The Clean Water State Revolving Fund: Green Infrastructure – Innovative Projects and State Activities

June 2012
EPA-832-F-12-026

The American Recovery and Reinvestment Act of 2009 (ARRA) opened the floodgates to expanded project opportunities for soft path, green infrastructure projects in both rural and urban environments across the country. The U.S. Environmental Protection Agency (EPA) defines green infrastructure as approaches and technologies that maintain and restore natural hydrology by infiltrating, evapotranspiring, capturing, and using stormwater. Since 1988, funds have been appropriated annually through the Environmental Protection Agency's Clean Water State Revolving Fund (CWSRF) program to all 50 states and Puerto Rico for the purpose of facilitating a wide variety of water quality projects, including nonpoint source, watershed protection and restoration, estuary management, as well as traditional municipal wastewater treatment projects. Since the program's inception, over $90 billion dollars in financial assistance for eligible water quality projects has been provided.

Recovery Act Accomplishments

Congress passed ARRA on February 17, 2009, and allocated $4 billion to the CWSRF. In the past, the majority of CWSRF funding has been directed to traditional municipal wastewater infrastructure projects that address point source pollution. However, the inclusion of the Green Project Reserve (GPR) under ARRA helped instigate a paradigm shift in water quality project priorities for many state CWSRF programs. Twenty percent of ARRA CWSRF funds were directed to go towards the GPR, which included four categories: energy efficiency, water efficiency and conservation, environmentally innovative projects, and green infrastructure.

As a result of the ARRA GPR, an unprecedented amount of nonpoint source, green infrastructure projects were funded by CWSRF programs across the United States to the tune of $209 million, representing 18 percent of the $1.13 billion set aside expressly for GPR projects. State CWSRF programs funded 259 green infrastructure project components. This demonstrates the growing importance of the CWSRF in supporting and encouraging more of these types of projects, which include technologies and practices that use natural or engineered systems designed to mimic natural hydrologic processes to infiltrate, evapotranspire, and reuse stormwater to improve water quality. Examples of such practices include pervious pavement, rain gardens, bioretention applications, constructed wetlands and riparian restoration projects.

The most effective best management practices for managing stormwater vary from region to region and state to state, so there is no "one size fits all" approach. The critical and often most challenging aspect of bringing these types of projects to fruition is the importance of public education, outreach, and developing cooperative partnerships with various public, private, state and federal entities, and stakeholders to ensure success in terms of

implementation and viability for years to come. The following CWSRF ARRA projects effectively illustrate the importance of partnership building among stakeholders and demonstrate how different green infrastructure technologies and practices can be applied in different settings.

LENEXA, KANSAS
CENTRAL GREEN STREAMWAY

The City of Lenexa received $1.1 million in CWSRF ARRA funds for the Central Green Streamway Project, which is part of the city's Vision 2020 planning strategy that emphasizes sustainable, livable communities through sound management of wastewater and stormwater infrastructure. The city introduced its Rain to Recreation program in the summer of 2000, and it has been nationally recognized for its innovative approach to stormwater management, natural resource conservation, and stakeholder outreach and involvement in natural resource management. The success of this program relies heavily upon the support of community members, local businesses, and nonprofit groups working together to enhance the quality of both natural and built environments. Lenexa's visioning strategy specifically identifies the need for innovative stormwater management planning, maintenance programs, efficient methods of irrigation, watershed protection, and continuing environmental education for community stakeholders.[1]

The Central Green Streamway Project echoes this vision and implements green stormwater management with a bioengineered step pool streamway, a constructed wetland, native vegetation plantings, and a water reuse irrigation system within the City Center North facility. The streamway will safely convey stormwater from the City Center development through the City Center North development while creating a usable public gathering space, enhancing infiltration, and allowing for increased bioremediation of stormwater run-off. The constructed wetland will help mitigate the impacts of stormwater in the Parkhurst neighborhood, the downstream streamway, and in Shawnee Mission Lake. Other components of the project include constructing trails adjacent to the streamway and planting native vegetation. The Central Green Streamway will help Lenexa fulfill its Vision 2020 goals of providing common open space for the community and beautifying the neighborhood while improving water quality.

SALT LAKE COUNTY, UTAH
JORDAN RIVER BANK STABILIZATION AND RESTORATION PROJECT

The Jordan River courses over 58 miles across the Salt Lake Valley. Beginning at Utah Lake atop Mount Timpanagos, it travels through Salt Lake City and ultimately drains into the Great Salt Lake. The river segments winding through the metropolitan area have become highly channelized over the years within this urban environment. Increased development adjacent to the river has resulted in significant erosion and sedimentation that has contributed to the degradation of water quality, wildlife habitat, and bank stability. As a result, the Jordan River has been declared an impaired water body for levels of dissolved oxygen and total suspended solids under Section 303(d) of the Clean Water Act.

As part of the Salt Lake City Open Space Program, the Jordan River Bank Stabilization and Restoration Project is a partnership effort

[1] City of Lenexa (1997). Lenexa Vision 2020. Available at http://www.ci.lenexa.ks.us/2020/PDF/Vision2020.pdf.

between Salt Lake City and Salt Lake County. This project received $484,200 in CWSRF ARRA funds from the Utah State Water Quality Board to restore four sites along the urban corridors of the Jordan River. The soil bank stabilization will be accomplished through implementing stone toe protection, grading back the river bank to a gradual 3:1 slope, and planting native vegetation. It is expected that this project will effectively eliminate approximately 950 cubic yards of sedimentation from the Jordan River annually and over time will help re-establish wildlife habitat, promote cooler river temperatures by providing ample stream shading, and encourage robust ecosystem function and water quality improvement by reducing levels of total suspended solids and increasing dissolved oxygen to healthy levels conducive to aquatic systems.[2]

SPOKANE, WASHINGTON
SPOKANE URBAN RUNOFF GREENWAY ECOSYSTEM (SURGE)

The City of Spokane received $599,000 in ARRA funds from the Washington State Department of Ecology's Water Pollution Control Revolving Fund to construct a demonstration project of street-side rain gardens to control pollution from stormwater runoff. The Spokane Urban Runoff Greenway Ecosystem, or SURGE, will examine the suitability of planning, designing, and retrofitting the existing urban landscape of curb and gutter systems using low-impact and green infrastructure practices to mimic the natural hydrologic process by capturing, treating, and infiltrating stormwater runoff. As part of the city's extensive Sustainability Strategic Plan, the ARRA funds were used to construct the West Broadway SURGE project, which demonstrates Spokane's ongoing commitment to adopting green practices that support a more sustainable approach towards wastewater treatment.

> *The Broadway Avenue SURGE project is a low-cost solution to capture, treat, and infiltrate runoff as close to where it falls as possible," says Mayor Mary Verner. "The storm gardens will enhance the beauty of Broadway Avenue and improve water quality by reducing the contaminants going to the Spokane River.*

The project consists of a network of rain gardens constructed between the curbs and sidewalks to intercept stormwater runoff. Rain gardens are an excellent example of green infrastructure design particularly suited for the inland Northwest, as they are capable of properly treating stormwater runoff flows from both rain and snow events. Street-side depressions, planted with native vegetation, are designed to capture runoff from impervious areas like roofs, streets, and parking lots, allowing it to naturally be absorbed into the ground.

In all, 37 rain gardens were constructed along with five drainage structures and over 1,200 square yards of pervious sidewalk. Each rain garden is comprised of a layering of structural soil, which includes a mix of gravel, top soil, and moisture retaining gel to support the growth of tree roots; a layer of treatment soil consisting of topsoil, sand, and organic matter to provide biological treatment to stormwater; and a layer of composted mulch at the surface to regulate moisture, minimize weed growth, and further enhance biological treatment cleansing.

[2] Salt Lake City Government (2009). SLCGreen – Open Space Lands Program. Available at http://www.slcgov.com/slcgreen/openspace/Jordan_River_Restoration.htm.

The environmental, economic, and social benefits associated with the SURGE project are broad, ranging from improving the operation of Spokane's combined sewer system, providing a low-cost alternative to treating and managing stormwater runoff, and increasing urban green space that provides an enhanced aesthetic environment through the reduction of paved surfaces.

The main purpose of this project is to improve water quality. By removing nitrogen and phosphorus loads from stormwater runoff, the water quality of Spokane's primary source of drinking water, its sole-source aquifer located directly beneath the city of Spokane, and the Spokane River, which runs through the heart of Spokane, is protected.

THE IMPORTANCE OF GREEN INFRASTRUCTURE

Green infrastructure can play an important role in municipal water quality management. Studies have shown that the green infrastructure applications previously mentioned not only result in substantial savings in both construction and life cycle costs as compared to conventional infrastructure, but can also provide more indirect economic and social benefits. The Center for Neighborhood Technology developed an online economic modeling tool called the Green Values® Calculator [3] which demonstrates that, on average, green infrastructure projects are often 30 percent less expensive to construct with 25 percent less associated life cycle costs than their conventional counterparts. Furthermore, soft path solutions such as permeable pavement, constructed wetlands and bioretention applications have efficacy ratings for removing nitrogen, total suspended solids, and reducing peak flows and runoff volumes between 40 and 75 percent. [4]

There are social benefits associated with the use of green infrastructure technologies as well that can be qualitatively measured for how effectively they enhance the quality of life for communities. These projects offer what conventional infrastructure cannot: natural beauty and public open spaces, habitat and enriched ecosystems for plants, animals and people, improved air quality, and reduced heat island effect. All of these benefits have a resounding, positive impact on the people and properties surrounding them.

There are a multitude of factors contributing to the water pollution problems associated with storm events. As urbanization continues, landscapes are becoming increasingly impervious. The health and integrity of surface waterbodies is significantly impacted by pollutant loads in stormwater runoff from surfaces that do not allow for onsite infiltration. Nutrients like phosphorus and nitrogen, as well sedimentation and other contaminants generated from combined sewer overflows and sanitary sewer overflows, represent real health concerns for both humans and the ecosystem alike.

In addition, groundwater resources are deprived of recharge, which reduces the ability of aquifers to maintain adequate base flow rates to urban lakes and streams and impairs the viability of drinking water sources. The conventional stormwater systems currently in

[3] Available at http://greenvalues.cnt.org/national/calculator.php.

[4] Jaffe et al (2009). The Illinois Green Infrastructure Study: A Report to The Illinois Environmental Protection Agency on the Criteria in Section 15 of Public Act 96-0026, The Illinois Green Infrastructure for Clean Water Act of 2009.

place in many municipalities, consisting of curbs, gutters, drains, and storm sewers, are often insufficient to handle current and anticipated stormwater management needs. It is also important to factor in the effects of climate change on wastewater and stormwater infrastructure, which are already beginning to be felt. Rising sea levels and storm surges, more intense rain and snow events, increased incidents of flooding, devastating wildfires, changes in the availability of drinking water, and warming water temperatures that alter the aquatic ecosystem and food web will all put a strain on existing water infrastructure.[5]

Building Partnerships for a Greener Future

The environmental, economic, and social benefits of undertaking more green infrastructure projects have been identified, but without increasing the level of partnerships among funding agencies, municipalities, public utilities, and stakeholder groups, many opportunities to devise creative mechanisms for addressing the growing need for sustainable and effective stormwater infrastructure and management will be lost. Bringing political subdivisions and utilities together with community stakeholders and nonprofit groups and organizations dedicated to the protection of water quality through stormwater initiatives, education and outreach activities can prime local and state leaders to pursue more projects that address the nonpoint source pollution issues derived from stormwater pollution. Many communities across the United States have undertaken efforts to encourage green infrastructure and soft path solutions to pollution abatement efforts.

In Idaho, a nonprofit organization called Partners for Clean Water is comprised of six agencies all working in partnership: the Idaho Transportation Department, Garden City, Drainage District Number Three, Boise State University, Boise Public Works, and the Ada County Highway District. These groups have collectively spearheaded efforts to reduce stormwater pollution through a targeted marketing campaign, community events, and public service announcements.

In California, the California State Water Board worked closely with the Santa Monica Baykeepers and the Santa Monica Restoration Foundation to install several large, low-impact development rain gardens adjacent to a blighted area along Ballona Creek. These rain gardens were designed to treat stormwater runoff from 15 acres of commercial, industrial, and residentially zoned areas of Culver City, California. The Ballona Creek project was a success largely due to the commitment and responsiveness of nonprofit organizations like these, working in tandem with state and federal financing agencies.

In more rural settings, water quality issues exist where it is difficult to locate a responsible party with the financial, technical and managerial means to undertake debt obligations for the purpose of implementing green infrastructure projects. For those water quality issues that are not closely associated with agricultural activities, there may be other options available, such as conservation easements for projects that address watershed protection by implementing erosion controls through streambank stabilization and riparian restoration projects. A study conducted by the American Water Works Association Research Foundation has shown that land ownership can

[5] U.S. Climate Change Science Program and the Subcommittee on Global Change Research (2008). Preliminary Review of Adaptation Options for Climate-Sensitive Ecosystems and Resources.

offer the most effective long-term protection against nonpoint source pollution.[6] Conservation easements can protect areas from land use conversion, thereby limiting the amount of development and increased impervious areas that further contribute to stormwater pollutant loads in surface and ground waters. Working through land trusts can be an effective means of addressing water quality impairments in wild land environments resulting from forest fires, logging, road building, and mining activities.

Building partnerships with The Trust for Public Land and local land trust organizations provides broader opportunities for stakeholders to implement best management practices and protect water at its source. Through the vehicle of land acquisition, green infrastructure initiatives can be used as an economical and sustainable method of addressing more challenging nonpoint source pollution issues that also support smart growth initiatives aimed at preserving open space and natural resources.

Conservation easements can be an effective tool in both rural and urban environments. For instance, in Milwaukee, Wisconsin, the Milwaukee Metropolitan Sewerage District (MMSD) began examining how green infrastructure could complement their conventional gray infrastructure investments. As a result, they created an innovative program called Greenseams targeted at reducing flood risks and pollution from stormwater runoff. In partnership with The Conservation Fund, a nonprofit organization that has successfully preserved 6 million acres of land, Greenseams began to acquire land containing hydric soils and water-absorbing vegetation through permanent conservation easements to ultimately create a successful program for green infrastructure flood management.[7]

Through the forging of partnerships between MMSD, Wisconsin Department of Natural Resources, and various planning commissions, as well as community members and property owners, over 2,000 acres of land have been preserved in the vicinity of Milwaukee since the program's inception in 2001. The Greenseams program has proven cost-effective for the Milwaukee utility and has provided both qualitative and quantitative benefits to the community by creating open spaces and wildlife habitat, improving the quality of life for nearby residents, and protecting water quality within the watershed.

In states like Colorado, water quality has been significantly impaired by catastrophic wildfires such as the Hayman Fire, which destroyed 140,000 acres in the summer of 2002 and damaged some of the state's major water supply reservoirs. Denver Water partnered with the Coalition for the Upper South Platte to undertake rehabilitative efforts to restore a devastated watershed and reduce sediment loading of waterways and water storage reservoirs due to post-fire flooding. These efforts to restore the Upper South Platte watershed, which drains into the Denver Metro area, have been successful in protecting water supplies and water quality for millions of people.

[6] The Trust for Public Land and the American Water Works Association (2004). Protecting the Source Land Conservation and the Future of America's Drinking Water.

[7] Hrobar, J. (2009). Innovative Program Connects Wastewater Utilities and Nature. WaterWorldVolume 4, Issue 4. Available at http://www.waterworld.com/index/display/article-display/0902785477/articles/urban-water-management/volume-4/issue-4/features/innovative-program-connects-wastewater-utilities-and-nature.html.

Though these organizations largely obtain funds through donations and are not typically used to seeking loan funds, there are opportunities to gain their participation in the CWSRF program through effective outreach and partnership building. The key to bringing a coalition of players together ultimately depends on strong community-based planning, ensuring public education and securing the commitment and financial support of the voting base. These efforts are apparent in the increasing commitment of communities and environmental organizations to address stormwater pollution challenges across geopolitical boundaries with the purpose of long-term protection of water quality.

For more information please see our website
http://www.epa.gov/cleanwatersrf