

WATER UNDERGROUND

A retail supercenter solves its runoff problem

By Muhammad Khan and Stefanie Geiss

The city of Santa Fe, N.M., recently added a Walmart Supercenter to the new Entrada Contenta subdivision. The mixed-used development consists of residential and commercial land uses. SMC Consulting Engineers P.C. was retained by Walmart to engineer approximately 17 acres of the watershed planned for the Supercenter, including the building, parking areas, driveways and landscaping.

Initially, the site was undeveloped and covered with native grass and scattered trees. The development increased

the impervious area of the site, requiring the engineers to design a storm water management system to mitigate the impact of the increased runoff volume and the higher rate of flow. The limited area available for the Walmart development did not allow for an above-ground storm water management system; therefore, the engineers needed an underground solution.

Aside from the space constraints, Santa Fe county also experiences severe drought conditions, which make water resources scarce in this climate. The average annual evapotranspiration rate

is approximately 47 in. and the average annual rainfall is less than 14 in. With conservation in mind, the decision was made to collect the storm water runoff from the store's roof catchment area for irrigation purposes. Using the harvested storm water for irrigation will reduce the use of potable water, especially in times when outdoor irrigation is limited due to water rationing restrictions imposed by the city. Furthermore, native desert plants were selected for site landscaping to further reduce irrigation demands.

Several factors were considered in the selection process for the underground



A rainwater harvesting system was installed to collect runoff from the store's roof.



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A construction crew excavated a 12-ft-deep area below the planned parking lot and set the 10-ft detention system on a compacted aggregate base.

storm water storage systems. Durability, long-term performance and ease of access for inspection and maintenance were important factors. Additional consideration was given to the speed and ease of installation, as well as the systems' accommodation of the existing subgrade conditions. Lastly, the overall footprint and a cost-benefit analysis were considered for each of the underground systems.

Choosing a System

After the detailed review of various underground storage systems, a modular precast concrete DoubleTrap system, manufactured by StormTrap LLC, was chosen for the site. The company provided one DoubleTrap system for storm water detention and a second system for rainwater harvesting. Together, they protect the downstream drainage system from increased flow rate and higher volume of storm water runoff from the Walmart site, and also provide a viable option for water reuse or irrigation.

A construction crew excavated a 12-ft-deep area below the planned parking lot and set the 10-ft detention system on a compacted aggregate base. To ensure that the system was watertight, an impermeable liner and geotextile fabric were wrapped around it. The detention system is designed to store more than 50,000 cu ft of storm water runoff. The runoff from the parking areas flows through the onsite storm sewer conveyance system and is treated by storm water quality devices prior to entering the detention system.

The stage-storage sizing of the underground detention system was designed for the SCS Type II, 24-hour storm interval for various storm events. Unit hydrographs and computed flood hydrographs for the existing and proposed conditions were developed using the Natural Resources Conservation Service hydrograph method. The outlet structure of the detention system was sized to regulate the release to the downstream storm water conveyance system at levels lower than historical flow rates.

Testing, Testing

An extensive weather modeling study was performed to calculate the appropriate size of the rainwater

harvesting system. The results of the study and the overall irrigation requirements were modeled using a computer simulation to find out how much landscape irrigation water would be needed during the projected growing season. These metrics then were compared with projected rain and snowfall events. After a detailed analysis of the supply and demand volumes, the system was found to be an economically viable solution for rainwater harvesting.

SMC Engineers performed testing on the rainwater harvesting system prior to commissioning it. A sequence of operations was developed to simulate various phases of the harvesting system and evaluate its response mechanism to different scenarios. Similar testing was done for the storm water detention system. Both systems functioned per intended design and were commissioned once they met the set operational benchmarks.

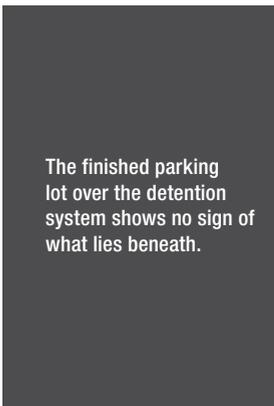
The rainwater harvesting system is composed of 50 10-ft DoubleTrap pieces and holds more than 15,000 cu ft of storm water runoff collected from the roof catchment area. The stored water is later utilized for irrigation of the landscaped areas of the site.

The storm water management systems allowed the project engineers to maximize the storage volume and minimize the project footprint to allow room for additional parking and reduce the overall cost. SMC Consulting Engineers found that both systems were easy to install and that the clear open configuration of the system allows walk-through access for future inspection and maintenance.

The Walmart Supercenter was completed in October 2011. SWS

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The finished parking lot over the detention system shows no sign of what lies beneath.



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