# The New York Recovery Network: E-Bulletin

## Published May 28, 2014

A special issue on stormwater management

SAVE THE DATE: June 27 workshop on stormwater management. Details coming soon!

## Headlines

**Stormwater 101**
A brief commentary on the importance of stormwater management and the movement toward green infrastructure, with a host of resources for further reading.

**Read More**

**A Look at New York Rising's Proposed Solutions to Stormwater Management**
Effective stormwater management emerged as a critical issue in the recovery plans of the communities taking part in the New York Rising Community Reconstruction (NYRCR) program. Plans covered both tried-and-true and new protection methods against wave action, storm surge, stormwater flooding, backwater inundation and wastewater system failures. This article examines several NYRCR plans to address the breadth of challenges and myriad solutions envisioned by New York communities**.**

**Read More**

**Stormwater Glossary**
Retention pond? Bioswale? This glossary defines important terms used in stormwater management in order to clarify solutions proposed in New York Rising Community Reconstruction plans.

**Read More**

## Recovery News

**Hempstead Village secures state funds for sewer system repairs**
Newsday, May 18, 2014

**Volunteers plant beach grass to bolster dunes in the Rockaways**
New York Times, May 20, 2014

**Nassau flooding shows post-Sandy fixes still needed**
Newsday, May 10, 2014

**Service coordinates $1.27 million effort to reconnect streams and prevent future flooding**
U.S Fish and Wildlife Service, May 9, 2014

**Jamie Rubin on storm recovery**

City & State, May 12, 2014

## Upcoming Events

June 1: American Littoral Society and the Jamaica Bay Ecowatchers
Community Marsh Planting Day in Jamaica Bay

June 11: Urban Green Council
Designing For Resiliency

June 17: Agility Recovery
Leading with Resiliency During a Disaster

June 19: Enterprise Community Partners, Inc.
Flood Mitigation Solutions for Property Perimeters

## Job Postings

Project Controls Cost Scheduler

Build It Back Plan Examiner

Associate Project Manager

Acquisition for Redevelopment Project Manager

Internal Auditor

Borough Director

Sandy Foreclosure Counselor

Executive Director, Business Recovery

## Stormwater 101

Stormwater is a natural resource that, when treated with respect and proper understanding, is invaluable, yet when not taken seriously can cause immense damage and loss of life. As humans have increased the scale and significance of their built environment rainwater and snowmelt cannot be absorbed sufficiently into the ground or flow naturally to streams. Planners and builders since ancient Greece have fashioned stormwater management systems for their villages, cities, and roadways to manage this water.

In a water-rich region such as ours, stormwater management is essential. Many of our traditionally built systems ("gray infrastructure") were designed to remove as much water from where it falls (or melts) as quickly as possible. These systems can be overwhelmed during intense precipitation events or can fail due to age-related system failures, causing flooding, structural damage, injuries and sometimes loss of life. Overflow also washes surface pollution and debris into our waterways, degrading local water quality.

The natural world has evolved incredible, sophisticated systems that manage stormwater effectively. Integrating systems that employ natural processes, topography and hydrology for stormwater management are called "green infrastructure" and have rapidly been gaining global acceptance as an essential stormwater management option. In addition to slowing stormwater, filtering debris, removing pollutants, modulating air temperature, improving air quality, recharging local ground water, and reducing the burden on conventional systems, green infrastructure adds to the local quality of life by providing natural beauty, wildlife habitat and an opportunity for the community to learn more about natural systems.

As our region faces uncertain weather, it is likely we will have a rise in sea level, more intense precipitation events, and more extreme heat. Just as great surfers learn how to use the ocean's natural forces to create a good ride, learning to deeply understand and work with the hydrologic cycle's natural forces instead of trying to control the uncontrollable will allow us to be smarter, wiser, more efficient and progressive in our thinking as we rebuild and plan for our long-term future.

In a new world of rising tides, super storms and uncertain weather, resilient and sustainable stormwater management infrastructure is no longer optional.

**Additional reading:**


New York Recovery Network: Green Infrastructure resources
https://max.omb.gov/community/display/DHSExternal/Natural+and+Cultural+Resources+-+Information+and+Guidance+%28Green+Infrastructure%29;

Wikipedia: Water cycle: http://en.wikipedia.org/wiki/Water_cycle

EPA: Green and Gray Infrastructure Research
http://www.epa.gov/nrmrl/wswrd/wq/stormwater/green.html

EPA: Stormwater Management
http://www.epa.gov/greeningepa/stormwater/

World Resources Institute: Green vs. Gray Infrastructure: When Nature Is Better than Concrete
http://www.wri.org/blog/2012/06/green-vs-gray-infrastructure-when-nature-better-concrete

Nature.org: The Case For Green Infrastructure: Joint-Industry White Paper
http://www.nature.org/about-us/the-case-for-green-infrastructure.pdf

The Solutions Journal: Green versus Gray: Nature's Solutions to Infrastructure Demands http://www.thesolutionsjournal.com/node/1241

USGS: How much water is there on, in, and above the Earth? http://water.usgs.gov/edu/earthhowmuch.html

## A Look at New York Rising's Proposed Solutions to Stormwater Management

One consequence of Hurricane Sandy, which brought a storm surge of nine to twelve feet, was the systematic failure of wastewater treatment systems due to a combination of flooding, storm runoff and loss of electrical power. This sent billions of gallons of raw and partially treated sewage into local waterways and residences. With the expectation of more frequent and severe storms, the improvement of stormwater management is a critical component to achieving a more resilient and sustainable future.

Stormwater drainage problems can be repetitive, even frequent events where water is eventually absorbed into the ground with little damage to the local infrastructure or environment. Certain areas are known to flood during torrential rainfalls and community residents are aware of what roads to avoid. But in major disaster events those minor inconveniences can turn into major problems with water overwhelming aging wastewater sewage systems, causing damage to vulnerable infrastructure and threatening economic and public health.

The need for effective stormwater management was recognized by all New York Rising Reconstruction Program planning committees in their final reports. Each community that experienced a significant failure of the existing stormwater system has unique characteristics and there are numerous strategies and solutions to address those weaknesses. In general, communities must begin with a comprehensive stormwater management system which includes a mix of gray (man-made) and green (natural) infrastructure. Here is a summary of the challenges and solutions noted by a few key communities in their reconstruction plans.

### Staten Island

In Staten Island, inadequate flood mitigation measures have existed for decades despite robust development and population growth following the opening of the Verrazano-Narrows Bridge to Brooklyn. The process has now begun of transferring lands that cannot be adequately protected from Sandy-like storms into restored and expanded wetlands as part of the New York City Department of Environment Protection's Bluebelt program. The Bluebelt program has already acquired lands for wetland conversion. Recently, Gov. Cuomo requested federal funding for the purchase of 77 properties in Midland Beach and New Dorp Beach that will be added to the Bluebelt. Coastal parks and natural areas would be enhanced as a "first line of defense" against future storms. Hylan Boulevard, the borough's primary economic corridor, was inundated during Sandy, making driving difficult and threatening the orderly evacuation of the population. Solutions to flood-prone roads now include a "green street" project that would incorporate storm drain inlets, vegetated bioswales, permeable paving, upgrades to gray and to green stormwater networks, the expansion of sewer capacity and installation and maintenance of tide gates at sewer outfalls. The U.S. Army Corps of Engineers is finalizing a study, authorized by Congress and with the input of State and City partners, to evaluate a system of levees, seawalls, stone revetments and preservation of natural open space on the South Shore of Staten Island.

### Southern Brooklyn Peninsula

During Hurricane Sandy, a large volume of water surged into the Gravesend Bay into Coney Island Creek, creating excessive backwater inundation to many homes, even though 70 percent of the damaged housing units did not border the Atlantic Ocean or the creek. The loss of power caused sanitary sewer pump stations to shut down and without means to remove sanitary waste, sewage backed up into many homes and businesses on the peninsula. Floodwaters from the ocean, Sheepshead Bay and Coney Island Creek also entered the storm drain system at numerous locations and resulted in significant building damage, high cleanup costs, exposure to noxious waste fumes and potential exposure to hazardous materials. A backflow prevention strategy has been proposed and would include sewer connection valves at outfall locations and cut-off valves in residential homes.

**Lower Manhattan**

For lower Manhattan, large areas of impervious surfaces (up to 95 percent in one community) prevented stormwater from infiltrating into the ground. A massive surge of saltwater caused flooding and sewer backup. Flooding primarily affected the areas with lowest elevation, adjacent to the shoreline. Fortunately, parks and other open spaces that border the tip of lower Manhattan provided a protective barrier that absorbed storm surge and mitigated flooding impacts to the interior downtown area. Nevertheless, the combined sewer system didn't have the capacity to handle the large volume of storm surge, which worsened the community-wide sewer backflow damage. A proposed prioritized project includes a study on smaller, short-term solutions that would increase stormwater capture and reduce the volume of water entering the combined sewer system. Solutions included increasing permeable pavement, bioswales and the adoption of other green infrastructure techniques that would focus on stormwater capture and retention. Other innovative approaches include increasing the resilience of community gardens and pocket parks for stormwater capture. Another green infrastructure project would fund the construction of a one-acre artificial wetland at East River Park that would replace an impervious surface with an absorptive one.

**Long Beach**

As a fully developed barrier island, Long Beach faces stormwater capture problems similar to lower Manhattan, without the massive Manhattan infrastructure. Long Beach has stormwater runoff problems because of years of development without adequate drainage systems. Flooding frequently hinders the movement of emergency vehicles and blocks evacuation routes. The use of permeable pavement for roads has emerged as the green infrastructure of choice. The proposed project includes stormwater retention and management improvements through the use of rain gardens, retention structures, new drainage piping and catch basins, pervious landscaping and decreasing paved surfaces. A second part of the project would install backflow prevention devices on stormwater outfall pipes and debris separation chambers in appropriate locations to improve water quality.

**Red Hook**

During Hurricane Sandy, Red Hook's combined sanitary and storm sewer systems presented special challenges. The pump that sends water to the Red Hook Wastewater treatment plant was damaged and

untreated sewage was discharged directly into the harbor. Red Hook already has a high water table and flooding of low-lying areas happens on a regular basis. A study of Red Hook's drainage system, better management of stormwater runoff and reduction of the combined sewer overflow (CSO) has been proposed. The objective is not just to prepare the community for severe storms but for smaller, more frequent flooding events. The Brooklyn Greenway Initiative is an ongoing effort to develop guidelines for integrated stormwater management and other resiliency measures in Red Hook and other parts of Brooklyn. Sewer backflow and stormwater flooding in locations throughout the area require improvements in drainage infrastructure and stormwater capture, issues exacerbated by Sandy.

**Sheepshead Bay and Gerritsen Beach**

Backflow from sewer systems during Hurricane Sandy caused extensive damage, particularly in the inland sections of the neighborhood. Floodwater and storm surge pushed into the stormwater sewer system through outfall pipes, preventing water and wastewater from escaping and causing backup into houses, businesses and streets. Backflow prevention technology works to keep backflow from inundating building interiors during periods of flooding, including extreme high tides. The proposed project would install valves or flap gates at appropriate stormwater outfall locations throughout Gerritsen Beach and Sheepshead Bay. It would also modify catch basins to maximize capacity while preventing overflow. Other elements of the plan include providing financial assistance for the installation of sewer connection cut-off valves in homes, businesses and community facilities.

**Upstate New York**

In Margaretville, historic and repetitive flooding is caused primarily by the village's proximity to the East Branch of the Delaware River and increased by a number of obstructions located in the floodplain. After running several alternative hydraulic modeling scenarios, it was determined that a multi-pronged approach is needed to chart a long-term strategy. This approach includes more detailed hydraulic modeling and an evaluation of all opportunities in terms of both flood mitigation and community livelihood. Additional proposed actions include repair and replacement of a culvert with an inlet structure at Binnekill Creek, property acquisition and the replacement of the Bull Run Creek/Main Street culvert, and additional protective measures for the Margaretville Central School, beginning with the purchase of a back-up power generator. Thus the plan for Margaretville runs the gamut from more immediate strategies to long-term redevelopment.

**General principles of stormwater management**

- Sandy demonstrated infrastructure weaknesses when the storm surge overwhelmed aging inadequate storm sewer systems.
- Drainage issues are a consequence of tidal actions, storm surge and/or stormwater runoff.
- Studies are needed on the effectiveness of stormwater outfalls and the installation of tidal gates and flapper valves.
- Permeable pavement has emerged as the green infrastructure of choice for many urban locations.
- Impacts of stormwater, tidal flooding and storm surge should be mitigated through enhanced natural systems and improvement of stormwater management and drainage systems.

- Coastal flood protection can be helped by constructing natural and man-made tidal barriers, reefs, floodgates, berms, dunes, breakwaters, detention ponds, vegetated bioswales and bioretention tree pits.

**Consequences of a deficient stormwater management system**

- Lack of maintenance causes many storm drains to clog with trash.
- Flooded roads prevent emergency responders from helping evacuation.
- As stormwater flows over impervious surfaces such as parking lots, it collects pollutants and excess fertilizer that then enter the system.

## Stormwater Glossary

| Term | Definition |
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| Aquatic habitat | An aquatic habitat is an ecosystem suited to the survival of species that live in wet or submerged environments including fish, seaweeds and wetland plants. |
| Armoring of creeks | Armoring of creeks or shorelines is the use of bulkheads or rock walls to stop erosion. It is the antonym of living shorelines. |
| Backflow preventer | A backflow preventer is a mechanism for protecting potable water in plumbing systems from contamination due to backflow such as that seen during storm surge. |
| Berm | A berm is a slightly elevated area of land that marks tidal recession and is a part of natural beach landscape. |
| Bioretention | Bioretention is the process of filtering stormwater through a vegetated area to capture contaminents and sediments in an on-site treatment process. Rain gardens are considered bioretention areas. |
| Bioswale | A bioswales is a planted area below street elevation designed to catch stormwater and allow for drainage. |
| Buffer strip | A riparian buffer strip is a linear band of permanent vegetation adjacent to an aquatic ecosystem intended to maintain or improve water quality by trapping and removing various nonpoint source pollutants from both overland and shallow subsurface flow. |
| Building elevation | Building elevation is the height of a structure built above the surface of the ground. |
| Bulkhead | A bulkhead is a wall that partitions the water from the land to prevent erosion, serves as flood mitigation and allows for docking of boats. |
| Catch basin | A catch basin is a receptacle or reservoir that receives surface water runoff or drainage, typically made of concrete or bricks with a metal grate on top to allow water to enter. |
| Check valve | A check valve is a mechanism that allows for the flow of water or other fluids in one direction and not the opposite direction. |
| Cistern | Cistern is a tank, reservoir or container underground for holding water or other fluids such as stormwater. |
| Coastal outflow | Coastal outflow describes the horizontal flow of pollutants from the continental boundary layer across a coastline into a layer above the marine boundary layer. |
| Code modification | Code modification refers to the changing of zoning regulations to allow for the adaptation of buildings to meet new baseline elevation and freeboard standards. |

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| Corridor | Corridor is a space that allows for movement and flow through an area that otherwise would not facilitate this movement. A corridor can facilitate the flow of water and allow for the migration of animals through an urban landscape. |
| Culvert redesign | Culvert redesign may refer to the reconstruction of a culvert for the funneling of water to allow for the passage of animals or to increase capacity. |
| Detention facility | A detention facility is a permanent structure for the collection and temporary storage of stormwater for controlled release. |
| Dune | A dune is a hill or ridge of sand that lies behind the part of the beach affected by tides and provides defense against storm surge events. |
| Floodplain | A floodplain is a flat, low-lying area bordering bodies of water that will flood during periods of high water including storm surge or precipitation events. |
| Gray infrastructure | Gray infrastructure is a conventional form of managing stormwater and wastewater and is usually made of hard materials such as concrete |
| Green infrastructure | Green infrastructure is the integration of natural systems and processes or engineered systems that mimic natural systems and processes into investments in resilient infrastructure. |
| Groin | A groin is a long, narrow structure built out into the water from a beach in order to prevent beach erosion or to trap and accumulate sand that would otherwise drift along the beach face and nearshore zone under the influence of waves approaching the beach at an angle. |
| Hardening | Hardening is the practice of preventing erosion and flooding through manmade structures that prevent natural processes such as vegetative growth from occurring. |
| Hydraulic modeling | Hydraulic modeling is the use of data in a simulation tool to analyze the hydraulic behavior of water systems including sewer, storm surge, and stormwater in order to plan for infrastructure improvements. |
| Infiltration basin | An infiltration basin is an artificial pond that allows for the collection and infiltration of stormwater into the ground and can be used to improve water quality and reduce erosion. |
| Marsh | Marshes are wetlands frequently or continually inundated with water characterized by emergent soft-stemmed vegetation adapted to saturated soil conditions; they provide many ecological services including water absorption and cleansing and storm surge protection. |
| Outfall pipe | An outfall pipe funnels treated or untreated stormwater and wastewater discharge to the ocean or other body of water. |
| Permeable pavement | Permeable pavement allows for the infiltration of water into the ground while conventional pavement does not allow water to drain from the surface. |

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| Rain garden | A rain garden is a planted area that is designed to absorb rainfall and stormwater runoff where there may be an existing stormwater management issue. |
| Stormwater management | Stormwater management is the planned control of precipitation runoff. |
| Retention pond | A retention pond is a permanent structures for storage of water that will be released by infiltration and/or evaporation. |
| Swale | A swale is a gently sloping drain for stormwater collection. |
| Tidal area | A tidal area refers to the reach of changing water levels during the tide cycle. |
| Tidal wetland | A tidal wetland is a wetland that is affected by the tide or changing water level. |
| Vegetative buffer | A vegetative buffer is an area of dense vegetation that filters sediment and pollutants while slowing runoff flow and allowing for infiltration into the ground. |
| Watershed management | Watershed management is the process of implementing comprehensive land use and water management practices to protect and improve the quality of the water and other natural resources within a watershed region. |
| Wetland | A wetland is a land that is saturated year-round which determines the types of soil, species of plants, and animal communities present. |