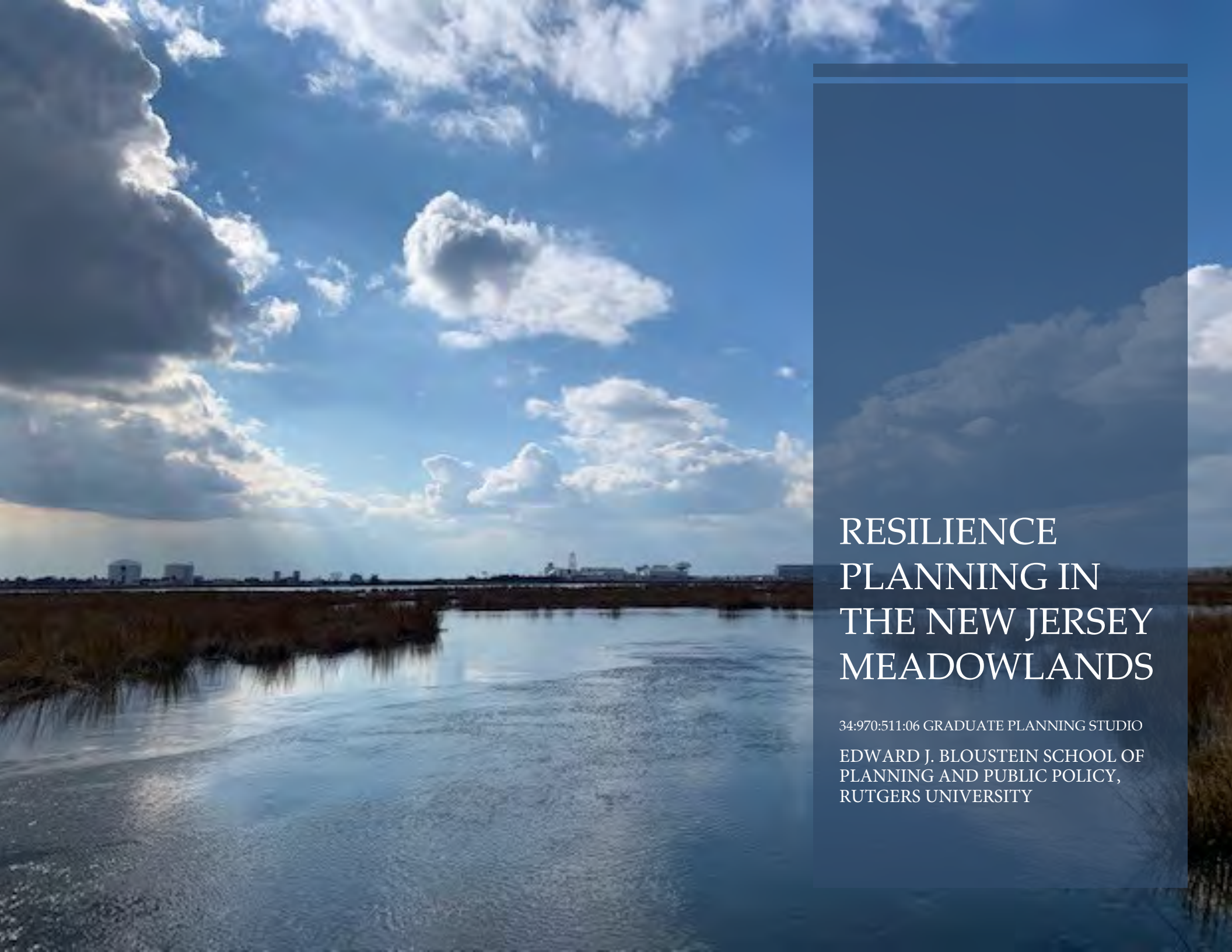

RESILIENCE PLANNING IN THE NEW JERSEY MEADOWLANDS

34:970:511:06 GRADUATE PLANNING STUDIO

EDWARD J. BLOUSTEIN SCHOOL OF PLANNING AND PUBLIC POLICY, RUTGERS UNIVERSITY

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Table of Contents

Executive Summary

This report includes an evaluation of existing resilience planning in the New Jersey Hackensack Meadowlands District and the larger Meadowlands region with recommendations on possible next steps for promoting science-informed, and equitable climate adaptation. The report is the outcome of a spring 2023 graduate planning studio course at the Rutgers University Edward J. Bloustein School of Planning and Public Policy that was a collaborative effort with the National Science Foundation Coastlines and People Megalopolitan Coastal Transformation Hub (www.coastalhub.org).

This studio reviewed the twelve resilience mitigation strategies outlined in the NJSEA's 2020 Master Plan update, as well as resilience elements of the U.S. Department of Housing and Urban Development *Rebuild By Design* planning process. In addition to reviewing the NJSEA's efforts in managing and maintaining stewardship of the land, this report also incorporates materials by the Meadowlands Conservation Trust (MCT), which was established by law in 1999, to acquire, preserve and manage ecologically sensitive areas. This studio also reviewed a variety of other stakeholders' climate mitigation plans, including county Hazard Mitigation plans, four plans developed in other areas of the state as part of the Resilient NJ program, municipal master plans for the fourteen municipalities within the District, and the products of the Rebuild By Design initiative. Many of the local hazard mitigation plans (HMPs) were sufficient in scope and ambition, but too narrowly geographically focused for the purposes of this studio or the NJSEA. Ultimately, this studio found that, while there are a variety of efforts underway in the District and throughout the region to consider planning for resilience, these efforts fall short of building public support and a framework for a cohesive approach to climate resilience planning that benefits the Meadowlands region as a whole.

Significant research time was devoted to looking into how the rules, policies, regulations, and organizational mandates of different stakeholders influenced and shaped resiliency approaches in the greater Meadowlands region. Some of the rules and policies that were studied include the currently proposed NJDEP rules on inland flooding, anticipated NJDEP rules on coastal flooding, the Army Corps of Engineers (ACOE) NY & NJ Harbor & Tributaries Focus Area Feasibility Study (HATS), and recently updated FEMA local mitigation planning guidance, provisions for consideration of natural hazards as part of a 2021 amendment to the New Jersey Municipal Land Use Law (MLUL), and other standards and guides for defining basic resilience standards in the Meadowlands.

Challenges and opportunities for building resilience were analyzed in the context of flooding rules, such as the NJDEP Inland Flood Protection Rule, which raises the regulatory floodplain in New Jersey. The HATS study by the Army Corps of Engineers proposes constructing various hard armoring solutions such as a series of barriers and gates to likewise contest with greater projected flooding risks. Our analyses of affordable housing identified opportunities for the NJSEA to consider resilience practices as part of any updates to its interim policies on affordable housing and site suitability guidelines, such as those proposed in the Hoboken's Green Building and Environmental Sustainability section of their Master Plan.

This studio explored other possible actions the NJSEA could expand upon to promote environmental sustainability. Relevant focus areas we identified are, utilizing infrastructure improvements for dual flood-protection and open-space uses, updating rules and regulations to meet updated sea level rise (SLR) and other risk mitigation standards, and fostering mixed-use and combined residential commercial land use in cluster zones.

This report has also outlined the funding opportunities the Meadowlands may benefit from with regards to the recent Bipartisan Infrastructure Law (BIL), which made $970 billion dollars of competitive federal discretionary grants available. The BIL funding opportunities that this studio believes will be of most interest to NJSEA are RAISE, INFRA, Safe Streets and Roads for All, and PROTECT funds. These BIL funds can support the development of multimodal, active, and resilience oriented transportation projects that are located away from sensitive or otherwise hazardous areas.

Finally, this studio conducted in-depth geospatial analyses of the Meadowlands, utilizing geographic information systems (GIS) technologies. These maps show vulnerabilities today and within various flooding scenarios based on different climate scenarios and SLR projections. The SLR projections outline considerable vulnerabilities in the greater region such as disruption to business operations, damage to infrastructure, and displacement of residents, with particular emphasis on threats to industrial infrastructure. These threats represent the potential for multi-dimensional shocks to the economic, infrastructural, and environmental sustainability of the Meadowlands region.

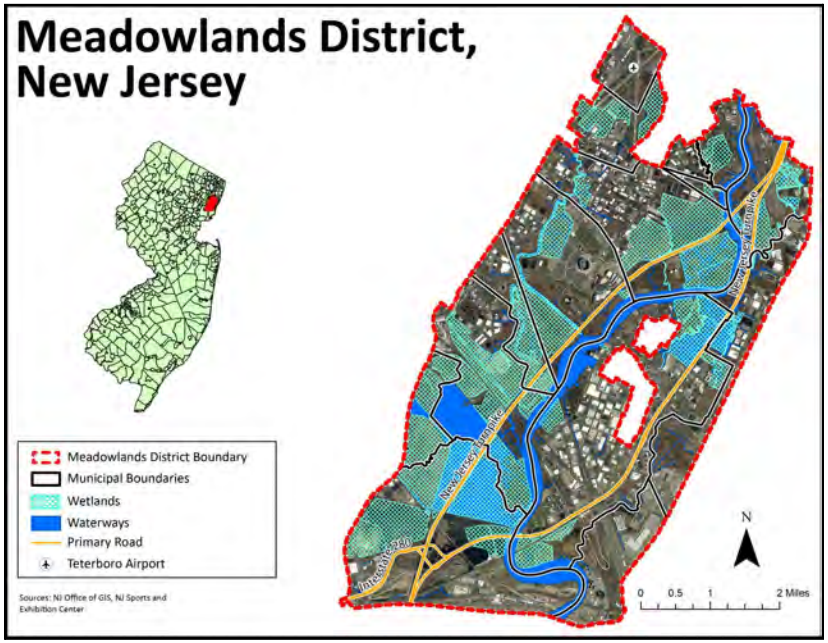
Despite the challenges facing the District and the larger Meadowlands region as a result of changing climate conditions, the research compiled by this studio points to benefits that could result from a science-informed and regionally coordinated resilience planning

effort that reflects that needs and priorities of the 14 municipalities in the District, is cognizant of the disproportionate impact that flooding and other changing climate conditions impose on socially vulnerable populations, and that welcomes engagement of local officials, residents, community leaders and others that call the District and the region home. The Studio offers the concept of NJSEA playing a facilitative role within the Meadowlands region for climate resilience planning that could include coordinating consistent use of future climate scenarios, data and science to inform regional and local planning as well as serving as a consulting clearinghouse on resilience mitigation strategies that may be most effective in and beneficial to the region including those strategies that offer the greatest potential to enhance the region's economy. In a facilitative role, NJSEA could also provide regional context on topics ranging from transportation to housing, flood risk assessments with future flood modeling, and resilience-oriented knowledge sharing to benefit regional and local officials, stakeholders, and residents.

PART ONE

CONTEXT, ISSUE, AND STUDIO PURPOSE

1. Context, Issue, and Studio Purpose



1.1 Introduction

The Hackensack Meadowlands District covers approximately 30.3 square miles along the Hackensack River, and its tributaries, and the Newark Bay area. Spanning across fourteen municipalities and two counties, Hudson and Bergen, the Meadowlands Region covers a wide array of natural and unnatural stressors. The District includes open bodies of water, closed landfills, undeveloped spaces, wetlands, and forested areas throughout the low lying watershed. Overtime, much of this area has remained undeveloped, while some portions have been transformed into highway corridors, industrial space, rail yards, and developed commercial, retail, office, and residential properties. Due to the nature of the environmentally sensitive areas within the District, such as the wetlands and low lying developed areas, the District is highly sensitive to natural hazards that have already started to worsen with climate change.

In conjunction with the studio client, the New Jersey Sports and Exposition Authority (NJSEA), this studio has sought to prioritize goals of furthering regional resilience and climate adaptation in the District by reviewing previous and current resilience efforts in the greater Meadowlands region as well as upcoming factors that may influence resilience efforts in the larger Meadowlands region. The goal of this report is to help the NJSEA answer questions it may encounter on the path to furthering resilience planning within the District and the greater Meadowlands Region.

For the purposes of this report, the New Jersey Sports and Exposition Authority will be henceforth referred to as 'the NJSEA.' The Hackensack Meadowlands District will be

referred to as 'the District,' and the whole of the fourteen municipalities will be referred to as 'the Region.'

Purpose of the Studio

In producing this report, the studio expanded upon two fundamental questions: *What does resilience planning look like in the Meadowlands? What is our studio's purpose in assisting the NJSEA?* The first question is a natural extension of what this studio provides in terms of our experience and academic backgrounds as planning students. The second question represents how our perspective in aiding the NJSEA evolved, as clearer information emerged regarding their organizational direction and capabilities. As planning initiatives have been ongoing within the Region, through both public and private efforts, the studio had initial difficulty in determining the best direction for our own planning process. In focusing on these two questions, the studio entered into a visioning exercise with the hopes of generating key themes and ideas to be incorporated into this report.

From this visioning exercise, this studio produced the following two vision statements, which acted as guides through the development of this report. Consequently, these statements also are intended to capture the general character of our contributions to the District.

This studio recognizes, as a central vision, that:

1. Both the District and the Region can benefit from resilience planning approaches that prioritize preservation of natural functions and advancement of social equity and climate justice.
2. Resilience planning is most effective when it is informed both by science and data as well as stakeholder engagement.

A major theme throughout the studio's preliminary research was the importance of community-led planning efforts. Many stakeholders have identified that consideration, in attempting to implement resiliency plans; they have often acknowledged the role local residents play in assessing vulnerability and articulating hazard mitigation goals is crucial.

Another goal of this studio was to inform future studio's efforts as well as research of the Megalopolitan Coastal Transformation Hub, a National Science Foundation regional resilience research initiative. This studio outlines possible future areas of focus for those potential efforts.

1.2 Resilience in the Meadowlands

1.2.1 Environmental History

As denoted before, the New Jersey Meadowlands comprises roughly 31 square miles of historic tidal and freshwater wetlands. However, rapid population growth and urbanization has drastically altered the Region's natural landscape. Engineers reclaimed land by altering the flow of water with dikes, tide gates, and pumps. These projects, guided by local officials and developers' underappreciation of the ecosystem's natural utility, aimed to in-fill "useless" wetlands and make them suitable for residential and industrial uses. By the mid-1900's, illegal dumping of garbage from the New York City area proliferated throughout the Meadowlands (Marshall, 2004), exacerbating ecological concerns. Eventually, the State of New Jersey recognized the environmental danger posed by these practices, and in 1969, the New Jersey legislature formed the Hackensack Meadowlands Development Commission (HMDC) with a statutory mandate that included the protection of the Region's "delicate balance of nature" (NJSEA, 2020).

Environmental advocacy work by the HMDC, and by the NJSEA as its latest successor, has helped to protect, restore, and conserve the Region's once neglected and diminishing wetlands. In addition to these formal conservation efforts, increasing development pressures prompted greater local environmental activism from organizations, such as Hackensack Riverkeeper. Hackensack Riverkeeper, among other activist groups, has fought against large wetlands in-fill projects, secured millions of dollars for environmental cleanup, and helped build broad support for regional environmental conservation (Hackensack Riverkeeper, 2021). Their efforts aided in the formation of the Meadowlands Conservation Trust (MCT) in 1999, and the reconfiguration of HDMC as the New Jersey Meadowlands Commission (NJMC) in 2001, removing "development" from the agency's name (NJSEA, 2020).

The 2004 NJMC Master Plan was a large environmental achievement for the District and the greater region, helping to conserve what is now the largest remaining network of brackish tidal wetlands in the New York-New Jersey Harbor Estuary. Incorporating input from environmentalists, NJMC - the preceding organization to the NJSEA - preserved large parcels of wetlands that the District's Master Plan had previously designated for development, and set new goals for large public acquisitions of wetlands (NJSEA, 2020). Through these efforts, 3,544 acres of wetlands have been conserved to date, an increase of 1,066 acres (43%) since 2004.

1.2.2 Ecosystem Services of Wetlands

The wetlands of the Meadowlands provide enormous benefits to the entire NJ-NYC megaregion, including water quality

improvements, critical habitat, and flood prevention (NOAA, 2022). Wetlands improve water quality by trapping and filtering sediment and absorbing pollutants from stormwater runoff. These ecosystems are also rich in biodiversity, being home to more than one-third of threatened or endangered species in the US (EPA, 2023). In spite of the Meadowlands' past environmental challenges, the District and greater region continues to be a habitat for a diverse array of wildlife, including raptors, migratory birds, the diamond-backed terrapin (a U.S. Geological Survey designated Species of Greatest Need), and even harbor seals (Kiviat & MacDonald, 2022).

Source: NJSEA, n.d.

As climate change continues to exacerbate flooding risks, the importance of wetlands' role as natural defenses to flooding events only grows. According to the EPA, one acre of wetlands can store between 1 and 1.5 million gallons of floodwater. Wetlands function as a sponge and natural buffer to storm surges, trapping and slowly releasing surface water, lowering flood heights, and recharging groundwater (EPA, 2023). One study has estimated that wetlands in the US save vulnerable communities $23 billion each year from hurricane damage (Costanza et al., 2008). More locally, it is estimated that wetlands prevented $625 million in flood damages to the Northeastern US during Hurricane Sandy (Narayan et al., 2017).

Wetland ecosystems also provide other benefits in the form of erosion control, carbon sequestration, ecotourism, and recreational activities. The ecological services provided by wetlands, therefore, offer much to modern urban, coastal communities within the Garden State and beyond.

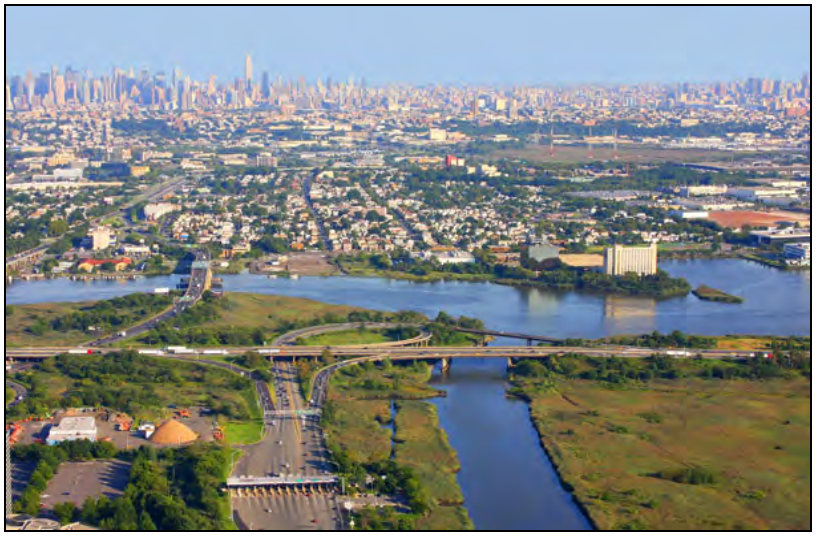
1.2.3 The NJSEA

The NJSEA has championed environmental resilience in the Meadowlands region for decades. The Hackensack Meadowlands Reclamation and Development Act of 1969, which established the NJSEA's predecessor, the Hackensack Meadowlands Development Commission (HDMC), set forth three objectives: (1) to promote environmental stewardship, (2) to manage solid waste, and (3) to promote the "orderly" development of the Hackensack Meadowlands. By pursuing

each of these priorities, the NJSEA has helped enhance the resilience of the Meadowlands, demonstrating its unique position to advance resilience planning across the greater regional area (NJSEA, 2020).

The NJSEA directly enhances and facilitates regional resilience planning through many ongoing initiatives. These foundational actions include reviewing all proposed development in the District for:

- Consistency with the State of New Jersey's Coastal Zone Management Program (CMP), implementing zoning regulations that safeguard the natural environment and enforces FEMA Special Flood Hazard Area (SFHA) requirements (NJSEA, 2020)
- Participation in the FEMA National Flood Insurance Program (NFIP) Community Rating System (CRS) program (NJSEA, 2020)
- Development of the Hackensack Meadowlands Floodplain Management Plan (FMP), recently updated in 2022 (NJSEA, 2020)
- Monitoring of tide gates, flood incidents, and water levels (NJSEA, 2020)
- The preservation and restoration of wetlands and environmental habitat, facilitating a remarkable resurgence in wildlife in the District's natural areas (NJSEA, 2020).



Source: The NJSEA, n.d.

Efforts of the Meadowlands Conservation Trust

Another driver of resiliency in the Meadowlands is the Meadowlands Conservation Trust (MCT), which was formed in 1999. The MCT collaborates with the NJSEA, but also functions independently as a "New Jersey state agency that 'is in but not of' the New Jersey Sports and Exposition Authority" (MCT, n.d.). The MCT aids in wetland preservation by acquiring lands and arranging conservation easements in the Meadowlands District and Hackensack River watershed. A portion of the trust funds are dedicated to funding the NJSEA staff to work on MCT projects. The MCT also coordinates conservation efforts with the mayors of the District's fourteen municipalities (Remaud, 2023).

In partnership with MCT, the NJSEA has preserved more than 3,500 acres of wetlands. Today, MCT manages nearly 1,000 acres of environmentally sensitive areas, including the 16-acre Skeetkill Creek Marsh Park, the 587-acre Richard P. Kane Natural Area in Carlstadt and South Hackensack, and several other natural areas beyond the District's boundaries (NJSEA, 2020).

Source: Regional Plan Association, n.d.

1.2.4 Demographics

An official and accurate population count for the Meadowlands District is currently not available, because the District boundary intersects political and census boundaries. To help inform appropriate planning for the District, 2020 Decennial Census Block data (U.S. Census Bureau, 2021) were used to estimate the current population using ArcGIS Pro. Census blocks that intersect the District boundary were visually inspected through ortho photography to determine which blocks to include in the District population count.

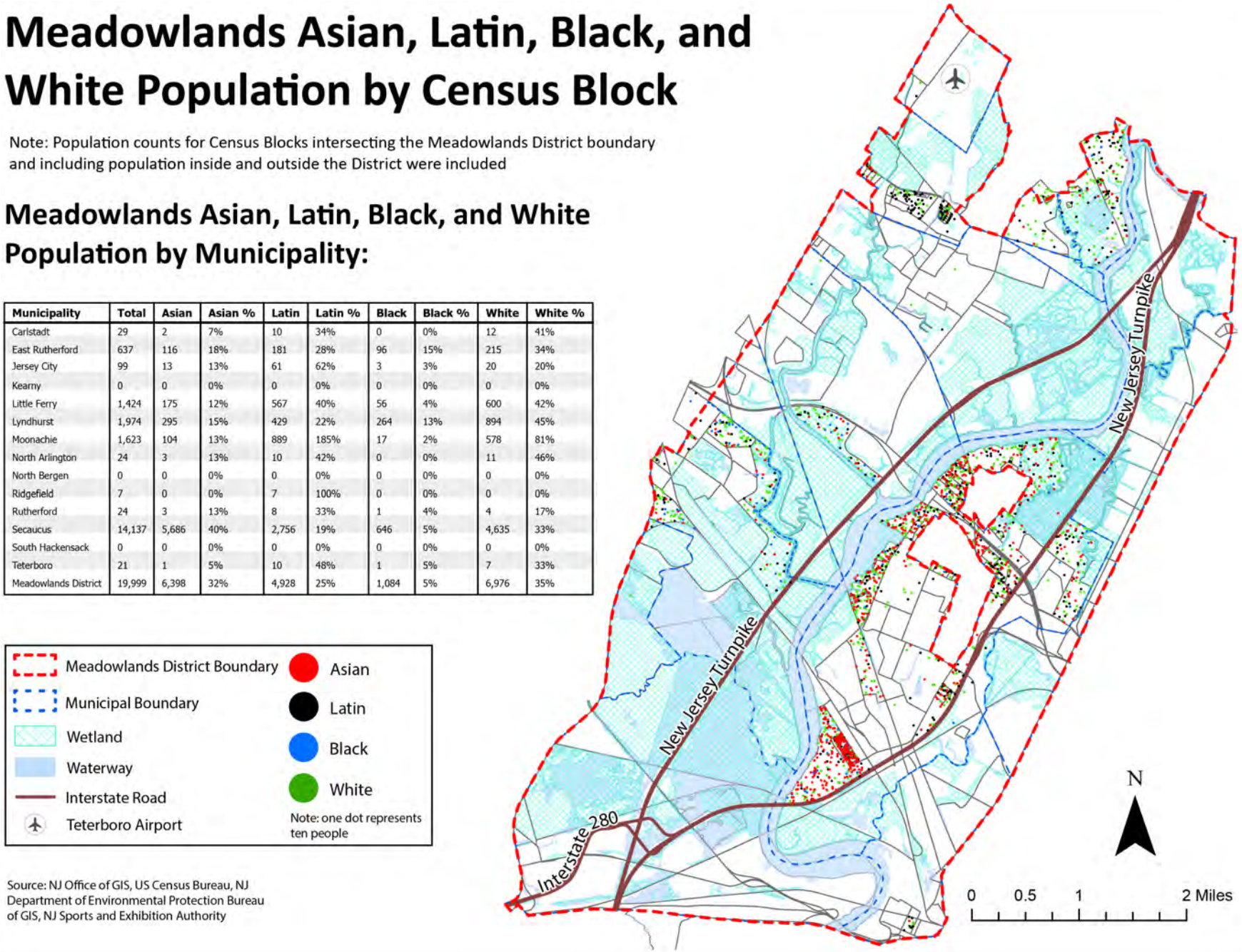
However, this method of determining the District's Population Count has certain limitations which are important to consider. Namely, while it excludes intersecting Census Blocks that do not have buildings within the District, it does include the total population counts of Census Blocks that have buildings both in and outside of the District. This potentially resulted in a slight overestimation of the total population, which was calculated by this studio to be 19,999. The following map displays the estimated Meadowlands population by race. The map and table show that the District is racially diverse and there is no racial majority. White is the largest racial group (35%), followed by Asian (32%), Latin (25%), and Black (5%). Other races that make up less than 1% of the population for each block were excluded for visual clarity.

Meadowlands Asian, Latin, Black, and White Population by Census Block

Note: Population counts for Census Blocks intersecting the Meadowlands District boundary and including population inside and outside the District were included

Meadowlands Asian, Latin, Black, and White Population by Municipality:

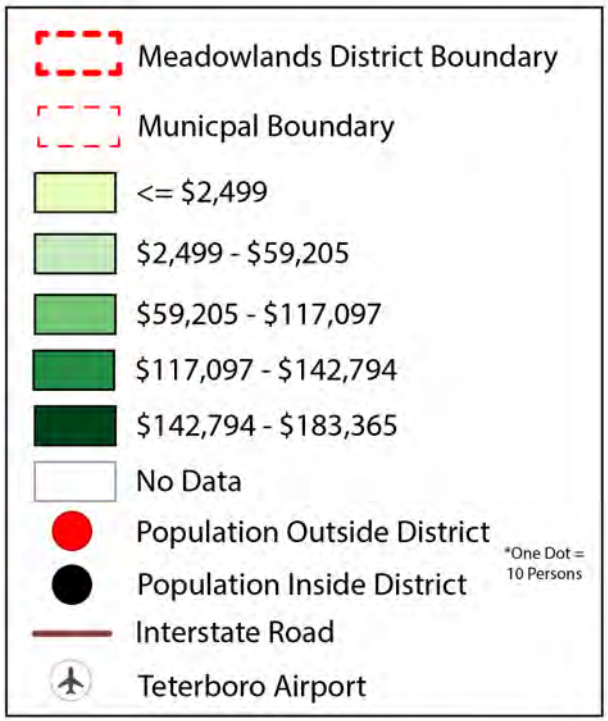
Municipality	Total	Asian	Asian %	Latin	Latin %	Black	Black %	White	White %
Carlstadt	29	2	7%	10	34%	0	0%	12	41%
East Rutherford	637	116	18%	181	28%	96	15%	215	34%
Jersey City	99	13	13%	61	62%	3	3%	20	20%
Kearny	0	0	0%	0	0%	0	0%	0	0%
Little Ferry	1,424	175	12%	567	40%	56	4%	600	42%
Lyndhurst	1,974	295	15%	429	22%	264	13%	894	45%
Moonachie	1,623	104	13%	889	185%	17	2%	578	81%
North Arlington	24	3	13%	10	42%	0	0%	11	46%
North Bergen	0	0	0%	0	0%	0	0%	0	0%
Ridgefield	7	0	0%	7	100%	0	0%	0	0%
Rutherford	24	3	13%	8	33%	1	4%	4	17%
Secaucus	14,137	5,686	40%	2,756	19%	646	5%	4,635	33%
South Hackensack	0	0	0%	0	0%	0	0%	0	0%
Teterboro	21	1	5%	10	48%	1	5%	7	33%
Meadowlands District	19,999	6,398	32%	4,928	25%	1,084	5%	6,976	35%

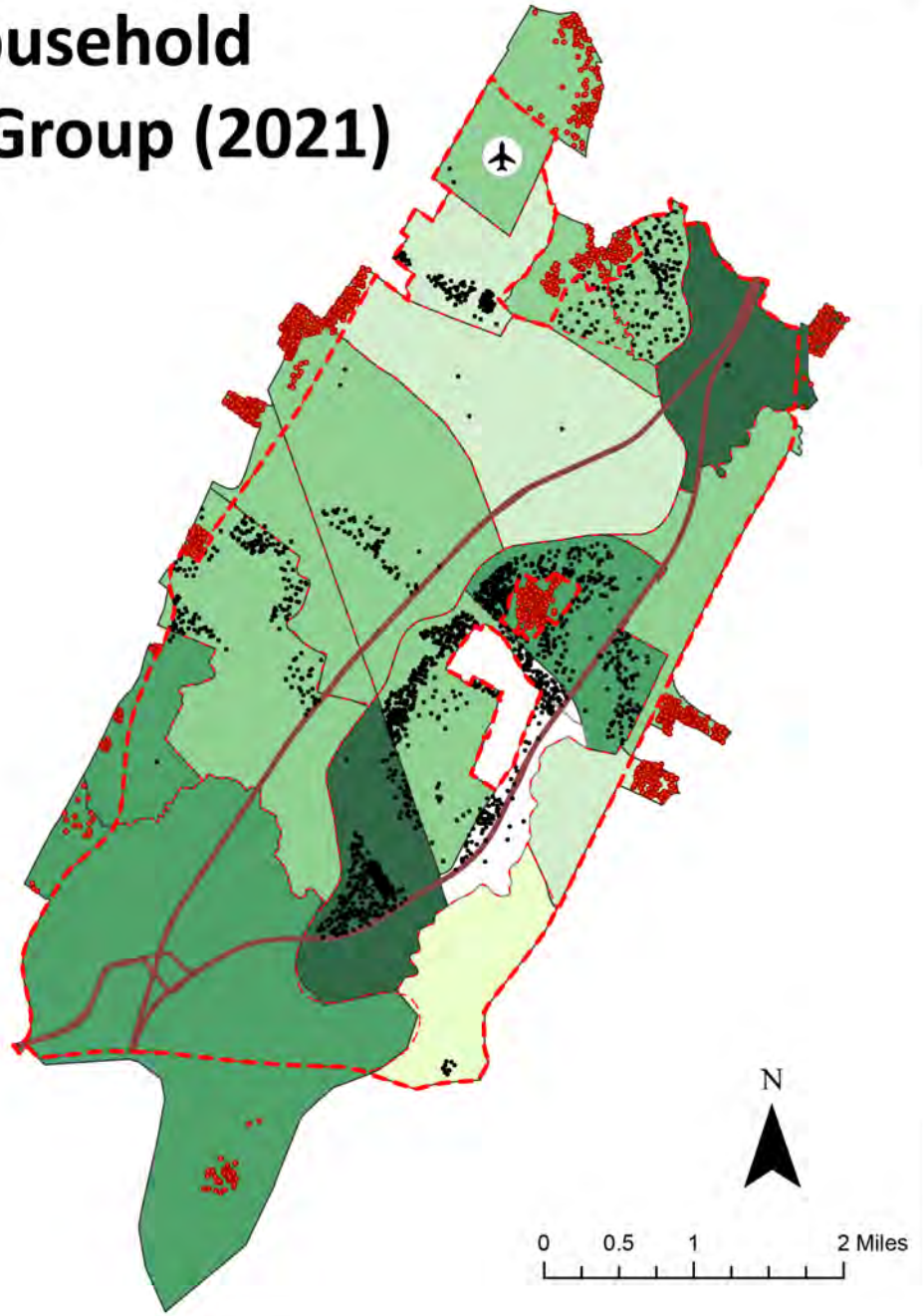


Source: NJ Office of GIS, US Census Bureau, NJ Department of Environmental Protection Bureau of GIS, NJ Sports and Exhibition Authority

Meadowlands Median Household Income, by Census Block Group (2021)

Note: Median Household Income data for Census block groups that intersect the Meadowlands District boundary are influenced by the population of these Census block groups outside the Meadowlands District and may not be representative of the population of those block groups within the District.





Sources: NJ Office of GIS, US Census Bureau

The previous map shows median household income by Census block group, based on 2021 American Community Survey (ACS) data, within the District (US Census Bureau, 2021). It is clear from the map that a number of block groups intersect the District boundary. Some of the data for these block groups may be heavily influenced by their population outside the District. The median household income for these block groups is not necessarily representative of the population within the District. A dot-density layer was used to show how much of a block group's population is within as opposed to outside the District to understand which block groups' data may be influenced by population outside the District.

The map also clearly shows a wide income distribution. For block groups whose entire population reside within the District, median household income is lowest ($2,499) in block group 1 of Census tract 69, which is located in Jersey City. This is considerably lower than the median household income of both New Jersey ($89,702) and the United States ($70,784) (US Census Bureau, 2022). For block groups whose entire population reside within the District, median household income is highest, ($158,906) in block group 1 of Census tract 201, located in Secaucus.

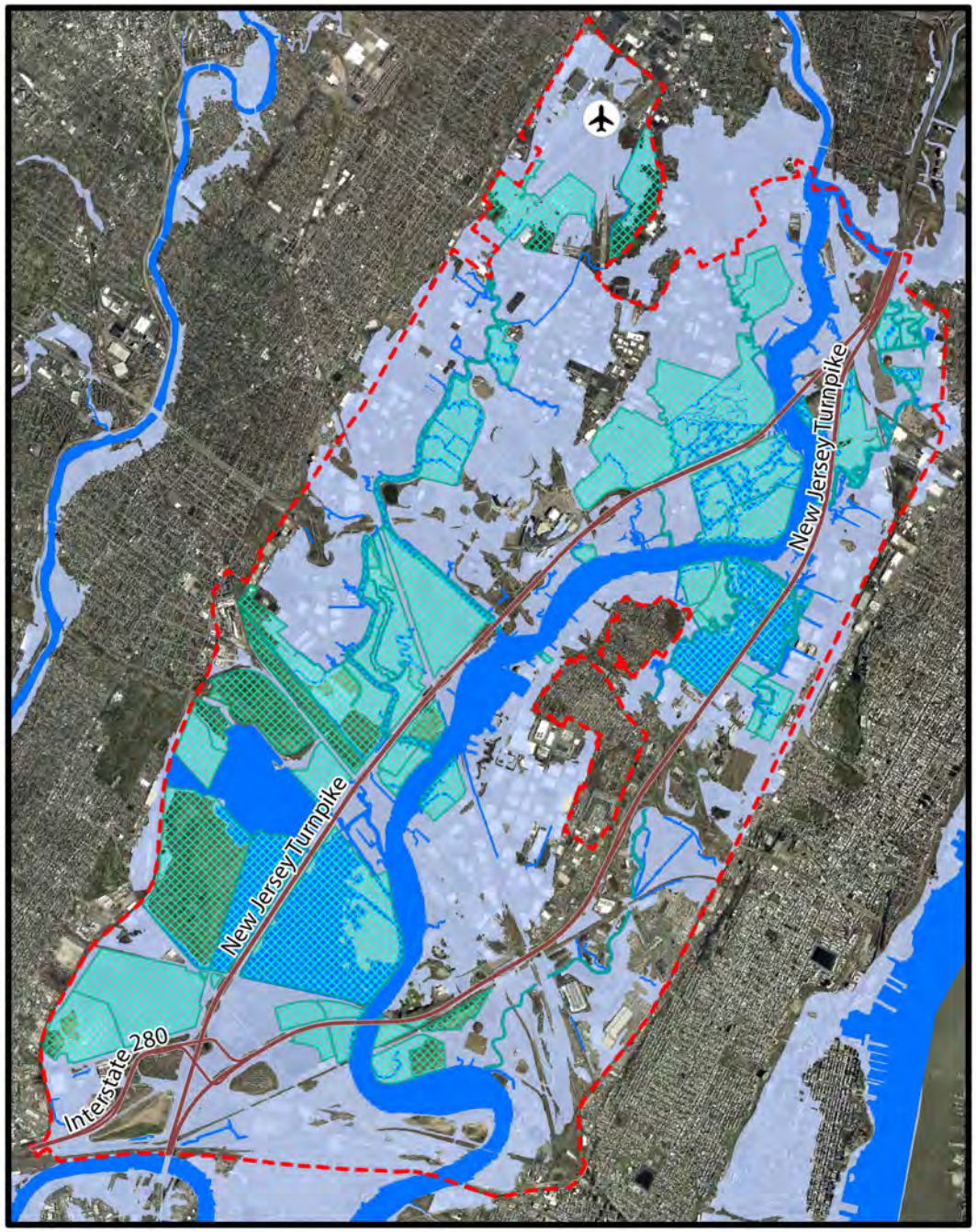
1.3 Climate Impacts and Flood Vulnerability

Climate change poses an enormous challenge for many of New Jersey's communities. Observed and expected impacts upon New Jersey include extreme heat, sea-level rise, variations in precipitation, increasing frequency and intensity of extreme storms, and a cascade of other effects on human and natural systems (NJDEP, 2020). Temperature and sea-level have been rising faster in New Jersey than many other parts of the globe.

As a low-lying estuarine region, flooding events have long been a concern for the Meadowlands District. Facing both urban development impacts and global sea-level rise, this problem has been exacerbated in recent years. Of the District's 19,405 acres, 14,991 acres (77%) are designated within the Federal Emergency Management Agency (FEMA) Special Flood Hazard Area - or SFHA (NJSEA, 2022). SFHAs are defined as areas that FEMA estimates will be inundated by a 100-year (or 1-percent chance) flood (NJSEA, 2022) and represent significant geographical flooding risks.

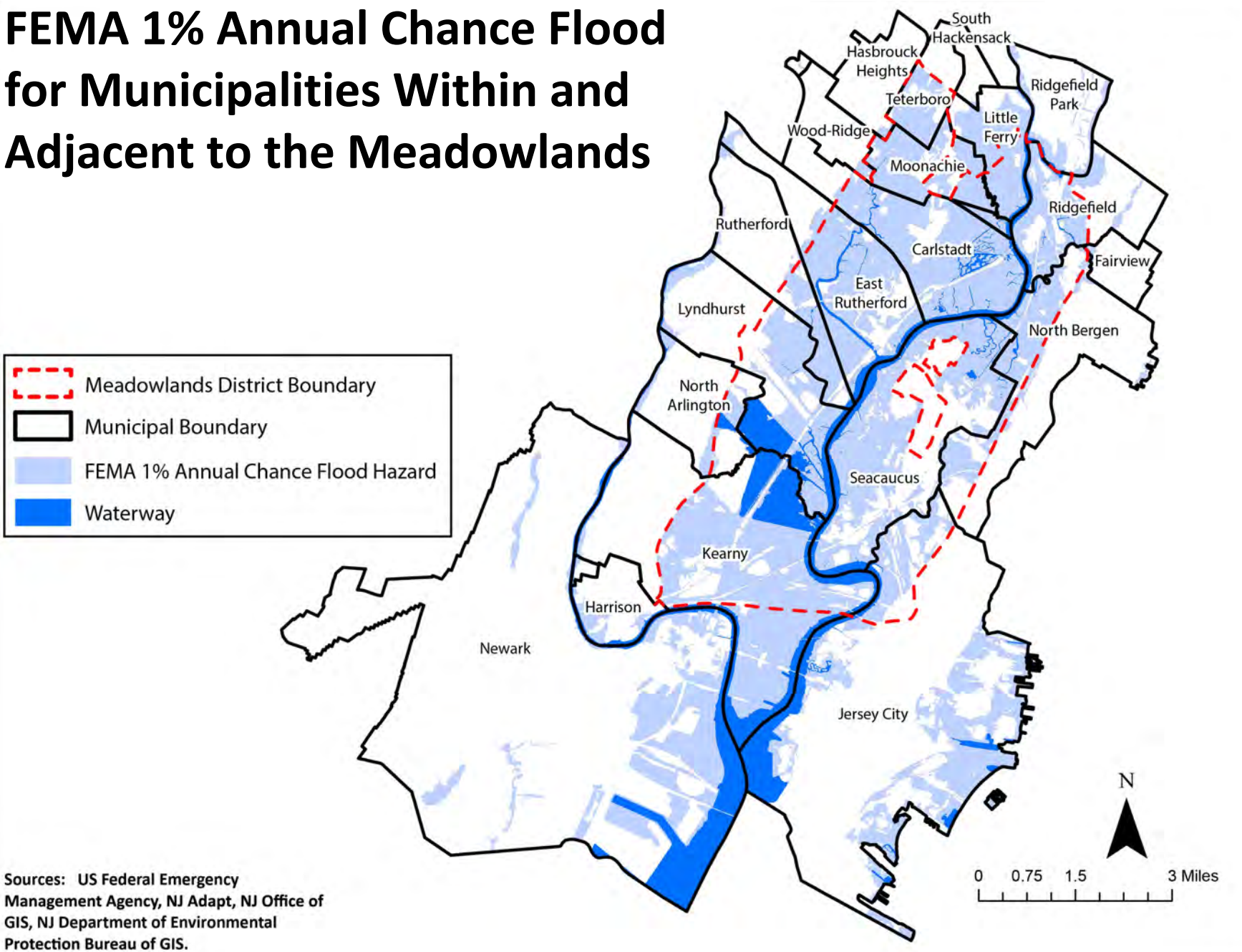
The following maps show the current FEMA 100-year floodplains first for the District and then for the entirety of the 21 municipalities that are within, intersect, or are adjacent to the District.

Meadowlands FEMA 1% Annual Chance Flood



Sources: US Federal Emergency Management Agency, NJ Adapt, NJ Office of GIS, NJ Department of Environmental Protection Bureau of GIS.

FEMA 1% Annual Chance Flood for Municipalities Within and Adjacent to the Meadowlands



Sources: US Federal Emergency Management Agency, NJ Adapt, NJ Office of GIS, NJ Department of Environmental Protection Bureau of GIS.

Encompassing a substantial portion of the New York-New Jersey Harbor Estuary, the Meadowlands comprises a unique network of wetlands and tributaries, including many creeks, streams, and channels that feed into the Hackensack River as it drains to Newark Bay. Prior to development, the Meadowlands area is estimated to have included more than 20,000 acres of tidal wetlands (Lewis, 2021). Wetlands store and filter enormous amounts of floodwater, providing a natural buffer from flooding to surrounding communities.

By 2019, estimates place the remaining wetlands and waterways in the Meadowlands at approximately 8,400 acres. Records indicate how the draining, filling, and development of much of the District's wetlands have contributed to the issue of flooding. After a boom in urban development over the course of the 1960's and 1970's, a *New York Times* journalist observed a substantial increase in flooding in the Meadowlands: "Because of the industrial and commercial development of the marshlands in the last five years," he wrote, "water that used to be absorbed is now overflowing and running into business areas" (Gansberg, 1978).

Sea-level rise fueled by rising temperatures threaten to permanently inundate large portions of the District. Under a moderate-emissions scenario, coastal areas of New Jersey are *likely* (at least a 66% chance) to experience a sea-level rise of 1.4-3.1 feet by 2070, and 2.0-5.2 feet by 2100 (Kopp *et al.*, 2019).

The District's freshwater and tidal wetlands, which provide critical habitat for wildlife and a natural defense to flooding, are at particular risk, as their ability to migrate inland is impeded by the District's ring of urban development and surrounding geology.

Source: Rutgers Center for Urban Environmental Sustainability, 2006.

A 2017 report by the Union of Concerned Scientists projected a majority of the District to experience chronic flooding within this century (Spanger-Siegfried et al, 2017). Upon four feet of sea level rise, they estimated 98% of Moonachie, 94% of Teterboro, and 84% of Little Ferry to experience chronic inundation, defined as when ten percent or more of the community's "usable, non wetland area" floods more than 26 times per year.

The District's high vulnerability to flooding came into sharp focus after Hurricane Sandy. Making landfall on October 29, 2012 in Brigantine, New Jersey, Sandy's wind gusts were recorded to reach up to 76 mph, while a full moon increased high tides by more than 20 percent (NJSEA, 2022). In New Jersey, the record-setting storm claimed 38 lives and up to $30 billion in economic loss, with enormous damage across the tri-state region (Stainton, 2022; Beeson & De Poto, 2012).

While Hurricane Sandy may bring to mind images of wreckage on the New Jersey shore, the storm also overwhelmed the Meadowlands's defensive network of tide gates and berms as the storm surge moved up the Hackensack River. Water levels were so high that they breached the New Jersey Turnpike, which stands 10-11 feet high (NJSEA, 2022).

Little Ferry and Moonachie were among the District's hardest hit communities, with thousands of homes becoming severely damaged and residents requiring emergency rescue (Fallon, 2022). Using FEMA's definition for repetitive loss properties as any National Flood Insurance Program (NFIP) "structure that has had at least 2 paid flood losses of more than $1,000 each in any 10-year period since 1978" (FEMA, 2020), there were fewer than 10 repetitive loss properties in the District before Hurricane Sandy. After Hurricane Sandy, there were 119 registered repetitive loss properties (NJSEA, 2022), 3,500 residents had to be rescued, 900 businesses were flooded, and two (2) people died in the District alone (Sargeant, 2022).

With sea-level rise, the damage caused by extreme storms are expected to worsen with great certainty. By one estimate, 12.8% of total property damage from Sandy can be attributed to sea-level rise (Shope et al., 2022). Environmental contamination, a pervasive issue in the Meadowlands, is also compounded by the risks associated with flooding. The news outline nj.com reported that, during Hurricane Sandy, for instance, Berry's Creek – a tributary in the District with the highest levels of mercury ever recorded in a US freshwater ecosystem – flooded the town of Carlstadt (Sargeant, 2022). The Environmental Protection Agency (EPA) added the Lower Hackensack River to the Superfund program's National Priorities List in September 2022.

With so much of the District vulnerable to climate change, planning and adapting its communities to these considerations may prove critical to the prosperity and safety of the Region. The NJSEA's ongoing commitments to environmental conservation and flood mitigation have already enhanced the Region's resilience, and it is hoped that further climate-oriented planning can help build on these efforts to protect the District's residents and defend its natural systems.

PART TWO

CLIMATE PLANNING IN THE REGION

2. Climate Planning in the Region

2.1 Review of Existing Resilience Planning in the Meadowlands

In planning for future climate considerations within the Meadowlands, it was recognized that a review of existing resilience planning efforts in the greater regional area could inform this studio both on the findings of available information and on the specific knowledge gaps. To this end, the following section identifies the role of the NJSEA, County Hazard Mitigation Planning, Municipal Master Plans, and the Rebuild by Design "New Meadowlands" project. This studio recommends that future planning processes build off of these existing efforts and aim to address any previous planning limitations.

2.1.1 Hackensack Meadowlands Master Plan

Released in 2020, the NJSEA's most recent master plan for the District demonstrates a commitment to resilience in its ninth section, "Sustainable Meadowlands: A Guide to Resiliency." This section details the tremendous regulatory and stewardship efforts carried out by the NJSEA in the District, such as regional stakeholder coordination. Such coordination efforts have prompted the NJSEA to engage with stakeholders across various levels of government, including federal, state, and local agencies (NJSEA, 2020).

The NJSEA's Guide to Resilience concludes with a set of twelve resiliency strategies addressing sea level rise, which are revisited in Section 3.4 of this report. The strategies found in the report include:

1. Comprehensive Planning (NJSEA, 2020)
2. Overlay Zones (NJSEA, 2020)
3. Floodplain Regulations (NJSEA, 2020)
4. Construction Codes (NJSEA, 2020)
5. Setbacks/Buffers (NJSEA, 2020)
6. Conditional Development (NJSEA, 2020)
7. Rebuilding Restrictions (NJSEA, 2020)
8. Hard Armoring (NJSEA, 2020)
9. Soft Armoring and Green Infrastructure
10. Acquisitions (NJSEA, 2020)
11. Conservation Easements (NJSEA, 2020)
12. Rolling Conservation Easements (NJSEA, 2020)

2.1.2 County Hazard Mitigation Plans

Alongside NJSEA's master planning, resilience planning in the District is greatly influenced by hazard mitigation planning at the county and state levels. In order for jurisdictions to be eligible for federal disaster assistance and mitigation grant funding, they must adopt a FEMA-approved Hazard Mitigation Plan (HMP), which must be updated every five

years. The two counties which encompass the District, Hudson County and Bergen County, last updated their HMPs in 2020. This studio reviewed these plans to advance understanding of regional resilience planning, and to glean priorities, consistencies, and strategies that could be built upon by the NJSEA.

Goals

The goals of Hudson and Bergen Counties were developed in alignment with the 2019 New Jersey State Hazard Mitigation Plan, which are to:

1. Protect life (NJOEM, 2019)
2. Protect Property (NJOEM, 2019)
3. Increase public preparedness and awareness (NJOEM, 2019)
4. Develop and maintain understanding of risks from hazards (NJOEM, 2019)
5. Enhance State and local mitigation capabilities to reduce hazard vulnerabilities (NJOEM, 2019)
6. Support continuity of operations pre-, during-, and post-hazard events (NJOEM, 2019)

Consistent with the goals of the NJSEA Master Plan, the two counties outline their goals of safeguarding critical public facilities and infrastructure, promoting a sustainable economy, preserving the natural environment, and supporting human health. These goals also serve as the foundation for the specific mitigation action items developed for every individual municipality as part of the HMP process.

Priorities

Both Counties' HMPs emphasize the fundamental importance of public and stakeholder engagement for effective hazard mitigation planning. Weaving these principles in their plan, Hudson County utilized multi-lingual outreach throughout the planning process, and aimed to author a HMP that would be more accessible to a general audience. Bergen County likewise developed a robust participation strategy for its planning process, offering several outlets for public participation.

In addition to public engagement, both HMPs coordinated with and engaged many regional stakeholders, including federal agencies (e.g., FEMA, USACE), state agencies, county and regional agencies (including the NJSEA), emergency services, utilities, transportation, academic partners, county municipalities, and neighboring counties. Through these efforts, these HMPs' planning processes sought out alignment with regional partners' goals and integration with existing plans and regulations.

As per FEMA requirements, both HMPs contain extensive community profiles and risk assessments of their respective hazards. These profiles could be useful resources for the

NJSEA and its partners, and perhaps they could serve as references in future resilience planning efforts. The maps, data, and explanations in both plans on flooding hazards, for instance, provide considerable general knowledge of hazards such as heat, sea-level rise, flooding, specific information on the Region's historical impacts, and projected risks compounded by climate change.

Strategies

The HMPs stress intergovernmental coordination and support the development of mitigation strategies and actions for each municipality. As Hudson County's document points out: "Strategies provide direction, but actions are fundable under grant programs" and can "meet multiple measurable objectives" (TetraTech, 2020, 1-13). Bergen County's HMP notes the NJSEA's attendance in all of the plan's meetings; the HMP suggests that this cross-agency coordination helped both partners deepen their understandings of local risk and vulnerability, and develop and incorporate mitigation strategies into their plans.

The Hudson County HMP discusses opportunities for plan integration and hazard mitigation through various planning and regulatory instruments. Among these instruments, the HMP includes master plans, building codes, zoning and subdivision ordinances, flood damage prevention ordinances, stormwater management plans, land use and open space plans, capital plans, and more. Although Hudson County has limited land use powers, it has identified and promoted resiliency opportunities through certain zoning regulations that govern county property. The 2016 Land Development Regulations Update, for instance, sets development guidelines for implementing green stormwater infrastructure when proposed projects are adjective to a county roadway or facility.

Alignment of Municipalities

Specific mitigation actions and strategies were developed in partnership between the counties' emergency management agencies and municipal representatives from every Hudson and Bergen municipality. Each municipality followed a mitigation action worksheet, in which they developed specific mitigation actions that supported at least one HMP goal. All municipalities rated their actions as high, medium, or low priority, and indicated whether they were proposed, ongoing, complete, or withdrawn.

The extent of mitigation actions provided between the District's different municipalities noticeably vary. Some municipalities proposed many possible mitigation actions (i.e., Jersey City and Little Ferry), while some produced just a few. Some actions were common across all municipalities, suggesting common-ground in possible regional resilience planning efforts. One notable example is that nearly every municipality included acquiring and/or demolishing repetitive

loss and severe repetitive loss properties as a high priority. Little Ferry, for instance, prioritized acquisitions on properties located on "slopes, ditches, and creeks," while Ridgefield specifies properties near Overpeck Creek and Wolf Creek. The NJSEA could consider working with NJDEP Blue Acres and municipal governments to identify flood-prone properties throughout the District and initiating a coordinated acquisition plan that advances wetlands conservation and safer land uses.

There is evidence to suggest this type of regional approach might already have some local support. In Section 6.4 of the Bergen County HMP, the township of Rutherford advocates for developing a Regional Resilience Plan for Hackensack Riverbank Communities, although only lists this action as a low priority. As the contents of the county HMPs suggest, there may be opportunity for the NJSEA to advance regional resiliency planning through direct coordination with its county and municipal partners.

FEMA HMP Policy Update

In April 2022, FEMA released updated Planning Policy Guides for state and local hazard mitigation planning. The new policies outlined in the guides are effective for all plans submitted on or after April 2023. As previously noted, Hazard Mitigation Plans in the Meadowlands region are implemented at the county level. Although these new policies do not directly apply to the NJSEA, they may be useful guidelines to follow for future resilience planning and to understand what rules are being followed within the greater Region.

A significant change to the new local mitigation guidelines require local governments to provide engagement opportunities for representatives from multiple sectors in the planning process. These guidelines list businesses, academics, non profits, and faith-based organizations as common examples of potential community representatives. The guidelines also state that it is important such opportunities for community representation include organizations that work with critical community assets or underserved/socially vulnerable populations.

Plans must also feature projected impacts of future conditions, including climate change. The new guides emphasize expanding mitigation capabilities through land use/development ordinances, building codes, and alignment with flood management tools such as the NFIP, Community Rating System (CRS), and flood risk mapping. The NJSEA is not required to produce a Hazard Mitigation Plan, however it may be beneficial for the organization to consider these principles when revising other planning documents and when coordinating at the county level. Hudson and Bergen Counties must submit hazard mitigation plans to FEMA that comply with the Local Mitigation Planning Policy Guide every five

years to remain eligible for select FEMA assistance grants such as the Building Resilient Infrastructure and Communities (BRIC) project grant. There may be an opportunity for the NJSEA to coordinate with these counties in the HMP development process and later with subsequent BRIC projects, which can advance climate mitigation planning in the Region (FEMA, 2022).

Source: NJSEA

2.1.3 Individual Municipalities

As previously noted, the Meadowlands District spans across significant parts of fourteen municipalities in both Bergen and Hudson County, and the NJSEA possesses planning and zoning authority over these parts within the District. Given the role of the NJSEA in exercising planning powers within this jurisdiction, there is much to consider with regards to how their work coincides with local planning efforts located outside of the District. Utilizing publicly accessible information from municipal and county websites and databases, this studio gathered all available municipal master plans and master plan re-examinations to gain a more comprehensive view of local planning goals and objectives.

Through this process, eighty-nine (89) plans were gathered from the fourteen municipalities that are encompassed within the District. The plans were then reviewed and classified by this studio for distinct plan elements, with the goal of assessing the most common and important elements for communities within the District. Utilizing this information, it was then the aim of this studio to gather information on these common planning elements and investigate their incorporation within local planning efforts and other new climate focused policies.

Existing Plans by Municipality

The plans were initially reviewed for categories pertaining to population and economy, land use, housing, transportation, environment, and resiliency. Each category then had further descriptors, or elements, that were reviewed more comprehensively. These elements included planning

subtopics such as zoning, future development or redevelopment, affordable housing, circulation plans, congestion problems, bikes and pedestrians, floodplains, wetlands, open space and conservation, resiliency strategies, and sustainability, among others. The basis for selecting these particular elements was their commonality and presence within Master Plans, as well as their applicability to resilience planning. The full review can be found in Appendix B.

Municipal Land Use Law

The Municipal Land Use Law (MLUL) was enacted by the state of New Jersey in 1975. Its purpose is "to encourage municipal action to guide the appropriate use or development of all lands in this State, in a manner which will promote the public health, safety, morals, and general welfare" (New Jersey Chapter). According to the MLUL section 40:55D-89, a master plan must be periodically re-examined every ten (10) years from the date of implementation. After re-examination, a master plan may be found to not need any additional changes, requiring no further action. In the event that the master plan re-examination process generates specific, additional recommendations or changes, then the Municipal Land Use Law requires an update to the Master Plan.

When conducting a review of the status of this process in Meadowlands communities, this studio found that six of the fourteen municipalities had plans that are up for re-examination in 2023. It was also evident that many of the municipal plans that were not up for re-examination according to the ten year time period, had previous re-examinations make specific recommendations that require an update and adoption of a new master plan.

Resilience Focused Plans

As of February 2021, Governor Murphy signed P.L.2021, c6, which amended the Municipal Land Use Law to incorporate climate change initiatives within the law. The NJSEA is not subject to municipal land use law, however, the portion of the municipalities that lie outside the District boundaries are subject to the law. The amended law will require municipalities to "prepare a climate change and hazard vulnerability assessment that is triggered by updating their land use plans" (Evans, 2021). As many of the municipalities within the District are vulnerable to climate change effects, updating a plan with respect to the new amendment will be important in addition to local resilience planning. Two municipalities, Jersey City and Little Ferry, stood out as having resiliency focused plans that were adopted prior to the amendment.

Jersey City - Resiliency Master Plan, June 2017

The Jersey City Resiliency Master Plan was developed to "analyze community data and storm history and determine areas of vulnerability within the City" to then inform the

following Master Plan that incorporates its recommendations and strategies that set forth from the analysis. Focusing on Hurricane Sandy, the plan zeros in on flooding within the city and its past, present, and future vulnerabilities and risks.

In order to assess risk and vulnerability, the plan identifies elements such as population, housing, economic profiles, existing land uses, infrastructure, and more. Each of these elements were used to inform the risk and vulnerability analysis which resulted in the mapping of social vulnerability, critical infrastructure, and economic development vulnerability, which are then merged to define vulnerable priority areas. Based on the risks and vulnerabilities identified, the plan identifies five key goals for the city that all come with their own objectives and strategies to be incorporated into further planning.

This plan puts resiliency planning and vulnerabilities of the area as the top priority and produces a product that helps inform the public and city officials of priority areas that will be impacted the most so that future planning and policy can be properly guided to protecting and mitigating these risks.

Little Ferry - Reexamination of the Master Plan, January 2017

This re-examination report is structured as a new resiliency amendment to the Master Plan. It focuses heavily on the meaning of resiliency as a framework for planning and helpfully lays out the Resilience Framework as laid out by the Rockefeller Foundation and Arup through their 100 Resilient Cities program. After developing a base for defining resilience, the plan lays out new policy frameworks that can be adopted by the Township of Little Ferry.

In addition to the resilient framework, the re-examination also lays out the impacts of Hurricane Sandy, a review of the Strategic Recovery Planning Report and several local and regional reports that covered flood mitigation, recovery, and risk reduction prepared by research institutions, planning consultants, counties, and local government groups. The re-examinations review helped to gather end goal policy changes for the Township of Little Ferry that both aligned with local planning goals and furthered resiliency within the area.

2.1.4 Rebuild by Design

Rebuild by Design (RBD) is a competitive funding and design program launched by the federal Department of Housing and Urban Development in 2013 to promote resilience in regions affected by the 2012 Hurricane Sandy. The "New Meadowlands Project," a product of the RBD competition facilitated by the NJDEP published in 2014, is arguably the most significant study recently conducted in the Meadowlands region. The Project proposed a plan to "protect, connect, [and]

grow" the Meadowlands region by increasing resilience to coastal storm surges and pluvial flooding. Proposed actions include gray infrastructure solutions (ex., berms, smart tide gates, pump stations) and green infrastructure improvements alongside redevelopment strategies. RBD's New Meadowlands report also contains an implementation strategy identifying small-scale projects that may be implemented independently and an accompanying timeline (RBD, 2014).

Significant research and engagement with stakeholders, including the Meadowlands Commission (now the NJSEA) and the public, contributed to the initial project report. The engagement that was a part of the RBD research project highlights an opportunity for a bold approach to climate adaptation in response to support from local stakeholders, "we found a coalition of the willing amongst many conversation partners, whether mayors of municipalities, ecological activists, business owners or developers, a real will and desire to think bigger and transform the Meadowlands from its current state to a far better, stronger, and more attractive basin" (RBD pg 57). For example, when engaging with a neighborhood in Little Ferry the RBD team discovered that there was a "openness and willingness to move" among the residents (RBD pg 71). In northern areas of the district where land acquisition was discussed, property owners seemed more concerned about the amount they would be compensated than the prospect of relocation itself (RBD, 2014).

The New Meadowlands Project proposes ideas that may still have value add to the Meadowlands today that align with the NJSEA's goals. For example, the Project notes that landfills in the area are an opportunity to build out a wildlife reserve that is less likely to be contested by developers due to the landfill caps constraints on feasible development projects. The New Meadowlands Project builds upon this wildlife reserve idea by suggesting that wildlife access points and more efficient public transportation are implemented as well. This aligns with the idea that increasing transit access to public spaces in the Meadowlands will foster ecological and economic benefits by attracting residents and tourists seeking nature-based recreational activities (RBD, 2014).

The project also introduces the concept of the "Meadowband." Rebuild by Design's proposal for acquiring miles of land along the Hackensack Riverbank to build berms, "naturally occurring or manmade mounds or walls of earth or sand", to protect housing (NJSEA, 2020). This studio has identified potential value in the proposed Meadowband Land Acquisition segments A, B, E and G for berming around the perimeter of 6 Buildings with affordable housing. However, Rebuild by Design's proposal for land acquisition was estimated to be very expensive at more than ninety-eight million dollars. Nonetheless, this studio supports nature-based

defense against future SLR and flooding and the value in further exploring this idea (RBD, 2014).

While these overarching ideas may still be relevant to the Meadowlands region, the data used to assess the hazards and vulnerability of the area is approximately a decade old and could benefit from another assessment to reflect more current flood projections and regulations, see section 3.2 for more information . The RBD generated future flood hazard maps were created using FEMA's 100-year flood and 2.5 feet of sea level rise. Since the creation of this hazard assessment, FEMA has released new flood maps for the area. Additionally, the RBD hazard assessment does not account for NJDEP's new Inland Flood Protection rule published in 2022 or their pending updated Coastal Design Flood Elevation as well, see section 2.2.1. Similarly, the vulnerability assessment does not use overburdened communities (OBCs) as an indicator, see section 2.2.3. To align with current regulations it would be beneficial for vulnerability assessments to utilize OBC boundaries in addition to the previous assessment tool, Social Vulnerability Index (SOVI). The NJ Legislature recently passed an Environmental Justice Law which requires the NJDEP to evaluate new development of certain facilities in OBC communities, see section 2.2.4 for more information. Besides updating data, the area of projects in future resilience assessments could be expanded; the initial plans for the New Meadowlands Project have a somewhat limited scope as the Project only focuses on three pilot areas (RBD, 2014).

Since the release of the project report in 2014, the implementation components of the RBD report have been pared down which limits the range and effectiveness of the Project. In 2018, an environmental impact statement was released for a "Build Plan" and "Future Plan." The main components of the Build Plan, which have secured funding and set plans to be implemented, include two pump stations. The Build Plan also includes parks and open space components, but, as of this writing, these are funding-dependent (NJDEP, 2022). Construction of the pump stations is expected to begin in 2023. However, establishment of easements and property acquisitions for one of the pump station locations are ongoing. NJDEP is planning to pursue funding for the parks and open space components of the plan once a local partner is identified (NJDEP, 2023c).

After reviewing local news and connecting with guest speakers who work and live in the Meadowlands region, this studio concluded that the RBD New Meadowlands project was well-intentioned but raised expectations among the public and local officials during an extensive research and stakeholder engagement process that ultimately, due to funding, were not able to be delivered (NJDEP, 2022b). Reflecting on the New Meadowlands project three main takeaways for future climate

adaptation planning stand out. First, the overarching ideas proposed throughout the original plan to "protect, connect, [and] grow" the Meadowlands region, not fully addressed by the implementation components, still have the potential to add value to the area (RBD, 2014). Second, the research conducted by the RBD team is almost a decade old, and new data with updated climate projections and indicators may be required for further planning. Third, it is vital to keep stakeholders' previous experience in mind during future regional engagement processes to avoid stakeholder fatigue.

2.2 Challenges and Opportunities

In addition to recognizing existing resilience planning in the Meadowlands it is crucial to recognize and review emerging efforts affecting regional resilience as well. This section identifies challenges and opportunities associated with recently implemented (or anticipated) regulatory changes, affordable housing, the NJ Environmental Justice law, transportation, and the Army Corps of Engineers New York and New Jersey Harbor and Tributaries Study. This studio recommends that future planning considers these emerging efforts.

Source: NBC News

2.2.1 NJDEP and Regulatory Changes

The NJDEP has introduced the Inland Flood Protection rule, which expands flood hazard permitting requirements and updates stormwater requirements for new developments in a portion of the District. The Inland Flood Protection rule raises the Design Flood Elevation by two feet in fluvial flood hazard areas, expanding the flood plain and requiring the first floors of all buildings in the floodplain to be at the NJDEP base flood elevation plus two feet, and from the FEMA 100 year elevation plus three feet.

The New Jersey Department of Environmental Protection (NJDEP) has released two reports by Cornell University that demonstrate the increasing need to address flooding issues in

the Meadowlands (DeGaetano, 2021) (DeGaetano & Tran, 2021). The Inland Flood Protection rule will also incorporate new precipitation projections for the year 2100 into stormwater best management practices designs, impacting the sizing of stormwater management systems. The proposed change recommends using projected precipitation totals at the 83rd percentile under the moderate RCP 4.5 scenario for the 2-, 10-, and 100-year storms using the timeframe of 2050-2099. Additionally, the rule discontinues the use of the Rational and Modified Rational Methods for runoff calculation, and provides guidance on the use of Cornell's Present Update Study and Projection Study to estimate the rate and volume of stormwater runoff. The proposed amendment would result in higher peak flow rates, more expansive and deeper flood hazard areas, and greater volumes of runoff, all designed to enhance flood resiliency. The Inland Flood Protection rule also introduces a new section to provide flexibility to public transportation entities in demonstrating regulatory compliance with respect to major developments associated with public roadways and railroads.

The need for these measures is highlighted by the significant financial loss and flood damage to properties outside of the Special Flood Hazard Area (SFHA), such as those caused by the remnants of Hurricane Ida. Preliminary claim data from FEMA shows that 31 percent of NJ claims from the remnants of Hurricane Ida occurred outside of the designated SFHA and had average claim payouts than those inside the SFHA (*Courtesy Copy of Inland Flood Protection Rule,* 2022), indicating the need for immediate action to ensure the safe construction and reconstruction of structures in these areas. The use of existing flood mapping is insufficient to account for the increased precipitation due to climate change, and new investments in public infrastructure and private development must be based on the best available flood data. While the Inland Flood Protection rule is intended to address climate change considerations and increase the resilience of the Meadowlands, it may catch some property owners off guard as it creates challenges for those who relied upon existing rules when they made investment decisions. Furthermore, developers will not have to comply with new FHA rules if:

- The regulated activity is part of a project with a valid FHA permit or
- The regulated activity is part of a project that needs an FHA permit, and a complete application was submitted to DEP prior to the emergency rule filling or
- The regulated activity is part of a project that did not need an FHA permit prior to the rule filling where:
    - the project received all federal, state and local approvals and;
    - construction commenced prior to the rulemaking

In addition to the Inland Flooding Protection Rules, which was proposed as an emergency rule, NJDEP is also working on drafting the coastal flooding portion of the New Jersey Protecting Against Climate Threats (NJPACT) rules. The coastal portion is expected to take into account an anticipated 5 feet of sea-level rise, which would increase flood elevations by 5 feet. NJDEP will be proposing changes to their coastal area rules in order to build resilience to sea-level rise and storm surge in new developments, improve risk disclosures, and address FEMA concerns about the state's consistency with the National Flood Insurance Program (NFIP).

The full NJPACT proposal is more than 1,000 pages and is expected to address emissions of greenhouse gasses and further incorporate climate change considerations into land use permitting requirements. In December 2022, NJDEP hosted two webinars summarizing its NJPACT Resilient Environments and Landscapes (REAL) regulatory reform. While the proposal is yet to be released, key implications could include:

- Revised construction standards: The new Coastal Design Flood Elevation (DFE) will require structures and roads to be constructed at a higher elevation (FEMA+6) to account for the anticipated sea-level rise. This will involve elevation or floodproofing of buildings to minimize flood damage and improve overall resilience.
- Inundation Risk Zone (IRZ) assessments: Developers will need to conduct risk assessments and evaluate alternatives in areas where regular or permanent standing water is expected due to sea-level rise. This will encourage careful planning and sustainable development in vulnerable areas.
- Enhanced risk disclosures: Updates to the FHA notice requirements will include a narrative risk acknowledgement, ensuring that property owners and potential buyers are fully informed about the risks associated with climate change and sea-level rise.
- Support for renewable energy and nature-based solutions: The proposed changes will promote the adoption of renewable energy sources and encourage the use of nature-based solutions to mitigate the impacts of climate change, such as restoring wetlands and implementing green infrastructure.
- Improved stormwater management practices: The new rules will emphasize the importance of effective stormwater management, reducing flood risks and protecting water quality in the Meadowlands District.
- Enhanced habitat protection: The proposed changes will strengthen mitigation requirements for habitat protection, preserving the biodiversity and ecological integrity of the greater Meadowlands region.
- Streamlined permitting processes: The implementation of Permits-by-Registration and requiring a NJ licensed

professional engineer or architect for FHA permit-by-certification will help streamline the permitting process while maintaining high environmental standards.

This information is pre-decisional and does not constitute a final agency decision or action. The proposal and full text was anticipated to be released in Quarter 2 of 2023 at the time of this webinar (Mazzei, 2022). However, by understanding and planning for regulatory changes, the NJSEA can ensure compliance within the District, plan for physical, social, and economic resilience, prepare for funding opportunities, and support resilience planning efforts that are consistent with the rulemaking throughout the greater region. It is crucial to track these rule proposals as they progress and plan for land use decisions in the District with these implications in mind.

2.2.2 Affordable Housing

In 2025, fourth round rules regarding New Jersey's Council on Affordable Housing (COAH) will go into effect. While NJSEA is not required to comply with these rules, it does have a court-ordered obligation to ensure that the affordable housing is provided within the District and N.J.S.A. 52:27D-329.9 directs regional planning authorities to plan for affordable housing where economically feasible. Additionally, the 14 municipalities within the larger Meadowlands region do have to comply with the 2025 fourth round obligations. Housing demand is expected to grow over the next five years with an increase of 10,370 households by 2023, but there is not enough affordable housing stock to support this trend (NJSEA p. 2-9). Current affordable dwellings may be vulnerable given future flooding predictions for New Jersey and planning for future housing demand in the District and the Region is challenged by current and future flooding as well as by other environmental constraints (i.e. closed landfills, contaminated sites, etc.).

In 2008, the New Jersey Meadowlands Commission (prior to the merge with the NJSEA) adopted Interim Policies Governing Affordable Housing Development in the Meadowlands District. These policies remain in effect to guide affordable housing development on an interim basis until new rules governing affordable housing are proposed by the NJSEA. The policies were revised in 2011. In Section IV A1 of the Interim Policies the following is stated: "The site is adjacent to compatible land uses and has access to appropriate streets". The section within the Interim Policies that this phrase resides in is Site Suitability Determination, so it is imperative that future housing development occur near areas where residents can use alternative modes of transportation other than a vehicle. The use of the wording appropriate streets is vague and could include more descriptive language that describes exactly what an appropriate street is. This phrase

could include verbiage regarding proximity to transit nodes such as a rail station, bus stops, etc.

To inform the NJSEA's efforts moving forward, this studio looked at neighboring Hoboken to see what they have done and are doing regarding integrating flood mitigation strategies into local ordinances and site suitability standards. This studio suggests that Hoboken may offer insights to NJSEA's efforts to strengthen its site suitability standards. The City of Hoboken has a section in its Master Plan titled *Green Building & Environmental Sustainability Element* which outlines the city's strategies and actions towards creating more sustainable buildings and communities. The subsection titled Land Use and Green Building Design describes concepts such as green building practices and low impact development, such elements that NJSEA may incorporate into future affordable housing development.

Incorporating green building practices in future affordable housing can reduce utility costs for residents. This includes implementing solar panels on roofs or recycling the building's water (Valle, n.d.). With elements like these, new buildings could potentially create their own energy reducing their dependence on the local energy grid and water supply. These examples and what Hoboken defines as "low-impact development" or incorporating a building's stormwater management system to mimic the site's redevelopment hydrology tie directly into the green infrastructure mitigation strategies the NJSEA included in their 2020 Master Plan.

Some of the innovations outlined in Hoboken's Green Building & Environmental Sustainability section coincide with some of the NJSEA's 12 mitigation strategies, specifically green infrastructure and setbacks. Elements that the City of Hoboken incorporates such as green infrastructure and increasing rear yard setbacks to allow for more pervious surface are approaches that the NJSEA could take into consideration towards building future affordable housing.

The Studio suggests that efforts to plan for affordable housing within the District as well as within the larger Meadowlands region will benefit from alignment with resilience planning that considers future flooding scenarios. Planning for resilience can consider housing demand within the District and planning for affordable housing and any updates to the interim policies will benefit from integration of mitigation strategies to address current and future flooding impacts.

Source: NJ.com, 2021

Constraints Imposed On Development Potentials

One of the barriers to development is the impending sea level rise. This studio utilized ArcGIS and overlaid 5ft SLR projections over municipal parcels and discovered the following percentage of parcel inundation: Rutherford, Carlstadt, and Ridgefield are projected to experience a mean average of 14%, 19%, and 22% parcel inundation, respectively. North Arlington, North Bergen, Secaucus, Jersey City, Kearny, Lyndhurst, East Rutherford, Teterboro, Little Ferry, Moonachie, South Hackensack are projected to experience an average of 84% to 100% parcel inundation.

Adding to this challenge is the fact that most parcels within the District are 'Sites with Known Contamination'. The Meadowlands region is ranked as one of the worst (90th to 100th percentile) in exposure to site contamination (Resilient Northeastern New Jersey, p. 169). In fact, a recent MERI's Water Quality Report in 2020 revealed increasing trends in dissolved metals and pollution found in waterways (MERI Lab 2020, p. 6). However, development of new housing is necessary as there are 4,768 unmet housing needs from the Third Round and the NJSEA has an obligation to support the efforts to provide affordable housing within the District (NJSEA p. 4-16).

2.2.3 Implementation of New Jersey Environmental Justice Law

On September 18th, 2020, Governor Murphy signed New Jersey's Environmental Justice Law ((N.J.S.A. 13:1D-157 (Act)) (NJDEP, 2023). This law mandates the New Jersey Department of Environmental Protection (NJDEP) to evaluate the environmental and public health impacts of certain facilities on overburdened communities (OBC) when reviewing certain permit applications (NJDEP, 2023). New Jersey requires permit denials if an environmental justice analysis determines a new facility will have a disproportionately negative impact on overburdened communities (NJDEP, 2023). The Environmental Justice Law requires NJDEP to evaluate the

environmental and public health impacts of certain facilities on overburdened communities when reviewing specific types of permit applications (NJDEP, 2023).

When reviewing specific permit applications, the facilities previously mentioned would be evaluated by the NJDEP to gauge the environmental and public health impacts of those facilities on said overburdened communities (NJDEP, 2023). The permit can be denied or approved conditionally for certain facilities that cannot avoid or appropriately minimize the occurrence of disproportionate environmental or public health stressors in that specific OBC (NJDEP, 2023) (NJDEP, 2023b).

Source: northjersey.com, 2021. Photo from 2012.

The following facilities are included in NJDEP's environmental justice analysis (NJDEP, 2023b):

- major sources of air pollution (gas fired power plants and cogenerative facilities)
- resource recovery facilities or incinerators; sludge processing facilities
- sewage treatment plants with a capacity of more than 50 million gallons per day
- transfer stations or solid waste facilities
- scrap metal facilities
- landfills
- medical waste incinerators, except those attendant to hospitals and universities

The State of New Jersey defines an overburdened community as any census block group where (NJDEP, 2023b):

- at least 35 percent of the households qualify as low-income households (at or below twice the poverty threshold as determined by USCB);
- at least 40 percent of the residents identify as minority or as members of a State recognized tribal community; or,
- at least 40 percent of the households have limited English proficiency (without an adult that speaks English "very well" according to USCB)

Within the State of New Jersey, there are approximately 348 municipalities with an estimated population of 4,687,381 that are considered “overburdened.” Approximately 18,025 of New Jersey’s overall overburdened population resides in the Meadowlands. The population of 18,025 spans eighteen overburdened census block groups that are within or intersect with the Meadowlands District boundaries. The most current OBCs are defined in 2020 block groups.

Implementation of the New Jersey Environmental Justice law will have implications for the District as well as the Meadowlands region because there are 27 facilities regulated under the law in the District/region as well as 18 overburdened block groups in the District that are defined as "overburdened." The law pertains to sewage treatment plants, major sources of air pollution, scrap metal facilities, solid waste recycling facilities, and transfer station / materials recovery facilities.

Source: Food and Water Watch, 2021.

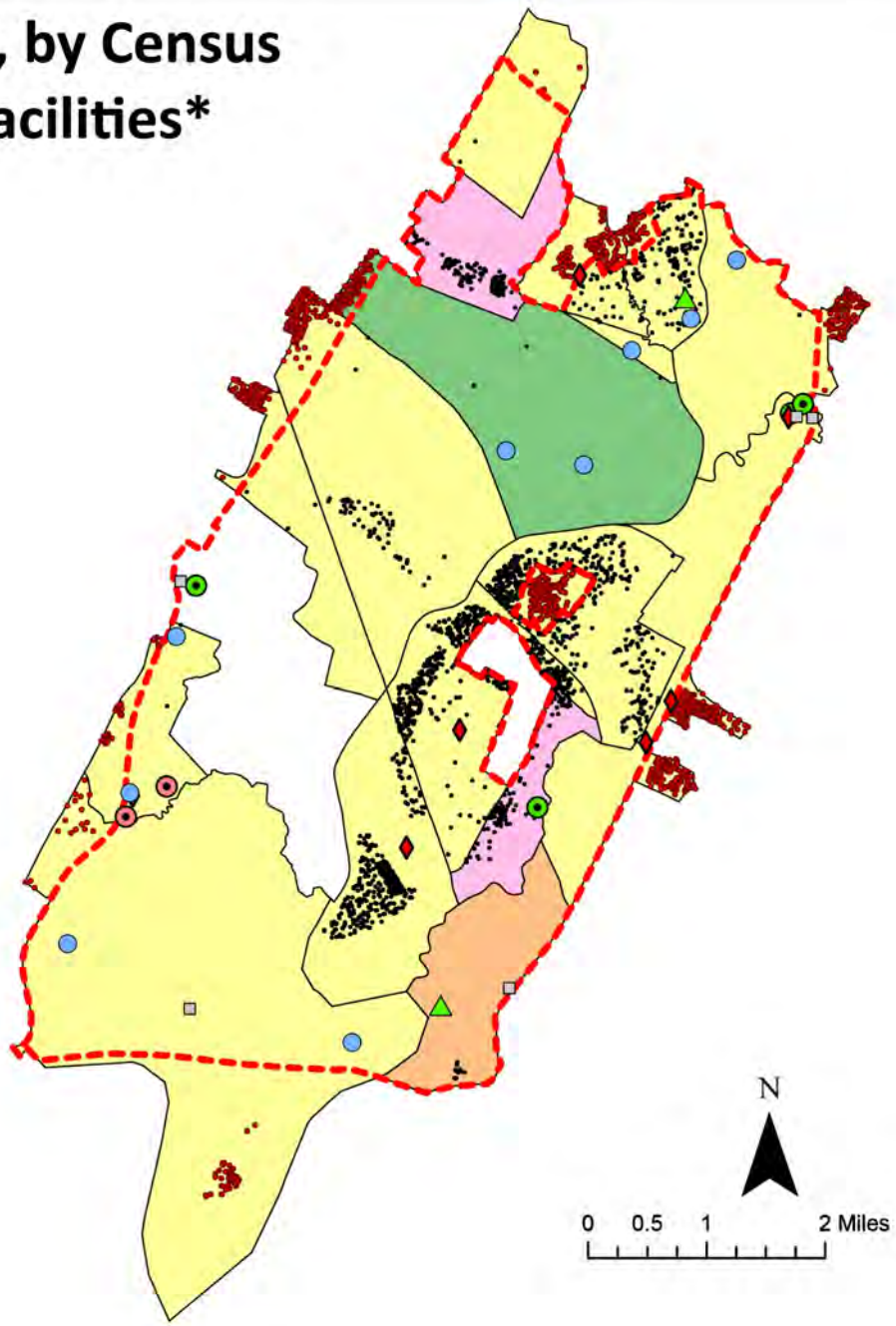
The following map shows Census block groups designated as OBCs in 2020 within or intersecting the District, the type of overburden in each block group, as well as regulated facilities within the District.

Overburdened Communities*, by Census Block Group, and Regulated Facilities* in the Meadowlands

*Under the New Jersey Environmental Justice Law

Note: Overburdened Communities data for Census block groups that intersect the Meadowlands District boundary are influenced by the population of these Census block groups outside the Meadowlands District and may not be representative of the population of those block groups within the District.

- Meadowlands District Boundary
- Teterboro Airport
- Low Income
- Low Income and Minority
- Low Income, Minority, and Limited English
- Minority
- o ata
- Population Inside District
- Population Outside District
- Sewage Treatment Plant 50mgd
- Major Source Of Air Pollution
- Scrap Metal Facility
- Solid Waste Recycling Facility - Class B
- Solid Waste Recycling Facility - Multi-Class B & C
- Transfer Station / Materials Recovery Facility



Source: NJ Office of GIS, US Census Bureau, NJ Department of Environmental Protection Bureau of GIS, NJ Sports and Exhibition Authority

According to the map, except for one block group, the entire District is designated as overburdened. The most common reason for this designation is that at least 40 percent of the residents are a racial minority. As with the Median Income Map above, a number of block groups intersect the District boundary. A dot-density layer was, again, used to show how much of a given block group's population is within the District. The dot-density layer helped the studio understand which block groups' data may be influenced by population outside the District. OBC data were produced by the NJDEP (2022).

2.2.4 Transportation and the Bipartisan Infrastructure Law

With the passage of the Bipartisan Infrastructure Law (BIL) in 2021, transportation policy makers across federal and state government agencies have substantial resources to address challenges that intersect with the Meadowlands's needs. According to the Metropolitan Transportation Commission, approximately $973 billion has been provided through the BIL throughout its five year timescale, with the majority going towards transportation programs (MTC, 2023). Investments in roads, bridges, and bicycle and pedestrian safety are expected to reach $350 billion, with another $210 billion being afforded for public transit and rail systems (MTC, 2023). The ability to capitalize on this critical window of federal transportation dollars will greatly influence communities' approaches to resilience, transportation, and land use planning.

Major general trends in transportation policy at the federal level are a growing emphasis on equity and on multimodality, the expansion of competitive or discretionary funds, and a shift towards climate-conscious projects. Regarding equity, the US Department of Transportation (USDOT) follows the Justice40 Initiative that allocates "at least 40% of the benefits from many of [their] grants, programs, and initiatives flow to disadvantaged communities" (USDOT, 2023). Disadvantaged communities are determined by "22 indicators collected at the census tract level and grouped into six (6) categories of transportation disadvantage"(USDOT, 2023b). These categories are:

- *Transportation Access Disadvantage* - Identifies communities and places that spend more, and take longer, to get where they need to go.
- *Health Disadvantage* - Identifies communities based on variables associated with adverse health outcomes, disability, as well as environmental exposures.
- *Environmental Disadvantage* - Identifies communities with disproportionately high levels of certain air pollutants and high potential presence of lead-based paint in housing units.
- *Economic Disadvantage* - Identifies areas and populations with high poverty, low wealth, lack of

local jobs, low homeownership, low educational attainment, and high inequality.

- *Resilience Disadvantage* - Identifies communities vulnerable to hazards caused by climate change.
- *Equity Disadvantage* - Identifies communities with a high percentile of persons (age 5+) who speak English "less than well."

In concert with the high number of competitive programs - programs where eligible applicants across the nation create proposals and compete directly for federal dollars - these federally recognized disadvantage indicators represent a competitive edge for grant proposals. As a result, the NJSEA and Meadowlands region municipalities that meaningfully incorporate such indicators are likely to receive better odds of funding. Likewise, project proposals that reduce carbon generation and total vehicle miles traveled (VMT) are more likely to draw attention from the current USDOT administration than proposals that do not engage with those considerations.

Appendix C.1 provides systemic information on different BIL programs highlighted on the White House's website. To summarize and elaborate on the information provided in the appendix, here are critical programs relevant to the NJSEA's transportation infrastructure and potential projects:

- PROTECT [$7.3 billion]: Formula grants designed increase the resilience of transportation systems. It includes funding for evacuation routes, coastal resilience, making existing infrastructure more resilient, or efforts to move infrastructure, and PROTECT funds can be applied to a resilience-orient subitems of transportation infrastructure projects.
- Safe Streets for All [$6 billion]: Provides funding directly to local and tribal governments to support their efforts to advance "vision zero" plans and other improvements to reduce crashes and fatalities, especially for cyclists and pedestrians.
- RAISE Grants [$15 billion]: Competitive grants designed to help State and local government project sponsors fund critical freight and passenger transportation infrastructure projects that otherwise may be harder to support through other USDOT grant projects.
- INFRA Grants [$8 billion]: INFRA (known statutorily as the Nationally Significant Multimodal Freight & Highway Projects) awards competitive grants for multimodal freight and highway projects of national or regional significance to improve the safety, efficiency, and reliability of the movement of freight and people in and across rural and urban areas.
- Bridge Investment Program [$12.5 billion]: Assists state, local, federal, and tribal entities in rehabilitating

or replacing bridges, including culverts. Large projects and bundling of smaller bridge projects will be eligible for funding.

- SMART Grants [$500 million]: Delivers competitive grants to states, local governments, and tribes for projects that improve transportation safety and efficiency. Focuses on that use technology interventions to solve real-world challenges
- All Station Accessibility Program [$1.75 billion]: Provides funding to legacy transit and commuter rail authorities to upgrade existing stations to meet or exceed accessibility standards under the Americans with Disabilities Act.

Source: Bond Buyer, 2023

Many of these programs serve as financial vehicles for multimodal, active, and resilience oriented transportation projects. These projects could assist the District's aim in shifting future development away from ecologically sensitive or hazardous areas through intentional capital planning. Federal-aided investments in complete street programs and transit projects could help support land use patterns that utilize cluster developments in less hazardous, more central areas of the District. Available RAISE, PROTECT, and Bridge Investment Program funding can augment the degree to which resilience improvements can be incorporated into the District's transportation infrastructure bottlenecks.

The applicability and eligibility of these competitive funding programs and others varies on a project to project basis. The next stage in competing for these federal transportation infrastructure dollars may be identifying appropriate multimodal or resilience improvement transportation projects within the District and considering the competitiveness of specific project proposals.

2.2.5 Army Corps of Engineers

In response to the impacts of current and future coastal storms in the North Atlantic region, the Army Corps of Engineers (ACOE) launched the New York and New Jersey Harbor and Tributaries (NYNJHAT) coastal storm risk management feasibility study. In September 2022, ACOE released a Draft

Integrated Feasibility Report and Tier 1 Environmental Impact Statement outlining a list of project alternatives identifying a Tentatively Selected Plan (TSP). The TSP (Alternative 3B) includes structural and nonstructural Risk Reduction Features (US ACOE, 2022).

The TSP includes features intended to protect the Meadowlands District. The Hackensack River Barrier, also called the Meadowlands Gate, is located within the District boundaries and provides coastal storm risk management. This barrier includes "a navigable sector gate and five non-navigable auxiliary flow vertical lift gates" located across the Hackensack between Kearny and Secaucus. The Draft Report also states that the Kill Van Kull Barrier and Arthur Kill Barrier would provide protection for communities in the Meadowlands as well; however, they are not located in the District. Both barriers include "navigable floating sector gates, as well as non-navigable auxiliary vertical lift flow gates" (US ACOE, 2022). The Kill Van Kull Barrier is located between the north shore of Staten Island, NY, and Bayonne, NJ leading into Newark Bay. The Arthur Kill Barrier is located between the South Shore of Staten Island, NY, and Perth Amboy, NJ, leading into the Arthur Kill River, see ACOE HATS map of TSP 3B (US ACOE, 2022).

The ACOE emphasizes the potential benefits of the study/future project, but local stakeholders have voiced concerns surrounding the data and projected impacts. For stakeholders in the Meadowlands, the effects of the proposed infrastructure on the Hackensack and Passaic rivers are a primary concern. There is uncertainty about whether the proposed gates will restrict flow to the Hackensack River, which provides drinking water (Remaud, 2023). Restricting water flow could also result in wetland retreat due to less frequent inundation. A local environmental nonprofit, Riverkeeper, submitted a formal commentary letter on the Draft Report which notes that the barriers could "interfere with tidal energy, reduce sediment transport, and slow the flushing of pollutants…". Similarly, Riverkeeper has expressed concern that when tide gates are closed or restricting water flow, sewer pollution released from combined sewer system outfalls (CSOs) will be restricted, trapping contaminants (Riverkeeper, 2023). Beyond a potential shift in water flow, local stakeholders are concerned with how the placement, construction, and management of these barriers will affect the sensitive wetland habitats and wildlife species of concern in and around the area where the barrier would be sited (Doss, 2023). Currently, it is also unclear how the TSP features may interact with existing tide gates in the Meadowlands.

Beyond these comments associated with infrastructure within the District boundaries, several stakeholders have expressed additional critiques about the overall study. Non-federal sponsors for the study, the NJDEP, the New York State

Department of Environmental Conservation, and the NYC Mayor's Office of Climate and Environmental Justice submitted a joint commentary letter in March 2023 to the ACOE voicing support for the TSP alongside recommendations for further research/outreach practices (NJDEP et. al., 2023). Recommendations in this joint letter include:

- Utilizing more accurate sea level rise data that is generated on the local level.
- Maintaining public access to the coast through "non-structural and nature-based features".
- Identify projects that can mitigate multiple risks and add social value to the community.
- Include a greater focus on environmental justice and equity.
- Revisit areas currently prone to flooding not identified as a project location.

The non-federal sponsors' recommendations reflect a majority of the public critiques. Below are a few additional topics of concern voiced by environmental organizations (Aguilar et al., 2023; Freudenberg & Calvin, 2023; Riverkeeper, 2023; Waterfront Alliance, 2021)

- Maintenance- who is responsible for funding and maintaining the project? Existing (non-related) projects in communities throughout the greater region lack proper maintenance, detracting from their value.
- Public perception - there is concern that the public will view the proposed barriers as a "solution" to flooding, but this solution fails to address the root cause of the issue and still leaves areas vulnerable.
- Induced flooding - where does the water go once restricted? How will communities outside the tide gates be impacted?
- Compound flood events - as more intense rain events like Hurricane Ida occur, why do the flood projections not account for both storm surge and pluvial flooding?
- Ecological risks - how will habitats, fish migration, tidal cycles, etc. be impacted?

This studio drafted a list of questions for the ACOE based on public comments released by various organizations and meetings with local stakeholders (prior to the publication of the non-federal sponsor's recommendations). In early March, this studio met with a representative from the ACOE who provided feedback to some of these questions. Highlights from the meeting are summarized below (Tommaso, 2023).

- Lack of modeling accounting for pluvial data- the selected data for the HATS assessment is based on instructions from Congress that specified the ACOE focus on coastal storm risk management.

- Concern of restricted water flow in communities with CSOs- if a feature would decrease the capacity of internal drainage, that is something the ACOE wants to avoid.
- Suggestion of more nature-based solutions- ACOE recognizes storm surge barriers open during a daily high tide do not provide flood protection, but they succeed at reducing risk during a coastal storm.
- Induced flooding- the ACOE recognizes that induced flooding could be an issue; however, they state that they modeled this and included induced flooding mitigation features (IFMF), floodwalls, and levees in front of the barrier in areas where they saw a potential increase.
- Maintenance- ACOE responded that operations and maintenance would likely be assumed by the non-federal sponsor associated with each feature's region.
- Ecological impacts- when the gates are open there would be little/no impact.

As of May 2023, the NYNJHAT study led by ACOE is still in a draft state and will continue to take shape over the next few months. The ACOE has welcomed public commentary indicating that additional upcoming phases of the study and the final feasibility report that will be released in June 2024, will be shaped based on public feedback. Although the public commentary period has passed, the NJSEA may still wish to track the progress of the NYNJHAT study as it progresses through the projected planning and implementation stages (Tommaso, 2023). Keeping up to date with the developments of the HAT study is essential for future planning in the impacted region, especially in regard to potential impacts on the Hackensack River.

2.3 Section Recommendations

- The NJDEP expressed that there is an increasing need to address flooding in the District. One way to best do so is increasing the flood levels to reflect a more up to date climate scenario. More specifically, using projected precipitation totals at the 83rd percentile under the moderate RCP 4.5 scenario for the 2-, 10-, and 100-year storms using the timeframe of 2050-2099 by utilizing new precipitation projections for the year 2100 into stormwater best management practice designs and impacting the sizing of stormwater management systems. This will help the NJSEA best prepare for the increase in flooding events associated with climate change.

- Given the demand for affordable housing within the Meadowlands and the current and future flooding challenges also faced by the District, there appears to be important opportunities and benefits to intersect

planning for affordable housing with planning for current and future flooding. Future planning for affordable housing and any updates to the Interim Policies Governing Affordable Housing Development in the Meadowlands District will benefit from integration of mitigation strategies to address current and future flooding impacts.

- The BIL has many grant opportunities that can be utilized to further the infrastructure improvement projects that were outlined in the MUTD of 2007. The grant opportunities are competitive and discretionary with fast approaching deadlines. It is unclear whether these grant opportunities will be initiated after a deadline has passed, so acting now is important.

- Identifying projects that will mitigate multiple risks and add social value to the community with a focus on environmental justice and equity is important for the Meadowlands region. Additionally, maintaining public access to the coast through 'non-structural and nature-based features', is key for furthering district resiliency.

- Staying informed on the developments associated with the NYNJHAT study is essential for future planning in the impacted region, especially in regard to potential impacts on the Hackensack River.

Source: Zoe Linder-Baptie, 2023.

PART THREE

REGIONAL RESILIENCE PLANNING

3. Regional Resilience Planning

Identifying the potential benefit of coordinating planning efforts across the Meadowlands region, this studio sought to compile and synthesize existing frameworks for developing regional resilience. To this end, this studio aimed to critically research existing Resilient NJ Plans, in order to provide the NJSEA greater context on comparable regional resilience planning processes and elements in the state. Such analyses are intended to be an addition to our other deliverables and to assist the NJSEA in its approach to the stakeholders and the public.

Our analysis includes a quick overview of Resilient NJ's general steps to planning for resilience in ways that benefit a multi-municipal region. (Initiate and Engage, Vulnerability/Risk Analysis, Develop a Strategy, Track Your Progress), and a synthesized review of 4 Resilient NJ Regional Plans.

3.1 Community Engagement

One goal of this studio is to provide the NJSEA with information regarding opportunities and challenges that can inform any efforts to engage stakeholders within the District and the larger Meadowlands region related to building climate resilience. Planning for climate resilience is increasingly viewed as an effort that intersects science, the natural and built environment, local and regional economies and community visioning. As a result, effective climate resilience planning involves comprehensive, systems-based approaches that are informed by robust community engagement and prioritization (Bucchin & Tuley, 2022). Community-engaged climate resilience planning encourages stakeholders and community members to actively participate in the process of developing and implementing strategies to adapt to the imminent impacts of climate change by:

- Putting forward a vision and asserting a set of community priorities.
- Assessing community vulnerabilities and assets.
- Building community/stakeholder voices and power (Gonzalez, 2017).

Ongoing practices point to stakeholder and community engagement as a critically important element to integrate local knowledge into climate resilience efforts to ensure that outcomes are feasible, sustainable and locally relevant (Lieberknect, 2022). Allowing stakeholders to play a fundamental role in resilience planning allows the community to feel empowered and involved in identifying their vulnerabilities, assessing current and future risks and developing resilience measures that are responsive to their identity, unique needs and priorities. The goal of community

and stakeholder engagement is to ensure that local knowledge, identity and perspective are captured and incorporated in the decision-making process and populations who are often left out of the process are included, and their voices and ideas are incorporated.

When researching best strategies for community and stakeholder engagement, this studio found that the NJDEP Resilient NJ Toolkit showcases the value of participatory and inclusive approaches to climate resilience planning where community members, including residents, local organizations, and stakeholders, are actively involved in all stages of the planning process, from understanding who they are as a community, to engaging in problem identification to solution development and implementation.

The NJDEP Toolkit also points to the value of developing an engagement plan very early in the climate resilience planning process with community representatives and socially vulnerable populations. The Toolkit points to the importance of having an engagement strategy that outlines "multiple layers of engagement, the identification of and strategies to engage socially vulnerable populations, the consistent messaging, the key data to be obtained, the milestones to be achieved, the benchmarks and indicators to monitor the success of the engagement plan, the timing, type, and frequency of each engagement strategy, and the deliverables" (NJDEP, 2022).

Source: NJDEP, Rebuild by Design, n.d.

Engagement of socially vulnerable populations is especially important as part of climate resilience planning. While changing climate conditions affect all populations, certain populations face disproportionate and unequal risks including those that are least able to anticipate, cope with, and recover from adverse impacts. As a result, effective stakeholder and community engagement ensures full involvement of socially vulnerable populations including low-income communities, communities of color, indigenous peoples, women, children, the elderly, and people with disabilities. These populations often face greater exposure to climate risks and have fewer resources to adapt and recover from climate impacts. Their perspectives and experiences are critical in understanding the localized impacts of climate change and developing effective

resilience strategies.

Engaging these communities can provide insights and solutions that may not be evident from external perspectives, leading to more contextually relevant and sustainable resilience measures (EPA, 2021). Furthermore, ensuring engagement of socially vulnerable populations is shown to strengthen social cohesion, enhance resilience for whole communities, and advance solutions that go beyond recovery to contribute to overall improvement of future responses and community vibrancy (EPA, 2021 September). This studio studied the benefits of integrating stakeholders and community engagement into climate resilience planning and have found examples of stakeholder engagement tools and strategies that can support regional climate resilience planning in the Meadowlands region, such as:

- Enhanced Decision Making: Stakeholder and community engagement provides diverse perspectives and local knowledge, leading to more informed decision-making. "Research finds that community recovery and pre-disaster planning is more effective when all people (and not just a powerful few) have a voice. Because socially vulnerable populations have historically been underrepresented in community decision-making, ensuring their involvement and their capacity to be involved is critical to ensure development of effective resilience and recovery plans." (A Seat at the Table, 2020) Thus, engaging with stakeholders and communities allows for a better understanding of their needs, priorities, and vulnerabilities, which can lead to more effective climate resilience plans that address their specific concerns and reduce risks.
- Co-creation of climate mitigation strategies with community representatives: Regional climate resilience efforts can benefit from collaboration with community stakeholders who have in-depth knowledge of the Meadowlands region. Engagement with community representatives can provide valuable insight into what engagement techniques might be culturally appropriate, what kinds of meeting materials might be most accessible and how to engage with populations who do not typically participate in planning processes. (Resilient NJ, 2021)
- Increased Ownership and Support: Involving stakeholders and communities in climate resilience planning fosters a sense of ownership and promotes buy-in from those directly affected. When stakeholders and communities are actively engaged, they are more likely to support and participate in the implementation of resilience measures. This can result in increased community support, cooperation, and willingness to adopt and implement resilience strategies, leading to more successful and sustainable outcomes.

- Improved Resilience Measures: Stakeholder and community engagement can lead to the identification of innovative and contextually relevant resilience measures. Local communities often have valuable knowledge about their environment, resources, and vulnerabilities, which can inform the development of effective resilience strategies. Engaging with stakeholders and communities can lead to the identification of locally driven, culturally appropriate, and sustainable solutions that are better aligned with the needs and values of the community.
- Developing transparent and accessible communications: Using Social Media is a great tool to keep stakeholders/community members engaged and informed on the planning process. Updating the NJSEA social media channels such as twitter, Instagram, facebook, snapchat etc. is a great way to provide a dashboard of resources, community discussion forums for residents to provide project input if they cannot attend meetings, and can be useful in relaying project updates, and information related to key benchmarks in the planning process. (Resilient NJ, 2021)
- Improved Communication and Education: Stakeholder and community engagement promotes communication and education about climate resilience. "It is to envision the planning process as a learning process; community-driven climate resilience planning thrives on the opportunities for learning amongst stakeholders and community members." (Gonzalez, 2017) Engaging with stakeholders and communities allows for the exchange of information, knowledge, and education on climate resilience, increasing awareness and understanding of climate risks, impacts, and strategies. This can empower stakeholders and communities to take informed actions and make better decisions to build their resilience.

When researching existing programs we found that Resilient NJ has had a strong focus on incorporating community and stakeholder engagement in the planning process. This can be a great resource for NJSEA to explore in the future. Resilient is the State of New Jersey's program that supports regional, multi-municipal planning with four regional efforts underway statewide. One of the four Resilient NJ regions is in the northeastern region of the state that includes Jersey City, Newark, Bayonne and Hoboken. In 2021, Resilient Northeastern New Jersey, RNNJ, worked with communities to complete a visioning process to identify regional values, priorities, and visions for the future." (Resilient NJ, 2021) RNNJ assigned a community advisory council consisting of a diverse group of community representatives from Jersey City, Newark, Hoboken, and Bayonne. Stakeholder and community engagement is a critical element of the Resilient NJ initiatives

(Resilient NJ, 2021). Engagement of stakeholders is focused on:

- Identifying vulnerabilities within the greater region including assessing what populations, critical facilities and community assets are especially vulnerable. Equitable approaches to community and stakeholder engagement promotes consideration of populations that may be socially vulnerable with less capacity to adapt. It may also set priorities for considering the vulnerability of cultural assets that are valued by underrepresented populations as well as the social networks and structures that support resilience;
- Creating a shared vision for the community that resilience efforts can contribute to and ensuring that the most underrepresented populations have a strong voice in creating the community vision; and
- Assessing the feasibility and sustainability of different types of resilience strategies and whether they will "work" in the particular community as well as considering whether important "co-benefits" can result from resilience efforts such as expansion of natural spaces for recreation.
- Identifying community strengths that can contribute to resilience efforts, such as the existence of social structures that provide community support in times of uncertainty and trauma, availability of community-based anchor institutions (i.e., hospitals, businesses, etc.), strong local economies, democratic governance structures and effective communication systems.
- Ensuring effective communications, outreach and education of community leaders, residents, and decision-makers.

Throughout this studio we have come to recognize that water does not stop at the District's border, and that resilience planning with the whole region in mind can deliver substantial benefits to both the District and the larger Meadowlands region. While this studio recognizes that the NJSEA's planning and zoning authority is limited to the District, we also recognize that the same changing climate conditions will affect the entire region and that the NJSEA may be best positioned to coordinate use of the latest science, data and modeling to inform consistent planning throughout the District, similar to efforts underway in Resilient NJ. Among this studio's recommendations is encouragement for the NJSEA to play a facilitative role in the greater region promoting consistent use of science, data and modeling as well as adoption of regionally beneficial community visioning and selection of climate mitigation strategies.

Engagement with community-based organizations goes hand-in-hand with dedicated engagement with local elected and appointed officials who represent the needs of constituent

communities and who can contribute to identification of climate resilience strategies that are aligned with municipal priorities. Any efforts on the part of the NJSEA to advance regionally consistent climate resilience planning would benefit from initial and ongoing engagement with local officials.

Source: Zoe Linder-Baptie, 2023.

3.2 Risk Analysis

3.2.1 Understanding Risk in the Meadowlands

Total Water Level (TWL) and Base Flood Elevation (BFE) are both important metrics used to assess flood risk, but they represent different aspects of flooding and are calculated using different approaches. While BFE is used throughout the United States to estimate flood risk, this report uses TWL, to understand risk in the same way as the Rutgers Climate Change Resource Center.

Base Flood Elevation, used by FEMA in the United States, represents the elevation of floodwaters during a base flood event, which is a flood that has a 1% chance of occurring in any given year (also known as the 100-year flood). BFE is determined using hydrologic and hydraulic analyses that take into account factors:

- Historical flood data and statistical analyses of past flood events.
- Rainfall patterns and intensity.
- River flow, storm tides, and coastal storm surge data.
- Topography and terrain, including features that may affect the flow of floodwaters.
- Land use and development patterns, which can influence runoff and water absorption.

FEMA calculates BFE using a vertical datum, such as the North American Vertical Datum of 1988 (NAVD88), which is a fixed reference point based on mean sea level. BFE is used to establish floodplain management regulations and inform building codes in flood-prone areas. BFE primarily focuses on riverine and coastal flooding and does not directly account for sea-level rise or other long-term changes in flood risk. It also

does not measure flood risk to urban flooding.

Total Water Level (TWL) is a term used to describe the combined height above mean higher high water of all the components of water that can impact a specific location. TWL accounts for:

- Astronomical tides: The regular rise and fall of water levels due to the gravitational pull of the moon and the sun.
- Storm surge: The abnormal rise in water levels caused by strong winds and low atmospheric pressure during storms or hurricanes.
- Sea-level rise: The long-term increase in global mean sea level due to factors such as melting ice sheets and thermal expansion of seawater.

Mean Higher High Water (MHHW) is typically higher than the vertical datum used by FEMA for calculating Base Flood Elevations (BFE). MHHW is a tidal datum that represents the average of the highest high tide levels observed over a specific period (usually 19 years) at a particular location. This means BFE and TWL are not directly comparable, and so it is important to not confuse the level of TWL referenced in this analysis with the level used for BFE.

TWL is a more comprehensive approach to understanding coastal flooding because it takes into account all the factors that contribute to flooding, including storm surge, tidal levels, and wave run-up. In contrast, FEMA flood maps only consider the 1% annual chance flood or the "100-year flood," which is based on historical data. Using historical data to determine flood risk may underestimate actual risk, as climate change impacts, including storms, sea level rise, and extreme precipitation, are becoming more frequent and increasing in intensity (Angarone et al., 2021). This may result in inadequate flood protection measures being put in place, leaving communities vulnerable to flooding and its consequences.

In the context of the Meadowlands, TWL is a significant concern due to the area's low elevation and its location in the estuary of the Hackensack and Passaic Rivers, which are both subject to tidal influence. The TWL in the Meadowlands is influenced by a number of factors, including the local topography, the tidal cycle, and storm events. The elevation of the land, the height of the sea level, and the intensity of storms can all contribute to the total water level experienced by the area. The following list shows the TWLs used in this report and the flood scenarios they represent:

Total Water Levels Used and Flood Scenarios Represented:

- **2ft:** Current High Tide Flooding, 2050 SLR projection.
- **3ft:** Current typical Nor'easter surge, 2070 SLR projection.
- **5ft:** Current 100-year flood, 2100 SLR projection.

- **7ft:** Current 500-year flood, Projected 100-year flood in 2050.
- **8ft:** Projected 100-year flood in 2070.
- **10ft:** Projected 100-year flood in 2100, Projected 500-year flood in 2070
- **12ft:** Projected 500-year flood in 2100.

In the long term, climate change is expected to increase the sea level, which will have a compounding effect on the other components of TWL. The increased risk of flooding and erosion can be addressed through adaptive measures such as land use planning, infrastructure design, and shoreline protection. In the short term, monitoring of tidal and storm events is necessary to inform emergency management and evacuation plans. By incorporating projections for these changes, TWL can help inform decisions about development, infrastructure planning, and emergency management that take into account future risk.

Summary of STAP Outcomes

Sea-level rise:

Table ES-1: New Jersey Sea-Level Rise above the year 2000 (1991-2009 average) baseline (ft)*

		2030	2050	2070			2100			2150		
				Emissions								
	Chance SLR Exceeds			Low	Mod.	High	Low	Mod.	High	Low	Mod.	High
Low End	> 95% chance	0.3	0.7	0.9	1	1.1	1.0	1.3	1.5	1.3	2.1	2.9
Likely Range	> 83% chance	0.5	0.9	1.3	1.4	1.5	1.7	2.0	2.3	2.4	3.1	3.8
	~50 % chance	0.8	1.4	1.9	2.2	2.4	2.8	3.3	3.9	4.2	5.2	6.2
	<17% chance	1.1	2.1	2.7	3.1	3.5	3.9	5.1	6.3	6.3	8.3	10.3
High End	< 5% chance	1.3	2.6	3.2	3.8	4.4	5.0	6.9	8.8	8.0	13.8	19.6

**2010 (2001-2019 average) Observed = 0.2 ft*

Notes: All values are 19-year means of sea-level measured with respect to a 1991-2009 baseline centered on the year indicated in the top row of the table. Projections are based on Kopp et al. (2014), Rasmussen et al. (2018), and Bamber et al. (2019). Near-term projections (through 2050) exhibit only minor sensitivity to different emissions scenarios (<0.1 feet). Low and high emissions scenarios correspond to global-mean warming by 2100 of 2°C and 5°C above early Industrial (1850-1900) levels, respectively, or equivalently, about 1°C and 4°C above the current global-mean temperature. Moderate (Mod.) emissions are interpolated as the midpoint between the high- and low-emissions scenarios and approximately correspond to the warming expected under current global policies. Rows correspond to different projection probabilities. There is at least a 95% chance of SLR exceeding the values in the 'Low End' row, while there is less than a 5% chance of exceeding the values in the 'High End' row. There is at least a 66% chance that SLR will fall within the values in the 'Likely Range'. Note that alternative methods may yield higher or lower estimates of the chance of low-end and high-end outcomes.

Table 1: New Jersey Sea-Level Rise above the year 2000 (1991-2009 average) baseline (ft)*, Table ES-1 from 2019 STAP Report (pg 1)

It is projected with 17% confidence in the Rutgers University 2019 Science and Technical Advisory Panel (STAP) report that sea level rise will reach 5 feet by 2100, as shown in Table 1 (Kopp et al., 2019). While the changes to the New Jersey Flood Area Hazard Rules will consist of regulatory, minimum standards for land use and development, understanding risk to TWL by 2100 offers a broader scope and more flexible considerations. It is important to understand that these scenarios are not distant possibilities but rather have tangible impacts in the foreseeable future. A 5-foot TWL not only represents the projected sea level rise by 2100 but also corresponds to the current 100-year flood event.

Source: Zoe Linder-Baptie, 2023.

Furthermore, a 10-foot TWL is anticipated to be the 500-year flood event within the next 50 years. By acknowledging the urgency of these scenarios, policymakers and planners can take appropriate action to mitigate risks and build resilience in the face of evolving climate challenges. Climate impacts will conflict with the urban environment and populations well before significant disasters occur. The economic sustainability of new investment which may not be resilient to climate impacts by the end of their useful life must also be considered.

The following maps show inundation from SLR, a 100-year flood, and the FEMA 100-year floodplain with an additional three feet for both the District and the 21 municipalities that are within, intersect, or are adjacent to the District. Both TWL, which is used to show SLR and the 100-year flood in 2100, and the FEMA 100-year floodplain with an additional three feet datasets are based on bare Earth elevation, so they do not accurately show inundation of elevated structures, such as roads, railroads, or bridges. They also do not factor in stormwater system capacity. The TWL dataset was produced by NJDEP (2023). The FEMA 100-year floodplain with an additional three feet dataset was produced by Rutgers University (2022).

Meadowlands Sea Level Rise (5ft) in 2100*

* Used in the New Jersey Department of Environmental Protection's forthcoming Coastal Flooding Rule

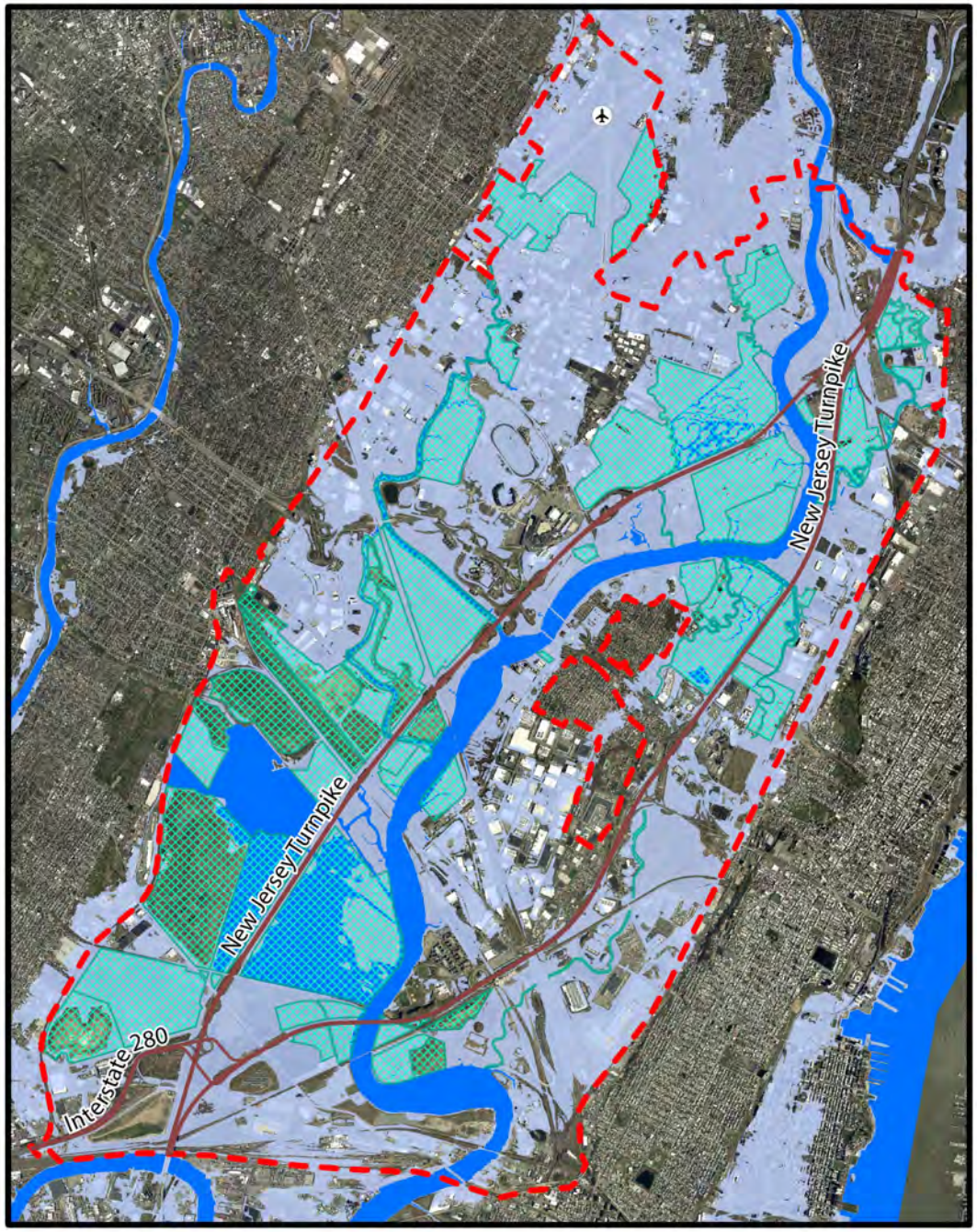
Note: 5ft sea level rise, projected by 2100, with 17 % confidence, under a moderate emissions scenario, is represented by 5ft Total Water Level. TWL is based on bare earth elevation and does not accurately reflect the inundation of elevated roads, railroads, or bridges. TWL does not factor in stormwater system capacity.

- Meadowlands District Boundary
- Wetlands
- Waterway
- 5 ft SLR
- Teterboro Airport
- Interstate Road

N

0 0.5 1 2 Miles

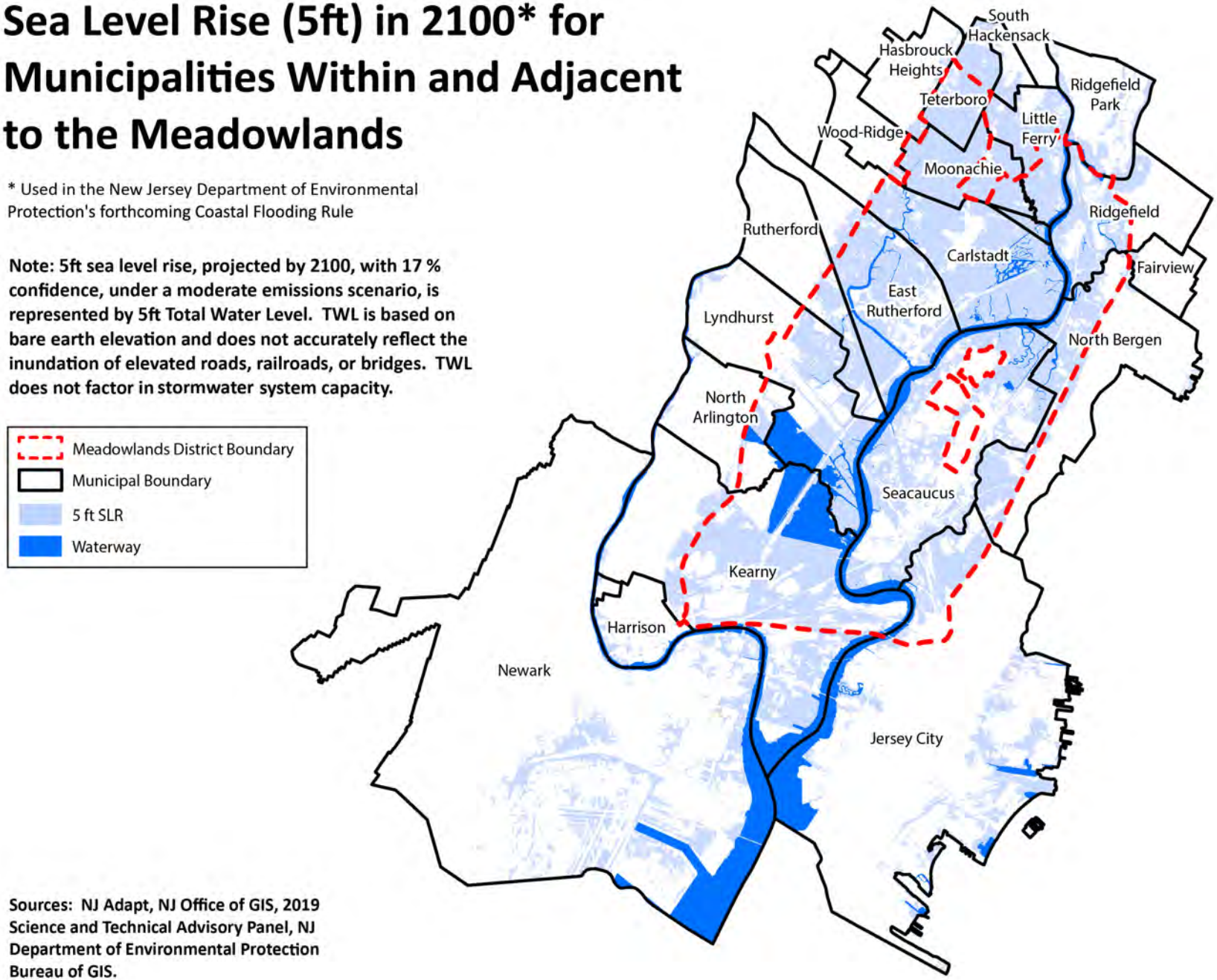
Sources: NJ Adapt, NJ Office of GIS, 2019 Science and Technical Advisory Panel, NJ Department of Environmental Protection Bureau of GIS.



Sea Level Rise (5ft) in 2100* for Municipalities Within and Adjacent to the Meadowlands

* Used in the New Jersey Department of Environmental Protection's forthcoming Coastal Flooding Rule

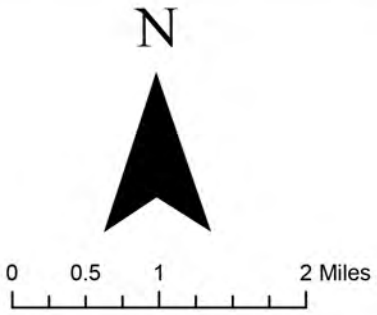
Note: 5ft sea level rise, projected by 2100, with 17 % confidence, under a moderate emissions scenario, is represented by 5ft Total Water Level. TWL is based on bare earth elevation and does not accurately reflect the inundation of elevated roads, railroads, or bridges. TWL does not factor in stormwater system capacity.



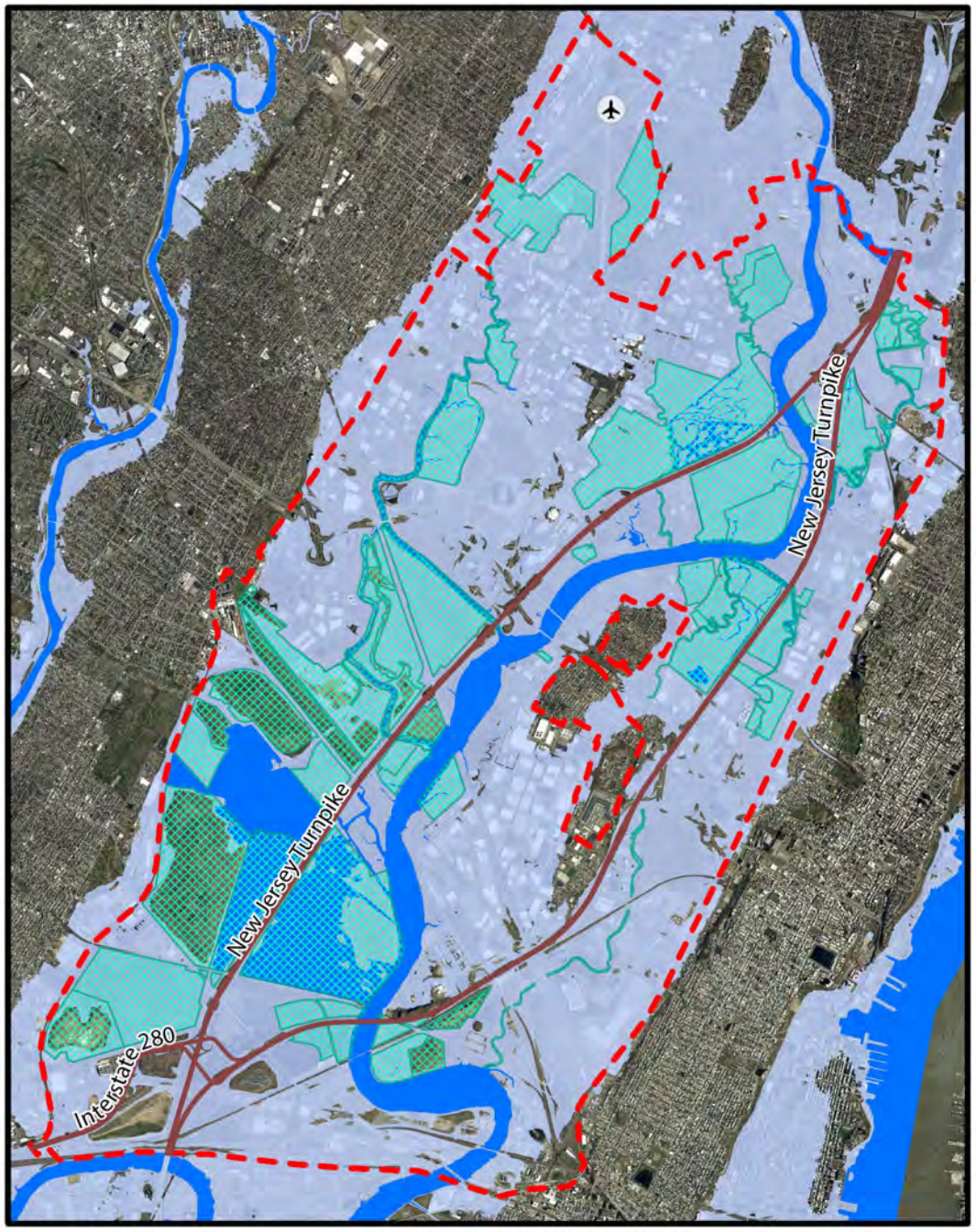
Sources: NJ Adapt, NJ Office of GIS, 2019 Science and Technical Advisory Panel, NJ Department of Environmental Protection Bureau of GIS.

Meadowlands 100-Year Flood in 2100

Note: Based on projections with 17 % confidence, under a moderate emissions scenario, 10ft Total Water Level was used to represent a 100-year storm in 2100. TWL is based on bare earth elevation and does not accurately reflect the inundation of elevated roads, railroads, or bridges. TWL does not factor in stormwater system capacity.

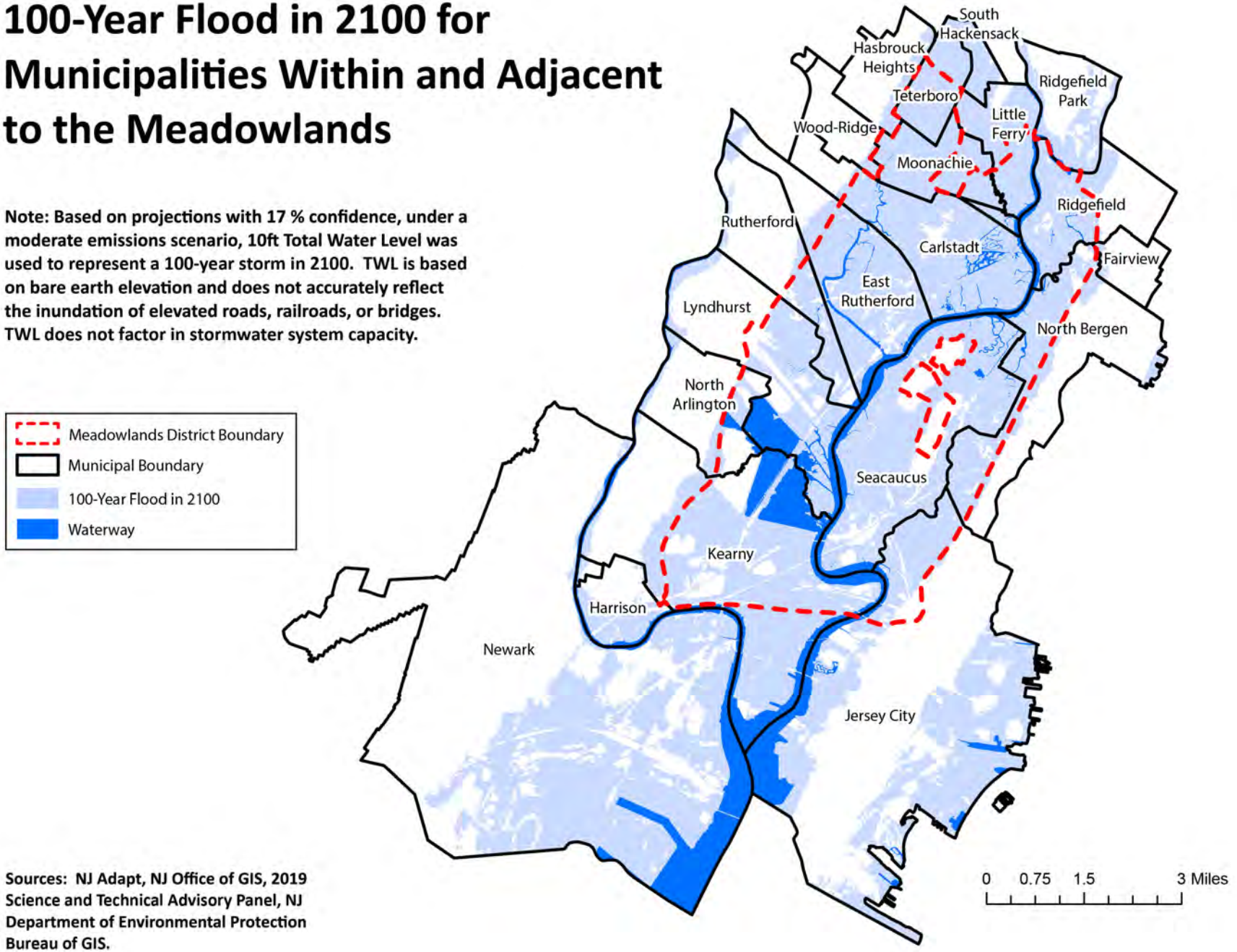


Sources: NJ Adapt, NJ Office of GIS, 2019 Science and Technical Advisory Panel, NJ Department of Environmental Protection Bureau of GIS.



100-Year Flood in 2100 for Municipalities Within and Adjacent to the Meadowlands

Note: Based on projections with 17 % confidence, under a moderate emissions scenario, 10ft Total Water Level was used to represent a 100-year storm in 2100. TWL is based on bare earth elevation and does not accurately reflect the inundation of elevated roads, railroads, or bridges. TWL does not factor in stormwater system capacity.



Sources: NJ Adapt, NJ Office of GIS, 2019 Science and Technical Advisory Panel, NJ Department of Environmental Protection Bureau of GIS.

Meadowlands 1% Annual Chance Flood plus 3 Feet*

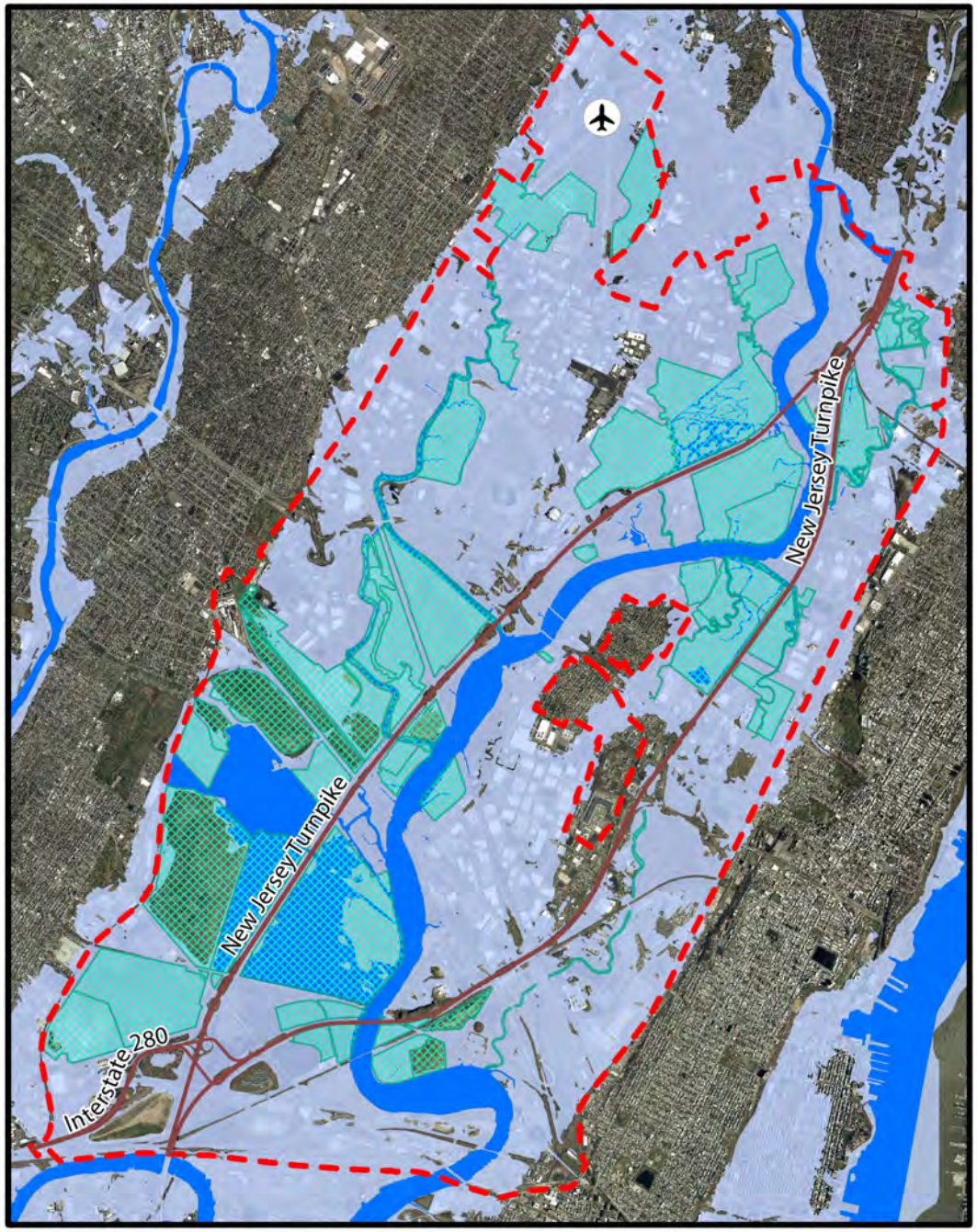
* Used in the New Jersey Department of Environmental Protection's Inland Flooding Rule.

- Meadowlands District Boundary
- Wetlands
- Waterways
- FEMA 1% Annual Flood + 3 Feet
- Teterboro Airport
- Primary Road

N

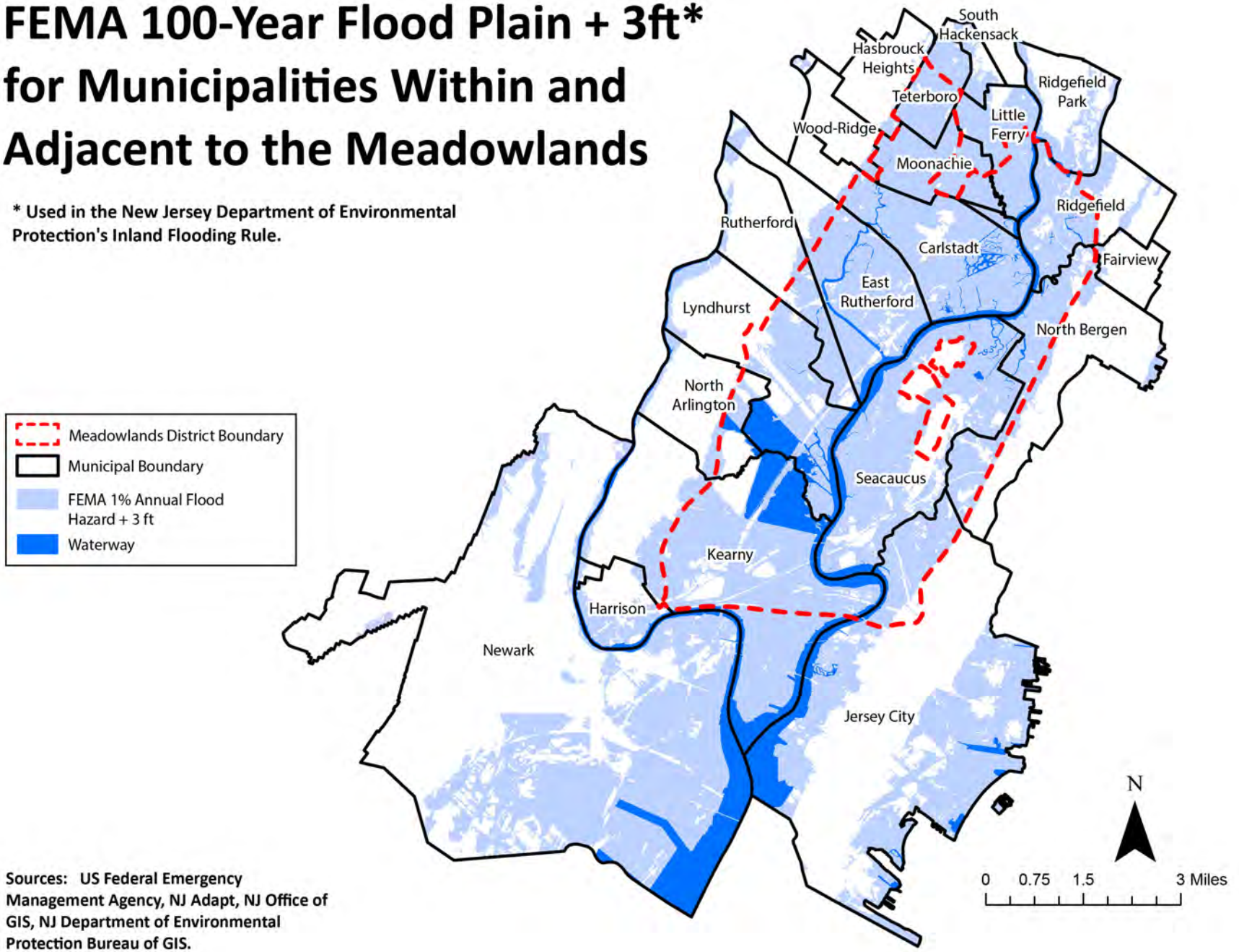
0 0.5 1 2 Miles

Sources: US Federal Emergency Management Agency, NJ Adapt, NJ Office of GIS, NJ Department of Environmental Protection Bureau of GIS.



FEMA 100-Year Flood Plain + 3ft* for Municipalities Within and Adjacent to the Meadowlands

*** Used in the New Jersey Department of Environmental Protection's Inland Flooding Rule.**



Sources: US Federal Emergency Management Agency, NJ Adapt, NJ Office of GIS, NJ Department of Environmental Protection Bureau of GIS.

Source: Colin Harrington, 2023.

3.2.2 Assessing Vulnerabilities

Parcel Level Analysis

A parcel flood analysis was conducted to assess the potential monetary damages incurred in future flood scenarios, Sea Level Rise and a 100-Year Flood in 2100, using ArcGIS Pro. NJ Adapt's Climate Planning Tool (2023) was referenced for guidance in this process. The MOD-IV Parcel Flood Analysis dataset, available through NJ HazAdapt (2023) provides the percent of each parcel in New Jersey inundated at each TWL. This was joined with the Parcels and MOD-IV Composite of NJ dataset, produced by the NJ Office of GIS (OGIS). Parcels with at least 50% inundation were considered a loss.

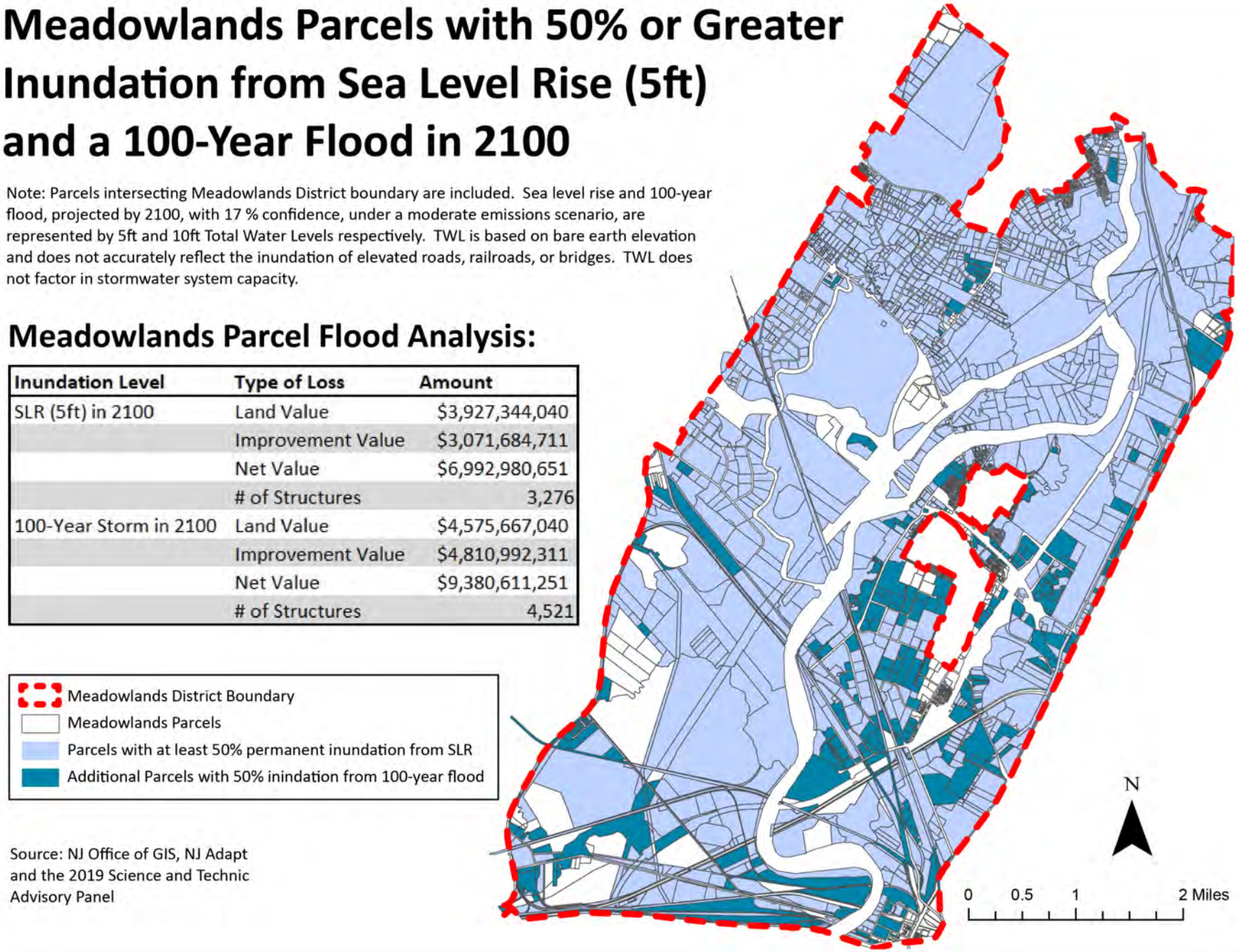
There is a significant amount of MOD-IV data missing for the 4,005 parcels in the Meadowlands, including assessment data for 1,223 parcels and property class data for 1,092 parcels. Noticeably few of the parcels analyzed provided building data. The NJSEA was able to provide missing assessment data for 578 parcels and property class data for 567 parcels. Assessment data are still missing for 645 parcels, so monetary damages may be significantly higher than estimated. Property class data is still missing for 525 parcels, so it is difficult to determine the number of parcels in each property class that may be inundated. A separate dataset containing all the buildings in the Meadowlands, provided by NJSEA, was used to determine the number of structures inundated at each TWL.

Meadowlands Parcels with 50% or Greater Inundation from Sea Level Rise (5ft) and a 100-Year Flood in 2100

Note: Parcels intersecting Meadowlands District boundary are included. Sea level rise and 100-year flood, projected by 2100, with 17 % confidence, under a moderate emissions scenario, are represented by 5ft and 10ft Total Water Levels respectively. TWL is based on bare earth elevation and does not accurately reflect the inundation of elevated roads, railroads, or bridges. TWL does not factor in stormwater system capacity.

Meadowlands Parcel Flood Analysis:

Inundation Level	Type of Loss	Amount
SLR (5ft) in 2100	Land Value	$3,927,344,040
	Improvement Value	$3,071,684,711
	Net Value	$6,992,980,651
	# of Structures	3,276
100-Year Storm in 2100	Land Value	$4,575,667,040
	Improvement Value	$4,810,992,311
	Net Value	$9,380,611,251
	# of Structures	4,521



Source: NJ Office of GIS, NJ Adapt and the 2019 Science and Technic Advisory Panel

The following table is the result of the analysis for the District, by municipality. 5ft TWL and 10ft TWL, highlighted in yellow, represent SLR and a 100-year flood in 2100 respectively. Separate tables for each municipality within the District, separated by property class can be found in Appendix D.

		Carlstadt	East Rutherford	Jersey City	Kearny	Little Ferry	Lyndhurst	Moonachie	North Arlington	North Bergen	Ridgefield	Rutherford	Secausus	South Hackensack	Teterboro	Meadowlands
2ft TWL	Land Value	$205,305,840	$60,916,900	$37,079,800	$67,679,000	$99,878,200	$136,589,900	$240,143,400	$27,343,900	$63,824,500	$17,322,900	$42,330,900	$75,818,500	$15,040,500	$237,659,020	$1,326,933,260
	Improvement Value	$179,482,880	$45,518,200	$433,900	$2,447,400	$355,995,300	$1,371,000	$164,571,600	$0	$27,773,100	$2,057,200	$57,675,600	$6,633,100	$81,528,100	$145,828,383	$1,071,315,763
	Net Value	$384,788,720	$104,281,900	$37,513,700	$70,126,400	$455,873,500	$137,960,900	$404,715,000	$27,343,900	$91,597,600	$19,380,100	$100,006,500	$82,451,600	$96,568,600	$383,487,403	$2,396,095,823
	# of Structures	118	8	22	100	296	19	705	1	13	6	7	49	10	26	1,380
3ft TWL	Land Value	$255,609,810	$147,938,800	$116,594,800	$75,867,700	$117,293,800	$269,090,800	$294,638,400	$27,343,900	$219,632,800	$36,415,100	$47,337,900	$107,850,400	$17,643,500	$246,704,420	$1,979,962,130
	Improvement Value	$258,847,688	$120,437,400	$18,235,600	$12,777,300	$385,401,000	$50,161,400	$369,383,000	$0	$126,302,900	$40,971,600	$67,314,700	$61,973,300	$110,675,000	$160,616,383	$1,783,097,271
	Net Value	$514,457,498	$262,328,100	$134,830,400	$88,645,000	$502,694,800	$319,252,200	$664,021,400	$27,343,900	$345,935,700	$77,386,700	$114,652,600	$169,823,700	$128,318,500	$407,320,803	$3,757,011,301
	# of Structures	197	47	41	137	458	26	858	2	34	16	11	134	14	45	2,020
5ft TWL	Land Value	$322,916,420	$1,234,520,100	$193,639,100	$93,177,800	$134,980,700	$424,093,400	$320,392,700	$27,343,900	$417,864,800	$140,566,500	$59,579,100	$282,971,800	$17,643,500	$257,654,220	$3,927,344,040
	Improvement Value	$424,898,628	$271,411,100	$52,114,400	$30,468,400	$417,062,700	$149,219,100	$434,893,200	$0	$366,847,000	$66,696,700	$109,858,100	$473,768,900	$110,675,000	$163,771,483	$3,071,684,711
	Net Value	$747,815,048	$1,499,883,100	$245,753,500	$123,646,200	$552,043,400	$573,312,500	$755,285,900	$27,343,900	$784,711,800	$207,263,200	$169,437,200	$756,740,700	$128,318,500	$421,425,703	$6,992,980,651
	# of Structures	315	110	122	210	596	60	958	8	109	49	19	637	15	62	3,276
7ft TWL	Land Value	$350,604,020	$1,287,208,600	$257,982,300	$121,008,000	$139,217,000	$489,106,500	$320,392,700	$32,089,700	$503,962,800	$197,975,600	$60,556,300	$454,063,500	$17,643,500	$257,675,220	$4,489,485,740
	Improvement Value	$473,420,128	$365,571,700	$59,417,300	$113,292,500	$431,944,700	$233,269,300	$434,893,200	$2,808,100	$549,418,300	$104,745,000	$110,396,500	$1,112,523,500	$110,675,000	$163,771,483	$4,266,146,711
	Net Value	$824,024,148	$1,646,732,200	$317,399,600	$234,300,500	$571,161,700	$722,375,800	$755,285,900	$34,897,800	$1,053,381,100	$302,720,600	$170,952,800	$1,566,587,000	$128,318,500	$421,446,703	$8,749,584,351
	# of Structures	353	135	166	267	610	90	962	20	141	90	37	1,090	15	76	4,056
8ft TWL	Land Value	$354,440,020	$1,289,800,600	$294,799,100	$127,130,600	$139,217,000	$491,195,100	$320,392,700	$35,019,900	$556,482,800	$198,095,600	$60,556,300	$501,162,800	$17,643,500	$257,675,220	$4,643,611,240
	Improvement Value	$483,171,828	$370,494,900	$86,735,100	$115,556,100	$431,944,700	$233,269,300	$434,893,200	$5,183,200	$823,600,200	$104,745,000	$110,396,500	$1,163,329,500	$110,675,000	$163,771,483	$4,637,766,011
	Net Value	$837,611,848	$1,654,247,400	$381,534,200	$242,686,700	$571,161,700	$724,464,400	$755,285,900	$40,203,100	$1,380,083,000	$302,840,600	$170,952,800	$1,664,492,300	$128,318,500	$421,446,703	$9,275,329,151
	# of Structures	360	148	173	279	615	97	963	26	158	96	38	1,219	15	76	4,271
10ft TWL	Land Value	$366,156,920	$1,297,006,400	$304,720,100	$131,653,400	$139,217,000	$505,151,000	$320,392,700	$35,019,900	$584,970,700	$0	$60,556,300	$555,503,900	$17,643,500	$257,675,220	$4,575,667,040
	Improvement Value	$495,994,528	$376,409,100	$88,834,800	$120,512,800	$431,944,700	$240,720,100	$434,893,200	$5,183,200	$854,951,000	$0	$110,396,500	$1,376,705,900	$110,675,000	$163,771,483	$4,810,992,311
	Net Value	$862,151,448	$1,667,367,400	$393,554,900	$252,166,200	$571,161,700	$745,871,100	$755,285,900	$40,203,100	$1,439,921,700	$0	$170,952,800	$1,932,209,800	$128,318,500	$421,446,703	$9,380,611,251
	# of Structures	375	161	176	304	616	110	963	30	173	102	38	1,374	15	76	4,521
12ft TWL	Land Value	$371,029,520	$1,297,006,400	$307,708,700	$132,755,000	$139,217,000	$534,777,200	$320,392,700	$35,019,900	$599,517,700	$198,890,600	$60,556,300	$568,863,400	$17,643,500	$257,675,220	$4,841,053,140
	Improvement Value	$513,295,828	$376,409,100	$89,456,200	$120,512,800	$431,944,700	$243,017,900	$434,893,200	$5,183,200	$854,951,000	$108,383,900	$110,396,500	$1,390,955,500	$110,675,000	$163,771,483	$4,953,846,311
	Net Value	$884,325,348	$1,667,367,400	$397,164,900	$253,267,800	$571,161,700	$777,795,100	$755,285,900	$40,203,100	$1,454,468,700	$307,274,500	$170,952,800	$1,959,818,900	$128,318,500	$421,446,703	$9,788,851,351
	# of Structures	390	164	180	307	616	130	963	35	184	110	38	1,456	15	76	4,672

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.
Due to Missing MOD-IV data for a significant number of parcels, an increase in the number of damaged structures may not be reflected in an increase in monetary damage.

Table 2: Parcel Flood Analysis for the Meadowlands district

As the map shows, the majority of parcels within the District are projected to be inundated by SLR and a 100-year storm by 2100. The table may be a useful planning tool for two reasons. The Improvement Value and number of structures calculated for each TWL may be used to estimate the monetary and structural damage incurred at each TWL, be it from permanent SLR inundation or storm flooding. The Net Value calculated for each TWL may be used to estimate the cost of relocating

residents through buyouts to prevent future monetary and structural damage as well as loss of life at each TWL.

Source: The Architect's Newspaper, 2017.

Critical and Community Assets

Critical assets are buildings, services, and infrastructure a community needs to provide education, care, and public safety to residents. Some critical assets may be in areas that flood now, or are expected to flood in the future. It is important to understand critical assets' exposures to flood events, along with exposures to roads leading to and from those facilities. Knowing the services provided by critical assets will help a community plan for flooding.

Built infrastructure (i.e., wastewater treatment facilities, energy generation locations, evacuation routes and rail lines) may be in areas that flood now, or are expected to flood in the future. It is important to understand the exposure of built infrastructure since communities and their residents rely on the services these infrastructure sources provide. Knowing the services provided by built infrastructure will help a community plan for flooding.

The map shows that a significant number of critical and community assets in the District are vulnerable to both sea level rise and the 100-year flood in 2100. This vulnerability poses a considerable risk to public safety, access to essential services, and the overall resilience of the community. Implications for each assets vulnerability could include:

- Wastewater Facilities: Wastewater management may be disrupted or overwhelmed during flood events, leading to potential environmental and public health hazards.
- Schools: There is a potential for disruptions to education and the need for alternative arrangements to ensure the safety of students and staff during such events.

- Police Stations: The sole police station in the District is vulnerable to both sea level rise and the 100-year flood, which could hinder the ability of law enforcement to respond effectively during emergencies and maintain public safety.
- Gas Stations: There may be disruptions to fuel availability during flood events, affecting transportation and emergency response capabilities, as well as potential for environmental contamination during flood events.
- Fire Stations: Of the 5 fire stations in the District, 3 are vulnerable to both sea level rise and the 100-year flood, potentially impairing the ability of emergency responders to provide timely assistance during disasters.
- Evacuation Shelters: Vulnerable evacuation centers raise concerns about the adequacy and accessibility of shelter options for affected residents during emergencies.
- Coastal Energy Plants: Energy production and distribution could be severely disrupted during flood events, resulting in widespread power outages.
- Childcare Facilities: This vulnerability may highlight the need for childcare facilities to develop emergency preparedness plans and ensure the safety of children during such events.

Source: Planetizen, 2019.

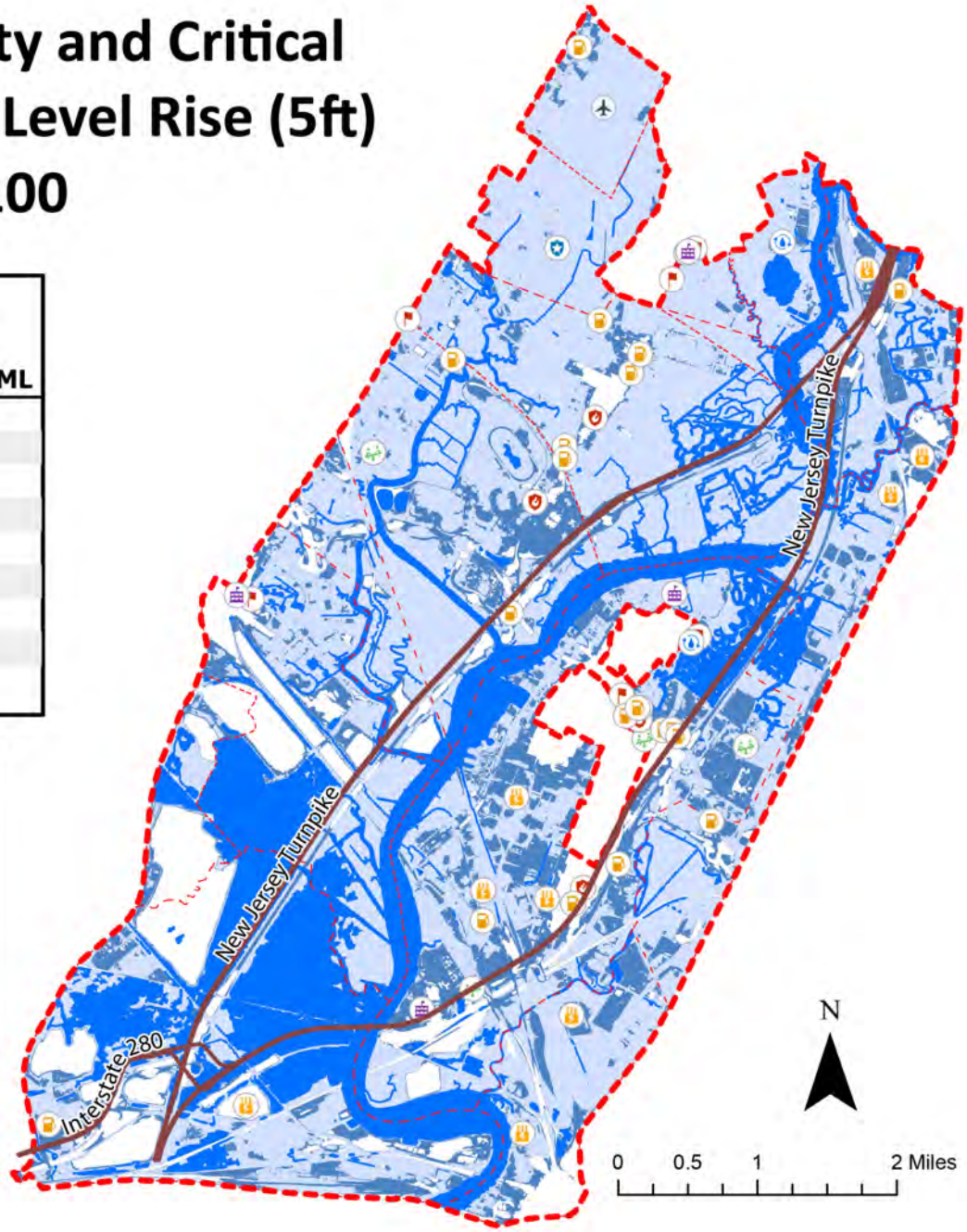
Given the vulnerability of essential infrastructure to sea level rise and flooding, it is crucial to invest in resilient infrastructure, develop contingency plans, and adopt mitigation strategies to minimize the impacts of these events on the community's safety, well-being, and overall resilience.

Meadowlands Community and Critical Assets Inundated by Sea Level Rise (5ft) and 100-Year Storm in 2100

Number of Assets Inundated by SLR and 100 -Year Flood in 2100:

Asset	SLR	100-Year Flood	Total in ML
Wastewater Facilities	1	2	2
Schools	2	3	4
Police Stations	1	1	1
Gas Stations	5	18	22
Fire Stations	3	3	5
Evacuation Shelters	4	5	8
Coastal Energy Plants	5	8	9
Childcare Facilities	1	1	4
Total Inundated	22	41	

Source: NJ Office of GIS, US Census Bureau, NJ Department of Environmental Protection Bureau of GIS, NJ Sports and Exhibition Authority



Public Health

The EPA FRS and KCSNJ databases track contaminated sites across the United States, specifically in New Jersey. While there may be overlap between the two lists, they differ in their criteria for inclusion and scope. Superfund sites, included in the EPA FRS list, are contaminated locations posing risks to human health or the environment due to hazardous substances. The Superfund program prioritizes cleanup efforts and addresses these sites to protect public health and the environment.

Source: Rutgers, Institute of Earth, Ocean, and Atmospheric Sciences, 2019.

In the Meadowlands Region, the implications of rising sea levels and increasing flood risk are significant, particularly for contaminated sites and landfills. Out of the 3,162 EPA sites, 1,876 are vulnerable to a 5-foot TWL, and 2,716 are vulnerable to a 10-foot TWL. Meanwhile, out of the 300 known contaminated sites, 178 are vulnerable to a 5-foot TWL, and 258 are vulnerable to a 10-foot TWL. Furthermore, out of the 47 landfills in the Meadowlands, 25 and 37 are vulnerable to 5-foot and 10-foot TWLs, respectively, with inundation considered beyond 50% coverage.

These findings underscore the urgency to address the potential impacts of flooding on contaminated sites and landfills in the Meadowlands Region. Vulnerable sites may pose increased risks to public health and the environment as floodwaters can spread hazardous substances and pollutants, leading to contamination of nearby water bodies and ecosystems. Moreover, while some landfills are elevated above inundation, many assets crucial for maintenance, monitoring, and management may be vulnerable.

Given these implications, it is crucial for the Meadowlands Region to prioritize appropriate mitigation measures, remediation efforts, and land-use planning strategies. This may include enhancing flood protection infrastructure, relocating vulnerable sites, or implementing nature-based solutions to increase resilience against rising sea levels and flooding events. Addressing these challenges will ultimately help protect public health, the environment, and the long-term sustainability of the Meadowlands Region.

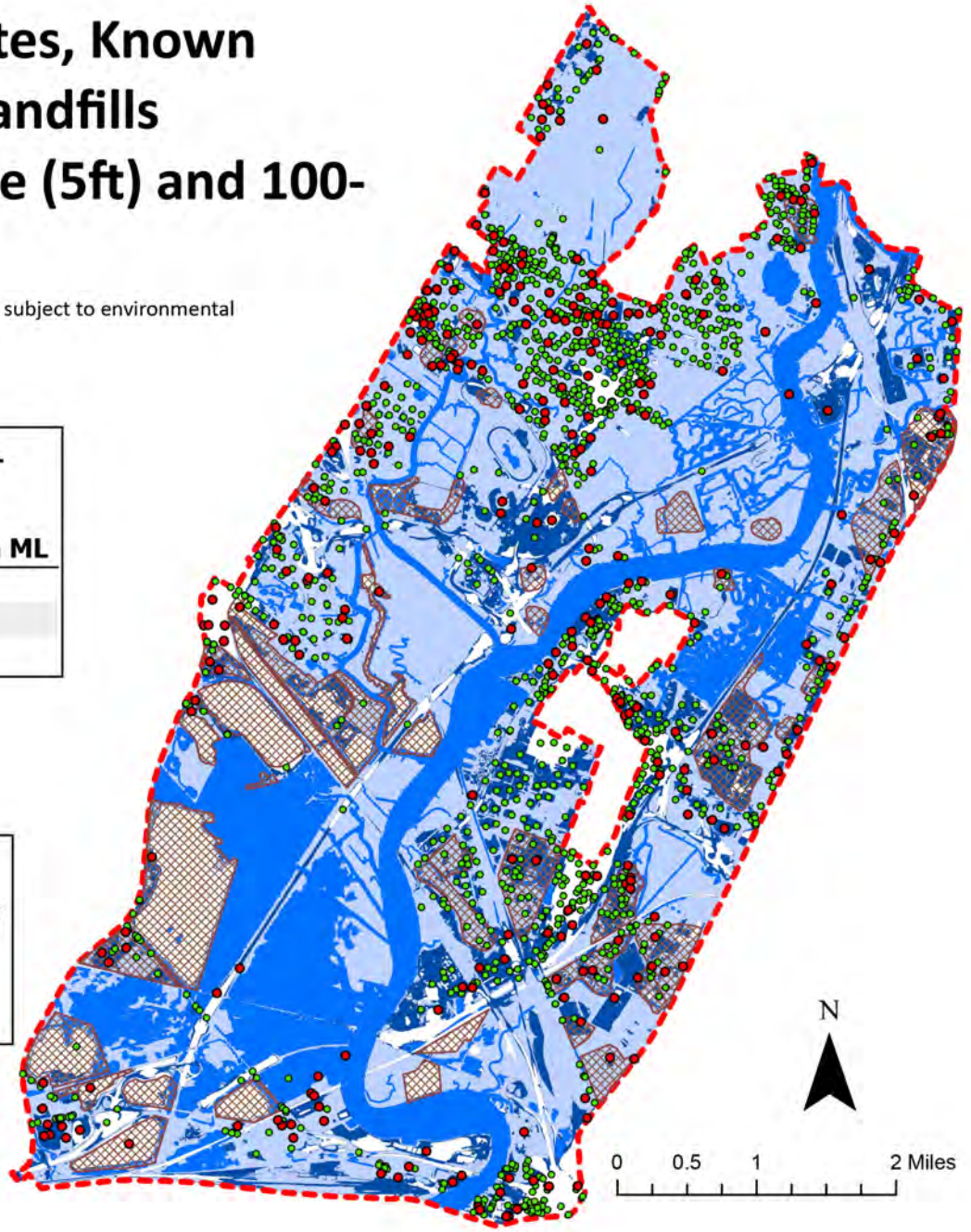
Meadowlands EPA FRS* Sites, Known Contaminated Sites, and Landfills Inundated by Sea Level Rise (5ft) and 100-Year Storm in 2100

*The Facility Registry Services (FRS) Sites are facilities, sites or places subject to environmental regulations or of environmental interest.

Number of Sites Inundated by SLR and 100-Year Flood in 2100:**

Site Type	SLR	100-Year Flood	Total in ML
EPA FRS Sites	1,867	2,716	3,162
Contaminated Sites	178	258	300
Landfills	25	37	47

**Landfills are considered inundated beyond 50% coverage



Source: NJ Office of GIS, US Census Bureau, NJ Department of Environmental Protection Bureau of GIS, NJ Sports and Exhibition Authority

Source: Patch.com, 2022.

Source: Patch.com, 2022.

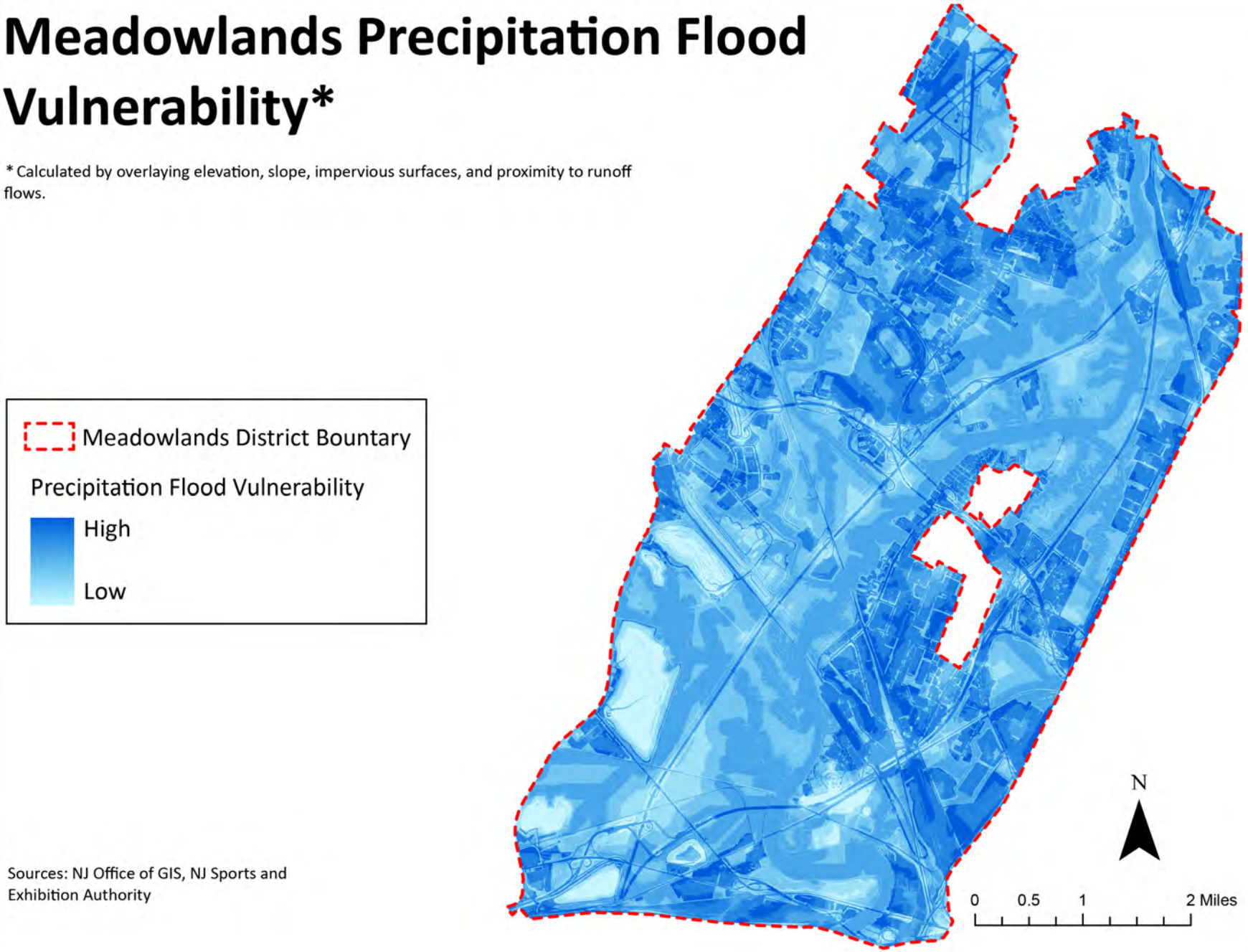
Precipitation Flood Vulnerability Analysis

There is no publicly available precipitation flood modeling data available for the Meadowlands. In a modest attempt to fill this gap, a precipitation flood vulnerability (PFV) analysis was conducted using ArcGIS Pro to determine which areas may be most vulnerable. Elevation, slope, impervious surface, and distance from runoff flow datasets were used as inputs. A 2022 digital elevation model (DEM), provided by the NJSEA, was used for elevation. Slope was derived from the DEM. The impervious surfaces dataset was derived from the Land Use/Land Cover of New Jersey dataset produced by NJDEP (2015). Distance from runoff flows was calculated using a runoff flow dataset created using the Hydrology toolset. Areas with the highest vulnerability are low, flat, impervious, and close to runoff.

It is clear from the following map and the previous flood maps that most of the District is vulnerable to flooding. The usefulness of this map is that it shows relative vulnerability. This may be useful in determining which areas are most vulnerable or which areas may be most suitable for future development.

Meadowlands Precipitation Flood Vulnerability*

* Calculated by overlaying elevation, slope, impervious surfaces, and proximity to runoff flows.



Sources: NJ Office of GIS, NJ Sports and Exhibition Authority

Land Use

A geospatial analysis was performed using ArcGIS to examine the vulnerability of existing land use in the District. A shapefile provided by the NJSEA delineated the following land uses, in order from most acreage to least.

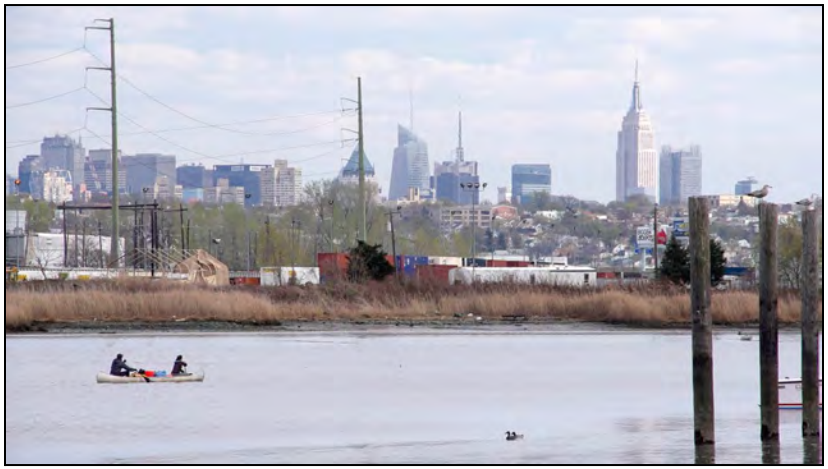
- Wetlands: Areas that are inundated or saturated by surface or groundwater, supporting vegetation and wildlife adapted for life in saturated soil conditions, including tidal mudflats and significant drainage facilities.
- Industrial: Manufacturing, assembly, processing, warehousing, and distribution facilities, including light and heavy industrial, bus and truck terminals, and auto and truck repair facilities.
- Transportation: Transportation routes and facilities, including railroads, park-and-ride lots, airports, and port facilities.
- Utilities: Power generation stations, transmission lines, water treatment facilities, sewage treatment facilities, and other utility infrastructure.
- Altered Land: Areas that have been transformed due to human activities, such as waste disposal, dredging, mining, and quarrying.
- Recreational Land: Areas developed for public recreational activities, such as golf courses, parks, marinas, swimming pools, stadiums, and cultural centers.
- Commercial: Buildings used for business or corporate offices
- Transitional Land: Previously developed properties that are inactive, undergoing development or redevelopment, or pending construction due to permit applications or approvals.
- Residential: All types of dwellings, including single-family residences, multi-unit dwellings, and mobile homes.
- Public: Government-owned or quasi-public facilities that serve the public, including post offices, educational institutions, hospitals, religious institutions, and cemeteries.
- Vacant Land: Undeveloped open areas not associated with active uses and showing no signs of past activities or site preparation.

The analysis of key land uses in the Meadowlands District, conducted using ArcGIS, reveals the vulnerability of these land uses to sea level rise and a 100-year flood in 2100.

Wetlands, covering 38.55% of the land use in the Meadowlands, are the most susceptible, with 97.24% at risk due to a 5-foot sea level rise and 99.24% at risk in the event of a 100-year storm. Industrial land use, comprising 20.18% of the Meadowlands, faces a significant threat as well, with 65.27% of the area at risk from a 5-foot sea level rise and 91.70% exposed

to a 100-year storm. Transportation and utility land use, which accounts for 18.78% of the Meadowlands, also has a high vulnerability, with 60.85% of the area at risk from a 5-foot sea level rise and 84.08% exposed to a 100-year storm. Altered, recreational, commercial, transitional, residential, public services, and vacant land also demonstrate varying degrees of vulnerability to these climate change-related events.

The implications of these findings are crucial for the future planning and development of the District. Wetlands, which provide essential ecosystem services, such as flood control, water filtration, and habitat for various species, are at the greatest risk. The loss of these wetlands could have significant environmental consequences and exacerbate the impacts of flooding events in the District. The gradual increase in sea levels contributes to the permanent inundation of low-lying coastal wetlands, leading to habitat loss and changes in species composition. In addition to inundation, increased wave action and storm surges brought on by sea level rise can lead to the erosion of wetland shorelines. This erosion further reduces the extent of these habitats, destabilizes the soil structure, and results in the loss of key nesting and feeding grounds for various species. Another consequence of rising sea levels is saltwater intrusion, which disrupts the chemical composition of the soil and water in freshwater wetlands. As a result, plant and animal communities may shift, with some species unable to tolerate the increased salinity levels. Saltwater intrusion can impact the quality of freshwater resources in the District, thereby affecting human water supply and agricultural activities.



Source: Untapped Cities - Documentary *Back Water*, n.d.

The hydrology of wetlands can also be altered due to sea level rise, affecting their ability to retain and filter water. This can exacerbate flooding in adjacent areas during heavy precipitation events or storm surges, diminishing the wetlands' capacity to provide natural flood protection. The loss of sediment supply, which wetlands rely on to maintain their elevation relative to sea level, poses another challenge. Human activities, such as dam construction and river channelization, can disrupt the natural sediment supply, making it more difficult for wetlands to keep pace with rising sea levels.

Source: Fox 5 New York, 2021. Photo taken in 2015.

The vulnerability of industrial, commercial, and residential areas to sea level rise and 100-year storms could have serious socioeconomic impacts, including disruptions to business operations, damage to infrastructure, and displacement of residents. Industrial land use makes up a large percentage of land use in the District, and 92% of that area is vulnerable to the 100-year flood in 2100. This could have consequences for the economy, environment, and surrounding communities. Industrial areas are crucial to local and regional economies, providing employment opportunities, supporting supply chains, and contributing to the tax base. Flooding in industrial areas can cause hazardous materials, chemicals, and pollutants to be released into the environment, contaminating water sources, soil, and the surrounding ecosystems. This pollution poses risks to public health in the environment, including the potential for harmful algal blooms, degradation of nearby wetlands and water bodies, and contamination of drinking water sources.

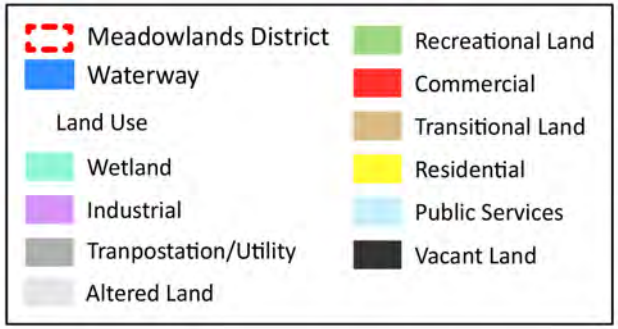
The transportation and utility sectors, which play a critical role in maintaining the functioning and connectivity of the Meadowlands region, may also face significant challenges. It is crucial to perform additional research to analyze how 5 foot and 10 foot TWL could impact evacuation routes, service disruptions, and maintenance costs.

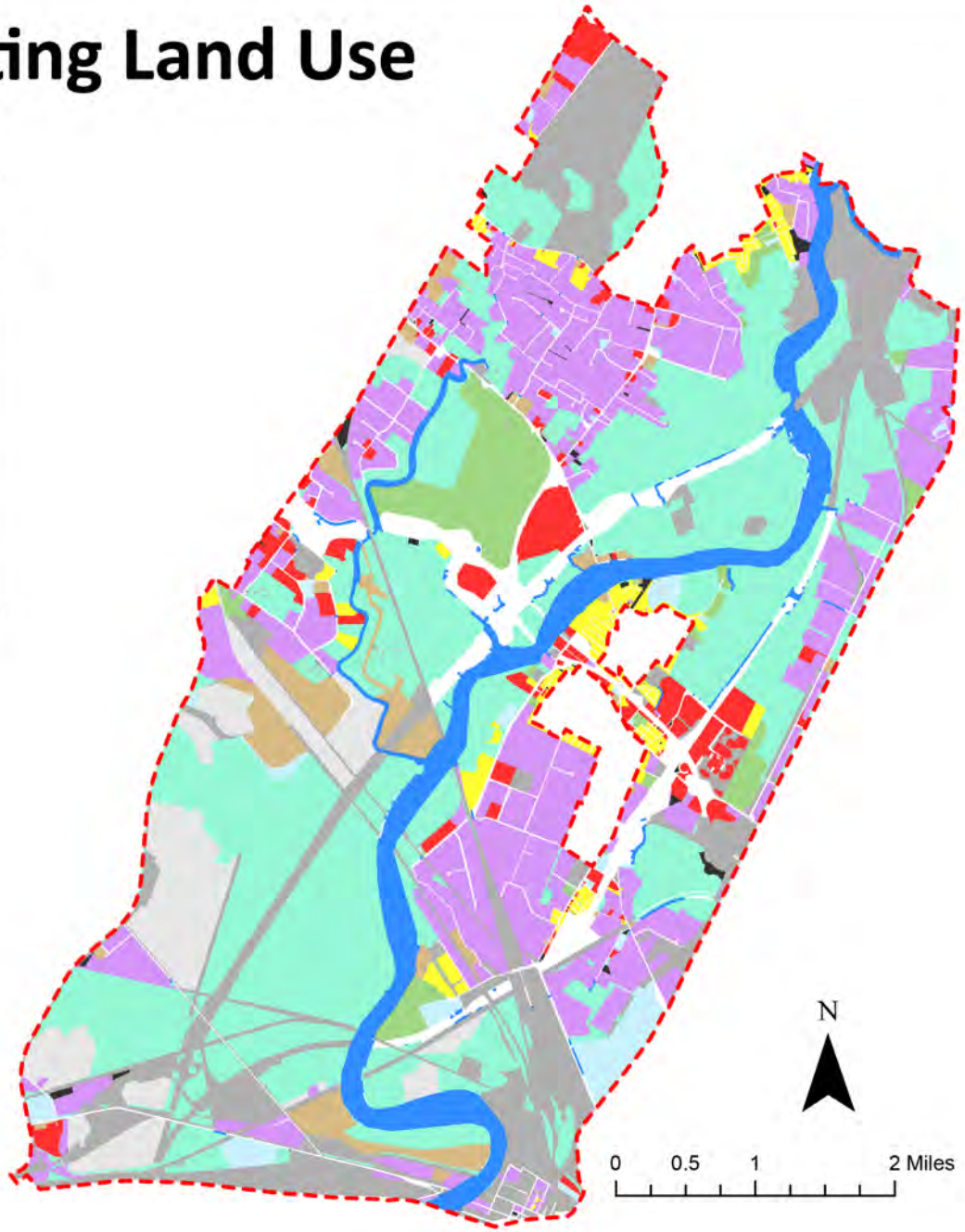
These findings highlight the importance of adopting resilient and adaptive strategies in the District's planning and development processes. Integrating climate change adaptation measures, such as nature-based solutions, resilient infrastructure, and land use policies that account for sea level rise and flood risks, can help mitigate the potential impacts of these climate change-related threats on the District’s ecosystems, communities, and economy.

Meadowlands Existing Land Use

Percent of Land Use Inundated by SLR and 100-Year Flood in 2100

Land Use	% of ML	SLR	100-Year Flood
Wetland	38.55%	97.24%	99.24%
Industrial	20.18%	65.27%	91.70%
Tranpostation/Utility	18.78%	60.85%	84.08%
Altered Land	6.28%	16.79%	27.32%
Recreational Land	4.15%	57.45%	88.88%
Commercial	3.84%	40.46%	91.79%
Transitional Land	3.52%	37.07%	65.09%
Residential	2.23%	49.10%	79.59%
Public Services	2.11%	75.43%	90.03%
Vacant Land	0.38%	71.30%	94.38%





Source: NJ Office of GIS, NJ Adapt, NJ Sports and Exhibition Authority

3.3 Affordable Housing Assessment

Vulnerability Of Current Housing

The following section discusses current affordable housing stock. The majority of people who live within the District are renters. Only 35.2% of housing are owner-occupied, which is much lower than the State's average of 62.5% home ownership (NJSEA p. 4-5). Maintaining rent affordability is critical for a District where the majority of households earn an average income of $88,151 (between $59,205 to $117,097) and rent is between $2,700 and $3,650 per unit which is already above 30% of this income bracket (NJSEA p. 4-10).

Risk Assessment Methodologies

This studio utilized ArcPro's Zonal Statistics and Tabulate Intersection tools to identify what percentage (%) of ground level (building footprint) would be inundated by at least 50%. We utilized ArcGIS shapefile 'Buildings 2023' as base file for assessing flood risks. This studio also noticed that several affordable housing buildings built between 2004-2018 were missing from The NJSEA's shapefile 'Buildings 2023'. We have since added those missing affordable housing units to the shapefile for future use.

Current Housing At Risk Of Inundation

All residential housing within the District are vulnerable to at least one of the three future climate scenarios (SLR, 100-year flood in 2100, and Precipitation Flood Vulnerability (PFV). All residential housing within the District is vulnerable to at least one of the three future climate scenarios: SLR, 100-year flood in 2100, and Precipitation Flood Vulnerability (PFV). For example, the Winston building in Lyndhurst contains 44 affordable units; compared to other complexes with affordable housing in the District, it is the most vulnerable to SLR. With 5ft of SLR, 63% of the Winston property will be permanently inundated, and 98% of the ground level will experience inundation during a 100-year flood event in 2100. Additionally, the property has a high PFV of 7.4. Appendix D.2 shows a table listing all 3,895 apartment units built between 2004 to 2018 which includes 511 affordable housing units. Table 1 provides three columns which lists the percentage of projected ground level inundation as well as PFV index from least vulnerable to high risk scores between 1-9.

Source: NJSEA, n.d.

5ft Sea Level Rise (permanent inundation/normal sea level in 2100)

Appendix D.3 lists the percentage (%) of ground level inundation as follows:

- 738 low income households in Lyndhurst are vulnerable to effects of 5-ft SLR:
    - 63% of ground level at The Winston is projected to be inundated. There are 44 affordable units in this building.
    - 17% of ground level at The Union is projected to be inundated. There are 328 market rate units in this building.
    - 8% of ground level at The Station is projected to be inundated. There are 39 affordable units in this building.
- 469 low income households in Secaucus are vulnerable to effects of 5-ft SLR:
    - 40% of ground level at The Winston is projected to be inundated. There are 94 affordable units in this building.
- All other housing will not be inundated.

100-year Flood in 2100

This studio assumed that if a building's ground level were to be inundated at least 50%, it would cause considerable damage to the building as well as to residents' properties. Flooding damages property such as cars parked on ground level.

- There are 1,548 total units at The Xchange in Secaucus, including 188 affordable housing units in total within this development. This studio's flood modeling projected 64% of this building's ground floor would be covered by a 100-year flood in 2100.
- Most of the District's apartment buildings will face between 40% to 100% of ground level inundation by a 100-year flood in 2100.

Precipitation Flood Vulnerability (PFV)

Risk Index: Low (1) to High (9)

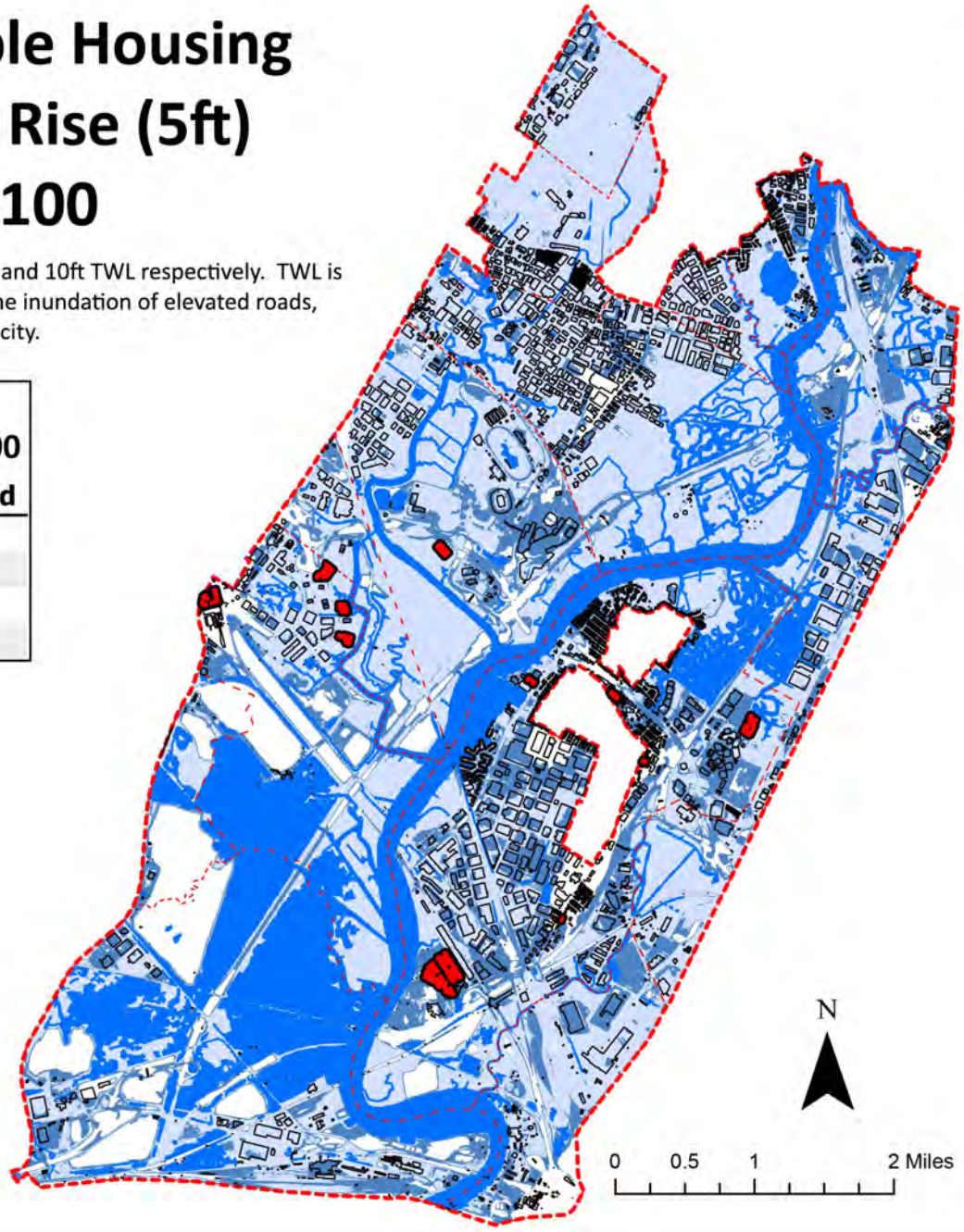
- The Xchange at Secaucus Junction, The Monarch, and Osprey Cove have scores of at least 8 which indicates that they are highly vulnerable to precipitation flooding.
- 425 (85%) existing affordable units within the District scored at least 7.0 which is considered 'high risk'.
- 310 (61% of total) affordable units within the District are at high risk of being affected by precipitation flooding.
    - 8 affordable units provided by the Secaucus Housing Authority are within OBC's.
    - 2 affordable units in City View Townhomes are within OBC's.

Meadowlands Affordable Housing Inundated by Sea Level Rise (5ft) and 100-Year Flood in 2100

Note: Sea level rise and a 100-year flood are represented by 5ft and 10ft TWL respectively. TWL is based on bare earth elevation and does not accurately reflect the inundation of elevated roads, railroads, or bridges. TWL does not factor in sewer system capacity.

Buildings with Affordable Housing Units Inundated by SLR and 100-Year Flood in 2100

Municipality	Total in ML	SLR	100-Year Flood
Lyndhurst	7	3	3
Secaucus	24	3	9
East Rutherford	1	0	1
Total	32	6	13



Sources: NJ Department of Environmental Protection Bureau of GIS, NJ Sports and Exhibition Authority, NJ Adapt

SLR Inundation Of Redevelopment Areas

This studio projected future SLR over Redevelopment Areas and discovered that The Hartz Carpet Center Redevelopment (RA-13) and Schmitt Realty Redevelopment (RA-14) where multi-family developments are permitted will be inundated. This studio recommends reviewing SLR projections and adopting new BFE requirements for building new residential units within these areas if any new residential units are constructed.

Resiliency Strategies

- Site-specific mitigation strategies such as hard armoring and berms can be implemented to protect existing affordable housing.
- Invest in hard armoring, flood walls, or berms specifically for protecting the most vulnerable affordable housing based on PFV Index.
- Protect affordable housing stock starting with the buildings with the most number of affordable units.
- Create retrofit programs aimed at helping landlords upgrade housing resiliency in Overburdened Communities.
    - "Planning for damage approach": incorporate resilient design requirements such as requiring roofs to have multiple slopes. Roofs with multiple slopes can withstand strong winds. Roof connections shall include strapping as required by the International Residential Code. Conventional methods of nailing down the roof does not provide enough resistance to a storm's uplift forces. Therefore, an engineering analysis may be required to demonstrate that the connections will resist intense wind forces (Construction Code Communicator, Hurricane SuperStorm Sandy Edition, 2013).

3.4 Resilience Planning Tools and Strategies

A list of 12 resiliency strategies to address sea level rise are featured in the NJSEA's 2022 master plan update, see section 2.1. To supplement this existing list of strategies, the pilot Resilient NJ regional resilience plans covering four distinct regions throughout New Jersey, including Atlantic County, Long Beach Island, Raritan Valley, and Northeastern New Jersey were examined. Detailed below are various strategies from the Resilient NJ plans. New strategies, as well as ones that overlap with the NJSEA's existing strategies, were included to provide examples of planning opportunities. Not

all of the strategies described are necessarily directly applicable to the District due to the varying geographical conditions. However, the purpose of this section is to provide a broad overview and ideally an inspiration for innovative solutions to the unique challenges faced by the District.

3.4.1 Land Use Planning Tools

The Resilient NJ plans identify a number of land-use planning tools that may help NJSEA secure vulnerable or critical land. A large number of tools that fall into the category of 'land-use' also have a financial or policy-oriented nature, but the tools described below are predominantly concerned with land usage and management. It is our hope that this list of land tools may inform NJSEA's plans to manage the land within the District.

Land Acquisitions

Voluntary land acquisitions, one of NJSEA's 12 strategies, are referenced in both the Long Beach Island and Raritan Valley resiliency plans via the NJDEP Green and Blue Acres programs. The Green Acres program involves land acquisitions for the purposes of preserving interconnected open space. Similarly, the Blue Acres program involves the acquisition of vulnerable flood-prone property to reduce the risk of flooding and restore natural floodplain functions Finally, the Ocean County Land Management Program involves the acquisition and maintenance of environmental areas.

Locally, the Bergen County Open Space Recreation, Floodplain Protection, Farmland & Historic Preservation Trust Fund provides finances for the strategic acquisition and restoration of flood-prone properties within Bergen County. In and around the District, the MCT is already engaged in the acquisition and preservation of wetlands and other environmental assets. In addition to the MCT, the NJDEP and Bergen County programs present potential partners and resources to assist NJSEA in preserving and expanding critical natural areas.

One of the Resilient NJ plans, the Resilient LBI Action Plan, also describes planning tools to support eventual managed retreat. Managed retreat encompasses a broad adaptation strategy of relocating communities, businesses, and other critical assets from high-risk areas, while preventing future development and restoring natural resources in vulnerable areas (Siders, 2013). In this portion, the studio intends to provide some overview of the tools to support a managed retreat strategy in the context of land acquisition.

In conversations with the NJSEA, the studio was made aware of the issue of acquiring lands with contamination, which creates complex liability issues for the property owner. The

studio consulted with John Cecil, Assistant Commissioner of State Parks, Forests, and Historic Sites at NJDEP, who indicated that environmental contamination in fact presents a statewide issue for acquisitions and conservation. There may be opportunities for a broader conversation with the state around strategies, coordination, and support for acquiring, conserving, and restoring contaminated natural lands.

Planning tools

Master Plans and Zoning act as important planning tools in the context of land acquisitions. Municipalities can amend Master Plans to identify managed retreat as a potential future strategy. In addition to master planning, zoning can also be enacted to identify where an overlay zone could be implemented and what specific provisions it could implement.

Rolling Easements

Rolling easements are based on the premise that coastal regions will inevitably need to retreat further inland. Mentioned in the Long Beach Island action plan (LBI), rolling easements may be part of a managed retreat strategy that will slowly move people, buildings, and infrastructure away from vulnerable land and further inland. Simply, rolling easements involve slowly pushing land uses further inland by limiting or prohibiting development overtime as sea-level rise encroaches further inland, eventually requiring the removal of structures as they become permanently inundated.

To make the most use of rolling easements, the NJSEA could identify the most vulnerable areas (what Long Beach Island calls the "Transfer Zone"). This process can be facilitated with the help of the various flood horizon maps created by our Risk Analysis team (see below).

Resilience Zoning and Permitting

Resilience zoning and permitting refers to the inclusion of a zoning and permitting section within municipal zoning codes that explicitly addresses vulnerabilities in high-risk areas, and may include text such as waivers for flood protection measures..

Resilience Overlay Zone

Resilience Overlay Zones are a zoning based tool that involve the creation of overlay zones based specifically on assessed vulnerability. These zones would be overlaid atop existing zoning maps to establish land use regulations based upon projected future flood risk. These would create the benefit of properly allowing municipalities (or in this case, the NJSEA) to draw zones to zone for risk on top of other zoning mapping.

An additional benefit of this tool is in the way it can reflect existing floodplain expansions with possible horizons reflected. The NJSEA may benefit from a similar program. For

further information, see the LBI Action Plan's plan for the Bayside Resilience Overlay Zone.

Transfer of Development Rights (TDR)

In general practice, a Transferable Development Rights (TDR) program maintains a property owners' asset value by transferring the right to build from an area where development is prohibited to an area where development is encouraged, often for conservation purposes (Rutgers NJAES, 2023). Involving 'sending' and 'receiving' areas, TDR programs facilitate land preservation in 'sending areas' while the right to develop is recouped elsewhere. In this scheme, TDR allows developers and/or property owners to recoup the value of their land, while the land remains preserved and - in this case - managed and mitigated against hazards. An example of this is the Pinelands Development Credit Program, which sought to preserve agricultural and farm lands in central and southern New Jersey. Conceptually, a Resilience TDR program would be designed to shift development or land-use in vulnerable areas towards less vulnerable areas within the District, or even outside of it based on the partnership and cooperation of local municipalities. TDR could discourage development where it is high-risk, while encouraging strategic growth in select areas. Further study of this concept, its potential implications for the District, assessment of authorities, and examination of impacts to individual municipalities would be needed before any further consideration.

Conservation Districts

Conservation districts involve coordination with entities such as open space trust funds for the acquisition of vulnerable properties for conservation and ecosystem management. Often led by local community members, they allow for local expertise to be involved in land stewardship and management by providing expertise and assistance within their purview.

3.4.2 Policy and Regulatory Changes

One theme that emerged in the various Resilient NJ plans was the opportunity for smart policy and regulatory changes.

Drawing from the Resilient NJ plans, this studio sees three areas outlined. Policy must reflect the geomorphic changes in our current planning horizon (see the Risk Analysis portions of this report), track the likelihood of a tipping point condition (a point at which the Meadowlands region will become rapidly and increasingly vulnerable), and most importantly, inform the public of these shifts. Therefore, climate adaptation planning involves more than a discussion of policy change in a vacuum but prompts greater consideration for the public's place in determining and implementing these changes. Various policy recommendations mentioned in the Resilient NJ plans include:

- Translating emergency preparedness materials for public consumption
- Increasing zoning densities
- Assemblages of individual single-family private lots with stipulations that new developments are required to implement shoreline improvements
- "Rezoning parcels within the mapped special flood hazard areas"
    - Jersey City Flood Overlay Zone requires green infrastructure during redevelopment within special flood hazard areas
- "Reviewing and updating municipal flood damage prevention ordinances"
- Stormwater management ordinances
    - Flood Mitigation Design Guidelines
    - Impervious Lot Coverage Regulations

3.4.3 Infrastructure Tools

Various proposals and materials within the report reference various infrastructure-based tools. These solutions are primarily physical in nature and involve changes in infrastructure or the addition of infrastructure designed to channel or otherwise control the flow of runoff and flood waters.

It may not be beneficial to go into each of these proposals in detail individually, as they may not all be applicable or useful to the NJSEA and the District. What may be useful, however, is to broadly discuss what role these tools play, their feasibility, and what kind of proposals or ideas have been recommended within context.

Examples of these are referenced throughout and include:

- Bulkheads are a hard armoring solution intended primarily to preserve the integrity of a shoreline and minimize coastal erosion. These are often interchangeable with sea-walls but technically refer to different types of defensive infrastructure.
- Sea walls are another hard armoring solution intended to provide protection from waves and sea-water. Often interchangeably discussed as bulkheads, sea-walls are strictly speaking intended for a separate purpose.
- Hardening above ground utility poles and burying power lines.
- Micro and nano grids are alternative energy grid designs that localize power. Nanogrids are self contained energy generation sources - usually on a household or building level - that connect to a micro-grid, which is a mutually supporting and self-sufficient energy grid
- Elevated roadways, prioritizing evacuation routes and key connectors

- Pump stations to pump water out of the vulnerable region and reduce the amount of flooding.
- Levees are another hard armoring solution consisting of packed hard earth that act as a natural barrier. They differ from sea walls in that they tend to be made of earth whereas sea walls tend to be built out of harder materials. For this reason, levees tend to be less expensive than sea walls
- Hoboken PATH station hardening to ensure the continued and safe operation of rail operations. This is specifically proposed in response to complaints of train inoperability during Hurricane Sandy.
- Groins are large perpendicular structures that catch sediments to prevent the build-up of sand and keep the beach clear.
- Shoreline armoring with vegetation to prevent erosion. Roots have the added benefit of holding dirt together

Rebuild By Design features a pumping station but little mention of resilient energy grids. Ultimately, especially with the recommendations of the Army Corps of Engineers, it is apparent to this studio that there will be no shortage of infrastructure related improvement proposals. However, these interventions can be very expensive, time-intensive, and often may generate unintended ecological consequences. Nature-based solutions tend to be more cost-effective and less damaging.

3.4.4 Nature-Based Solutions/Natural Systems Tools

One major theme explored by this studio has been the role of preservation in contributing to resilience efforts in the Meadowlands. In addition to possessing intrinsic natural value in of themselves (to which a price cannot necessarily be ascribed), preserving the natural spaces of the Meadowlands also has important natural functions that contribute towards resilience in the Meadowlands.

This studio has identified a common theme of protecting current ecosystems, enhancing ecosystem functions, and economic values related to recreation, fisheries, wildlife habitat, and sense of place. While specific nature-based systems must be specific to their ecosystem, some examples of nature-based solutions identified in the Resilient NJ plans include:

- Nature based stormwater management via green regenerative infrastructure (e.g.,. stormwater or resilience parks)
- Habitat restoration. Especially in the context of the ACCR Back Bay tidal marshes to capture excess flood water in the case of flooding
- Beach nourishment - or the act of adding more sand onto beaches to counteract coastal erosion - mentioned

in both Atlantic county and Long Beach Island resilience plans

- Sheet pile dune core - which involves the installation of interlocking steel sheets to act as a barrier to retain soil and water
- Greenways which involve the creation of mixed-use paths through natural habitats for conservation and aesthetic purposes.
- Coastal wetland restoration and expansion (NENJ plan, LBI plan)
- Raised land involving the raising of land by the addition of soil or other compact materials to elevate features to counteract sea level rise
- Newark Bay Living Shorelines - a project to create a series of habitats with recycled and natural materials to promote biodiversity and conservation

Overall, the theme that emerged here was a shared recognition of the need for preserving natural ecosystems through the integration of relatively low-impact and cost-effective solutions that could take advantage of the natural features of habitats and ecosystems. There is recognition and consideration among these plans of the need to preserve natural habitats not just for political, social or cultural reasons, but because it is also important to protect our vulnerable built-spaces.

3.4.5 Tools Summary

In short, this section highlights that conservation and resilience can be achieved by a combination of planning tools. This overview of tools is to showcase just a snapshot of the resilience toolbox already being utilized in New Jersey. What works for one region may not necessarily work for all others. Furthermore, and perhaps more salient for the NJSEA, is the recognition that perhaps there is no solution that is inherently superior to any other but instead that all of these tools carry with them expenses, trade-offs, and other features.

Some of these tools are already being employed by the NJSEA. Overlay zones, habitat and coastal wetland restoration, nature based stormwater management, conditional development, hard / soft armoring, green infrastructure, acquisitions, easements and rolling easements are already tools employed or proposed by the NJSEA.

3.5 Section Recommendations

- Further develop community engagement by encouraging stakeholders and community members to actively participate in the process of developing and implementing strategies to adapt to the imminent impacts of climate change by putting forward a vision and asserting a set of community priorities, assessing

community vulnerability and assets, and building community/stakeholder voices and power.

- Recognizing that flooding does not stop at the District's border, the NJSEA can play a facilitative role in the Meadowlands region by promoting a consistent use of science, data and modeling as well as adoption of regionally beneficial community visioning and selection of climate mitigation strategies.

- With heavy flooding events becoming more common in the Meadowlands, a significant number of critical and community assets in the District will become more vulnerable to the 100-year flood by 2100. It is up to policymakers and planners in the greater region to take appropriate and timely action to mitigate risks and build resilience in the face of evolving climate challenges to protect public safety.

- Integrating climate resiliency mitigation strategies into affordable housing within the District can help to extend resiliency actions into underserved and overburdened communities. Creating retrofit programs, site specific mitigation strategies, and planning for damage approaches can all be ways to appropriately meet housing goals, while proactively planning for the changing environment.

- There are a plethora of resilience tools and strategies available to entities within the Meadowlands. While some tools and strategies may already be used by NJSEA it is important to review and deploy additional tools, strategies, and resilience frameworks that may work either alone or in combination with others.

PART FOUR

FINAL CONCLUSIONS

4. Final Conclusions

4.1 Key Takeaways

Reflecting on this studio's preliminary climate adaptation planning research for the Meadowlands, five key takeaways stand out.

1. The entire District is vulnerable to flooding, but some places are more susceptible than others.

Progressive flood models using TWL account for several planning horizons. The risk analysis completed by this studio describes how flooding will impact land parcels, affordable housing, critical infrastructure, public health, and land use. Summarized below are highlights of this analysis that may add significant value to future flood risk and resilience planning.

Parcel Analysis

Most parcels are projected to be inundated by SLR and a 100-year storm by 2100. This analysis estimates the monetary and structural damage incurred at each TWL, be it from permanent SLR inundation or storm flooding. Additionally, it may be used to estimate the cost of relocating residents through buyouts to prevent future monetary and structural damage as well as loss of life.

Affordable Housing

This analysis reveals that many buildings containing affordable housing units are anticipated to be inundated due to SLR in the coming decades. It is vital for future planning to consider the types of climate scenarios that put renters occupying affordable units at risk.

Critical Infrastructure

Given the vulnerability of essential infrastructure to sea level rise and flooding, it is crucial to invest in resilient infrastructure, develop contingency plans, and adopt mitigation strategies to minimize the impacts of these events on the community's safety, well-being, and overall resilience.

Land Use

As previously noted, areas throughout the District are vulnerable to flooding. A land use analysis shows that wetlands are the most susceptible, with 97.24% at risk due to a 5-foot sea level rise and 99.24% at risk in the event of a 100-year storm. The risk of all other land uses was ranked by the percentage of inundated acres. Following wetlands, industrial land use and transportation and utility land use are the most at risk.

Public Health

It is crucial for the Meadowlands Region to prioritize appropriate mitigation measures, remediation efforts, and land-use planning strategies. Enhancing flood protection infrastructure by either relocating vulnerable sites or implementing nature-based solutions to increase resilience against rising sea levels and flooding events would assist in addressing the challenges brought on by climate change. Taking these precautionary measures in ensuring our infrastructure is protected will ultimately protect the environment, public health and long-term sustainability of the Meadowlands region.

2. There are opportunities to build resilience through investments in built infrastructure, notably transportation and affordable housing.

Climate Adaptation & Transportation

Incorporating ecological and climate considerations into the Meadowlands' transportation projects would aid the District's pursuit of competitive federal funding dollars. Additionally, future transportation projects in the District can assist in directing land use patterns away from flood risks and towards more sustainable, transit-oriented community developments. Reducing the carbon emissions and air pollution generated by the District's transportation networks could help mitigate the impacts of climate change. To this end, expanding access to public transit also doubles as a climate adaptation, in addition to the other economic and social benefits such services also provide. Academic literature and previous studies such as Rebuild by Design advocate for a multimodal approach to expanding transit access (RBD, 2014). In the context of the District, a multimodal approach includes but is not limited to adding stops and stations, improving walkability, and adding micro-mobility services - such as e-scooter or e-bike sharing services (RBD, 2014).

Climate Adaptation & Housing

When considering future redevelopment in the District where to build and building strategies are both important. There are opportunities to incorporate some of the mitigation strategies identified by NJSEA into planning and design of new development, including affordable housing development, such as use of setback and nature-based infrastructure provisions. Nature-based infrastructure elements create longer, more sustainable housing structures while proper setback requirements allow more space for "pervious surfaces. Incorporating resilience strategies can help avoid potential maladaptation; NJSEA could consider building provisions for analyses of future risks into any new development projects in the District.

3. Coordinated preservation of natural systems.

The preservation of natural systems greatly enhances regional resilience. Conservation goals can be achieved through a

variety of planning mechanisms such as overlay zones, easements, and acquisitions; however, it is possible that some tools may provide different levels of protection. The Studio heard from stakeholders that, in addition to the tools currently employed by the NJSEA and MCT, resilience efforts in the District may also benefit from coordinated efforts among NJSEA, state, and county agencies to conserve, preserve, and steward natural systems. Coordinated efforts could increase the number of protections for natural areas (including non-wetland areas, such as uplands), while also mitigating against future hazards and expanding ecotourism. This concept of coordinated protection of natural lands could also be a subject of future work.

4. Now is the time to plan.

As emerging resilience efforts in the Meadowlands become more prevalent, there are funding opportunities, large scale projects, and new regulations for the NJSEA to take into consideration.

The NJSEA has the opportunity to capitalize on funding opportunities such as the Bipartisan Infrastructure Law (BIL), a time-sensitive and competitive process with discretionary funds. Local decision-makers may be incentivized to identify projects in the District that will mitigate multiple risks and add social value to the community with a focus on environmental justice and equity.

Additionally, with affordable housing at the forefront of decision-makers' minds as the fourth round of COAH approaches, now is the ideal time to plan for the intersection of affordable housing with current and future flood risk. Although the NJSEA is not bound by COAH, the District still has affordable housing obligations. Initiatives to strategically address the growing demand for affordable housing while overcoming flood risk may be gaining momentum with the 2025 COAH deadline. The NJSEA could be a regional leader in these planning efforts.

Another component for the NJSEA to keep in mind when planning is the ACOE NYNJHAT study. The final feasibility report is underway, and there is an opportunity for the NJSEA to consider how the projected developments of the HAT study will impact the region, especially regarding potential impacts on the Hackensack River. As the HAT study is still pending, now is an ideal time for the NJSEA to consider factoring this study into future planning efforts. Similarly, there are developing NJDEP Coastal Zone Management rules, among other new regulations, that emphasize flood protection which should be taken into consideration in all future planning efforts.

With the momentum of BIL funding, and awareness of projects and regulations coming down the pipeline, the NJSEA

is in a position to be proactive and incorporate all of these considerations into future planning efforts.

5. The NJSEA is ideally positioned to be a potential facilitator of regional resilience planning.

The NJSEA has an opportunity to act as a regional facilitator to coordinate climate adaptation planning across communities (beyond its jurisdictional bounds). The county-level Hazard Mitigation Plans, municipal-level aster plans, and Resilient NJ plans examined in this report highlight the benefits of regional-level planning. Although the planning and zoning authority of the NJSEA is limited to the District, the greater region may benefit from a facilitative effort by NJSEA that can involve coordinating use of the latest science, data, and modeling to inform consistent planning throughout the Meadowlands.

Incorporate Climate Change Impacts in all Planning and Decision-Making

Strong mitigation planning includes integrating resilience strategies across boundaries and throughout all plans. NJSEA could consider how regional efforts can prioritize climate change impacts in stakeholders' planning and decision-making. As previously noted, the ecosystem services generated by the wetlands in the Meadowlands District benefit the entire region. Similarly, the natural hazards affecting the Meadowlands District also impact communities outside jurisdictional boundaries. Impactful climate adaptation planning crosses jurisdictional boundaries to reflect the patterns of nature.

Framing Conversations with Municipalities

In a facilitator role, the NJSEA could encourage communities to think about potential mitigation strategies as useful actions that, overtime, would increase their economic and social value. The NJSEA may consider offering planning support to communities while allowing local elected officials who implement them to take ownership in generating community support. A community-driven climate resilience plan would help the NJSEA and the surrounding municipalities formulate an action plan for implementing resilience strategies that are more likely to succeed and reflect community needs.

Overall, the research presented in this report emphasizes the importance of maintaining a cohesive multi-tool approach to resiliency planning. Similar to a comprehensive plan, a successful climate adaptation plan includes community engagement and data backed by strong science, connecting all sectors of a community, including natural lands, residential areas, and transportation. This approach to planning may be the most effective, with the NJSEA guiding the greater region as a facilitator of comprehensive resilience planning.

4.2 Future Research

Within 12 weeks, this studio conducted thorough research and analysis on a variety of topics and elements towards a comprehensive resiliency strategy. Due to time constraints not all research elements considered by this studio were able to be carried out. Described below are additional elements that are worth future consideration and research to gain an enhanced understanding of the Meadowlands District.

Conduct a Heat Vulnerability Analysis

Building off the New Jersey Heat Vulnerability Index, developed by the New Jersey Climate Change Resource Center at Rutgers University (2023), there may be benefits to the Meadowlands in further evaluating heat vulnerability in the District and the greater region to assess populations and infrastructure vulnerable to temperature increases from global warming in the District and Region. Deriving a surface temperature dataset from Landsat data would be an important step in this process.

Update the Total Water Level Dataset

The current TWL dataset is based on bare Earth elevation, so it does not show inundation of elevated roads, railroads, and bridges. It is recommended that the dataset be updated to account for inundation of elevated structures using LiDAR data. These additional measures are necessary to assess flood risk of transportation infrastructure, inform future transportation projects, and for evacuation and emergency planning.

Conduct a Dynamic Adaptive Policy Pathway (DAPP) Analysis

DAPP is a decision making tool for investment and policy decisions that can "support decision making under uncertainty". DAPP can be used to evaluate multiple alternatives as well as be used to assess the feasibility of the NJSEA's 12 mitigation strategies to see which are more cost effective, timeline sensitive, and achievability.

Review Stormwater Management Opportunities

There may be advantages to a regional stormwater utility plan. Additionally, future studies may wish to consider the 25 million square feet of flat roof of warehouses and commercial buildings as a significant opportunity for installing Blue Roofs.

Explore Expanding Access to Ecotourism

The District sits within a hub of transportation, yet, many of the great parks and trails are not accessible by the transportation that runs through the District. By improving transportation access, the District would become more convenient for ecotourism and residents of surrounding communities alike. Improving the pedestrian and cyclist infrastructure within the District would not only provide more

access from adjacent communities, but a more environmentally sustainable approach to expanding access to the park. Ecotourism could be capitalized on by expanding opportunities to access the NJSEA's boat rides, canoe trips, and nature walks. Greater access to ecotourism can also enhance the NJSEA's community engagement initiatives by increasing a sense of identity for the neighboring municipalities through a clearer perception of the Meadowlands.

Research the Impacts and Opportunities of Lower Hackensack's Recent Superfund Status

In 2022, the EPA added Lower Hackensack to the Superfund program's National Priorities List (NPL) (EPA, 2022).

4.3 Data Limitations

The data included in this report reflects the best data available. Described below are gaps in existing data which this studio recommends addressing in future research initiatives.

Public Engagement

The most notable data gap in this report is the lack of direct feedback from stakeholders in the Meadowlands region including local elected officials and the public due to Institutional Review Board (IRB) constraints. It is crucial to ensure that local knowledge, preferences and priorities are reflected in future climate resilience planning. However, future stakeholder engagement should consider potential stakeholder fatigue from existing resilience planning efforts.

Missing MOD-IV Data for more than 500 Parcels in the Meadowlands

This data is necessary to assess the potential monetary and structural damage incurred by future SLR and storm flooding as well as estimate the cost of relocation through buyouts to prevent future damage and loss of life.

Missing Elevated Structure Elevation Data

Current flood maps are based on bare-earth elevation so they do not accurately show inundation of elevated structures. This is necessary to accurately assess potential inundation of elevated roads, railroads, and bridges.

Missing Stormwater System Capacity & Flow Rate Data

Current flood models do not account for stormwater system capacity/flow rate. This is necessary to account for the amount of storm water diverted into the stormwater system.

Projections for Future Temperature Increases due to Climate Change

Projections for multiple warming scenarios are necessary to

assess populations and infrastructure potentially vulnerable to temperature increase.

Conclusion

Despite encountering limitations in available data, this studio set out to provide the NJSEA with information that could support future climate adaptation planning efforts and regional cooperation. Through an analysis of existing and emerging climate planning in the Meadowlands, a risk assessment, and an overview of regional resilience planning, this studio observed the importance of four critical themes: Engaging Stakeholders, Considering Regional Impacts, Incorporating Nature-Based Solutions, and the NJSEA's potential role as a facilitator.

APPENDIX A. References

Appendix A. References

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APPENDIX B. Existing Master Plans by Municipality

Please zoom in to see details

Existing Municipal Master Plans and Reexaminations

Municipality	Plan Name	Year	Plan URL
Carlstadt	Master Plan	December 1978	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Carlstadt/05-003.pdf
	Master Plan Reexamination Report	August 1999	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Carlstadt/05-004.pdf
	Borough of Carlstadt Reexamination Report	January 2006	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Carlstadt/05-002.pdf
	General Reexamination of the Master Plan	November 2013	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Carlstadt/05-015.pdf
East Rutherford	Master Plan Report 1, Land Use Plan for the Meadowlands	September 1954	https://bchapeweb.co.bergen.nj.us/planning/masterplans/East%20Rutherford/11-003.pdf
	Master Plan Report 1, Existing Conditions	September 1966	https://bchapeweb.co.bergen.nj.us/planning/masterplans/East%20Rutherford/11-001.pdf
	Master Plan Report 2, Master Development Plan	July 1967	https://bchapeweb.co.bergen.nj.us/planning/masterplans/East%20Rutherford/11-004.pdf
	Master Plan Reexamination Report	July 1982	https://bchapeweb.co.bergen.nj.us/planning/masterplans/East%20Rutherford/11-010.pdf
	Borough of East Rutherford Reexamination Report	February 2006	https://bchapeweb.co.bergen.nj.us/planning/masterplans/East%20Rutherford/11-006.pdf
Jersey City	Master Plan 2000 Volume 2 of 2	May 2000	https://us.ftp.opendatasoft.com/analyzejerseycity/files/Master%20Plans/2--jersey-city-master-plan-2000-vol.-2-of-2.pdf
	Master Plan Reexamination Report	December 2, 2005	https://us.ftp.opendatasoft.com/analyzejerseycity/files/Master%20Plans/7%20-%20Reexamination%20Report%2012-02-2005.pdf
	Master Plan Amendment Historic	December 20, 2005	https://us.ftp.opendatasoft.com/analyzejerseycity/files/Master%20Plans/8---master-plan-amendment-historic-12-20-2005.pdf
	R-1A Amendments to the Jersey City Master Plan	October 18, 2006	https://us.ftp.opendatasoft.com/analyzejerseycity/files/Master%20Plans/10%20-%20R-1A%20Amendments%20to%20the%20Jersey%20City%20Master%20Plan.pdf
	R-1A Master Plan Reexamination Report	November 13, 2006	https://us.ftp.opendatasoft.com/analyzejerseycity/files/Master%20Plans/09-R-1A%20MP%20Re-examination%20Report%2011-13-2006.pdf
	R-1F Master Plan Re-examination Report	July 31, 2007	https://us.ftp.opendatasoft.com/analyzejerseycity/files/Master%20Plans/11%20-%20R-1F%20Master%20Plan%20Re-examination%20Report%2007-31-2007.pdf
	City of Jersey City Recreation & Open Space Master Plan	June 2008	https://us.ftp.opendatasoft.com/analyzejerseycity/files/Master%20Plans/13---jersey-city-recreation-master-plan.pdf
	Master Plan 2000 Volume 1 of 2 Amendment	April 9, 2015	https://us.ftp.opendatasoft.com/analyzejerseycity/files/Master%20Plans/1-jersey-city-master-plan--2000-vol.-1-of-2-amd-4.9.15.pdf
	Jersey City Master Plan Regulations and Reexamination Report	February 16, 2016	https://us.ftp.opendatasoft.com/analyzejerseycity/files/Planning%20Board%20Meeting%2020160223/JerseyCityMasterPlanRegulationsReExamReport_20160223.pdf
	Resiliency Master Plan	June 13, 2017	https://us.ftp.opendatasoft.com/analyzejerseycity/files/Master%20Plans/resiliency-mp-adopted-061417.pdf
	Adaptation Master Plan	June 13, 2017	https://us.ftp.opendatasoft.com/analyzejerseycity/files/Master%20Plans/adaptation-mp-adopted-061317.pdf
Kearny	Master Plan Reexamination Report, Master Plan Revision	December 3, 2008	https://www.kearnynj.org/wp-content/uploads/2018/10/Master-Plan-Reexamination-Report_Whole-document.pdf
Little Ferry	Existing Conditions Report Number 1	December 1962	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-019.pdf
	Master Plan Report 2	January 1964	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-018.pdf
	Master Plan	July 24, 1978	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-017.pdf
	Master Plan Report 1, Population and Housing Element	1984	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-006.pdf
	Master Plan Report 2, Land Use	1984	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-008.pdf
	Master Plan Report 4, Traffic and Economy	1985	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-005.pdf
	Summary Master Plan Master Plan Report 1 Land Use, Community Facilities, Historic Preservation	1985 1989	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-011.pdf https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-015.pdf
	Master Plan Report 2, Economy	1989	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-012.pdf
	Master Plan Report 3, Traffic and Circulation	1990	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-016.pdf
	Summary Master Plan Master Plan Report 1 Population, Energy Conservation, Recycling, Flood Control, Storm Water Management,	1990 May 1990	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-009.pdf https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-010.pdf
	Master Plan Reexamination Report	March 2003	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-014.pdf
	Amendment to the Reexamination of Master Plan	September 2010	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-035.pdf
	Reexamination of the Master Plan	February 2017	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Little%20Ferry/30-040.pdf
Lyndhurst	Lyndhurst in the Region Report Number 1	September 1960	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Lyndhurst/32-008.pdf
	Existing Conditions Report Number 2	January 1961	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Lyndhurst/32-009.pdf
	Master Plan Report Number 4	October 1961	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Lyndhurst/32-007.pdf
	Basis for a Continuing Planning Program	October 1961	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Lyndhurst/32-006.pdf
	Reexamination Report, Lyndhurst Master Plan	December 1982	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Lyndhurst/32-004.pdf
	Housing Element a Portion of the Lyndhurst Master Plan	November 1988	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Lyndhurst/32-005.pdf
	Master Plan Update and Reexamination Report	June 1, 2001	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Lyndhurst/32-003.pdf
	2008 Master Plan Reexamination	August 5, 2008	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Lyndhurst/32-014.pdf
	The 2014 Master Plan Reexamination	June 2, 2014	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Lyndhurst/32-017.pdf
Moonachie	Master Plan and Proposed Zoning Regulations	March 20, 1960	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Moonachie/37-009.pdf
	Moonachie Land Use Plan	November 1978	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Moonachie/37-008.pdf
	Borough of Moonachie Master Plan Reexamination	November 4, 1982	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Moonachie/37-017.pdf
	Periodic Reexamination Borough of Moonachie	December 1988	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Moonachie/37-011.pdf
	1994 Periodic Reexamination Report	December 1994	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Moonachie/37-013.pdf
	Periodic Reexamination Report Borough of Moonachie	December 14, 2000	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Moonachie/37-003.pdf
	Master Plan Reexamination Report	May 1, 2007	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Moonachie/37-002.pdf
North Arlington	Municipal Stormwater Management Plan	March 23, 2006	https://www.northarlington.org/_Content/pdf/Municipal-Stormwater-Management-Plan.pdf
	Master Plan Reexamination Report	May 27, 2016	https://www.northarlington.org/_Content/pdf/Master-Plan-Reexamination-Report.pdf
North Bergen	Township of North Bergen Master Plan	January 13, 1987	https://www.northbergen.org/_Content/pdf/1987-Master-Plan.pdf
	Master Plan Update	April 1994	https://www.northbergen.org/_Content/pdf/Updated-Master-Plan-1994.pdf
	Reexamination Report of the Master Plan 5	June 6, 2003	https://www.northbergen.org/_Content/pdf/ReexamReport-06-06-03.pdf
	Adopted Reexamination of the Master Plan	October 22, 2009	https://www.northbergen.org/_Content/pdf/AdoptedReex-10-22-09.pdf
Ridgefield	Borough of Ridgefield Master Plan	June 15, 1979	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Ridgefield/49-006.pdf
	Housing Element Ridgefield Borough Master Plan Report #1	December 14, 1988	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Ridgefield/49-001.pdf
	Housing Element Part II Borough of Ridgefield Master Plan Report #	May 9, 1989	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Ridgefield/49-005.pdf
	Summary Master Plan	October 24, 1989	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Ridgefield/49-007.pdf
	Existing Land Use Borough of Ridgefield NJ Master Plan Report 2	November 8, 1989	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Ridgefield/49-002.pdf
	Master Plan Report #3 Community Facilities, Population, Economy, Recycling, Historic Preservation	November 8, 1989	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Ridgefield/49-003.pdf
	Master Plan Report 4 Traffic and Energy Conservation	November 8, 1989	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Ridgefield/49-004.pdf
	Housing Element Master Plan Report 7	October 4, 1991	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Ridgefield/49-010.pdf
	Housing Element Master Plan Report 7 revised	1995	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Ridgefield/49-011.pdf
	Master Plan Reexamination Report	November 25, 2003	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Ridgefield/49-013.pdf
	Master Plan Housing Element and Fair Share Plan	December 12, 2005	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Ridgefield/49-012.pdf
	Master Plan Reexamination	November 6, 2009	https://bchapeweb.co.bergen.nj.us/planning/masterplans/Ridgefield/49-018.pdf
Rutherford	Borough of Rutherford 2007 Master Plan an	December 20, 2007	https://storage.googleapis.com/static.rutherford-nj.com/committees/planning%20board/11.27.19%202007%20Master%20Plan.pdf
	2018 Master Plan Reexamination Report	January 18, 2018	https://storage.googleapis.com/static.rutherford-nj.com/committees/planning%20board/2018%20MASTER%20PLAN%20REEXAMINATION%20REPORT%20FINAL%20(00072944xD43F8).PDF
Secaucus	Town of Secaucus Stormwater Management Plan	August 2005	https://green.secaucusnj.gov/meetings/stormwater/25-stormwater-management-plan/file
	Open Space and Recreation Plan, An Element of the Master Plan	February 18, 2014	https://green.secaucusnj.gov/meetings/green-times-newsletter/18-open-spaces-plan/file
South Hackensack	Master Plan Township of South Hackensack	January 17, 1979	https://bchapeweb.co.bergen.nj.us/planning/masterplans/South%20Hackensack/59-022.pdf
	Master Plan Reexamination Report Township of South Hackensack	July 27, 1982	https://bchapeweb.co.bergen.nj.us/planning/masterplans/South%20Hackensack/59-021.pdf
	Housing Element of the Master Plan	November 1990	https://bchapeweb.co.bergen.nj.us/planning/masterplans/South%20Hackensack/59-011.pdf
	Addendum to South Hackensack Housing Element of the Master Pl	April 1991	https://bchapeweb.co.bergen.nj.us/planning/masterplans/South%20Hackensack/59-018.pdf
	Land Use Element of the Master Plan	February 28, 2001	https://bchapeweb.co.bergen.nj.us/planning/masterplans/South%20Hackensack/59-007.pdf
	Master Plan Housing Element and Fair Share Plan	January 25, 2006	https://bchapeweb.co.bergen.nj.us/planning/masterplans/South%20Hackensack/59-006.pdf
	2008 Master Plan Periodic Reexamination Report	July 21, 2008	https://bchapeweb.co.bergen.nj.us/planning/masterplans/South%20Hackensack/59-005.pdf
	Master Plan Amendment	July 28, 2008	https://bchapeweb.co.bergen.nj.us/planning/masterplans/South%20Hackensack/59-001.pdf
	2020 Master Plan Reexamination Report	January 15, 2020	https://bchapeweb.co.bergen.nj.us/planning/masterplans/South%20Hackensack/59-030.pdf
Teaneck	Township of Teaneck Master Plan	April 12, 2007	https://www.teaneckn j.gov/media/Government/Master%20Plans/2007%20Master%20Plan%20(PDF)
	Master Plan Reexamination	May 9, 2011	https://www.teaneckn j.gov/media/Government/Master%20Plans/2011%20Master%20Plan%20Re-examination%20(PDF)
	Master Plan Reexamination Report	March 13, 2014	https://www.teaneckn j.gov/media/Government/Master%20Plans/2014%20Master%20Plan%20Reexamination%20(PDF)
	Proposed Reexamination Report	April 14, 2017	https://www.teaneckn j.gov/media/Government/Master%20Plans/2017%20Proposed%20Teaneck%20Reexamination%204-17-17%20(PDF)
	Master Plan Reexamination Report for the Township of Teaneck	April 27, 2017	https://www.teaneckn j.gov/media/Government/Master%20Plans/2017%20Teaneck%20Reexamination%20(PDF)
	Fair Share Housing Element Master Plan Addition	February 6, 2019	https://www.teaneckn j.gov/media/Government/Master%20Plans/Fair%20Share%20Housing%20Element%20Master%20Plan%20Addition%20February%202019.pdf

Municipality	Plan	Date	Type of Plan	Up for Reexam or New Report? (Y/N)	Mentions Meadowlands? (Y/N)	Population and Economy			Land Use			Housing		Transportation					Environment						Resiliency	
						Demographics	Employment/Econ. Dev.	Trends/Projections	Zoning (existing/prop.)	Utilities/Community Facilities	Develop./Redev.	Profiles/Stock	Affordable	Circulation Plan	Congestion	Bike/Ped	Rail	Future Dev.	Floodplains	Wetlands	Waterways	Existing Conditions	Open Space/Conservation	Stormwater	Goals/Strategies	Sustainability
Carlstadt	Master Plan	December 1978	Master Plan	-	No	x	x	x	x			x							x				x			
	Master Plan Reexamination Report	August 1999	Reexamination	-	Yes	x			x		x		x													
	Borough of Carlstadt Reexamination Report	January 2006	Reexamination	-	Yes	x			x		x	x	x							x						
	General Reexamination of the Master Plan	November 2013	Reexamination	Yes	Yes	x		x			x	x	x		x											x
East Rutherford	Master Plan Report 1, Land Use Plan for the Meadowlands	September 1954	Master Plan Element	-	Yes				x	x							x					x				
	Master Plan Report 1, Existing Conditions	September 1966	Master Plan Element	-	No	x	x							x								x				
	Master Plan Report 2, Master Development Plan	July 1967	Master Plan Element	-	Yes			x	x		x			x												
	Master Plan Reexamination Report	July 1982	Reexamination	-	No		x	x	x	x		x														
	Borough of East Rutherford Reexamination Report	February 2006	Reexamination	Yes	No				x	x	x				x				x	x						
Jersey City	Master Plan 2000 Volume 2 of 2	May 2000	Master Plan	-	No				x		x															
	Master Plan Reexamination Report	December 2, 2005	Reexamination	-	No				x		x	x					x									
	Master Plan Amendment Historic	December 20, 2005	Master Plan	-	No				x																	
	R-1A Amendments to the Jersey City Master Plan	October 18, 2006	Master Plan Element	-	No				x																	
	R-1A Master Plan Reexamination Report	November 13, 2006	Reexamination	-	No				x			x														
	R-1F Master Plan Re-examination Report	July 31, 2007	Reexamination	-	No				x		x	x														
	City of Jersey City Recreation & Open Space Master Plan	June 2008	Master Plan Element	-	No					x				x		x							x			
	Master Plan 2000 Volume 1 of 2 Amendment	April 9, 2015	Master Plan	No	Yes		x		x	x		x	x	x	x	x	x					x	x			
	Jersey City Master Plan Regulations and Reexamination Report	February 16, 2016	Reexamination	No	No				x		x															
	Resiliency Master Plan	June 13, 2017	Master Plan Element	No	No	x	x					x							x	x	x	x		x	x	
	Adaptation Master Plan	June 13, 2017	Master Plan Element	No	Yes														x	x	x	x		x	x	
Kearny	Master Plan Reexamination Report, Master Plan Revision	December 3, 2008	Reexamination	Yes	Yes	x				x	x	x	x		x			x					x		x	
Little Ferry	Existing Conditions Report Number 1	December 1962	Master Plan Element	-	No	x	x	x	x	x		x		x								x				
	Master Plan Report 2	January 1964	Master Plan	-	No	x	x	x	x	x	x	x		x								x				
	Master Plan	July 24, 1978	Master Plan	-	Yes	x	x			x		x		x												
	Master Plan Report 1, Population and Housing Element	1984	Master Plan Element	-	No	x		x				x	x													
	Master Plan Report 2, Land Use	1984	Master Plan Element	-	Yes				x		x								x		x	x		x		
	Master Plan Report 4, Traffic and Economy	1985	Master Plan Element	-	No		x							x	x											
	Summary Master Plan	1985	Master Plan	-	Yes			x	x	x	x	x		x					x							
	Master Plan Report 1, Land Use, Community Facilities, Historic Preservation	1989	Master Plan Element	-	Yes				x	x	x								x							
	Master Plan Report 2, Economy	1989	Master Plan Element	-	No		x																			
	Master Plan Report 3, Traffic and Circulation	1990	Master Plan Element	-	No									x	x											
	Summary Master Plan	1990	Master Plan	-	Yes				x		x				x							x	x			
	Master Plan Report 4, Population, Energy Conservation, Recycling, Flood Control, Storm Water Management, Reexamination Report, Policy Statements, Continuing Planning	May 1990	Master Plan Element	-	No	x		x											x					x		x
	Master Plan Reexamination Report	March 2003	Reexamination	-	No				x		x	x							x							
	Amendment to the Reexamination of Master Plan	September 2010	Reexamination	-	No							x	x							x						
	Reexamination of the Master Plan	February 2017	Reexamination	No	Yes	x	x	x	x		x		x	x		x			x	x	x	x	x	x	x	x
Lyndhurst	Lyndhurst in the Region Report Number 1	September 1960	Master Plan Element	-	No		x	x							x											
	Existing Conditions Report Number 2	January 1961	Master Plan Element	-	No				x	x	x	x		x								x				
	Master Plan Report Number 4	October 1961	Master Plan	-	No	x		x	x	x		x		x								x				
	Basis for a Continuing Planning Program	October 1961	Master Plan Element	-	No																					
	Reexamination Report, Lyndhurst Master Plan	December 1982	Reexamination	-	No			x	x		x	x		x	x											
	Housing Element a Portion of the Lyndhurst Master Plan	November 1988	Master Plan Element	-	No	x	x	x				x	x													
	Master Plan Update and Reexamination Report	June 1, 2001	Reexamination	-	No	x		x	x		x		x							x						
	2008 Master Plan Reexamination	August 5, 2008	Reexamination	-	Yes			x	x		x		x													
	The 2014 Master Plan Reexamination	June 2, 2014	Reexamination	No	Yes	x		x	x			x	x													
Moonachie	Master Plan and Proposed Zoning Regulations	March 20, 1960	Master Plan	-	Yes	x	x	x	x	x		x		x												
	Moonachie Land Use Plan	November 1978	Master Plan Element	-	Yes	x	x		x	x	x	x														
	Borough of Moonachie Master Plan Reexamination	November 4, 1982	Reexamination	-	No				x		x															
	Periodic Reexamination Borough of Moonachie	December 1988	Reexamination	-	Yes			x		x	x	x		x	x					x						x
	1994 Periodic Reexamination Report	December 1994	Reexamination	-	Yes		x	x	x		x	x		x						x		x	x			
	Periodic Reexamination Report Borough of Moonachie	December 14, 2000	Reexamination	-	Yes		x	x	x		x	x	x													
	Master Plan Reexamination Report	May 1, 2007	Reexamination	Yes	Yes		x	x			x	x	x		x											
North Arlington	Master Plan Reexamination Report	May 27, 2016	Reexamination	No	Yes	x	x	x	x	x			x		x	x							x	x	x	
North Bergen	Township of North Bergen Master Plan	January 13, 1987	Master Plan	-	Yes	x	x	x	x			x		x					x	x	x		x			
	Master Plan Update	April 1994	Master Plan	-	Yes				x	x	x	x	x	x	x		x	x								

North Bergen	Reexamination Report of the Master Plan	June 6, 2003	Reexamination	-	Yes				x		x		x													
	Adopted Reexamination of the Master Plan	October 22, 2009	Reexamination	Yes	No	x	x	x	x		x		x													
Ridgefield	Borough of Ridgefield Master Plan	June 15, 1979	Master Plan	-	Yes	x	x		x	x	x	x	x	x	x					x			x			
	Housing Element Ridgefield Borough Master Plan Report #1	December 14, 1988	Master Plan Element	-	No	x	x	x				x														
	Housing Element Part II Borough of Ridgefield Master Plan Report #5	May 9, 1989	Master Plan Element	-	No				x				x													
	Summary Master Plan	October 24, 1989	Master Plan	-	Yes				x	x	x	x		x									x	x		
	Existing Land Use Borough of Ridgefield NJ Master Plan Report 2	November 8, 1989	Master Plan Element	-	Yes				x			x							x			x				
	Master Plan Report #3 Community Facilities, Population, Economy, Recycling, Historic Preservation	November 8, 1989	Master Plan Element	-	No	x	x			x												x				x
	Master Plan Report 4 Traffic and Energy Conservation	November 8, 1989	Master Plan Element	-	No									x	x								x		x	x
	Housing Element Master Plan Report 7	October 4, 1991	Master Plan Element	-	No	x	x	x	x			x	x						x							
	Housing Element Master Plan Report 7 revised	1995	Master Plan Element	-	No	x	x	x				x	x													
	Master Plan Reexamination Report	November 25, 2003	Reexamination	-	Yes			x	x	x	x	x	x	x								x	x			x
	Master Plan Housing Element and Fair Share Plan	December 12, 2005	Master Plan Element	-	Yes	x	x	x				x	x													
	Master Plan Reexamination	November 6, 2009	Reexamination	Yes	No				x	x	x	x								x			x			
Rutherford	Borough of Rutherford 2007 Master Plan	December 20, 2007	Master Plan	-	Yes		x	x	x	x	x			x					x	x			x			
	2018 Master Plan Reexamination Report	January 18, 2018	Reexamination	No	Yes		x	x					x													
Seacaucus	Open Space and Recreation Plan, An Element of the Master Plan	February 18, 2014	Master Plan Element	No	Yes				x	x													x		x	
South Hackensack	Master Plan Township of South Hackensack	January 17, 1979	Master Plan	-	Yes				x		x															
	Master Plan Reexamination Report Township of South Hackensack	July 27, 1982	Reexamination	-	Yes						x															
	Housing Element of the Master Plan	November 1990	Master Plan Element	-	No	x	x	x			x	x	x													
	Addendum to South Hackensack Housing Element of the Master Plan	April 1991	Master Plan Element	-	No	x	x	x				x														
	Land Use Element of the Master Plan	February 28, 2001	Master Plan Element	-	No	x	x		x	x	x	x							x	x		x		x		
	Master Plan Housing Element and Fair Share Plan	January 25, 2006	Master Plan Element	-	No	x		x				x	x													
	2008 Master Plan Periodic Reexamination Report	July 21, 2008	Reexamination	-	No	x	x		x		x	x														
	Master Plan Amendment	July 28, 2008	Master Plan	-	No						x															
	2020 Master Plan Reexamination Report	January 15, 2020	Reexamination	No	No	x	x	x			x	x				x							x			x
Teaneck	Township of Teaneck Master Plan	April 12, 2007	Master Plan	-	No		x	x	x	x		x		x								x	x			x
	Master Plan Reexamination	May 9, 2011	Reexamination	-	No		x		x	x	x	x		x									x			x
	Master Plan Reexamination Report	March 13, 2014	Reexamination	-	No		x	x	x	x	x	x		x									x			x
	Proposed Reexamination Report	April 14, 2017	Reexamination	-	No		x	x	x	x	x	x		x									x			x
	Master Plan Reexamination Report for the Township of Teaneck	April 27, 2017	Reexamination	No	No		x	x	x	x	x	x		x									x			x
	Fair Share Housing Element Master Plan Addition	February 6, 2019	Master Plan Element	-	No	x	x	x				x	x													

Note: These are only the municipality plans that could be accessed by the public through open online sources. There may be more plans that have been adopted by municipalities but cannot be easily accessed by the public through open source data.

APPENDIX C. Resilience Planning & Funding in Transportation

APPENDIX C.1 IIJA Federal Transportation Grants

Please zoom in to see details

IIJA Federal Transportation Grants

Name of Program	Agency	Competitive or Formula	Total Available Funds	Fiscal Year Funding [If avail.]	Description	Example Projects [Location]	Notes on how it applies to the Meadowlands (if so)	Next Application Availability [If Known]	Is it an IIJA Program?	Program URL
Safe Streets for All program	OST	Competitive	$6 billion	FY22 $800 million	Provides funding directly to local and tribal governments to support their efforts to advance "vision zero" plans and other improvements to reduce crashes and fatalities, especially for cyclists and pedestrians.	DVRPC received ~$1.4 mil to develop a comprehensive safety action plan [South Jersey & PA]	With the new pedestrian and cyclist improvements to the Hackensack Meadowlands District, the NJSEA could win over funds in developing a comprehensive safety program that targets all individual proects aiming for improved pedestiran infrastructure improvements.	Expected for April 2023	Yes	https://www.transportation.gov/grants/SS4A
RAISE Grants	OST	Competitive	$15 billion	FY23 $1.5 billion	RAISE discretionary grants help project sponsors at the State and local levels, including municipalities, Tribal governments, counties, and others complete critical freight and passenger transportation infrastructure projects. The eligibility requirements of RAISE allow project sponsors to obtain funding for projects that are harder to support through other U.S. DOT grant programs.	NJDOT received $20,000,000 to construct the elevation of one of Atlantic City's main evacuation routes for vehicles and pedestrians, provide upgrades to drainage systems along the route, and relocate associated utilities.	RAISE funds applicable to resilience improvements to Secaucus Station or other railyards	February 28, 2023; next round in 2024	IIJA Expanded	https://www.transportation.gov/RAISEgrants
INFRA Grants (Part of the MPDG)	OST	Competitive	$8billion	NA	INFRA (known statutorily as the Nationally Significant Multimodal Freight & Highway Projects) awards competitive grants for multimodal freight and highway projects of national or regional significance to improve the safety, efficiency, and reliability of the movement of freight and people in and across rural and urban areas.	NJDOT received $26,000,000 to make drainage improvements on approximately two miles on Route 7, including raising the roadway by approximately 3.5 feet, adding three pump stations, raising and improving a bridge approach, and installing new pipes, inlet structures, outfalls, and flood walls.	NJDOT has received INFRA grants in the past for raising vulnerability highways such as those in Districts, pump stations, and other transportation-related gray infrastructure.	Application deadline of May 23, 2022	IIJA Expanded	https://www.transportation.gov/grants/infra-grants-program
Low and No Emission Bus Programs	FTA	Competitive	$5.6 billion	FY23 $1.1 billion	Provides funding to state and local governmental authorities for the purchase or lease of zero-emission and low-emission transit buses as well as acquisition, construction, and leasing of required supporting facilities.	NJT received ~$44 million to to renovate its Union City bus garage to create a public bus terminal, house admin. services, and deploy battery electric buses.	Could assist the District in modernizing local bus services to EV models, raising the quality and appeal of bus service.	April 13, 2023	IIJA Expanded	https://www.transit.dot.gov/lowno
FTA Buses + Bus Facilities Competitive Program	FTA	Competitive	~$2billion	FY23 $384 million	Provides competitive funding to states and direct recipients to replace, rehabilitate, and purchase buses and related equipment and to construct bus-related facilities including technological changes or innovations to modify low or no emission vehicles or facilities.	NA	Could assist the District in modernizing local busfacilities to EV models, raising the quality and appeal of bus service.	April 13, 2023	IIJA Expanded	https://www.transit.dot.gov/funding/grants/fact-sheet-buses-and-bus-facilities-program
Capital Investment Grants (CIG) Program	FTA	Competitive and Formula	$23 billion	FY23 $4.6 billion	BIL guarantees $8 billion, and authorizes $15 billion more in future appropriations, to invest in new high-capacity transit projects communities choose to build.	Projects must meet CIG program requirements to receive funding. In New Jersey, such recommended projects include the Portal North Bridge in Secaucus currently under construction.	Seems like the Portal North Bridge in Secaucus is a likely candidate for this additional funding.	Three different types of applications: "New Starts", "Small Starts", and "Core Capacity"; dates unclear_?	IIJA Expanded	https://www.transit.dot.gov/CIG
FAA Terminal Program	FAA	Competitive	$5 billion	FY22 $1 billion	Provides funding for airport terminal development and other landside projects	In NY, Long Island MacArthur Airport received $14 million for upgrades to FAA Terminal Program the Main Terminal Building utilities and fire and life safety systems to comply with current building codes and provide greater energy efficiency.	Could potentially be used to expand or improve certain aspects of Teterboro Airport.	FY23's deadline was October 24, 2022	Yes	https://www.faa.gov/bil/airport-terminals
MEGA Projects (Part of MPDG)	OST	Competitive	$5 billion	NA	A new National Infrastructure Project Assistance grant program will support multi-modal, multi-jurisdictional projects of national or regional significance.	Hudson Yards Concrete Casing in Manhattan, NY (~$292 million)	Could potentially be used on transit hub development in the District that have regional implications (i.e. Secaucus Junction)	"Available until expended"	Yes	https://www.transportation.gov/grants/mega-grant-program

PROTECT Program	FWHA	Formula	~$7.3 billion	FY23 $1.43 billion	Provides $7.3 billion in formula funding to states and $1.4 billion in competitive grants to eligible entities to increase the resilience of our transportation system. This includes funding for evacuation routes, coastal resilience, making existing infrastructure more resilient, or efforts to move infrastructure to nearby locations not continuously impacted by extreme weather and natural disasters.	NA	Can help fund resilience improvement elements in other transportation projects.	NA	Yes	https://www.fhwa.dot.gov/bipartisan-infrastructure-law/protect_fact_sheet.cfm
Port Infrastructure Development Program	MARAD	Competitive	~$2.25 billion	FY23 ~$662 million	Investment in America's coastal ports and inland waterways, helping to improve the supply chain and enhancing the resilience of our shipping industry. Claimed that BIL overall doubles the level of investment in port infrastructure and waterways, helping strengthen our supply chain and reduce pollution.	Port of Camden Access and Infrastructure Resiliency Project ($25,000,000) [Camden, NJ]	Relevant only if port facilities are within the District.	April 28, 2023	IIJA Expanded	https://www.maritime.dot.gov/PIDPgrants
5307 Ferry Program	FTA	Competitive	NA	FY22 $294.5 million	Passenger ferry program for ferries that serve urbanized areas.	The Borough of Carteret & Carteret Port Authority received $6,000,000 for Carteret Ferry Service Terminal	Relevant only if ferry services are in the District or the creation of such services is desired.	Last listed for September 6, 2022; perhaps the next one will be September 2023	No	https://www.transit.dot.gov/passenger-ferry-grants
Electric or Low Emitting Ferry Program	FTA	Competitive	$500 million	FY23 $100 million	Support the transition of passenger ferries to low or zero emission technologies.	New Jersey Transit received $7,298,010 for converting two New York Waterway vessels from diesel power to battery electric propulsion systems and to buy charging equipment to support them.	Relevant only if ferry services are in the District or the creation of such services is desired.	NA	Yes	https://www.transit.dot.gov/funding/grants/grant-programs/electric-or-low-emitting-ferry-pilot-program-iija-ss-71102
Rural Ferry Program	FTA	Competitive	$2 billion	FY2023 $400 million	Ensures that basic essential ferry service continues to be provided to rural areas by providing funds to States to support this service.	The North Carolina Department of Transportation Ferry Division received $1,345,241 to modernize the NCDOT Manns Harbor Shipyard paint facility, increasing safety and bringing it up to a state of good repair.	Unlikely to be relevant.	NA	Yes	https://www.transit.dot.gov/funding/grants/grant-programs/ferry-service-rural-communities-program-iija-ss-71103
Bridge Investment Program (BIP)	FWHA	Competitive	$12.5 billion	FY2023 $2.487 billion	Assists state, local, federal, and tribal entities in rehabilitating or replacing bridges, including culverts. Large projects and bundling of smaller bridge projects will be eligible for funding.	CT received $158,150,000 to rehabilitate the northbound structure of the Gold Star Memorial Bridge that carries I–95 over the Thames River between New London and Groton, Connecticut.	Could assist in the funding of Sawtooth Bridge or rehabilating a bundle of small bridges' drainage systems.	Last listed the application period (for FY2022) as between June 10, 2022 to September 8, 2022	Yes	https://www.fhwa.dot.gov/bipartisan-infrastructure-law/bip_factsheet.cfm
All Station Accessibility Program	FTA	Competitive	$1.75 billion	FY2023 $350 million	Provides funding to legacy transit and commuter rail authorities to upgrade existing stations to meet or exceed accessibility standards under the Americans with Disabilities Act.	The New Jersey Transit Corporation received $18,187,378 in funding to improve accessibility at the Anderson St-Hackensack and New Bridge Landing stations on the Pascack Valley Line	Could assist in making Secausus Station more accessible to visitors with disabilities.	Last listed the application period (for FY2022) as between July 26, 2022 to October 7, 2022	Yes	https://www.transit.dot.gov/funding/grants/fact-sheet-all-stations-accessibility-program
Charging and Fueling Infrastructure Discretionary Grant Program	FWHA	Competitive	$2.5 billion	FY 2023 $400 million	Competitive grant program to strategically deploy publicly accessible electric vehicle charging infrastructure and other alternative fueling infrastructure along designated alternative fuel corridors.	FY 2022 and FY 2023 are being combined; no examples yet	Can assist in the roll out of EV infrastructure within the District.	Notice of Funding Opportunity (NOFO) are expected to come up soon, but no concrete information (i.e. dates) is known	Yes	https://highways.dot.gov/newsroom/biden-harris-administration-announces-latest-steps-deliver-national-network-convenient
NEVI National Electric Vehicle Infrastructure Formula Program	FWHA	Formula	$5 billion	FY 2023 $1 billion	Provides funding to States to strategically deploy electric vehicle (EV) charging infrastructure and to establish an interconnected network to facilitate data collection, access, and reliability.	NJ TRANSIT plans to pair NEVI funding with state Bus Modernization projects	Can assist in the roll out of EV infrastructure within the District.	Formula process; applications do not compete	Yes	https://www.fhwa.dot.gov/bipartisan-infrastructure-law/nevi_formula_program.cfm

Reconnecting Communities Pilot Program	OST	Competitive	$1 billion	FY 2023 $198 million	Provides dedicated funding to state, local, MPO, and tribal governments for planning, design, demolition, and reconstruction of street grids, parks, or other infrastructure.	NJ TRANSIT's Long Branch Station Pedestrian Tunnel (LBSPT) received $13,215,036 in capital funding	Can assist if a community in the District is lanced through highways and desires to transition to a more walkable, sustainable built environment. There is potentially added relevancy to the District for	Last listed deadline October 13, 2022, for FY2022	Yes	https://www.transportation.gov/grants/reconnecting-communities
Nationally Significant Federal Lands and Tribal Projects	FWHA	Competitve	$1.78 billion	FY2023 $355 million	Provides funding for the construction, reconstruction, and rehabilitation of nationally-significant projects within, adjacent to, or accessing Federal and tribal lands. BIL amends this program to allow smaller projects to qualify for funding and allows 100% federal share for tribal projects.	National Park Service received $54,278,000 to rehabilitate an 83-mile section of the Natchez Trace Parkway in Mississippi from milepost 121 to 204	Unlikely to be relevant.	"Next call for applications [is] expected in Summer 2023"	IIJA Expanded	https://www.fhwa.dot.gov/bipartisan-infrastructure-law/NSFLTP_fact_sheet.cfm
Strengthening Mobility and Revolutionizing Transportation (SMART) Grant Program	OST	Competitve	$500 million	FY 2023 $100 milion	Delivers competitive grants to states, local governments, and tribes for projects that improve transportation safety and efficiency.	NA	Could potentially assist in capital improvements to the District's Meadowlands Adaptive Signal System for Traffic Reduction (MASSTR) system.	Last listed deadline November 18, 2022, for FY2022	NA	https://www.transportation.gov/sites/dot.gov/files/2022-07/SMART%20Program%20Fact%20Sheet.pdf
Rural Surface Transportation Grant Program (Part of the MPDG)	OST	Competitve	$2 billion	NA	Improves and expands surface transportation infrastructure in rural areas, increasing connectivity, improving safety and reliability of the movement of people and freight, and generate regional economic growth.	Louisiana Department of Transportation and Development received $25,000,000 for a ferry service across the Mississippi River between Highway 23 and Highway 39 at Pointe a la Hache, and between Belle Chasse and Scarsdale in Plaquemines Parish.	Less than likely to be relevant.	Last listed the application period (for FY2022) as between March 25, 2022 to May 23, 2022	Yes	https://www.transportation.gov/grants/rural-surface-transportation-grant
Congestion Mitigation and Air Quality (CMAQ) Improvement Program	FHWA	Competitive	$13.2 billion	FY2023 $2.587 billion	The CMAQ program provides a funding source for states and local governments to fund surface transportation improvements or programs that improve air quality and mitigate traffic congestion.	NA	Could assist modal shifts or EV projects that lower air pollution within the District.	NA	IIJA Expanded	https://www.fhwa.dot.gov/bipartisan-infrastructure-law/cmaq.cfm
Surface Transportation Block Grant Program (STBGP)	FWHA	Formula	$72 billion	FY2023 $14.112 billion	The Surface Transportation Block Grant Program is available for the roughly one million miles of Federal-aid highways, for bridges on any public road, and for transit capital projects. Generally distributed through the state government.	NA	Depending on NJDOT priorities, these funds could be allocated to roads in the District	NA	IIJA Expanded	https://www.fhwa.dot.gov/bipartisan-infrastructure-law/stbg.cfm
Transportation Alternatives (TAP) (Set-Aside)	FWHA	Competitive	$7.2 billion	FY 2023 $1.411 billion	Encompasses a variety of smaller-scale transportation projects such as pedestrian and bicycle facilities, recreational trails, safe routes to school projects, community improvements such as historic preservation and vegetation management, and environmental mitigation related to stormwater and habitat connectivity.	NA	Could support active mobility and green, pedestrian infrastructure in the District	NA	IIJA Expanded	https://www.fhwa.dot.gov/bipartisan-infrastructure-law/ta.cfm

Source: US Department of Transportation, Bipartisan Infrastructure Law, NJ - https://www.transportation.gov/briefing-room/bipartisan-infrastructure-law-will-deliver-new-jersey

APPENDIX C.2 Best Practices in Resilience Planning for Transportation, Annotated Bibliography

Annotated Bibliography - Best Practices in Resilience Planning for Transportation Services and Systems

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California Governor's Office of Emergency Services. (2023). Evacuation & Transportation. *State of California*. Retrieved from https://www.caloes.ca.gov/office-of-the-director/policy-administration/access-functional-needs/evacuation-transportation-2/.

This brief webpage by the California Office of Emergency Services describes the relation between evacuation and transportation planning best practices while providing further links to their agency's guidance on this intersection. It posits the following core considerations and questions that are relevant to assessing how the Meadowlands' hazard risks can be approached:

- Do plans identify how individuals with access and functional needs will be evacuated from their community?
- What plans currently exist and are multiple entities dependent on the same provider(s)? Are protocols or memorandums of understanding/agreement (MOU/MOA) in place to avoid confusion when accessing and deploying assets?
- Do plans identify the transportation providers that will be responsible for and have the capacity to move individuals with access and functional needs from schools, neighborhoods, medical facilities, nursing facilities, etc.?
- Are disability and older adult transportation providers incorporated into evacuation plans, including the use of vehicles, drivers, and dispatch?
- Do drills/exercises incorporate first responders, accessible transportation providers and people with access and functional needs as victims?

California Governor's Office of Emergency Services. (2023). Voluntary Disaster Registry Planning Guidance. S*tate of California*. Retrieved from https://www.caloes.ca.gov/wp-content/uploads/AFN/Documents/General/CalOES-Voluntary-Disaster-Registry-Planning-Guidance-1.pdf.

The California Office of Emergency Services has produced guidelines for creating a disaster register that would allow vulnerable residents to voluntarily report if they are individuals who may have difficulty evacuating in a disaster event. The California OES identifies local governments and community-based planning organizations as being the touchpoints for their states program, and classifies vulnerable individuals as falling into these categories:

- Developmental, intellectual, or physical disabilities;
- Chronic conditions or injuries;
- Limited English proficiency or who are non-English speaking;
- Older adults, children, or pregnant;
- Living in institutional settings;
- Low-income, homeless, and/or transportation disadvantaged.

Though this program exists in a different state, the Meadowlands communities could capitalize on this concept and create similar registries to help smooth out evacuation processes in the case of a major storm event. Such registries would give Meadowlands governments an idea of their evacuation needs and aid their communities in assessing what additional materials and training may be required.

Committee on Transportation Resilience Metrics. (2021). Investing in Transportation Resilience: A Framework for Informed Choices. *Transportation Research Board, National Academy of Sciences.* Retrieved from trb.org/Publications/Blurbs/182431.aspx.

Released in 2021, the Transportation Research Board's 157 page special report on *Investing in Transportation Resilience* is a relevant, current, authoritative resource for understanding best practices, case studies, modeling, and research literature on transportation resilience. One section specifically describes a decision-making framework for resilience investments to transportation infrastructure. Broad emphasis is placed on acquiring high-quality data and analytic tools that can assess criticality (estimations of asset's vulnerability and functional value) that aligns with New Jersey DOT efforts.

Redundancy is mentioned as a way to build in resilience into transportation systems; the variety of commuter patterns of the Meadowlands (commuting motorists, train riders, etc.) could be seen in this light as a type of multi-modal redundancy that could be expanded on to ensure greater resiliency as hazard risks increase. Though not directly identified in the paper, this perspective means that commitments to pedestrian and bike planning could likewise reduce the vulnerability of local residents' travel by providing additional modes of transportation to existing infrastructure.

Another useful element of this paper is its discussion of federal pilot programs conducted by FHWA and FTA to advance resilience planning and decision making among transportation agencies. The FTA Climate Change Adaptation Initiative is noted as identifying climate hazards, extreme heat, assessment of system vulnerabilities, and adaptation strategies.

Additional information is likewise provided on comprehensive approaches to resilience being used by state DOTs such as the RAMCAP model, Hazus-MH, and Resilience and Disaster Recovery Metamodel.

Ernest Frazier Sr., Yuko Nakanishi, Pierre Auza, Jeffrey Western, Patricia Bye, and Deborah Matherly (2020). A Guide to Emergency Management at State Transportation Agencies. *National Cooperative Highway Research Program, Transportation Research Board, National Academy of Sciences.* Retrieved from https://www.trb.org/Main/Blurbs/179534.aspx.

The Transportation Research Board's 2020 *Guide to Emergency Management at State Transportation Agencies* discusses the capabilities and responsibilities of transportation agencies in serving emergency management tasks. It provides an introduction and five other sections which are about:

- Institutional Context for Emergency Management
- Nature and Degrees of Hazards and Threats
- Develop[ing] an Emergency Preparedness Program
- Emergency Management Stakeholders and Regional Collaboration
- Emergency Management Training and Exercises

Though the target audience of this guide is state-level DOTs, it permits local governments and researchers an understanding of the best practices and capabilities that such agencies can bring to hazard planning. The guide's section on hazards explains the process of "Threat and Hazard Identification and Risk Assessment (THIRA)" that can be adapted to Meadowlands' jurisdictions. Additionally, it also provides templates, resources, and case studies that can be utilized to help strengthen the Meadowlands' resiliency.

Federal Highway Administration. (2015). Transportation System Resilience to Extreme Weather and Climate Change. *U.S. Department of Transportation*. Retrieved from https://ops.fhwa.dot.gov/publications/fhwahop15025/fhwahop15025.pdf.

This Federal Highway Administration document provides their definition of resilience that, in turn, informs how other levels of governments view transportation and resiliency. According to the FHWA, resilience is "the ability to prepare for changing conditions and withstand, respond to, and recover rapidly from disruptions". Generally broad, this description is intended to guide the adaptation of state and local DOT's transportation systems management and operations (TSMO) to climate change

by highlighting how existing capabilities can be deployed to mitigate and respond to hazard risks. The document gives a multi-step process for actualizing this type of adaptation:

1. Define Scope
2. Assess Vulnerability
3. Integrate into Decision Making
4. Monitor and Revisit
5. Develop New Objectives

These process steps are expanded on in greater detail within the document and a checklist is provided so that TSMO officials can quickly assess what changes could be made to increase their transportation systems' resiliency.

Federal Transit Administration. (2003). The Public Transportation System Security and Emergency Preparedness of Transportation Federal Transit Planning Guide. *U.S. Department of Transportation*. Retrieved from https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/PlanningGuide.pdf.

This 2003 guide addresses planning public transportation systems to be more resilient against major hazard events. Though an older document and consequently more focused on counter-terrorism measures, the FTA paper describes a federal approach towards intersection of emergency management and public transportation. It provides forms such as a "Security and Emergency Preparedness Planning Guide" on page 54 of 176 that give an examiner a methodology for conducting a Capabilities Assessment on Transportation System Resources in a disaster setting. This type of information and other discussion on how federal and local transportation agencies can proactively prepare for disaster events makes this document a valuable resource in engaging with the vulnerabilities of the Meadowlands' transportation infrastructure.

US Climate Resilience Toolkit. (2021). Transportation. *Climate Program Office, National Oceanic and Atmospheric Administration*. Retrieved from https://toolkit.climate.gov/topics/built-environment/transportation.

This US Climate Resilience Toolkit web page describes the vulnerability of transportation infrastructure to climate change and flooding events. It denotes that transportation planners in coastal regions such as the Meadowlands will have to consider the following strategies in assessing the long-term management of transportation assets:

- Integrate climate change considerations into asset management.
- Strengthen or abandon infrastructure that is vulnerable to flooding.
- Raise standards for the resilience of new infrastructure.
- Add redundant infrastructure to increase system resiliency.
- Promote zoning, insurance, and disaster recovery policies that discourage development in vulnerable areas.

There are embedded links on this web page to other resiliency topics that could prove useful in understanding and summarizing the Meadowlands' future challenges and opportunities.

APPENDIX D. Additional Maps and Data

Please zoom to see details

APPENDIX D.1 Parcel Analysis Tables by Municipality

Meadowlands District, Parcel Analysis Tables by Municipality

	Municipality	Carlstadt	East Rutherford	Jersey City	Kearny	Little Ferry	Lyndhurst	Moonachie	North Arlington	North Bergen	Ridgefield	Rutherford	Secausus	South Hackensack	Teterboro	Meadowlands
2ft TWL	Land Value	$205,305,840	$60,916,900	$37,079,800	$67,679,000	$99,878,200	$136,589,900	$240,143,400	$27,343,900	$63,824,500	$17,322,900	$42,330,900	$75,818,500	$15,040,500	$237,659,020	$1,326,933,260
	Improvement Value	$179,482,880	$45,518,200	$433,900	$2,447,400	$355,995,300	$1,371,000	$164,571,600	$0	$27,773,100	$2,057,200	$57,675,600	$6,633,100	$81,528,100	$145,828,383	$1,071,315,763
	Net Value	$384,788,720	$104,281,900	$37,513,700	$70,126,400	$455,873,500	$137,960,900	$404,715,000	$27,343,900	$91,597,600	$19,380,100	$100,006,500	$82,451,600	$96,568,600	$383,487,403	$2,396,095,823
	# of Structures	118	8	22	100	296	19	705	1	13	6	7	49	10	26	1,380
3ft TWL	Land Value	$255,609,810	$147,938,800	$116,594,800	$75,867,700	$117,293,800	$269,090,800	$294,638,400	$27,343,900	$219,632,800	$36,415,100	$47,337,900	$107,850,400	$17,643,500	$246,704,420	$1,979,962,130
	Improvement Value	$258,847,688	$120,437,400	$18,235,600	$12,777,300	$385,401,000	$50,161,400	$369,383,000	$0	$126,302,900	$40,971,600	$67,314,700	$61,973,300	$110,675,000	$160,616,383	$1,783,097,271
	Net Value	$514,457,498	$262,328,100	$134,830,400	$88,645,000	$502,694,800	$319,252,200	$664,021,400	$27,343,900	$345,935,700	$77,386,700	$114,652,600	$169,823,700	$128,318,500	$407,320,803	$3,757,011,301
	# of Structures	197	47	41	137	458	26	858	2	34	16	11	134	14	45	2,020
5ft TWL	Land Value	$322,916,420	$1,234,520,100	$193,639,100	$93,177,800	$134,980,700	$424,093,400	$320,392,700	$27,343,900	$417,864,800	$140,566,500	$59,579,100	$282,971,800	$17,643,500	$257,654,220	$3,927,344,040
	Improvement Value	$424,898,628	$271,411,100	$52,114,400	$30,468,400	$417,062,700	$149,219,100	$434,893,200	$0	$366,847,000	$66,696,700	$109,858,100	$473,768,900	$110,675,000	$163,771,483	$3,071,684,711
	Net Value	$747,815,048	$1,499,883,100	$245,753,500	$123,646,200	$552,043,400	$573,312,500	$755,285,900	$27,343,900	$784,711,800	$207,263,200	$169,437,200	$756,740,700	$128,318,500	$421,425,703	$6,992,980,651
	# of Structures	315	110	122	210	596	60	958	8	109	49	19	637	15	62	3,276
7ft TWL	Land Value	$350,604,020	$1,287,208,600	$257,982,300	$121,008,000	$139,217,000	$489,106,500	$320,392,700	$32,089,700	$503,962,800	$197,975,600	$60,556,300	$454,063,500	$17,643,500	$257,675,220	$4,489,485,740
	Improvement Value	$473,420,128	$365,571,700	$59,417,300	$113,292,500	$431,944,700	$233,269,300	$434,893,200	$2,808,100	$549,418,300	$104,745,000	$110,396,500	$1,112,523,500	$110,675,000	$163,771,483	$4,266,146,711
	Net Value	$824,024,148	$1,646,732,200	$317,399,600	$234,300,500	$571,161,700	$722,375,800	$755,285,900	$34,897,800	$1,053,381,100	$302,720,600	$170,952,800	$1,566,587,000	$128,318,500	$421,446,703	$8,749,584,351
	# of Structures	353	135	166	267	610	90	962	20	141	90	37	1,090	15	76	4,056
8ft TWL	Land Value	$354,440,020	$1,289,800,600	$294,799,100	$127,130,600	$139,217,000	$491,195,100	$320,392,700	$35,019,900	$556,482,800	$198,095,600	$60,556,300	$501,162,800	$17,643,500	$257,675,220	$4,643,611,240
	Improvement Value	$483,171,828	$370,494,900	$86,735,100	$115,556,100	$431,944,700	$233,269,300	$434,893,200	$5,183,200	$823,600,200	$104,745,000	$110,396,500	$1,163,329,500	$110,675,000	$163,771,483	$4,637,766,011
	Net Value	$837,611,848	$1,654,247,400	$381,534,200	$242,686,700	$571,161,700	$724,464,400	$755,285,900	$40,203,100	$1,380,083,000	$302,840,600	$170,952,800	$1,664,492,300	$128,318,500	$421,446,703	$9,275,329,151
	# of Structures	360	148	173	279	615	97	963	26	158	96	38	1,219	15	76	4,271
10ft TWL	Land Value	$366,156,920	$1,297,006,400	$304,720,100	$131,653,400	$139,217,000	$505,151,000	$320,392,700	$35,019,900	$584,970,700	$0	$60,556,300	$555,503,900	$17,643,500	$257,675,220	$4,575,667,040
	Improvement Value	$495,994,528	$376,409,100	$88,834,800	$120,512,800	$431,944,700	$240,720,100	$434,893,200	$5,183,200	$854,951,000	$0	$110,396,500	$1,376,705,900	$110,675,000	$163,771,483	$4,810,992,311
	Net Value	$862,151,448	$1,667,367,400	$393,554,900	$252,166,200	$571,161,700	$745,871,100	$755,285,900	$40,203,100	$1,439,921,700	$0	$170,952,800	$1,932,209,800	$128,318,500	$421,446,703	$9,380,611,251
	# of Structures	375	161	176	304	616	110	963	30	173	102	38	1,374	15	76	4,521
12ft TWL	Land Value	$371,029,520	$1,297,006,400	$307,708,700	$132,755,000	$139,217,000	$534,777,200	$320,392,700	$35,019,900	$599,517,700	$198,890,600	$60,556,300	$568,863,400	$17,643,500	$257,675,220	$4,841,053,140
	Improvement Value	$513,295,828	$376,409,100	$89,456,200	$120,512,800	$431,944,700	$243,017,900	$434,893,200	$5,183,200	$854,951,000	$108,383,900	$110,396,500	$1,390,955,500	$110,675,000	$163,771,483	$4,953,846,311
	Net Value	$884,325,348	$1,667,367,400	$397,164,900	$253,267,800	$571,161,700	$777,795,100	$755,285,900	$40,203,100	$1,454,468,700	$307,274,500	$170,952,800	$1,959,818,900	$128,318,500	$421,446,703	$9,788,851,351
	# of Structures	390	164	180	307	616	130	963	35	184	110	38	1,456	15	76	4,672

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.
Due to Missing MOD-IV data for a significant number of parcels, an increase in the number of damaged structures may not be reflected in an increase in monetary damage.

Meadowlands District, Parcel Analysis Tables by Municipality

Carlstadt		1 Vacant	2 Residential	4A Commercial	4B Industrial	4C Apartment	15A/B/C Schools/ Public	15d Churches/ Charities	15F Other Exempt	Other	No Class Data	Total
2ft TWL	Land Value	$8,063,580	$0	$7,814,600	$121,965,600	$0	$60,493,260	$0	$0	$684,500	$6,284,300	$205,305,840
	Improvement Value	$0	$0	$8,146,600	$165,697,380	$0	$777,900	$0	$0	$0	$4,861,000	$179,482,880
	Net Value	$8,063,580	$0	$15,961,200	$287,662,980	$0	$61,271,160	$0	$0	$684,500	$11,145,300	$384,788,720
3ft TWL	Land Value	$10,261,780	$0	$12,230,000	$163,033,200	$0	$60,726,720	$0	$0	$977,100	$8,381,010	$255,609,810
	Improvement Value	$2,900	$0	$11,853,600	$239,901,288	$0	$783,400	$0	$0	$0	$6,306,500	$258,847,688
	Net Value	$10,264,680	$0	$24,083,600	$402,934,488	$0	$61,510,120	$0	$0	$977,100	$14,687,510	$514,457,498
5ft TWL	Land Value	$12,755,580	$16,100	$34,336,150	$203,547,000	$0	$62,903,480	$0	$0	$977,100	$8,381,010	$322,916,420
	Improvement Value	$2,877,900	$0	$73,235,500	$340,884,788	$0	$1,593,940	$0	$0	$0	$6,306,500	$424,898,628
	Net Value	$15,633,480	$16,100	$107,571,650	$544,431,788	$0	$64,497,420	$0	$0	$977,100	$14,687,510	$747,815,048
7ft TWL	Land Value	$14,846,280	$16,100	$39,197,250	$221,682,100	$0	$63,102,180	$0	$0	$977,100	$10,783,010	$350,604,020
	Improvement Value	$2,877,900	$0	$86,332,400	$372,866,288	$0	$1,593,940	$0	$0	$0	$9,749,600	$473,420,128
	Net Value	$17,724,180	$16,100	$125,529,650	$594,548,388	$0	$64,696,120	$0	$0	$977,100	$20,532,610	$824,024,148
8ft TWL	Land Value	$14,942,880	$16,100	$39,512,250	$224,708,600	$0	$63,500,080	$0	$0	$977,100	$10,783,010	$354,440,020
	Improvement Value	$2,877,900	$0	$87,561,300	$381,389,088	$0	$1,593,940	$0	$0	$0	$9,749,600	$483,171,828
	Net Value	$17,820,780	$16,100	$127,073,550	$606,097,688	$0	$65,094,020	$0	$0	$977,100	$20,532,610	$837,611,848
10ft TWL	Land Value	$14,942,880	$16,100	$44,091,250	$231,556,700	$0	$63,506,380	$0	$0	$977,100	$11,066,510	$366,156,920
	Improvement Value	$2,877,900	$0	$92,285,600	$388,820,988	$0	$1,593,940	$0	$0	$0	$10,416,100	$495,994,528
	Net Value	$17,820,780	$16,100	$136,376,850	$620,377,688	$0	$65,100,320	$0	$0	$977,100	$21,482,610	$862,151,448
12ft TWL	Land Value	$14,942,880	$16,100	$45,679,750	$235,666,700	$0	$63,657,580	$0	$0	$977,100	$11,066,510	$372,006,620
	Improvement Value	$2,877,900	$0	$94,425,300	$403,005,488	$0	$1,593,940	$0	$0	$0	$10,416,100	$512,318,728
	Net Value	$17,820,780	$16,100	$140,105,050	$638,672,188	$0	$65,251,520	$0	$0	$977,100	$21,482,610	$884,325,348

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.

Meadowlands District, Parcel Analysis Tables by Municipality

East Rutherford		1 Vacant	2 Residential	4A Commercial	4B Industrial	4C Apartment	15A/B/C Schools/ Public	15d Churches/ Charities	15F Other Exempt	Other	No Class Data	Total
2ft TWL	Land Value	$7,845,400	$0	$0	$36,938,700	$0	$15,056,200	$0	$0	$0	$1,076,600	$60,916,900
	Improvement Value	$0	$0	$0	$38,941,600	$0	$5,500,000	$0	$0	$0	$1,076,600	$45,518,200
	Net Value	$7,845,400	$0	$0	$75,880,300	$0	$20,556,200	$0	$0	$0	$0	$104,281,900
3ft TWL	Land Value	$8,855,100	$0	$8,567,500	$111,154,900	$0	$15,345,900	$0	$0	$0	$4,015,400	$147,938,800
	Improvement Value	$0	$0	$1,286,100	$108,806,600	$0	$5,500,000	$0	$0	$0	$4,844,700	$120,437,400
	Net Value	$8,855,100	$0	$9,853,600	$219,961,500	$0	$20,845,900	$0	$0	$0	$2,812,000	$262,328,100
5ft TWL	Land Value	$9,086,900	$0	$48,205,300	$219,836,000	$0	$933,435,600	$0	$0	$0	$23,956,300	$1,234,520,100
	Improvement Value	$0	$0	$24,157,800	$210,916,600	$0	$5,500,000	$0	$0	$0	$30,836,700	$271,411,100
	Net Value	$9,086,900	$0	$72,363,100	$430,752,600	$0	$938,935,600	$0	$0	$0	$48,744,900	$1,499,883,100
7ft TWL	Land Value	$9,086,900	$0	$100,893,800	$219,836,000	$0	$933,435,600	$0	$0	$0	$23,956,300	$1,287,208,600
	Improvement Value	$0	$0	$118,318,400	$210,916,600	$0	$5,500,000	$0	$0	$0	$30,836,700	$365,571,700
	Net Value	$9,086,900	$0	$219,212,200	$430,752,600	$0	$938,935,600	$0	$0	$0	$48,744,900	$1,646,732,200
8ft TWL	Land Value	$9,086,900	$0	$103,485,800	$219,836,000	$0	$933,435,600	$0	$0	$0	$23,956,300	$1,289,800,600
	Improvement Value	$0	$0	$123,241,600	$210,916,600	$0	$5,500,000	$0	$0	$0	$30,836,700	$370,494,900
	Net Value	$9,086,900	$0	$226,727,400	$430,752,600	$0	$938,935,600	$0	$0	$0	$48,744,900	$1,654,247,400
10ft TWL	Land Value	$9,086,900	$0	$110,691,600	$219,836,000	$0	$933,435,600	$0	$0	$0	$23,956,300	$1,297,006,400
	Improvement Value	$0	$0	$129,155,800	$210,916,600	$0	$5,500,000	$0	$0	$0	$30,836,700	$376,409,100
	Net Value	$9,086,900	$0	$239,847,400	$430,752,600	$0	$938,935,600	$0	$0	$0	$48,744,900	$1,667,367,400
12ft TWL	Land Value	$9,086,900	$0	$110,691,600	$219,836,000	$0	$933,435,600	$0	$0	$0	$23,956,300	$1,297,006,400
	Improvement Value	$0	$0	$129,155,800	$210,916,600	$0	$5,500,000	$0	$0	$0	$30,836,700	$376,409,100
	Net Value	$9,086,900	$0	$239,847,400	$430,752,600	$0	$938,935,600	$0	$0	$0	$48,744,900	$1,667,367,400

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.

Meadowlands District, Parcel Analysis Tables by Municipality

Jersey City		1 Vacant	2 Residential	4A Commercial	4B Industrial	4C Apartment	15A/B/C Schools/ Public	15d Churches/ Charities	15F Other Exempt	Other	No Class Data	Total
2ft TWL	Land Value	$7,509,700	$0	$2,820,000	$0	$0	$26,750,100	$0	$0	$0	$0	$37,079,800
	Improvement Value	$0	$0	$107,300	$0	$0	$326,600	$0	$0	$0	$0	$433,900
	Net Value	$7,509,700	$0	$2,927,300	$0	$0	$27,076,700	$0	$0	$0	$0	$37,513,700
3ft TWL	Land Value	$7,662,700	$0	$3,315,000	$0	$0	$105,617,100	$0	$0	$0	$0	$116,594,800
	Improvement Value	$0	$0	$113,800	$0	$0	$18,121,800	$0	$0	$0	$0	$18,235,600
	Net Value	$7,662,700	$0	$3,428,800	$0	$0	$123,738,900	$0	$0	$0	$0	$134,830,400
5ft TWL	Land Value	$12,761,900	$0	$5,569,900	$36,089,000	$0	$139,218,300	$0	$0	$0	$0	$193,639,100
	Improvement Value	$0	$0	$173,500	$13,841,200	$0	$38,099,700	$0	$0	$0	$0	$52,114,400
	Net Value	$12,761,900	$0	$5,743,400	$49,930,200	$0	$177,318,000	$0	$0	$0	$0	$245,753,500
7ft TWL	Land Value	$30,491,900	$0	$5,979,900	$74,973,400	$0	$146,537,100	$0	$0	$0	$0	$257,982,300
	Improvement Value	$0	$0	$445,900	$20,859,300	$0	$38,112,100	$0	$0	$0	$0	$59,417,300
	Net Value	$30,491,900	$0	$6,425,800	$95,832,700	$0	$184,649,200	$0	$0	$0	$0	$317,399,600
8ft TWL	Land Value	$30,491,900	$0	$7,372,700	$109,092,400	$0	$147,842,100	$0	$0	$0	$0	$294,799,100
	Improvement Value	$0	$0	$577,200	$48,045,800	$0	$38,112,100	$0	$0	$0	$0	$86,735,100
	Net Value	$30,491,900	$0	$7,949,900	$157,138,200	$0	$185,954,200	$0	$0	$0	$0	$381,534,200
10ft TWL	Land Value	$30,491,900	$0	$7,372,700	$110,436,400	$0	$156,419,100	$0	$0	$0	$0	$304,720,100
	Improvement Value	$0	$0	$577,200	$50,145,500	$0	$38,112,100	$0	$0	$0	$0	$88,834,800
	Net Value	$30,491,900	$0	$7,949,900	$160,581,900	$0	$194,531,200	$0	$0	$0	$0	$393,554,900
12ft TWL	Land Value	$30,997,000	$0	$7,372,700	$112,632,400	$0	$156,706,600	$0	$0	$0	$0	$307,708,700
	Improvement Value	$0	$0	$577,200	$50,766,900	$0	$38,112,100	$0	$0	$0	$0	$89,456,200
	Net Value	$30,997,000	$0	$7,949,900	$163,399,300	$0	$194,818,700	$0	$0	$0	$0	$397,164,900

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.

Meadowlands District, Parcel Analysis Tables by Municipality

Kearny		1 Vacant	2 Residential	4A Commercial	4B Industrial	4C Apartment	15A/B/C Schools/ Public	15d Churches/ Charities	15F Other Exempt	Other	No Class Data	Total
2ft TWL	Land Value	$1,730,600	$0	$0	$2,864,800	$0	$48,648,300	$0	$9,935,200	$2,705,900	$1,794,200	$67,679,000
	Improvement Value	$0	$0	$0	$2,303,400	$0	$140,000	$0	$0	$0	$4,000	$2,447,400
	Net Value	$1,730,600	$0	$0	$5,168,200	$0	$48,788,300	$0	$9,935,200	$2,705,900	$1,798,200	$70,126,400
3ft TWL	Land Value	$2,558,200	$0	$0	$8,999,400	$0	$48,974,300	$0	$10,005,300	$3,337,300	$1,993,200	$75,867,700
	Improvement Value	$0	$0	$0	$12,633,300	$0	$140,000	$0	$0	$0	$4,000	$12,777,300
	Net Value	$2,558,200	$0	$0	$21,632,700	$0	$49,114,300	$0	$10,005,300	$3,337,300	$1,997,200	$88,645,000
5ft TWL	Land Value	$3,546,100	$0	$226,000	$15,567,400	$0	$52,704,800	$0	$11,613,100	$7,223,300	$2,297,100	$93,177,800
	Improvement Value	$0	$0	$30,000	$30,251,000	$0	$166,400	$0	$0	$0	$21,000	$30,468,400
	Net Value	$3,546,100	$0	$256,000	$45,818,400	$0	$52,871,200	$0	$11,613,100	$7,223,300	$2,318,100	$123,646,200
7ft TWL	Land Value	$6,263,700	$0	$226,000	$20,619,000	$0	$53,384,900	$0	$22,973,600	$14,894,600	$2,646,200	$121,008,000
	Improvement Value	$0	$0	$30,000	$35,075,100	$0	$166,400	$0	$0	$78,000,000	$21,000	$113,292,500
	Net Value	$6,263,700	$0	$256,000	$55,694,100	$0	$53,551,300	$0	$22,973,600	$92,894,600	$2,667,200	$234,300,500
8ft TWL	Land Value	$6,872,300	$0	$5,167,000	$20,619,000	$0	$53,648,800	$0	$22,973,600	$14,894,600	$2,955,300	$127,130,600
	Improvement Value	$0	$0	$2,293,600	$35,075,100	$0	$166,400	$0	$0	$78,000,000	$21,000	$115,556,100
	Net Value	$6,872,300	$0	$7,460,600	$55,694,100	$0	$53,815,200	$0	$22,973,600	$92,894,600	$2,976,300	$242,686,700
10ft TWL	Land Value	$9,642,300	$0	$5,167,000	$21,231,500	$0	$54,280,400	$0	$23,396,000	$14,980,900	$2,955,300	$131,653,400
	Improvement Value	$0	$0	$2,293,600	$40,031,800	$0	$166,400	$0	$0	$78,000,000	$21,000	$120,512,800
	Net Value	$9,642,300	$0	$7,460,600	$61,263,300	$0	$54,446,800	$0	$23,396,000	$92,980,900	$2,976,300	$252,166,200
12ft TWL	Land Value	$10,214,800	$0	$5,167,000	$21,231,500	$0	$54,478,000	$0	$23,396,000	$15,312,400	$2,955,300	$132,755,000
	Improvement Value	$0	$0	$2,293,600	$40,031,800	$0	$166,400	$0	$0	$78,000,000	$21,000	$120,512,800
	Net Value	$10,214,800	$0	$7,460,600	$61,263,300	$0	$54,644,400	$0	$23,396,000	$93,312,400	$2,976,300	$253,267,800

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.

Meadowlands District, Parcel Analysis Tables by Municipality

Little Ferry		1 Vacant	2 Residential	4A Commercial	4B Industrial	4C Apartment	15A/B/C Schools/ Public	15d Churches/ Charities	15F Other Exempt	Other	No Class Data	Total
2ft TWL	Land Value	$123,300	$35,418,900	$263,300	$7,600,100	$0	$56,175,700	$0	$296,900	$0	$0	$99,878,200
	Improvement Value	$0	$42,981,300	$114,500	$10,976,200	$0	$301,634,600	$0	$288,700	$0	$0	$355,995,300
	Net Value	$123,300	$78,400,200	$377,800	$18,576,300	$0	$357,810,300	$0	$585,600	$0	$0	$455,873,500
3ft TWL	Land Value	$1,049,400	$46,040,400	$1,290,000	$12,100,900	$0	$56,175,700	$0	$296,900	$0	$340,500	$117,293,800
	Improvement Value	$0	$57,268,100	$2,481,600	$23,662,100	$0	$301,634,600	$0	$288,700	$0	$65,900	$385,401,000
	Net Value	$1,049,400	$103,308,500	$3,771,600	$35,763,000	$0	$357,810,300	$0	$585,600	$0	$406,400	$502,694,800
5ft TWL	Land Value	$2,865,900	$51,863,500	$2,352,300	$20,018,900	$449,300	$56,793,400	$0	$296,900	$0	$340,500	$134,980,700
	Improvement Value	$0	$66,829,800	$4,254,300	$42,634,400	$1,091,500	$301,898,100	$0	$288,700	$0	$65,900	$417,062,700
	Net Value	$2,865,900	$118,693,300	$6,606,600	$62,653,300	$1,540,800	$358,691,500	$0	$585,600	$0	$406,400	$552,043,400
7ft TWL	Land Value	$2,865,900	$51,863,500	$4,118,600	$22,488,900	$449,300	$56,793,400	$0	$296,900	$0	$340,500	$139,217,000
	Improvement Value	$0	$66,829,800	$7,644,000	$54,126,700	$1,091,500	$301,898,100	$0	$288,700	$0	$65,900	$431,944,700
	Net Value	$2,865,900	$118,693,300	$11,762,600	$76,615,600	$1,540,800	$358,691,500	$0	$585,600	$0	$406,400	$571,161,700
8ft TWL	Land Value											
	Improvement Value											
	Net Value											
10ft TWL	Land Value											
	Improvement Value											
	Net Value											
12ft TWL	Land Value											
	Improvement Value											
	Net Value											

Same as 7ft TWL

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.

Meadowlands District, Parcel Analysis Tables by Municipality

Lyndhurst		1 Vacant	2 Residential	4A Commercial	4B Industrial	4C Apartment	15A/B/C Schools/ Public	15d Churches/ Charities	15F Other Exempt	Other	No Class Data	Total
2ft TWL	Land Value	$2,825,300	$0	$0	$7,946,800	$0	$82,251,000	$0	$0	$0	$43,566,800	$136,589,900
	Improvement Value	$0	$0	$0	$630,300	$0		$0	$0	$0	$740,700	$1,371,000
	Net Value	$2,825,300	$0	$0	$8,577,100	$0	$82,251,000	$0	$0	$0	$44,307,500	$137,960,900
3ft TWL	Land Value	$2,825,300	$0	$5,396,000	$7,946,800	$0	$99,681,000	$0	$0	$0	$153,241,700	$269,090,800
	Improvement Value	$0	$0	$2,623,800	$630,300	$0		$0	$0	$0	$46,907,300	$50,161,400
	Net Value	$2,825,300	$0	$8,019,800	$8,577,100	$0	$99,681,000	$0	$0	$0	$200,149,000	$319,252,200
5ft TWL	Land Value	$4,181,300	$12,000,000	$15,146,000	$45,013,200	$0	$111,861,000	$0	$0	$0	$235,891,900	$424,093,400
	Improvement Value	$0	$2,409,400	$13,087,400	$17,668,900	$0	$11,220,700	$0	$0	$0	$104,832,700	$149,219,100
	Net Value	$4,181,300	$14,409,400	$28,233,400	$62,682,100	$0	$123,081,700	$0	$0	$0	$340,724,600	$573,312,500
7ft TWL	Land Value	$8,816,800	$12,000,000	$36,256,000	$53,830,800	$5,800,000	$118,811,000	$0	$0	$0	$253,591,900	$489,106,500
	Improvement Value	$0	$2,409,400	$28,827,400	$21,447,500	$59,800,000	$11,220,700	$0	$0	$0	$109,564,300	$233,269,300
	Net Value	$8,816,800	$14,409,400	$65,083,400	$75,278,300	$65,600,000	$130,031,700	$0	$0	$0	$363,156,200	$722,375,800
8ft TWL	Land Value	$10,905,400	$12,000,000	$36,256,000	$53,830,800	$5,800,000	$118,811,000	$0	$0	$0	$253,591,900	$491,195,100
	Improvement Value	$0	$2,409,400	$28,827,400	$21,447,500	$59,800,000	$11,220,700	$0	$0	$0	$109,564,300	$233,269,300
	Net Value	$10,905,400	$14,409,400	$65,083,400	$75,278,300	$65,600,000	$130,031,700	$0	$0	$0	$363,156,200	$724,464,400
10ft TWL	Land Value	$12,976,700	$12,000,000	$36,256,000	$54,850,600	$5,800,000	$118,811,000	$0	$0	$0	$264,456,700	$505,151,000
	Improvement Value	$0	$2,409,400	$28,827,400	$21,948,500	$59,800,000	$11,220,700	$0	$0	$0	$116,514,100	$240,720,100
	Net Value	$12,976,700	$14,409,400	$65,083,400	$76,799,100	$65,600,000	$130,031,700	$0	$0	$0	$380,970,800	$745,871,100
12ft TWL	Land Value	$15,422,900	$12,000,000	$36,256,000	$54,850,600	$5,800,000	$118,811,000	$0	$0	$0	$291,636,700	$534,777,200
	Improvement Value	$0	$2,409,400	$28,827,400	$21,948,500	$59,800,000	$11,220,700	$0	$0	$0	$118,811,900	$243,017,900
	Net Value	$15,422,900	$14,409,400	$65,083,400	$76,799,100	$65,600,000	$130,031,700	$0	$0	$0	$410,448,600	$777,795,100

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.

Meadowlands District, Parcel Analysis Tables by Municipality

Moonachie		1 Vacant	2 Residential	4A Commercial	4B Industrial	4C Apartment	15A/B/C Schools/ Public	15d Churches/ Charities	15F Other Exempt	Other	No Class Data	Total
2ft TWL	Land Value	$3,457,500	$4,895,600	$8,642,400	$45,988,400	$0	$359,500	$0	$176,800,000	$0	$0	$240,143,400
	Improvement Value	$0	$7,751,600	$12,036,200	$144,649,900	$0	$133,900	$0	$0	$0	$0	$164,571,600
	Net Value	$3,457,500	$12,647,200	$20,678,600	$190,638,300	$0	$493,400	$0	$176,800,000	$0	$0	$404,715,000
3ft TWL	Land Value	$3,480,100	$9,655,400	$13,935,500	$89,103,500	$0	$1,043,200	$351,200	$177,069,500	$0	$0	$294,638,400
	Improvement Value	$0	$14,768,000	$38,319,400	$315,864,200	$0	$147,300	$284,100	$0	$0	$0	$369,383,000
	Net Value	$3,480,100	$24,423,400	$52,254,900	$404,967,700	$0	$1,190,500	$635,300	$177,069,500	$0	$0	$664,021,400
5ft TWL	Land Value	$3,480,100	$13,984,600	$14,151,300	$105,304,600	$0	$1,775,200	$351,200	$181,345,700	$0	$0	$320,392,700
	Improvement Value	$0	$20,665,700	$38,571,800	$374,842,600	$0	$147,300	$284,100	$381,700	$0	$0	$434,893,200
	Net Value	$3,480,100	$34,650,300	$52,723,100	$480,147,200	$0	$1,922,500	$635,300	$181,727,400	$0	$0	$755,285,900
7ft TWL	Land Value											
	Improvement Value											
	Net Value											
8ft TWL	Land Value											
	Improvement Value											
	Net Value											
10ft TWL	Land Value											
	Improvement Value											
	Net Value											
12ft TWL	Land Value											
	Improvement Value											
	Net Value											

Same as 5ft TWL

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.

Meadowlands District, Parcel Analysis Tables by Municipality

North Arlington		1 Vacant	2 Residential	4A Commercial	4B Industrial	4C Apartment	15A/B/C Schools/ Public	15d Churches/ Charities	15F Other Exempt	Other	No Class Data	Total
2ft TWL	Land Value	$400,000	$0	$0	$0	$0	$26,943,900	$0	$0	$0	$0	$27,343,900
	Improvement Value	$0	$0	$0	$0	$0		$0	$0	$0	$0	$0
	Net Value	$400,000	$0	$0	$0	$0	$26,943,900	$0	$0	$0	$0	$27,343,900
3ft TWL	Land Value	$400,000	$0	$0	$0	$0	$26,943,900	$0	$0	$0	$0	$27,343,900
	Improvement Value	$0	$0	$0	$0	$0		$0	$0	$0	$0	$0
	Net Value	$400,000	$0	$0	$0	$0	$26,943,900	$0	$0	$0	$0	$27,343,900
5ft TWL	Land Value	**Same as 3ft TWL**										
	Improvement Value											
	Net Value											
7ft TWL	Land Value	$400,000	$0	$174,000	$0	$0	$31,515,700	$0	$0	$0	$0	$32,089,700
	Improvement Value	$0	$0	$443,600	$0	$0	$2,364,500	$0	$0	$0	$0	$2,808,100
	Net Value	$400,000	$0	$617,600	$0	$0	$33,880,200	$0	$0	$0	$0	$34,897,800
8ft TWL	Land Value	$400,000	$0	$174,000	$0	$0	$34,445,900	$0	$0	$0	$0	$35,019,900
	Improvement Value	$0	$0	$443,600	$0	$0	$4,739,600	$0	$0	$0	$0	$5,183,200
	Net Value	$400,000	$0	$617,600	$0	$0	$39,185,500	$0	$0	$0	$0	$40,203,100
10ft TWL	Land Value	**Same as 8ft TWL**										
	Improvement Value											
	Net Value											
12ft TWL	Land Value											
	Improvement Value											
	Net Value											

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.

Meadowlands District, Parcel Analysis Tables by Municipality

North Bergen		1 Vacant	2 Residential	4A Commercial	4B Industrial	4C Apartment	15A/B/C Schools/ Public	15d Churches/ Charities	15F Other Exempt	Other	No Class Data	Total
2ft TWL	Land Value	$5,361,100	$0	$0	$34,725,000	$0	$13,204,000	$0	$10,534,400	$0	$0	$63,824,500
	Improvement Value	$0	$0	$0	$27,773,100	$0	$0	$0	$0	$0	$0	$27,773,100
	Net Value	$5,361,100	$0	$0	$62,498,100	$0	$13,204,000	$0	$10,534,400	$0	$0	$91,597,600
3ft TWL	Land Value	$5,361,100	$0	$18,956,000	$168,971,400	$0	$13,204,000	$0	$10,614,500	$1,387,800	$1,138,000	$219,632,800
	Improvement Value	$0	$0	$2,010,700	$124,292,200	$0	$0	$0	$0	$0	$0	$126,302,900
	Net Value	$5,361,100	$0	$20,966,700	$293,263,600	$0	$13,204,000	$0	$10,614,500	$1,387,800	$1,138,000	$345,935,700
5ft TWL	Land Value	$15,361,100	$0	$54,819,000	$293,043,400	$0	$13,594,000	$0	$28,314,500	$4,624,800	$8,108,000	$417,864,800
	Improvement Value	$0	$0	$46,863,500	$319,089,600	$0	$0	$0	$471,400		$422,500	$366,847,000
	Net Value	$15,361,100	$0	$101,682,500	$612,133,000	$0	$13,594,000	$0	$28,785,900	$4,624,800	$8,530,500	$784,711,800
7ft TWL	Land Value	$18,498,100	$0	$81,223,000	$335,348,400	$0	$13,594,000	$0	$38,389,500	$8,801,800	$8,108,000	$503,962,800
	Improvement Value	$0	$0	$140,344,700	$406,949,100	$0	$0	$0	$1,212,000	$490,000	$422,500	$549,418,300
	Net Value	$18,498,100	$0	$221,567,700	$742,297,500	$0	$13,594,000	$0	$39,601,500	$9,291,800	$8,530,500	$1,053,381,100
8ft TWL	Land Value	$18,498,100	$0	$81,223,000	$361,798,400	$0	$13,594,000	$0	$64,459,500	$8,801,800	$8,108,000	$556,482,800
	Improvement Value	$0	$0	$140,344,700	$673,831,800	$0	$0	$0	$8,511,200	$490,000	$422,500	$823,600,200
	Net Value	$18,498,100	$0	$221,567,700	$1,035,630,200	$0	$13,594,000	$0	$72,970,700	$9,291,800	$8,530,500	$1,380,083,000
10ft TWL	Land Value	$22,422,000	$0	$81,223,000	$382,216,400	$0	$13,594,000	$0	$64,459,500	$12,947,800	$8,108,000	$584,970,700
	Improvement Value	$0	$0	$140,344,700	$705,182,600	$0	$0	$0	$8,511,200	$490,000	$422,500	$854,951,000
	Net Value	$22,422,000	$0	$221,567,700	$1,087,399,000	$0	$13,594,000	$0	$72,970,700	$13,437,800	$8,530,500	$1,439,921,700
12ft TWL	Land Value	$36,049,000	$0	$81,223,000	$382,216,400	$0	$13,594,000	$0	$65,379,500	$12,947,800	$8,108,000	$599,517,700
	Improvement Value	$0	$0	$140,344,700	$705,182,600	$0	$0	$0	$8,511,200	$490,000	$422,500	$854,951,000
	Net Value	$36,049,000	$0	$221,567,700	$1,087,399,000	$0	$13,594,000	$0	$73,890,700	$13,437,800	$8,530,500	$1,454,468,700

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.

Meadowlands District, Parcel Analysis Tables by Municipality

Ridgefield		1 Vacant	2 Residential	4A Commercial	4B Industrial	4C Apartment	15A/B/C Schools/ Public	15d Churches/ Charities	15F Other Exempt	Other	No Class Data	Total
2ft TWL	Land Value	$1,110,000	$210,900	$1,705,000	$12,787,800	$0	$84,400	$0	$1,424,800	$0	$0	$17,322,900
	Improvement Value	$0	$260,900	$835,000	$961,300	$0	$0	$0	$0	$0	$0	$2,057,200
	Net Value	$1,110,000	$471,800	$2,540,000	$13,749,100	$0	$84,400	$0	$1,424,800	$0	$0	$19,380,100
3ft TWL	Land Value	$5,417,000	$210,900	$9,595,500	$18,718,500	$0	$84,400	$0	$1,424,800	$0	$964,000	$36,415,100
	Improvement Value	$0	$260,900	$33,472,900	$5,887,800	$0	$0	$0	$0	$0	$1,350,000	$40,971,600
	Net Value	$5,417,000	$471,800	$43,068,400	$24,606,300	$0	$84,400	$0	$1,424,800	$0	$2,314,000	$77,386,700
5ft TWL	Land Value	$5,444,000	$210,900	$15,490,300	$56,174,200	$0	$84,400	$0	$1,424,800	$59,688,900	$2,049,000	$140,566,500
	Improvement Value	$0	$260,900	$37,576,900	$26,658,900	$0	$0	$0	$0	$350,000	$1,850,000	$66,696,700
	Net Value	$5,444,000	$471,800	$53,067,200	$82,833,100	$0	$84,400	$0	$1,424,800	$60,038,900	$3,899,000	$207,263,200
7ft TWL	Land Value	$5,444,000	$210,900	$15,490,300	$69,454,900	$0	$137,600	$0	$45,500,000	$59,688,900	$2,049,000	$197,975,600
	Improvement Value	$0	$260,900	$37,576,900	$62,288,700	$0	$0	$0	$2,418,500	$350,000	$1,850,000	$104,745,000
	Net Value	$5,444,000	$471,800	$53,067,200	$131,743,600	$0	$137,600	$0	$47,918,500	$60,038,900	$3,899,000	$302,720,600
8ft TWL	Land Value	$5,444,000	$210,900	$15,490,300	$69,454,900	$0	$137,600	$0	$45,620,000	$59,688,900	$2,049,000	$198,095,600
	Improvement Value	$0	$260,900	$37,576,900	$62,288,700	$0	$0	$0	$2,418,500	$350,000	$1,850,000	$104,745,000
	Net Value	$5,444,000	$471,800	$53,067,200	$131,743,600	$0	$137,600	$0	$48,038,500	$60,038,900	$3,899,000	$302,840,600
10ft TWL	Land Value Improvement Value Net Value	**Same as 8ft TWL**										
12ft TWL	Land Value	$5,444,000	$210,900	$15,490,300	$70,249,900	$0	$137,600	$0	$45,620,000	$59,688,900	$2,049,000	$198,890,600
	Improvement Value	$0	$260,900	$37,576,900	$65,927,600	$0	$0	$0	$2,418,500	$350,000	$1,850,000	$108,383,900
	Net Value	$5,444,000	$471,800	$53,067,200	$136,177,500	$0	$137,600	$0	$48,038,500	$60,038,900	$3,899,000	$307,274,500

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.

Meadowlands District, Parcel Analysis Tables by Municipality

Rutherford		1 Vacant	2 Residential	4A Commercial	4B Industrial	4C Apartment	15A/B/C Schools/ Public	15d Churches/ Charities	15F Other Exempt	Other	No Class Data	Total
2ft TWL	Land Value	$2,099,200	$0	$3,923,500	$18,367,600	$0	$7,758,600	$0	$0	$0	$10,182,000	$42,330,900
	Improvement Value	$0	$0	$8,459,000	$28,173,600	$0	$0	$0	$0	$0	$21,043,000	$57,675,600
	Net Value	$2,099,200	$0	$12,382,500	$46,541,200	$0	$7,758,600	$0	$0	$0	$31,225,000	$100,006,500
3ft TWL	Land Value	$2,099,200	$0	$3,923,500	$23,374,600	$0	$7,758,600	$0	$0	$0	$10,182,000	$47,337,900
	Improvement Value	$0	$0	$8,459,000	$37,812,700	$0	$0	$0	$0	$0	$21,043,000	$67,314,700
	Net Value	$2,099,200	$0	$12,382,500	$61,187,300	$0	$7,758,600	$0	$0	$0	$31,225,000	$114,652,600
5ft TWL	Land Value	$3,320,400	$0	$9,169,500	$26,560,600	$0	$10,346,600	$0	$0	$0	$10,182,000	$59,579,100
	Improvement Value	$0	$0	$42,413,000	$46,402,100	$0	$0	$0	$0	$0	$21,043,000	$109,858,100
	Net Value	$3,320,400	$0	$51,582,500	$72,962,700	$0	$10,346,600	$0	$0	$0	$31,225,000	$169,437,200
7ft TWL	Land Value	$3,320,400	$0	$9,169,500	$27,100,600	$0	$10,783,800	$0	$0	$0	$10,182,000	$60,556,300
	Improvement Value	$0	$0	$42,413,000	$46,737,100	$0	$203,400	$0	$0	$0	$21,043,000	$110,396,500
	Net Value	$3,320,400	$0	$51,582,500	$73,837,700	$0	$10,987,200	$0	$0	$0	$31,225,000	$170,952,800
8ft TWL	Land Value	$3,320,400	$0	$9,169,500	$27,100,600	$0	$10,783,800	$0	$0	$0	$10,182,000	$60,556,300
	Improvement Value	$0	$0	$42,413,000	$46,737,100	$0	$203,400	$0	$0	$0	$21,043,000	$110,396,500
	Net Value	$3,320,400	$0	$51,582,500	$73,837,700	$0	$10,987,200	$0	$0	$0	$31,225,000	$170,952,800
10ft TWL	Land Value	**Same as 8ft TWL**										
	Improvement Value											
	Net Value											
12ft TWL	Land Value											
	Improvement Value											
	Net Value											

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.

Meadowlands District, Parcel Analysis Tables by Municipality

Secaucus		1 Vacant	2 Residential	4A Commercial	4B Industrial	4C Apartment	15A/B/C Schools/ Public	15d Churches/ Charities	15F Other Exempt	Other	No Class Data	Total
2ft TWL	Land Value	$18,578,200	$1,433,200	$457,100	$1,743,400	$0	$33,919,100	$0	$18,819,700	$0	$867,800	$75,818,500
	Improvement Value	$0	$1,166,600	$664,200	$1,248,800	$0	$3,240,700	$0	$158,600	$0	$154,200	$6,633,100
	Net Value	$18,578,200	$2,599,800	$1,121,300	$2,992,200	$0	$37,159,800	$0	$18,978,300	$0	$1,022,000	$82,451,600
3ft TWL	Land Value	$22,093,000	$5,428,300	$8,764,000	$7,749,200	$829,200	$42,393,600	$600,000	$19,023,800	$0	$969,300	$107,850,400
	Improvement Value	$0	$7,686,300	$6,154,500	$6,475,500	$7,692,100	$28,088,100	$5,000,000	$632,100	$0	$244,700	$61,973,300
	Net Value	$22,093,000	$13,114,600	$14,918,500	$14,224,700	$8,521,300	$70,481,700	$5,600,000	$19,655,900	$0	$1,214,000	$169,823,700
5ft TWL	Land Value	$29,844,200	$27,168,000	$57,244,100	$92,369,000	$3,029,200	$46,669,300	$600,000	$20,516,300	$0	$5,531,700	$282,971,800
	Improvement Value	$0	$39,876,700	$150,255,800	$223,298,100	$10,992,100	$30,807,600	$5,000,000	$1,149,700	$0	$12,388,900	$473,768,900
	Net Value	$29,844,200	$67,044,700	$207,499,900	$315,667,100	$14,021,300	$77,476,900	$5,600,000	$21,666,000	$0	$17,920,600	$756,740,700
7ft TWL	Land Value	$32,133,800	$36,435,200	$141,766,700	$157,249,900	$3,029,200	$50,533,900	$600,000	$26,004,600	$0	$6,310,200	$454,063,500
	Improvement Value	$0	$53,671,100	$520,805,200	$459,974,400	$10,992,100	$38,525,200	$5,000,000	$9,390,100	$0	$14,165,400	$1,112,523,500
	Net Value	$32,133,800	$90,106,300	$662,571,900	$617,224,300	$14,021,300	$89,059,100	$5,600,000	$35,394,700	$0	$20,475,600	$1,566,587,000
8ft TWL	Land Value	$33,275,300	$39,366,300	$144,886,400	$167,691,200	$4,029,200	$78,732,800	$600,000	$26,271,400	$0	$6,310,200	$501,162,800
	Improvement Value	$0	$57,178,400	$534,956,000	$481,307,900	$22,762,900	$38,568,800	$5,000,000	$9,390,100	$0	$14,165,400	$1,163,329,500
	Net Value	$33,275,300	$96,544,700	$679,842,400	$648,999,100	$26,792,100	$117,301,600	$5,600,000	$35,661,500	$0	$20,475,600	$1,664,492,300
10ft TWL	Land Value	$34,794,000	$45,010,900	$159,131,500	$178,347,900	$7,223,100	$78,782,800	$600,000	$26,808,600	$0	$24,805,100	$555,503,900
	Improvement Value	$0	$63,714,800	$683,682,600	$514,164,900	$47,494,000	$38,568,800	$5,000,000	$9,647,800	$0	$14,433,000	$1,376,705,900
	Net Value	$34,794,000	$108,725,700	$842,814,100	$692,512,800	$54,717,100	$117,351,600	$5,600,000	$36,456,400	$0	$39,238,100	$1,932,209,800
12ft TWL	Land Value	$36,395,100	$47,866,100	$159,989,600	$180,825,200	$7,223,100	$78,782,800	$600,000	$32,376,400	$0	$24,805,100	$568,863,400
	Improvement Value	$0	$67,697,400	$684,770,900	$523,343,600	$47,494,000	$38,568,800	$5,000,000	$9,647,800	$0	$14,433,000	$1,390,955,500
	Net Value	$36,395,100	$115,563,500	$844,760,500	$704,168,800	$54,717,100	$117,351,600	$5,600,000	$42,024,200	$0	$39,238,100	$1,959,818,900

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.

Meadowlands District, Parcel Analysis Tables by Municipality

South Hackensack		1 Vacant	2 Residential	4A Commercial	4B Industrial	4C Apartment	15A/B/C Schools/ Public	15d Churches/ Charities	15F Other Exempt	Other	No Class Data	Total
2ft TWL	Land Value	$0	$0	$0	$10,003,500	$0	$5,037,000	$0	$0	$0	$0	$15,040,500
	Improvement Value	$0	$0	$0	$81,528,100	$0	$0	$0	$0	$0	$0	$81,528,100
	Net Value	$0	$0	$0	$91,531,600	$0	$5,037,000	$0	$0	$0	$0	$96,568,600
3ft TWL	Land Value	$0	$0	$859,000	$11,747,500	$0	$5,037,000	$0	$0	$0	$0	$17,643,500
	Improvement Value	$0	$0	$10,558,100	$100,116,900	$0	$0	$0	$0	$0	$0	$110,675,000
	Net Value	$0	$0	$11,417,100	$111,864,400	$0	$5,037,000	$0	$0	$0	$0	$128,318,500
5ft TWL	Land Value											
	Improvement Value											
	Net Value											
7ft TWL	Land Value											
	Improvement Value											
	Net Value											
8ft TWL	Land Value											
	Improvement Value											
	Net Value											
10ft TWL	Land Value											
	Improvement Value											
	Net Value											
12ft TWL	Land Value											
	Improvement Value											
	Net Value											

Same as 3ft TWL

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.

Meadowlands District, Parcel Analysis Tables by Municipality

Teterboro		1 Vacant	2 Residential	4A Commercial	4B Industrial	4C Apartment	15A/B/C Schools/ Public	15d Churches/ Charities	15F Other Exempt	Other	No Class Data	Total
2ft TWL	Land Value	$0	$0	$0	$5,577,020	$0	$16,900	$0	$232,065,100	$0	$0	$237,659,020
	Improvement Value	$0	$0	$0	$15,508,383	$0	$10,000	$0	$130,310,000	$0	$0	$145,828,383
	Net Value	$0	$0	$0	$21,085,403	$0	$26,900	$0	$362,375,100	$0	$0	$383,487,403
3ft TWL	Land Value	$0	$0	$500,000	$11,767,320	$0	$401,000	$0	$234,036,100	$0	$0	$246,704,420
	Improvement Value	$0	$0	$830,300	$26,377,483	$2,268,600	$35,000	$0	$131,105,000	$0	$0	$160,616,383
	Net Value	$0	$0	$1,330,300	$38,144,803	$2,268,600	$436,000	$0	$365,141,100	$0	$0	$407,320,803
5ft TWL	Land Value	$84,000	$0	$750,000	$12,017,320	$0	$10,316,800	$0	$234,036,100	$0	$450,000	$257,654,220
	Improvement Value	$0	$0	$1,381,900	$27,180,983	$2,268,600	$1,835,000	$0	$131,105,000	$0	$0	$163,771,483
	Net Value	$84,000	$0	$2,131,900	$39,198,303	$2,268,600	$12,151,800	$0	$365,141,100	$0	$450,000	$421,425,703
7ft TWL	Land Value	$84,000	$0	$750,000	$12,017,320	$0	$10,337,800	$0	$234,036,100	$0	$450,000	$257,675,220
	Improvement Value	$0	$0	$1,381,900	$27,180,983	$2,268,600	$1,835,000	$0	$131,105,000	$0	$0	$163,771,483
	Net Value	$84,000	$0	$2,131,900	$39,198,303	$2,268,600	$12,172,800	$0	$365,141,100	$0	$450,000	$421,446,703
8ft TWL	Land Value											
	Improvement Value											
	Net Value											
10ft TWL	Land Value											
	Improvement Value						**Same as 7ft TWL**					
	Net Value											
12ft TWL	Land Value											
	Improvement Value											
	Net Value											

Notes: Damages for each TWL are cumulative, and therefore include damages from previous TWLs, but are not the sum of damages recorded for previous TWLs.
Due to Missing MOD-IV data for a significant number of parcels, monetary damages are likely underestimated.

APPENDIX D.2 Affordable Housing Risk Map

Affordable Housing & Projected Flooding Inundation

511 Affordable Housing Stock within Meadowlands District (2004-2018)					Risk based on Zonal Statistics and Tabulate Intersection		
Percentage of Total Affordable Housing in the District	Affordable Units	Residential Building	Municipality	Total Units in Building	5 ft SLR permanent inundation	% Ground Level Inundated by 100-yr Flood in 2100	Precipitation Flood Vulnerability PFV (1-9)
61%	94	The Harper at Harmon Meadow	Secaucus	469	40%	87%	7.6
	64	Xchange (Fraternity Meadows) Bldg. C	Secaucus	304	0%	68%	8.2
	60	Vermella	Lyndhurst	296	0%	0%	6.9
	48	Xchange (Fraternity Meadows) Bldg. D	Secaucus	318	0%	69%	8.1
	44	The Winston at Lyndhurst	Lyndhurst	218	63%	98%	7.4
36%	39	The Station at Lyndhurst	Lyndhurst	192	8%	41%	7.4
	38	Xchange (Fraternity Meadows) Bldg. A	Secaucus	178	0%	68%	8.1
	38	Xchange (Fraternity Meadows) Blgd. K	Secaucus	160	0%	68%	8.1
	32	The Monarch	East Rutherford	316	0%	100%	8.0
	24	Osprey Cove	Secaucus	116	0%	100%	8.0
	13	Osprey Cove II	Secaucus	62	0%	100%	8.0
3%	8	**Secaucus Housing Authority	Secaucus	8	0%	0%	8.0
	7	Axis Development Townhouses	Secaucus	35	0%	0%	0%
	2	**City View Townhomes	Secaucus	14	0%	0%	6.0
	0	Xchange (Fraternity Meadows) Bldg. I &	Secaucus	588	0%	64%	8.0
	0	The Union (Avalon Bay)	Lyndhurst	328	17%	100%	7.0
	0	Sussex Green	Secaucus	26	0%	0%	0%
	0	Riverside Court Townhomes	Secaucus	212	0%	0%	0%
	0	Liberty Court Townhomes	Secaucus	12	0%	0%	0%
	0	City Homes at Creekside Manor	Secaucus	43	0%	0%	0%
			Total =	3,895			

**Affordable Units located within Overburdened Communities (OBC)

Source: Figure 4.13 NJSEA 2020 Master Plan (p. 4-15)

LEGEND: Affordable units | Industrial / Commercial / Residential Buildings | Flood | Overburdened Community

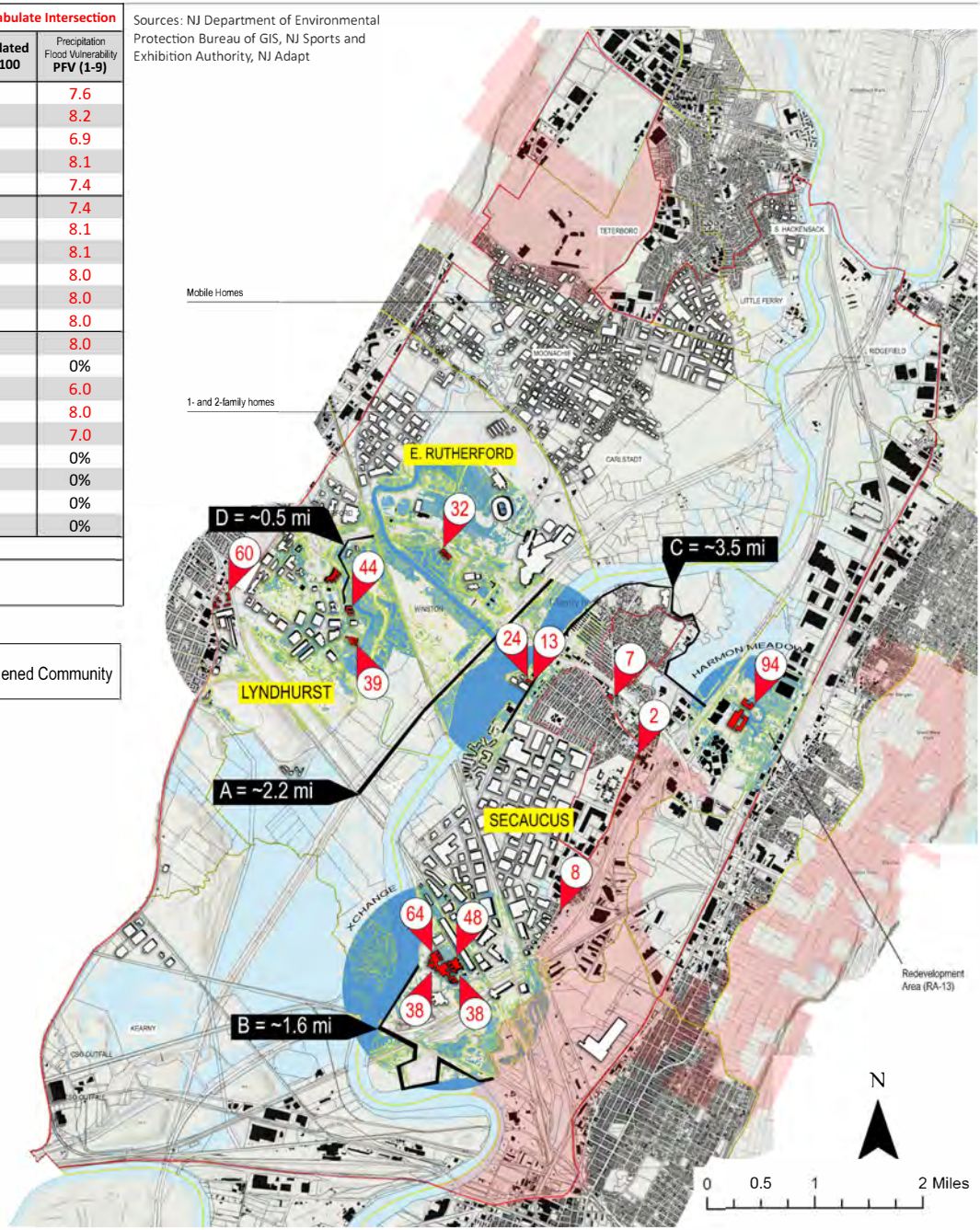
Berms proposed by Rebuild by Design for Mitigating Flood

- A = ~2.2 mi — Berms along I-95 could protect The Vermella, The Winston, and The Station
- B = ~1.6 mi — Berms along Hackensack Riverfront could protect The XChange
- C = ~3.5 mi — Berms along Hackensack Riverfront could protect Secaucus neighborhoods
- D = ~0.5 mi — Berms mitigate flooding from Berry Creek

Cost = $3.5 MM per mile.

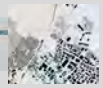
Source: Rebuild by Design

Sources: NJ Department of Environmental Protection Bureau of GIS, NJ Sports and Exhibition Authority, NJ Adapt



APPENDIX D. 3 SLR Inundation of Redevelopment Area

SLR INUNDATION OF REDEVELOPMENT AREA

Redevelopment Area	Name	NSEA Redevelopment Plans p. 3-	5 ft SLR permanent inundation	Block	% Ground Level Inundated by 5ft SLR	Permitted Uses	Acres	Lot	Municipality
RA-1	**Vincent Place**			286	86%	Medium Density Residential	2.2	47	Teterboro
RA-2	**Paterson Plank Road**			Commercial Gateway Center: 110, 111, 113, 114, 115, 116, 117, 118, 119, 121, 122, Light Industrial: 91, 92, 97, 98, 99, 100, 101, 102, 103, 104	0%	Commercial Gateway; Restaurant, Retail	252.8	91: 1, 51, 13th St. / 97: 1-3, / 98: 1, 400 14th St. / 100: 3, 181 Broad St. / 119: 1, 20th and Broad Streets / 105.01: 1, 932 Paterson Plank Rd. / Berry's Creek Drainiage Basin	Carlstadt, East Rutherford
RA-3	**Highland Cross**			219.04, 219.02	0%	Commercial; Restaurant, Retail, Warehousing. (Within Proximities to Blocks 105.01 and 105.02. See Sites with Moderate PFV Scores 1-6)	28.1	219.04: 1, 2.01, 2.02, 3, 61 / 219.02: 65.05, 65.06, 65.07	Rutherford
RA-4	**Kingsland**			Kearny 149 / N. Arlington 175-193 / Lyndhurst 231, 233, 236, 237	87%	Commercial; Restaurant, Retail	1362.5	149: 10 / 175-192: 1 / 184: 1 and 4 / 193: 3, 4, and 12 / 231: 9, 10, 11, 12, 13, and 14 / 233: 1.01, 4, 5, 9 (portion), 10, 11, 12, 13, 14, 15, 16.01, and 16.03 / 236: 1.01, 1.02 / 237: 9	Lyndhurst, Rutherford
RA-5	**Belleville Turnpike**			150, 150.01	82%	Light Industrial; Data Centers; Special Exceptions: Health care centers	77.7	150: 30, 30.01, 31, 33, 34, 35.01, 35.02, 36, 37, 38, 39, 40, 41, 42, 43, 44.01, and 45.01 / 150.01: 52.01, 52.04, 64.01, and 64.02	Kearny
RA-6	**Kearny**			205, 253, 275, 284, 285, 286	91%	Harrison Avenue Retail Center: Commercial; Restaurant, Retail	444.6	205: 18, 19.02, 24, 25, 26.01, 26.02, 27-33 / 253: 5.01, 5.02 / 275: 1 / 284: 2.01, 3.01, 4.01, 7, 7.02, 9.01, 9.03, 9.05, 11.01, 11.02, 11.04 / 285: 1.01, 2, 3, 14, 15 / 286: 4, 4.01, 5, 6.01, 6.02, 7, 9, 16, 47, 47.01, and 48	Kearny
RA-7	**Secaucus Transit Village**			5.01, 5.02, 5.03, 5.04, 5. 05, 5, 8, 9, 10, 12, 20.01	87%	Station Square Zone; Transition Zone; Riverfront Landing Zone; Passive Recreation Zone. Commercial; Restaurant, Retail	209.1	5.01: 3.01 and 3.02 / 5.02: 3.03 and 3.04 / 5.03: 3.05 / 5.04: 3.06 / 5.05: 3.07 and 3.08 / 5: 4 (including Lot 4.01), 6, 7.01, 7.02, 8 and 9 / 8: 1 and 2 / 9: 8.05, 8.06, 9, 10 and 11 / 10: 6.01, 8.01, 9.01, 10, 11, 12, and 13 / 12: 1; and 20.01: 0.16-acre portion of Lot 16	Secaucus
RA-8	**16th Street**			449, 449A	83%	Light Industrial; Warehouses	82.6	449: C1, C2, 6A, 6B, and 7 / 449A: A1-1, 1-1. 2-1, and 1B	North Bergen
RA-9	**Block 228, Lot 3, Lyndhurst**			228	93%	Commercial; retail; banks (Consider Resilient Retail Typologies)	6	3	Lyndhurst
RA-11	**Teterboro/ Industrial Ave.**			202	73%	Mixed-Use	63.2	4	Teterboro
RA-12	**Koppers Coke**			286, 287	93%	Industrial	361.1	286: 34, 35, 36, 37.01, 37.02, and 37.03 / 287: 5, 5.01, 5.02, 32.01, 32.02, 32.03, 35, 36, 37, 38.01, 38.02, 39, 40, 41, 41.01, 42, 43, 43.01, 44, 45, 45.01, 46, 47, 47.01, 48, 49, 49.01, 50, 50.01, 51, 52, 52.01, 53, 54, 55, 56, 57, 58, 59, 60, 60.01, 61.01, 61.02, 61.03, 62, 62.01, 63, 64, 65, 65.01, 66, 66.01, 67, 67.01, 67.02, 68, 69, 70, 70.01, 71, 71.01, 73, 73.02, 79, 80, 81, 82, and 83	Kearny
RA-13	**Hartz Carpet Center**			227	92%	Multi-Family; Retail; Daycare	13.5	4.03, 4.04	Secaucus
RA-14	**Schmitt Realty**			191	100%	Multi-Family; Retail; Daycare or Low-Density Residential	3.1	15, 15.01, 15.02, 15.03	Secaucus
RA-15	**Hilco**			3101, 7402	82%	Commercial; retail; warehouses	117.4	3101: 21, 22, 23, 24, 25, 26, 29, 30, 31, 32, 36, 37, 42, 43, and 44 / 7402: 21, 22, 23, 24, 33, 34, and 35	Jersey City