STORMWATER RUNOFF MANAGEMENT EISA SECTION 438 IMPLEMENTATION

HSS Office of Health, Safety and Security

Synopsis of Requirements

Section 438 of the Energy Independence and *Security Act* (EISA) requires the sponsor of any **development or redevelopment project** involving a Federal facility **with a footprint that exceeds 5,000** square feet to:

- Use site planning, design, construction, and maintenance strategies for the property; and
- Maintain or restore, to the maximum extent technically feasible, the **predevelopment hydrology** of the property with regard to the temperature, rate, volume, and duration of flow.

In December 2009, the Environmental Protection Agency (EPA) issued *Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act* (Guidance). The Guidance defines the following key terms:

<u>Sponsor:</u> The Federal department or agency that owns, operates, occupies or is the primary user of the facility and has initiated the development or redevelopment project. The Federal entity remains the sponsor if it hires another entity to perform activities such as construction or maintenance.

<u>Development or Redevelopment:</u> Any action that results in the alteration of the landscape during construction of buildings or other infrastructure such as parking lots or roads. Examples include grading, removal of vegetation, and soil compaction. Examples of “redevelopment” are the reconstruction or replacement of structures or other infrastructure involving site disturbance. Typical patching or resurfacing of parking lots or other travel areas is not included.

<u>Footprint:</u> All land areas that are disturbed as part of the facility development or redevelopment project.

INTRODUCTION

EISA raised the compliance bar for stormwater management at all Federal facilities, including those of the Department of Energy (DOE). The new standards promote “slowing down stormwater runoff” and “infiltrating runoff into the ground” as the two main principles for stormwater management around construction sites. For many DOE sites, this change in approach not only affects current construction planning, but impacts longer-term regulatory drivers and environmental remedies. It also offers an opportunity to approach the issue of stormwater management more holistically, on a site-wide basis, and with an eye to meeting additional environmental goals, such as water conservation.

This Brief offers an overview to DOE site designers and facility planners of EISA Section 438 requirements, implementation methods and considerations, and the green infrastructure/low impact development (GI/LID) approaches recommended by EPA.

BACKGROUND

Traditional development creates impervious surfaces such as roads, driveways, sidewalks, parking lots, and buildings that contribute to runoff, even during small precipitation events. Under natural conditions this precipitation would be readily absorbed by the soil and vegetation. Such imperviousness leads to increases in runoff volume, peak flow, duration of discharge, pollutant loadings, and runoff temperature. Excessive runoff scours streambeds, erodes stream banks, and causes large quantities of sediment and other entrained pollutants to enter water bodies, impacting aquatic biota.

EPA's Guidance notes that the traditional wet pond approach to managing stormwater is not adequate to protect downstream hydrology because it offers:

- Poor peak control for small, frequently-occurring storms;
- Negligible volume reduction; and
- Increased duration of peak flow

The Guidance recommends the use of GI/LID techniques and technologies that use or mimic natural processes to achieve predevelopment hydrology. This will deliver runoff with a rate, volume, duration, and temperature approximating the naturally evolved receiving conditions of the water body.

ESTABLISHING PERFORMANCE DESIGN OBJECTIVES

Implementing Section 438 first requires DOE facility planners and site designers to determine the predevelopment hydrology of a site. The Guidance describes two approaches to make that determination.

Option 1 assumes that the predevelopment hydrology managed all rainfall events less than or equal to the 95^{th} percentile rainfall event. The 95^{th} percentile rainfall event is the event for which the measured depth of precipitation over a 24-hour period is greater than or equal to 95 percent of all 24-hour storms over a 30-year period. Under this option, a DOE facility should manage 100% of the volume of water from storm events less than or equal to the 95^{th} percentile event to the maximum extent technically feasible.

Rainfall data needed for this calculation is collected by airports and other locations across the country and can be obtained from sources such as the National Oceanic and Atmospheric Administration (NOAA). To calculate the 95^{th} percentile rainfall event using this data, DOE facility planners should remove events that generate 0.1 inch or less as they typically do not generate runoff. They should then sort the remaining events from largest to smallest, and calculate the event that equals or exceeds 95% percent of the rest.

Option 2 allows Federal facilities to determine predevelopment hydrology from a site-specific assessment that relies on conditions and local meteorology to determine the combination of runoff, infiltration, and evapotranspiration rates and volumes that likely existed on the site prior to development. Suggested hydrologic models to assist in this assessment include Natural Resource Conservation Service Technical Release 55 (TR-55), EPA Stormwater Management Model, the U.S. Department of Agriculture (USDA) Hydrologic Simulation Program – Fortran, and the Quality Hydrology Model.

IMPLEMENTATION APPROACH

To provide site designers maximum flexibility, the Guidance takes a performance-based approach in lieu of a prescriptive approach, allowing a range of GI/LID techniques and technologies to accommodate local conditions such as meteorology and soil type.

The Guidance describes the most useful of these techniques and technologies. These include: bioretention systems, green roofs, permeable pavements and pavers, cisterns, trees and tree boxes, rain gardens, vegetated swales and bioswales, pocket wetlands, and riparian buffers. A short description of each can be found at the end of this brief. The Guidance also contains a number of examples of the integrated approaches employed by various projects across the country.

IMPLEMENTATION CONSIDERATIONS

The Department is responsible for ensuring compliance with Section 438 of EISA. Section 438's requirements are not automatically included as part of any state or local stormwater permitting requirements or any national green building certification program, such as Leadership in Energy and Environmental Design (LEED). Section 438's requirements should be included as part of any efforts to comply with DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*.

Because of the potential complexity and opportunities for integrated design in implementing Section 438, Integrated Project Teams should ensure that GI/LID practices are integrated as early as possible into various project development processes and systems, including the site evaluation process and the Conceptual Design Report. Project budget documents should also clearly identify Section 438 requirements.

Such early integration may require someone with significant stormwater management expertise as part of the Team. Familiarity with local or Federal stormwater permit requirements alone will likely not be sufficient, as Section 438's coverage is more comprehensive than most local permitting requirements.

The use of GI/LID on contaminated sites adds additional technical complexity. A DOE site with these conditions needs to address these challenges early in the development process, given the potential limitations associated with stormwater infiltration and possible implications for Resource Conservation and Recovery Act and other regulatory requirements. Fortunately, the erosion control associated with Section 438 implementation may contribute to meeting these additional environmental requirements. For additional information about using GI/LID on contaminated sites see: http://epa.gov/brownfields/tools/swdp0408.pdf.

Larger DOE sites with multiple structures should also consider addressing stormwater runoff as part of a campus-wide master stormwater plan, as opposed to a building-by-building approach. A campus-wide strategy not only improves environmental performance, but it should also make it easier to address stormwater runoff on future projects covered by Section 438. This aligns with the Guidance, which provides that off-site measures should be employed if on-site measures are not feasible.

Many DOE sites are already covered by stormwater discharge General Permits and Stormwater Pollution Prevention Plans (SWPPPs). While these documents may be the first place to look in connection with any project that impacts site hydrology, Section 438 may add additional performance requirements. These additional requirements should be incorporated in future SWPPPs.

An additional consideration for DOE sites may be the presence of unique and/or sensitive environmental features, such as wetlands. If these features are taken into account early in the site planning and design process, development that restores the area to its pre-development hydrology may even improve their condition. In addition, the expansion or creation of such natural features may offer solutions for stormwater management supported by Section 438.

Using GI/LID also offers opportunities to address other sustainability goals. For example, Executive Order (E.O.) 13514, *Federal Leadership in Environmental, Energy, and Economic Performance,* cites implementing and achieving the objectives of the Guidance as a means to help meet the E.O.'s goals of reducing potable, industrial, landscaping and agricultural water use. Such an approach carries the opportunity for additional points under the U.S. Green Building Council's LEED rating system.

Further, while the Guidance was intended to cover new projects, it also provides a means to establish compliance with the Guiding Principles for Federal Leadership in High-Performance Sustainable Buildings (Guiding Principles) in existing buildings, as the Guiding Principles provide that an existing building must "employ strategies that reduce storm water runoff and discharges of polluted water offsite."

DOCUMENTING COMPLIANCE

Compliance with EISA Section 438 requires that DOE stormwater management strategies be implemented to the maximum extent technically feasible.

DOE sites should develop and maintain documentation of design criteria early in the project development process. These criteria should include:

- Site evaluation and soils analysis;
- Calculations of the pre-development runoff volumes and rates (Option 1 or 2);

- Design calculations for stormwater management practices employed;
- Respective volume of stormwater managed by each practice and system as a whole;
- Operations and maintenance protocols for the stormwater management system; and
- Any technical constraints in site design that limit stormwater management options.

Examples of technical constraints include:

- Adverse impacts on receiving water flows from retaining storm water on site;
- Shallow bedrock, contaminated soils, high groundwater, underground facilities or utilities;
- Limited soil infiltration capacity;
- Too small a site to infiltrate significant volume;
- Non-potable water demand (for irrigation, toilets, wash-water, etc.) is too small to warrant water harvesting and reuse systems;
- State or local requirements that restrict water harvesting; and
- State or local requirements that restrict the use of GI/LID.

The final design and as-built drawings for each facility should be reviewed by a registered professional engineer.

TECHNIQUES AND TECHNOLOGIES

Bioretention Systems: These systems are designed to retain and infiltrate stormwater and consist of a soil bed planted with appropriate non-invasive vegetation. Stormwater runoff entering the area is filtered before infiltrating into the existing subsoil or being conveyed downstream by an underdrain system. The vegetation provides uptake of pollutants and runoff while maintaining pore space to assist infiltration. These systems typically have the lowest cost per unit of stormwater treated.

Green Roofs: Vegetated roof systems are designed with light weight soil media and vegetation on top of a waterproof membrane to provide various ecosystem functions. Green roofs manage stormwater runoff by retaining and evapotranspiring rainfall and delaying the flow of runoff into traditional stormwater conveyance systems, and they also act as a "cool roof" to reduce a building's energy consumption. Although limited by the structural capacity of a building, these systems can offer substantial economic savings by extending roof longevity.

Permeable or Porous Pavements: These pavements permit the movement of water and air around the paving material. Permeable pavement systems achieve reductions in stormwater runoff through increased infiltration through pore spaces within the paving material, or through void spaces between individual paving blocks. These systems can include materials such as concrete, asphalt, and aggregate, and may be continuous systems or comprised of individual pavers. Permeable pavements are generally not recommended for high traffic areas, due to the risk of compaction, or for loading bays due to possible environmental contamination from accidental chemical releases.

Cisterns or Storage Tanks: Rainwater harvesting from rooftops or other catchment areas can aid in managing stormwater and reduce potable water use for non-potable purposes on-site. Cisterns may be underground, at grade, or elevated and may be located outside or inside buildings. These systems are watertight, with enclosed lids, and are generally made from non-reactive materials such as galvanized steel, reinforced concrete, and plastic. Total storage volume should be based on the impervious surface area and runoff quantities directed into the cistern(s). Depending on regional water laws, harvesting or storage of water for future use may be permissible at a facility. This technology can assist in meeting the water efficiency goal of E.O. 13514 through reduced water use particularly for landscaping activities.

Trees and Tree Boxes: Where there is sufficient space or designed space using structural soils, trees can develop full canopies and root systems to effectively take up excess nutrients and water and enhance infiltration. For healthy root systems, reservoir design depths should be at least 24 inches when using trees for stormwater management.

Riparian Buffer System: Designed riparian buffer systems typically are comprised of three zones as established by the USDA. Zone 1 is an area of undisturbed land nearest a stream that stabilizes streambanks, provides shade to moderate stream temperatures, and provides large woody debris to the stream. The area immediately adjacent to Zone 1 is designed to improve water quality through vegetative uptake and biogeochemical processes in the soil. As trees in Zone 2 mature, selective timber harvesting and stand improvements may be necessary to promote growth of the remaining trees. Zone 3 serves as a buffer between the developed adjoining land and Zone 2. Often Zone 3 is an area of dense grass with the purpose of slowing and spreading runoff flows to promote the release of suspended sediments and infiltration into the ground.

ADDITIONAL INFORMATION AND RESOURCES

Stormwater Management: Structural Soils in Urban Forestry:
http://www.cnr.vt.edu/urbanforestry/stormwater/

Managing Wet Weather with Green Infrastructure:
http://www.epa.gov/npdes/greeninfrastructure

Sustainable Streets:
http://www.flowstobay.org/ms_sustainable_streets.php

NOAA Climatic Data Online:
http://www.ncdc.noaa.gov/oa/ncdc.html

Welsch, D.J. 1991. Riparian forest buffers - function and design for protection and enhancement of water resources. USDA Forest Service Northeastern Area State & Private Forestry. NA-PR-07-91. Radnor, PA. 20 p.
http://www.na.fs.fed.us/spfo/pubs/n_resource/buffer/cover.htm

Day, S.D. and Dickinson, S.B. 2008. Managing Stormwater for Urban Sustainability using Trees and Structural Soils. Virginia Polytechnic Institute and State University, Blacksburg, VA.

http://cnre.vt.edu/urbanforestry/stormwater/Resources/TreesAndStructuralSoilsManual.pdf

EPA Design Principles for Stormwater Management on Compacted, Contaminated Soils in Dense Urban Areas.
http://epa.gov/brownfields/tools/swdp0408.pdf

The Office of Environmental Policy and Assistance establishes environmental policy for DOE, and provides assistance to DOE elements on implementation of policy and resolution of compliance matters. Please refer any questions and requests for assistance concerning the subject material covered in this Information Brief to:

Corey Buffo
Office of Environmental Policy and Assistance, HS-22
U.S. Department of Energy
1000 Independence Ave., S.W.
Washington, D.C. 20585

Phone: (202) 586-9661
E-mail: Corey.Buffo@hq.doe.gov