Staten Island Bluebelt Expands to Queens

by A. Dean Cavallaro

Photo by Ken Kellai, EKLA

Rain garden during construction. Straw bales surround diffusion well during this phase and protect voids from clogging with sediment (Site No. 5).

The Staten Island Bluebelt is a nationally recognized program that provides ecologically sound and cost effective stormwater management for approximately one third of Staten Island. This long-standing New York City Department of Environmental Protection (NYCDEP) initiative preserves natural drainage corridors, called Bluebelts, including streams, ponds and other wetland areas. Preservation of these wetland systems allows them to perform their functions of conveying, storing and filtering stormwater. The Bluebelt program is cost effective because it reduces the amount and sizing of necessary traditional infrastructure, such as storm sewer pipes, chambers and storage tanks, in favor of natural conveyance and detention while providing important community open spaces and diverse wildlife habitats. This article shares NYCDEP's expansion of the Staten Island Bluebelt into Queens.

Until recently, the Bluebelt program was focused solely on Staten Island because that borough had the least developed network of storm sewers and the most significant stand of freshwater wetlands in New York City; this translated into the greatest opportunity to design a network of traditional storm sewers coupled with constructed wetlands and natural drainage corridors. As part of PlaNYC (2007) and the NYC Green Infrastructure Plan(2010), the city called for expansion of the Bluebelt program to other parts of the five boroughs where Bluebelt-type flood control and stormwater management solutions could be effectuated.

The first capital improvement project undertaken as part of the Bluebelt expanded mandate is Oakland Lake Park in Bayside, Queens. Oakland Lake and Ravine is a 15,000-year-old spring-fed glacial kettle pond located in Alley Pond Park. Oakland Lake's 13 acres of open water are home to a variety of fish species, including bluegill carp, perch and bass. The natural diversity of the area also attracts cardinals, dark-eyed juncos, herons, mallards and scaups, in addition to thousands of migratory birds.

Design Components

Completed last year at a cost of $2.5 million, the Bluebelt project repairs damage to the 46-acre Oakland Lake Park from uncontrolled stormwater flows from the surrounding streets. The multi-site restoration included repairing and recontouring the park's perimeter side slopes and lake shoreline; constructing a rain garden; planting thousands of new trees, shrubs, herbaceous and aquatic plants; building provisions for new recreational opportunities; installing off-street stormwater management features; and constructing and retrofitting catch basins and storm sewers in the streets peripheral to the park to manage storm flows and prevent erosion.

These restorative efforts will improve the ecological health of Oakland Lake, which suffered from significant erosion on the ravine slopes as well as sediment and debris accumulations within the ravine and lake due to unmitigated stormwater runoff. Improving the water quality of the lake will enhance the wildlife habitat, increase faunal species diversity, and offer expanded opportunities for recreational users to enjoy water activities such as fishing, canoeing and kayaking.

Off-Street Stormwater Management Features

At all sites, NYCDEP has redirected stormwater from peripheral streets that had previously flowed untreated into the park and Oakland Lake. Existing catch basins peripheral to the park were retrofitted with curb pieces to accept more runoff, new catch basins were installed at street low points, and curb heights increased to prevent storm flows from "jumping" curbs and flowing unimpeded into the lake. As part of the restorative effort, French drains at a parking lot located at the edge of Site 2 ***(Figure 1)*** were installed. These drains intercept stormwater from the parking lot and redirect it underground and downslope to the bottom of the ravine. The stormwater now enters the ravine from a concealed outfall, preventing the recurrence of erosion gullies.

Lake and Woodland Restoration

The NYCDEP stabilized side slopes with black locust logs, boulders and both organic and engineered erosion control media. Black locust logs parallel to the contours of eroded slopes were installed to reduce runoff velocities, double as steps for trail users, and facilitate trail renewal as woodland detritus fills in around the logs over time. To convey stormwater flow downslope into the ravine in a non-erosive manner, NYCDEP workers constructed armored drainage swales, consisting of layered boulders, field stones and gravel in several key locations. They also excavated accumulated sediment and invasive phragmites rhizomes from around the lake's existing outlet structure and adjacent shoreline that were impeding the flow of water into the outlet structure.

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Courtesy of NYS DOP (Area sites adapted by Patrick Streeter, NYCDEP environmental planner.)

Figure 1. This aerial of Queen's Oakland Lake Park shows the lake and five area work sites where repairs were accomplished in the 46-acre park to manage stormwater, including a rain garden (Site No. 5).

Vegetation

Replanting efforts evolved as debris removal, slope regrading and invasive plant eradication opened up new areas requiring vegetation. The NYCDEP selected plant species native to New York to revegetate the forest canopy, forest understory, herbaceous layer and the lake shoreline. These species will provide food for native wildlife and complement the indigenous plant communities found onsite. Deciduous trees such as oaks, American beech, tulip tree and hickories are the dominant hardwoods within Oakland Lake Park's forested areas, and additional quantities of these and associate species were planted along the regraded side slopes. Partnering with the New York City Department of Parks and Recreation, the MillionTreesNYC initiative planted native trees onsite after huge erosion gullies were filled and the ravines recontoured.

Recreational Access

As part of the restoration effort, NYCDEP filled in redundant woodland paths with plantings and selected preferred paths for hard surfacing to facilitate nature walks and bird watching. Limited runs of wood-simulated, pigmented concrete post and rail fencing were installed to discourage access to the lake's shoreline and wooded ravine in several locations. To prevent soil compaction and erosion along the lake edge, NYCDEP installed three new paved fishing pads and canoe launches with shoreline boulder seating to improve access to the water and increase park visitors' enjoyment while also limiting access to the lake edge.

Rain Garden

As part of the capital improvement, NYCDEP created a rain garden at the crest of a gullied hillside along the park's periphery. For years, runoff from the adjacent neighborhood flowed unabated down the steep wooded slope, transporting sediment directly into Oakland Lake. The new rain garden is strategically sited off-road, between the adjacent street pavement and vulnerable hillside, where it intercepts urban runoff from a 4.2-acre drainage area ***(Figure 2)***. The vegetated, trapezoidal-shaped depression is designed to detain approximately 53,500 gallons of stormwater. A diffusion well, installed beneath the rain garden, percolates infiltrating stormwater through its multi-layered gravel, river stone and boulder tiers, and into an existing natural sand layer. To intercept the natural sand layer, the diffusion well extends 10 feet below the bottom of the rain garden, and is wrapped in a porous geotextile fabric ***(Figure 3)***. In the event that the rate of stormwater inflow exceeds the rate of percolation, the overflow is designed to tip at a mortared field stone weir, and be conveyed into an armored stone and log drainage swale. Field inspections have revealed that this is an infrequent occurrence.

Photo by Carl Ambrose, NYCDEP

One of the fishing pads was constructed with a canoe launch at the lake's shoreline.

Photo by Carl Ambrose, NYCDEP

The completed rain garden intercepts stormwater flows from the surrounding streets, and promotes infiltration (Site 5).

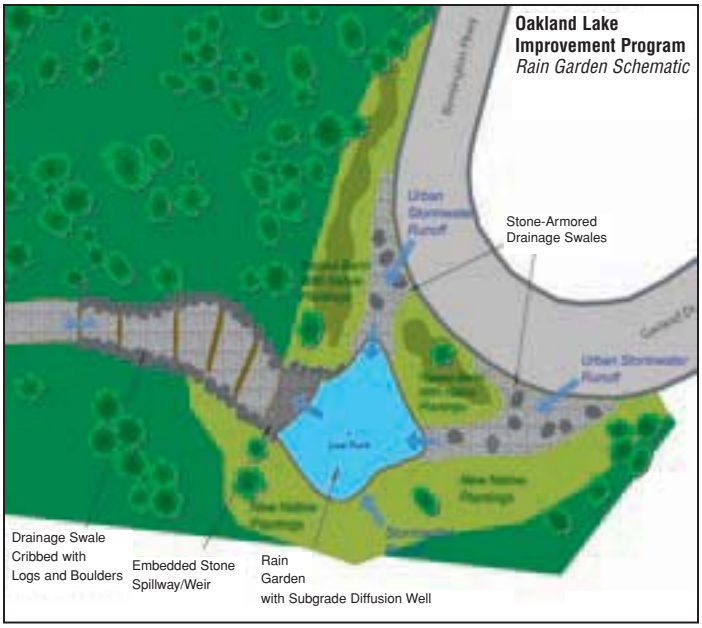

Image by Patrick Streeter, NYCDEP environmental planner

Figure 2. Bluebelt installations that include new bermed plantings and riverstone drainage swales surround the rain garden site to create an effective stormwater collection system.

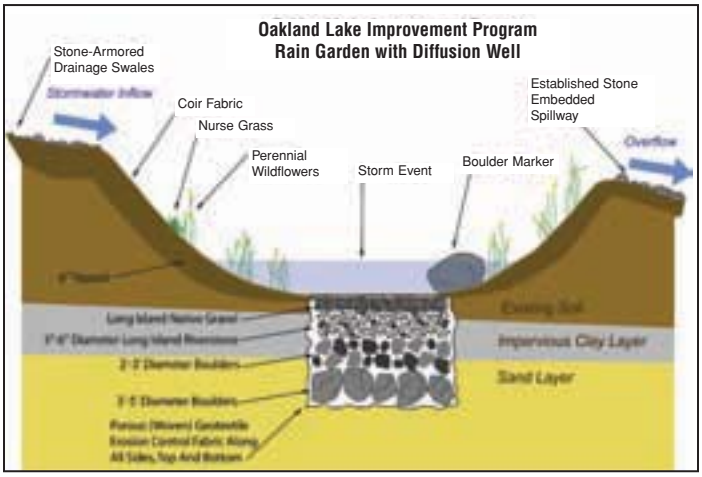

Image by Patrick Streeter, NYCDEP environmental planner

Figure 3. This diagram shows subgrade components that comprise the rain garden system, including the multi-layered diffusion well.

Challenges

The Bluebelt program is well-supported on Staten Island as it has demonstrated sound engineering, sensitivity to plant and animal habitats, and an aesthetic result. Even though Queens is a part of New York City, the Bluebelt program's work on wetland restorations was unknown there, and so the agency forged new working relationships with local elected officials, borough offices of sister city agencies, and the local community.

The lake and ravine restoration for Oakland Lake Park is the first Bluebelt project constructed in Queens to manage stormwater and improve water quality, and is part of the stormwater runoff control plan that NYCDEP has put in place to help avoid combined sewer overflows into New York Harbor.

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