

Project Groundwork: Sustainable Infrastructure Broadens the Options

Consent Decree Negotiation Facilitates Sustainable Infrastructure Solutions

Consent Decrees are the product of intensive negotiation between all parties involved. In MSD's case, we worked with the regulators and other interested parties to ensure the affordability of the program, flexibility in project selection, and that MSD's wet weather strategy supports the goals of the Consent Decree. The Consent Decree provides for the incorporation of sustainable source control solutions, and MSD has adopted a three-pronged approach to evaluate and implement these techniques. The strategic prong focused on optimizing the solutions for reducing CSOs, especially stormwater source control. The flexibility prong enabled us to investigate and demonstrate the value of sustainable infrastructure solutions in the overall wet weather program approach. Finally, and importantly, the economic prong insisted on an affordable solution for ratepayers. Because of this focus, our source control demonstration projects are documenting the economic value of these solutions in addition to technical parameters.

Project Groundwork is MSD's program for meeting the requirements of the federally mandated Consent Decree. The detailed projects and plans for Project Groundwork are posted at the dedicated program Web site, at www.projectgroundwork.org.

Project Groundwork is one of the largest public works projects in the history of our community, costing an estimated \$3 billion by the time the second phase is complete, and involving the construction of new, separated sewer infrastructure, enhanced treatment capacity at MSD's wastewater treatment plants, and installation of rainwater source controls.

In this section, we present a special aspect of Project Groundwork's Wet Weather Strategy that incorporates both environmental and social aspects of sustainability – the sustainable infrastructure strategy for “source control” and the potential community benefits that can be realized through integrated public/private planning and investment.

Source Control: A Key Aspect of the Wet Weather Strategy

To achieve the required improvements, MSD's Wet Weather Strategy focuses on storage and conveyance, treatment, and source control. The first two approaches represent a more traditional approach to wet weather improvements, which entails collecting, conveying, and treating combined rainwater and sewage. The third approach – source control – is more strategic. It involves diverting rainwater from the sewer system, thereby eliminating the need to convey and treat essentially “clean” water.

Source control techniques use natural systems (such as forests, fields, ponds, and streams), or simulations of natural systems (such as green roofs, porous pavement, bioswales, and raingardens). These systems are designed to detain or drain stormwater into the soil or allow it to evaporate into the atmosphere. Sometimes, this type of infrastructure is called “green” or “sustainable” because it mimics the processes that nature uses to soak up rain.

Figure 7 shows a variety of source control techniques being evaluated. Source control is the greatest leverage point for solving the CSO problem as required by the Consent Decree, because clean rainwater entering the sewer system is the primary cause of CSOs. If these types of solutions are installed at many locations within a watershed, they could radically reduce the amount of stormwater entering the sewer system during a rainstorm.

Figure 7: Sustainable Source Control Techniques



Bioswales are designed to capture stormwater, filter out pollutants, and reduce flooding.



Green roofs not only detain stormwater – they also insulate buildings and create habitat for birds and insects.



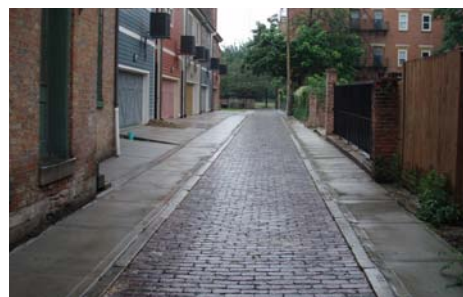
Reforestation restores the natural water balance in the region and enhances water quality in streams.



Community garden create permeable open space and make great places for people to meet and play.



Native meadows naturally absorb rainwater, keeping it out of storm drains and streams.



Pervious pavers help rainwater seep into the ground, thereby helping to reduce stormwater runoff.

MSD's SWEP – Looking at Sustainable Wet Weather Solutions by Watershed

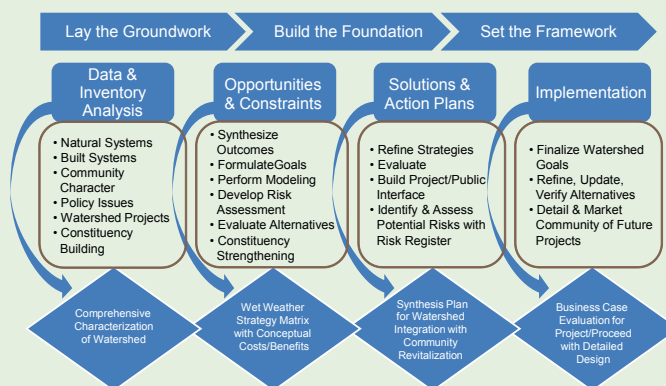
To create successful outcomes for wet weather projects, MSD needed to develop a systematic approach to identify opportunities for source control of rainwater. Keeping rainwater from entering the sewer system can lower construction costs of future infrastructure, and more importantly can provide the best opportunity to keep future annual costs as low as possible.

MSD developed the Sustainable Watershed Evaluation Process (SWEP), to take stock of ambient conditions and consider a wide range of options and strategies before determining the best way for reducing the volume of CSOs.

In South Fairmount (see the story on page 21), the SWEP was used to identify and evaluate existing and historical conditions of natural resources, infrastructure (roads, sewers), and socio-economic factors. The evaluation allowed MSD to develop a wet weather strategy and systematically determine how to best address wet weather needs in

different locations and conditions. The process identified four different approaches to be deployed throughout the Lick Run watershed to achieve a potential reduction of over 1 billion gallons of overflow reduction.

The MSD Sustainable Watershed Evaluation Process



Aside from reducing CSOs, source control offers many other environmental and social benefits. When rainwater is removed, it frees up capacity in the sewer system for sanitary sewage flow and vastly reduces the number of overflows into local streams. This reduces the public health threat caused by the pollutants in the CSOs, improves water quality for recreation and aquatic life, and eliminates offensive odors and unsightly debris. It also lowers the operation and maintenance costs at wastewater treatment facilities.

MSD's program to support and investigate source control options follows three avenues, with the purpose of substantiating the technical, economic, social, and environmental costs and benefits of these techniques.

- **Direct Implementation** – Through Project Groundwork, MSD has begun the planning, design, and implementation of sustainable CSO reduction projects. These projects are funded and staffed by MSD.
- **Enabled Implementation** – MSD has assisted project partners to construct demonstration and early success projects.
- **Inform and Influence** – MSD encourages other organizations to research and deploy source control installations, by providing information and education.

MSD selected projects to demonstrate early successes and measure real impacts in terms of source control. The following project examples feature the kind of sustainable solutions, community partnerships, and results that MSD is striving to achieve.



Rain barrels collect stormwater from roofs making it available for garden irrigation.



Rain gardens soak up stormwater before it runs off into streets and sewers.

American Red Cross Demonstrates and Educates

The American Red Cross recently built a new headquarters located just off Interstate 71, between Evanston Avenue and Realistic Avenue, in Cincinnati. The project site is located at a CSO structure currently averaging 58 annual overflows, resulting in 201 million gallons of annual overflow volume.

As part of Project Groundwork's enablement projects, MSD sponsored the American Red Cross' effort to construct two source control features, including a 2,000-square-foot, sloped, vegetative roof and a 13,330 square-foot bio-infiltration area. The sloped roof will be highly visible and will demonstrate the effectiveness of green roofs in reducing the volume of rooftop runoff. The bioinfiltration basin will store stormwater so that it doesn't contribute to peak flows in combined sewers, and it will reduce stormwater flow overall by enabling stormwater seepage into the ground. As a result, in a typical year of rainfall, the combined annual runoff volume could be reduced by nearly 978,000 gallons.

The American Red Cross coupled a significant educational program with these features, so that visitors could learn about the benefits of source control. The educational program included posters, brochures and flyers that highlight the stormwater management systems and MSD's role in this project. An interactive, electronic touch-screen display describes the major components. The data from a flow monitor is also incorporated into the interactive display.



North Fairmount Spray Aquatic Park: Early Success with Source Control

Like many cities, the Cincinnati Recreation Commission (CRC) is making investments and enhancing community value by reinventing urban aquatic parks. The Commission is pressed to eliminate traditional swimming pools and construct facilities with lower operating costs, such as spray water parks. Since many of the CRC facilities are also located within the same watersheds where MSD needs to remove stormwater from the combined sewer system, MSD is seeking to collaborate with some of these planned public investments.

In the Denham Watershed, the CRC had planned to construct a spray park in the North Fairmount Community and MSD was looking for strategic stormwater source reduction projects. These dual goals can give rise to a collaboration that created a win-win for the CRC, MSD, and the community of North Fairmount.

The result is a spray park funded by CRC and scheduled to open in June 2011, for which MSD is contributing buried infrastructure (a 60" separate storm sewer within the park footprint for future MSD stormwater separation work), porous concrete for the walkways around the park, and a 2-acre bio-infiltration basin to improve water quality. The addition of the bio-infiltration basin will expand the park boundary and add environmental education features, thereby enhancing the park's value to the community. While the CRC project requires MSD to accelerate its timeline for Project Groundwork in this area, doing so will reduce the negative impact of future construction on the same property.



Wyoming Rain Barrel Project Uses the Power of Multiplication



In the City of Wyoming, the total average overflow volume amounts to about 9 million gallons per year. As part of a pilot program to reduce CSOs to the Mill Creek, MSD and the City of Wyoming teamed up to offer Wyoming residents rain barrels at a sharply discounted price. Rain barrels help manage stormwater runoff by cutting down on the amount of runoff entering the storm sewer system. While one rain barrel may not have a great impact, the installation of many can help reduce the regional combined sewer overflow problem. For example, a 1,000-square-foot roof can generate 24,600 gallons of runoff a year. Multiply this by a thousand homes, and the runoff volume climbs into the millions of gallons.

In June 2010, 206 rain barrels were sold to property owners. Roughly half the property owners purchased more than one barrel. MSD is working on how to verify that rain barrels were installed and to quantify the volume of rooftop runoff captured by the rain barrels.

Cincinnati Zoo Leads in Green Infrastructure Projects

Aiming for high impact and high visibility, MSD partnered with the Cincinnati Zoo in an effort to remove the Zoo from the stormwater grid. The first project, located at the Zoo's Main Entry, incorporates over 30,000 square feet of pervious pavers; a rainwater harvesting, storage, and irrigation reuse system; and bioinfiltration of collected runoff via the nearby elephant moat.

MSD is monitoring these features through a series of shallow wells and measuring flow volumes in the nearby combined sewer. MSD provided funding for installation of small-scale stormwater controls, including a rain garden, pervious concrete and a green roof in an educational Green Garden located behind the entry court. This project was completed in April 2009. Since then, over 1 million zoo visitors have walked over the pervious paving and enjoyed viewing lush vegetation kept healthy by the reuse of rainwater.

The second project, now under construction, is in the new African Savannah exhibit. MSD funding will be used to replace an asphalt parking lot with pervious surfaces, including grasses, with enhanced soils and porous concrete walkways. A new 55,000-gallon underground storage facility will re-distribute rainwater collected from nearby roofs and hard surfaces to an irrigation system, and replenish water in Swan Lake and the Zoo's bear pools. We anticipate that these features will capture between 12 and 15 million gallons of stormwater runoff in a typical year.



MSD worked with the Zoo to help design, fund, manage, and construct this project. Focused on enabled implementation of projects such as this, opportunities for cost sharing and collaboration between MSD and key watershed stakeholders are a vital element to MSD's approach to help reduce overall treatment costs and meet the demands of the Consent Decree. Through an internal grant program, MSD is able to offer funding to support these types of green infrastructure improvements. In return, MSD hopes to demonstrate savings in CSO control and treatment costs as green infrastructure is integrated into the traditional pipe catchment method.

Furthering our partner's goals as well, the stormwater source control improvements at the Zoo has contributed to part of an ongoing, award-winning effort by the Cincinnati Zoo to establish itself as "the greenest zoo in America." The Cincinnati Zoo will now serve as a nationwide educational resource to learn not only about elephants and giraffes, but also about the many benefits of source control.



Cincinnati Zoo New Main Entry with MSD-Funded Storm Water Control

Transformation in Center Hill: From Landfill to Light Industrial Development



Through early actions surrounding the Consent Decree, MSD began design and construction of six Supplemental Environmental Projects (SEPs). Starting in 2004, our collaboration with Mill Creek Restoration, a local nonprofit organization dedicated to improvement and restoration of the Mill Creek watershed, ensured that the SEP projects would leverage work that was already being done.

Four of the SEPs involved stabilizing a stream bank and constructing more than a mile of Greenway trail extending to the Elmwood Place Landfill and the Center Hill Landfill. The projects included building leachate collection systems that would prevent further landfill pollution from entering the creek. At the same time, the City of Cincinnati was assessing and remediating the landfills as a part of their Strategic Property for Urban Redevelopment (SPUR) program. The 60-acre Center Hill site, a SPUR district, is located less than a mile west of

the Winton Hills neighborhood and could support up to 500,000 square feet of new light industrial space. If the project achieves its potential, City officials estimate that it could bring up to 500 new jobs to the area, while adding \$1 million in annual property tax revenue and just under \$500,000 in earnings tax revenue.

Within 5 years, the City of Cincinnati obtained the Covenant Not to Sue (CNS) from the Ohio Environmental Protection Agency, making the site ready for redevelopment as the Center Hill Commerce Park. Now, with filling operations nearly complete, the City is preparing for negotiations with several light industrial end-users that have expressed an interest in the site. A lasting legacy of MSD's contribution, this SPUR district has the first mile of constructed Greenway Trail along Mill Creek.

Bioinfiltration Basins at St. Francis Court Apartments

Located in Cincinnati's South Fairmount neighborhood, the St. Francis Court Apartments occupy nearly 11 acres just north of Queen City Avenue. This landmark property was formerly the St. Francis - St. George Hospital. During rainstorms, stormwater used to flow down the steep hillsides south of Harrison Avenue to the St. Francis property. On the property's eastern vacant concrete parking lots, stormwater had nowhere to go but into the combined sewer system.

Based on a typical year of rainfall, annual stormwater flow from the property is about 417,000 gallons. To help reduce the volume of stormwater runoff from this site, the property owner agreed to partner with MSD on the project to remove two underutilized parking lots and replace them with two large rain gardens, also known as bio-infiltration basins.

Although the basins look like regular gardens, they use special soils and native plant species to absorb and clean stormwater runoff. The upper rain garden captures stormwater flowing off the adjacent hillside. The lower rain garden captures excess flow from the upper garden. The site also includes a walking path for maintenance as well as community gardens for residents to grow plants and vegetables. In addition, trees were planted along the eastern half of the property and along the southern edge of the main parking lot to help provide shade and stormwater benefits.

This project provides numerous benefits to both MSD and the South Fairmount community, including:

- The rain gardens will reduce the volume of stormwater entering MSD's combined sewer system by about 27 percent.



- The garden plants will absorb and cleanse stormwater while simultaneously providing habitat and food sources for insects, birds, and butterflies.
- Trees will help capture rainfall while also providing attractive landscaping for this highly visible site.
- Community gardens will give residents an opportunity to meet each other and grow their own produce.

Leverage for Creating Community Value

The Consent Decree requires MSD to make significant investments in wet weather infrastructure in order to achieve the mandated reduction in CSOs. The scope and scale of these investments offers a unique platform, from which MSD and its partners can leverage additional investments in brownfield development, urban revitalization, and the creation of livable communities.

Sustainable stormwater source control, described earlier, is a central part of this strategy. Because sustainable source control solutions typically feature vegetation, landscaping, and water features, they can do double-duty as parks and trails for walking and biking. Such amenities, according to the Trust for Public Land, are important investments in community well-being that contribute to economic development and urban renewal. MSD is contributing its expertise in source control to several projects aimed at community revitalization, including the examples shown here.

Communities of the Future Brings Sustainability Into Focus Through Source Control

An MSD initiative called Communities of the Future is leading the development of an alternative vision for MSD's largest CSOs – a vision that addresses the source of the problem (rainwater) and marries this source control strategy with community revitalization. MSD has designated the Lick Run as our first, fully integrated effort to develop a sustainable solution for the community based on source control.

South Fairmount was first settled in the early 1800s around the Lick Run, the primary stream in this watershed that drains to Mill Creek. As Cincinnati grew, roadways, buildings and sewer pipes gradually replaced streams and trees. The resulting increase in runoff led to increased frequency and intensity of flooding events and sewer overflows. Gradually, Mill Creek and tributaries like Lick Run became the dumping ground for human and industrial waste.

To move the waste away from the South Fairmount neighborhood and resolve this public health threat, several tributaries of Lick Run were enclosed within a large sewer pipe. That 19.5-foot-diameter pipe remains today, running a distance of 3,700 feet along buildings and streets. It connects to CSO #5, a relief outfall at the east end of Queen City Avenue that overflows into Mill Creek during heavy rains. Each year, about 1.7 billion gallons of combined sewage and stormwater overflow

through this CSO. Of that total, only 25 percent is sewage; the rest comes from stormwater drains and what used to be natural stream flow.

Today, the South Fairmount area faces many challenges. People who live in this neighborhood bear one of the highest unemployment rates, lowest median household incomes, and highest school dropout rates in the region. The area also has a high volume of under-utilized lands, brownfields, and abandoned properties.

The Communities of the Future watershed solution for Lick Run includes the installation of over 75,000 linear feet of strategic storm sewers or reconstructed waterways along with retention basins for storage. Reforestation and downspout disconnections were identified as other strategic methods to apply in selected areas, resulting in a whole-systems approach to wet weather control. The resulting improvements can help to spur revitalization efforts and improve the quality of life within the neighborhood, while achieving the wet weather goal of reducing the amount of water that must be sent to a tunnel to be pumped and treated.

The pictures below illustrate source control and reconstructed waterway solutions that create community value in Kalamazoo, Michigan, and could be used for the Lick Run.



Revive Cincinnati Puts Source Control to Work

The Cincinnati I-75 Corridor is a dynamic area with key transportation routes and infrastructure, major industry, and established neighborhoods. The City of Cincinnati and MSD are jointly conducting the Revive Cincinnati neighborhood study, which capitalizes on Ohio Department of Transportation investments, GO Cincinnati, Agenda 360, and multiple community renewal efforts. The project has four focus areas:

- Mitchell Avenue Interchange
- I-74 Interchange
- Hopple Street Interchange
- Queensgate/Central Business District

The project seeks to create beautiful, viable neighborhoods along the I-75 corridor that offer attractive places to live, work, and play. To achieve this vision, the City of Cincinnati and MSD studied

opportunities for creating community value, neighborhood revitalization, and transportation improvements. After an extensive community involvement process, the final plan for Revive Cincinnati will be put before the City Council for adoption in the final quarter of 2010. The Revive Cincinnati plan will also be incorporated into the City of Cincinnati's Comprehensive Plan.

MSD's contribution to the plan was to promote the use of source control to meet two goals: improve stormwater management and create positive conditions for economic development. The plan includes ecosystem restoration through planting trees, adding wetlands, and building raingardens throughout the corridor. The result will reduce peak stormwater flows while enhancing property values, create more livable communities, and attract new businesses.

