

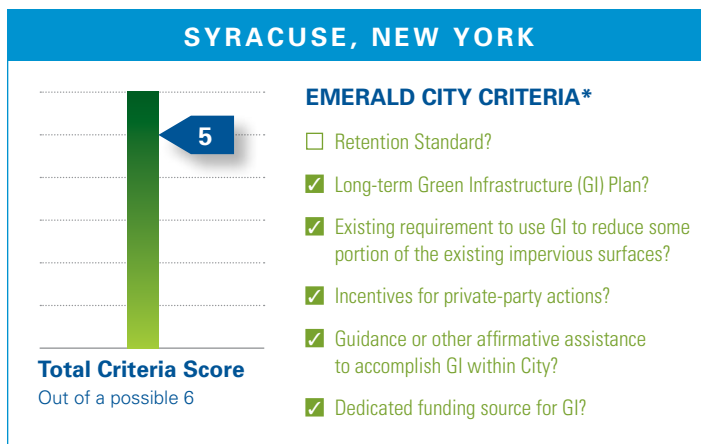
SYRACUSE, NEW YORK

A CASE STUDY OF HOW GREEN INFRASTRUCTURE IS HELPING MANAGE URBAN STORMWATER CHALLENGES

TYPES OF GREEN INFRASTRUCTURE USED: Green roofs, rain barrels/cisterns, permeable pavement, rain gardens, vegetated swales, street trees, green streets, planter boxes



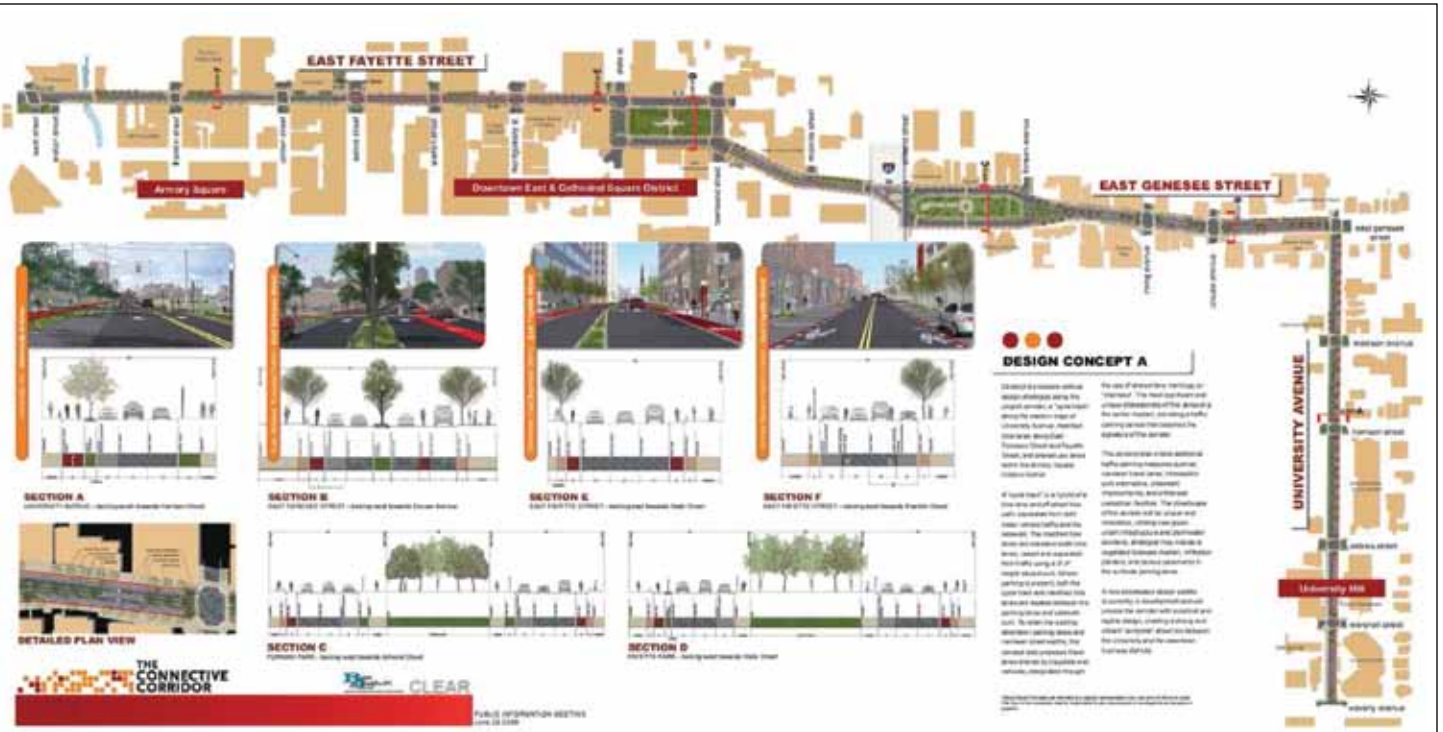
In 2009, when Onondaga County gained federal court approval of its new Save the Rain program, Syracuse became the first community in the United States with a legal requirement to reduce sewage overflows with green infrastructure. The county's strategy integrates both green and gray approaches to meet binding CSO targets phased in over nine years. Green infrastructure investments, totaling nearly \$80 million, will account for nearly two-thirds of future CSO reductions. The program is funded with a combination of sewer fees and low-interest loans and grants from the state. The county has installed a number of demonstration projects and expects to complete at least 50 projects by the end of 2011. To encourage green infrastructure on private property, the county has launched a comprehensive public outreach and education program and provides financial incentives in the form of a direct grant program and rain barrel giveaways. There is currently no retention standard for new development or redevelopment, but the county is working with the city of Syracuse on a new ordinance that may include such a standard.



BACKGROUND

Onondaga Lake, located on the northern edge of Syracuse, was at one time “arguably the most polluted lake in the United States.”¹ The roughly 4.6-square-mile lake, whose 285-square-mile drainage area includes two counties, one city, 18 towns, six villages, and the Onondaga Nation Territory,² has long suffered from pollution problems due to its highly urbanized surroundings.^{3,4} As a means of addressing this pollution, in 2009 Onondaga County (which includes the city of Syracuse) became the first metropolitan area in the United States with a binding legal obligation to build green infrastructure to achieve specific, quantitative reductions in combined sewer overflows (CSOs).

Beginning in the 1800s, power plants, steel mills, and other manufacturers used the lake and its tributaries as a dumping ground for their waste.⁵ With little or no regulation, industrial pollution from mercury, PCBs, pesticides, creosotes, heavy metals, PHAs, and volatile organic compounds severely degraded the lake's water quality.⁶ Parallel to the industrial discharges, wastewater from municipal sources has similarly been a problem since the late-19th century. In the 1940s the



The Connective Corridor showcases the diverse art and cultural assets of Syracuse, igniting a resurgence of economic development, tourism, and urban residential smart growth. In addition to its focus on culture, the Connective Corridor will feature creative lighting, sustainable transportation options, green infrastructure, technological hot spots, and more.

lake was deemed unsuitable for swimming. In 1970, fishing was banned due to concern over the level of contaminants in fish.^{7,8} Although regulation of discharges after the passage of the Clean Water Act in 1972 helped to mitigate industrial pollution and improve the lake's condition, the damage has been lasting. In 1994 the entire lake bottom as well as certain sites around the lake were added to the federal Superfund list.⁹

As industrial pollution waned, water pollution from municipal sources came sharply into focus. One major pollution source was the discharge of excess ammonia and phosphorus from Onondaga County's Metropolitan Sewage Treatment Facility. Another key source was—and continues to be—the county's aging combined sewer infrastructure.^{10,11}

In 1988 the Atlantic States Legal Foundation (ASLF), joined by the state of New York and the New York State Department of Environmental Conservation (NYSDEC), brought a lawsuit against Onondaga County to prevent raw sewage overflows from polluting Onondaga Lake and to reduce pollutant loadings from the Metro plant. The case resulted in a consent judgment, in 1989, requiring the county to evaluate the need for upgrading Metro and providing treatment of the CSOs in the Metro service area.¹² In 1998, the consent judgment was amended to incorporate a 15-year schedule to construct various upgrades to the Metro plant and the sewer system. At that time, the system was capturing and treating only 74 percent of the annual wet weather flow through the combined sewer system; the amended consent judgment required the county to achieve 95 percent capture and treatment.¹³

SYRACUSE'S 2009 AMENDED CONSENT JUDGMENT

Over the next two decades, the county proceeded down a path that strictly used gray infrastructure to mitigate its water problems. While nutrient loading has been significantly reduced since the 1989 judgment,¹⁴ millions of gallons of sewage overflow continue to pollute the lake and its tributaries after storm events.¹⁵ Further, the county's gray infrastructure approach to CSO abatement was met with increasing resistance from the community, especially after the first of four regional treatment facilities (RTFs) was built in 2007 amid much controversy in a low-income, primarily African-American neighborhood.^{16,17,18} Community groups and organizations had strongly objected to the construction of this RTF for fear it would put unfair burdens on the disadvantaged neighborhood and its residents, including being inconvenienced during construction and subjected to potential odors and stigma when it was completed. This local opposition, coupled with the potential for cost savings, was largely the impetus behind the decision to seek an alternative to the three additional RTFs slated for construction.

With the election of new local officials in 2008, ASLF and the Onondaga Nation initiated talks about the alternatives with county and city officials, who then solicited input from local environmental and community groups, the State University of New York Environmental College of Science and Forestry (SUNY ESF), and the New York State Department of Environmental Conservation (DEC) to identify green alternatives for CSO mitigation.¹⁹ In November 2009,

with consensus among these stakeholders and an official statement of support from EPA,²⁰ the federal court approved an amendment to the consent judgment that eliminated the three planned RTFs and explicitly required the use of green infrastructure technology to reduce sewer overflows to Onondaga Lake and its tributaries.^{21,22,23} Syracuse and Onondaga County thus became the first community in the United States to be legally required to meet binding targets for CSO reduction by using green infrastructure.

As of 2009, the county's sewer system was capturing 84.6 percent of wet weather flow in a typical year. The amended decree requires 95 percent capture by 2018 using a combination of green and gray approaches—resulting in more pollution reduction than the original decree, since the RTFs would have provided only partial treatment of combined sewage and stormwater, whereas green infrastructure both treats stormwater and frees up capacity for sewage treatment plants to accept, and fully treat, greater volumes of sanitary sewage.²⁴ Nearly two-thirds of the future CSO reductions will come from the use of green infrastructure.²⁵

ONONDAGA COUNTY'S SAVE THE RAIN CAMPAIGN

The county is now embracing the unique opportunity to meet its CSO reduction mandates by using green infrastructure practices. The County Executive's office has launched Save the Rain, a comprehensive plan to incorporate green infrastructure into all types of land use in the city to manage stormwater, restore Onondaga Lake, and more generally to "cultivate a green urban culture in Syracuse," while also including certain localized gray infrastructure improvements such as storage facilities and sewer separation.²⁶ The use of green infrastructure will be divided into 10 program types, including streets, parks and open space, rooftops, public facilities, grants that will incentivize green infrastructure retrofits on private property, and a stormwater ordinance. Each program type has more than one strategy for implementing green infrastructure retrofits. The total 2011–2018 green infrastructure budget for the Save the Rain program, with funding from sewer fees, state low-interest loans, and grants, is approximately \$78 million.^{27,28} Notably, some estimates have indicated that Save the Rain, with its balance of gray and green infrastructure, will save the county as much as \$20 million compared with traditional CSO mitigation programs.^{29,30}

A handful of projects have already been implemented. The Pearl Street parking lot retrofit project, completed in 2010, transformed an existing 1-acre asphalt/gravel lot into a lot partially covered with porous pavement, including

25,000 square feet of subsurface infiltration to capture an estimated 1.3 million gallons of stormwater runoff annually.³¹ A stormwater retrofit project at City Parking Lot #3 included the conversion of a traditional lot into one with porous pavement, plus the planting of 26 trees in the interior of the lot and along its perimeter; an estimated 678,000 gallons of stormwater will be captured annually there.³² The Townsend Median stormwater retrofit project, completed in 2011, included redesigning the median to be below surface grade to allow approximately 317,000 gallons of stormwater runoff capture per year. The project also included the planting of four "stormwater trees," with new inlets built into the existing curb to allow stormwater runoff to infiltrate the soil around the trees.³³

AN AMBITIOUS PLAN FOR GREEN INFRASTRUCTURE: SAVE THE RAIN—PROJECT 50

After several years of extensive planning, Onondaga County began construction on a long list of green infrastructure projects. The county has identified 82 potential projects to date and has a goal of advancing 50 during calendar year 2011: the Save the Rain—Project 50 campaign.^{34,35} Projects in the pipeline vary widely in their size and expense, ranging from a 3,500-square-foot porous sidewalk that will capture around 60,000 gallons of water annually to a 12-acre wetlands project that will capture an estimated 14.9 million gallons per year.³⁶

To meet its commitment to 95 percent total volume capture by 2018, the county will need to capture 250 million gallons per year. While it aims to achieve this capture for an average of about 35 cents per gallon, the county is willing to spend more on certain high-profile projects because "they will generate significant dialogue in the community, and also showcase the whole [green infrastructure program] nationwide."³⁷ One key example is the project planned for the War Memorial Arena, home to the Syracuse Crunch hockey team: the installation of a \$1 million system to collect rainwater from the roof in cisterns and then filter, disinfect, and use the rainwater to make ice for the hockey rink. The collected rainwater will also be used for irrigation around the facility, and will potentially replace potable water in the facility's heating/cooling system.^{38,39,40} The county recently received a \$712,000 grant for the system, which will capture around 366,000 gallons per year,⁴¹ through the New York State Environmental Facilities Corporation's Green Innovation Grant Program.⁴²

Another prominent project will be the construction of a massive green roof on top of the Nicholas J. Pirro Convention Center. Built for an estimated \$1 million, the 1.5 acre green

roof will be one of the largest in the Northeast, absorbing an estimated 1 million gallons of rain annually that would otherwise run into the combined sewer system.^{43,44,45}

ADDITIONAL PROGRAMS AND STRATEGIES TO REDUCE STORMWATER IN SYRACUSE

In addition to the short-term goal of advancing 50 green infrastructure projects in 2011, Save the Rain includes a number of longer-term programs that aim to implement, or promote the implementation of, green infrastructure on public and private property. For example, Onondaga County is initiating an Urban Forestry Program. Partnering with the city of Syracuse, the county will plant 8,500 trees in neighborhoods throughout the city.⁴⁶ Tree species will be chosen on the basis of their appropriateness for the region and ability to sustain a canopy for maximum rainwater capture, and a long-term maintenance program will be implemented to ensure that these trees are being cared for appropriately. Additionally, a sophisticated asset management system called Maximo will be used to manage these trees.^{47,48} Onondaga County is also adding green infrastructure elements to its conventional storm water storage projects. Interceptor sewer construction restoration includes rain gardens, tree plantings and infiltration boxes, and more than 10 million gallons of constructed storm water storage facilities include rainwater reuse systems and bioretention.⁴⁹

The county is also taking steps to encourage the use of green infrastructure on private property. A rain barrel program, funded in 2009 by grant money through New York State's Green Innovation Grant Program, provides free rain barrels to homeowners in designated CSO sewer sheds in Syracuse. To receive a rain barrel, residents must attend a brief workshop on rain barrel installation and maintenance; a companion guide is available online. To date, the county has distributed more than 300 rain barrels to local residents^{50,51,52} and aims to have more than 1,000 in use within the next two years. The county also aims to develop a more sophisticated tracking system for the rain barrel program, making use of GIS data to pinpoint where the barrels are located.⁵³

Additionally, the county has developed a multimillion-dollar Green Improvement Fund (GIF) that offers grants for green infrastructure retrofits on private property, including businesses and nonprofits, in combined sewer drainage areas.^{54,55,56} Projects that have received funding include, but are not limited to, tree trenches, planter boxes, porous swales, rain gardens, green roofs, green streetscapes, and cisterns.^{57,58}

Save the Rain has launched a comprehensive public outreach campaign that includes green infrastructure education at the neighborhood level, within the public

school system, and via a new website (www.savetherain.us). Green infrastructure design charrettes, public meetings, and workshops are frequently held within local communities, and every third-grade class in the city of Syracuse is learning about green infrastructure. The county has also partnered with a number of community-based organizations that offer additional support for green infrastructure. For example, some groups offer workshops for residents on creating rain gardens and constructing rain barrels. The county is considering fee structures based on impervious area for future implementation and is currently working with the city of Syracuse on revisions to the current ordinance that may ultimately require enhanced stormwater mitigation on redevelopment projects.^{59,60}

GREEN JOBS TRAINING IN SYRACUSE

While Onondaga County proceeds with its Save the Rain campaign and continues to identify and execute green infrastructure projects, two programs providing green jobs training for Syracuse residents, particularly those in underemployed demographic groups, have been established in the region. SUNY ESF operates a training program that partners with regional organizations to train unemployed or underemployed residents in development and implementation of green infrastructure projects such as rain gardens, permeable pavers, and urban forests.⁶¹ Additionally, in 2010 CNYWorks won a \$3.7 million grant from the U.S. Department of Labor to train up to 750 Syracuse residents in energy efficiency, renewable energy, and green infrastructure jobs over a two-year period.⁶²

MEASURING THE EFFECTIVENESS OF SYRACUSE'S GREEN INFRASTRUCTURE

To satisfy the CSO reduction requirements of the amended consent judgment, the effectiveness of all green infrastructure projects must be quantifiable. Onondaga County uses a cost-effectiveness calculator on every project to compare the proposed project costs with actual costs of completed projects of similar scope, to ensure that the county is paying for the most cost-effective green infrastructure projects.⁶³ For every project undertaken with public funds, the Save the Rain website will include fact sheets detailing costs and stormwater capture volumes, as well as technical plans and specifications.⁶⁴ After projects are completed, performance evaluations are used to monitor the effectiveness of different types of capture practices. Additionally, as mandated by the amended consent judgment, the county has developed a comprehensive Ambient Monitoring Program (AMP) for Onondaga Lake and its tributaries to assess the program's

overall performance and impact on the lake. If the green infrastructure projects undertaken under the Save the Rain program are functioning properly, then AMP data should demonstrate reduced nutrient loading from captured runoff as well as reduced contamination from CSO events.⁶⁵

Currently, metrics illustrating the ancillary benefits of green infrastructure are being developed. The county has partnered with a number of organizations to measure these additional benefits, including U.S. EPA, Syracuse University, and SUNY ESF. A few examples of the benefits that will be studied include air quality improvements, economic impacts, mitigation of the urban heat island effect, energy savings, and recreational and transportation improvements. Syracuse University recently approached the county about conducting on-site monitoring of the aforementioned Nicholas J. Pirro Convention Center green roof. In addition to measuring the roof's stormwater capture, the university will also measure energy savings and the reduction of the heat island effect.⁶⁶

On April 20, 2011, the EPA recognized Onondaga County's efforts by selecting it as one of 10 green infrastructure partner communities in the United States. The EPA's Green Infrastructure Partnership program focuses on identifying opportunities and providing technical assistance to communities implementing green infrastructure approaches to control stormwater runoff.⁶⁷ The EPA will partner with Onondaga County to exchange information regarding green infrastructure best management practices utilized in Syracuse, highlighting the county's program as a model for other municipalities on how to implement effective green infrastructure programs.

***EMERALD CITY RATING SYSTEM**

Each of the cities profiled in *Rooftops to Rivers II* is a leader in green infrastructure investment—rethinking the design of municipal services and infrastructure. These cities leverage funding in creative ways. They provide tools to residential and commercial land owners to retrofit private properties and realize the multiple benefits provided by green infrastructure. In short, they are changing how cities look and function.

NRDC's Emerald City Rating System identifies six actions cities should undertake to maximize their green infrastructure investment. Our metric does not directly compare one city to another, due to geographical, population, budgetary and other differences. Instead, it identifies the presence or absence of common factors of success that NRDC believes are essential elements of a robust green infrastructure commitment. Only one city profiled, Philadelphia, is undertaking each of the actions identified, although each city is undertaking at least one.

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