

## Objectives:

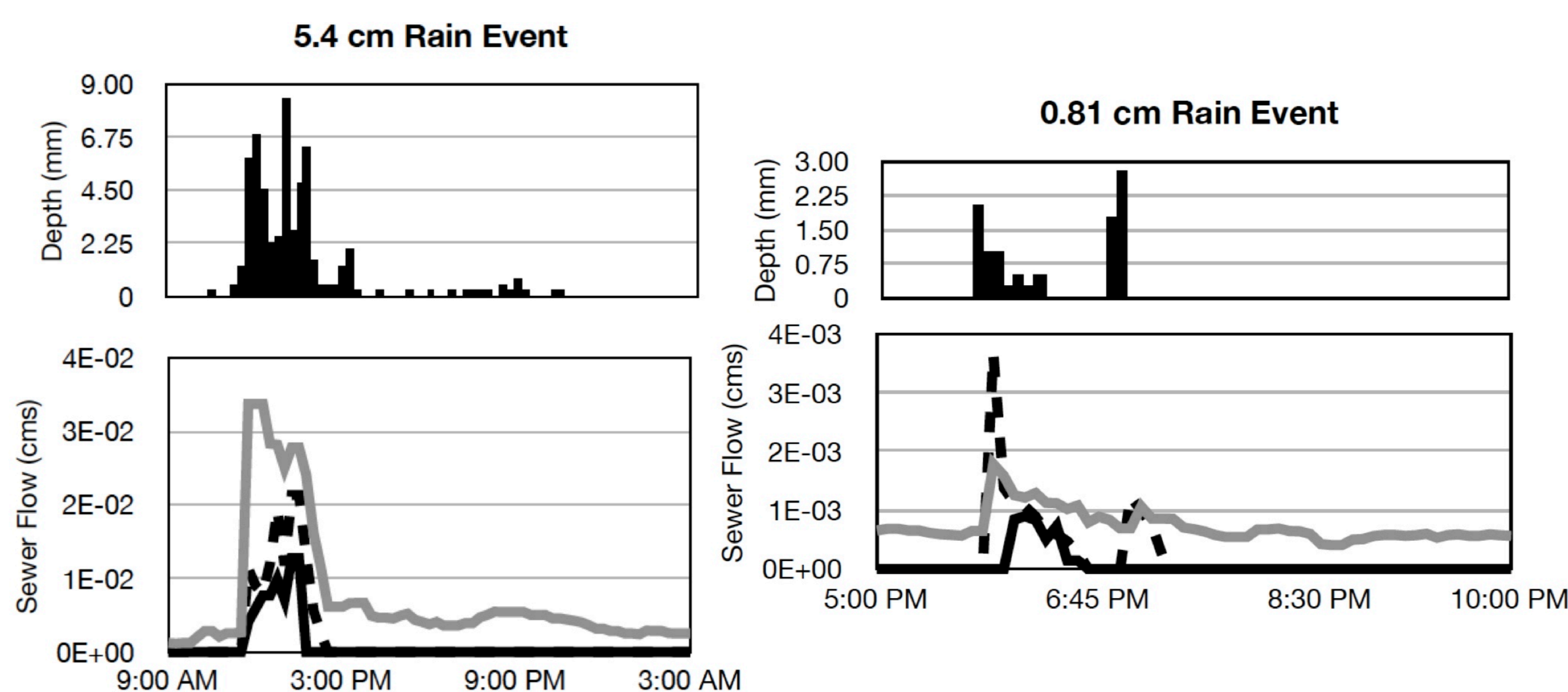
- Determine green stormwater infrastructure (GSI) water capture efficiency through environmental monitoring
- Compare various techniques to understand pros and cons of each design
- Determine limitations and maximum storage capacities of the GSI

## Methods:

- Monitor stormwater inflow and outflow of various GSI using hydraulic flumes, rain gauges, and other remote sensors over the course of multiple years
- Compare pre-green to post-green hydrology through monitoring overland runoff and catchbasin sewer flow
- Efficiency will be defined in terms of volume retained relative to net stormwater inflow

## Expected Results:

- Define water capture ranges for emerging urban GSI in terms efficiency and required area (gallons of stormwater captured / ft<sup>2</sup> of GSI)
- Determine cost effectiveness of each GSI (gallons captured / \$)
- Suggest improvements for next generation GSI
- Derive empirical analytic methods for modeling



These hydrographs and hyetographs illustrate sewer flow (cms) in the pre-greened Stratford Ave catchment relative to rainfall (mm). The grey line represents flow through the central combined sewer that services the residential block and the two black lines (dotted and solid) represent flow through each stormwater catchbasin at the end of the block. Sewer flow rises proportional to rainfall with little lag time.

## GIG Sites

### NYC BIOSWALES

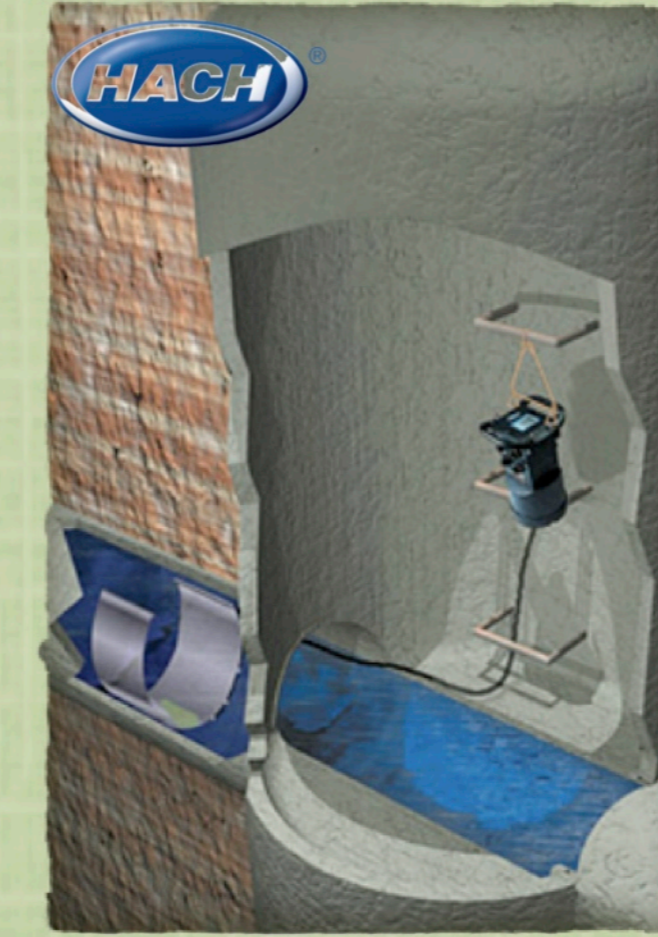
Various Sites around the Bronx  
2013-2014



## Site Description and Monitoring

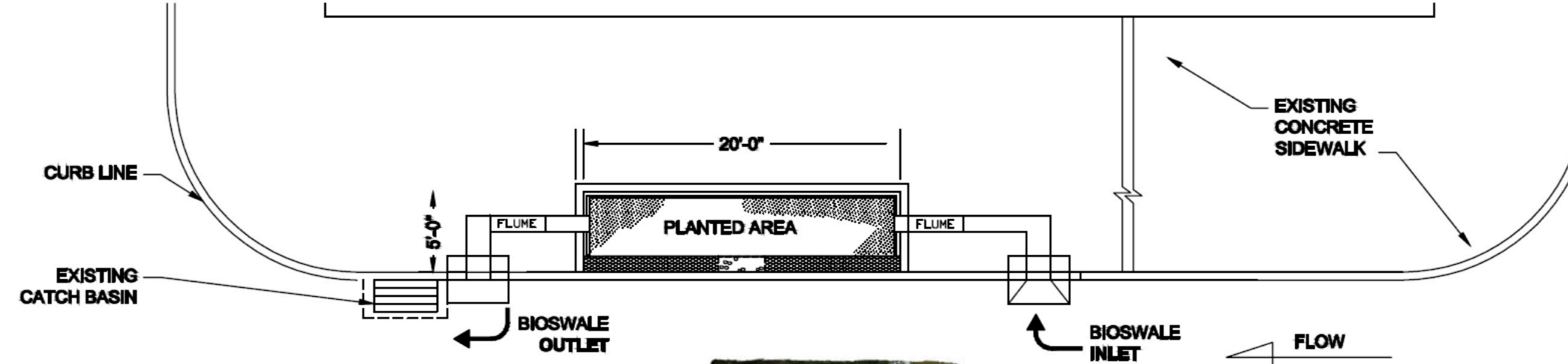
The GIG sites capture street runoff in greened sidewalk. The five GIG sites are 20x5 foot bioswales installed in sidewalks to capture street runoff. They have small curb cuts to allow for water inflow and infiltration. Water inflow will be monitored by channeling the inlet flow through trapezoidal

flumes buried beneath the sidewalk. Ponding and infiltration of the bioswales will be monitored using a series of piezometers or water level sensors. Sewer flow will be monitored inside the sewer catchbasins adjacent to each site in order to measure reductions in stormwater flow.



Sewer flow is monitored in real-time using portable area-velocity flow sensors installed in the sewer

## Proposed Monitoring of 20x5' NYC Type 1 Bioswale



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**STANDARD INLET**



© Justin Martin  
**FLUME CHANNEL CONCEPT**



© Richard B. Levine  
**APPROACH CONCEPT**

## Nashville

### NYC GREENSTREET

116th Ave & Nashville Blvd, Queens, NY 11411  
Completed 2011

## Site Description and Monitoring

Nashville is a NYC greenstreet that captures curbside runoff

This site is one of several bioswales built in conjunction with the NYC Parks Department that captures street runoff at the bottom of a hill. Inflow is measured using a trapezoidal flume, infiltration and ponding using piezometers and shallow wells, in addition to being equipped with a full climate station.



## Stratford

### BIOSWALE AND RAIN BARRELS

Stratford Ave & 174th St, Bronx, NYC  
2013-2014

## Site Description and Monitoring

Stratford Ave shows a before and after picture of green infrastructure's effect on sewer flow

This project seeks to monitor the flow of water through one residential sewer block in the Bronx. GSI will be built through the block including rain barrels and a bioswale. This will show the direct effect of GSI on sewer flow and what reductions can be expected for future projects.



## ABC Carpet

### ARTIFICIAL WETLAND

Bruckner Blvd & Bronx River Ave, Bronx, NY  
Completed June 2012



Before



The site before construction was unkept and under-used



After

Wetlands act as "earth's kidneys" as they remove pollution from water flowing to the receiving rivers, lakes, and oceans.<sup>2</sup>

## Site Description and Monitoring

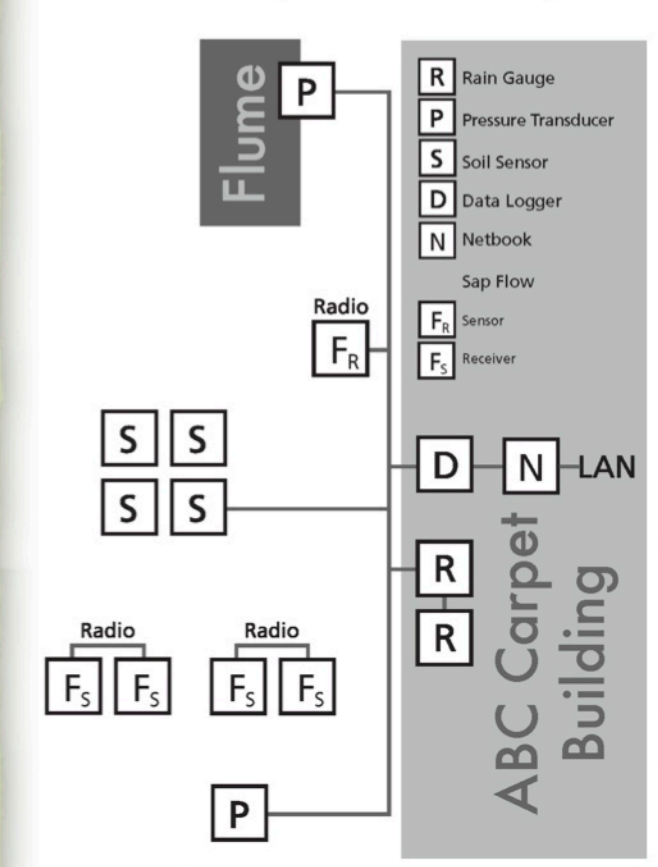
The ABC Carpet wetland captures and purifies runoff from the factory parking lot

The ABC Carpet wetland project converted the riparian buffer between the Bronx River and the ABC Carpet Warehouse from an unkept and under-used space to an artificial wetland. Runoff from the factory parking lot is pumped into the wetland to purify the water before

entering into the Bronx River while decreasing the direct runoff on the factory.

**Community Involvement** Local youth organization Rocking the Boat works to restore the Bronx River while educating the community on the importance of environmental stewardship. Students help with research monitoring and maintenance of the wetland.

## ABC Carpet Monitoring



## St. Mary's Recreation Center

### GREEN ROOF

450 St Anns Ave, Bronx, NY  
2013-2014

## Site Description and Monitoring

St. Mary's Rec Center will capture rainwater with a traditional green roof

This project seeks to understand the hydrologic effects of implementing a green roof on top of the St. Mary's Recreation Center located in the Bronx, NY. This study will focus primarily on the discharge of water from a small section of the roof. This small catchment is currently all impervious surface and drains into an inlet connected to the city

sewers. The total water flow passing through this drain will be monitored during current impervious conditions, and again after the green roof is added to the catchment. This comparison will illustrate the effect of the green roof on stormwater discharge leaving the site.

Complementing the stormwater data, a weather station will be located on site to record climatic data including: rainfall, temperature, pressure,

solar radiation, and relative humidity. These readings will help us understand the correlations weather and green roof performance.



## References:

- <sup>1</sup> Prince Georges County, Maryland Department of Environmental Resources Programs and Planning Division "Low-Impact Development Hydrologic Analysis", July 1999
- <sup>2</sup> US EPA, "Constructed Treatment Wetlands", August 2004
- <sup>3</sup> Hormoz Pazwash, "Urban Storm Water Management", 2011, Taylor and Francis Group

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