EPA United States Environmental Protection Agency

Green Infrastructure Program

Quarterly Newsletter

Fall 2011

TO OUR READERS

After a bit of an hiatis, it's time that we sent a bulletin to tell you about the activities that have been underway here at EPA for the past year. After months of cross-Agency discussion of how far we've come and where we want to be, EPA released a new Strategic Agenda renewing the Agency's support for green infrastructure and outlining the actions the Agency intends to take to promote its effective implementation. The Agenda was announced by Deputy Administrator Bob Perciasepe at the EPA Region 3 Green Streets Green Jobs Forum – an event that highlighted the importance of innovation and information exchange among local practitioners and represented a key component of the Agenda's bottom-up, top-down approach. One of the most important objectives of the Strategic Agenda is the formation of partnerships with green infrastructure communities across the nation. Partnerships with "model communities" spotlighting progress to date will be followed by partnerships with "budding communities" offering targeted technical assistance to interested local governments, tribes, and watershed groups. Deputy Administrator Perciasepe announced the first 10 partner communities along with the new Strategic Agenda.

EPA Deputy Administrator Bob Perciasepe (right) joined Onondaga County Executive Joanne Mahoney (center) to announce the selection of Syracuse, NY as a partner community

The announcement of the Agenda and the first 10 partner communities was accompanied by the release of a joint memo developed by EPA's Office of Water (OW) and Office of Enforcement and Compliance Assurance (OECA) supporting the use of green infrastructure. The memo reaffirms the commitment of both offices to work with interested communities on incorporating green infrastructure into stormwater permits and into remedies for non-compliance with the Clean Water Act (such as Combined Sewer Overflow consent decrees).

Questions about these efforts and other issues concerning green infrastructure can be directed to our Headquarters and Regional coordinators.

In This Issue

Contact Us

EPA Headquarters

Chris Kloss, OW/OWM

Tamara Mittman, OW/OWM

Lourdis Bufill, OECA

Robert Goo, OW/OWOW

EPA Regions

Johanna Hunter, R1

Jeff Gratz, R2

Dominique Lueckenhoff, R3

Mary Jo Bragan, R4

Bob Newport, R5

Suzanna Perea, R6

Kerry Herndon, R7

Stacey Eriksen, R8

John Kemmerer, R9

Krista Mendelman, R10

FEATURE PROJECT: Grand Valley State University Stormwater Initiative

Content contributed by Kerri Miller, P.E., LEED-AP (FTC&H) and James Moyer, LEED-AP (GVSU)

Grand Valley State University (GVSU) is a public university chartered in 1960 to serve Michigan's second largest metropolitan region. Located in Allendale, Michigan, the main campus sits on a bluff along the Grand River above a system of wooded ravines. Since opening its doors in 1963, the Allendale campus has grown from a handful of buildings serving 225 students to a sprawling 1,300 acre commuter campus with a student body of 24,500 and 170 acres of buildings and pavement. As the campus expanded in the 1970s and 80s, stormwater infrastructure was installed to provide efficient drainage, but water quality control was not yet a design objective. Most of the campus stormwater infrastructure therefore consists of pipes and ponds that drain into the wooded ravines at the campus edge. By the mid-1990s, however, it had become apparent that this end-of-pipe approach was not a sustainable solution. As more and more stormwater was diverted to the wooded ravines, some of the slopes became destabilized, and the eroding slopes began to creep towards adjacent buildings and pavement.

Grand Valley State University is a growing university on the west side of Michigan

Motivated by persistent erosion, unstable slopes, and the principles of sustainability, GVSU decided to integrate green infrastructure into both its campus planning and its educational programs. Instead of continuing to invest in costly end-of-pipe approaches to manage growing volumes of stormwater, GVSU decided to restore the campus's natural hydrology and manage stormwater at its source. Since 1997, GVSU has worked with its engineering consultant, Fishbeck, Thompson, Carr, & Huber, Inc. (FTC&H), to restore the campus' natural hydrology by advancing the following objectives:

- Abandon the tradition of isolated storm water management solutions for each construction project;
- Develop and adopt an overall, campus-wide approach to stormwater management;
- Employ, monitor, and evaluate multiple best management practices for reducing the amount of runoff generated;
- Identify alternate uses for the water generated from hard surfaces; and
- Engage faculty and students in the effort to reduce runoff.

Severe erosion in the campus ravines

Integrating Green Infrastructure into the GVSU Campus

Since 2004, GVSU has integrated green infrastructure practices into new and existing development at a range of scales – from permeable parking lots that manage stormwater directly where it falls, to a constructed wetland complex that manages stormwater from large areas of the campus. Many of these projects demonstrate the adaptability of green infrastructure to challenging site characteristics. Though most of the campus sits on clay soils and some projects offered limited space, GVSU was able to tailor the design of each project to the characteristics of the site. GVSU not only installed engineered systems that mimic natural hydrology, but has worked with grounds keepers to modify landscape management practices as well. The implementation of these structural and behavioral strategies is summarized in GVSU's Storm Water Management Timeline.

One of the first green infrastructure systems installed on campus was a pair of porous asphalt parking lots. Completed in 2004, the parking lots added 380 parking spaces for commuter students. The clay soils beneath the parking lot required thoughtful design, but did not preclude the installation of permeable pavement. Underdrains in the storage reservoir promote infiltration while allowing for excess water to drain to the storm sewer. By installing a parking surface that infiltrates water, GVSU was able to both maintain the natural hydrology of the site and save space and money. The permeable parking lot eliminated the need for a detention pond to manage peak flows and allowed GVSU to avoid the associated costs of grading, excavation, and materials. Another benefit of the porous asphalt system is that it does not allow black ice to form in winter. Any water on the pavement surface infiltrates into the storage reservoir, so melted snow does not refreeze. This feature enhances safety and reduces maintenance needs.

Green infrastructure was integrated into three major building projects in 2008. The 83,000 square foot addition to Mackinac Hall featured a green roof, rainwater harvesting and reuse, and swales planted with native grasses. The rainwater reuse system is particularly innovative, collecting water not only from the portion of the roof that is not vegetated, but from the pervious concrete courtyard as well. The collected water is then pumped into the campus irrigation system. The second large project that integrated green infrastructure into its design was the redevelopment of a six-acre parking lot into the Honors College and two housing units. By including a green roof, eight rain gardens, and a native grass field in the site design, the project not only manages stormwater on-site, but produced a net gain in green space for students to enjoy. The replacement of the traditional lawn with a native grass field is an interesting feature that has several environmental and economic benefits. Native grasses have deeper roots than conventional turf grass, maintaining higher soil infiltration rates and supporting higher transpiration rates. Native grasses also require far less maintenance than conventional turf grass – requiring no irrigation and only two mowings per year.

Native landscaping at the Honors College

The third green infrastructure project developed in 2008 was a larger scale project designed to offset the footprint of a new building and manage water from an existing parking lot while remaining an attractive landscape feature. To manage stormwater from the 138,000 square foot Kelly Family Sports Center and a nearby 11-acre parking lot, GVSU designed a large stormwater reuse pond. Placed within an existing golf course, the pond is seamlessly integrated into the campus landscape and serves as a water feature for golfers. Stormwater from the Kelly Family Sports Center and nearby parking lot is collected in the pond and stored for irrigation. By using the collected water for campus irrigation, GVSU not only reduces the volume of stormwater flowing into its sensitive ravines, but offsets about 25% of its monthly water demand for irrigation.

Stormwater reuse pond in the campus golf course

GVSU recently completed another large-scale green infrastructure project to manage stormwater from several new recreation fields and a large area of existing development. A 44-acre wetland complex was constructed in multiple cells to manage stormwater from a 123-acre drainage area. The wetland is a key component of a plan to reduce stress on the campus ravines by restoring the natural drainage divide. Water stored in the wetland complex will be used in the campus irrigation system, and walking trails and overlooks will provide recreational opportunities.

To maximize the benefits of its green infrastructure investments, GVSU works with its grounds keepers to adopt alternative management practices. These include standards for native plantings instead of sod lawns, redefined mowing practices for native vegetation, protection of special habitat areas, and storm water reuse for irrigation. GVSU has also worked with grounds keepers to increase tree cover by 500 percent since the date of the land acquisition. Trees are even more effective than native grasses at maintaining higher infiltration rates and supporting higher rates of evapotranspiration.

Reaping the Benefits of Sustainable Stormwater Management

GVSU's natural environment, quality of life, and bottom line have all benefited from the integration of green infrastructure into the campus design. Flow regimes in the ravine system have become less erosive and more natural, allowing the ravine slopes to stabilize and ravine habitat to recover. The reduction in ravine erosion is estimated to have reduced sediment delivery to the Grand River by over 3,000 tons per year. Within the campus, wetlands, rain gardens, green roofs, and native grasses have enhanced the habitat for native insects, birds, and other wildlife.

GVSU's green infrastructure has also significantly enhanced its educational programs and quality of life. The campus's green infrastructure practices offer an "outdoor learning laboratory" for students and faculty, with students actively engaged in the monitoring of rain gardens and ravines. GVSU's green infrastructure features also serve as a teaching tool for the broader community. GVSU has hosted several tours for local, state, and federal officials to discuss the opportunities for sustainable stormwater programs on university campuses. But the campus's green infrastructure features offer much more than learning opportunities. The rain gardens, green roofs, native vegetation, and wetlands woven throughout the campus create a more aesthetically pleasing environment, and offer students, staff, and visitors many opportunities for recreation and reflection.

All of these benefits have come at minimal extra cost to the university. Managing stormwater on-site allows the university to eliminate the need for (and expense of) some detention basins, while preventing further degradation of the campus ravines. By preserving the wooded ravines at the campus edge, the university is also avoiding the expense of continually restoring and stabilizing steep slopes. By reusing stormwater to supply its irrigation needs, GVSU also reduces its water bills. As GVSU faculty and students continue to monitor the impacts of its green infrastructure, we look forward to learning more about the benefits of designing with nature.

Rain gardens, green roofs, native vegetation, and wetlands woven throughout the GVSU campus create an aesthetically pleasing environment with many opportunities for recreation and reflection.

ASK THE EXPERT

Green infrastructure may most often be associated with areas with lots of rainfall, but as interest has grown in sustainable water infrastructure, its use has spread throughout the United States. To understand how communities in arid and semi-arid regions have adapted green infrastructure to drier climates, we spoke with the Watershed Management Group's (WMG's) James MacAdam. WMG is a Tucson-based non-profit that works with Arizona communities to promote rainwater harvesting, green infrastructure, and other practices that conserve soil and water resources. James MacAdam is currently managing WMG's Green Streets – Green Neighborhoods Program, which teaches residents how to improve water quality in their own streets, yards, and local washes through green infrastructure projects. He is also the lead organizer of the 2012 AridLID conference.

Q: What do you think are the most important functions of green infrastructure in arid areas?

JM: I think one important function of green infrastructure in arid areas is as a supplemental source of water for urban forestry. My understanding of green infrastructure, though, is that when you separate out any one of the functions and do it just for that purpose, it isn't cost effective. So there is the benefit of managing stormwater – improving water quality and reducing flooding – and the benefit of providing a source of water for urban forestry, but at the core the functions need to be integrated. The more you integrate the water functions with things like traffic calming, neighborhood beautification, and reducing urban heat island effect, the more it makes sense.

Water soaks into a chicane, or curb bump-out, on a Tucson green street.

Q: How does Watershed Management Group advance the implementation of green infrastructure?

JM: We take a multi-pronged approach, but our main way of implementing green infrastructure is through a community-based model where we do hands on workshops and training. We teach people how to do really simple retrofits like creating rain gardens and cutting curbs in the right of way, and in the process we hope that they learn how to do it and why to do it, and get out and meet each other and build some community. At another scale we run into policy challenges that make our work difficult, and so one of the things that we've done is join a group of various representatives from municipalities and private entities in southern Arizona to look at how we can effectively use green infrastructure in the ways that I've mentioned. There are many people here working on the same thing under the terms rainwater harvesting, stormwater management, and traffic calming, and often we don't even know what each other is doing. So that has been one of our first steps. Also we try to bring communities together to be able to work more effectively with the municipalities and vice versa. As an example we worked with the Tucson Department of Transportation to create design standards for street related green infrastructure retrofits like chicanes, traffic circles, and curb cuts.

Q: Which green infrastructure practices do you think represent the "lowest hanging fruit" in arid areas?

JM: The lowest hanging fruits are those practices that can be integrated into new development and redevelopment projects. By redevelopment I mean anything from someone turning a brownfield into a cool new project to street widening. If you think about

it, we are constantly rebuilding the city infrastructure. Everything is designed to last 30-50 years, so every time we rebuild something we can rebuild it smarter. When we re-do a street now we shouldn't be adding stormwater to the meager stormwater infrastructure that we already have. Redeveloped streets should have built in bioretention areas on both sides or in the median. The hard work is the retrofits, which relates to the way that we work. We use the retrofits as an education tool – a way for residents and the public to see the concepts and learn how green infrastructure works, but primarily a way to demonstrate it. We don't have any illusions that we're going to retrofit all of Tucson.

Q: What are the most common challenges in implementing green infrastructure in arid areas and how are you addressing them?

JM: I've gone to several conferences, and pretty much every city always says they're unique and nobody understands their problem. And it's kind of true. The solutions that are going to work in San Antonio aren't going to work in Tucson. It's always going to be a local solution, but the concepts are totally the same. Another challenge that comes up in arid areas is that the predevelopment hydrology involves water laden with sediment and comes with gigantic floods with long periods of drought in between. So in the Southwest we may need to revisit the idea that green infrastructure is about mimicking predevelopment hydrology or add to the idea.

I think that a related challenge is the perception that in a place like Tucson or Albuquerque green infrastructure in general is only going to work for small storms. So you need to have the flood infrastructure as well. We need to straighten out to what degree that perception is true. To what extent can green infrastructure augment or reduce the need for the large-scale gray infrastructure?

Finally there is the perception that green infrastructure is always going to need irrigation in arid areas. First of all, in arid areas green infrastructure is almost always going to need irrigation to get it established, but if it's designed to use the stormwater as a resource then there is a very good chance that you can reduce or eliminate the need for supplemental irrigation in the long term. That's what we have seen in Tucson. If you are using native plants and you capture and use the stormwater effectively, you can, at the very least, reduce the need for irrigation in the long term. In Tucson there is a new ordinance that requires commercial buildings not only to grade their parking lots to landscaped areas, but also to put in irrigation sensors that turn off the irrigation when the soil is moist. I think many arid communities would save tremendous amounts of water with an ordinance like that.

A median planted with native vegetation collects stormwater from this Tucson parking lot. Because the vegetation is drought tolerant, it requires minimal supplemental irrigation.

Q: Describe the project that you are most proud of to date.

JM: We have a program called Neighborhood Leaders and right now we have 20 people from six neighborhoods in Tucson who took 30 hours of training with us over six months. We taught these leaders about community-based retrofit methods and led them through a comprehensive process where they assessed their neighborhoods for green infrastructure opportunities. Now we're in the phase of the program where all of the neighborhoods have EPA funding to do hands-on volunteer workshops and actually build their projects, and it's really exciting to see the projects they're choosing. For example in one case the neighborhood is ripping up the pavement in an abandoned alley and putting in bioretention basins along with some seating areas; basically creating a mini pocket park that captures stormwater. In another case a school with absolutely no stormwater measures is adding a planting area right next to where the kids come in. Those two projects are particularly exciting.

TRAININGS AND CONFERENCES

Integrated Water Management for Buildings and Sites
October 29, 2011. San Diego, CA.

Water Friendly Codes and Ordinances
November 3, 2011. Duluth, MN.

Growing Green Infrastructure in New York State
November 16 – 17, 2011. Syracuse, NY.

CitiesAlive: 9th Annual Green Roof & Wall Conference
November 30 – December 3, 2010. Philadelphia, PA.

7th Annual WERF Research Forum
December 6, 2011. Online Forum.

The Utility Management Conference 2012
January 30 – February 2, 2012. Miami, FL.

AWWA 2012 Sustainable Water Management Conference & Exposition
March 18 – 21, 2012. Portland, OR.

2012 Arid LID Workshop
March 27 – 29, 2012. Tucson, AZ.

Stormwater Symposium 2012
July 18 – 20, 2012. Baltimore, MD.

New Green Infrastructure Certificate Program
Beginning this fall, the Pratt Institute's Center for Continuing and Professional Studies is offering a green infrastructure certificate program. The program consists of two comprehensive courses on green infrastructure design, construction, maintenance, and monitoring. Brooklyn, NY.

PUBLICATIONS

Barriers and Gateways to Green Infrastructure. Clean Water America Alliance: Washington, DC. Released September 2011.

Managing Stormwater in Redevelopment and Greenfield Development Projects Using Green Infrastructure. ECONorthwest: Eugene, OR. Released June 2011.

The Value of Green Infrastructure: A Guide to Recognizing Its Economic, Social and Environmental Benefits. Center for Neighborhood Technology: Chicago, IL. Released January 2011.

Examination of Thermal Impacts from Stormwater Best Management Practices. UNH Stormwater Center: Durham, NH. Released January 2011.

Using Green Infrastructure to Manage Urban Stormwater: A Review of Selected Practices and State Programs. University of Illinois at Chicago: Chicago, IL. Released June 2010.

We also welcome you to view EPA's newest videos on Green Infrastructure and Low Impact Development:
Building Green: A Success Story in Philadelphia
Reduce Runoff: Slow It Down, Spread It Out, Soak It In

Before and after pictures from the Elmer Avenue green street retrofit in Los Angeles, CA. Photo courtesy of Edward Belden.

For more information on managing wet weather with green infrastructure please see our website at: www.epa.gov/greeninfrastructure. To be added to an email distribution list for future issues of this newsletter, or to submit items of interest for future issues, send an e-mail to mittman.tamara@epa.gov.