



Managing Cleveland's Stormwater through Green Design

Hundreds of U.S. cities, with a combined population of about 40 million people, have water infrastructure where stormwater and human sewage mingle in the same network of underground pipes. In a combined sewer system, rainwater typically enters storm drains, mixes with sewage, and is directed to a water treatment plant. The treated water is then discharged into a nearby stream, river, or lake.

Occasionally, an influx of snowmelt or heavy rainfall can overwhelm treatment plants. As a result, untreated rainwater and sewage is released, along with a host of industrial pollutants, pathogens, and flushed debris, into the nearest water body. These events are known as combined sewer overflows (CSOs).

CLEVELAND AND LAKE ERIE

Cleveland, OH has long struggled with a number of urban stormwater issues, which directly impact the Lake Erie ecosystem. In 2011, the EPA, the State of Ohio, and the City of Cleveland signed an agreement outlining a plan to bring the City of Cleveland into compliance with federal Clean Water Act standards. According to the agreement, Cleveland's Northeast Ohio Regional Sewer District (NEORS) would work with the City of Cleveland to undertake a series of infrastructure projects to reduce CSOs, by modifying the sewage system and installing surface-level stormwater controls. Although sustainable energy systems are being installed in the region, there is a severe lack of technical expertise regarding the maintenance and repair of energy systems, resulting in inefficiencies and shortened system lifecycles. Without ensuring the productivity of new sustainable energy systems, the region will likely continue to rely on diesel fuel generators.

The agreement also earmarked \$42 million for "green infrastructure" projects, or control measures. These include special gardens designed to absorb and redirect stormwater as it moves across parking lots, roadways, and other areas. Plant-based control measures help hold water in the soil, filter out contaminants, provide habitat for native plant and animal species, and reduce erosion and flood risk. Installing bioswales or bioretention gardens can also enhance neighborhoods by transforming vacant land into attractive green space.

In addition, a significant part of stormwater control may be accomplished through "grey infrastructure" projects. Examples include enhancing water treatment plants and building large underground storage tunnels that can hold combined sewage during heavy rain events.

REDESIGNING DOAN BROOK

The Dow Fellows student team focused on improving stormwater management for the Doan Brook stream. The stream flows through several metropolitan areas on the east side of the City of Cleveland, including the City of Shaker Heights and the low-income Buckeye-Shaker neighborhood. Students worked with partners to determine how the Doan Brook Conservation Area could be transformed into inviting, public green space for neighbors and visitors. This series of small parks acts as an important water-retention area and could serve as a valuable public amenity. However, residents are not fully aware of the park system, due to steep banks and thick vegetation separating the stream from their backyards. The project introduces the benefits of small-scale interventions in making Doan Brook more inviting, while controlling the large-scale ramifications of CSOs.

Many existing green and grey infrastructure projects are concentrated around Doan Brook, because it has often borne the brunt of Cleveland's CSOs. For this project, students partnered with the non-profit design organization LAND Studio, and developed a set of new design interventions around the Brook. These would allow visual and/or physical access to the Brook, aiming to resurrect the connection to the water body's role in the city.

STORMWATER-FRIENDLY DESIGN

The Dow Fellows team identified strategic areas where trees could be planted to stabilize eroding banks, and rain gardens could be built to capture rainwater on its way to Doan Brook. To make the Conservation Area more visible to neighboring communities, the team proposed creating staircases, ramps, scenic lookouts, decks, and bridges. These improvements would provide access points for visitors from nearby public transit lines, bike trails, schools, and a senior care facility. Adding bus shelters, bike racks, and paths would make it easier for visitors to reach and explore the Conservation Area. After assigning a priority ranking to each potential design item, the team made recommendations to LAND studio, which is using them to inform future efforts.

COMBINED SEWER SYSTEMS

More than 850 U.S. communities, including Cleveland, rely on combined sewer systems. Since most of these communities are concentrated in Great Lakes states, CSOs pose a direct threat to Great Lakes health. Separating a city's sewage and stormwater infrastructure requires tremendous effort and cost. Thus, the EPA has outlined a variety of alternative control measures for reducing the impact of CSOs. These reduction measures are now required under the Clean Water Act.

URBAN WATERS GRANT

The team's grant proposal to the EPA Urban Waters program focuses on the Buckeye-Shaker neighborhood. The proposed project would engage residents from a low-income neighborhood through a six-week event series designed to convey the benefits of green infrastructure projects, and share information about the Doan Brook watershed region. Events would include design workshops for educational signage, rain barrel demonstrations, nature walks, and storytelling sessions for residents to describe their experiences with Doan Brook.

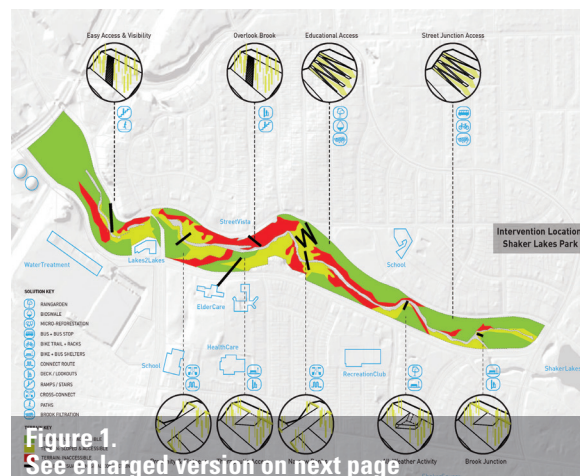


Figure 1. See enlarged version on next page

TEAM MEMBERS

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PROJECT PARTNERS

- LAND studio [<http://www.land-studio.org>]
- Northeast Ohio Regional Sewer District [<http://www.neorsd.org>]
- Gowanus Canal Conservancy
- Newtown Creek Alliance

READ MORE

- Retrofitting Landscapes in Ohio - Full Project Report (PDF) [<http://sustainability.umich.edu/media/files/dow/Dow-Retrofitting-Landscapes.pdf>]
- Dow Masters Professional Fellowship

SUPPORT

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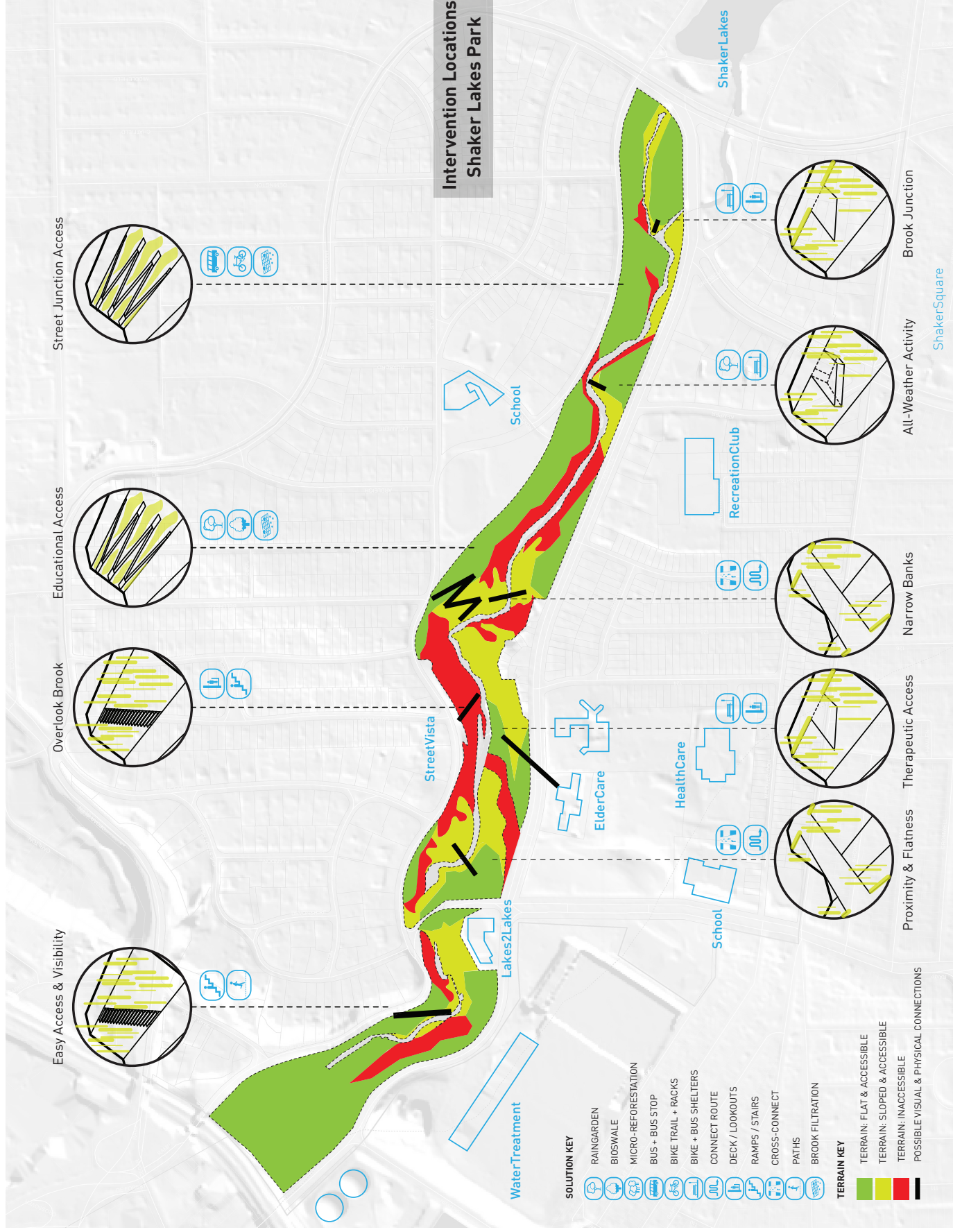


Figure 1: The project team developed a design solution to create inviting public green space adjacent to the Doan Brook stream, including the areas in the City of Shaker Heights and the Buckeye-Shaker neighborhood.



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