difficult. Not because of the system itself, though. "We had a number of issues, not the least of which was the extreme cold weather," says Limcaco. "We received state approval in late November of 2005, then we had one of the coldest Decembers on record. ... If it weren't for the weather, we probably could've installed the system in two weeks." Instead, it took a month. "But if we had to use any other type of technology, something that was not pre-manufactured, we would've had to shut the project down and wait until it warmed up before we could restart the installation."

Maintaining the Success

In addition to completing the system design and installation, AlgaeWheel is also operating and managing the BACPAC system.

This was a real plus for Ken Ford, who owns Crazy D's, and for local health department officials who had to shut down the previous systems because of lack of maintenance.

Ford was pleased with the timely installation, as well as the fact that the new BACPAC system takes up less than a quarter of the area previously required by the constructed wetland system.

Even though extreme weather conditions made construction difficult, the project was completed relatively quickly and within budget.

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**RETURN TO
TABLE OF
CONTENTS**

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