This sewage treatment facility is designed to look like just another office building, thus blending seamlessly into the surrounding neighborhood.

The Invisible Sewage Plant

Some of the best processes are the ones that go unnoticed. For example, if you go looking for a particular sewage treatment plant in Cincinnati, Ohio, the first thing you'll notice is…you might not notice it at all. In fact, you might drive right by the facility, dismissing it as just another office building. It just does not look like a treatment plant.

That was one of the design goals for this pilot project recently built in a western suburb of Cincinnati. Officially known as the Muddy Creek-Westbourne High Rate Treatment Facility, it was placed into operation in June of 2001 by the Metropolitan Sewer District of Greater Cincinnati (MSD). An unmanned satellite plant, it is set-up to automatically handle high volume, wet weather sewage flow. Developed with the consulting firm of BBS Corporation of Columbus, Ohio, it was designed to blend seamlessly into the surrounding neighborhood.

"That was the intention," said Don Cuthbert, vice president of BBS. "You don't see it, you don't smell it and it just sits there, quietly cleaning up the creek. In designing it, the main concerns were public health and water quality. But from a community perspective, I think they're more interested in aesthetics, odors and overall appearance."

Happily, in this situation, both sets of objectives were met.

Alleviating a CSO

Like many cities, Cincinnati is attempting to find the best ways to meet state and federal requirements concerning Combined Sewer Overflows (CSOs). CSOs occur in older sewer systems, where sanitary and storm sewers often are combined. In such systems, the flow resulting from heavy rainfalls often exceeds the capacity of sewage treatment plants. Usually, the excess is diverted as an overflow to the nearest creek or river.

Efforts to reduce or eliminate CSOs generally focus on three solutions. The most expensive solution is to separate the sewer flows. Typically this is done by building a new sanitary sewer and using the existing combined sewer as a storm sewer. A second and more limited course of action is to increase the ability of the treatment plants to receive high rate flows.

A third solution is to develop storage capacity within the system, so as to equalize the flow to the treatment facility. This can be done with in-pipe storage. Some cities have built large tunnels to capture and hold sewage for later treatment. Others have used vortex regulators to restrict and back up the flow in existing sewers.

An alternative method to in-pipe storage is to divert high rate flows to satellite tanks that fill and then empty into interceptor lines running to the main treatment plant. This is the method used by MSD at their pilot project.

One of the advantages of building satellite tanks is the latitude afforded in site selection. Since the facility was the first of a possible ten to thirty plants the MSD may build, not only could they choose where to locate near a particular CSO, but they also had several CSOs to select from.

Marty Umberg, MSD's chief engineer said the selection was guided by a desire to make an impact on an urban stream. "We were looking at implementing facilities of this sort first in suburban type areas; where we can make impacts and real improvements to the streams."

The site selected for this first facility was at the origin of the Muddy Creek, which winds its way to the Ohio River. In dry weather, the Muddy Creek barely exists.

At this location, a trunk sewer passes by, carrying the combined storm and sanitary flow from a suburban drainage basin of roughly 2,000 acres. Before the pilot plant went into operation, whenever it rained, the stormwater would pour into the trunk line until the interceptor was full, and then the combined flow would divert into the Muddy Creek. The creek then would receive all the debris swept into the storm sewers, not to mention the contents of the sanitary flow.

"I think people in the neighborhood welcomed the new facility because a lot of odors used to come out of that area, especially in the summer," Umberg said. "But it's not like there's been strong emotions expressed about it. It hasn't been in operation for a full year yet, and we have not had a lot of comment on it, either way."

Quite possibly, no comment is good comment. Few people phone in their approval of a lack of odors.

Diversion and Detention

Built on a property of an acre and a half at a construction cost of a little more than five million dollars, the satellite plant separates the flow from the trunk line at a diversion chamber and runs it through a coarse screen and over a grit pit.

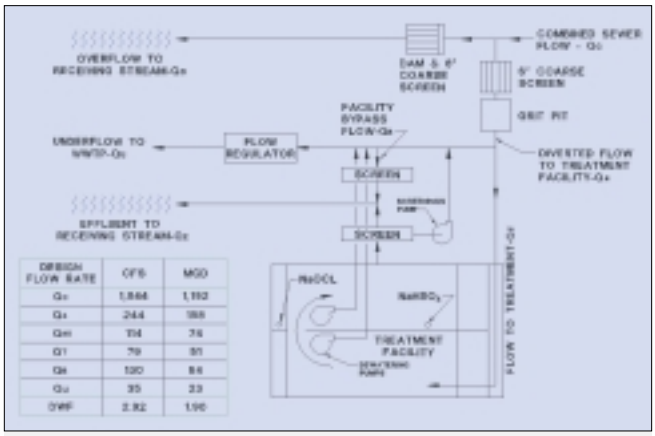
The flow then is channeled to a regulator that in dry weather allows it to move

Up to four inches of sludge and trash may be left after the detention tank is drained. Chopper pumps must chew through this debris before it can be disposed.

downstream to a wastewater treatment plant. However, in a rainfall event, as the flow rate increases, the regulator diverts the flow to a detention tank. The tank, which is below ground, is approximately 200′ long by 90′ wide. The bottom of the tank slopes from a depth of 19′ down to 26′, allowing it to hold a maximum of 1.7 million gallons.

After the high-rate flow subsides, sensors trigger the pumping of sewage out of the tank to the underflow line and then to the main treatment plant. As the detention tank empties out, sensors open up, in sequence, a series of six five-foot high flush basins that clean out all the sludge and debris that accumulates along the tank's bottom. At that stage, the system is ready for the next rainfall event.

For most of the events exceeding the tank's capacity, it still serves to settle out the solids. The treated flow is chlorinated and dechlorinated and then overflowed through fine screens and sent off to Muddy Creek.



Muddy Creek and Westbourne CSO No. 198 facility flow schematic.

During a prolonged heavy event, the regulator will permit the flow to bypass the tank, sending it through fine screening and then to the creek. Finally, in the heaviest of all events, the initial diversion chamber will overflow directly to the creek with the flow receiving only coarse screening.

"The facility can treat about 79 cubic feet per second, maximum rate," Cuthbert said. "Most of the events it'll see in a year have fairly low rates. There won't be many hours in excess of what we can treat through the facility."

Before the facility was put on line, there typically were 130 rainfall events with nearly 600 hours of rainfall. Overflows would occur nearly 50 times per year for about 260 hours in an average year.

"With this facility on-line, we're now in a treatment mode for about 200 hours per year and in a bypass mode through a secondary screen for about 16 events, about 100 hours per year. The point is, we're trying to intercept and treat at least 85 percent of the annual wet weather flow. That's the goal we're shooting for, and I think it'll turn out to be quite a bit more than that."

Chop and Pump

Because of all the debris entering the detention tank, the job of emptying the tank relies on a sturdy pair of chopper pumps, purchased from the Vaughan Company.

When the detention tank empties out after a normal event, up to four inches of sludge may be built up on the bottom. "Mixed in with the sludge are papers, leaves, beer cans, plastic bottles…a lot of junk, and it all has to go through the chopper pumps," said Lou LaCortiglia, MSD's project manager for the plant.

While two 25 hp pumps (800 gpm) are used to empty the tank, a smaller 15 hp pump (300 gpm) is used to chew through the debris raked from the fine screens and sent to the screenings sump. "That might be the bigger challenge for a pump," LaCortiglia said. "It's unbelievable how many cigarette butts can end up in there."

From the passing road, the unmanned facility stands as a trim little building in something of a Cape Cod design. The above ground structure is about half the length of the underground tank and houses the plant's control room, chemical operations and fan rooms. The facility runs on automatic and is monitored from the main treatment plant miles away. The fan rooms act to circulate air from the underground operations and to send it through filters of activated carbon. As a result, the facility is practically odorless.

About the Author:
Carl Dorsch is a mechanical design engineer, now doing freelance technical writing. He lives in Cincinnati and graduated with a BSME from the University of Toledo.