BUFFALO NIAGARA RIVERKEEPER®

Buffalo Niagara RIVERKEEPER

Green Infrastructure Presentation

and

CSO No. 60 Pilot Project (Green Streets)

The intent of this presentation is to explain the existing function of combined sewer systems and their impact on human health and public safety. This handbook highlights the usage of sustainable measures such as green infrastructure techniques to manage stormwater.

Older cities have combined stormwater and sanitary sewer systems. As cities grew and development increased, so did the amount of impervious surfaces and has caused these combined systems to overflow. Stormwater has played a major role in the overflow events. The combined sewer systems are adequately sized to handle the sanitary components of the system when storm events occur, rain water flows into the combined system at a rapid rate and overwhelms the existing infrastructure. When this occurs, raw sewage and untreated water are emptied into local waterways to relieve the local water treatment plants and prevent basement backups. The untreated spillage causes harmful pollutants to overflow into locations where people fish, swim and play in the local waterways.

Outline

Introduction to Buffalo Niagara RIVERKEEPER

Stormwater and Combined Sewer Systems

Green Infrastructure as a Solution to Combined Sewer Overflows (CSO's)

Green Infrastructure in Buffalo, NY

Buffalo Sewer Authority

Green Infrastructure Pilot Project

Questions/Comments

BUFFALO NIAGARA RIVERKEEPER®

Defending your right to clean water.

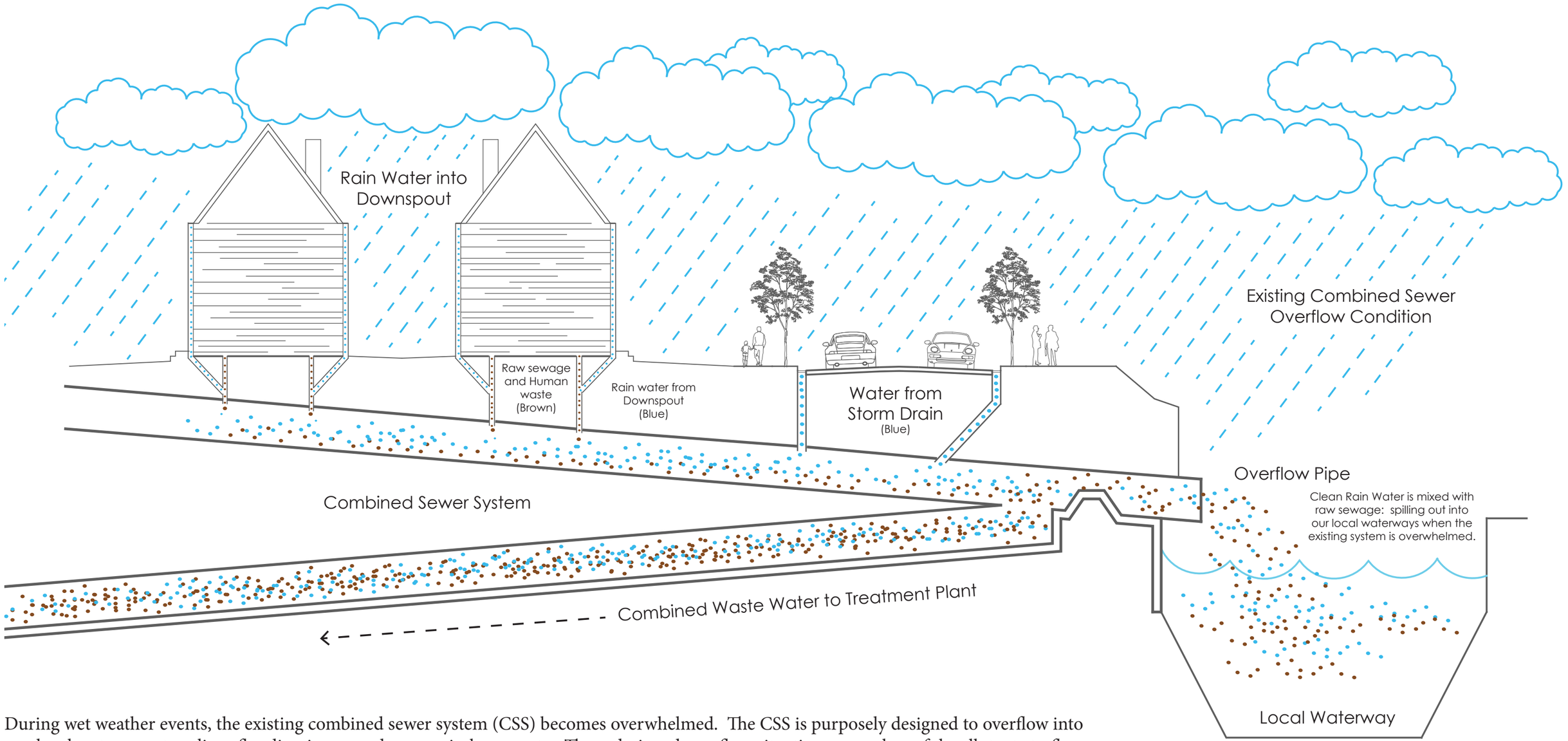
Riverkeeper combines firsthand knowledge of our waterways with an unwavering commitment to the rights of our communities to clean water and for the wise and equitable use of water resources. Our goal is for fishable, swimmable and drinkable waterways throughout the Buffalo Niagara region. Riverkeeper is a member of the global WATERKEEPER ALLIANCE®.

Source: phillywatersheds.org

Stormwater

Stormwater runoff is generated when precipitation from rainfall and snowmelt flows over land or impervious surfaces and does not percolate into the ground. As runoff flows over saturated land or over impervious surfaces (paved streets, plazas and sidewalk, parking lots, and building rooftops) it accumulates debris, chemicals, sediment or other pollutants that adversely affects water quality if the runoff is directly discharged untreated into our waterways. Although the City of Buffalo's combined stormwater and sewer systems are adequately sized to carry flow during dry weather, it is currently designed to send overflow into our waterways during large storm events. As the amount of paved surfaces has increased over time so has the number of overflow events.

Combined Sewer Systems



During wet weather events, the existing combined sewer system (CSS) becomes overwhelmed. The CSS is purposely designed to overflow into our local waterways to relieve flooding issues and sewage in basements. These designed overflow situations cause harmful pollutants to flow into our local water systems.

Unfortunately, the combined sewer overflow (CSO) pipes are located in public right of ways along water bodies where people fish, swim, boat and play, causing a major health and public safety concern.

CSO overflows cause floatables, toxins and other pollutants to accumulate in our local waterways. →

Combined Sewer Systems in the USA

Source: EPA.gov

The dots on the map mark the cities across our country that still rely upon combined sewer systems to transport wastewater to their treatment facilities

This map identifies the locations of Combined Sewer Systems (CSS) in the United States of America. Most are found in older industrial cities. You should notice how they are most often located near, or on, major waterways within our fresh water systems, especially along the Great Lakes and major rivers such as the Mississippi River. These CSS's are playing a major role in polluting our fresh waters.

Our Local Waterways

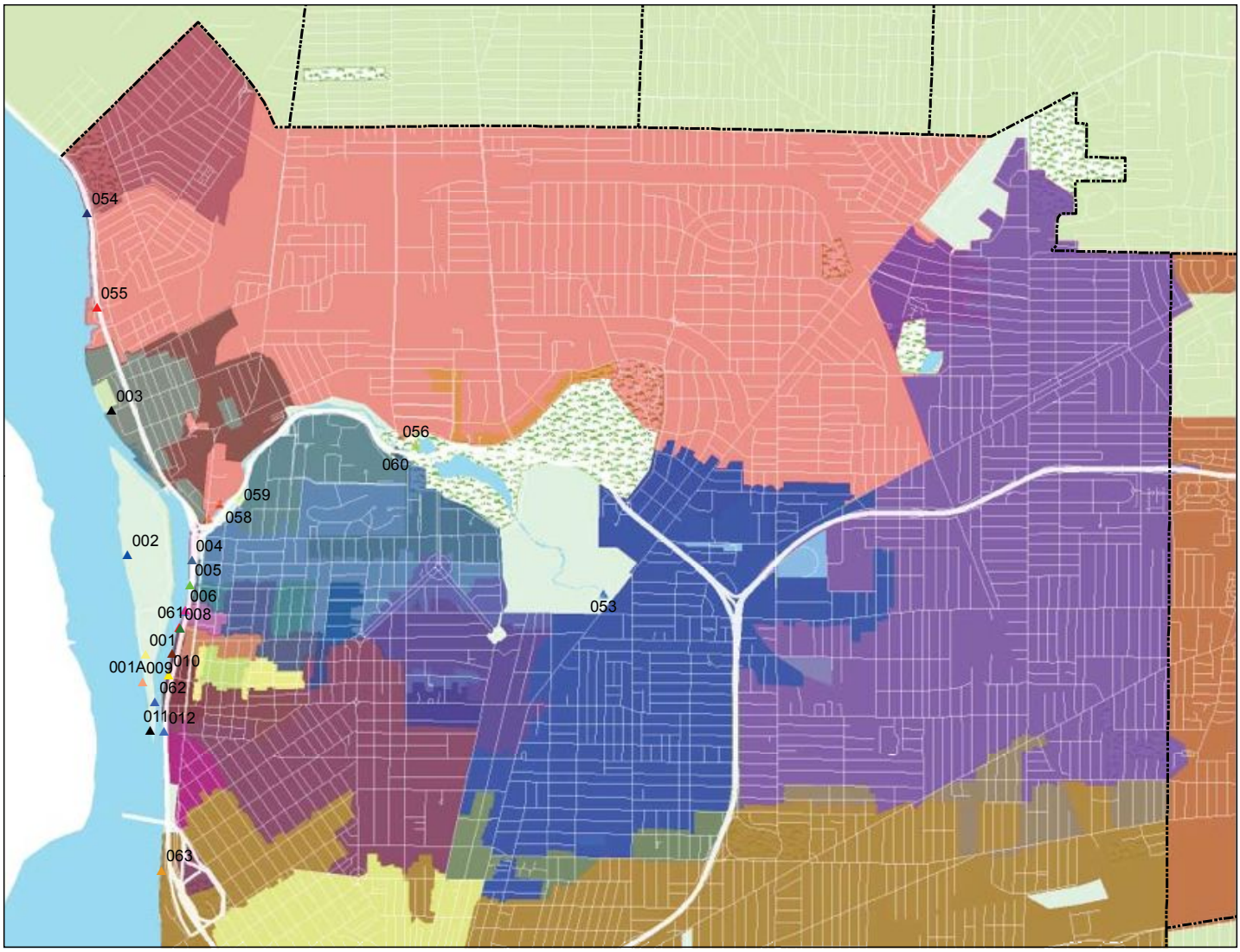
Local communities fish along the Niagara River, some for a hobby, and some for sustenance, catching fish to feed their families.

Kayakers in the Black Rock Canal, at Broderick Park.

The Niagara River after a typical one inch rain event. There is a very clear distinction of fresh blue water and the brown overflow from combined stormwater and sewer outfall pipes

Our local waterways of the Buffalo River and the Niagara River are a great attribute to this area. People fish, swim and recreate in these waters. Many local residents use these waterways to fish for food. When combined sewer overflows occur, there is a major public health and safety concern for those who are in contact with these waters.

Combined Sewer Systems:
Buffalo, New York



Source: Buffalo Niagara Riverkeeper

Combined Sewer Overflow Locations and Sewersheds (Niagara River)

This sewershed map of the Niagara River District shows the coverage of each combined sewer system (colored regions). These areas have high impermeable rates and the overflow pipes are being overwhelmed by the stormwater flowing into the system. Notice the overflow locations (numbered triangles) that are located on the Niagara River and Scajaquada Creek.

Combined Sewer System:
Buffalo, New York

BUFFALO SEWER AUTHORITY

150 MGD Sanitary Sewage Average (Dry Flow) + 590.5 MGD Wet Weather (1 inch Event)

740.5 MGD
During Wet Weather
(1 inch Event)

Source: Buffalo Niagara Riverkeeper

Sewer Shed Name	Road Surface Area (SF)	Road Surface Area (Acres)	Total Parcel Area Acres	Impermeable Parcel Coverage	Total Impermeable Coverage With Roads	Gallons of Runoff (1 inch event)
Albany Street	6,512,596.06	149.51	707.89	64%	70%	16,296,360
South Central	75,967,450.78	1,743.97	11,355.33	53%	60%	213,980,021
Hertel	25,577,726.68	587.18	3,751.26	55%	60%	70,681,738
Scajaquada	100,344,253.17	2,303.59	14,451.56	53%	60%	273,704,431
Ontario	4,774,507.37	109.61	445.68	54%	63%	9,452,565
Parish	1,927,174.30	44.24	352.50	53%	60%	6,414,414
Totals	215,103,708.36	4,938.10	31,064.21			590,529,530

Source: Buffalo Niagara Riverkeeper

The Buffalo Sewer Authority does a great job of managing raw sewage, especially on dry weather days. The system is actually oversized for the amount of treatment that is required. During large wet weather events increased stormwater negatively impacts the existing system. A one-inch rain event (90% of Buffalo's rain storms) generates over 590 million gallons of stormwater. This type of storm causes raw sewage to overflow into our local waterways, polluting where people fish, swim and recreate.

What is the Solution?

What is the Traditional Solution?

Grey Infrastructure

Source: jlrichards.ca

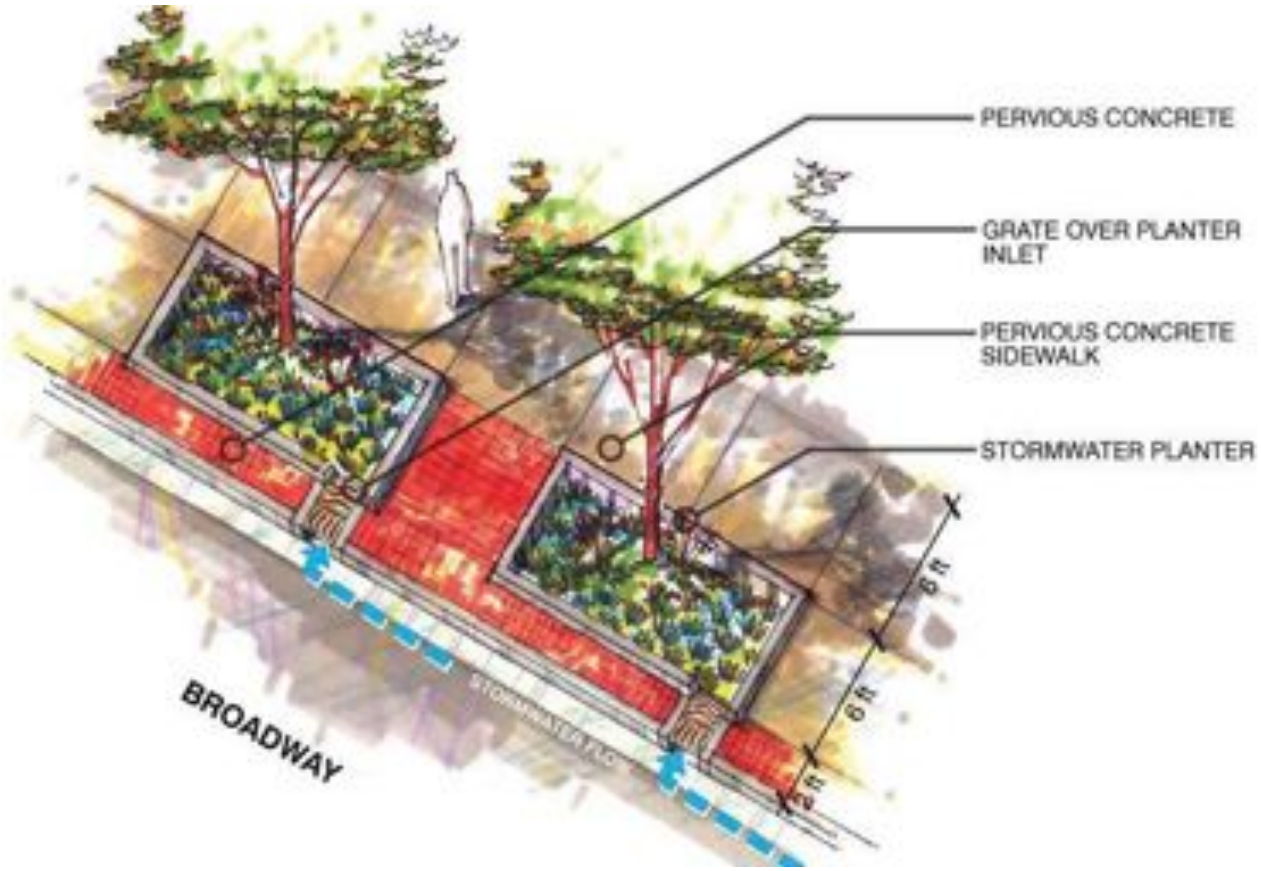
Source: heneghanassoc.com

Source: erdmananthony.com

The traditional solution is separation of the existing combined system by adding a separate system of pipes to carry stormwater and leaving the adequately sized sewer pipeline. This is often called a grey infrastructure approach. Massive pipes and tanks are installed to either carry or hold large volumes of stormwater. This method is very expensive and often is a high-impact process. It usually requires large construction staging areas and it can be very disruptive, for long periods of time, as most of the pipes are installed in roadways. In addition, the end result offers very little aesthetic or beautification value, as the resulting finished system is buried underground.

What is the Sustainable Solution?

Green Infrastructure



Source: City of Portland

Green stormwater infrastructure includes a range of soil-water-plant systems that intercept stormwater, infiltrate a portion of it into the ground, evaporate a portion of it into the air, and in some cases, store water so that a purified portion can be released slowly back into the sewer system or ground water table.

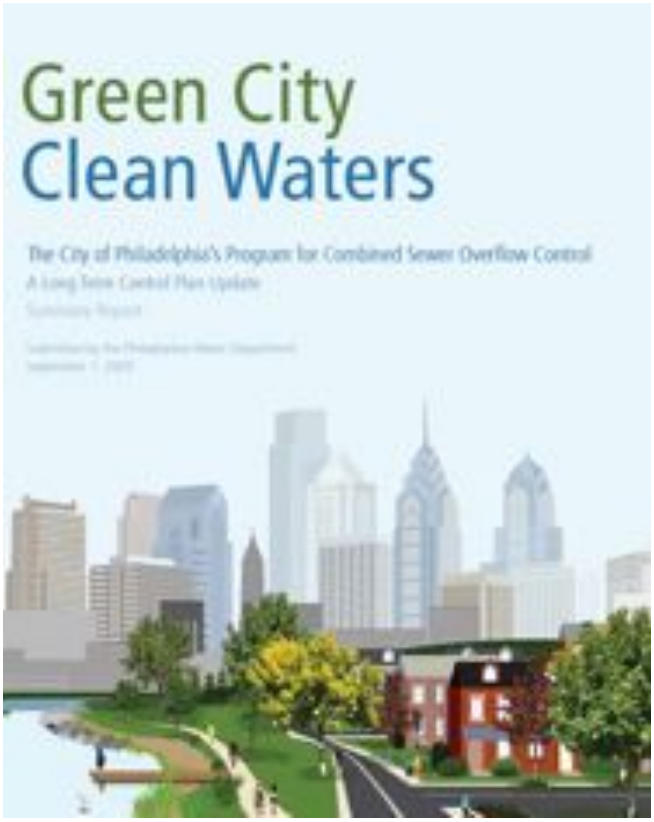
Green Infrastructure:
Case Studies

Source: City of Portland

Philadelphia, PA
Portland, OR
Seattle, WA
University of New Hampshire, NH
New York State

The Evironmental Protection Agency (EPA) and the American Society of Landscape Architects (ASLA) have put together many case studies that deal with sustainable design and green infrastructure. Some are listed above, and also discussed further in following examples. These progressive communities are using innovative measures and sustainable design to improve their local environments.

Green Infrastructure:
Case Studies (Philadelphia, PA)



Source: phillywatersheds.org

Green Streets
Green Schools
Green Public Facilities
Green Parking Lots
Green Public Open Space
Green Industry, Business, Commerce and Institutions
Green Alleys, Driveways and Walkways
Green Homes

Philadelphia is a progressive city that understands the importance of their watersheds and stormwater's impact on the adjacent Delaware River. The city uses the river for drinking water as well as recreational activities. They have put together a comprehensive plan to greatly reduce and or eliminate combined sewer overflow events. Some programs the city is working on are listed above. Philadelphia has been moving in a sustainable direction and is setting a precedent for other older cities that started with combined sewer systems. Philadelphia has started to manage stormwater through best management practices (BMP's) such as Green Infrastructure.

Green Infrastructure:
Case Studies (Portland, OR)

Source: City of Portland

Portland, Oregon is also using green infrastructure for stormwater management as an alternative to conventional grey infrastructure. The city is reducing the amount of stormwater that enters into their combined system by disconnecting roof drains and requiring new developments to include green infrastructure installations. The above photos are examples of innovative designs that allow stormwater to flow into designated spaces, rather than directly into the combined system. These vegetated areas not only help reduce the amount of overflow events each year, but they also provide a beautiful aesthetic component that can raise property value.

Green Infrastructure:
Case Studies (Seattle, WA)

Source: City of Seattle

Seattle is another city that has a combined sewer system in a climate that generates a significant amount of stormwater each year. They also have taken a sustainable approach and have redesigned their streets to capture stormwater prior to its entering the sewer system, keeping the systems from becoming overwhelmed. The examples above reflect a green infrastructure treatment called bioretention cut-outs. They are located between the sidewalk and the curb line of the roadway (in the snow storage area). Contrary to conventional design, these are recessed areas without curbs or with inlets cut out of the curb, that allow roadway runoff to enter the treatment area. These stormwater collection areas allow groundwater to re-charge into the local water table while also providing an aesthetic barrier between vehicles and pedestrians.

Green Infrastructure:
Case Studies (New Hampshire)

Source: UNH Stormwater Center

Source: UNH Stormwater Center

Source: zingersnead.com

The University of New Hampshire has been investigating the use of porous pavement applications in cold weather climates. They have been researching and testing these new materials during snow events. The test results show that this product reduces slick and slippery surfaces, allows slush and small snow events to melt and drain downward and works well in cold weather climates.

Green Infrastructure:
Case Studies (New York State)

New York, New York

Source: designtrust.org

green one city ROCHESTER
Supporting Environmental Sustainability.

Rochester, New York

Source: cityofrochester.gov

Save the Rain

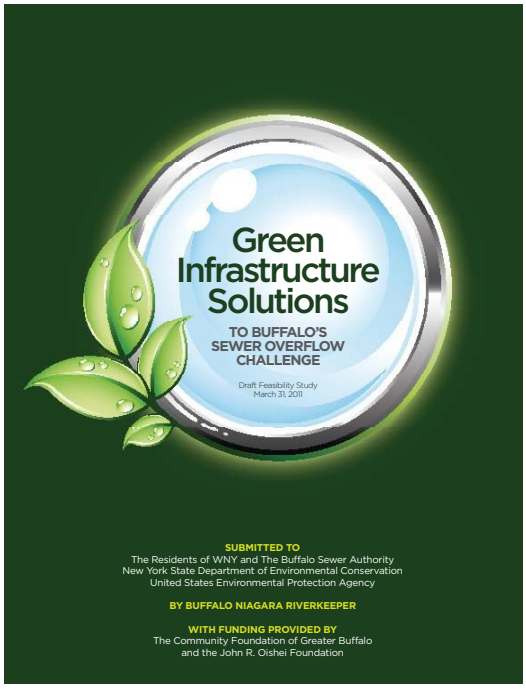
Syracuse, New York

Source: savetherain.us

New York State has been moving in a sustainable direction and now it is time to bring these standards to Buffalo. New York City has developed a set of standards called, "High Performance Landscape Guidelines" and the City has been incorporating green infrastructure into their design process. Syracuse and Onondaga County have been very active, working with communities and schools to educate and promote sustainable lifestyles. The City of Rochester has also incorporated green infrastructure into their urban fabric to reduce the amount of stormwater overflowing from their existing combined sewer system.

Green Infrastructure:
Buffalo, New York

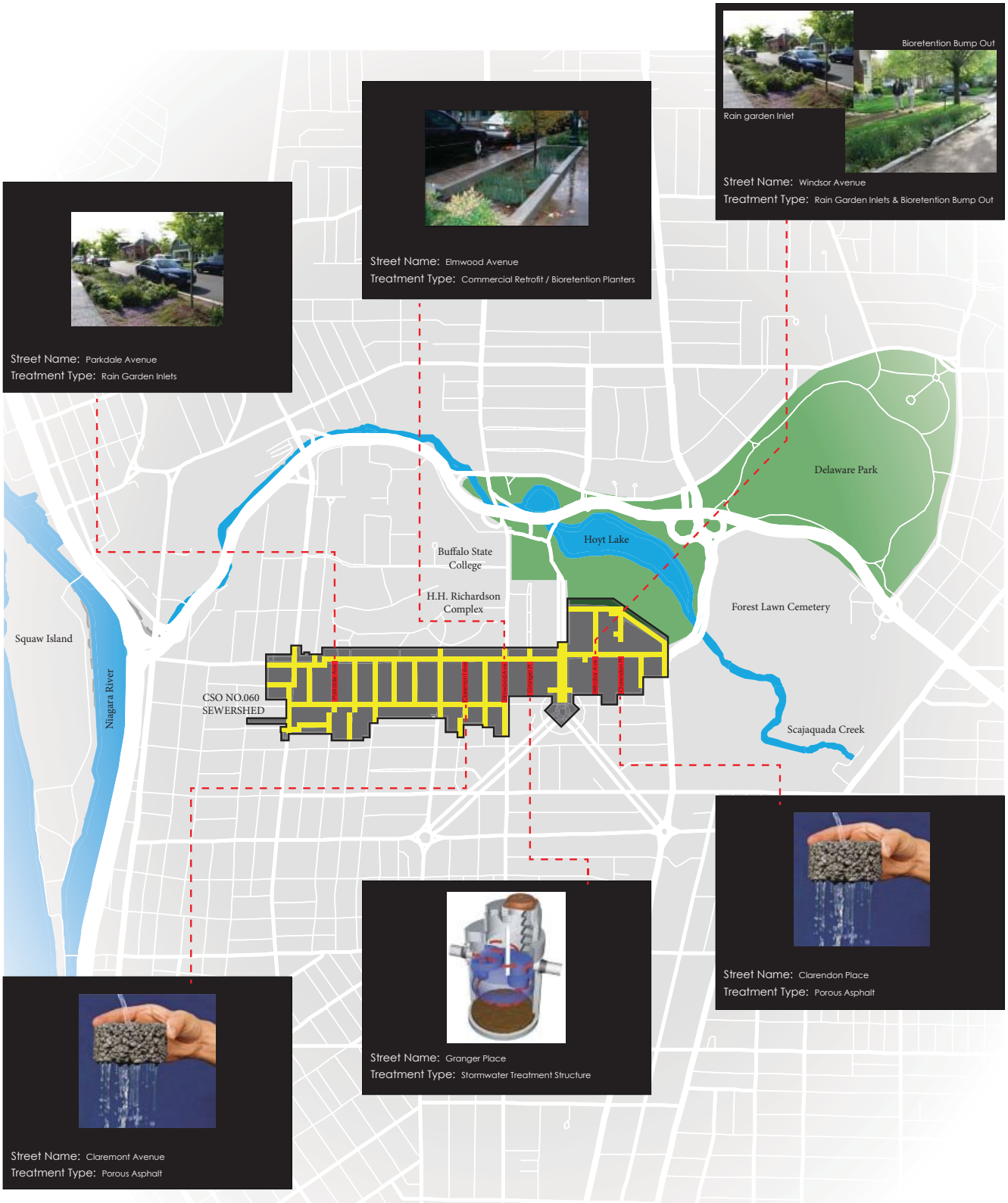
URS



Source: Buffalo Niagara Riverkeeper

The Buffalo Sewer Authority (BSA) is in a position where they can adopt and install green infrastructure practices to manage their stormwater issues. Working with the EPA, the DEC and Buffalo Niagara Riverkeeper, the BSA has agreed to install a pilot project that will test a series of different green infrastructure treatments and compare one to another. Buffalo Niagara Riverkeeper has developed a report to explain the existing problems that are caused by combined sewer overflows in Buffalo, NY which also provides recommendations for green infrastructure solutions to eliminate combined sewer overflow events. URS Corp. is the engineering firm working on this pilot project.

Green Infrastructure:
CSO No. 60 Pilot Project

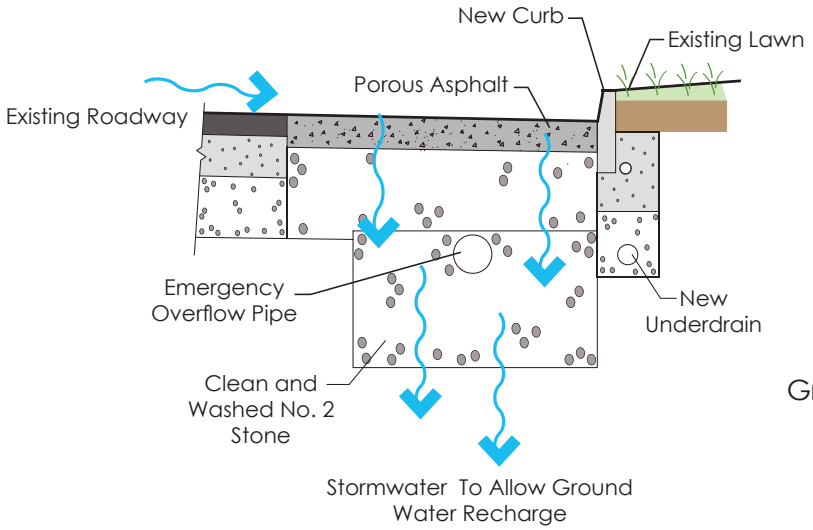


The BSA CSO No. 60 (Green Streets) Pilot Project consists of these streets located in the Scajaquada sewershed: Clarendon Avenue, Claremont Avenue, Elmwood Avenue, Parkdale Avenue, Windsor Avenue and Granger Place. This project will incorporate various types of sustainable stormwater treatments. These designs will be monitored by the BSA to measure the amount of stormwater that is being reduced by the proposed green infrastructure systems and to test quality of the water as well.

Green Infrastructure:
CSO No. 60 Pilot Project

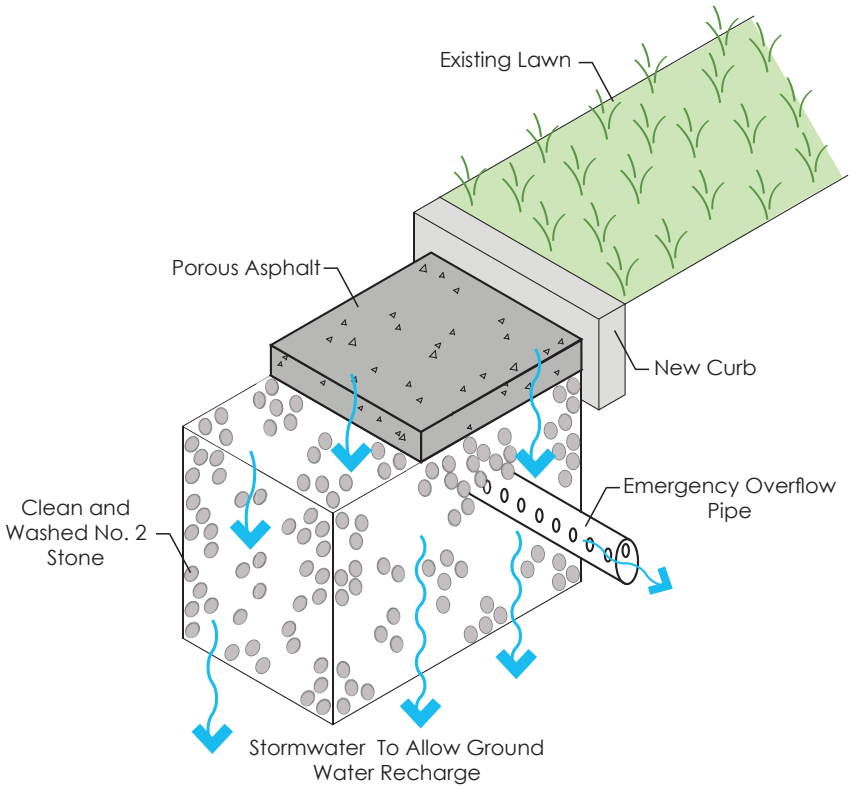
Clarendon Avenue and Claremont Avenue
Green Treatment: Porous Asphalt

Green Infrastructure: Porous Pavement **Section**



Source: Buffalo Niagara Riverkeeper

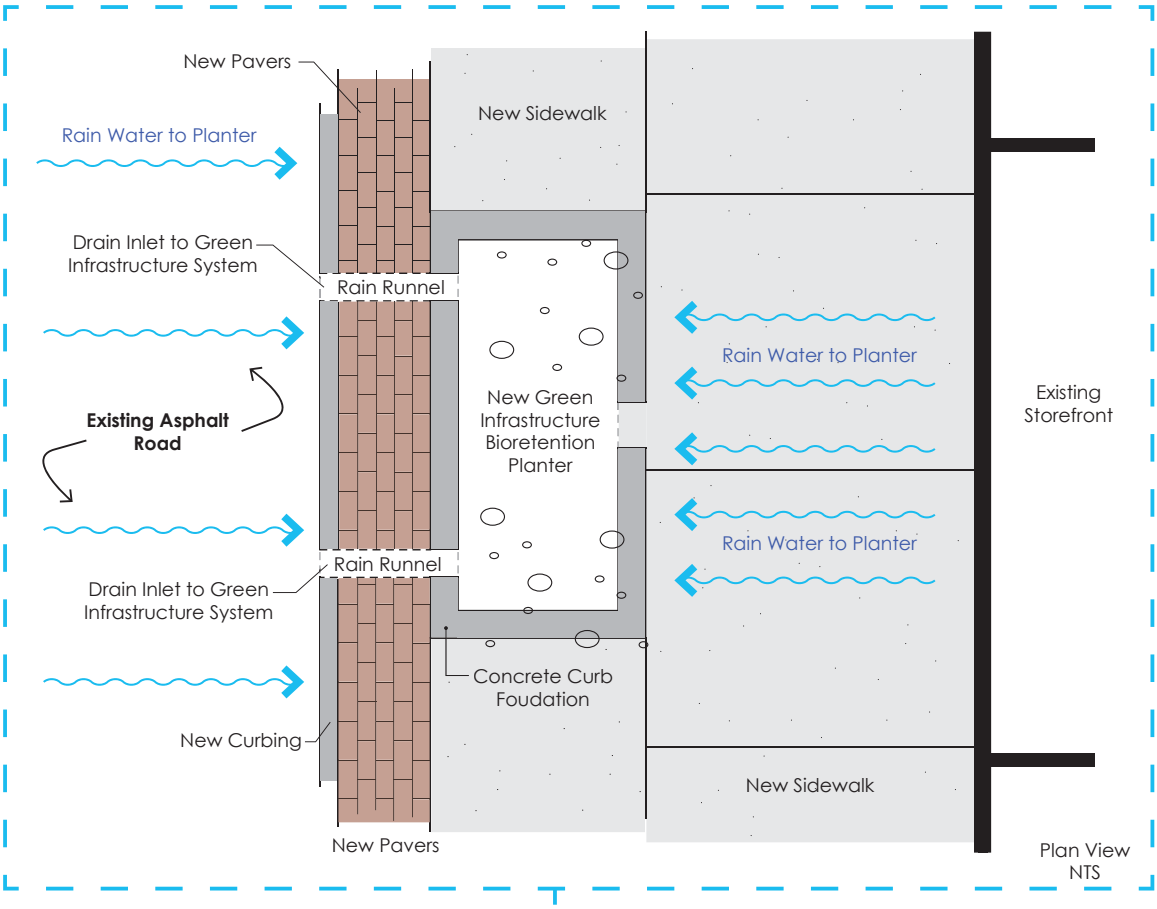
Green Infrastructure: Porous Pavement **Axonometric**



On Clarendon Avenue and Claremont Avenue, porous asphalt will be installed on two different streets to test the effectiveness in different soils. (One street's soils are more permeable than the other). The porous asphalt will be installed in a 4-foot long strip located adjacent to the roadway curbing. The water will sheet from the center of the road towards the curb, where it will infiltrate into the permeable pavement, helping to reduce the amount of stormwater flowing into existing drain inlets, while at the same time allowing for groundwater recharge.

Green Infrastructure:
CSO No. 60 Pilot Project

Commercial Green Infrastructure Retrofit for Elmwood Ave (Plan View)



Source: Buffalo Niagara Riverkeeper

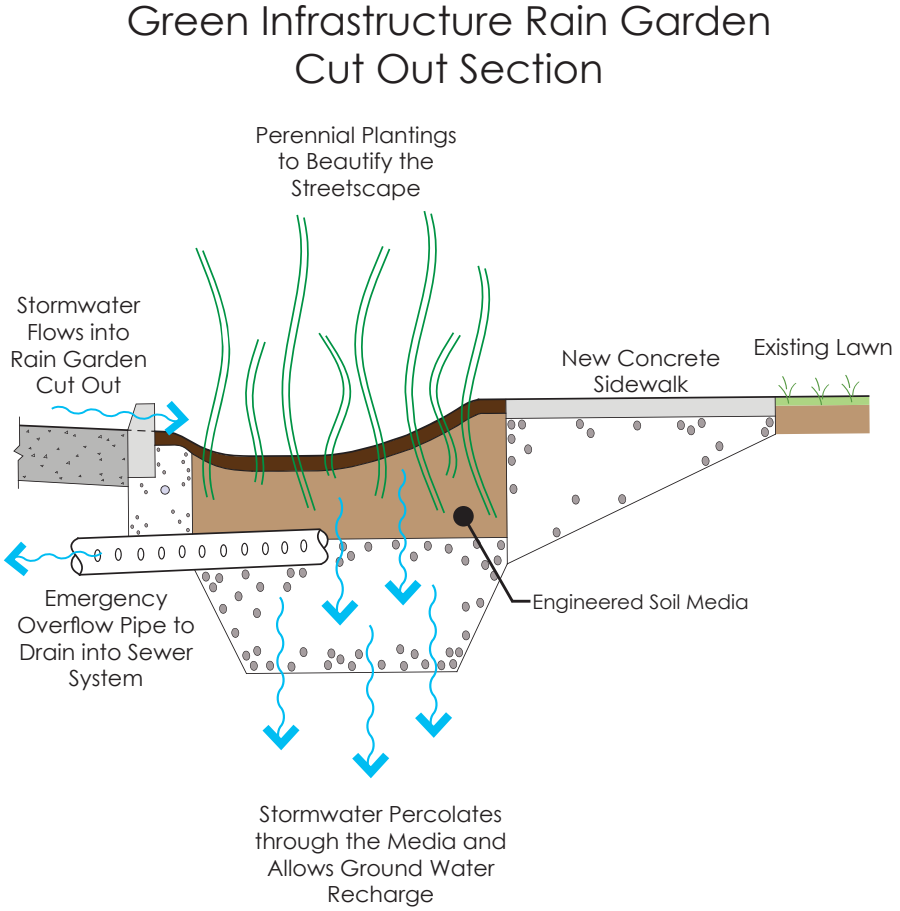
Photo Overlay of Green Infrastructure: Commercial Retrofit

Elmwood Avenue will receive a green infrastructure commercial-retrofit design. This system will introduce curb inlets to allow stormwater to drain into bioretention planters. This treatment offers a positive educational experience to the public, as they will be able to witness the hydrology of the stormwater as it flows into the designed spaces. Bioretention planters will be planted with colorful, hardy perennials that are salt and drought tolerant.

Green Infrastructure:
CSO No. 60 Pilot Project

Parkdale Avenue
Green Treatment: Cut Out Rain Gardens

Source: City of Seattle



Source: Buffalo Niagara Riverkeeper


Indian Blanket Flower
(Gaillardia X Grandfolia)


Southern Blue Flag Iris
(Iris Viginica)


Moonshine Yellow
(Achillea Moonshine)


Purple Dome Aster
(Asater Novae-Angliae Purple Dome)


Day Lilly
(Hemerocallis SP.)


Scaly Blazing Star
(Liatris Squarrosa)


Purple Cone Flower
(Echinacea Purpurea)


Prarie Coreopsis
(Coreopsis Palmata)

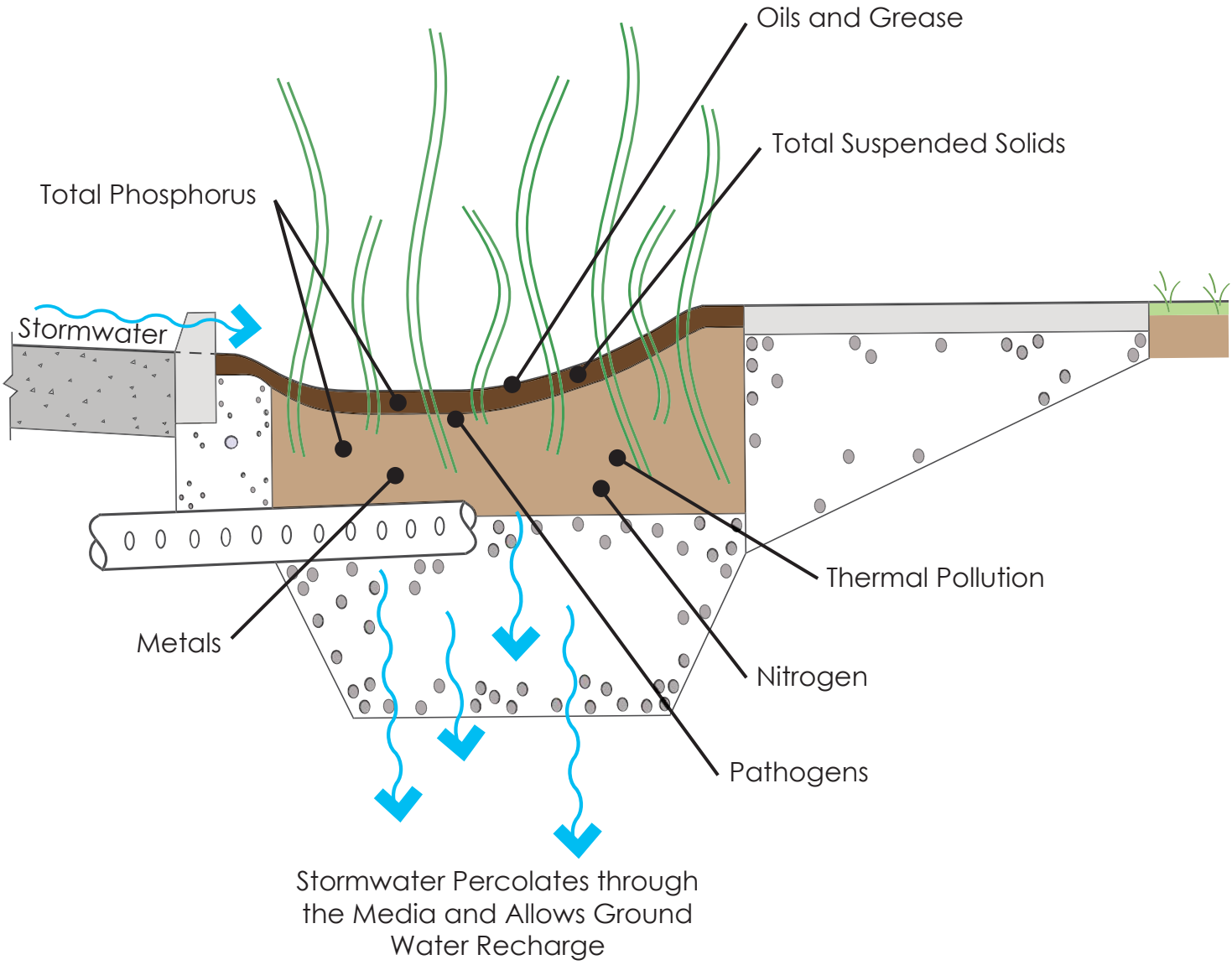

Blue Flag Iris
(Iris Versicolor)


Sun Sage
(Carex Pensylvanica)

Parkdale Avenue will be retrofitted with Green Infrastructure cut-outs which are designed to accept sheet flow from the road surface as well as the sidewalk runoff. The stormwater will flow into the designated rain gardens and plant material will absorb pollutants and toxins as the water infiltrates downward to recharge the local groundwater table.

Green Infrastructure:
CSO No. 60 Pilot Project

Green Infrastructure Bio-Remediation



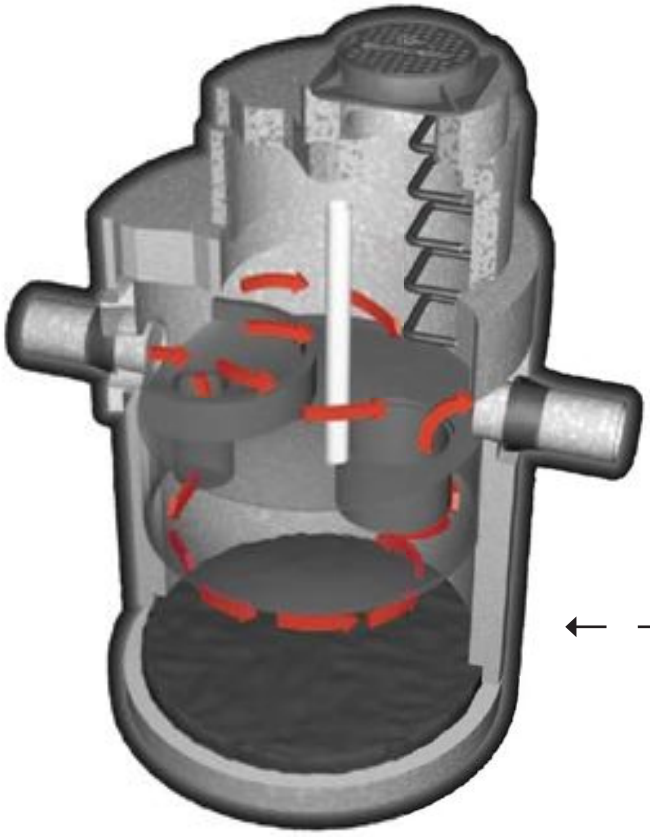
Specific vegetation can be used to help clean stormwater. This graphic shows locations within the planted space where several toxins are absorbed, captured and removed from stormwater. This system will contribute to reducing the amount of stormwater entering the existing sewer system as well as contributing water quality improvements.

Green Infrastructure:
CSO No. 60 Pilot Project

Granger Place
Treatment: Stormceptor Structure

Vehicular oil spillage found on roadway surfaces such as this one will eventually flow into the sewer system. — — — — — — — →

Source: gadha.org



← — — Stormceptor:
This engineered system will capture oils and sediments and allow cleaner stormwater to pass through and enter the existing combined sewer system.

Source: www.imbriumsystems.com

Granger Place will receive a Stormceptor structure. It is important to understand that this particular structure is not a green infrastructure treatment. However, it is part of this pilot project. This system will be tested along with other green treatments. This device will remove stormwater pollutants such as oil and sediment collected from road surfaces. This treatment will be the most obtrusive to local residents compared to others in this pilot project and will have no effect on stormwater reduction.

Green Infrastructure:
CSO No. 60 Pilot Project

Flow monitoring the reduction of stormwater

Source: awcompany.com

Source: watertestingblog.com

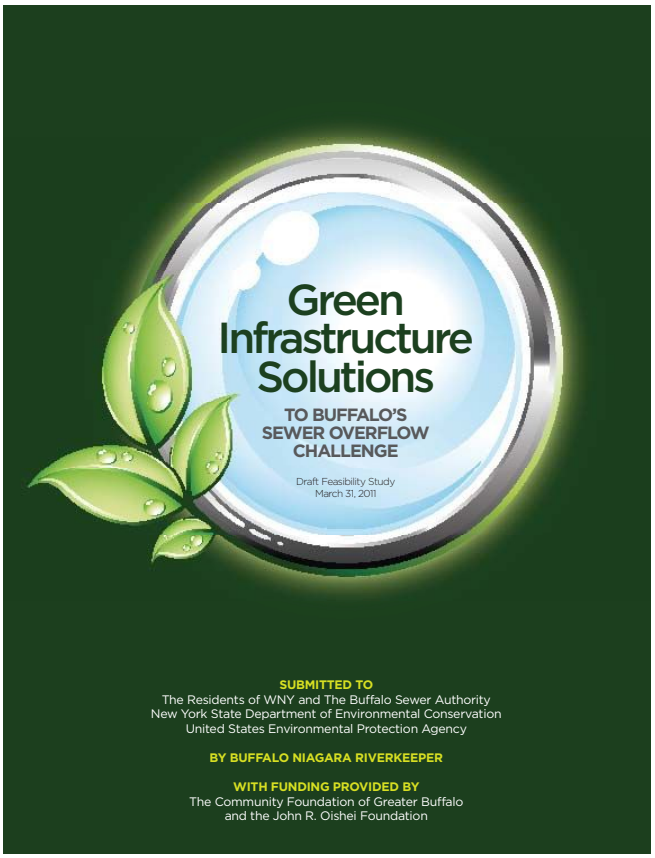
As mentioned before, this pilot project will incorporate scientific data collection and testing to quantify the various sustainable treatments. Water quality testing will determine which system best removes toxins, road surface sediments and engine oils from stormwater. Flow monitors will also be utilized to measure the amount of stormwater that has been reduced from the green infrastructure designs. The data will be compared to test data of the existing systems located within the same sewershed. A matrix will be developed to convey the testing results.

Buffalo Niagara RIVERKEEPER:
Active Role In Our Community

Rain barrels for rain water harvesting

Working with volunteers for habitat restoration

River Academy: A collaboration between ECC and Buffalo Niagara Riverkeeper to teach members of the local communities about stream science, watershed restoration and riparian restoration.



Buffalo Sewers Report:
Green Infrastructure Solutions

Questions?

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If you have any questions, you may contact:

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