



TOUGH TERRAIN TACKLED BY HDPE STORM WATER QUALITY CONTROL UNIT

PUTNAM, Conn - EPA Phase II regulations have made storm water treatment a chief priority for construction projects. Getting terrain to cooperate in order to comply with environmental protection requirements, however, is not always easy. For a recent storm water management installation at a Tractor Supply retail center here, the designer of the system, CPH Engineers (Vernon, CT), found the solution to be a 40-foot long water quality unit made from corrugated high-density polyethylene (HDPE) pipe.



A section of the 40-foot long, 36-inch diameter Counter Flow Technology storm water control unit is easily put into place due to its construction from long-life, durable corrugated HDPE pipe.

The New England-area site presented some challenges such as steep grades, a high water table along with a contiguous stream and wetland area at the rear of the lot. These elements constricted land use and restricted excavation work to a very limited area. Once CPH completed the storm sewer design, the only area available to place the water quality

unit was along the highest contour adjacent to a steep backfilled slope. The storm water quality system was designed for the retail center with some 126 parking spaces in a lot covering more than seven acres with some 32,000 square feet of retail space that is anchored by a 19,000 square foot Tractor Supply store.

"In this northeast area of Connecticut we have to design around hills, slopes and rocky terrain," explained Alan Carpenter, P. E. of CPH Engineers and the company's lead engineer for the New England area. "More and more of the water quality issues relating to discharge are becoming increasingly sensitive as the Connecticut Department of Environmental Protection (DEP) and local wetland commissions try to clean up water resources.

"Controlling the amount and the quality of runoff coming off the site, and maintaining that discharge as cleanly as possible is very important. We want to do our part environmentally to make sure we're not making the downstream conditions worse both from water quantity and quality measures.

"In Connecticut, the EPA has recommendations on how to design water quality systems to attain an 80 percent total suspended solid removal and that's the goal," he continued. "Normally, the sites we design are well in excess of that...probably closer to 95 to 100 percent removal before any discharge."

"With EPA's Phase II requirements in effect, engineers such as Al Carpenter are eager for creative, reliable and cost-effective solutions to provide storm water treatment in compliance with the new regulations," stated Tony



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Radoszewski, executive director of the Plastics Pipe Institute (PPI), a non-profit advocacy group for the industry. “Able to handle a large volume of water and debris, a water quality unit made from HDPE provides an economical solution that is also light in weight for ease of handling, which is especially important in difficult terrain, and it can last for upwards of 75 to 100 years.”

Called a Counter Flow Technology (CFT) Water Quality Unit from Lane Enterprises (Camp Hill, PA), a PPI member company, it is 36 inches in diameter and is fed by two manhole risers. Capacity is some 3,000 gallons. Custom built by Lane following the requirements from CPH Engineers, the 40-foot long unit is made from corrugated HDPE pipe with sections inside to take storm water runoff in and, in a controlled manner, release it. It also has chambers to contain solids, sediment and floatable debris, which are cleaned out.



The CFT unit is designed to handle the water flow expected to be treated for the first flush of water. “All we had to do was provide the water flow information to Lane and they designed the system necessary to handle that flow and fit the terrain,” Carpenter stated.

“From what I understand of the concrete products, they’re not designed to handle a specific volume of flow. You just order an off-the-shelf tank size, connect the pipe and whatever you get you get.” Carpenter continued. “But the HDPE products are engineered for a calculated flow and to handle the expected solids and floatables that will be contained in the system. That is a major design benefit.

“The HDPE unit provided the level of treatment to help us get to the removal level recommended by the DEP,” he explained. “You get a certain level in the catch basin. Then you get another level by using the water quality unit. And you get another level in the detention area. It all adds up to the level of removal that is your goal. And when you’re presenting these aspects to a wetlands commission, the more you can exceed the goal, the better off you’ll be.

“Most designers understand that this is their goal - to make sure they’re using the design elements that either DEP recommends or engineers come up with to obtain that goal. Again the better cost effectiveness of the materials and products, the more measures you can put in, and the better the water quality will be that is exiting the site.”

Carpenter also said that clients realize that more elements of a "treatment train" are required because of the increasing need for



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improved water quality. “There is a cost/benefit analysis that you go through with clients,” he explained. “They understand they have to pay to incorporate these elements and we try to control those costs as much as possible. Most environmentally responsible corporate retailers, such as Tractor Supply Company, realize the short and long-term benefits of water control system plus other initiatives, and they are willing to incur reasonable cost in their pollution prevention measures to protect the environment.”

He further explained the inner workings of the unit. “It has baffles that retain the floatables inside the unit. And a chamber that allows solids to be trapped that are carried in the storm water. The unit handles the first flush of water of the site, which generally carries most of the pollutants.”

“Just think about a parking lot that has been sitting in a dry condition for a certain amount of time,” he said. “Here in New England, snow removal and maintenance of a parking lot occurs quite a lot in the winter and spring months, so there’s a buildup of solids and hydrocarbons which get carried into the catch basins on the site. If it is not collected it would be carried into the water body as opposed to being treated primarily at the site. The unit traps materials that travel in the storm water runoff at the site. A certain amount goes into that first flush, which contains primarily most of the solids, hydrocarbons, floatables, trash and all. Because the CFT unit maintains a certain water level, the floatables and hydrocarbons stay on the surface and are kept inside by a baffle for later cleanout.”

One manhole is located in the solid section and the other in the floatable section so each

area can be easily cleaned out. CPH is recommending two clean outs a year, one in late spring, the other before the start of winter.

Product Versatility

Using corrugated HDPE pipe to make the CFT permitted the unit to be located on top and parallel to an unaccommodating slope, while providing additional benefits: a shallower trench capable of providing minimum cover; the ability to have equipment and personnel working on level surfaces throughout the installation; and an installation location directly beneath a level parking lot surface versus a steep slope, maintaining the accessibility needed for future inspection and maintenance.

Water quality units such as the CFT can be incorporated in a wide variety of storm sewer alignments. It is capable of being installed on either side of the alignment, whether parallel, perpendicular or at 90° storm sewer bends. Since storm sewer alignments are determined before considerations for a water quality unit, this feature is essential to prevent unnecessary site plan modifications or additional pipe.

“Versatility in designing a system for storm water quality control is important today because it provides for cost savings while meeting environmental requirements,” stated PPI’s Radoszewski.

“National environmental legislation often requires that municipalities establish regulations limiting the quantity of storm water being discharged from newly developed or redeveloped sites. Where land costs are high or discharge limits have been established, underground detention systems and water quality management units are the most cost-effective solution because the ground surface



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over these systems can be used for parking or as a "green-zone" as is the case here in Connecticut.

"Storm water quality units provide a means for controlling the quality of discharge from a newly developed site," he continued. "The purpose of these structures is to make certain the discharge from a site complies with national regulations concerning the concentrations of pollutants in storm water. These structures are typically constructed in conjunction with storm water management systems. The ease with which products made from HDPE pipe can be fabricated, makes it ideal for both types of systems."

For additional information and technical literature, go to: www.plasticpipe.org.

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Here are some tips for designing a system using corrugated HDPE pipe and products:

- **Custom design and layout** – Storm water quality units are specifically designed based on the storage needs, parcel dimensions, environmental regulations (e.g. maintaining a certain distance above groundwater), and other restrictions. As such, they can be complex and time consuming to design. However, HDPE corrugated pipe producers greatly simplify the process by providing components, such as headers and fittings, made specifically for retention/detention systems. Some producers have staff available to lay out a system in a parcel based on the

engineer's criteria; this assistance greatly simplifies product selection.

- **Streamlined installation** - Because components of a system – the water quality unit and the corrugated HDPE pipe that conveys the water – are specially made for this purpose, they fit together much like a puzzle. Few if any field modifications are required. The lightweight feature of the pipe and components help speed handling and placement. Quality joints that are easy-to-assemble help make installation a less time-consuming process. Contractors spend their time completing the system, not making field modifications to the product.
- **Resistant to aggressive environments** - Runoff may stay in the system for extended periods. If the runoff contains harsh chemicals, the pipe material must be able to tolerate them. Abrasion and rust resistant, HDPE is ideal for such applications, but many chemicals even in dilute concentrations shorten the life of concrete or metal systems.
- **Suitable in minimum cover situations** - Most systems are installed as shallow as possible to limit excavation costs and maintain clearance between the system and the groundwater. Properly installed corrugated HDPE pipe can withstand AASHTO HS-25 loads with at least one foot (0.3m) of cover for pipe 48-inch



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(1200 mm) and smaller, or two feet (0.6 m) of cover for larger pipe diameters. This allows for driveways, access roads, parking lots, and similar structures to be built above the system.

- **Simplified inspection and maintenance** - Grit and debris often enter a storm water control system and can gradually impact its effectiveness by taking up storage volume or sealing off perforations. The system may need to be flushed and the debris pumped out. The smooth interior of corrugated HDPE pipe makes it easier to get a cleaner system. Access ports can be designed into HDPE pipe at regular intervals so that inspection can be easily conducted. These ports can also serve as entry ports for pumping and flushing equipment.
- **Cost-effective installations** – Corrugated HDPE pipe and components that are specifically engineered for a system allow for low installed cost and long life resulting in cost-effective installation.
- **Environmental stewardship** – Not only is the weight of the pipe an issue for the on-site crew, it is also a critical consideration in the cost of fuel needed to deliver product. Five times the amount of HDPE pipe can be shipped at about one-eighth the weight of fewer reinforced concrete pipe (RCP) sections. This makes for safer roads and less fuel used. Another part of

plastic pipe's favorable carbon footprint is its energy-needed-to-manufacture requirement. For example, the heat needed just to melt iron is 2795°F, while HDPE melts at 275°F -- a 90 percent savings in energy.



About PPI

The Plastics Pipe Institute Inc. (PPI) is the major trade association representing all segments of the plastic pipe industry and is dedicated to promoting plastics as the material of choice for pipe applications. PPI is the premier technical, engineering and industry knowledge resource publishing data for use in development and design of plastic pipe systems. Additionally, PPI collaborates with industry organizations that set standards for manufacturing practices and installation methods.