

## Villanova Pervious Concrete Site

Villanova University's Stormwater Research and Demonstration Park is home to a Best Management Practice-Pervious Concrete Site. The site, formerly a standard asphalt paved area, is located between two dormitories. The area was reconstructed in the summer of 2002 and



outfitted with three infiltration beds overlain with pervious concrete. The site originally had a conventional storm sewer system which channeled runoff directly to the headwaters of Mill Creek, a high-priority stream on Pennsylvania's Clean Water Act (303d) List. Usage of the site consists primarily of pedestrian traffic with some light automobile traffic. The site also serves as a stormwater research facility.

Pervious concrete has functionality and workability similar to that of regular concrete. However, the pervious concrete mix lacks the sand and other fine particles found in regular concrete. This creates a significant amount of void space which allows water to flow relatively unobstructed through the concrete. Additives are often used to increase the strength of the concrete.



The site is designed to capture and infiltrate storms of up to two inches of rainfall. From these events there is virtually no runoff from the site. Before the retrofit this rainwater would have runoff to the nearby first-order streams contributing to flooding problems which cause excessive stream bank erosion and sedimentation. Instead the rainwater now recharges the local groundwater and helps maintain baseflow in the same first-order streams. This recharge is especially crucial since Villanova University is located in the extreme headwaters of the watershed.

The pervious concrete itself only drains the grass areas and some impervious areas of the entire 1.3 acre drainage area. The roof drains from the adjacent dormitories and some impervious areas are piped directly to the infiltration beds. The three infiltration beds are arranged in a cascade formation. The beds are approximately three feet deep and filled with AASHTO #2 stones which create approximately 40% void space in the beds. Here the rainwater is temporarily stored while it infiltrates back into the undisturbed soil below the beds. In extreme events when the capacity of the storage beds is exceeded, flows are permitted to exit the site and flow out the original storm sewer system.



The Pervious Concrete site is part of the Villanova University Stormwater BMP Park. It has been fully equipped with monitoring instrumentation. The site is instrumented to record rainfall using a standard tipping bucket rain gage. Movement of the rainwater through the undisturbed soil is measured using a series of twelve Water Content Reflectometers placed at various depths. A key component to measuring the effectiveness of the site is monitoring the amount of water leaving the site. For this task a V-notch weir was machined and installed. The weir, in conjunction with a pressure transducer provides accurate outflow measurements for the site.

Another component of the research is water quality. Groundwater samplers called lysimeters have been installed both beneath and alongside the infiltration beds. These samplers allow the infiltrated rainwater to be extracted from the soil and taken to the lab for chemical analysis. The usage characteristics of the site do not present any major concerns for potential water quality concerns. The site is being monitored for various metals, nutrients and conventional water quality parameters such as pH and conductivity.

Pervious concrete in this region is still a relatively new technology. It is hoped that the research and knowledge gained from this project will encourage the use of similar systems in the future. Funding for the project was provided by the Pennsylvania DEP 319 program.