# The Salt Marsh – Pier 1:
## Brooklyn Bridge Park

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## ABSTRACT

This article details the design and construction of the Pier 1 salt marsh in Brooklyn Bridge Park, New York City. The construction of this humble wetland signals a shift in urban park-making, as it compels visitors to venture and engage with the water's edge, instead of viewing it from afar, separated from the waterfront by constructed barriers. This softening of the waters' edge represents an appreciation for the value of urban nature, and makes real the notion that urban parks can be more than an escape *from* the city—they can be a place to enjoy nature *within* the city.

***Keywords:*** Brooklyn bridge park, park design, demolition, removal

*Figure 1:*
*Aerial photo of the salt marsh at Pier 1 in Brooklyn Bridge Park.*

## CONCEPT

The first public meeting for Brooklyn Bridge Park took place in the winter of 1999. Like most open dialogues about transformative neighborhood projects, it was both raw and painful—like democracy itself—but also provided some astonishing moments of insight and clarity. Late in the evening, an octogenarian woman named Mickey Murphy, who was small but self-possessed and clearly well regarded in the room, came to the microphone. What she said struck all of us with great force: “I am retired. I live on a fixed income. I am old. I can no longer go to the country for vacations. I want to be able to go down to the East River at night and put my feet in the water and see the reflection of the moon.”

This impassioned suggestion, that the river’s edge and New York Harbor might be planned not as next to the park but as part of it, helped shape Brooklyn Bridge Park. Previously and conventionally in park design, water had been something that existed to be seen rather than experienced; something “over there.”One of the finest examples of this practice, the Brooklyn Heights Promenade, lies directly above the site of Brooklyn Bridge Park. First imagined in the 1940s by New York City Parks Commissioner Robert Moses, the Promenade is a masterpiece that fuses highway infrastructure and landscape. A sublime and lovely civic platform, it sits atop the herculean Brooklyn-Queens Expressway, a highway stacked into three vertical layers that slices through the Brooklyn Heights hillside. It’s an ideal viewing point for visitors to look down on the bustling, majestic New York Harbor.

What Mickey Murphy spoke of was something else entirely: not gazing out at the water from a high prospect, but actually having the opportunity, in the middle of the city, to engage with river and harbor in both mind and body. She inspired in us a new way of thinking about the 1.3 mile-long watery edge of Brooklyn Bridge Park, a rich and varied meditation that produced ideas for kayak ramps into the water for paddling out; a beach for dipping feet in to test the temperature; floating boardwalks to connect the outer edges of the piers; a salvaged pile field for registering the rising tide; and salt marshes that, unlike fixed retaining walls designed to separate land from water, would provide access, protection, and definition at the water’s edge.

This last idea, of using nature itself to negotiate the vulnerable edge between sea and land, had already been on the mind of MVVA’s Matt Urbanski for some time. Having spent a great deal of his childhood along the Jersey shore, where open shoreline, complex ecological habitats, and areas of human occupation are intermingled, he had an intuitive sense that a different kind of waterfront was possible. A year before our Brooklyn Bridge Park meeting, he had proposed such a plan as part of our design for a small waterfront park on Fan Pier in Boston. Though that version of the park was never built, Matt filed away his concept for future use.

That use presented itself in the site for Brooklyn Bridge Park, a derelict former industrial facility so thoroughly engineered for the unloading of boats that it could be simplified no further. The boundlessness of the 85 acre site was sublime and awe-inspiring, but also harsh and inhospitable. The idea of creating a salt marsh initially emerged as a low-tech and relatively inexpensive way to create both ecological and experiential variety. But as the planning of Brooklyn Bridge Park unfolded over the next several years and we became more aware of the threats of climate change, including rising tides and storm surges, we realized that creating a softer, more malleable edge on the shoreline, informed by the properties of the interrelated materials and phenomena that shape the landscape (soil, plants, drainage, slope, solar aspect, wind, salt air, water), would also be more adaptable to coming water threats. In terms of both the environment and the public, our Pier 1 Salt Marsh has created a more intricate, valuable physical relationship between land’s edge and water’s edge.

## DESIGN AND LOCATION

The salt marsh that was ultimately constructed on Pier 1 was originally proposed for a site that lies between the Brooklyn and Manhattan Bridges, at the park’s northern end. Because installing it in this spot would have required a significant amount of fill, for which legal permitting was difficult to secure, we began to look elsewhere along the waterfront. The discovery of accumulating sediment just south of Pier 1 (itself just south of the Brooklyn Bridge), which precluded the originally proposed marina at that site, made this location ideal for a salt marsh.

Before the design process, MVVA gathered more information about the chosen site. Marine engineers analyzed the existing structures: a concrete pier supported by piles and beneath it a retaining wall


*Figure 2:*
*Aerial image of the East River, showing the proposed and eventual location of the salt marsh relative to the Brooklyn Bridge (left) and the Manhattan Bridge (right).*

which held fill in place to support the pier. The wooden retaining wall was failing, and the team decided that after excavation of the marsh site, a rip rap gravity wall would be installed and the old retaining wall removed. In addition to converting the hard, infrastructural edge into a post-industrial "soft edge," the mobility of the stones comprising the new wall would allow it to maintain its form while absorbing wave impact, thereby protecting the salt marsh.

To ensure the creation of a healthy marsh, the MVVA team visited two nearby salt marshes, one natural and one man-made. In Pelham Bay Park, in the Bronx borough of New York City, we explored roughly 200 acres of native *Spartina* grass salt marshes. The grasses thriving here were located in the upper third of the tidal zone, where they were exposed only to brief periods of saltwater inundation. At lower elevations, the grasses would drown, as the team saw in the constructed marshes they visited in Bayonne, New Jersey. Part of a post-industrial brown field site that had been dredge-filled and converted into a golf course, these man-made marshes were filled with grasses dying due to low planting elevations. In addition, they were inadequately protected from Hudson River ice floes, which sheared much of the vegetation from the marshes each winter. The grasses here were also prone to uprooting by Canada geese, which flock to the marshes in the area every winter to feed.

As a result of these site visits, the team compiled a list of specific design features required to ensure a viable marsh. The grasses would have to be planted at precise elevations in the upper third of the tidal zone to protect them from salt water inundation, but not so high up as to expose them to *Phragmites* infestation. Grading that allowed for drainage would also be a critical feature. The marsh would also need ample protection from ice floes and debris (in addition to the protection the rip rap wall offered against wave impact). The preserved pile field beneath Pier 1, which would be exposed once the concrete decking was removed, would perform this function ideally while also allowing the team to repurpose an element of the existing structure. In order to ensure that the *Spartina* grass was not decimated by wintering geese, the team devised precise specifications for soil and plant preparation, and planned to complete the installation of the grass plugs by early summer, the time of year best suited to proper root establishment and active growth.

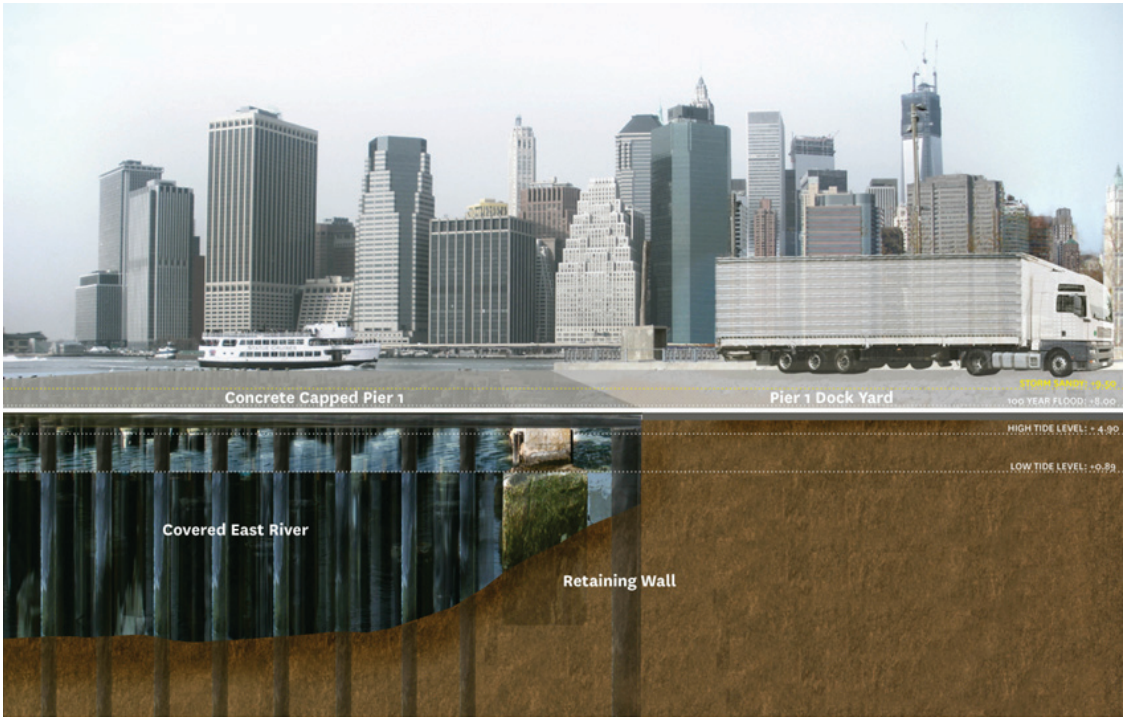


*Figure 3:*
*Existing conditions at the salt marsh site.*

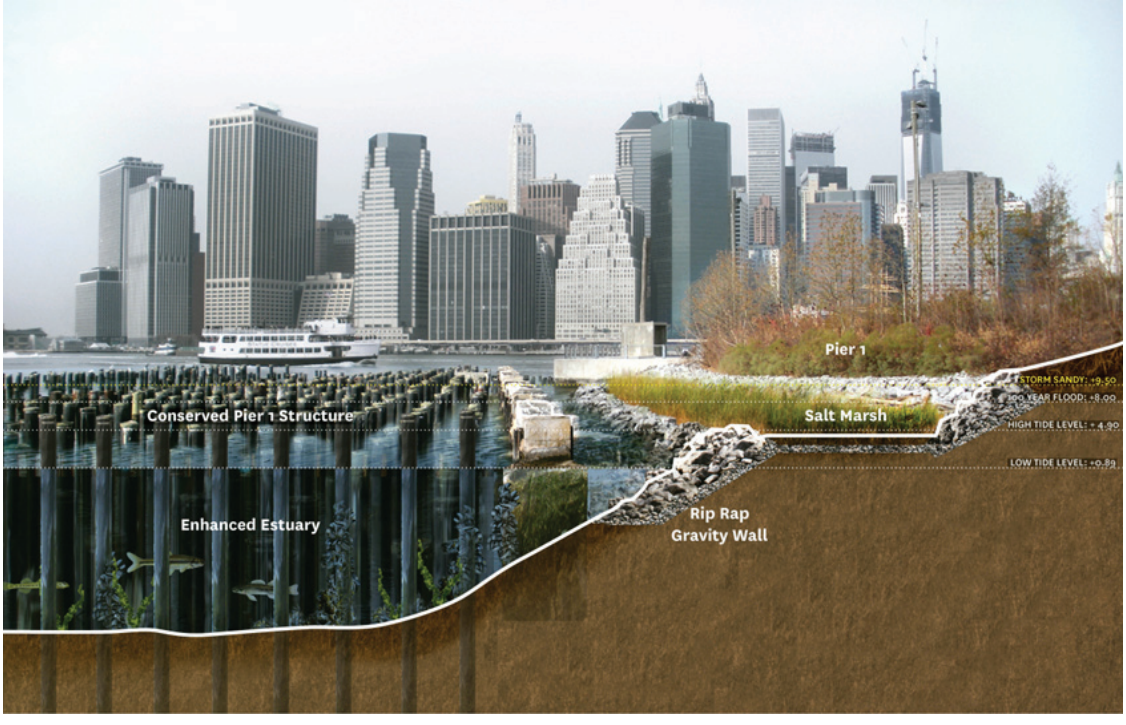


*Figure 4:*
*The salt marsh after construction.*

## CONSTRUCTION

In 2008, the project began with the demolition of the cold storage sheds on the uplands of Pier 1. (As part of a larger commitment to reusing materials throughout the park, the wood from these structures, Longleaf Yellow Pine, was salvaged and used to create cladding for new park structures, site furnishings, and wooden decking.) Next, the salt marsh site was excavated during periods of both high and low tide. Though it was underwater during much of the construction process, workers were able to stabilize the site each day. Fill was removed to the MVVA team's specified sub-grade elevations, based on their earlier salt marsh research visits, and stone bedding and filter fabric were placed to prevent piping.

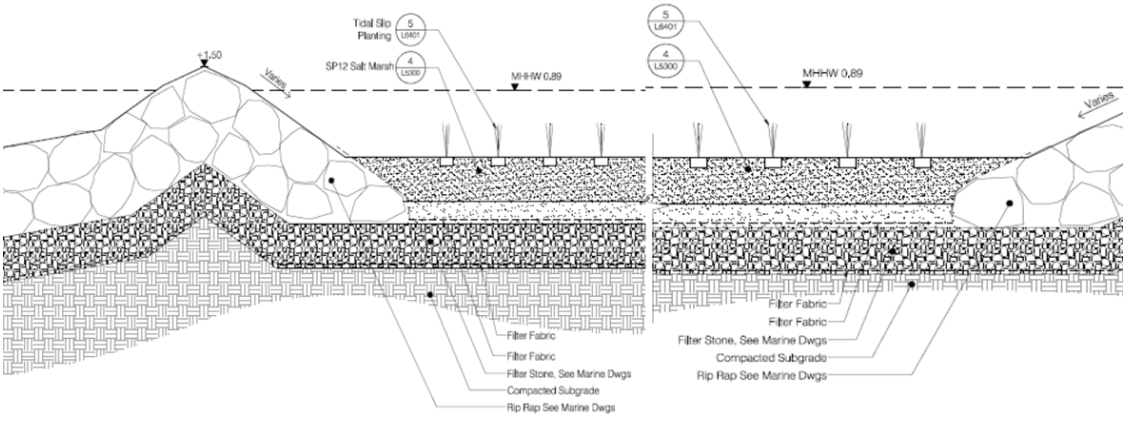


*Figure 5:*
*Salt marsh section showing multiple sub-grade layers – filter stone, filter fabric, rip rap, and planting soil.*

*Figure 6:*
*Reclaimed granite blocks from the old Willis Avenue Bridge were re-used for seating around the salt marsh.*

Chunks of quarried limestone, shipped to the site on barges, were placed on top of the filter system to keep it in place. The rip rap gravity wall, comprised of granite chunks, was installed, and reclaimed granite blocks from the reconstructed Willis Avenue Bridge in Manhattan were installed as a seating area that steps down into the marsh.

With the rip rap wall in place, demolition and removal of the site's original retaining wall began. Once this was complete, construction workers removed the concrete pier decking adjacent to the salt marsh site by sawing it into sections, which were then loaded into trucks and hauled off site.

Uncovering the water long hidden beneath the pier transformed a previously barren space into an estuary with the potential to once again become a productive natural habitat for marine life and plants. It also put on vivid display the integration of natural ecosystems and infrastructure that is at the very heart of Brooklyn Bridge Park. Once exposed, the pile field, which was left intact to protect the salt marsh against ice floes as planned, was found to contain voids corresponding to the A and C line subway tunnels which take New Yorkers back and forth under the water between Brooklyn and Manhattan.

These open spaces, as much as the view of Lower Manhattan across the water from the park, are literal representations of the future of urban park planning: the co-mingling of nature and man-made designs.

In 2009, construction of the salt marsh entered its final stage with the placing of a two-layer soil profile into the previously excavated space. The subsoil was comprised of equal parts medium sand and mature compost; the planting soil was comprised of four parts medium sand, one part sandy loam, and one part compost. Both soil blends had an organic matter content of two to three percent and a combined silt and clay content of three to eight percent. The marsh vegetation, a monoculture of *Spartina alterniflora* (Smooth Cordgrass), was acclimated to salt water at Pinelands Nursery, in Columbus, NJ ,before planting. By feeding the plants water that matched the exact salinity of the tide at Pier 1 (twenty-two parts per thousand) the team hoped to give the grasses the best possible chance to thrive in their new location. The *Spartina* was planted in the upper third of the tidal zone, about one foot on center.

*Figure 7:*
*The concrete pier decking is removed, exposing the pile field beneath.*

*Figure 8:*
*Aerial photo of the salt marsh under construction. Voids in the pile field trace the paths of two underwater tunnels serving the A and C subway trains*

Because it is a warm-season grass that shows active growth in the summer, the planting process was finished before June 1 to ensure proper root establishment, thereby protecting the grasses as much as possible from Canada geese. The construction of the marsh took one year to complete, and Pier 1 opened to the public in 2010.

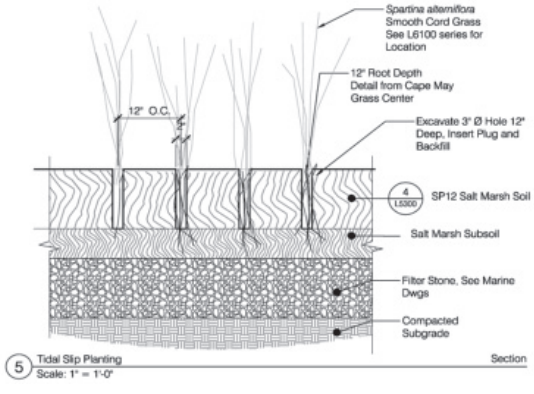


*Figure 9:*
*Section showing planting of the Spartina plugs within the salt marsh.*

## PERFORMANCE EVALUATION

In its first year, the Pier 1 salt marsh faced the expected challenges and came through them well. The *Spartina*, as predicted, had filled in completely after one growing season.

Flocks of geese arrived in the winter to feed on it, but because the grasses had been pre-treated with saline and given maximum time to establish their roots, the birds were not able to uproot them and the grasses recovered fully the following summer. The soft edge of the marsh held up well through winter storms and the pile field kept ice and other debris away.

Then in October 2012, the salt marsh faced an extraordinary threat: Hurricane Sandy, the largest Atlantic hurricane on record and the first to make a direct hit on New York City and New Jersey in several decades. The perils of climate change that were still notional to us when we originally designed the marsh were made real in the form of record-breaking storm surges up to 1.5 feet higher than the 100-year flood elevation. Where the old, static Pier 1 would have

*Figure 10:*
*Spartinaalterniflora shortly after planting.*

been overwhelmed by water, allowing the surge to reach further onto land, the loose rip rap edge of the marsh, which rises to a higher elevation than the old pier, absorbed most of the tremendous wave impact. The unprecedented flooding of Sandy left the soft edge, and the park beyond, virtually unscathed. Though the *Spartina* grasses were flattened by the many tons of debris the storm swept into the marsh, their well-established root systems held fast, ensuring resiliency and the grasses emerged undamaged. The numerous floatables that were washed into the marsh by the storm surge were later removed by hand.

Put to the ultimate test, the Pier 1 salt marsh demonstrated the value and necessity of designing for the world in which we now live, where violent storms are becoming more frequent and flood resiliency strategies will need to include engineered ecologies to prevent future damage. It can be seen as a meshing of two disciplines: marine engineering and landscape design and it shifts the definition of what can be considered designed space.

But critically important as that shift is, the Pier 1 salt marsh is more than just an example of design for our climate-challenged future. As part of a signature park for the next century it is a key to understanding that habitat restoration has intangible qualities as well as functional ones. Given its location, it may be the most visited salt marsh in the world, giving it tremendous environmental education value as well. It offers peaceful respite from urban life, allowing New Yorkers to engage on an intimate level with the water that surrounds them but goes all too often unnoticed. The marsh brings us full circle; making an ecosystem that was once devalued and destroyed into a focal point for people and animals alike. In doing so, it reminds us of the possibility for positive change in the face of enormous ecological challenges, the importance of refuge, and the power of nature.

*Figure 11:*
*The salt marsh after one growing season.*

*Figure 12:*
*Destruction and debris in the salt marsh following Hurricane Sandy.*

*Figure 13:*
*A view from the salt marsh showing Manhattan's financial district skyline across the East River.*

*Figure 14:*
*Aerial photo showing Pier 1 during a public movie screening.*