Wetlands Protection and Management in NYC since PlaNYC 2007

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Abstract

Though wetlands protection was not the focus of any single initial PlaNYC goal or investment, PlaNYC pointed to the importance of wetlands functions in contributing to water quality and flood control management, and to programs that utilized wetlands as nature-based solutions. Momentum around wetlands protection and restoration in NYC was growing when PlaNYC was written in 2007 – environmental advocates, governmental agency representatives at local, state and federal levels, and elected officials, were collaborating on several policy and restoration initiatives. PlaNYC, and several local laws, also committed to further analyses and policy development to manage wetlands, building on existing support for these actions. The resulting reports and plans included recommendations and specific commitments to wetland projects and programs that communicated the value of wetlands and helped secure grant funding. After these subsequent PlaNYC reports, it was external catalyzing events, like Hurricanes Sandy and Ida, that played a large role in garnering support for funding for projects that included wetlands restoration and reconstruction or mitigation. Together, all PlaNYC reports recognized wetlands as part of natural infrastructure critical to the social and physical well-being of NYC. However, the on-going challenges of sea level rise, development pressure, space constraints, and water quality, and physical and biotic process stressors mean fundamental conservation goals, such as no net loss of wetlands, have not been and are becoming increasingly hard to achieve.

Thesis / Key Messages:

1. For the first time in a citywide mayoral document, PlaNYC (2007) communicated the importance of wetlands for a climate resilient city and committed the city to take specific actions to protect wetlands across agencies and programs in recognition of essential services wetlands provide.

2. Subsequent PlaNYC publications expanding PlaNYC 2007 commitments (the Regulatory Gap Analysis (2009), PlaNYC 2011, and the Wetlands Strategy (2012)) were mandated by Local Laws. They reported that wetland regulatory protections were limited by inadequate mapping and enforcement. This led to further investment and partnerships to improve mapping, identify wetland threats and implement restoration actions.

3. While budgets and political priorities varied, PlaNYC commitments helped secure support for city, state, federal and private funding and ensure accountability, which encouraged continued advocacy by and partnerships with NGOs. Reports and plans such as the Wetland Transfer Task Force (WTTF) (2007) Hudson Raritan Estuary Comprehensive Restoration Plan (2016) and Wetlands Management Framework (2021) identified opportunities and needed actions. When major storms in 2012 and 2021 drew attention to contributions of wetlands to resiliency, these Plans provided justification and priorities for funding.

4. PlaNYC and subsequent work by the city and partners highlighted that successful wetlands management requires protection, restoration, mitigation, and assessment. It also underscored the importance of effective and supportive policy, on-going projects, new analyses and strategic planning to address challenges, and long-term protection in

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recognition of the ecological services wetlands provide. Despite PlaNYC and other planning efforts, NYC is still losing wetlands, particularly salt marshes, due to sea-level rise and other stressors, at a rate of approximately two horizontal feet per year along many coastal shorelines.

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I. Introduction

Wetlands are highly productive, ecological systems that provide varied habitat, support a diverse array of plants and animals, filter water, store carbon, and detain and hold floodwaters. In dense urban environments, wetlands also provide the critical benefits of open space and access to nature and wildlife for recreation and health. This is particularly true in NYC, with a population over 8 million where only about 15% of the tidal wetlands and less than 5% of the freshwater wetlands remain from the vast array of salt marshes, streams, riparian floodplains, swamp forests, kettle ponds and other wetlands that covered the landscape prior to colonization (RPA 2002, Sanderson 2009). These wetlands and the estuary were critical to the indigenous communities in this region and later to its commercial and industrial development. Due to its latitude and position, NYC still has thousands of wildlife and plant species that depend on wetlands for some part of their life cycle (NYC DEP 2007, Stinnette et al. 2018, Weldy et al 2019). Today, NYC still has approximately 6,400 acres of wetlands, 3,600 acres of salt marsh and 2,800 acres of freshwater wetlands citywide (NYC Parks 2026). Urban wetlands are particularly valuable in making cities livable (Dooley and Stelk 2021). They provide New Yorkers with places to birdwatch, hike, kayak and experience nature, and they provide services and value including absorbing wave action, trapping sediment, sequestering carbon, processing pollutants, and providing nursery and forage habitat for wildlife. But despite their presence in all five boroughs (from kettle ponds at the top of the glacial moraine in Forest Park, Queens, to the coastlines of northwest Staten Island, Pelham Bay Park in the Bronx, and Jamaica Bay in Queens) these natural systems were never centered in any comprehensive policy or planning effort. For the first time in a mayoral, citywide plan, PlaNYC Greater Greener New York (2007) stated the importance of wetlands to sustainability and climate resiliency and committed the city to take specific actions to protect wetlands across agencies and programs in recognition of essential services wetlands provide.

II. The context and drivers for including wetlands in PlaNYC

The inclusion of wetlands in PlaNYC was driven by converging policy, scientific, and advocacy developments. PlaNYC was also informed by decades of actions to correct for historical wetland loss and limit on-going wetland degradation. By the 1970s, New York City had dredged, filled, and built on top of the thousands of acres of salt marsh along its shorelines, and had redirected, buried, and piped the thousands of acres of freshwater wetlands and hundreds of miles of streams that had defined the landscape. The Clean Water Act of 1972 was critical in saving the remaining tidal and freshwater wetlands in NYC after industrialization, infrastructure construction and land-reclamation efforts of the early to mid-twentieth century. Specifically, Section 404 of that Act ensured regulation of dredging and filling of wetlands and waters of the United States and thus slowed the fastest cause of wetland loss in NYC. Federal protection of tidal and freshwater wetlands also applied, under the jurisdiction of the U.S. Army Corps of

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Engineers (USACE), which was responsible for regulating fill in tidal or freshwater wetlands of any size with a nexus to navigable waters of the U.S.

New York State (NYS) implemented Federal law with the passing of NYS tidal wetland protection laws in 1973 (ECL § 25-0101 *et seq.*) followed by the Freshwater Wetland Act (FWA) in 1975 (ECL § 24-0101 *et seq*.). These laws regulated actions in tidal wetlands of any size and in freshwater wetlands greater than 12.4 acres (5 ha), as well as smaller wetlands designated as having "Unusual Local Importance" as determined by procedures and standards set forward under the regulations. These regulations also provided protection to wetlands by regulating the adjacent 100 ft buffer of regulated freshwater wetlands, and the adjacent 300 ft (150 ft in NYC) of tidal wetlands of any size. Buffer protection was a critical addition to the state law by acknowledging that adjacent land uses can influence the quality and function of wetland habitat (Boyd 2001, Cook 1992, MACC 2019). The FWA also required ranking of the value of freshwater wetland by Class (I-V), requiring less stringent protection for the least valuable Class V wetlands (ECL § 24-0105).

Despite these transformative protection measures, the damage had been done, and remaining wetlands were still vulnerable to degradation and destruction through development in New York City, in part because protection is dependent upon accurate wetland mapping and resources and commitment to enforcement. At the state level, to implement and establish a basis for wetland regulations, the New York State Department of Environmental Conservation (NYSDEC) had to map existing wetland extent and type, which they did using aerial photography in 1974 for tidal wetlands, and in 1987 for freshwater wetlands. But there is inherent inaccuracy in drawing wetland boundaries from aerial photos by hand at 1:24,000 scale without the hydrologic, soil, and vegetation indicators from the field. In NYC this is particularly true, as most wetlands have already been fragmented, reduced in size, and severely altered. Still, the mapping NYSDEC conducted in NYC included 36 wetland complexes smaller than 12.4 acres designated as being of Unusual Local Importance (PlaNYC 2012). The U.S. Fish and Wildlife Service also conducted a National Wetlands Inventory (NWI), last updated in 1991, which aimed to assess freshwater wetland uniformly across states. This used a different classification system and more field verification. Although NWI identified more, smaller freshwater wetlands in NYC than DEC, the red parent material in areas of Staten Island made hydric soils difficult to distinguish, and the facultative quality of many forest tree species found in both wetlands and uplands, could have led to underestimating wetland extent (NYSDEC 1995, Tiner 2000, PlaNYC 2009, Isleib et al. 2010). The NWI did not provide greater regulatory protection but did identify more sites with conservation and protection needs.

On-going wetlands degradation in the 1990s included the development of small freshwater wetlands in Staten Island at Graniteville Swamp, in the Lemon Creek watershed, and at Bloomingdale Woods. As noted above, forested wetlands at these sites may have been under-mapped for the same reasons: difficult-to-distinguish hydric soils and facultative woody vegetation. Also in the early 1990s, several oil spills in the Arthur Kill contaminated vast stretches of tidal salt marsh in Staten Island and New Jersey. These spills required immediate remediation, as well as legal actions and that resulted in natural resource damages funding for salt marsh restoration, and ultimately increased attention to and awareness of threats to tidal wetlands.

These on-going impacts further fueled community resolve and agency **commitment** to fight for investment in the city's remaining wetlands that, despite being fragmented and undervalued, supported the iconic harbor herons and hundreds of other species (Partridge et al. 2026; Washburn et al. 2016). In 1997, a decade after its creation, the NY-NJ Harbor Estuary Program

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(HEP) issued its first Comprehensive Conservation and Management Plan, which identified main causes of impairments and responses needed. NYC agencies and not-for profit partners participating in HEP identified dozens of sites and properties across NYC where there were conservation and restoration opportunities. Land conservation initiatives for the City's large wetland complexes in Jamaica Bay and Staten Island were launched by The Trust for Public Land and New York City Audubon[1] (Trust for Public Land, 1987, 1991, and Trust for Public Land & NYC Audubon 1991). At the state level, the legislature created the Environmental Benefit Fund program and voters passed the 1996 Clean Water / Clean Air Environmental Bond Act which brought tens of millions of dollars to the City to acquire dozens of acres of open space, including wetland and coastal land along the Arthur Kill, Hudson River, Kill van Kull, Raritan Bay, Jamaica Bay and Long Island Sound (Cleaver 2009). The 1996 Bond Act also provided funding for 10 stream and wetland restoration projects (e.g., Soundview, Strack Pond, Gerritsen Creek, Bronx River) in all five boroughs of the City totaling over $6.3 million.

NYC agencies also opportunistically advanced restoration and enhancement actions through their own programs. Restoration was sometimes needed to offset adjacent infrastructure impacts, for example, to mitigate impacts of sewer projects at Willowbrook and Idlewild Parks in the 1990s, or was proactively pursued to incorporate wetlands and stream corridors as nature-based solutions in watershed drainage and stormwater management plans, e.g. as the NYC Department of Environmental Protection (DEP) did at Richmond Creek in Staten Island and other Bluebelt locations. Open space and community advocates, including the NYC Audubon, Regional Plan Association, and Soil and Water Conservation District, recognized the importance of protecting wetlands on city property and ensuring it would not be disposed of for development. They worked with NYC elected officials to legislate, through Local Law (LL) 83 of 2005, the establishment of a Wetland Transfer Task Force (WTTF) with the express purpose of inventorying and evaluating city parcels with wetlands and if feasible, and transferring, or reassigning those properties to either the NYC Department of Parks & Recreation (Parks) or DEP for conservation. This taskforce, comprised of agency and non-governmental partners, ultimately recommended 158 parcels totaling 267 acres, for transfer to Parks or DEP or for further review including Arlington Marsh on Staten Island and Sunset Cove in Queens (see Section VI). The Task Force Report also called for a citywide wetlands policy as well as other policy recommendations intended to conserve and manage wetland resources.

Even in the absence of development or direct damage, existing tidal wetland loss was also becoming alarming, most apparently in Jamaica Bay from the 1970s-1990s (Arnold et al. 2001). Research showed that vegetated marsh islands were shrinking and converting to mud flats at a rate that suggested these habitats and the ecological services they provide could be lost in decades (Hartig et al. 2002). This loss reflected the cumulative impacts of numerous anthropogenic actions including modification of bay bathymetry, hydrodynamics and sediment supply, nutrient loading from stormwater and sewage, boat wakes, and sea level rise. In response to this concern, the U.S. Army Corps of Engineers (USACE), National Park Service (NPS), NYSDEC, and NYC DEP collaborated to beneficially reuse clean New York Harbor sand dredge material to reconstruct eroding Jamaica Bay marsh islands - - the first effort of its kind in NYC, beginning with 40 acres of sand placement and salt marsh plantings at Elders Point East Marsh Island from 2006 to 2007. Local and regional environmental advocates, including the Jamaica Bay Ecowatchers, the American Littoral Society, and the Natural Resources Defense Council, also succeeded in passing LL 75 of 2005, which required the development of a Jamaica Bay Watershed Plan to address marsh loss through research and the development and implementation of wide-ranging pollution reduction and mitigation actions.

[1] Now known as NYC Bird Alliance

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III. Wetland Initiatives that PlaNYC (2007) Incorporated and Advanced

The wetlands initiative in PlaNYC 2007 focused on protection and was subsumed under the larger goal of improving water quality and waterways. Several other initiatives in the Plan identified programs using wetlands (Bluebelts) or aquatic systems (shellfish reefs) to support the overarching goal of improved water quality and safe waterways. PlaNYC authors at the NYC Office of Long-Term Planning and Sustainability (OLTPS) worked closely with agencies and non-governmental partners to include the on-going initiatives to protect wetlands mentioned above. The well-established benefits of wetland for water quality, habitat, and flood management aligned with PlaNYC's broader sustainability objectives, while local legislative mandates—such as the establishment of the Wetland Transfer Task Force and requirements for Jamaica Bay watershed planning—provided a policy and legal foundation.

Focusing directly on protection, PlaNYC recognized at that time that state and federal regulations and policies did not ensure protection of all wetlands and that these regulatory gaps needed to be assessed and protections potentially expanded. For example, freshwater wetlands smaller than 12.4 acres, unmapped wetlands, and freshwater wetland buffer areas had limited protection. Such an analysis of regulatory gaps was recommended in the New York-New Jersey Comprehensive Conservation and Management Plan (CCMP, 1996) a decade earlier but not yet implemented by New York State or NYC. PlaNYC also included the City's legal requirement to complete the obligations of the Wetland Transfer Task Force and to produce an associated report. These steps were viewed as essential to developing a comprehensive policy to protect and manage wetlands in the City.

PlaNYC 2007 also committed to expanding ecological services wetlands provide for water quality, referencing multiple, on-going NYC DEP initiatives, often in partnership with NYC Parks. These included the NYC DEP Bluebelt program, initiated in 1997 in Staten Island, that reconstructed stream and freshwater wetland systems to manage stormwater and flooding, as well as to create and add park-like amenities. Another initiative was to pilot the shellfish reefs—features of intertidal wetland and marine ecosystems—for their water filtration function. In the uplands, particularly in combined sewer systems, PlaNYC committed to expand green infrastructure, e.g. tree beds and rain gardens, emphasizing the potential for a watershed approach both to incorporate wetlands as green infrastructure in the landscape and to benefit downstream water quality, as well as wetlands through management of pollutants and hydrologic disturbance. These initiatives were linked under the umbrella of Best Management Practices, all codifying existing commitments to expand wetlands use for ecological services and to indirectly help protect wetlands through water quality improvement initiatives.

In the years immediately following PlaNYC 2007, several key reports were produced, and several local laws were passed which fulfilled or codified the wetlands protection recommendations named in PlaNYC. New legislation, whether local or state, helped ensure actions were taken and, to various degrees, ensured accountability. In 2008, NYC DEP published a sustainable stormwater plan for NYC, mandated by LL 5/2008, and pledged to construct more wetlands for stormwater management and reduce pollution loads to help protect tidal marshes. NYS-mandated Long Term Control Plans across the city, negotiated by NYC DEP over four years, compelled the implementation of stormwater green infrastructure, as well as wetlands restoration, to improve the quality of the city's waterways.

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A year later, OLTPS produced a report analyzing wetland regulatory gaps and other threats, which examined effectiveness of wetland protection laws and other causes of wetland loss in NYC (PlaNYC 2009). The report suggested that inaccurate wetlands mapping was a significant problem and recommended improved wetland and floodplain mapping to further assess risk to wetlands and to gather the data needed to recommend local policy changes and help inform restoration and management. The report also stressed the importance of continuing the related work of implementing the WWTF, the Jamaica Bay watershed plan, stormwater best management practices, acquiring property for Bluebelts, adapting wetlands management sea level rise, improving mitigation practices, and exploring more approaches to management and stewardship.

In 2009, two local laws passed to address wetlands protection. First, LL 21 required the NYC Department of Buildings coordinate with regulators to ensure permits are not issued for development on wetlands, a problem that the Regulatory Gap Analysis Report noted *(More discussion planned with DEC to provide context on this)*. Later, LL 31 mandated steps to improve wetland maps as well as the development and implementation of a wetland protection strategy for the City, both recommendations made in PlaNYC 2007. Subsequently, city agencies and partners continued to work closely, both on the development of improved wetland maps (DEP 2010) and on developing collaborative research and assessment priorities and sharing restoration location and functional objectives (NYC Parks 2010).

In the first update to PlaNYC, in 2011, the wetland protection goals were articulated in the goals for public open space, including calling for the establishment of a Natural Areas Conservancy. Under the goal of establishing clean and safe waterways, PlaNYC 2011, articulated four initiatives related to enhancing wetland protection, expanding wetlands restoration, improving wetlands mitigation, and enhancing habitat for aquatic species, each of which representing existing programs and projects, and which provided the basis for the legally mandated Wetlands Strategy to follow.

IV. Development and Implementation of the Wetlands Strategy of 2012

The 2012 NYC Wetlands Strategy fulfilled the requirement of LL 31 for a wetland protection strategy for the city. It was produced by NYC's OLTPS, primarily authored by Aaron Koch, and was a culmination and compilation of on-going agency programs and collaborations, as well as findings from reports and analyses that were named or grew out of PlaNYC's wetland agenda. For the first time, the Wetlands Strategy established a goal of no net loss of wetlands in NYC, in alignment with the federal administration nationwide goals beginning in 1989, and promoted a multi-pronged management approach including protection, mitigation, restoration, and assessment. The Wetlands Strategy articulated 30 specific commitments with multiple milestones, focusing on increasing protection of vulnerable wetlands, improving mitigation guidance, completing more than a dozen restoration projects, and improving metrics for assessing wetlands restoration. Most of the projects identified were in some stage of development, and many were first identified in the PlaNYC 2011 update. Existing programs were leveraged to support the Wetlands Strategy and there was both close interagency collaboration to establish commitments, as well as distinct motivations and interests by agencies contributing to the plan.

Protection goals in the Wetlands Strategy focused primarily on implementing the recommendations in the Wetland Transfer Task Force Report, recognizing areas of ecological significance in the NYC Waterfront Revitalization Program (WRP), and improving wetlands mitigation both to achieve better functioning wetland and to reduce cost and inefficiency in

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permitting. The WRP serves as a supplement to the State's Coastal Management Program (New York Executive Law, Article 42 (Sections 910–922); 19 NYCRR Part 600), which supersedes the Federal Coastal Zone Management Act (Coastal Zone Management Act, 16 U.S.C. §§ 1451–1464) in New York State. The WRP and state coastal program include policies and a framework that help guide implementation and protection of water uses with coastal resource protection, which can provide an additional layer of regulation for wetlands.

The Wetlands Strategy completed the policy evaluation called upon in the Wetland Gap analysis. The authors determined that, while creating new local regulation could be easier than changing state or federal policies, a new city regulation for freshwater wetlands would not be prudent. The analysis showed local regulations could improve protection for approximately 100 acres in total based on mapping from NWI. But, new local regulations would potentially have significant administrative, political, and economic cost, given this total acreage was distributed across hundreds of properties. Consequently, the Wetlands Strategy recommended focusing on using other levers to improve wetlands protection, including through mitigation.

When wetland impacts are necessary, wetlands mitigation offsets those impacts through restoration. However, wetland mitigation was inconsistently implemented and enforced in NYC, and it was increasingly difficult and expensive to find suitable and sufficiently large sites to re-establish wetlands. The Wetlands Strategy championed the on-going interagency effort, led by the NYC Economic Development Corporation (EDC), to pilot a wetland mitigation bank for that purpose. With funding (from New York State Department of State's Local Waterfront Revitalization Program, Empire State Development, and city capital funds), and the ability to use city parkland, the commitment to implement the mitigation bank at Saw Mill Creek in Staten Island garnered essential support from City Law and NYC Office of Management and Budget.

Restoration goals in the Wetlands Strategy largely committed to 35 actions associated with on-going, long planned, funded or partially funded projects or programs, rather than new initiatives. These included the federal, state and city collaboration to reuse dredge material for Jamaica Bay marsh island reconstruction. Goals included implementing 17 tidal and freshwater marsh restoration, shoreline stabilization, and habitat connectivity, programs funded by various state and federal programs and mostly lead by NYC Parks, as well as NYC DEP. Some of the project commitments in the Wetlands Strategy were also reinforced by regulatory requirements, such as the Department of Environmental Protection's Long Term Control Plans, which linked water quality improvements to ecosystem restoration.

New initiatives were also part of the Wetlands Strategy, in particular the commitment to assess the vulnerability of existing wetlands and identify additional policies to protect and manage them. This emphasis on assessment reflected the need to not only map the extent of wetlands in NYC but characterize their condition and then determine and prioritize appropriate management interventions.

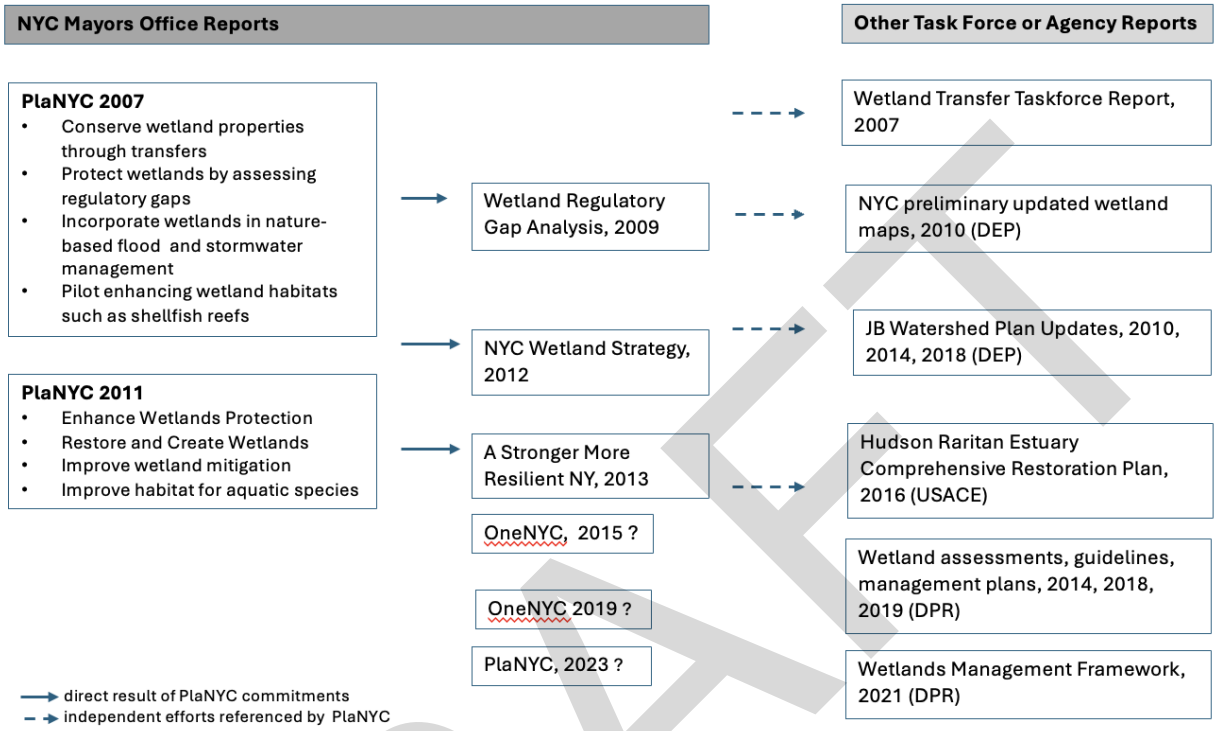
The Wetlands Strategy, in the PlaNYC vein, espoused a multi-pronged approach for wetlands restoration and protection that recommitted to existing laws and policies, promoted on-going efforts by agencies, and recommended new analyses and planning that for the most part were in progress by agencies.

This was the last Mayor's Office report focused entirely on wetlands. Over the years, the initiatives and recommendations in the Strategy were pursued and completed, as described below in section VI. These restoration actions, studies, and assessments informed the next

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comprehensive plan for wetland management, the Wetland Management Framework, which was written by NYC Parks in 2021, as discussed below.

Draft Figure 1. PlaNYC Reports with Goals for Wetlands and Associated Reports



V. How various factors shaped wetlands protection and PlaNYC implementation

The multiple strategies, initiatives, and recommendations for wetlands protection and management in the PlaNYC reports were advanced without any major, single or on-going financial commitment from the city. Implementation of plan recommendations proceeded largely due to 1) agency resources committed to existing programs, 2) robust partnerships, 3) regulatory requirements, 4) state and federal grants whose programs aligned with PlaNYC goals, and, 5) funding triggered by catalytic events such as storms, which continually renew the role of wetlands and nature-based solutions in resilience.

Beginning with PlaNYC 2007, the global financial crisis in 2008 impacted the city budget and limited initiatives requiring city funding towards wetland projects, beyond city match for grants and cost sharing. Partly as a result, PlaNYC 2011 and the NYC Wetlands Strategy identified NYC Parks-led initiatives for wetland restoration projects that had already secured at least partial funding through state and federal grants, such as the 1996 Clean Water Clean Air Bond Act or with the U.S. Army Corps of Engineers (USACE) Hudson-Raritan Estuary program. NYC DEP largely met commitments via their existing Capital program and regulatory obligations. For example, by 2012, the City invested over $9 billion to improve waterways and the waterfront by reducing combined sewer discharges and improving water quality in New York Harbor (PlaNYC 2012).

Developing and strengthening partnerships with non-profits and community groups allowed the city to work towards its goals despite limited resources. For example, in 2012, the Natural Areas

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Conservancy (NAC) formed as a non-profit Partner to work closely with NYC Parks to study and support the forests, wetlands, grasslands and other remaining natural ecosystems in NYC, while expanding research, advocacy, and communications support to Parks. NAC and Parks received a U.S. Environmental Protection Agency (EPA) grant in 2012, funded an assessment of the condition and vulnerability of marshes to sea-level rise—a key recommendation from PlaNYC 2011). This evaluation and partnership led to reports that allowed NYC Parks to shift more towards data-driven restoration planning and expand opportunities for funding.

NYC also continued to work closely with the NY-NJ HEP and the USACE to draft the Comprehensive Restoration Plan (CRP), finalized in 2016, to identify over 15 restoration opportunities. The CRP brought critical federal funding to restoration projects in NYC, usually with a 35% match from the City as local sponsor (HEP, USACE 2016). To refine the remaining restoration opportunities in NYC, NYC Parks worked with the Natural Areas Conservancy to document feasible sites in coastal areas (NAC 2016) and since then Parks continues to refine and expand a newer version of this restoration opportunity inventory. NYC Parks and USACE leveraged funding federal, state Bond Act grant, and city funding to complete large restoration projects (included in Table 1).

Beyond ongoing partnerships and typical sources of funding, catalytic events like hurricanes Irene (2011) and Sandy (2012)) drew attention to the importance of wetlands, natural riparian floodplains and undeveloped vegetation shoreline in helping to provide buffers and areas to manage floodwater and for future resilience. Superstorm Sandy hit NYC in October 2012, devastating neighborhoods across NYC and prompting the Special Initiative for Rebuilding and Resiliency - the final PlaNYC report of the Bloomberg administration (PlaNYC 2013), as well as numerous subsequent local plans for hurricane impacted neighborhoods (cite). Sandy increased city government awareness of the importance of wetlands and the role that they play in resiliency, particularly as wetlands were not damaged by the hurricane, but development on former wetlands was. After Sandy, the city, with the state, bought out a portion of damaged property around the coastline, for future land preservation. While the city did not directly commit additional funding to wetlands, individual community-supported wetland projects outlined in post-Sandy neighborhood plans received significant grant funding, including from the U.S. Department of the Interior and the National Fish and Wildlife Foundation's Hurricane Sandy Coastal Resiliency Program. The city provided matching funds for these and other grants. One critical example of this was Sunset Cove. Sunset Cove was a parcel identified in the Wetland Transfer Task Force Report after having been acquired by the city following the closure of a marina following numerous environmental violations. The site was transferred to Parks and then restored to tidal wetland, with a coastal upland for marsh migration, and a pathway surrounding the site that serves as a protective berm.

Regulations, and particularly mitigation have also significantly driven funding and implementation. Both the state and the federal government require mitigation to offset the wetland impacts associated with dredge and filling. Wetland mitigation funding was a significant component of funding for these restorations, where the project was expanded to accommodate mitigation needs from city or private projects. These mitigation and restoration projects required permits from NYSDEC and USACE and require post construction performance monitoring standards. This environmental compliance monitoring was key to NYC Parks, for the first time, in 2016, receiving the city staffing lines dedicated to wetland management under the de Blasio Administration.
Federal grant funding was critical to the wetland assessment work by NYC Parks, in particular the USEPA Wetland Program Development Grant (WPDG), which supported staff to conduct field monitoring and analysis to an unprecedented extent with grant funding in 2012, 2014,

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2015, 2017 and 2019). In addition to evaluating the health of existing salt marshes, freshwater wetlands and streams, NYC Parks used this grant program to evaluate 20 years of restoration and mitigation projects and produce updated monitoring and design guidelines. The WPDGs also supported the development of the 2021 Wetlands Management Framework (WMF), discussed in Section VI below, in partnership with NAC.

During COVID, while funding dipped and hiring freezes impacted all city agencies, the City invested in wetland restoration and green infrastructure projects in response to the devastating impacts of Hurricane Ida at the end of 2021. Hurricane Ida demonstrated the city's vulnerability to inland as well as coastal flooding as a consequence of increased frequency of high-intensity of storms and filling of historic streams, wetlands and floodplains (Royte and Sanderson 2026). The same year, the WMF provided a road map for how and where restoring wetlands and constructing wetland-like features in the landscape could help absorb and store rainwater. Thus, as a consequence of this extreme event, the City made its first commitment towards implementing the WMF by allocating capital funding to new specific wetland restoration and green infrastructure projects in flood impacted neighborhoods, as well as funding to NYC DEP for daylighting Tibbetts Brook (PlaNYC 2021).

Finally, while the mitigation bank was constructed in 2019 and successfully addresses private mitigation needs, the city recognized that failure to secure timely wetland mitigation approvals was delaying critical waterfront infrastructure projects. This led to the first baselining of capital funding for NYC Parks for wetland projects in 2025. Although that funding is not sufficient to address all wetland mitigation needs it was a recognition that programmatic funding is critical for timely restoration efforts.

(Additional specific funding drivers to reference or provide more detail on in text or footnote: Buy-out programs (MOCEJ/HPD); CWCA Bond Act, 1996 – Final projects implemented; WCS-NOAA Community Restoration Partnership/Earmarks 2002-2012; USACE Partnership Continuing Authorities Program, HRE, etc.; CDBG; Mitigation; BIL-IRA, Environmental Bond Act, 2022)

VI. Progress towards wetland goals laid out in PlaNYC

PlaNYC 2007 and subsequent reports, including the Wetland Transfer Task Force Report, PlaNYC 2011, and the NYC Wetlands Strategy, presented analyses and identified and prioritized actions intended to help protect and restore and assess wetlands, ensure open space conservation and improve the wetland mitigation process. Below, we review the status of key initiatives listed in these reports as summarized in Table 1. With the end of the Bloomberg administration OLTPS was reorganized and renamed in 2014 and thus responsibility for some initiatives was transferred to agencies. Ultimately, NYC Parks took the initiative to develop a NYC Wetlands Management Framework moved from a plan centered on existing initiatives, to a more ambitious framework that outlined future needs, particularly for wetland management actions.

Table 1. Status of wetland goals and initiatives named in PlaNYC 2007, PlaNYC 2011 and Wetlands Strategy (2012). "Complete" is used when a task, initiative or project was clearly defined and has no directly related follow up actions. "Not complete" is used when a goal had not been substantially met and there is no clear path to achieving it. "On-going" is used when the initiatives lacked specific success criteria or related efforts continue today.

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Strategy / Sub-Strategy	Initiatives in PlaNYC 2007 only (*), PlaNYC 2011 only (**) and in Wetlands Strategy 2012	Responsible	Status
Protection			
Assess the vulnerability of existing wetlands and identify additional policies to protect and manage them*		OLTPS	Complete
Expand the Bluebelt program, included acquiring 4,000 acres of land with wetlands to conserve for stormwater management*		DEP	Ongoing
Evaluate the vulnerability of salt marshes through additional monitoring **		Parks	Complete
Develop a comprehensive strategy for wetlands**		OLTPS	Complete
Strengthen protection of vulnerable wetland parcels	Complete the transfer of 10 City-owned parcels to Parks**	Parks	Complete
	Complete the transfer of 9 City-owned parcels to DEP for inclusion in the Staten Island Bluebelt system**	DEP	Complete
	Evaluate funding needs for the necessary improvements that are required for future transfers to Parks**	Parks	Complete/ Ongoing
Increase wetlands acquisition efforts	Seek to acquire additional acres of private lands for inclusion in the Staten Island Bluebelt system	DEP	Complete/ Ongoing
	Work with local, State, and Federal partners to evaluate opportunities for additional wetlands acquisitions	Parks, DEP	Complete/ Ongoing
Update the Waterfront Revitalization Program to enhance wetlands protection**		DCP	Complete
Mitigation			
Work with State and Federal partners to revise wetlands mitigation guidance and provide clear, transparent, and scientifically-sound guidelines**		OLTPS	Not complete/ Ongoing
Develop a mitigation banking or in-lieu fee mechanism for public projects**		OLTPS	Not complete
Restoration			
Complete City-funded wetlands restoration projects	Pugsley Creek; Randalls Isl. Shoreline **; Tallapoosa; Turtle Cove; Soundview Park, Calvert Vaux; Pralls Island; Crescent Beach; Bronx River riparian floodplain; Bronx River Tributary Connection; Inwood Park; Meadow Lake; Freshkills Park, North Park	Parks	Complete
	Paerdegat Basin; Yellow Bar; Black Wall and Rulers Bar; Brookfield Landfill; $15M investment in restoration in Jamaica Bay.	DEP	Complete
Create a natural areas conservancy	Incorporate the natural areas conservancy and raise funding for staffing and management	Parks	Complete
Work with state, federal and regional partners to finalize the USACE/EPA Hudson Raritan Estuary Comprehensive Restoration Plan and seek opportunities for implementation*		DEP, Parks	Complete; Ongoing
	Develop a strategy to advance restoration efforts	OLTPS/ DEP	Complete
	Complete eel grass and ribbed mussel bed pilot; expand oyster pilot project and conduct additional research	DEP	Complete
Assessment			
Improve wetlands mapping in New York City	Create a one-foot contour Digital Elevation Model utilizing LiDAR data	DEP	Complete
	Create a new preliminary wetlands survey incorporating one-foot contour Digital Elevation Model*	DEP	Compete
	Work with DEC and other partners to turn the preliminary wetlands surveys into a final wetlands regulatory map*	DEP	Not complete
Monitor tidal wetlands and analyze the	Establish Surface Elevation Tables at two more parks, including one of the large marsh complexes in Staten Island*	Parks	Complete

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potential impacts of sea level rise	Determine data needs and seek funding to conduct horizontal marsh migration analyses*	Parks	Complete
Assess the conditions and functions of New York City wetlands	Conduct tidal rapid assessments at six New York City Parks sites where long-term monitoring is being conducted*	Parks	Complete
	Collect data on vernal pools and make comparisons across sites within and outside the city	Parks	Complete
Develop a research agenda to address wetlands challenges	Work with regional partners to develop and implement a research agenda to address wetlands challenges	OLTPS, DEP, Parks	Complete
	Work with regional partners to evaluate the feasibility of establishing an enhanced urban ecology research center in Jamaica Bay	OLTPS, DEP, Parks	Complete

PlaNYC 2007 Wetland Initiatives

City agencies implemented most of the wetlands protection initiatives of the first PlaNYC report, providing the foundation for ensuring progress towards subsequent wetland commitments. Collaborations between agencies and non-governmental organizations to advocate for vegetated infrastructure, including natural wetlands, to protect water quality, including took many forms. The Bluebelt, stormwater green infrastructure, pilot projects for restoring aquatic vegetation, and shellfish initiatives all continued, expanded and evolved. The analysis of wetland protection regulatory gaps was completed – very recent regulatory decisions at the state and federal levels require a new analysis, however, as will be discussed later.

Wetland Transfer Task Force Recommendations

By 2012, 96 acres had been transferred to Parks (and 7.9 acres to NYC DEP) (PlaNYC 2012) and by 2026, a total of 230.6 acres across 31 parcels have been transferred to Parks and 10.3 acres across 54 parcels to NYC DEP. Most of the area recommended to go to Parks has been transferred but there the majority of individual parcels remain, indicating they are mostly small. The largest wetland properties transferred met long standing objectives: for example Arlington Marsh was in the Special Waterfront Natural Areas identified in the 1990s NYC Waterfront Revitalization Program and was also named as a priority for conservation in the NY/NJ Harbor Estuary Program's Comprehensive Restoration Plan in 2009 and in the 2011 NYC Comprehensive Waterfront Plan. Most parcels transferred to NYC DEP supported the Bluebelt Program. The WTTF accomplished critical conservation goals, but it was constrained, given agencies sometimes wanted to hold on to parcels for future development, or did not want to accept parcels that would require remediation or restoration and maintenance obligations without any apparent source of funding and without meeting a clear need for the agency. This was the case for most of the remaining parcels not transferred.

Table 2. Status of Wetlands Transfer Task Force Recommendations

Borough	Status	Special Review* [Acres (Parcels)]	Recommended to Parks [Acres (Parcels)]	Recommended to DEP [Acres (Parcels)]	Total [Acres (Parcels)]
Bronx	Recommended	258.6 (36)	64.9 (1)	0 (0)	323.5 (37)
	Transferred	17.1 (2)	64.9 (1)	0.0 (0)	82 (3)
	Remaining	241.5 (34)	0 (0)	0 (0)	241.5 (34)
Brooklyn	Recommended	16.9 (16)	0 (0)	0 (0)	16.9 (16)
	Transferred	0.3 (3)	0 (0)	0.0 (0)	0.3 (3)

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	Remaining	16.6 (13)	0 (0)	0 (0)	16.6 (13)
Queens	Recommended	46.9 (35)	63.26 (68)	0 (0)	110.16 (103)
	Transferred	19.9 (7)	31.3 (4)	0.0 (0)	51.2 (11)
	Remaining	27 (28)	31.96 (64)	0 (0)	58.96 (92)
Staten Island	Recommended	50.6 (24)	127.2 (13)	12.2 (76)	190 (113)
	Transferred	2 (3)	95.1 (11)	10.3 (54)	107.4 (68)
	Remaining	48.6 (21)	32.1 (2)	1.9 (22)	82.6 (45)
Total	Recommended	373 (111)	255.36 (82)	12.2 (76)	640.56 (269)
	Transferred	39.3 (15)	191.3 (16)	10.3 (54)	240.9 (85)
	Remaining	333.7 (96)	64.06 (66)	1.9 (22)	399.66 (184)

Note: *Special Review parcels were all transferred to Parks

PlaNYC 2011 Initiatives

Wetlands were referenced much more comprehensively in the 2011 update than in the initial PlaNYC, not only in relation to water quality and flood mitigation, but also with the goal of aquatic ecosystem and habitat protection. In PlaNYC 2011, tasks were usually discrete actions that were typically defined so that they could be accomplished. They were generally feasible, funded, could be advanced to some degree without funding, or represented on-going efforts or previously existing commitments. For example, most of the goals for restoring or creating wetlands referenced on-going capital projects (Table 1). Other strategies focused on protection resulted in new, protected public open space, improved environmental review (e.g. by improving mitigation and expanding recognized areas of ecological significance in the WRP), and a better understanding of wetland location, condition and restoration needs (e.g., by improving mapping and conduction resource assessments).

NYC Wetlands Strategy 2012 Initiatives

NYC agencies completed most of the milestones listed under initiatives in the NYC Wetlands Strategy (Table 1). The city has continued to advance efforts that were not completed such as updating mitigation policy. Some of the most impactful strategies included conducting wetland assessments and mapping, which has helped NYC Parks, in particular, better understand the threats to wetlands and identify additional strategies for their long-term protection. The expansion of partnerships, including the creation of the Natural Areas Conservancy and the Science and Resiliency Institute at Jamaica Bay, has also allowed the city to better leverage research and alternative funding to advance goals. These strategies, including wetland protection, mitigation program development and policies, restoration, and assessment, are described below.

Wetland Protection:

No specific recommendations were identified in PlaNYC to protect the estimated 100 acres of freshwater wetlands in NYC that were not protected by regulations. Instead, recommendations focused on completing recommended wetland transfers to NYC Parks and DEP, which were largely completed (Table 2), seeking more opportunities for wetland acquisition, which is an on-going and difficult process, and improving wetland mitigation regulations, as discussed below. However, NYC Parks continued mapping efforts to improve understanding of the location and condition of unmapped and unregulated wetland, particularly vernal pools and forested wetland,

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as these were presumed to be underrepresented in existing mapping due to challenges described above.

(Potentially need to expand the above, and acknowledge Graniteville swamp wetland loss)

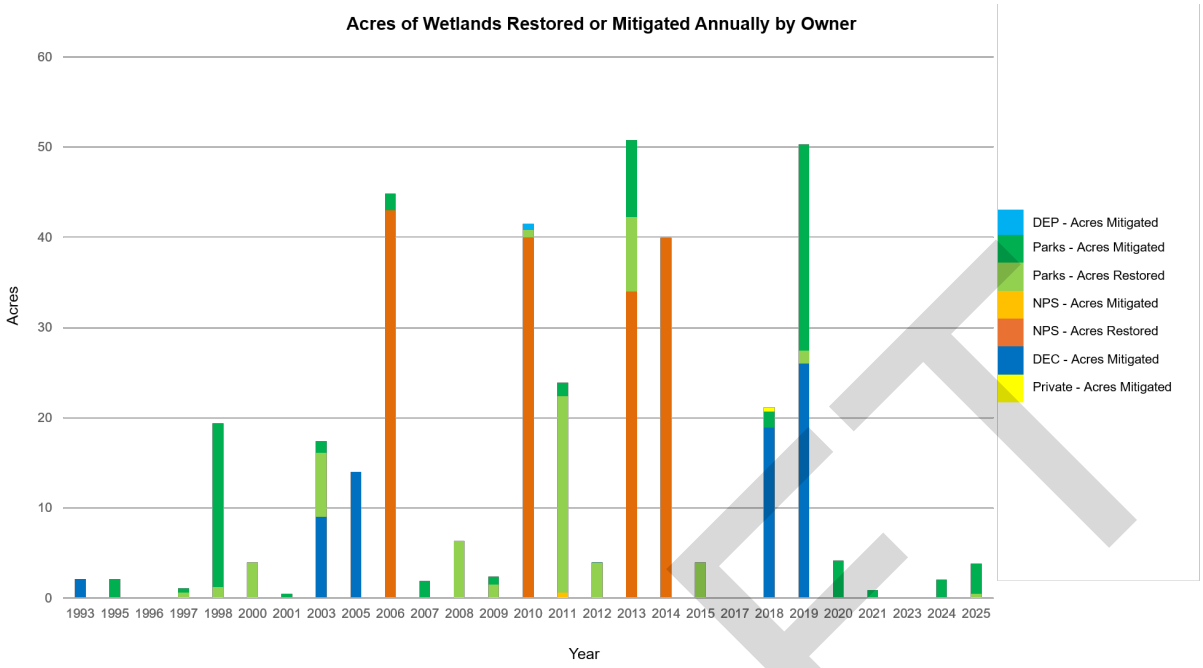
Wetland Mitigation:
The NYC Wetlands Strategy evaluated mitigation policies at state and federal agencies, including a discussion of failures, permitting delays, and banking programs as an approach for meeting the city's mitigation needs. NYC and EDC implemented the first mitigation bank, approved in 2015, as a pilot for New York State. Construction of the bank was completed in 2019 and the final credits are currently for sale, but only for private entities, with a few exceptions due to constraints associated with the funding sources. NYC Parks and EDC continue to explore formal mitigation banking options that city agencies can utilize. The City still had an on-going need to work with regulators to clarify mitigation guidance, which differs between state and federal agencies and can involve regulator discretion, leading to appearance of inconsistency and planning challenges. The successful establishment of the bank for the private market and demand for credits has highlighted a continued need for wetland mitigation sites for projects in the city. Mitigation is increasingly needed not just for development and infrastructure repair, but also for waterfront projects aimed at resiliency and incorporating nature-based features.

(Need to consider example to add above)

Wetland restoration:
All of the on-going restoration and mitigation projects that were named and funded in the Wetlands Strategy, were completed. In total, from 2008 to 2025, a total of 59 projects covering 355 acres were implemented across NYC for about $242M, and from 1993 to 2007, 57 projects were constructed over approximately 200 acres for about $46M. Included in that is NYC DEP's investments of over $120M in wetland restoration from 2000-2026. The majority of the restoration is salt marshes, with 26 acres of freshwater habitat restored and another 50 acres enhanced. Salt marsh restoration and mitigation by property owner is shown in Figure 2. NYC Parks evaluation of past salt marsh projects determined that these projects, which usually involved removal of historical landfill, were largely successful (NYC Parks 2018). As less and less undeveloped land on filled wetlands remains, and these sites have deeper, more contaminated, costlier fill to remove, feasible opportunities for wetland creation have dwindled. The City has not been able to restore or mitigate wetlands at a rate that matches on-going tidal wetland loss, and thus the City's no net wetland loss goal continues to be elusive.

Draft Figure 2. Salt marsh restoration and mitigation projects 1993-2025. A total of 218 acres of salt marsh has been restored and an additional 144 acres through mitigation in NYC. On NYC Parkland 134 total acres have been restored, 63 acres through voluntary restoration and 73 acres as compensatory mitigation. Additionally over 157 acres have been restored on NPS property–largely the reconstruction of the Jamaica Bay Marsh Islands and 70 acres mitigated on state property. Less than an acre has been mitigated on NPS, DEP, and private property.

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Wetland Assessment:
Environmental and conservation agencies and organizations had long recognized the need for a comprehensive assessment of wetland conditions and threats to inform appropriate management, and this was reflected as a key goal in the Wetlands Strategy. First focusing on tidal wetlands, NYC Parks secured funding from USEPA and, in partnership with The Nature Conservancy and the NAC, completed an ecological assessment of salt marshes across NYC parkland, which evaluated marsh conditions and threats to the marsh ecosystems. This research showed that 1) over 160 acres of wetlands had been lost along the shoreline since the NYS Tidal Wetlands Act required mapping in 1974, 2) all of the wetlands were exhibiting signs of degradation, and 3) fewer than 260 acres of space remained for marshes to migrate inland under sea-level rise. Based on the findings, the authors also developed a suite of recommended management actions to respond to the greatest threats to these marshes. These included strong recommendation to trial restoration techniques such as thin-layer sediment placement aimed at preserving the elevation and functions of existing marshes that are being inundated with sea level rise.

(Need to add statement on PlaNYC regulatory mapping initiative that was not complete: it was an initiative that depended unrealistically on state action….)

<u>NYC Wetlands Management Framework</u>
NYC Parks and the Natural Areas Conservancy developed the Wetlands Management Framework (WMF) to present an updated comprehensive set of goals for wetlands in NYC as well as strategies for protection, restoration and management based on the past decade of work. The WMF focused on management of wetlands on NYC parkland but also served as an unofficial update and continuation of the 2012 NYC Wetlands Strategy. This framework drew on the previous multi-year studies that made a range of recommendations across disparate sites, conditions, and wetland types, but did not present a comprehensive statement of need or actions for these ecosystems across the city. The WMF outlined a 30-year roadmap for wetlands management through 2050 with a focus on those managed by NYC Parks.

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The WMF policy recommendations were to: plan for marsh migration, expand sediment placement approaches to retain existing wetlands; invest in permanent staff to manage and monitor wetlands and stormwater green infrastructure; increase monitoring and assessment. All of these recommendations require time and resources, and each is making incremental progress, through pilot projects, opportunistic acquisitions, grant funding, inter-agency collaboration and partner advocacy.

The WMF also outlined 19 projects that were a priority for the agency in the near-term—over 60 percent are in progress with various levels of funding (Table 3).

Table 3. Status of Priority Projects in the NYC Wetlands Management Framework (*Table will be reformatted to better convey restoration approaches underway and needed)*

Site: Restoration Approach	Acres	Type of Restoration	Status
Bridge Park, BX: Fill Removal & Waterward Expansion	0.6	Voluntary	In progress
Four Sparrow Marsh, BK: Waterward Expansion & Sediment Placement	1.0	Voluntary and Mitigation	Complete
Snug Harbor - Harbor Brook, SI: Fill Removal (led by EDC)	2.5	Mitigation	In progress
Idlewild, QN: Sediment Placement	4.3	Voluntary and Mitigation	In progress
Rice Fields - Pelham Bay Park, BX: Fill Removal	0.4	Mitigation	In progress
Soundview Lagoon South, BX: Fill Removal & Waterward Expansion	1.0	Mitigation	In progress
Alley Pond Park, QN: Fill Removal	4.5	Voluntary and Mitigation	In progress
Brandt Point, QN: Fill Removal	2.6	Mitigation	Not started
Broad Channel, QN: Fill Removal	0.1	Mitigation	Not started
Bronx River, BX: Fish Passage	--	Voluntary	In progress
MARSHES Phase 2 - Saw Mill Creek, SI: Fill Removal (led by EDC)	5.0	Mitigation	In progress
Ramblersville - public lots, QN: Fill Removal	5.0	Voluntary and Mitigation	In progress
Alley Pond Park, QN: Waterward Expansion & Sediment Placement	6.6	Voluntary	In progress
Clove Lakes Park, SI: Stormwater Management	--	Voluntary	In progress
Deadman's Creek - Blood Root Valley, SI: Stormwater Management	--	Voluntary	Not started
Fresh Creek Park, BK: Fill Removal & Waterward Expansion	4.0	Voluntary and Mitigation	In progress
Goose Pond - Broad Channel Wetlands, QN: Elevation Enhancement	3.6	Voluntary	Not started
Lemon Creek Park, SI: Elevation Enhancement	2.7	Voluntary	Not started
Tibbetts Brook, BX: Stream Daylighting (led by DEP)	--	Voluntary and Mitigation	In progress
TOTALS	43.9		

Short-comings

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- On-going wetland loss
- Slow project implementation
- Regulatory barriers and lack of incentives and scientific imperatives
- Protection failures on private properties (GATX & Graniteville Swamp)
- Regulatory weakening

VII. Challenges and Opportunities for the Future

PlaNYC reports (2011, NYC Wetlands Strategy) underscored the complexity of wetlands management and called for multiple strategies for wetlands restoration and protection, including the importance of effective and supportive policy. Overall PlaNYC promoted on-going efforts, prompted new analyses and strategic planning to address challenges, and encouraged their long-term protection in recognition of the ecological services wetlands provide. This was critical, as wetlands cross jurisdictions and property boundaries. They are managed and regulated by multiple agencies. Wetlands are significantly influenced by indirect changes upstream in their watershed. PlaNYC acknowledged some of these challenges and brought agencies together to discuss and address cross jurisdictional challenges.

Strategies and policies that were first communicated in PlaNYC reports still carry relevance today and, in many cases are being more deeply evaluated, such as regulation of freshwater wetlands, particularly smaller wetlands; protection of wetland buffers; and mitigation. New challenges have also emerged, such as the regulation and promotion of nature-based solutions as ways to restore wetlands. *(Elaborate on challenge e.g. Probably need to say something about needing to assess the sustainability of this approach given cost, acres of marsh at risk, on-going reluctance from regulators to approve widely without extensive scientific review, etc.)*

Limitations of Wetland Regulations

While both state and federal regulations limit direct filling of wetlands and waterbodies, limitations leave small wetlands, particularly urban wetlands that are altered with urban stressors, more vulnerable to further degradation. For example, small freshwater wetlands have no regulatory protections, development can occur to the edge of freshwater wetlands with proper approvals, and regulations do not have capacity to address the ongoing, indirect, and cumulative effects of anthropogenic stressors.

Small urban wetlands provide important refuge and forage habitat for wildlife, support biological diversity and provide areas for stormwater retention. The vast majority of NYC's individual freshwater wetlands are smaller than 1 acre, even though wetlands that meet NYSDEC's size criteria of over 12.4 acres constitute nearly half of NYC's wetland area (NYC Parks, unpublished data). The Regulatory Gap Analysis used National Wetland Inventory data to determine that approximately 100 acres of wetlands were not protected in NYC under the federal or state regulations in 2009. An example of these wetlands is shown in Figure 3. With improved mapping, developed in 2018 and verified in 2021, however, NYC Parks estimated that hundreds more acres in NYC may be unregulated (unpublished data). In 2025, New York State updated the Freshwater Wetlands Act to increase regulatory protection in New York State, reducing the size threshold to 7.4 acres and expanding the definition of Unusual Local Importance, which included all urban wetlands (ECL § 24-0701 *et seq*.). This would have increased wetlands protection in NYC, and compensated for the rollback of federal wetland regulations under Sackett decision, which greatly narrowed the definition of when a wetland has a nexus to navigable waters (Sackett v. Environmental Protection Agency, 598 U.S. 651 (2023)). As of April 2026, the NYS regulations have been overturned, leaving NYC's small freshwater wetlands less likely to be protected at the state or federal level.

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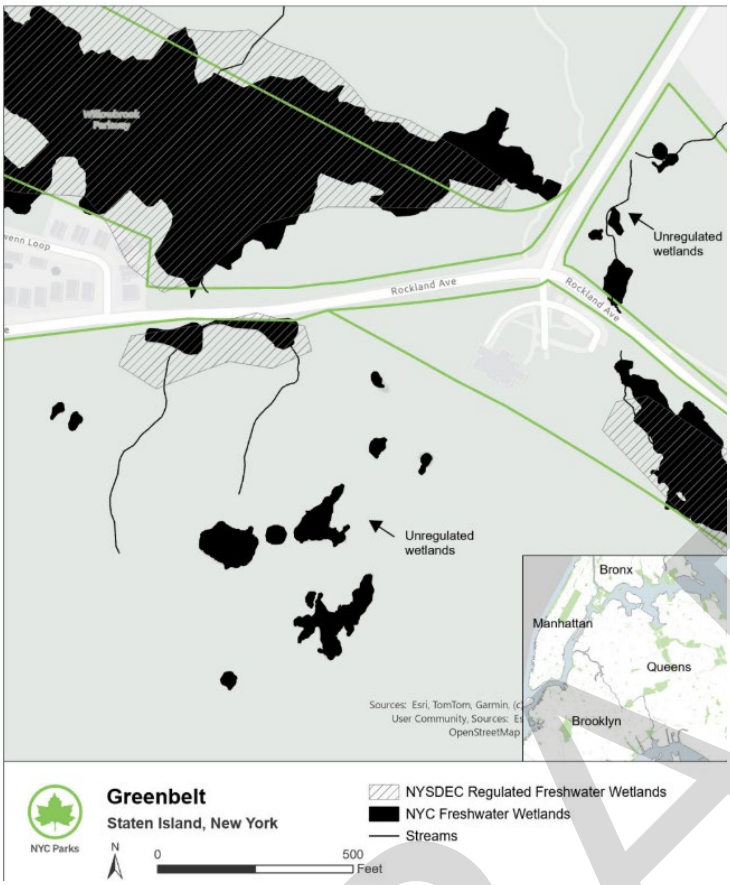


Figure 3. Small unregulated wetlands that are not regulated by the federal government (connected to the harbor via streams) or the stat (under 12.4 acres, mapped, or of unusual local importance) lack regulatory protections. Wetlands on private property are at greater risk. *(May create a different graphic to explain)*

Wetland buffers are important protection for wetlands, providing habitat for wildlife, reducing disturbance within the wetland, and absorbing and capturing sediment and pollutants in stormwater flowing to wetlands (Boyd 2001, Cook 1992, MACC 2019). As a result, protecting buffers surrounding wetlands is imperative in NYC where so many wetlands are smaller. NYSDEC regulates a 100 foot buffer around freshwater wetlands and a 150 foot buffer around tidal wetlands in NYC. Development around tidal wetlands requires mitigation within a 30 foot setback landward of the tidal wetland line. There is no such setback for freshwater wetlands, leaving them very vulnerable to pressure from surrounding development, despite being regulated. *(Getting DEC input on this)*

Finally, salt marsh loss and conversion of vegetated wetland to mudflat due to sea-level rise, erosion, water quality, and other factors is well documented in NYC, particularly in Jamaica Bay (Hartig et al. 2002; NPS 2008). NYC Parks has also documented continued wetland degradation and conversion of vegetated salt marsh to mudflat since the 1970s, but this loss is unregulated with numerous causes. Regulations only consider direct dredging and filling, but, do not have clear ways to help address ongoing loss of tidal wetlands from cumulative impacts of indirect anthropogenic actions.

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Mitigation Guidance

The Wetlands Strategy also highlighted the need for formal mitigation guidance, though this was described broadly. The approach of creating wetlands to offset unavoidable impacts to wetlands is preferred and aligns with the No Net Loss Framework set forward by USACE in 2008. Regulatory agencies have in the past required creating a larger area than was impacted (e.g. at a two or three to one ratio), because it can take decades for constructed wetlands to achieve the ecological functions of existing wetlands. Today, however, NYC has few sites remaining for wetland creation through fill removal, the primary approach used in NYC. Fill in these sites is often deep, requiring a significant depth of excavation to reach tidal elevation and/or is too contaminated to make project feasible or cost effective. The city does, however, have extensive areas where existing wetlands need active interventions, or enhancement, to prevent on-going degradation. Enhancement actions include removing anthropogenic debris that has accumulated on the marsh, and other nature-based approaches, described below. Today in NYC the pace of salt marsh loss exceeds that of creation (or marsh migration) so we believe enhancement actions, at a higher ratio than wetland creation) should be accepted as mitigation actions that can benefit the health of the city's wetlands. While the need to wetland impacts should be avoided whenever possible, the city will continue to have a need for mitigation sites due to unavoidable impacts along the waterfront, whether due repairing and making more resilient bridges, esplanades and other infrastructure, or building coastal protection features.

Advancement of New Nature-Based Restoration Approaches

Another challenge for wetlands management is researching, piloting, and evaluating new restoration techniques and nature-based solutions, to expand the actions that regulators will consider as mitigation. Nature-based restoration approaches use natural processes to reduce risks and restore habitat benefits. These can recognize how nature can be restored by mimicking how ecosystems naturally adapt to change. For example, to help salt marshes adapt to rising seas, sediment placement mimics the natural process of sediment deposition from floodwaters by placing a thin layer of sediment on existing salt marshes that are not accreting at the same rate of sea level rise. In NYC, these natural processes have been severed for a century or more due to dredging of the harbor, filling and piping of inland streams, and hardening shorelines for industry. Alternatively, building back salt marsh that has eroded by placing and securing clean sand on recently exposed mudflat and using rock, wood, or other materials to slow wave erosion can help reconstruct eroded shorelines.

Just by virtue of being new, nature-based solutions are challenging to implement and permit; however they also may contradict some basic tenets of the Clean Water Act and NYS Tidal Wetlands Act, such as the prohibition against placing fill in waters of the United States. Continued research and regulatory collaborations are also needed to assess threats to the city's wetlands from sea-level rise and increased flooding and inform restoration needs and promotion of these approaches, including where to most successfully and cost-effectively implement the most critical projects. By learning how to successfully implement new techniques and maintain this infrastructure through adaptive management, agencies can improve outcomes of both restoration practices and reduce impacts to existing wetlands from sea-level rise, while helping reduce regulatory concerns.

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