Water Efficiency, Storm Water Management and Restorative and Indigenous Landscaping

The efficient use of water and the best management practices for storm water management are mission-sensitive to the department. That mission is embodied in the function and design of the Lewis and Clark State Office Building and has succeeded in providing a source of water and eliminating erosion. There are several credits within LEED™ certification that intersect these criteria, but none more so than the "efficient use and conservation of water," "protection of landforms from erosion" and "the use of landscaping techniques to restore the site, conserve water usage, create habitat and control storm water discharge."

The efficient use of water within the building is established by use of a gray water cistern, used to flush toilets only, and the low-flow restroom water closet equipment that was specified. Erosion is controlled by use of a system of level spreaders, bioswales and detention basins that surround the building to control storm water runoff. Restoration of the site was a two-fold process. Indigenous grasses, plants and shrubs were used as a restorative measure to eliminate erosion of exposed and highly erodible soil. The use of indigenous plantings was also required in order to create sustainable habitats and eliminate the future need for watering vegetation.

Land Disturbance Permit

The extensive use of silt fences helped mitigate excessive sediment runoff during the construction of the Lewis and Clark State Office Building.

A general state operating permit for land disturbance activities was issued by the department per state statute prior to the start-up of construction. The permit was issued to the Office of Administration, Division of Design and Construction, with responsibility to assure that the construction contractor developed an erosion-control plan. This was critical since elevation changes were planned for the property prior to construction. The use of best management practices such as silt fencing, sediment traps and stabilization of steep slopes were required to protect the construction site from degradation. The project was under the same inspection and reporting scrutiny as any other construction project in Missouri, and subject to the same state laws.

The department's regional office program staff inspected the site on several occasions because the department issued the permit and the project was permitted on state property. Therefore, the project was not subject to municipal inspection.

Storm Water Management

A system of erosion-control strategies were designed for groundwater recharge and maximizing storm water infiltration. Three sets of parallel bioswales were designed, one north of the building and two south of the building, on either side of the entry roadway. The bioswale troughs are 10 feet wide with a 2.5-feet deep trench in the lower middle 3 feet of the trough. Trenches are lined with geotextile filter fabric and filled with 2 inches-3 inches no-fine aggregate mixed in a 1:4 ratio with topsoil in the bottom 2 feet with 6 inches of compost topsoil at the top.

Three detention basins were designed as artificial flow-control structures that collect water for a limited period of time, allowing water to infiltrate. These detention basins are located on three sides of the building and vary in size dependent upon the drainage area. All are lined like the bioswales and contain the same mix

of aggregate and topsoil as the bioswales, but deployed in much larger areas. The aggregate and topsoil mixture allows the basins to control pollution runoff, especially from two small, impervious paved areas on the site.

Buried level spreaders are also installed in the upper portion of both the basins to the west of the building. These are designed to eliminate damage from excess surface water runoff from the hillside in front of the building and from the driveway on the west end of the building. Buried level spreaders significantly reduce the velocity of concentrated storm water above detention basins. They spread the concentrated flow of water uniformly over a stable, undisturbed area and release the flow simultaneously across the same elevation, and eventually into the detention basins.

Bioswales and detention basins were designed to carry 2 inches of rainfall per hour and can handle most rainfall events without overflow from the basins. Rainfall events that exceed 2 inches per hour are rare in this area.

Indigenous vegetation also plays a role in storm water damage prevention onsite by eliminating soil erosion from water runoff. The site's topography was amended and enhanced to minimize the effects of rainwater flowing into basins where the construction of bioswales was not practical.

Landscaping

Landscaping decisions were tailored to address the exposed and highly erodible soil contained on site. Objectives included minimizing erosion, using plants that require no watering other than from normal rainfall, and minimizing invasive nonnative species. Whenever possible, aesthetically pleasing plant species were employed to create habitats for wildlife, butterflies and migratory birds.

The soils are primarily clay and, in some instances, actually subsoil. A series of native plants were chosen for the revegetation dependent on their site location, including wetland, prairie and woodland ecosystems. Many species are tolerant of clay soils and drought and require no supplemental watering. Other environmental factors were aspect-related, including north- and south-facing slopes, shading and wetlands. South- and west-facing exposures are hotter and drier than north- and east-facing exposures, which are cooler and retain moisture better. Wetland plants that can withstand drought were chosen for the storm water retention basins.

The following list contains those plant species presently growing on the Lewis and Clark State Office Building grounds:

http://www.dnr.mo.gov/greenbldg/wildflowers/default.htm

Water Efficiency

Cistern

The building contains a below-ground, concrete-cast, in-place gray water cistern with a 50,000-gallon capacity. Water is collected via pipes running from the 30,000-sq. ft. roof surface to flush toilets. Incoming water is circulated through four charcoal filters. When the cistern experiences a drop in water level of approximately 6 inches, the circulation pump is activated, circulating the water through a UV filtering treatment system. The filtration system operates for approximately twenty minutes to eliminate bacteria. The primary focus of the cistern is to reduce dependence on city water and provide a significant storm water benefit by recycling 1,290 gallons of water each day from the grey water system.

Building occupants use approximately 1,290 gallons of water in toilets daily. The 50,000-gallon tank was designed to handle 95 percent of that daily water requirement, and presently saves approximately 390,600 gallons of water per year. If a drought occurs and diminishes the water supply from the below-ground cistern, the building will automatically switch over to the public water supply as a backup by automatically opening supply valves to allow the toilets to access city water.

This 50,000-gallon capacity cistern saves gray water for flushing toilets in the building. This water would otherwise have to come from Jefferson City's public drinking water supply.

There were a number of factors taken into consideration for determining the size of cistern required. These included anticipated annual precipitation, the roof water collection area (square feet) and expected demand. Designing a larger cistern would have had a twofold result – greater water efficiency and improved storm water control. However, the smaller, 50,000-gallon cistern was chosen due to cost. That necessity eliminated further storm water control as an alternative-use mechanism for the cistern.

Waterless Urinals

The building contains Kalahari no-flush urinals in the restrooms made by the Waterless Company. The waterless urinals contain a cartridge that acts as a funnel directing flow through the liquid sealant preventing any odors from escaping. The cartridge then collects sediment allowing the remaining waste to pass freely down the drain. The cartridge is the main component and is installed at the base of the urinal. A biodegradable environmentally friendly sealant liquid is poured into the drain that is contained within the cartridge. A barrier is formed between the drain and the open air by the liquid sealant, thereby eliminating odors if the cartridge is changed and biodegradable sealant liquid is added as recommended by the manufacturer. The cartridge is designed to collect uric sediment. The remaining liquid, which is non-corrosive and free of hard water, is allowed to flow into the drainage pipe.

Waterless urinals are used in the men's rest rooms throughout the Lewis and Clark State Office Building.

The result is no wasted water and an odor-free environment. Maintenance should be performed by replacing the cartridge after approximately 7,000 uses.

More information about the company's unique products can be found at www.waterless.com/

Low-Flow Water Closets

Low-flow toilets were also specified for the building. The Kohler Kingston model K-4330 chosen for the building uses 1.6 gallons of water per flush, allowing the cistern water to last longer.

Additional information about low-flow toilets can be found on the manufacturer's Web site at www.us.kohler.com/onlinecatalog/detail.jsp?prod_num=4330-L

It was essential that the strategies for the efficient use of water, management of storm water and associated landscaping intersect with the department's mission. Twenty-one percent of the LEED™ credits earned in this project are directly related to these strategies. Planners and designers effectively decreased the demand for water use and provided an alternative source to meet the needs of building occupants. The Lewis and Clark State Office Building not only uses water more efficiently, but conserves it at the same time.

The gray water cistern, low-flush water closets and indigenous plantings work sustainably to reduce the withdrawal of fresh water and minimize its use. Storm water control devices reduce water runoff to minimize erosion while simultaneously controlling pollution from impervious surfaces.

The cumulative effect of these strategies will provide a large portion of the building's cost and resource savings, which were planned and included in the facility's life cycle cost analysis.

MISSOURI DEPARTMENT OF NATURAL RESOURCES

Missouri Lewis & Clark State Office Building DNR

PO Box 176 1101 Riverside Dr. Jefferson City, MO 65102