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# An Underground Solution in Wallace Township, PA

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In May 2005, the Pennsylvania Turnpike Commission sought a way to control and treat stormwater runoff along the highway as it ran through Wallace Township in southeastern Pennsylvania. Particularly affected was the Peter J. Camiel Service Plaza, an area bustling with traffic and bordering a green natural area. The commission hired Terre Hill Concrete Products (THCP) to create an affordable, environmentally friendly solution.



The Camiel Plaza included two open detention basins in the middle of a parking lot. "When trucks turned around the open basins, the turn radius was too tight for them. Their wheels hit the bollards and slipped into the detention basin," says Dale Groff, the site's project manager at Terre Hill Concrete Products based in Terre Hill, PA. "At the same time, the township adjacent to the property was observing that they were getting pollutants carried to the watershed."

The original design had called for two separate subsurface detention areas followed by an oil grit separator. The project was specified in a maintenance and repair contract. Terre Hill Concrete Products made a value engineering change proposal.

"The most difficult part of the installation was placing the oil grit separator in front of the detention area and creating total volume in a single detention area design," says Groff. "We had to match the volume of the water they wanted to contain underground. They had the 4-foot pipe and 5-foot pipe in two different places. The other issue became maintaining the same hydraulic flow. With the

help of Rettew Engineering, we constructed an exact match to meet that criteria to what was originally designed."

The original design included an area where plastic pipes would be located underneath a parking area for extremely heavy trucks, something the Turnpike Commission sought to avoid.

"The aboveground system had bollards to protect the edges of the existing open detention basins," says Pam Hatalowich, engineering project manager with the Pennsylvania Turnpike Commission. "These were in the tractor-trailer parking spaces, and the trucks kept hitting them. It was more of a maintenance issue."

Additionally, in the original plan, large amounts of soil would have had to be excavated from two storage locations and hauled away, because there was no room to store it onsite, according to Groff.

"They would have had to bring stone in to place back in that excavation," he notes. "By using a precast concrete Terre Box, we had only one location that they worked with instead. We were able

to combine the storage at one location, and that storage volume equaled the pipe design at the two locations.

“They did not have to stockpile stone,” he adds. “They could truck that in and dump that on top of the culvert immediately; that expedited the process.”

Because the revamped design included only one site, a reduced amount of stone was needed as well.

Groff recommended the Terre-Kleen oil/grit separator should be placed upstream from the detention basin for two reasons: first to treat the runoff prior to entering the Terre Box, and second to make the process easier when trucks arrived to clean out the system. Installation time was also a concern, says Hatalowich, and was a reason THCP’s system was chosen.

Selecting the Terre-Kleen system reduced the five weeks estimated for project installation to one and a half days, with one additional day for final adjustments to the project. At \$191 per square foot of sedimentation area, the Terre-Kleen 18 system proved a cost-effective solution for the site as well.

One of the project’s challenges was that the plaza would have to remain active during the construction process. “We were restricted as to how much of the plaza we could take up,” explains Groff.

“We were able to manufacture and stockpile all the precast [components] offsite. The precast was designed to HS-25 loading. When it receives that amount of weight, it remains stable. Because of that, they were able to use the space directly above the system for parking.” Seven new truck parking spaces were created as a result.

In half-hour increments, pieces of the Terre Box system, a precast, enclosed concrete system used for stormwater detention and retention-recharge, were removed from the truck by crane and placed within the excavation hole. The pieces have an interior size of 5 feet by 20 feet. Joints received joint sealers. Post-tensioning took place to close the joints, and the ducts were grouted to create a state-of-the-art sealed culvert. Both Terre-Kleen and Terre Box are accessible via manhole, reducing the need for confined-space entry. Next, the Terre-Kleen Water Quality Treatment device, an inclined plate hydrodynamic separator used to capture pollutants from stormwater runoff, was lifted from the truck and placed in front of the Terre Box, connected with a pipe. Backfill was placed around the installed systems.

Stormwater from existing inlets flows into a primary chamber of the Terre-Kleen, where the floatables, trash, oil, grease, and heavier sediment are removed. These pollutants are captured not just during first flush but also throughout an entire storm event. The nominal design removes 100-micron and larger particles during the 3.8-cubic-foot-per-second design storm. The gravity settler can remove 20-micron particles and greater during lower-flow events. A Terre Microbes bag in the primary chamber contains organisms that convert hydrocarbons in the runoff into carbon dioxide and water. The microbes remain in the protective bag and are inspected for functionality during routine maintenance.

The water in the Terre-Kleen rises as it flows into a chamber with a baffle-protected series of stacked inclined plates. According to Gene LaManna of THCP, the inclined plate hydrodynamic separator has been shown in third-party verified testing to remove 83% of total suspended solids. Floatables, including remaining trash, oil, and grease that rise with the water, are removed in addition to the sediment and the metals attached to it. The inclined plates don’t allow captured pollutants to reenter the treated stormwater. The treated stormwater leaves the Terre-Kleen system to enter the Terre Box and reaches the watershed through a controlled discharge orifice.

Vacuum trucks are used to remove the captured pollutants in the Terre-Kleen TK18 oil/grit separator’s two chambers. At this site, routine maintenance will be required once every 18 months. TCHP and the Turnpike Commission continue to monitor the site closely.

“The goal of the Terre-Kleen system is to remove the oils, the litter, and the sediment—and that’s exactly what it’s doing. The Terre Box is to be used to store the water and slowly discharge it,” says Groff. “There is a 15-inch pipe connected to the sump area; connected to that pipe is a 9-and-a-half-inch orifice.”

The treated water then leaves the system and enters the watershed, where vegetation has thrived significantly since the system’s installation. A side benefit is that on hot days, the water cools as it passes through the concrete system before



reaching the watershed. Water temperature is defined as a stormwater pollutant because of its adverse effect on aquatic habitat.

"It acts as a buffer to lower the temperature of the water," says Groff. "The concrete structure is in the 54-degree-Fahrenheit environment."

The Terre-Kleen system is currently undergoing verification testing at another site and the results are being presented in a paper at WEFTEC 2006.

"I was contracted by Terre Hill Concrete Products to perform two verification testing activities on the Terre-Kleen," says Dr. Shirley Clark, P.E., an assistant professor of environmental engineering at Penn State. Although unable to discuss the results of her report until reviews are completed, she explains, "One involved the testing in the field of a full-scale device at the Harrisburg Public Works Yard. The device, the TK09, was tested as part of the USEPA Environmental Technology Verification program, with my contract actually being through NSF International, the EPA-selected verification agency. That report is just being completed and should be released to the public within a few weeks after it has cleared the final EPA reviews. The second verification activity was the interim laboratory evaluation of a full-scale device using the New Jersey DEP [Department of Environmental Protection] interim certification standards. That project is ongoing and is scheduled to be completed by the end of February 2007."

The Pennsylvania Environmental Council has awarded THCP a BMP Recognition award for the stormwater BMP retrofit at the Peter J. Camiel Service Plaza.

At the Camiel Plaza, the new system's installation placed protective measures for the environment and improved the discharge, explains Hatalowich, noting the Turnpike Commission sought to limit the possibility any pollution could enter the adjacent marsh. Vegetation at the site has thrived, providing a lush, healthy environment motorists can enjoy as they pass through the scenic Pennsylvania landscape moving from the Philadelphia suburbs toward the Lancaster County countryside.

Topics: [BMP Manufactured](#), [Project design](#)

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