



Section IV: Mitigation Strategy



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1) Introduction

The Mitigation Strategy section describes how New York City will reduce or eliminate potential losses from hazards identified in the Natural Hazard Risk Assessment section. The strategy focuses on existing and potential mitigation actions that will mitigate the effects of a natural hazard event on New York City's population, economy, and property. The Mitigation Strategy is a coordinated effort by 39 New York City agencies and partners to develop and implement a comprehensive range of inventive and effective natural hazard mitigation actions.

a) Mitigation Strategy Approach

- Establish mitigation goals and objectives that aim to reduce or eliminate New York City's long-term vulnerability to natural-hazard events.
- Identify and analyze a comprehensive range of hazard-specific mitigation actions that aim to achieve the goals and objectives of the Mitigation Strategy.
- Describe how New York City will prioritize, implement, and administer mitigation actions.

b) FEMA Requirements Addressed in this Section

The OEM Hazard Mitigation Planning Team (Planning Team) developed the mitigation strategy consistent with the process and steps presented in the Federal Emergency Management Agency's (FEMA) How-To-Guide: Developing the Mitigation Plan (FEMA 386-3). This section satisfies the following requirements:

- **Requirement §201.6(c)(3)(i):** [The hazard mitigation strategy *shall* include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.
- **Requirement §201.6(c)(3)(ii):** [The mitigation strategy *shall* include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements, as appropriate.
- **Requirement: §201.6(c)(3)(iii):** [The mitigation strategy section *shall* include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization *shall* include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

2) Developing Goals and Objectives

The first step in developing a hazard mitigation strategy is to establish goals and objectives that aim to reduce or eliminate New York City's long-term vulnerability to natural hazard events. Mitigation goals are general guidelines explaining what New York City wants to achieve in terms of hazard and loss prevention. Objectives are specific, measurable strategies or implementation steps used to achieve the identified goals. Developing clear goals and objectives helped reinforce New York City's overall purpose and mission for undertaking a mitigation planning process.

The Planning Team developed a preliminary set of hazard mitigation goals and objectives based on the findings of the Natural Hazard Risk Assessment and the New York State Multi-Hazard Mitigation Plan and presented these to the Steering Committee. The Planning Team also presented the goals at each of the community involvement meetings. Based on input and suggestions from the Steering Committee, the Planning Team revised and refined the goals and objectives into the final list below.

The goals and objectives set forth below provide the necessary framework to develop a mitigation strategy. New York City will re-evaluate its hazard mitigation goals and objectives each plan maintenance cycle to ensure they continue to represent New York City's hazard mitigation priorities.

Hazard Mitigation Goals and Objectives	
Goal 1: Protect public health and safety	
Objective 1.1	Improve systems that provide warning and emergency communications.
Objective 1.2	Reduce the impacts of hazards on vulnerable populations.
Objective 1.3	Strengthen state and local building code enforcement.
Objective 1.4	Train emergency responders.
Goal 2: Protect property	
Objective 2.1	Implement mitigation programs that protect critical facilities and services and promote reliability of lifeline systems to minimize impacts from hazards, maintain operations, and expedite recovery in an emergency.
Objective 2.2	Consider known hazards when identifying a site for new facilities and systems.
Objective 2.3	Create redundancies for critical networks such as water, sewer, digital data, power, and communications.
Objective 2.4	Adopt and enforce public policies to minimize hazard impacts on buildings, infrastructure, and neighborhoods and enhance safe construction in high hazard areas.
Objective 2.5	Integrate new hazard and risk information into building codes and land use planning mechanisms.
Objective 2.6	Educate public officials, developers, realtors, contractors, building owners, and the public about hazard risks and building requirements.

Hazard Mitigation Goals and Objectives	
Objective 2.7	Promote appropriate mitigation actions for all public and privately owned property within the City's jurisdiction including, but not limited to, residential units, commercial structures, educational institutions, healthcare facilities, cultural facilities, and infrastructure systems.
Objective 2.8	Incorporate effective mitigation strategies into New York City's capital improvement projects.
Objective 2.9	Promote post-disaster mitigation as part of restoration and recovery.
Goal 3: Promote a sustainable economy	
Objective 3.1	Form partnerships to leverage and share resources.
Objective 3.2	Continue critical business operations.
Objective 3.3	Partner with private sector, including small businesses, to promote structural and non-structural hazard mitigation as part of standard business practice.
Objective 3.4	Educate businesses about citywide contingency planning, targeting small businesses and those businesses located in high-risk areas.
Objective 3.5	Partner with private sector to promote employee/employer education about disaster preparedness while at work and at home.
Goal 4: Protect the environment	
Objective 4.1	Develop hazard mitigation policies that protect the environment.
Objective 4.2	Promote climate change adaptation strategies that mitigate the long-term effects of natural hazards on the environment.
Goal 5: Increase public preparedness for disasters	
Objective 5.1	Enhance understanding of natural hazards and the risks they pose.
Objective 5.2	Improve hazard information, including databases and maps.
Objective 5.3	Improve public knowledge of hazards and protective measures allowing individuals to appropriately prepare for and respond to hazard events.

Table 1: Hazard Mitigation Goals and Objectives

3) Identification and Analysis of Mitigation Actions

Mitigation actions include programs, plans, projects, or policies that help reduce or eliminate the long-term risk to human life and property from natural hazards. The Planning Team, with the assistance of the Steering Committee, identified and analyzed a comprehensive range of hazard-specific mitigation actions with particular emphasis on actions that affect new and existing buildings and infrastructure within New York City.

a) Identification

Mitigation Planning Council (MPC) members identified both existing and potential mitigation actions within their respective agencies that have the following criteria:

- Reduce or eliminate the long-term risk to human life and property from at least one of the eight natural hazards identified in the Risk Assessment Section
- Fall under one or more of the six FEMA mitigation action categories
- Achieve one or more of the five hazard mitigation goals and 23 objectives

Thirty-nine MPC agencies submitted 493 preliminary mitigation actions for inclusion in this mitigation strategy. The Planning Team worked with MPC members on a one-on-one basis to revise their agencies' mitigation actions. The final submittal resulted in 306 mitigation actions (145 existing and 161 potential) that meet the criterion above.

i) Mitigation Action Categories

FEMA organizes mitigation actions into six broad categories. These categories allow similar types of mitigation actions to be compared, and provides a standardized method for eliminating unsuitable actions. All mitigation actions identified in this strategy fall within one of the FEMA mitigation action categories below:

1. **Prevention:** Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities that reduce hazard losses. Examples from this strategy include building and construction code revisions, zoning regulation changes, and computer-hazard modeling.
2. **Property Protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard, or removal from the hazard area. Examples from this strategy include seismic retrofits, roadway elevations, and floodproofing.
3. **Public Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them. Examples from this strategy include programs that target severe repetitive loss properties and vulnerable populations.
4. **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems. Examples from this strategy include projects create open space, greenbelts, bluebelts, or wetlands.

5. **Emergency Services:** Actions that protect people and property during and immediately after a disaster or hazard event. Examples from this strategy include enhancements that provide advanced warning and redundant communications.
6. **Structural Projects:** Actions that involve the construction of structures to reduce the impact of a hazard. Examples from this strategy include projects that control floodwater, reconstruct dams and seawalls, and construct green roofs.

ii) **Planning Team**

The final list of mitigation actions includes many structural projects that apply to both new and existing buildings and infrastructure. Many of the actions protect public health and safety, promote a sustainable economy, protect the environment, and increase public preparedness for disasters. The following table summarizes New York City's mitigation actions by hazard, mitigation action category, and goal/objective addressed. All actions described in this Plan reflect an April 2008 submission.

Summary of Mitigation Actions			
Category	Existing	Potential	Total
Number of Mitigation Actions	145	161	306
Mitigation Actions by Hazard Addressed			
Coastal Erosion	0	2	2
Coastal Storms	0	9	9
Drought	6	7	13
Earthquakes	8	12	20
Extreme Temperatures	9	9	18
Flood	52	39	91
Windstorms/Tornadoes	1	4	5
Winter Storms	3	1	4
Multi-Hazard	66	78	144
Total	145	161	306
Mitigation Actions by Category			
Prevention	53	15	68
Property Protection	32	56	88
Public Education and Awareness	11	19	30
Natural Resource Protection	16	6	22
Emergency Services	20	34	54
Structural Projects	13	31	44
Total	145	161	306
Mitigation Actions by Goal/Objective Addressed*			
1.1	12	6	18
1.2	3	11	14
1.3	11	1	12
1.4	1	0	1
2.1	71	79	150
2.2	15	3	18
2.3	14	15	29
2.4	25	5	30

Summary of Mitigation Actions			
Category	Existing	Potential	Total
2.5	23	12	35
2.6	7	9	16
2.7	88	104	192
2.8	21	52	73
2.9	2	4	6
3.1	5	4	9
3.2	1	1	2
3.3	10	6	16
3.4	5	6	11
3.5	3	4	7
4.1	28	26	54
4.2	13	8	21
5.1	16	30	46
5.2	12	20	32
5.3	9	13	22
Total	395	419	814

*Many mitigation actions address more than one goal and/or objective

Table 2: Mitigation Actions Summary Table

iii) Existing Mitigation Actions

Existing mitigation actions are New York City's programs, plans, projects, and policies currently underway that mitigate hazards. By assessing what the City is currently doing to mitigate natural hazards, the Planning Team was able to determine how the City might expand or improve upon these programs. Identifying New York City's existing mitigation actions also allowed the Planning Team to determine which hazards the City needs to address. The MPC identified 145 existing mitigation actions that have taken place or are in progress in the City.

For further details on the fields displayed in this table, see Table 13 on page 153. Each mitigation action is assigned an index value to indicate the hazard addressed, whether it is an existing or potential action, and its alphabetized placement in the list. For example, the mitigation action with the index EQ.E.9 is the ninth existing mitigation action that addresses earthquakes.

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
Drought								
D.E.1	179th Street Pumping Station Rehabilitation: Provide additional redundancy for water supply operations by allowing DEP to move water between the Croton and Catskill/Delaware systems to supplement the local distribution system.	DEP	NYPA	TBD	\$16,000,000	Capital Budget	Structural Projects	2.1, 2.3, 2.7, 2.8
D.E.2	Water Quality Protection: Construct a water filtration plant to protect the Croton supply.	DEP	USGS, NYSDEC	5 Years	TBD	TBD	Structural Projects	2.1, 2.7, 2.8
D.E.3	Water Quality: Remove sediment from the Schoharie Reservoir Intake Channel to allow proper water flow and potentially lower turbidity levels. Extreme weather events introduce significantly turbid run-off into the reservoir. Schoharie Reservoir provides 10% of the City's water supply.	DEP	N/A	1 Year	\$6,699,000	Capital Budget	Natural Resource Protection	2.1, 2.7

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
D.E.4	Construction Code Revision: Allow the use of waterless urinals as part of an approved water conservation plan.	DOB	N/A	Revision complete; Will be phased in by July 1, 2009	TBD	Staff Time	Prevention	2.5, 2.7, 4.1
D.E.5	Water Conservation: Replace existing water fixtures with new code-compliant low water use fixtures at the Gouverneur Healthcare Services facility.	HHC	DASNY	4 Years	\$680,000	General Obligation Bonds	Prevention	2.1, 2.7, 4.1
D.E.6	Water Conservation: Reduce fleet-washing activities upon notification of drought conditions. Evaluate water usage at facilities, particularly concerning fleet cleaning. Use study results to develop a potential system-wide water conservation standard to reduce the impact of drought.	MTA	N/A	TBD	TBD	TBD	Prevention	2.1, 4.1

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
Earthquake								
EQ.E.1	Facility Protection: Install a seismically-resistant fire standpipe, air monitoring, and automatic valve system in all New York City tunnels to provide a fully automated and monitored fire suppression system.	Amtrak	FDNY, MTA	5 Years	\$85,000,000	FRA, General Capital Funding, LIRR	Emergency Services	2.1, 2.3
EQ.E.2	Hudson County Portal Bridge Replacement: Replace portal bridge in Hudson County, NJ with new bridge designed to withstand seismic activity.	Amtrak	NJT, PANYNJ	10 Years	\$1,200,000,000	FRA, Amtrak, NJT, PANYNJ	Structural Projects	2.1, 2.8
EQ.E.3	Construct City Tunnel 3: Construct a seismically resistant and redundant third water tunnel. City Tunnels 1 and 2 currently distribute water to all five boroughs of New York City. These tunnels are nearly 90 and 70 years old respectively, and have never been taken out of service.	DEP	N/A	TBD	\$561,000,000	Capital Budget	Structural Projects	2.1, 2.3, 2.7, 2.8

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
EQ.E.4	Construction Code Revision: Require new critical facilities, such as fire stations and hospitals, to be designed with redundant structural systems. The previous code had no such requirement.	DOB	N/A	Revision complete; Will be phased in by July 1, 2009	TBD	Staff Time	Prevention	2.1, 2.3, 2.5, 2.7
EQ.E.5	Construction Code Revision: Update seismic engineering requirements to current national standards. Take into account soil and foundation underpinning. Require seismic detailing and inspections to ensure compliance. This will make new buildings both stronger and more flexible in an earthquake.	DOB	N/A	Revision complete; Will be phased in by July 1, 2009	TBD	Staff Time	Prevention	2.5, 2.7
EQ.E.6	Building Upgrade: Design Gouverneur Healthcare Services building to meet new seismic codes.	HHC	DASNY	4 Years	\$184,000	General Obligation Bonds	Property Protection	2.1, 2.7
EQ.E.7	Building Upgrade: Design Harlem Hospital superstructure to meet new seismic codes.	HHC	DASNY	12 Months	\$12,986,500	General Obligation Bonds	Property Protection	2.1, 2.7

New York City Existing Hazard Mitigation Actions

Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
EQ.E.8	Ground Stabilization: Densify soil beneath the new Patient Pavilion building at Harlem Hospital to reduce the impact of seismic activity.	HHC	DASNY	4 Months	\$8,500,000	General Obligation Bonds	Property Protection	2.1, 2.4, 2.7
Extreme Temperatures								
ET.E.1	Peak Load Management Program: Conserve power during summer peak demand hours, usually noon to 6 PM, on days designated by NYPA. Conservation measures include: pre-cooling buildings before the peak demand hours, raising chill water temperatures and thermostats, turning off selected lighting and office equipment, and shutting down 10% to 15% of elevators.	DCAS	DCAS-DFMC	5 Years FY 2009–2014	TBD	Expense Budget	Prevention	2.1, 2.7, 4.1

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
ET.E.2	Code Blue and Extended Outreach: Coordinate personnel to increase efforts to keep New York City's street homeless population safe during extreme cold events.	DHS	DOHMH	Ongoing	\$120,000	City Tax Levy	Public Education and Awareness	1.2, 5.3
ET.E.3	Construction Code Revision: Require roof coverings or setbacks with a slope less than a 25% (3 units vertical in 12 units horizontal) to be white or a color rated by EnergyStar as highly reflective. This color shall cover at least 75% of the area of the roof or setback surface to better reflect heat.	DOB	N/A	Revision complete; Will be phased in by July 1, 2009	TBD	Staff Time	Prevention	2.4, 2.5, 2.7, 4.1, 4.2

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
ET.E.4	Public Health Information for Healthcare Providers: Provide timely and accurate extreme heat health alerts, advisories, and updates to healthcare providers through the Health Alert Network, Dialogic NXT Communications System, and blast fax.	DOHMH	OEM	Ongoing	TBD	TBD	Public Education and Awareness	1.1, 1.2
ET.E.5	Public Health Risk Communication for the General Public: Raise public awareness on how to reduce or prevent heat illness and heat mortality through 311, www.NYC.gov, printed materials, and media.	DOHMH	OEM	Ongoing	TBD	TBD	Public Education and Awareness	1.2, 5.1, 5.3
ET.E.6	Syndromic Surveillance Systems: Monitor health impacts of heat wave using syndromic surveillance of heat-related calls to EMS and chief complaints in hospital emergency departments to trigger appropriate interventions and predict future trends.	DOHMH	N/A	Ongoing	TBD	TBD	Public Education and Awareness	5.1, 5.2

New York City Existing Hazard Mitigation Actions

Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
ET.E.7	<p>Summer Operations Manual: Perform pre-trip bus inspections to confirm windows and hatches are closed and the air conditioning system is working properly. Provide bus operators with summer uniforms and information about heat stress.</p>	MTA (Buses)	OEM	TBD	TBD	Agency Operating Budget	Prevention	2.1, 5.1, 5.3
ET.E.8	<p>Protect System from Heat-Related Damage: Protect engines, increase pantograph inspections, and prepare for response to heat-related incidents including increased switch, bridge, signal, catenary, and track circuit failures, as well as heat kinks.</p>	MTA (LIRR/MNR)	N/A	TBD	TBD	Agency Operating Budget	Property Protection	2.1

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
ET.E.9	Infrastructure Protection: Advocate for Con Ed to implement recommendations from the City's report on the northwest Queens power outages. Power outages of this magnitude are often caused by extreme-heat events.	OLTPS	Con Ed, NYSPSC	8 Years	TBD	TBD	Prevention	2.1, 2.7
Flood								
F.E.1	Culvert Improvement: Increase culvert diameter from 18" to 24" to improve drainage along Pelham Bay.	Amtrak	N/A	1 Year	\$50,000	Amtrak	Structural Projects	2.1, 2.7
F.E.2	Floodgates: Upgrade floodgate hardware and mechanisms to control rise rate of water into Penn Station tunnels.	Amtrak	MTA, NJT	2 Years	\$3,000,000	General Capital Funding, MTA, NJT	Structural Projects	2.1, 2.7
F.E.3	Tunnel Radio/Communication Improvement: Add resiliency to facility communication technology by using fiber optics.	Amtrak	MTA	5 Years	\$100,000	FRA	Emergency Services	1.1, 2.3

New York City Existing Hazard Mitigation Actions

Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
F.E.4	Upgrade Mid-River Pumps: Upgrade East River pumps to handle flooding conditions in tunnels under the river.	Amtrak	MTA, NJT	2 Years	\$150,000	MTA, NJT	Property Protection	2.1, 2.7
F.E.5	Mapping Improvements: Improve/enhance flood vulnerability data. Enhance planning by using surveys to more accurately define flood vulnerability of electric supplies.	Con Ed	N/A	3 Years	\$100,000	Agency Operating Budget	Prevention	3.3, 5.1, 5.2

New York City Existing Hazard Mitigation Actions

Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
F.E.6	<p>Combined Sewer Overflow (CSO) Storage Tanks: CSO storage tank projects at Paerdegat Basin, Spring Creek, Flushing Bay, and Alley Creek. These tanks will capture and store millions of gallons of combined sanitary and stormwater during extreme weather to reduce CSO into surrounding water bodies. The collected combined sewage is later conveyed to a wastewater treatment plant after the sewer system returns to normal to be fully treated before discharged into surrounding water bodies.</p>	DEP	N/A	<p>Flushing Bay and Spring Creek—Complete; Paerdegat Basin—September 2009; Alley Creek—June 2009</p>	\$764,860,000	Capital Budget	Structural Projects	2.1, 4.1, 2.8

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
F.E.7	Dam Inspection Program: Implement New York City dam-inspection program on both monthly and yearly cycles to facilitate appropriate maintenance and attain state of good repair.	DEP	N/A	Ongoing Beginning Fall 2008	\$100,000	Agency Operating Budget	Prevention	2.1, 2.8
F.E.8	Infrastructure Enhancement: Construct high-level storm sewers in the following combined sewer areas: Laurelton, Throgs Neck, and Gowanus. This will reduce the impact of flooding by draining more stormwater from these areas.	DEP	DDC	25 Years	\$750,000,000	Capital Budget, Federal Funding	Structural Projects	2.1, 2.7, 2.8
F.E.9	Infrastructure Improvement: Install additional storm sewers in the following flood-prone areas: southeast Queens, Rockaways, Coney Island, and Flushing.	DEP	DDC	50 Years	\$6,000,000,000	Capital Budget, Federal Funding	Structural Projects	2.1, 2.7, 2.8

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
F.E.10	Natural Resource Enhancement: Construct bluebelts in the following areas: Springfield Lake, Baisley Pond, Udall's Cove, Brookville Triangle, Meadow Lake, and Van Cortlandt Park.	DEP	DDC, Parks, NYSDEC	15 Years	\$100,000,000	Capital Budget	Natural Resource Protection	2.2, 2.4, 2.7, 4.1
F.E.11	Natural Resource Enhancement: Construct bluebelts on Staten Island's South Shore, Mid Island, and Snug Harbor.	DEP	DCP, DDC, Parks, NYSDEC	25 Years	\$300,000,000	Capital Budget	Natural Resource Protection	2.2, 2.4, 2.7, 4.1
F.E.12	Property and Infrastructure Protection: Prepare large area drainage plans for the following flood prone areas: southeast Queens, Rockaways, Coney Island, and Whitestone. These plans will examine and optimize how storm and floodwater is managed in these areas.	DEP	DOH, DCP	3 Years	\$7,000,000	Capital Budget	Prevention	2.1, 2.7, 2.8

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
F.E.13	Stormwater/Flooding Public Outreach and Education Program: Develop school curricula and public outreach materials to educate the public about flooding and stormwater.	DEP	N/A	TBD	TBD	Operating Budget	Public Education and Awareness	2.6, 5.1, 5.2, 5.3
F.E.14	Water Quality Protection: Integrate high-level storm sewers into major new developments, as appropriate. This will alleviate street flooding in problematic areas.	DEP	DOT, DOB	8 Years	TBD	TBD	Structural Projects	2.7, 2.8
F.E.15	Water Quality Protection: Pilot one swale to collect rainwater from roadways to reduce flooding during storms.	DEP	DOT, OLTPS	8 Years	TBD	TBD	Structural Projects	2.7, 2.8, 5.1
F.E.16	Natural Resource Protection: Purchase (anticipated) 126 acres on Staten Island to construct and recreate wetlands, which will help mitigate the impact of flooding.	DEP	Law Department, Parks, NYSDEC	10 Years	\$200,000,000	Capital Budget	Natural Resource Protection	2.2, 2.4, 2.7, 4.1

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
F.E.17	Construction Code Revision: Clarify current flood regulations and adopt the latest national standards.	DOB	N/A	Revision complete; Will be phased in by July 1, 2009	TBD	Staff Time	Prevention	2.4, 2.5, 2.7
F.E.18	Construction Code Revision: Require new critical facilities located in flood zones to be raised above the base flood elevation.	DOB	N/A	Revision complete; Will be phased in by July 1, 2009	TBD	Staff Time	Prevention	2.1, 2.2, 2.4, 2.5, 2.7
F.E.19	Facility Protection: Execute flood elimination capital projects at 20 sites that need long-term solutions for reoccurring flood damage due to groundwater infiltration.	DOE	DOE-SCA	1 Year	TBD	FEMA	Property Protection	2.1, 2.7, 2.8
F.E.20	Natural Resource Restoration: Include wetlands restoration as part of waterfront development projects to comply with aesthetic permitting or stormwater management requirements.	EDC	NYSDEC	TBD	TBD	NYSDEC, City Capital	Natural Resource Protection	2.2, 2.4, 2.7, 4.1
F.E.21	Wetland Restoration: Implement Flushing Airport Wetlands Mitigation Project in College Point, Queens.	EDC	NYSDEC	TBD	\$9,000,000	NYSDEC, City Capital	Natural Resource Protection	2.4, 2.7, 4.1

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
F.E.22	Facility Protection: Install special waterproofing membrane in the basement of the Gouverneur Healthcare facility to prevent groundwater from entering the building's basement.	HHC	DASNY	4 Years	\$225,000	General Obligation Bonds	Property Protection	2.1, 2.7
F.E.23	Track Drainage Study: Perform track drainage study on the Harlem Line at the Mott Haven Interlocking located near 149th and 159th streets in the Bronx. Depending on the recommendations of this study and support by the City, initiate capital project to improve drainage and reduce impact of flooding in this area.	MTA (MNR)	DEP, DOT, MTA, DOE-SCA	2 Years	\$3,000,000 – \$5,000,000	MTA Capital Budget	Emergency Services	2.1, 2.7, 2.8

New York City Existing Hazard Mitigation Actions

Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
F.E.24	<p>Baisley Park Depot Drainage Improvement: Implement corrective actions to mitigate repetitive flooding caused by moderate to heavy rain. This flooding interferes with bus service. The drainage deficiencies that cause this flooding were identified by a recent study.</p>	MTA (NYCT-Bus)	DEP, FTA, NYSDEC	2 Years	TBD	Capital Budget	Property Protection	2.1, 2.7
F.E.25	<p>Flood Control: Dewater oil-water separators at East New York, Castleton, Michael J. Quill, and Grand Avenue depots to provide additional capacity for incoming rainwater. Drain 200,000 gallon stormwater retention tank to accept incoming rainwater. This tank is normally full and used for bus washing.</p>	MTA (NYCT-Bus)	N/A	Ongoing	TBD	TBD	Property Protection	2.1, 2.7

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Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
F.E.26	JFK Depot Drainage Improvement: Include on-site stormwater management improvements at new parking facilities to decrease flow to DEP treatment facilities during high-volume precipitation events.	MTA (NYCT-Bus)	DEP, FTA, NYSDEC	2 Years	\$3,234,000	Capital Budget	Structural Projects	2.2, 2.7
F.E.27	Draft NYCT Flood Plan: Perform pre-storm flood mitigation actions in pre-identified flood prone areas. Actions include checking drains, vents, and installed-pumps as well as deploying tarps and sand bags to pre-identified sites to cover vents and protect subway entrances.	MTA (NYCT-Subway)	NJT, PANYNJ (PATH)	Ongoing	TBD	TBD	Emergency Services	2.1, 2.7
F.E.28	Drainage Improvement Plan: Finalize Flood Plan, including mapping of critical areas, mitigation plan, and contingency plan.	MTA (NYCT-Subway)	DEP	Ongoing	TBD	Agency Operating Budget	Emergency Services	2.1, 5.1, 5.2

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F.E.29	Drainage Improvement: Implement joint DEP/NYCT station inspection and cleaning program. This program will feature cleaning of catch basins, sewers, and siphons at flood-prone areas.	MTA (NYCT-Subway)	N/A	Ongoing	TBD	Agency Operating Budget	Property Protection	2.1, 2.7
F.E.30	Facility and Infrastructure Protection Plan: Conduct system-wide flood study to determine locations and impacts of storm-related water infiltration into the NYCT system.	MTA (NYCT-Subway)	N/A	2 Years	\$3,000,000	MTA	Emergency Services	2.1, 2.7
F.E.31	Facility Protection: Raise identified street entrances above 100-year flood plain, avoid street gratings, and install large sump system.	MTA (NYCT-Subway)	N/A	7 Years (Phase 1)	TBD	FTA, Capital Budget	Property Protection	2.1, 2.7

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F.E.32	Stormwater Drainage Improvement: Install 34 check valves at all direct connections to the City's combined sewer/storm drainage system to prevent backflow into the NYCT drainage system.	MTA (NYCT-Subway)	DEP	3 Years	TBD	NYCT, Capital Budget	Structural Projects	2.1, 2.7, 2.8
F.E.33	Stormwater Drainage Improvement: Raise vent grating and subway entrances at five locations: (1) Broadway-7th Avenue Line: 77th to 96th Street; (2) Broadway-7th Avenue Line: Chambers Street; (3) 8th Avenue Line: 34th Street; (4) Hill Avenue Line; and (5) Broadway Line.	MTA (NYCT-Subway)	DEP	Ongoing	TBD	NYCT, Capital Budget	Property Protection	2.1, 2.7, 2.8
F.E.34	Critical Facility Relocation: Relocate OEM supply warehouse to higher elevation, out of the 100-year floodplain and coastal storm-surge zone.	OEM	N/A	1 Month	\$20,000	Agency Operating Expenses	Property Protection	2.1, 2.2, 2.7

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Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
F.E.35	Resiliency Improvement: Update FEMA 100-year floodplain maps for New York City to reflect current weather conditions and topography/bathymetry.	OLTPS	DOB, DCP, EDC, OEM	8 Years	TBD	TBD	Prevention	2.4, 2.5, 5.2
F.E.36	Water Quality Protection: Form interagency Best-Management Practices (BMP) task force. Encourage addition of stormwater BMPs to New York City projects. Currently, stormwater BMPs are included to the extent allowed by the project's budget. Additionally, task force will pilot innovative stormwater BMPs.	OLTPS	DEP, DOB, DOT, Parks, EDC	8 Years	TBD	TBD	Emergency Services	2.5, 3.1, 5.1, 5.2, 5.3

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F.E.37	Backflow Preventers: Install backflow prevention devices and water meter upgrades to Port Authority-controlled buildings at JFK airport in accordance with the New York State Sanitary Code and City regulations. Perform water-meter upgrades as required.	PANYNJ (Aviation)	NYC, NYS	6 Years	\$19,203,000	Capital Budget	Property Protection	2.1, 2.7
F.E.38	Drainage Improvement: Install synthetic material at two locations at the intersection of Runways 4L and 31L to increase permeable surfaces and enhance stormwater runoff capacity at JFK airport.	PANYNJ (Aviation)	FAA	13 Years	\$29,998,000	Capital Budget	Property Protection	2.1, 2.7
F.E.39	Drainage Improvement: Retrofit and/or rebuild stormwater outfalls, including replacing terminating section of concrete triple box culvert, to enhance drainage capacity at JFK airport.	PANYNJ (Aviation)	DEP, NYSDEC	8 Years	\$8,434,000	Capital Budget	Property Protection	2.1, 2.7,

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F.E.40	Facility Upgrade: Redesign and retrofit runways 13R-31L at JFK airport, including raising existing grade, modifying existing drainage, and installing new lighting and concrete pavement.	PANYNJ (Aviation)	FAA	4 Years	\$218,063,000	Capital Budget	Property Protection	2.1, 2.7
F.E.41	Storm Drainage Rehabilitation—Phase III: Upgrade existing storm drainage pipe system by replacing pipe or installing an inner-lining system to eliminate leaks in the stormwater pipe system at LGA airport.	PANYNJ (Aviation)	PANYNJ	15 Years	\$12,000,000	2007–2016 Capital Plan	Property Protection	2.1, 2.7
F.E.42	Facility Improvement: Retrofit and floodproof eastbound and westbound platforms.	PANYNJ (PATH)	N/A	6 Years	\$73,000,000	2007–2016 Capital Plan	Property Protection	2.1, 2.7
F.E.43	Facility Upgrade: Redesign and floodproof eastbound and westbound station head houses at Harrison Station.	PANYNJ (PATH)	N/A	6 Years	\$95,000,000	2007–2016 Capital Plan	Property Protection	2.1, 2.7

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F.E.44	Facility Upgrade: Redesign, floodproof, and strengthen existing PATH car running repair shop.	PANYNJ (PATH)	N/A	4 Years	\$16,000,000	2007–2016 Capital Plan	Property Protection	2.1, 2.7
F.E.45	Facility Upgrade: Redesign, floodproof, and strengthen Grove Street Station from street level to mezzanine and mezzanine to platform.	PANYNJ (PATH)	N/A	5 Years	\$100,000,000	2007–2016 Capital Plan	Property Protection	2.1, 2.7
F.E.46	Facility Upgrade: Redesign, floodproof, and strengthen substations 7, 8, and 9.	PANYNJ (PATH)	N/A	8 Years	\$71,000,000	2007–2016 Capital Plan	Property Protection	2.1, 2.7
F.E.47	Drainage Improvement: Enhance drainage capacity in caisson #1 to prevent water intrusion into PATH emergency exit shaft.	PANYNJ (PATH)	N/A	1 Year	\$40,000	2007–2008 Operating Major Works Project Budget	Property Protection	2.1, 2.7
F.E.48	Facility Protection: Provide means of preventing or diverting stormwater infiltration into the Hudson Corridor during a severe flooding event.	PANYNJ (PATH)	N/A	3–4 Years	\$5,000,000	2007–2016 Capital Plan	Property Protection	2.1, 2.7
F.E.49	Facility Upgrade: Retrofit and waterproof entire west end of Pavonia Station.	PANYNJ (PATH)	N/A	5–8 Years	\$35,000,000	2007–2016 Capital Plan	Property Protection	2.1, 2.7

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F.E.50	Wetland or Upland Habitat Restoration: Improve ability of land to absorb and retain water. Prevent flooding and release of silt and dirt into sewers and habitat. Parks' Natural Resources Group oversees upland and wetland restoration.	Parks	N/A	5 Years	\$10,000 – \$50,000 per acre	HMGP, Other Grants	Natural Resource Protection	2.4, 2.7, 2.8, 4.1
F.E.51	Water and Air Quality Protection: Assess vulnerability of existing wetlands and identify additional policies to protect them.	Parks, DEP, OLTPS	EDC, DCP, USEPA, USNPS	8 Years	TBD	TBD	Emergency Services	2.4, 2.7, 4.1
F.E.52	Facility Protection: Perform pre-storm inspection, testing, and maintenance of central office cable vault sump pumps and battery backups. Sump pumps activate automatically when certain water levels are reached.	Verizon	N/A	Ongoing	TBD	Expense and Capital Budget	Property Protection	2.1, 2.7

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Windstorms/Tornadoes								
WT.E.1	Advance Warning: Monitor forecasts of wind speed to issue speed restrictions or ensure suspension of service prior to major wind impact (all elevated structures).	MTA	NWS	Ongoing	TBD	Agency Operating Budget	Emergency Services	1.1
Winter Storms								
WS.E.1	Construction Code Revision: Apply the latest national standards for the determination of snow load, snowdrift loads, and sliding snow loads.	DOB	N/A	Revision complete; Will be phased in by July 1, 2009	TBD	Staff Time	Prevention	2.2, 2.4, 2.5, 2.7
WS.E.2	Advanced Warning and Equipment Protection: Disseminate protocols in the Winter Standard Operating Procedures for declaring advisories and alerts, adjusting or reducing service, and protecting rolling stock prior to and during winter weather emergencies.	MTA	N/A	TBD	TBD	Agency Operating Budget, HMGP	Emergency Services	1.1, 2.1

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Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
WS.E.3	Infrastructure and Equipment Protection: Store trains underground when forecast calls for temperatures -10° F, ice storms, icing conditions, or > 5 inches of snow.	MTA (NYCT-Subway)	N/A	Ongoing	\$220,000/per year	Agency Operating Budget	Property Protection	2.1
Multi-Hazard								
MH.E.1	1st Avenue Ventilation System Rehabilitation: Upgrade tunnel sump pumps to control flooding and seismically harden the evacuation/response staircase with a reinforced concrete staircase. The existing stairs were built in 1909.	Amtrak	FDNY, MTA	7 Years	\$200,000,000	FRA, General Capital Funding, MTA	Property Protection	2.1, 2.7
MH.E.2	Emergency Power System: Provide redundancy to lighting, ventilation, and pumps in Penn Station and in the tunnel system.	Amtrak	MTA	5 Years	\$1,500,000	General Capital Funding, NJT	Emergency Services	2.1, 2.3

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MH.E.3	<p>Long Island City Ventilation System Rehabilitation: Upgrade tunnel sump pumps to control flooding and seismically harden the evacuation/response staircase with a reinforced concrete staircase. The existing stairs were built in 1909.</p>	Amtrak	FDNY, MTA	6 Years	\$110,000,000	FRA, General Capital Funding, MTA	Property Protection	2.1, 2.7
MH.E.4	<p>Improved Weather Forecasting: Develop a multi-party team to apply IBM's Deep Thunder technology to forecast weather-caused damage at a micro-geographic level. IBM's Deep Thunder can predict rain, wind speed and direction, and temperature to assist in advance warning capabilities.</p>	Con Ed	N/A	2 Years	\$400,000	Agency Research and Development Budget	Emergency Services	1.1, 3.3

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MH.E.5	<p>Vegetation Management Program: Perform vegetation management to ensure infrastructure, as well as the public, is secure during and after a natural hazard event. Proper pruning and thinning of the tree canopy is important to minimize damage during hurricanes and wind events. Improperly maintained trees damage utilities and require extensive clean-up after storms.</p>	Con Ed	N/A	Ongoing	\$4,000,000	Agency Operating Budget	Prevention	2.1, 2.7, 3.3, 4.1

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MH.E.6	<p>Green Zoning Regulations: Promote the greening of new and expanded commercial parking lots of more than 18 spaces or 6,000 square feet by requiring landscaping, perimeter screening, tree planting, and maneuverability standards based on the lot size. In keeping with the Mayor's PlaNYC: A Greener, Greater New York (PlaNYC) sustainability goals, the new regulations, approved in 2007, will assist in effectively managing stormwater runoff, cooling the air, improving vehicular circulation, and enhancing the City's public realm by visually improving unsightly expanses of pavement.</p>	DCP	DOB, OLTPS	Ongoing	TBD	TBD	Prevention	2.4, 2.5, 4.1, 4.2

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MH.E.7	<p>Hazard Mitigation Planning and Zoning: Examine ways to incorporate hazard mitigation goals into future City-sponsored rezoning initiatives. A number of re-zonings with waterfront and floodplain components have recently been initiated by the City, including: Hunter's Point, Flushing, City Island, Throgs Neck, and Greenpoint/Williamsburg. Future/in progress zoning initiatives include Coney Island, the Rockaways, Sherman Creek, and the Lower Concourse. These re-zonings incorporate goals established in the Waterfront Revitalization Program (WRP) and pave the way for the predictable development of open space along the waterfront.</p>	DCP	DOB, EDC, Parks	Ongoing	TBD	TBD	Prevention	2.2, 2.4, 2.5, 2.7

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MH.E.8	<p>Open Space: Promote the preservation and development of waterfront open space. Pursuant to Policy 8 of the WRP, the development of public open space along the waterfront is promoted through public and private initiatives.</p>	DCP	DOB, Parks	Ongoing	TBD	TBD	Natural Resource Protection	2.2, 2.4, 3.3 2.5, 4.1
MH.E.9	<p>Planning and Zoning: Review discretionary projects for consistency with WRP. Policy 6 of the City's WRP establishes a goal of "minimizing loss of life, structures and natural resources caused by flooding and [coastal] erosion," and impacts decisions regarding all discretionary review of development on the waterfront and in the 100-year floodplain.</p>	DCP	N/A	Ongoing	TBD	TBD	Prevention	2.2, 2.4, 2.5

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MH.E.10	<p>Stormwater Management Regulations: Prevent excessive paving of front yards. Require a minimum percentage of all front yards be landscaped, prohibit steeply pitched driveways in front yards, and encourage rear-yard garages to maximize planting area in the front yard. This package of regulations mitigates stormwater runoff, reduces surrounding temperatures, and enhances the attractiveness of neighborhood streets while furthering the Mayor’s PlaNYC sustainability goals.</p>	DCP	DOB, OLTPS	Adopted April 30, 2008	TBD	Staff Time	Prevention	2.4, 2.5, 5.2

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MH.E.11	<p>Street Tree Requirements: Require planting of one street tree for every 25 feet of street frontage of the zoning lot for virtually all new developments, major enlargements, and certain use conversions. Each lot is subject to a minimum of one street tree. This zoning resolution establishes requirements for sidewalk planting strips in lower density residential districts. These zoning regulations support the Mayor's PlaNYC goals for increased street-tree canopy, air-quality improvement, and stormwater management.</p>	DCP	DOB, Parks, OLTPS	Adopted April 30, 2008	TBD	TBD	Natural Resource Protection	2.5, 4.1, 4.2

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MH.E.12	<p>Waterfront Planning and Zoning: Prepare comprehensive waterfront plan to establish citywide and site-specific guidelines for regulating development at the water's edge (See New York City Comprehensive Waterfront Plan: Reclaiming the City's Edge, 1992 and New Waterfront).</p>	DCP	N/A	Ongoing	TBD	TBD	Prevention	2.2, 2.4, 2.5
MH.E.13	<p>Water and Air Quality Protection: Design five expanded tree pits with below-grade water catchments to increase stormwater infiltration and monitor impacts.</p>	DEP	Parks	8 Years	TBD	TBD	Structural Projects	2.7, 4.1

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MH.E.14	<p>Advanced Warning System: Provide advanced warning of wind and other weather hazards to registered construction superintendents, site safety managers, and the media. This system allows construction sites to take mitigating steps prior to the onset of hazardous weather.</p>	DOB	N/A	Completed	TBD	Staff Time	Emergency Services	1.1
MH.E.15	<p>Construction Code Revision: Enhance connectivity requirements for structural components. These changes increase the structural integrity of new buildings, allowing them to better withstand an unanticipated event.</p>	DOB	N/A	Revision complete; Will be phased in by July 1, 2009	TBD	Staff Time	Prevention	2.2, 2.4, 2.5, 2.7

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MH.E.16	Construction Code Revision: Introduce importance factors into the design of new critical facilities, power generating facilities, water-treatment plants, and buildings where 300 people or more congregate in one area. Importance factors increase the design seismic, snow, and wind loads of a structure to prevent catastrophic collapse.	DOB	N/A	Revision complete; Will be phased in by July 1, 2009	TBD	Staff Time	Prevention	2.1, 2.2, 2.4, 2.5, 2.7
MH.E.17	Construction Code Revision: Provide fee rebates to encourage construction of sustainable buildings.	DOB	N/A	Revision complete; Will be phased in by July 1, 2009	TBD	Staff Time	Prevention	2.5, 4.1, 4.2
MH.E.18	Construction Code Revision: Require overflow drains to protect roof structures if primary roof drains fail. The structural load of accumulated rainwater will be accounted for in roof design.	DOB	N/A	Revision complete; Will be phased in by July 1, 2009	TBD	Staff Time	Prevention	2.4, 2.5, 2.7

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MH.E.19	Existing Building Code Revision: Develop a building code that will promote the inclusion of natural hazard mitigation measures into existing building design and retrofit projects.	DOB	N/A	TBD	\$475,000	Agency Operating Budget	Prevention	2.2, 2.4, 2.5, 2.7
MH.E.20	Interagency Coordination: Participate in regular interdepartmental coordination with OEM to discuss natural hazard mitigation.	DOB	OEM	Ongoing	Staff Time	Agency Operating Budget	Prevention	3.1, 5.1, 5.2
MH.E.21	Staff Development: Participate in natural hazard mitigation code and standards development by sending staff to national events and training sessions that focus on seismic, wind, and flood codes.	DOB	N/A	Ongoing	\$25,000	Agency Operating Budget	Public Education and Awareness	2.5, 2.6, 5.1
MH.E.22	Training: Send staff to national training sessions and seminars on hazards and mitigation practices.	DOB	N/A	Ongoing	\$25,000	Agency Operating Budget	Public Education and Awareness	2.6, 5.1

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MH.E.23	Cogeneration Plant: Install cogeneration plant to reduce reliance on Con Ed power while complying with Mayor Bloomberg's GreeNYC Plan for the Department.	DOC	DCAS, DMJM HARRIS, NYPA	3 Years	\$57,000,000	NYPA	Emergency Services	2.3, 4.1, 4.2
MH.E.24	Redundant Communications: Establish a redundant emergency communications system.	DOE	OEM	2 Years	\$5,000,000	FEMA	Emergency Services	1.1, 2.3
MH.E.25	Emergency Planning for Employers Workshop: Host annual conference to provide mitigation and emergency preparedness resources to New York City employers and building managers. Conference targets small businesses and addresses earthquake-related building code changes, evacuation plans, fire safety, and business continuity.	DOHMH	OEM	Annual	\$50,000 per annum	USCDC Public Health Emergency Preparedness Grant	Public Education and Awareness	2.6, 3.1, 3.3, 3.4, 3.5, 5.1, 5.2

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MH.E.26	Environmental Data Exchange Network: Facilitate environmental data exchange among government agencies using web-based data system. Interagency data exchange supports timely identification and characterization of potential hazards and provides a means to mitigate impacts of natural disasters.	DOHMH	Various	Ongoing	\$2,400,000	USCDC Public Health Emergency Preparedness Grant, USDHS UASI Grant	Public Education and Awareness	5.1, 5.2
MH.E.27	Interagency Environmental Data Workshop: Host annual conference to improve interagency coordination, promote best practices, and introduce emerging tools for data sharing, risk analysis, and vulnerability assessment.	DOHMH	OEM	Annual	\$50,000 per annum	USCDC Public Health Emergency Preparedness Grant	Public Education and Awareness	3.1, 5.1, 5.2
MH.E.28	Health Code Revisions: Examine the New York City Health Code to identify what elements can be revised to bolster natural hazard mitigation.	DOHMH	N/A	Ongoing	TBD	TBD	Prevention	2.4

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MH.E.29	<p>Advance Warning/Infrastructure Protection: Implement electronic chart display and information system for DOT vessels. This advance notification system, designed to prevent loss of life and property, provides real-time updates of impending severe weather conditions (including wind and current), chart information, email, and navigational information from shore.</p>	DOT	N/A	2 Years	\$2,400,000	Agency Operating Budget, HMGP	Emergency Services	1.1, 2.1
MH.E.30	<p>Critical Facility Protection: Protect existing and future critical facilities from natural hazards. Facilities considered under this action include the Traffic Management Center, Signs and Markings-Maspeth Shop, Signals and Street Lighting Facility, and Division of Parking.</p>	DOT	EMS, FDNY, OEM	TBD	TBD	Expense and Capital Budget	Property Protection	2.1, 2.7, 2.8

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MH.E.31	East River Bridges Retrofit (Design): Perform study to identify potential seismic retrofit and structural hardening projects for the Brooklyn, Manhattan, and Queensboro Bridges.	DOT	FDNY, FEMA, NYPD, USCG	1 Year	\$34,079,247	Capital Improvement Budget, FEMA, Grants	Prevention	2.1, 2.7, 2.8
MH.E.32	Emergency Training: Provide electronic chart display and information system and radar training.	DOT	GMATS	2 Years	\$750,000	USDHS Grants, Agency Operating Budget, HMGP	Emergency Services	1.4
MH.E.33	Infrastructure Protection: Determine if protective film and blast curtains are necessary for the large glass areas in Whitehall Terminal, St. George Terminal, and Pier 79. Study is being performed by the U.S. Army Corps of Engineers.	DOT	USACE	TBD	\$3,300,000	USDHS Grants	Property Protection	2.1, 2.7

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MH.E.34	Power Redundancy: Provide five large and 60 small emergency power generators to facilities during a natural hazard event.	DSNY	N/A	Completed	\$1,021,500	Agency Operating Budget, Other-Than-Personnel-Services	Emergency Services	2.1, 2.3
MH.E.35	Infrastructure Upgrade: Provide technical assistance to inform the design and installation of passenger ferry landings. EDC has experience with regard to the mooring, anchoring, and stabilization mechanisms available for ferry landings that are able to withstand the effects of various natural hazard events.	EDC	DOT	TBD	TBD	EDC, DOT	Public Education and Awareness	2.1, 2.7
MH.E.36	Infrastructure Upgrade: Upgrade Arthur Kill lift bridge including possible construction of new bulkheads/pier.	EDC	N/A	TBD	TBD	EDC	Property Protection	2.1, 2.7
MH.E.37	Power Redundancy: Provide emergency power generators to facilities during a natural hazard event.	EDC	NA	Ongoing	TBD	EDC, OEM	Emergency Services	2.3

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MH.E.38	Power Redundancy: Install back-up electrical power generators in firehouses.	FDNY	OEM	TBD	TBD	Capital Budget	Emergency Services	2.1, 2.3
MH.E.39	Property Protection/Water Supply Redundancy: Increase water drafting capabilities citywide. Drafting water refers to the use of suction to move water from a body of water to a fire apparatus. Drafting can decrease the demand on the water supply system and provides redundant fire suppression water in the event of a drought or earthquake induced water supply disruption.	FDNY	DEP, USEPA	TBD	TBD	Grants	Emergency Services	2.1, 2.3
MH.E.40	Power Redundancy: Install redundant emergency generators for Group 1 Trauma Centers.	HHC	DASNY	5 Years	\$102,000,000	General Obligation Bonds	Emergency Services	2.1, 2.3

New York City Existing Hazard Mitigation Actions

Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
MH.E.41	Communications Redundant System: Communications system is with surge protection to allow uninterrupted operation during potential power surges due to rolling black-outs or electrical storms. Additional system include steam generator back-up and "failsoft" computer-based protection.	MTA (Buses)	N/A	TBD	TBD	TBD	Emergency Services	1.1, 2.3
MH.E.42	Tree Pruning: Reduce probability of downed trees or limbs due to tornadoes, windstorms, and coastal storms along active rail lines by engaging in preventive tree pruning measures.	MTA (LIRR)	N/A	TBD	TBD	Agency Operating Budget, HMGP	Natural Resource Protection	2.1, 2.7
MH.E.43	Warning System: Improve communications link to Doppler Radar located at JFK and Newark airports to improve severe weather detection and warning.	NWS	N/A	1 Year	TBD	TBD	Emergency Services	1.1

New York City Existing Hazard Mitigation Actions

Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
MH.E.44	<p>Facility Protection: Install new flashing and four-ply torch applied modified bitumen roofing with high reflective coating over polyisocyanurate tapered insulation in 46 developments (524 buildings) citywide. This project will involve removal of existing roofing and insulation and asbestos abatement. These improvements will increase storm resiliency and reduce the impacts of extreme heat events.</p>	NYCHA	DOE-SCA	1 Year Beginning FY 2008	\$126,184,945	Capital Improvement Budget	Property Protection	2.7, 2.8
MH.E.45	<p>Facility Protection: Install new shatter resistant operable windows and frames, and repair lintels and sills in nine developments (62 buildings) citywide. Remove existing windows and conduct asbestos abatement.</p>	NYCHA	DOE-SCA	2 Years Beginning FY 2008	\$14,388,787	Capital Improvement Budget	Property Protection	2.7, 2.8

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
MH.E.46	Facility Protection: Remove all loose and damaged brick, stucco, and copping to reduce the amount of flying debris during wind storms, coastal storms, and tornadoes. Install new brick and copping in 34 developments (313 buildings) citywide.	NYCHA	N/A	2 Years Beginning FY 2008	\$237,141,686	Capital Improvement Budget	Property Protection	2.7, 2.8
MH.E.47	Continuity of Operations (COOP): Ensure City agencies can provide essential services to the public during emergencies, while maintaining internal critical functions. Agencies are developing plans that build contingencies around essential services, mitigate the impact of disruptions to services, and enhance the ability to provide Citywide Incident Management System (CIMS) operations, social services, and government operations.	OEM	DoITT	4 Months	\$3,100,000	USDHS-UASI Grant	Emergency Services	2.1, 3.2

New York City Existing Hazard Mitigation Actions

Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
MH.E.48	<p>Incident-Based Distribution Project: Implement program to track and study areas impacted by natural disasters using OEM Watch Command data and Geographic Information Systems technology. Target affected areas for post-disaster outreach and Ready New York materials. Encourage property owners to incorporate mitigation measures during recovery.</p>	OEM	N/A	Ongoing	\$25,000	USDHS-UASI Grant	Emergency Services	2.9, 5.1, 5.2, 5.3
MH.E.49	<p>Insurance Working Group: Use the insurance industry and regulators to partner with the private sector and provide educational opportunities on insurance related mitigation measures.</p>	OEM	NYS Insurance Department	TBD	TBD	TBD	Prevention	3.1, 3.3, 3.4, 3.5

New York City Existing Hazard Mitigation Actions

Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
MH.E.50	<p>Public Education: Promote Ready New York guides as a tool to educate New Yorkers about natural hazards. This program offers all-hazards guides, as well as hazard-specific guides for hurricanes, floods, and heat. There are also guides geared specifically for seniors and people with disabilities, children, and businesses. Guides contain information on how to mitigate, prepare for, and respond to an emergency. Brochures are offered in up to 14 languages as well as audiotapes and Braille. In 2006 and 2007, OEM mailed over 1.6 million hurricane guides to households within the City's hurricane evacuation zones.</p>	OEM	DOE, DEP, Mayor's Office, SBS, DFTA, MOPD	Ongoing	\$1,060,000	USDHS-UASI Grant	Public Education and Awareness	2.6, 3.4, 5.3

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
MH.E.51	Public Outreach: The Ready New York program provides public outreach throughout the City by presenting and tabling at community and private sector events. This program encourages communities to understand the impact of natural hazards so they may better mitigate, prepare, and respond to these hazards.	OEM	N/A	Ongoing	\$50,000	USDHS-UASI Grant	Public Education and Awareness	2.6, 3.4, 5.3
MH.E.52	Green Roof Installation: Encourage the installation of green roofs through a new incentive program. Green roofs can reduce the volume of stormwater runoff by absorbing or storing water and help reduce the impact of the urban heat island effect.	OLTPS	DOB, DOF	8 Years	TBD	TBD	Structural Projects	2.7, 3.3, 4.1, 4.2

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
MH.E.53	Public Education: Create a community planning process and "tool kit" to engage all stakeholders in community-specific climate adaptation and flood-mitigation strategies.	OLTPS	OEM	2 Years	TBD	TBD	Public Education and Awareness	2.6, 4.2, 5.1, 5.3
MH.E.54	Resiliency Improvement: Amend the building code to address the impacts of climate change.	OLTPS	DOB	8 Years	TBD	TBD	Prevention	2.5, 4.2
MH.E.55	Emergency Notification System: Install advanced automated early warning and emergency notification system in the green and blue quadrants of JFK airport's central terminal area. System includes variable message signs along main access roads.	PANYNJ (Aviation)	DOT	8 Years	\$18,033,000	Capital Budget	Emergency Services	1.1

New York City Existing Hazard Mitigation Actions

Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
MH.E.56	<p>Engineered Material Arresting System (EMAS): Design and build EMAS to prevent aircraft from overrunning the runway during severe weather at JFK airport.</p>	PANYNJ (Aviation)	FAA	3 Years	\$19,637,000	Capital Budget	Structural Projects	2.7
MH.E.57	<p>Drainage and Air Quality Improvement: Expand Green Streets program to transform unused road space into open (green) space. Green space can reduce the volume of stormwater runoff by absorbing or storing water. It may also help reduce the impact of extreme heat events. The goal of this project is to add 40 Green Streets totaling 75 acres of open space with a storage capacity of four million gallons of stormwater.</p>	Parks	DOT	8 Years	\$15,000,000	Private Donors	Prevention	2.7, 4.1, 4.2

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
MH.E.58	Drainage and Air Quality Improvement: Fill every available street tree opportunity in New York City. This will improve drainage across the City and reduce the effects of extreme temperatures. The goal is to raise the street stocking level from 74% to 100%.	Parks	DOT, DOB	8 Years	\$246,900,000	TBD	Natural Resource Protection	2.7, 4.1, 4.2
MH.E.59	Drainage Improvement: Convert 24 asphalt fields to either natural or synthetic turf fields with new drainage systems. Either would result in improved drainage and possible reduction of the urban heat island effect in large park areas.	Parks	HHC, DOH	8 Years	\$42,100,000	TBD	Property Protection	2.7, 4.1, 4.2
MH.E.60	Environmental Protection: Reforest 2,000 acres of parkland.	Parks	USNPS	10 Years	\$118,000,000	TBD	Natural Resource Protection	2.7, 4.1, 4.2

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
MH.E.61	Tree Pruning: Implement program to prune or remove old and overgrown trees. This program is designed to reduce the impact of severe weather including tornadoes, windstorms, and coastal storms.	Parks	N/A	5 Years	TBD	PlaNYC	Natural Resource Protection	2.7
MH.E.62	Water and Air Quality Protection: Assess the vulnerability of existing wetlands and identify additional policies to protect them.	Parks, DEP, OLTPS	EDC, DCP, USEPA, USNPS	8 Years	TBD	TBD	Natural Resource Protection	2.4, 2.7, 4.1
MH.E.63	Drainage and Air Quality Improvement: Partner with stakeholders to help plant one million trees by 2017. Trees reduce temperature, absorb additional stormwater, and decrease flooding.	Parks, OLTPS	DOT, DOB, USNPS	9 Years	TBD	TBD	Natural Resource Protection	2.7, 4.1, 4.2

New York City Existing Hazard Mitigation Actions								
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives
MH.E.64	Emergency Response Unit: Support team of business counselors that assist businesses in recovering and reopening in the wake of a disaster or emergency. Team can provide information on mitigation business practices.	SBS	OEM, Other City, State, and Federal Partners as Necessary	Ongoing	TBD	Agency Operating Budget	Public Education and Awareness	2.9, 3.3, 3.4, 3.5
MH.E.65	Infrastructure Protection: Implement tree-pruning program near overhead aerial cables to prevent damage from windstorms, tornadoes, and coastal storms.	Verizon	N/A	Ongoing	TBD	Expense and Capital Budget	Natural Resource Protection	2.7, 3.3, 4.1
MH.E.66	Warning System: Implement enhanced proactive network surveillance of facilities to reduce and/or minimize outage durations.	Verizon	N/A	Ongoing	TBD	Expense and Capital Budget	Emergency Services	1.1, 2.7, 3.3

Table 3: New York City Hazard Mitigation Action Table (Existing)

iv) Potential Mitigation Actions

Potential mitigation actions are programs, plans, projects, or policies New York City may implement to help reduce or eliminate the long-term risk to human life and property from natural hazards. The Planning Team and MPC identified, analyzed, and prioritized all potential actions. *Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.*

For further details on the fields displayed in this table, see Table 13 on page 153. Each mitigation action is assigned an index value to indicate the hazard addressed, whether it is an existing or potential action, and its alphabetized placement in the list. For example, the mitigation action with the index EQ.P.9 is the ninth potential mitigation action that addresses earthquakes.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
Coastal Erosion									
CE.P.1	Rikers Island Shoreline Protection: Install various shoreline protection structures to mitigate coastal erosion.	DOC	USACE	TBD	\$8,000,000	FEMA	Property Protection	2.1, 2.7	Low
CE.P.2	Beach Renourishment: Renourish Orchard Beach in the Bronx. Beach facilities periodically require renourishment with sand to prevent greater erosion and protect infrastructure.	USACE	Parks	5 Years	\$7,000,000	USACE, HMGP	Natural Resource Protection	2.1, 2.7, 4.1	Medium
Coastal Storms									
CS.P.1	Facility Protection: Elevate electrical substations, switchgear, feeders, and main sewage pump motors above Category 3 storm surge level to ensure treatment is not interrupted.	DEP	Con Ed, LIPA, NYPA, NYSDEC	>10 Years	\$5,600,000,000	Capital Program	Property Protection	2.1, 2.7, 2.8	High

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
CS.P.2	Hillview Reservoir Cover: Construct a cover to protect Hillview Reservoir from debris and degradation of water quality due to exposure resulting from extreme-weather events, including coastal storms. Hillview Reservoir is the final balancing reservoir for 90% of the City's water supply and is the water's last point of exposure to the elements prior to passing into the City's distribution tunnels.	DEP	N/A	5 Years	\$1,607,450,000	Capital Budget	Structural Projects	2.8, 4.1	Medium

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
CS.P.3	Kensico Reservoir Turbidity Curtain: Repair existing and install back-up turbidity curtain. These curtains will catch floatables and allow more time for particulate matter to settle out of the water prior to being conveyed to the City. Floatables and particulate matter affect water quality and are introduced to the reservoir from overland runoff during extreme weather events including coastal storms. At least 90% of the City's water supply passes through Kensico Reservoir.	DEP	N/A	2 Years	\$1,000,000	Capital Budget	Structural Projects	2.8, 4.1	Medium
CS.P.4	Natural Resource Protection: Dredge the Fresh, Hendrix, Flushing, and Newtown Creeks, Flushing Bay, and the Bergen and Thurston Basins to provide better flow, and channel area for water exiting sewer system tide-gates during significant storm events. This action will also reduce the impacts of flooding in low-lying areas.	DEP	N/A	TBD	\$296,800,000	Capital Budget	Natural Resource Protection	2.1, 2.7	Low

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
CS.P.5	Computer Modeling: Determine engineering effectiveness and cost-benefit of various coastal storm/hurricane mitigation measures using computer modeling. DOB will evaluate various coastal storm/hurricane design enhancements using prototypical New York City building types.	DOB	N/A	1 Year	\$2,250,000	Grants	Emergency Services	5.1, 5.2	High
CS.P.6	Protective Measures for Critical Facilities: Install coastal storm control measures around facilities in hurricane Sea, Lake, and Overland Surges from Hurricanes (SLOSH) zones.	DOC	N/A	TBD	TBD	TBD	Property Protection	2.1, 2.7	Medium
CS.P.7	Infrastructure Improvements and Study: Design and install flood gates and barriers at Brooklyn-Battery Tunnel and Queens-Manhattan Tunnel. Determine the coastal storm vulnerability of the Triborough Bridge.	MTA (Bridges and Tunnels)	MTA	2 Years	\$35,000,000	Capital Improvement Budget	Structural Projects	2.1, 2.7, 2.8	High
CS.P.8	Facility Protection: Retrofit hurricane shelter windows to withstand winds associated with coastal storm events.	OEM	DOE, FEMA, NYSEMO	TBD	TBD	HMGP, PDM-C	Property Protection	2.1, 2.7	Medium

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
CS.P.9	Hazards U.S. Multi-Hazard (HAZUS-MH) Modeling: Determine losses generated by a coastal storm/hurricane and engineering effectiveness and cost-benefit of various coastal storm mitigation measures using HAZUS-MH computer modeling. Evaluate various flood and wind design enhancements using prototypical New York City building types.	OEM	DOB	3 Months	TBD	Agency Operating Budget	Emergency Services	2.5, 5.1, 5.2	High
Drought									
D.P.1	Water Conservation: Install hands-free sensors in restroom sinks during renovations to 53 City-owned buildings.	DCAS	DCAS-DFMC	Ongoing	\$2,000,000	Capital Budget	Prevention	2.1, 2.7, 4.1	High
D.P.2	Water Conservation: Install low-water use toilets and flush sensors during renovations to 53 City-owned buildings.	DCAS	DCAS-DFMC	Ongoing	\$2,000,000	Capital Budget	Prevention	2.1, 2.7, 4.1	High

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
D.P.3	Aquifer Storage and Recovery: Store drinking water, supplied from upstate reservoirs below ground, within the City for future use. This action reduces drought impact and provides a redundant source of water.	DEP	N/A	TBD	\$20,000,000	Capital Budget	Structural Projects	2.1, 2.3	Medium
D.P.4	Croton Falls and Cross River Pump Station Rehabilitation: Provide additional redundancy for water supply operations by allowing DEP to move water between the Croton and Catskill/Delaware systems to supplement the local distribution system. Upgrade pump stations to provide 87 million additional gallons per day into distribution if there is an emergency service disruption in the Catskill or Delaware system.	DEP	N/A	TBD	\$109,530,000	Capital Budget	Structural Projects	2.1, 2.3, 2.7, 2.8	Medium

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
D.P.5	Delaware-Rondout Parallel Tunnel: Create redundant parallel tunnel to maintain adequate water supply. Existing tunnel crosses a faulted fractured rock formation and has cracks that are leaking up to 30 million gallons per day. Parallel tunnel will provide alternate means of conveyance to allow for repair of existing tunnel, and redundancy in case of emergency. Delaware system accounts for 50% of City water supply.	DEP	N/A	TBD	\$20,525,000,000	Capital Budget	Structural Projects	2.1, 2.3, 2.7, 2.8	Medium
D.P.6	Hydrant Locking Program: Fit critical fire hydrants in the City with locks to limit water usage during a drought. Conduct a pre-installation study to identify the best available hydrant-locking technology.	DEP	N/A	TBD	TBD	Capital Budget	Prevention	2.1, 2.7	Medium

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
D.P.7	Increase Catskill Aqueduct Capacity: Increase capacity to allow movement of water out of the Catskill systems, thereby providing up to 60 million gallons per day of additional flow from the Catskill Watershed in the event of a localized drought or loss of access to the Croton and Delaware systems.	DEP	N/A	TBD	\$1,254,000,000	Capital Budget	Structural Projects	2.1, 2.7, 2.8	Low
Earthquake									
EQ.P.1	Mechanical Equipment Seismic Upgrade: Install new mechanical equipment to resist seismic forces in 53 City-owned buildings.	DCAS	DCAS-DFMC	Ongoing	\$500,000	Capital Budget, NYPA	Property Protection	2.4, 2.7, 2.8	High

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
EQ.P.2	Construct Redundant Kensico City Aqueduct: Construct a seismically resistant and redundant third aqueduct between Kensico and Hillview Reservoirs. At present, two aqueducts carry 90% of the City's water supply from Kensico Reservoir to Hillview Reservoir. Neither of these aqueducts can be taken out of service without jeopardizing sufficient supply of water into the City. A third means of conveyance is necessary to ensure continuity of service in case of seismic disruption or planned shutdown to either of the existing aqueducts.	DEP	N/A	TBD	\$5,520,000,000	Capital Budget	Structural Projects	2.1, 2.3, 2.7, 2.8	Medium
EQ.P.3	Hunt's Point Wastewater Treatment Plant Facility Seismic Retrofit: Retrofit wastewater treatment facility and methane gas storage system to withstand seismic activity. Design facility to exceed current building codes.	DEP	TBD	TBD	\$25,000,000	Capital Budget	Property Protection	2.1, 2.7, 2.8	High

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
EQ.P.4	Rondout West Branch Tunnel Repair: Repair cracks and leaks in tunnel to reduce impact of seismic activity. This deep-bored tunnel crosses a faulted fractured rock formation, which makes it more vulnerable to seismic activity. This tunnel carries 50% of the City's water supply from the Delaware system across the Hudson River and is currently losing 30 million gallons of water per day. DEP intends to repair the tunnel once alternate sources or means of conveyance ensure a sufficient supply of water into the City.	DEP	N/A	TBD	\$425,000,000	Capital Budget	Property Protection	2.1	Low
EQ.P.5	Seismic Infrastructure Protection: Inspect and repair structural deficiencies in intercepting sewers to reduce the impact of seismic activity.	DEP	DOHMH, FEMA	>10 Years	\$80,000,000	Capital Program	Property Protection	2.1, 2.7, 2.8	High

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
EQ.P.6	Seismic Inspection and Retrofit Program: Conduct study to determine seismic design standards and seismic resiliency of drinking water distribution system (tunnels, piping, clean water pump stations, dams, shafts, and tanks). Use study results to prioritize and retrofit distribution infrastructure to appropriate seismic standards as needed.	DEP	N/A	TBD	TBD	Capital Budget, Grants	Property Protection	2.1, 2.7, 2.8	Medium
EQ.P.7	Computer Modeling: Determine engineering effectiveness and cost-benefit of various earthquake mitigation measures using computer modeling. Evaluate various seismic design enhancements using prototypical New York City building types.	DOB	N/A	1 Year	\$2,250,000	Grants	Emergency Services	2.5, 5.1, 5.2	High
EQ.P.8	Facility Retrofit: Perform seismic study of existing tall buildings. Retrofit buildings to exceed new building code seismic provisions.	DOE	DOE-SCA, DOB	10 Years	TBD	FEMA	Property Protection	1.2, 2.1, 2.7	Medium

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
EQ.P.9	Rikers Island Bridge Seismic Retrofit: Retrofit all bridges to withstand a magnitude 8 earthquake.	DOT	DOC	TBD	TBD	HMGP, PDM-C	Property Protection	2.1, 2.7, 2.8	Medium
EQ.P.10	Facility Improvement: Retrofit HPD site offices to withstand a magnitude 8 earthquake.	HPD	DCAS	2 Years	\$10,000,000	Grants	Property Protection	2.7	Medium
EQ.P.11	Seismic Studies and Retrofit: Identify and incorporate seismic requirements in bridge and tunnel restoration projects.	MTA (Bridges and Tunnels)	MTA-HQ	Beginning 2010	\$154,000,000	Capital Improvement Budget	Property Protection	2.1, 2.7, 2.8	Medium
EQ.P.12	HAZUS-MH Modeling: Evaluate various seismic building design enhancements using HAZUS-MH to identify enhancements that reduce losses generated by earthquakes.	OEM	DOB	3 Months	TBD	Agency Operating Budget	Emergency Services	2.5, 5.1, 5.2	High
Extreme Temperatures									
ET.P.1	Power Conservation: Install energy saving light fixtures in 53 City-owned buildings.	DCAS	DCAS-DFMC	5 Years FY 2009–2014	\$10,000,000	Capital Budget, PlaNYC	Prevention	2.1, 2.7, 4.1	High

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
ET.P.2	Power Redundancy: Install generators in select buildings to provide power during blackouts and emergency operations. Determine locations from the 53 City-owned buildings.	DCAS	DCAS-DFMC	5 Years FY 2009–2014	\$10,000,000	Capital Budget	Emergency Services	2.1, 2.3	Medium
ET.P.3	Equipment Upgrade: Increase blower output and diffuser density to wastewater treatment tanks. During periods of extreme heat, increased levels of dissolved oxygen are necessary to achieve safe and balanced wastewater treatment. The blower sends dissolved oxygen to the tank where the diffuser distributes it throughout the tank.	DEP	NYSDEC	>10 Years	\$140,000,000	Capital Program	Emergency Services	2.1, 2.7, 2.8, 4.1	High
ET.P.4	Facility Upgrade: Continue to review status of air conditioning systems and requirements for upgrading systems in senior centers with window air conditioners to help mitigate the effects of extreme heat.	DFTA	NYCHA	2 Years	TBD	TBD	Emergency Services	1.2, 2.7	Medium

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
ET.P.5	Facility Upgrade: Provide ducted central air conditioning system at BRC Senior Center located at 411 Delancey St. in Manhattan.	DFTA	Parks	1 Year	\$150,000	TBD	Emergency Services	1.2, 2.7	Medium
ET.P.6	Property Protection: Advocate to expand Weatherization, Referral, and Packaging Program to help low-income seniors and people with disabilities weatherize their homes against extreme cold and heat events.	DFTA	HRA, MOPD	2 Years	TBD	TBD	Public Education and Awareness	1.2, 2.6, 5.1	High
ET.P.7	Public Outreach: Advocate to expand Home Emergency Assistance Program to include financial assistance to low-income seniors and people with disabilities who require help paying electric bills for air conditioning during extreme heat events.	DFTA	HRA, MOPD	2 Years	TBD	TBD	Public Education and Awareness	1.2, 5.1, 5.3	Medium
ET.P.8	Public Outreach: Secure funding to make air conditioners available to qualified seniors and people with disabilities.	DFTA	DOHMH, HRA, NYSDHCR, NYSOTDA	2 Years	TBD	NYSDHCR	Public Education and Awareness	1.2, 3.1, 5.3	High

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New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
ET.P.9	Health Education and Outreach: Conduct "Extreme Heat—Extreme Care" workshops with community-based organizations that provide services to vulnerable populations (children, seniors, inmates, the homeless, and mentally ill). Workshops provide targeted instruction on how to reduce the risk of heat-related illness and mortality among affected populations.	DOHMH	DEP, DFTA, HRA, OEM	TBD	TBD	TBD	Public Education and Awareness	1.2, 2.6, 5.1, 5.3	Medium
Flood									
F.P.1	Drainage Improvement: Improve drainage along the Empire Line Corridor.	Amtrak	N/A	3–5 Years	\$250,000	General Capital Funding	Structural Projects	2.1, 2.7	High
F.P.2	Scour Protection: Replace rip-rap for bridges on Northeast Corridor to prevent scour during a flood event.	Amtrak	NJT	10 Years	\$2,000,000	FRA, General Capital Funding, NJT	Property Protection	2.1, 2.7	High
F.P.3	Tunnel Structure Rehabilitation: Enhance tunnel protection from water infiltration, flooding, and potential structure breach.	Amtrak	TBD	TBD	TBD	Amtrak, FRA	Property Protection	2.1, 2.7	Medium

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New York City Potential Hazard Mitigation Actions									
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F.P.4	Facility Damage Prevention: Avoid occupying any space near or in designated SLOSH zones A and B, even if the HRA-General Support Services program can accept the space from DCAS.	DCAS	HRA	TBD	TBD	Agency Lease Budget	Prevention	2.2	Medium
F.P.5	Infrastructure Protection: Create spill vaults to minimize damage from flooding in below-grade fuel-storage containers.	DCAS	DOE	TBD	TBD	FEMA	Property Protection	2.7, 4.1	Medium
F.P.6	Check Valve Installation/ Plumbing Improvement Subsidies: Seek federal subsidies for check valve or ejector pump system installations in flood prone areas to mitigate sewer back-ups.	DEP	DOB	TBD	TBD	Federal Grants	Property Protection	2.7	Low
F.P.7	Drainage Improvement Plan and Design: Identify flash flood and coastal flood prone areas and determine appropriate improvements to drainage services and levels of flood protection.	DEP	DCP, DOB, DOT, Parks	20–50 Years	\$25,000,000 – \$50,000,000	Capital Budget, Federal Grants	Property Protection	2.7, 2.8, 5.1	Medium

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New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
F.P.8	Drainage Improvement: Promote and expand bluebelts and other projects that absorb water that would otherwise be sent to the stormwater system. Parks has also installed two gray water systems that re-use water to irrigate horticulture.	DEP	Parks	5 Years	TBD	Capital Improvement Budget, HMGP, PlaNYC	Natural Resource Protection	2.4, 2.7, 4.1	High
F.P.9	Facility Protection: Construct tide gates on outfalls to reduce sea surge into the system citywide.	DEP	USACE	10 Years	\$20,000,000	Capital Budget, Federal Funding	Structural Projects	2.1, 2.7, 2.8	Medium
F.P.10	Facility Redesign: Reconstruct wastewater pumping stations so electrical equipment is above the flood plain to ensure sewer service for the tributary community.	DEP	DOHMH, FEMA, NYSDEC	>10 Years	\$470,000,000	Capital Program	Property Protection	2.1, 2.7, 2.8	High
F.P.11	Infrastructure Protection: Rebuild seawalls at wastewater treatment plants to prevent flooding of equipment.	DEP	DOHMH, NYSDEC	>10 Years	\$112,000,000	Capital Program	Structural Projects	2.1, 2.7, 2.8	Medium

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New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
F.P.12	Infrastructure Upgrade: Perform regulator improvements for sewer outfalls around East River, Westchester Creek, Hutchinson Creek, Flushing Bay, and Newtown Creek. Improved regulators will control releases from the sewer system during storms, reduce street flooding, and prevent sewer backups.	DEP	N/A	TBD	\$134,060,000	Capital Budget	Structural Projects	2.1, 2.7, 2.8, 4.1	Medium
F.P.13	Infrastructure Upgrade: Reconfigure and expand sewer system capacity in Bergen Basin and Tallman Island Wastewater Treatment Plant drainage areas to capture more stormwater, reduce combined sewer overflow into surrounding water bodies, and prevent sewer back-ups and street flooding.	DEP	N/A	TBD	\$80,495,000	Capital Budget	Structural Projects	2.1, 2.7, 2.8, 4.1	High
F.P.14	Infrastructure Upgrade: Replace main sewage pumps with higher-head units to overcome hydraulic resistance created by a flooding event.	DEP	NYSDEC, Con Ed, LIPA, NYPA	>10 Years	\$350,000,000	Capital Program	Structural Projects	2.1, 2.7, 2.8	Medium

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New York City Potential Hazard Mitigation Actions									
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F.P.15	Natural Resource Protection: Perform pre-storm and preventive maintenance of bluebelt structures.	DEP	Parks, NYSDEC	50 Years	\$5,000,000	Operating Budget	Natural Resource Protection	2.4, 2.7, 4.1	Medium
F.P.16	Facility Improvement: Perform floodproofing at senior centers.	DFTA	Aging Network, DFTA, NYCHA, OEM	5 Years	TBD	TBD	Property Protection	1.2, 2.1, 2.7	Medium
F.P.17	Facility Improvements: Relocate electrical closets from the lower floors/basements to higher levels at the 29 DHS sites.	DHS	N/A	Ongoing	\$13,500,000	TBD	Property Protection	2.1, 2.7	Medium
F.P.18	Computer Modeling: Determine the engineering effectiveness and cost-benefit of various flood mitigation measures using computer modeling. Evaluate various flood design enhancements using prototypical New York City building types.	DOB	N/A	1 Year	\$2,250,000	Grants	Emergency Services	2.5, 5.1, 5.2	High
F.P.19	Roadway Elevation and Regrade: Redesign and regrade roadways on Rikers Island to alleviate flooding conditions.	DOC	N/A	TBD	TBD	FMA, HMGP, PDM-C, SRL, RFC	Property Protection	2.1, 2.7	Medium

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F.P.20	Wet/Dry Floodproofing: Install flood proof measures at all DOC facilities to ensure flood waters do not affect operations.	DOC	N/A	TBD	TBD	FMA, HMGP, PDM-C, SRL, RFC	Property Protection	2.1, 2.7	Medium
F.P.21	Curb Repair and Installation: Remediate low-level curbs in potential flooding areas with higher ones to prevent excess flooding into basements and other structures. Higher curbs ensure excess stormwater runoff is discharged into catch basins or open channels.	DOT	N/A	Ongoing	\$6,000,000	CHIP	Structural Projects	2.7, 2.8	High
F.P.22	Drainage Improvement: Expand use of pedestrian plazas and refuge islands that incorporate street and open space trees to capture and hold stormwater.	DOT	DEP	4 Years	TBD	Capital Improvement Budget, CHIP	Property Protection	2.7, 2.8, 4.1	High
F.P.23	Building Upgrade: Install flood proofing in Coney Island Hospital basement as part of the phase II modernization.	HHC	TBD	7 Years	\$13,293,000	General Obligation Bonds	Property Protection	2.1, 2.7, 2.8	High

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New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
F.P.24	Marine Parkway Bridge Protection: Perform substructure and underwater work to prevent damage from flooding, including scour.	MTA (Bridges and Tunnels)	MTA	2 Years	\$11,591,562	Capital Improvement Budget	Property Protection	2.1, 2.7	Medium
F.P.25	Drainage Mitigation: Design and install storm-water pump stations to relieve major flood problem areas in LIRR track system.	MTA (LIRR)	N/A	TBD	TBD	Agency Operating Budget, HMGP	Structural Projects	2.1, 2.7	Medium
F.P.26	Drainage Improvement: Study flood-prone areas to determine ways to prevent water from entering system. This water-balance study will involve analyzing inflow and outflow capacity, storage, etc. Identify funding and implement Drainage Master Plan, if recommended by study.	MTA (NYCT-Subway)	DEP	5 Years (study) 20 Years (improvements)	TBD	FEMA, NYCT	Emergency Services	2.1, 2.7	Medium
F.P.27	Basement/Cellar Equipment Safeguard: Install duplex sump pumps for dewatering, additional floor drains, and elevated platforms for vital equipment. Avoid using cellars for public use (i.e. meeting rooms, centers, etc.).	NYCHA	N/A	Fiscal Year 2010	\$7,700,000	Capital Improvement Budget	Property Protection	2.7, 2.8	High

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Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
F.P.28	Critical Infrastructure Protection: Implement flood mitigation measures for New York City's back-up Emergency Operations Center, including sump-pumps, wet flood proofing, and drainage improvements.	OEM	DCAS, DDC, NYPD	2-3 Years	\$10,000,000	HMGP, PDM-C, SRL, RFC	Property Protection	2.1, 2.7	Medium
F.P.29	HAZUS-MH Modeling: Evaluate various building design enhancements using HAZUS-MH to identify opportunities to reduce flooding.	OEM	DOB	3 Months	Staff Time	Agency Operating Budget	Emergency Services	2.5, 5.1, 5.2	High
F.P.30	Property Protection: Enroll in NFIP Community Rating System. By implementing floodplain management initiatives and reducing the City's flood risk, residents can receive discounted flood insurance.	OEM	DCP, DOB	5 Years	TBD	Agency Operating Budget	Prevention	2.4, 2.7	Medium
F.P.31	Public Information and Guidance: Disseminate mitigation information and help provide technical assistance to property owners affected by flood events.	OEM	DEP, FEMA, NYSEMO	TBD	TBD	HMGP, PDM-C, SRL, RFC	Public Education and Awareness	2.6, 5.1, 5.2, 5.3	High

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Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
F.P.32	Severe Repetitive Loss Outreach and Education: Compile and map SRL properties throughout the city. Determine SRL funding eligibility and target these properties for outreach.	OEM	DEP, FEMA, NYSEMO	TBD	TBD	HMGP, PDM-C, SRL, RFC	Public Education and Awareness	2.9, 5.1, 5.2, 5.3	High
F.P.33	Drainage Improvement: Upgrade pumps and electrical power supply, and modify structural walks and platform decks in Pump House #4 and #6 at LGA airport.	PANYNJ (Aviation)	PANYNJ	6 Years	\$7,500,000	2007–2016 Capital Plan	Property Protection	2.1, 2.7	Medium
F.P.34	Facility Protection: Redesign “moat” system that surrounds each fuel farm tank as a protection against flooding at JFK airport.	PANYNJ (Aviation)	NYC, NYS	4 Years	\$7,000,000	Capital Budget	Structural Projects	2.1, 2.7, 4.1	High
F.P.35	Facility Protection: Reinforce dike wall along Bowery Bay and Runways 13–31 at LGA airport.	PANYNJ (Aviation)	NYSDEC	4 Years	\$5,000,000	2007–2016 Capital Plan	Structural Projects	2.1, 2.7	Medium
F.P.36	Facility Upgrade: Redesign and upgrade existing sanitary lift station at JFK airport in Central Terminal area to prevent flooding in the facility.	PANYNJ (Aviation)	NYC, NYS	5 Years	\$8,000,000	Capital Budget	Property Protection	2.1, 2.7	High

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F.P.37	Facility Upgrade: Redesign and retrofit of runways 4R and 22L including raising the existing grade, modifications to existing drainage, new lighting and concrete pavement at JFK airport.	PANYNJ (Aviation)	FAA	4 Years	\$40,000,000	Capital Budget	Property Protection	2.1, 2.7	Medium
F.P.38	Facility Upgrade: Redesign and retrofit runways 4L and 22R including raising the existing grade, modifications to existing drainage, new lighting and concrete pavement at JFK airport.	PANYNJ (Aviation)	FAA	4 Years	\$47,997,000	Capital Budget	Property Protection	2.1, 2.7	Medium
F.P.39	Floodproofing at Olmsted Site: Implement flood proofing actions including possible elevation and creation of additional drainage capacity. The Olmsted Center, Parks' capital division headquarters, suffers repetitive flooding.	Parks	N/A	5 Years	\$20,000,000	TBD	Property Protection	2.1, 2.7	Medium

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Windstorms/Tornadoes									
WT.P.1	Infrastructure Protection: Develop enhanced inspection program of all street, parking, and life-protecting signs throughout the City to ensure these do not become potentially hazardous debris during high wind events.	DOT	N/A	3 Years	\$3,250,000	CHIP	Emergency Services	2.7	High
WT.P.2	Building Retrofit: Replace windows at Coney Island Hospital to withstand a high-wind event.	HHC	TBD	2 Years	\$2,000,000	TBD	Property Protection	2.1, 2.7	High
WT.P.3	Facility Protection: Secure rooftop equipment to withstand high-wind events at HRA facilities.	HRA	OEM, DEP, DDC, DCAS, FEMA	5 Years	\$5,000,000	Agency Capital Budget	Property Protection	2.7	Medium
WT.P.4	Infrastructure Reinforcement: Study and design to construct bridge features that mitigate against the effects of severe windstorm events.	MTA (Bridges and Tunnels)	N/A	TBD	\$64,800,000	Capital Improvement Budget	Structural Projects	2.1, 2.7, 2.8	Medium
Winter Storms									
WS.P.1	Public Outreach: Partner with DOB to educate property owners about the impacts of snow load, snow drift loads, and sliding snow loads.	OEM	DOB	1 Year	TBD	Agency Operating Budget	Public Education and Awareness	2.6, 3.4, 5.3	High

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Multi-Hazard									
MH.P.1	Danger Tree Program: Identify and eliminate right-of-way tree and dead vegetation hazards.	Con Ed	N/A	TBD	\$600,000	Agency Operating Budget	Prevention	2.7, 3.3	Medium
MH.P.2	Building Retrofit: Perform window replacement upgrades at 100 Centre Street, 1 Centre Street, 22 Lafayette Street, 125 Worth Street, and 80 Centre Street.	DCAS	DCAS-DFMC	10 Years	\$15,000,000	Capital Budget	Property Protection	2.1, 2.7, 2.8	Medium
MH.P.3	Green Roof Installation: Install two green roofs a year on City-owned buildings. Green roofs can reduce the volume of stormwater runoff by absorbing or storing water and help reduce the urban heat island effect.	DCAS	DCAS-DFMC	5 Years	\$12,000,000	Capital Budget, PlaNYC	Structural Projects	2.7, 2.8, 4.1, 4.2	High
MH.P.4	Bridge Reconstruction and Stabilization: Reconstruct and stabilize DEP-owned bridges and culverts located in the Croton, Catskill, and Delaware watersheds. Adhere to NYSDOT bridge	DEP	N/A	TBD	Active Contracts—\$77,823,000	Capital Budget	Property Protection	2.1, 2.7, 2.8	Medium

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	safety standards to meet 50-year storm event design standards and withstand seismic loading. Thirty-one bridges and culverts are under construction or were recently upgraded. Another 23 are currently planned for reconstruction.				Future Contracts— \$322,700,000				
MH.P.5	CSO Storage: Install tunnels, relief sewers, and inline sewer storage for Flushing Bay and Newtown Creek areas to capture and store combined sanitary and stormwater during extreme weather. These facilities will reduce CSOs into surrounding water bodies. The inline sewer-storage installation is underway and is anticipated for completion in July 2009. The remaining projects will be initiated at a later date.	DEP	N/A	TBD	\$5,182,925,000	Capital Budget	Structural Projects	2.1, 2.7, 2.8, 4.1	Medium

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MH.P.6	Critical Facility Protection: Implement programmatic inspection and upgrade program to ensure all critical DEP facilities maintain continuity of operations during flood, hurricane, or earthquake events. This program will include floodproofing and structural retrofits of DEP offices, field locations, and other critical facilities.	DEP	N/A	10–20 Years	TBD	Capital Budget, Federal Grants	Property Protection	2.1, 2.7, 2.8	Medium

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MH.P.7	<p>Dam Reconstruction Program: Reconstruct seven high-hazard dams to safely pass the probable maximum flood criteria in accordance with NYS Dam Safety Guidelines and withstand seismic loading based on NYSDEC seismic guidance. This program will mitigate the impact of flooding and storm surge by capturing stormwater and runoff. The following dams are being reconstructed: Gilboa Dam (impounding Schoharie Reservoir), Olivebridge Dam (impounding Ashokan Reservoir), New Croton Dam (impounding New Croton Reservoir), Cannonsville Dam (impounding Cannonsville Reservoir), Merriman Dam (impounding Rondout Reservoir), Downsville Dam (impounding Pepacton Reservoir) and Neversink Dam (impounding Neversink Reservoir).</p>	DEP	N/A	TBD	\$1,011,000,000	Capital Budget	Structural Projects	2.1, 2.7, 2.8	Medium

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MH.P.8	<p>Drainage Improvement: Develop a drainage improvement plan that will use enhanced conveyance capacity and redundant sewers to enhance drainage citywide. This plan will include sewer design and construction, maximize the use of the City right of way and City-owned parcels for stormwater management, consider potential for climate change, and integrate with DEP’s capital planning process.</p>	DEP	DOB, DCP, DOT, Parks	20–50+ Years	TBD	Capital Budget, Federal Grants	Structural Projects	2.1, 2.3, 2.7, 2.8, 5.2	High
MH.P.9	<p>Facility and Infrastructure Protection: Reconstruct and harden sludge-vessel docks and piping to ensure continuity of treatment and protection of marine fleet assets.</p>	DEP	NYSDEC, USCG	>10 Years	\$70,000,000	Capital Program	Property Protection	2.1, 2.7	High

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MH.P.10	Groundwater Development: Construct treatment facilities throughout the southeast Queens groundwater system to provide up to 55 million gallons per day of additional water. Removal and treatment of groundwater lowers the water table, which can mitigate flooding impacts. This water will be treated to meet EPA Safe Drinking Water Act standards.	DEP	N/A	TBD	\$3,225,930,000	Capital Budget	Structural Projects	2.1, 2.3, 2.7, 2.8	Medium
MH.P.11	Groundwater Treatment Plant: Construct a treatment facility in southeast Queens for four existing groundwater wells to provide an additional 12 million gallons of water supply for the City. Removal and treatment of groundwater lowers the water table, which can mitigate flooding impacts. This water will be treated to meet EPA Safe Drinking Water Act standards.	DEP	N/A	TBD	\$253,900,000	Capital Budget	Structural Projects	2.1, 2.3, 2.7, 2.8	Medium

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MH.P.12	Mapping and Analysis Enhancement: Develop flood and storm surge impact model for sewer system. This model will allow the system to be tested under various conditions to appropriately target and prioritize mitigation actions. This effort includes securing more accurate topographical/grade information for the entire City and coupling this information with the actual built condition of the sewer system. Model could help proactively identify areas that are prone to repetitive losses due to street flooding and sewer backups.	DEP	OEM	>10 Years	\$10,000,000	Capital Budget	Emergency Services	5.1, 5.2	High
MH.P.13	Wetlands Restoration: Restore wetlands in Alley Creek, Paerdegat Basin, and Oakland Ravine to improve natural drainage of stormwater to reduce flooding, improve harbor water quality, and prevent coastal erosion.	DEP	N/A	TBD	\$38,000,000	Capital Budget	Natural Resource Protection	2.7, 4.1	High

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MH.P.14	Public Education: Develop and conduct educational forums or seminars addressing emergency preparedness and hazard-mitigation actions.	DFTA	OEM, ARC	2 Years	TBD	TBD	Public Education and Awareness	2.6, 3.3, 3.4, 5.3	Medium
MH.P.15	Public Outreach: Increase enrollment in Carrier Alert and Safe Return programs to prepare seniors to meet the challenges of disasters.	DFTA	Alzheimer's Foundation, HRA, MOPD, NYPD, USPS	2 Years	TBD	Agency Operating Budget	Public Education and Awareness	1.2, 5.3	High
MH.P.16	Building Upgrade: Add exterior reinforcements and energy performance enhancements to 29 DHS-owned buildings. These improvements will exceed the requirements of New York City building codes.	DHS	N/A	Ongoing	TBD	TBD	Property Protection	2.1, 2.7, 2.8	Medium
MH.P.17	Communications Equipment: Purchase 600 radios to provide redundant 800 MHz communications. Develop pre-event radio operations training program.	DHS	OEM, HHC, DOHMH,	Ongoing	\$600,000	TBD	Emergency Services	1.1, 2.3	Medium

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MH.P.18	Facility Improvements: Add ballast to roofs (flat roofs only) of 21 DHS-owned facilities to protect against elements such as high winds, heavy rain, and flying debris. These improvements will exceed the requirements of the City's building codes.	DHS	N/A	Ongoing	\$2,000,000	TBD	Property Protection	2.1, 2.7, 2.8	High
MH.P.19	Facility Retrofit: Retrofit existing windows in 29 DHS-owned facilities by glazing to withstand effects of a coastal storm, windstorms, and tornadoes. These improvements will exceed the requirements of the City's building codes.	DHS	N/A	Ongoing	\$18,000,000	TBD	Property Protection	2.1, 2.7, 2.8	Medium
MH.P.20	Power Redundancy: Install redundant power supply for eight special medical needs shelters, the maximum number the City will need to support its special needs population during a disaster.	DHS	CUNY, DOE, DOHMH, OEM,	Ongoing	\$400,000 (8 x \$50000)	TBD	Emergency Services	1.2, 2.3	Medium

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MH.P.21	Power Redundancy: Purchase five large capacity (50kw) emergency generators to provide redundant power supplies for critical operations at the Bedford/Atlantic, Jamaica, Franklin, and Fort Washington Armories as well as the PATH facility.	DHS	N/A	Ongoing	\$250,000 (5 x \$50,000)	TBD	Emergency Services	2.1, 2.3	Low
MH.P.22	Property Protection: Obtain restrictive covenants on six DHS shelters to replace with non-residential structures in areas within the flood and SLOSH zone.	DHS	N/A	Ongoing	TBD	TBD	Prevention	2.2, 2.7	Medium

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New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.23	Construction Code Revision: Develop construction code amendments to reduce both energy demand and reliance on fossil fuels as part of the Mayor's PlaNYC for 2030. These amendments will apply to both existing and new buildings and in some cases may result in energy reductions beyond the requirements of the Energy Conservation Construction Code of New York State. Review existing literature on how climate change will impact New York City, and review provisions developed by other jurisdictions to mitigate against the anticipated effects of climate change.	DOB	OLTPS	2 Years	\$5,800,000	Agency Operating Budget	Prevention	2.5, 4.1, 4.2, 5.1	High
MH.P.24	Information Gathering: Conduct a review and assessment of how other jurisdictions have incorporated mitigation measures into their construction codes.	DOB	N/A	3 Months	Staff Time	Agency Operating Budget	Prevention	2.5, 5.1	Medium

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.25	Information Gathering: Conduct an environmental review of the proposed building code for existing buildings.	DOB	N/A	1 Year	\$250,000 (budgeted)	Agency Operating Budget	Prevention	2.5, 4.1, 5.1	Medium
MH.P.26	Information Gathering: Conduct study on the effect of introducing mitigation measures into building codes on insurance rates and losses following a disaster.	DOB	N/A	3 Months	Staff Time	Agency Operating Budget	Prevention	2.5, 5.1	Medium
MH.P.27	Stormwater Management: Upgrade steam tunnel pumps to remove water that may enter during a coastal storm or a flooding event.	DOC	N/A	TBD	TBD	FEMA	Structural Projects	2.1, 2.7	Medium
MH.P.28	Critical Equipment Redundancy: Acquire portable generators, pumping station, lighting systems, radios, and other essential equipment to create redundancy for critical networks.	DOE	DOE	TBD	\$1,000,000	FEMA	Emergency Services	2.3	Medium

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.29	Facility Protection: Implement program to prune or remove old and overgrown trees near DOE facilities. This program is designed to prevent damage to the electrical distribution grid and nearby structures during tornadoes, windstorms, and coastal storms.	DOE	DOE-SCA	TBD	TBD	TBD	Property Protection	2.1, 2.7	Medium
MH.P.30	Green Roof Installation: Install updated building management systems that include green roof structures for DOE facilities. Green roofs can reduce the volume of stormwater runoff by absorbing or storing water and help reduce the urban-heat island effect.	DOE	DOE-SCA	TBD	TBD	TBD	Property Protection	2.7, 4.1, 4.2	Medium
MH.P.31	Infrastructure Protection: Install surge suppression protection for critical electrical systems to minimize impacts from severe weather.	DOE	DOE-SCA	TBD	TBD	TBD	Emergency Services	2.1, 2.7	Medium
MH.P.32	Power Redundancy: Install emergency power generation systems at existing DOE facilities.	DOE	DOE-SCA	TBD	\$1,250,000	FEMA	Emergency Services	2.3	Low

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.33	Early Warning System: Develop an enhanced notification system for contacting City employees using a variety of communication media to simultaneously notify, alert, and/or instruct City employees prior to and during an emergency.	DoITT	N/A	TBD	TBD	TBD	Emergency Services	1.1	Medium
MH.P.34	Bridge Inspections: Implement inspection program to identify bridges susceptible to natural hazards. Use results to develop structural mitigation actions designed to prevent collapse or failure of structure.	DOT	NYSDOT	2 Years	\$2,000,000	Federal, State, City	Prevention	2.1, 2.7, 2.8	High
MH.P.35	Critical Facility Loss Estimation: Conduct a detailed natural hazard loss estimation on critical facilities using increased positional accuracy-building attribute databases and available hazard maps.	DOT	DOB, OEM	TBD	\$50,000	Expense	Emergency Services	5.1, 5.2	High

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.36	Curb Repair and Installation: Remediate low-level curbs in flood prone areas to prevent excess flooding into basements and other structures. Higher curbs ensure that excess stormwater runoff is channeled and discharged into catch basins or open channels.	DOT	N/A	Ongoing	\$6,000,000	CHIP	Structural Projects	2.7, 2.8	Medium
MH.P.37	Drainage and Surface Improvement: Incorporate use of porous and albedo concrete into street reconstruction projects to reduce the amount of stormwater that enters the sewer system and the urban heat island effect. DOT will make this a standard specification for all street reconstruction projects.	DOT	DEP	Ongoing	TBD	Capital Improvement Budget, CHIP	Structural Projects	2.1, 2.7, 2.8, 4.2	High
MH.P.38	East River Bridges Retrofit (Construction): Implement seismic retrofit and structural hardening of Brooklyn, Manhattan, and Queensboro Bridges.	DOT	FDNY, FEMA, NYPD, USCG	2 Years	\$473,391,280	Capital Improvement Budget, FEMA, Grants	Property Protection	2.1, 2.7, 2.8	Medium

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.39	Information Update: Track formalized response to natural hazard-based incidents to identify repetitive loss locations or hazards. Use this information to inform the creation and implementation of future mitigation actions.	DOT	OEM	2 Years	\$150,000	Expense and Capital Budget	Emergency Services	5.1, 5.2	High
MH.P.40	Infrastructure Protection: Inspect and retrofit all moveable bridges to ensure they can withstand natural hazards.	DOT	FDNY, FEMA, NYPD, USCG	2 Years	TBD	Capital Improvement Budget, FEMA, Grants	Property Protection	2.1, 2.7, 2.8	High
MH.P.41	Critical Infrastructure Relocation: Relocate passenger ferry barge at World Financial Center to Hunters Point. Provide for stable landing at Hunters Point, allowing for transportation system redundancy.	EDC	DOT	TBD	\$300,000	EDC	Property Protection	2.1, 2.7	High
MH.P.42	Green Roof Installation: Install green roofs on facilities, where appropriate. Green roofs can reduce the volume of stormwater runoff by absorbing or storing water. They can also help reduce the urban-heat island effect.	EDC	DEP	TBD	TBD	TBD	Property Protection	2.7, 2.8, 4.1, 4.2	Medium

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.43	Backup Water Main System: Develop system to transmit fire suppression water throughout the City if existing infrastructure is disrupted due to a drought or earthquake.	FDNY	N/A	TBD	TBD	TBD	Emergency Services	2.1, 2.3	Medium
MH.P.44	Public Awareness: Develop hazard- mitigation and emergency preparedness program for homeowners.	HPD	N/A	2 Years	\$5,000,000	Grants	Public Education and Awareness	2.6, 5.3	High
MH.P.45	Critical Facility Protection: Evaluate flood-protection measures in long-term leased buildings in or near flood zones and coastal storm evacuation zones A and B. Make recommendations to building owners.	HRA	OEM, DCAS, DEP, DOT	5 Years	TBD	Lease Budget, Other-Than-Personnel-Services Budget	Public Education and Awareness	2.7, 5.1	High
MH.P.46	Explore Loss Reduction Actions: Assist potentially affected historic or landmarked properties with appropriate protection and/or retrofit options.	LPC	DOB	TBD	TBD	Agency Operating Budget, Grants	Public Education and Awareness	2.6, 2.9	High

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.47	Public Education and Outreach: Provide information on site and building preservation in severe repetitive loss and high hazard areas.	LPC	DOB, CPC, DOT, DCAS	TBD	TBD	Agency Operating Budget, Grants	Public Education and Awareness	2.6, 2.9, 5.1, 5.3	High
MH.P.48	Technical Assistance: Provide technical assistance to owners of historic or landmarked structures that are subject to severe repetitive loss.	LPC	DOB, CPC, DOT, DCAS	TBD	TBD	Agency Operating Budget, Grants	Public Education and Awareness	2.6, 2.9	High
MH.P.49	Far Rockaway Depot Green Roof: Design and install green roof. Green roofs can reduce the volume of stormwater runoff by absorbing or storing water and help reduce the urban-heat island effect.	MTA (Bus)	DEP, NYSDEC, FTA	2 Years	\$4,703,730	Capital Improvement Budget	Structural Projects	2.7, 4.1, 4.2	High
MH.P.50	Advanced Warning: Improve NWS ability to communicate forecast in non-text formats.	NWS	N/A	2 Years	TBD	TBD	Emergency Services	1.1	Medium
MH.P.51	Doppler Radar Upgrade: Upgrade software and hardware to improve precipitation-type detection and rainfall estimation.	NWS	N/A	4 Years	TBD	TBD	Emergency Services	1.1	Medium

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New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.52	Grounds, Pavements, and Drainage: Install planting for soil stabilization and to create buffer zones. Increase strength of anchorage/footings for play equipment and pole lighting in nine developments (91 buildings) citywide.	NYCHA	N/A	FY 2010	\$9,390,708	Capital Improvement Budget	Property Protection	2.7, 2.8	High
MH.P.53	Facility Protection: Enhance facility design of the 40th, 66th, 70th, 110th, 120th, 121st, and Central Park Precincts to endure severe wind, rain, and flooding events.	NYPD	N/A	TBD	TBD	TBD	Property Protection	2.1, 2.7, 2.8	High
MH.P.54	Facility Protection: Enhance facility design of the Public Safety Answering Center I, Public Safety Answering Center II, and Joint Operations Center to endure severe wind, rain, and flooding events.	NYPD	N/A	TBD	TBD	TBD	Property Protection	2.1, 2.7, 2.8	Medium
MH.P.55	Facility Protection: Promote hardening of existing and future critical facilities from the primary and secondary effects of natural hazards.	NYPD	N/A	TBD	TBD	TBD	Property Protection	2.1, 2.7, 2.8	High

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New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.56	Advance Warning System Integration: Integrate Notify NYC and NY-ALERT advance warning and emergency capabilities. When fully operable, this system will provide advance warning to New York City residents prior to natural hazard events.	OEM	DoITT, FEMA, NYSEMO	TBD	TBD	HMGP	Emergency Services	1.1	Low
MH.P.57	Critical Facility Protection: Conduct or update natural hazard vulnerability assessments for critical facilities throughout the City.	OEM	MPC	5 Years	TBD	TBD	Emergency Services	2.7, 5.1	Medium
MH.P.58	Educational Outreach: Coordinate and provide educational outreach on mitigation strategies the private sector can take to reduce or eliminate the impact of hazards on their services and infrastructure. Opportunities to educate OEMs private sector partners include conferences, OEMs website, and presentations.	OEM	N/A	TBD	TBD	TBD	Public Education and Awareness	3.1, 3.3, 3.4, 3.5	High

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.59	Facility Protection: Conduct or update natural-hazard vulnerability assessments for all OEM facilities. Harden facilities to damage from natural hazard events.	OEM	DCAS, FEMA, NYSEMO	TBD	TBD	HMGP, PDM-C	Property Protection	2.1, 2.7, 2.8	Medium
MH.P.60	Facility Protection: Install storm shutters at OEM headquarters designed to protect windows from flying debris.	OEM	N/A	3–5 Years	\$800,000	HMGP, PDM-C	Property Protection	2.1, 2.7	High
MH.P.61	HAZUS-MH Update: Optimize use of HAZUS-MH software for New York City's unique urban environment. The software update will allow New York City to generate more accurate loss estimates for various hazards.	OEM	FEMA, NYSEMO	1 Year	TBD	HMGP, PDM-C	Emergency Services	2.5, 5.1, 5.2	High

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New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.62	Incorporate Hazard Mitigation into Community Emergency Response Team (CERT) Curriculum: Adapt CERT curriculum to educate teams members on strategies that will mitigate the impact of natural hazards to the City. This can include education on protecting utility services, redundant communication, continuity of business services (for corporate CERTs), and property protection.	OEM	NYPD, FDNY	Ongoing	\$200,000	USDHS–UASI, Grants	Public Education and Awareness	3.2, 3.4, 3.5, 5.3	High
MH.P.63	Infrastructure Systems Modeling: Coordinate the development of a multi-hazard infrastructure vulnerability model, including storm surge barriers.	OEM	FEMA, NYSEMO, Academic Institutions	3 Years	TBD	HMGP	Emergency Services	5.1, 5.2	High
MH.P.64	Loss Estimation Assistance: Assist agencies in determining loss estimates using HAZUS-MH.	OEM	MPC	5 Years	TBD	HMGP, PDM-C, FMA	Emergency Services	5.1, 5.2	Medium

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.65	Natural Hazard Event Database: Create a natural hazard event database to capture description, severity, location, impact, and potential loss/damage estimate from an event. This data will be used to update the hazard analysis and mitigation actions for New York City.	OEM	FEMA, NYSEMO	5 Years	TBD	Agency Operating Budget	Emergency Services	5.1, 5.2	Medium
MH.P.66	Partner with Community Groups: Partner the CERT program with local community organizations, including civic, faith-based, and tenant associations, to promote mitigation strategies.	OEM	NYPD, FDNY	Ongoing	\$200,000	USDHS–UASI, Grants	Public Education and Awareness	3.1, 3.3, 3.4, 3.5, 5.3	High
MH.P.67	Public Outreach: Update and expand Ready New York for seniors and people with disabilities.	OEM	DFTA, MOPD	1 Year	TBD	OEM	Public Education and Awareness	1.2, 5.3	High

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.68	Public/Private Mitigation Initiatives: Support the resiliency of the City's private sector through information sharing, partnership building, training and education on mitigation principles and the City's Hazard Mitigation Plan.	OEM	N/A	Ongoing	TBD	TBD	Public Education and Awareness	3.1, 3.3, 3.4, 3.5	High
MH.P.69	Regional Critical Infrastructure Mapping: Map critical infrastructure for the New York City region to better understand the interrelationships among the various components of the region's infrastructure. This information will also support the Hazard Mitigation Plan's Risk Assessment Section.	OEM	DHS, NYSOHS, PANYNJ	12 Months	TBD	TBD	Emergency Services	5.1, 5.2	Medium
MH.P.70	Subway Depths Mapping: Collaborate with NYCT to assign depth below-street level and absolute depth below sea level elevations for subway stations and tunnels. This effort will support planning for flooding and secondary impacts from other natural hazards.	OEM	NYCT	12 Months	TBD	TBD	Emergency Services	5.1, 5.2	Medium

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.71	Vegetation Data: Develop vegetation data for New York City for use in HAZUS-MH and other hazard-impact models This will allow for better debris estimates and will identify areas more susceptible to the urban-heat island effect.	OEM	Parks	6 Months	TBD	TBD	Prevention	5.1, 5.2	Medium
MH.P.72	Zoning for Hazard-Prone Areas: Correlate natural hazard vulnerable areas with existing zoning districts to identify areas where mitigation actions would be necessary to maintain the responsible and sustainable development of these areas.	OEM	DCP	12 Months	TBD	TBD	Prevention	2.4, 2.5, 5.1, 5.2	Medium
MH.P.73	Warning System/Environmental Protection: Implement advance-warning system for emergency fuel shut off during a natural disaster event.	PANYNJ (Aviation)	NYC, NYS	3 Years	\$500,000	Capital Budget	Emergency Services	1.1, 4.1	High

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.74	Green Roof Installation: Install green roofs on select Parks facilities. Green roofs can reduce the volume of stormwater runoff by absorbing or storing water and help reduce the urban heat island effect. Estimated cost is approximately \$25 per square foot.	Parks	DOE-SCA	2 Years	\$30,000 – \$50,000 per site	HMGP, Other Grants	Property Protection	2.7, 2.8, 4.1, 4.2	High
MH.P.75	Green Streets: Transform selected traffic medians from concrete to areas densely planted with trees and horticulture. Green streets can reduce the volume of stormwater runoff by absorbing or storing water and help reduce the urban-heat island effect.	Parks	DOT	2 Years	\$50,000 per site	HMGP, Other Grants	Natural Resource Protection	2.7, 2.8, 4.1, 4.2	High
MH.P.76	Land Acquisition: Leave purchased or donated land and wetlands in a natural state to absorb floodwaters, mitigate storm surge impacts, reduce heat impacts, and prevent construction in flood zones.	Parks	N/A	5 Years	\$1,000,000 per acre	HMGP	Property Protection	2.2, 2.5, 2.7, 4.1	Medium

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

New York City Potential Hazard Mitigation Actions									
Index	Mitigation Action and Description	Lead Agency	Supporting Agency(s)	Project Timeframe/ Duration	Estimated Project Cost	Possible Funding Source(s)	FEMA Category	Goals and Objectives	Prioritization
MH.P.77	Seawall, Pier, and Marina Structural Repairs: Restore docks and other seawall structures at the 79th Street Boat Basin in Manhattan. Emergency repair to Shore Road seawall in Brooklyn (completed). Parks has jurisdiction over miles of seawall, including much of Manhattan’s frontage on the East River. Seawalls help mitigate erosion and prevent flooding.	Parks	N/A	5 Years	TBD for Seawall, \$1,000,000 for 79th Street Boat Basin	HMGP	Structural Projects	2.7	Medium
MH.P.78	Infrastructure Upgrade: Construct diverse redundant air- pressure system to maintain pressure on underground telephone cables during flooding from major storms/hurricanes.	Verizon	N/A	1 Year	\$1,140,000	Capital improvement budget	Structural Projects	2.1, 2.3, 3.3	Medium

Table 4: New York City Hazard Mitigation Action (Potential)/Implementation Table

Note some mitigation actions identified may not ultimately be implemented due to prohibitive costs, scale, low benefit/cost analysis ratios, or other concerns.

b) Analysis

The Planning Team and Steering Committee analyzed potential mitigation actions using the FEMA STAPLEE method and HAZUS-MH. This analysis helped determine whether actions achieved one or more of the five hazard mitigation goals and 23 objectives. The analysis also established the opportunities and constraints of implementing each potential mitigation action.

i) STAPLEE Analysis

The Planning Team and Steering Committee conducted a qualitative evaluation of potential mitigation actions using the STAPLEE (social, technical, administrative, political, legal, economic, and environmental) review method. STAPLEE is an evaluation process developed by FEMA that is a systematic method to help identify the benefits and constraints of a particular mitigation action. The table below provides a summary of the STAPLEE criteria.

STAPLEE Summary Table	
Criteria	Description
<u>S</u>	Social criteria: The social aspects of the proposed mitigation action are considered including: <ul style="list-style-type: none"> • Community acceptance • Effect on segment of population
<u>T</u>	Technical criteria: The technical aspects of the proposed mitigation action are considered including: <ul style="list-style-type: none"> • Technical feasibility • Long-term solution • Secondary impacts
<u>A</u>	Administrative criteria: The administrative aspects of each proposed mitigation action are considered including: <ul style="list-style-type: none"> • Staffing • Funding allocation • Maintenance/operations
<u>P</u>	Political criteria: The political aspects of the proposed mitigation action are considered including: <ul style="list-style-type: none"> • Political support • Public support
<u>L</u>	Legal criteria: The legal authority to implement proposed mitigation action is considered including: <ul style="list-style-type: none"> • State authority • Existing local authority • Potential legal challenges
<u>E</u>	Economic criteria: The economic aspects of the proposed mitigation action are considered including: <ul style="list-style-type: none"> • Benefit of action • Cost of action • Outside funding requirements
<u>E</u>	Environmental criteria: Environmental impacts of the proposed mitigation action are considered including: <ul style="list-style-type: none"> • Effect on land/water • Consistent with community environmental goals

Table 5: STAPLEE Summary Table

The table below summarizes the STAPLEE evaluation of potential mitigation actions organized by hazard. The seven STAPLEE evaluation criteria were assigned a plus (+), if the proposed action is favorable; a minus (-), if the action is unfavorable; or a Not Applicable (N) if the evaluation criteria does not apply to the mitigation action.

Potential Mitigation Actions STAPLEE Analysis Table																				
Index	Mitigation Action	Lead Agency	Social		Technical			Administrative			Political		Legal			Economic			Environment	
			Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Staffing	Funding Allocation	Maintenance/Operations	Political Support	Public Support	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Outside Funding Required	Effect on Land/ Water	Consistent with Community Environmental Goals
Coastal Erosion																				
CE.P.1	Rikers Island Shoreline Protection	DOC	-	+	+	+	-	-	-	+	+	+	-	-	+	+	+	-	-	-
CE.P.2	Beach Renourishment	USACE	+	+	+	+	-	+	-	-	+	+	+	-	+	+	-	-	-	+
Coastal Storms																				
CS.P.1	Facility Protection	DEP	+	+	+	+	N	+	+	+	+	+	N	+	+	+	-	+	N	+
CS.P.2	Hillview Reservoir Cover	DEP	+	+	+	+	-	+	+	-	+	+	-	-	+	+	-	+	-	+
CS.P.3	Kensico Reservoir Turbidity Curtain	DEP	+	+	+	+	-	+	+	-	+	+	-	-	+	+	+	+	-	-
CS.P.4	Property Protection	DEP	-	-	+	+	-	+	+	-	+	-	-	-	+	-	+	-	-	-
CS.P.5	Computer Modeling	DOB	+	N	+	+	N	+	-	+	+	+	+	+	+	+	+	N	N	N
CS.P.6	Protective Measures for Critical Facilities	DOC	N	+	+	+	+	-	-	-	+	+	N	+	+	+	N	-	+	N
CS.P.7	Infrastructure Improvements and Study	MTA (Bridges and Tunnels)	+	+	+	+	N	+	+	-	+	+	-	-	+	+	+	+	N	+
CS.P.8	Facility Protection	OEM	+	+	+	+	N	-	-	+	+	+	N	+	+	+	N	-	N	N

Potential Mitigation Actions STAPLEE Analysis Table																				
Index	Mitigation Action	Lead Agency	Social		Technical			Administrative			Political		Legal			Economic			Environment	
			Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Staffing	Funding Allocation	Maintenance/Operations	Political Support	Public Support	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Outside Funding Required	Effect on Land/ Water	Consistent with Community Environmental Goals
CS.P.9	HAZUS-MH Modeling	OEM	N	+	+	+	N	+	+	+	+	+	N	N	+	+	+	+	N	N
Drought																				
D.P.1	Water Conservation	DCAS	+	+	+	+	+	-	+	+	+	+	N	+	+	+	+	+	+	+
D.P.2	Water Conservation	DCAS	+	+	+	+	+	-	+	+	+	+	N	+	+	+	+	+	+	+
D.P.3	Aquifer Storage and Recovery	DEP	+	+	+	+	-	+	+	-	+	+	-	-	+	+	-	+	-	-
D.P.4	Croton Falls and Cross River Pump Station Rehabilitation	DEP	+	+	+	+	-	+	+	-	+	+	-	-	+	+	-	+	-	+
D.P.5	Delaware-Rondout Parallel Tunnel	DEP	+	+	+	+	-	+	+	-	+	+	-	-	+	+	-	+	-	-
D.P.6	Hydrant Locking Program	DEP	-	+	+	+	+	+	-	-	+	+	N	+	+	+	N	+	+	+
D.P.7	Increase Catskill Aqueduct Capacity	DEP	-	-	+	+	-	+	+	-	+	-	-	-	-	+	-	+	-	-
Earthquake																				
EQ.P.1	Mechanical Equipment Seismic Upgrade	DCAS	N	N	+	+	N	+	+	+	+	+	N	+	+	+	+	+	N	N

Potential Mitigation Actions STAPLEE Analysis Table																				
Index	Mitigation Action	Lead Agency	Social		Technical			Administrative			Political		Legal			Economic			Environment	
			Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Staffing	Funding Allocation	Maintenance/Operations	Political Support	Public Support	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Outside Funding Required	Effect on Land/ Water	Consistent with Community Environmental Goals
EQ.P.2	Construct Redundant Kensico City Aqueduct	DEP	+	+	+	+	-	+	+	-	+	+	-	-	+	+	-	+	-	-
EQ.P.3	Hunt's Point Wastewater Treatment Plant Facility Seismic Retrofit	DEP	+	+	+	+	+	+	+	-	+	+	N	+	+	+	-	+	+	+
EQ.P.4	Rondout West Branch Tunnel Repair	DEP	+	+	+	+	-	+	+	-	-	-	-	-	+	-	-	+	-	N
EQ.P.5	Seismic Infrastructure Protection	DEP	-	+	+	+	-	+	+	+	+	+	N	+	+	+	-	+	+	+
EQ.P.6	Seismic Inspection and Retrofit Program	DEP	+	+	+	+	+	-	-	N	+	+	+	+	N	+	N	N	N	+
EQ.P.7	Computer Modeling	DOB	N	+	+	+	N	+	-	+	+	+	N	N	+	+	-	+	N	N
EQ.P.8	Facility Retrofit	DOE	N	N	+	+	-	-	-	+	+	+	+	-	+	+	N	-	+	N
EQ.P.9	Rikers Island Bridge Seismic Retrofit	DOT	+	+	+	+	N	-	-	+	+	+	N	+	+	+	N	-	N	N
EQ.P.10	Facility Improvement	HPD	N	N	+	+	+	-	-	+	+	+	N	+	+	-	-	-	+	N
EQ.P.11	Seismic Studies and Retrofit	MTA (Bridges)	+	+	+	+	-	+	+	+	+	+	-	-	+	+	-	+	-	+

Potential Mitigation Actions STAPLEE Analysis Table																				
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		and Tunnels)																		
EQ.P.12	HAZUS-MH Modeling	OEM	N	+	+	+	N	+	-	+	+	+	N	N	+	+	-	+	N	N
Extreme Temperatures																				
ET.P.1	Power Conservation	DCAS	N	+	+	+	+	+	+	-	+	+	N	+	+	+	+	+	+	+
ET.P.2	Power Redundancy	DCAS	N	N	+	-	N	+	-	-	+	+	N	+	+	+	-	-	N	N
ET.P.3	Equipment Upgrade	DEP	+	+	+	+	+	+	+	-	+	+	N	+	+	+	-	+	+	+
ET.P.4	Facility Upgrade	DFTA	+	+	+	+	N	+	-	-	+	+	N	+	+	+	N	-	N	N
ET.P.5	Facility Upgrade	DFTA	+	+	+	+	N	+	-	-	+	+	N	+	+	+	N	-	N	N
ET.P.6	Property Protection	DFTA	+	+	+	+	+	+	-	+	+	+	N	+	+	+	N	-	+	+
ET.P.7	Public Outreach	DFTA	+	+	+	+	N	+	-	+	+	+	N	+	+	+	N	-	N	-
ET.P.8	Public Outreach	DFTA	+	+	+	-	N	+	+	-	+	+	N	+	+	+	N	+	N	+
ET.P.9	Health Education and Outreach	DOHMH	+	+	+	-	N	+	-	+	+	+	N	+	+	+	N	-	N	N
Flood																				
F.P.1	Drainage Improvement	Amtrak	+	+	+	+	-	+	+	+	+	+	-	-	+	+	+	+	+	+
F.P.2	Scour Protection	Amtrak	-	+	+	+	N	+	+	-	+	+	+	-	+	+	+	+	N	+

Potential Mitigation Actions STAPLEE Analysis Table																				
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F.P.3	Tunnel Structure Rehabilitation	Amtrak	-	+	+	+	+	-	-	+	+	+	+	-	N	+	N	-	+	+
F.P.4	Facility Damage Prevention	DCAS	N	N	+	+	N	-	+	N	+	+	N	+	+	-	N	+	N	N
F.P.5	Infrastructure Protection	DCAS	+	+	+	+	+	+	-	+	N	N	+	-	+	+	N	-	+	-
F.P.6	Check Valve Installation/Plumbing Improvement Subsidies	DEP	+	+	+	+	+	+	-	-	+	+	-	-	+	-	N	-	+	-
F.P.7	Drainage Improvement	DEP	+	+	+	+	+	-	-	N	+	+	+	+	+	+	N	-	+	+
F.P.8	Drainage Improvement Plan and Design	DEP	+	+	+	+	N	+	+	N	+	+	N	+	+	+	+	+	N	N
F.P.9	Facility Protection	DEP	+	+	+	+	+	+	+	-	+	+	-	-	-	+	+	+	-	-
F.P.10	Facility Redesign	DEP	+	+	N	+	+	+	+	+	+	+	+	-	+	+	-	+	+	+
F.P.11	Infrastructure Protection	DEP	+	+	+	-	+	+	+	-	+	+	+	-	N	+	-	+	+	-
F.P.12	Infrastructure Upgrade	DEP	+	+	+	+	-	+	+	-	+	+	-	-	+	+	-	+	-	+
F.P.13	Infrastructure Upgrade	DEP	+	+	+	+	-	+	+	+	+	+	N	+	+	+	-	+	+	+
F.P.14	Infrastructure Upgrade	DEP	+	+	+	+	+	+	+	-	+	+	-	-	+	+	-	+	+	+

Potential Mitigation Actions STAPLEE Analysis Table																				
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F.P.15	Natural Resource Protection	DEP	+	+	+	+	+	+	+	-	+	+	-	-	N	+	+	+	+	+
F.P.16	Facility Improvement	DFTA	+	+	+	+	+	-	-	+	+	+	N	+	+	+	N	-	+	N
F.P.17	Facility Improvements	DHS	+	+	+	+	N	-	-	+	+	+	N	+	+	+	+	-	N	N
F.P.18	Computer Modeling	DOB	N	+	+	+	N	+	-	N	+	+	N	N	+	+	+	-	N	N
F.P.19	Roadway Elevation and Regrade	DOC	-	+	+	+	+	-	-	+	N	N	N	+	+	+	N	-	+	+
F.P.20	Wet/Dry Flood proofing	DOC	-	+	+	+	N	-	-	+	N	N	N	+	+	+	N	-	N	N
F.P.21	Curb Repair and Installation	DOT	+	+	+	+	+	+	+	+	+	+	-	-	+	+	-	+	+	+
F.P.22	Drainage Improvement	DOT	+	+	+	+	+	+	+	+	+	+	-	-	+	+	N	+	+	+
F.P.23	Building Upgrade	HHC	+	+	+	+	+	-	+	+	+	+	N	+	+	+	+	+	+	N
F.P.24	Marine Parkway Bridge Protection	MTA (Bridges and Tunnels)	N	N	+	+	N	+	+	-	N	N	N	N	+	+	-	+	N	-
F.P.25	Drainage Mitigation	MTA (LIRR)	+	+	+	+	+	+	-	-	+	+	-	-	+	+	N	+	+	+

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F.P.26	Drainage Improvement	MTA (NYCT-Subway)	+	+	+	N	N	+	-	N	+	+	N	+	+	+	N	-	N	N
F.P.27	Basement/Cellar Equipment Safeguard	NYCHA	+	+	+	+	+	+	+	-	+	+	-	-	+	+	+	+	+	+
F.P.28	Critical Infrastructure Protection	OEM	N	N	+	+	+	+	-	-	+	+	N	+	+	+	+	-	+	N
F.P.29	HAZUS-MH Modeling	OEM	+	+	+	+	+	+	+	+	+	+	N	+	+	+	+	+	+	N
F.P.30	Property Protection	OEM	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+	+	N
F.P.31	Public Information and Guidance	OEM	+	+	+	+	+	+	-	+	+	+	N	+	+	+	+	-	+	N
F.P.32	Severe Repetitive Loss Outreach and Education	OEM	+	+	+	+	+	+	-	+	+	+	N	+	+	+	+	-	+	N
F.P.33	Drainage Improvement	PANYNJ (Aviation)	N	N	+	+	+	N	+	-	+	+	N	+	N	+	+	+	N	N
F.P.34	Facility Protection	PANYNJ (Aviation)	-	+	+	+	+	N	+	+	+	+	+	-	+	+	+	+	N	-

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F.P.35	Facility Protection	PANYNJ (Aviation)	-	N	+	+	+	N	+	-	+	+	+	-	+	+	+	+	N	N
F.P.36	Facility Upgrade	PANYNJ (Aviation)	N	+	+	+	+	N	+	+	+	+	N	+	+	+	-	+	N	N
F.P.37	Facility Upgrade	PANYNJ (Aviation)	-	+	+	+	+	N	+	+	N	N	N	+	+	+	-	+	N	N
F.P.38	Facility Upgrade	PANYNJ (Aviation)	-	+	+	+	+	N	+	+	N	N	-	-	+	+	-	+	N	N
F.P.39	Flood Proofing at Olmsted Site	Parks	+	+	+	+	+	+	-	+	+	+	N	+	+	+	-	-	+	N
Windstorms/Tornadoes																				
WT.P.1	Infrastructure Protection	DOT	+	+	+	+	+	+	+	-	N	+	-	-	+	-	+	+	+	+
WT.P.2	Building Retrofit	HHC	N	N	+	+	N	+	-	+	+	+	N	+	+	+	+	-	N	N
WT.P.3	Facility Protection	HRA	N	N	+	+	N	+	+	+	N	N	-	-	+	-	+	+	N	N
WT.P.4	Infrastructure Reinforcement	MTA (Bridges and Tunnels)	+	+	+	+	N	N	+	-	+	+	-	-	+	+	-	+	N	N

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Winter Storms																				
WS.P.1	Public Outreach	OEM	+	+	+	+	+	+	+	+	+	+	+	N	N	+	+	+	+	+
Multi-Hazard																				
MH.P.1	Danger Tree Program	Con Ed	+	+	+	+	-	+	+	-	+	+	+	-	-	+	+	+	-	-
MH.P.2	Building Retrofit	DCAS	-	+	+	+	+	+	+	+	+	+	N	+	+	+	-	+	+	N
MH.P.3	Green Roof Installation	DCAS	N	+	+	+	+	N	+	-	+	+	N	+	+	+	-	+	+	+
MH.P.4	Bridge Reconstruction and Stabilization	DEP	+	+	+	+	-	+	+	-	+	+	-	-	+	+	-	+	+	+
MH.P.5	Combined Sewer Overflow Storage	DEP	+	+	+	+	-	+	-	-	+	+	-	-	+	+	-	-	+	+
MH.P.6	Critical Facility Protection	DEP	+	+	+	+	+	+	-	+	N	N	N	+	+	+	N	-	+	+
MH.P.7	Dam Reconstruction Program	DEP	+	+	+	+	+	+	+	-	+	+	-	-	+	+	-	+	+	+
MH.P.8	Drainage Improvement	DEP	+	+	+	+	+	+	N	+	+	+	N	+	+	+	N	-	+	+
MH.P.9	Facility and Infrastructure Protection	DEP	N	+	+	+	+	+	+	-	+	+	+	-	+	+	-	+	+	N
MH.P.10	Groundwater	DEP	+	+	+	+	-	+	+	-	+	+	-	-	+	+	-	+	+	+

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	Development																			
MH.P.11	Groundwater Treatment Plant	DEP	+	+	+	+	+	+	+	-	+	+	-	-	+	+	-	+	+	+
MH.P.12	Mapping and Analysis Enhancement	DEP	+	+	+	-	+	+	+	+	+	+	+	-	+	+	+	+	+	+
MH.P.13	Wetlands Restoration	DEP	+	+	+	+	+	+	+	-	+	+	N	+	+	+	M	+	+	+
MH.P.14	Public Education	DFTA	+	+	+	+	N	+	-	-	+	+	N	+	+	+	N	-	N	N
MH.P.15	Public Outreach	DFTA	+	+	+	+	N	+	+	-	+	+	N	+	+	+	N	+	N	N
MH.P.16	Building Upgrade	DHS	-	+	+	+	+	-	-	+	+	+	N	+	+	+	N	-	+	N
MH.P.17	Communications Equipment	DHS	-	+	+	-	N	-	-	-	+	+	N	N	N	+	+	-	N	N
MH.P.18	Facility Improvements	DHS	N	N	+	+	+	N	-	+	+	+	N	+	+	+	+	-	+	+
MH.P.19	Facility Retrofit	DHS	N	+	+	+	+	-	-	+	+	+	N	+	-	+	+	-	+	N
MH.P.20	Power Redundancy	DHS	N	N	+	-	N	+	-	-	+	+	N	+	+	+	-	-	N	N
MH.P.21	Power Redundancy	DHS	N	N	+	-	N	+	-	-	+	+	N	+	+	+	-	-	N	N
MH.P.22	Property Protection	DHS	N	N	+	+	+	+	-	+	+	+	N	+	+	+	N	-	+	N
MH.P.23	Construction Code Revision	DOB	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+

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MH.P.24	Information Gathering	DOB	-	N	+	-	N	+	+	+	+	+	N	+	+	+	+	+	N	N
MH.P.25	Information Gathering	DOB	-	N	+	-	N	+	+	+	+	+	N	+	+	+	+	+	N	N
MH.P.26	Information Gathering	DOB	-	N	+	-	N	+	+	+	+	+	N	+	+	+	+	+	N	N
MH.P.27	Stormwater Management	DOC	+	+	+	+	N	+	-	+	+	+	N	+	+	+	N	-	N	N
MH.P.28	Critical Equipment Redundancy	DOE	+	+	+	-	+	+	+	-	+	+	N	+	+	-	+	-	+	+
MH.P.29	Facility Protection	DOE	+	+	+	+	-	+	+	-	+	+	N	+	+	+	N	-	-	+
MH.P.30	Green Roof Installation	DOE	+	+	+	+	+	+	-	-	+	+	+	-	+	+	N	-	+	+
MH.P.31	Infrastructure Protection	DOE	+	N	+	+	N	+	-	+	+	+	+	-	+	+	N	-	N	N
MH.P.32	Power Redundancy	DOE	N	N	+	-	N	+	-	-	+	+	N	+	+	+	-	-	N	N
MH.P.33	Early Warning System	DoITT	+	+	+	+	+	+	-	+	+	+	N	+	+	-	N	-	+	+
MH.P.34	Bridge Inspections	DOT	+	+	+	+	+	+	+	+	+	+	N	+	+	+	+	+	+	+
MH.P.35	Critical Facility Loss Estimation	DOT	+	+	+	+	+	+	+	+	+	+	N	N	+	+	+	+	+	N
MH.P.36	Curb Repair and Installation	DOT	+	-	+	+	+	+	+	-	+	+	-	-	-	+	-	+	+	+
MH.P.37	Drainage and Surface	DOT	+	+	+	+	+	+	+	-	+	+	-	-	+	+	N	+	+	+

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	Improvement																			
MH.P.38	East River Bridges Retrofit (Construction)	DOT	+	+	+	+	+	+	+	+	+	+	N	-	-	+	-	-	-	+
MH.P.39	Information Update	DOT	+	-	+	+	+	+	-	+	+	+	N	+	+	+	+	-	-	N
MH.P.40	Infrastructure Protection	DOT	+	+	+	+	N	+	+	+	+	+	N	+	+	+	N	+	N	N
MH.P.41	Critical Infrastructure Relocation	EDC	+	+	+	+	+	+	+	+	+	+	N	+	N	+	+	+	+	N
MH.P.42	Green Roof Installation	EDC	+	+	+	+	+	+	-	-	+	+	N	+	+	+	N	-	+	+
MH.P.43	Back up Water Main System	FDNY	+	+	+	+	+	-	-	-	+	+	N	+	+	+	N	-	+	+
MH.P.44	Public Awareness	HPD	+	+	+	+	+	+	-	-	+	+	N	+	+	+	+	-	+	+
MH.P.45	Critical Facility Protection	HRA	+	+	+	+	+	-	+	+	+	+	N	+	N	+	N	+	+	N
MH.P.46	Explore Loss Reduction Actions	LPC	+	+	+	+	+	+	+	+	+	+	N	+	+	+	N	+	+	N
MH.P.47	Public Education and Outreach	LPC	+	+	+	+	N	+	+	-	+	+	N	+	+	+	N	+	N	N
MH.P.48	Technical Assistance	LPC	+	N	+	+	+	+	+	-	+	+	N	+	+	+	N	+	+	N

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MH.P.49	Far Rockaway Depot Green Roof	MTA (Bus)	+	+	+	+	+	+	+	-	+	+	N	+	+	+	+	+	+	+
MH.P.50	Advanced Warning	NWS	+	+	+	+	+	+	-	+	+	+	-	-	N	-	N	-	+	+
MH.P.51	Dopler Radar Upgrade	NWS	+	+	+	+	+	+	-	-	+	+	N	+	+	-	N	-	+	+
MH.P.52	Grounds, Pavements, and Drainage	NYCHA	+	+	+	+	+	+	+	+	+	+	-	-	+	+	+	+	+	N
MH.P.53	Facility Protection	NYPD	+	N	+	+	+	+	-	+	+	+	N	+	+	+	N	-	+	N
MH.P.54	Facility Protection	NYPD	+	+	+	+	N	+	-	+	+	+	N	+	+	+	N	-	N	N
MH.P.55	Facility Protection	NYPD	+	+	+	+	+	+	-	+	+	+	N	+	+	+	N	-	+	N
MH.P.56	Advance Warning System Integration	OEM	+	+	+	+	+	+	-	-	+	+	-	-	N	-	+	-	+	N
MH.P.57	Critical Facility Protection	OEM	+	+	+	+	+	+	-	+	N	N	N	+	+	+	N	-	+	N
MH.P.58	Educational Outreach	OEM	+	+	+	+	+	+	-	+	+	+	N	+	N	+	N	-	+	N
MH.P.59	Facility Protection	OEM	+	N	+	+	+	+	-	-	+	+	N	+	+	+	N	-	+	N
MH.P.60	Facility Protection	OEM	+	+	+	+	N	+	-	-	+	+	N	+	+	+	+	-	N	+
MH.P.61	HAZUS-MH Update	OEM	N	N	+	+	+	+	+	+	+	+	N	+	+	+	N	+	+	N

Potential Mitigation Actions STAPLEE Analysis Table																				
Index	Mitigation Action	Lead Agency	Social		Technical			Administrative			Political		Legal			Economic			Environment	
			Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Staffing	Funding Allocation	Maintenance/Operations	Political Support	Public Support	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Outside Funding Required	Effect on Land/ Water	Consistent with Community Environmental Goals
MH.P.62	Incorporate Hazard Mitigation into CERT Curriculum	OEM	+	+	+	+	N	+	+	-	+	+	N	+	+	+	+	+	N	N
MH.P.63	Infrastructure Systems Modeling	OEM	+	+	+	+	-	+	+	+	+	+	+	+	-	+	N	-	-	+
MH.P.64	Loss Estimation Assistance	OEM	-	N	+	-	N	+	-	+	+	+	N	+	+	+	N	-	N	N
MH.P.65	Natural Hazard Event Database	OEM	-	N	+	-	N	+	+	+	+	+	N	+	+	+	N	+	N	N
MH.P.66	Partner with Community Groups	OEM	+	-	+	+	N	+	+	+	+	+	N	+	+	+	+	+	N	N
MH.P.67	Public Outreach	OEM	+	+	+	+	N	+	+	+	+	+	N	+	+	+	N	-	N	N
MH.P.68	Public/Private Mitigation Initiatives	OEM	+	+	+	+	N	+	-	+	+	+	N	+	+	+	N	-	N	N
MH.P.69	Regional Critical Infrastructure Mapping	OEM	-	N	+	-	N	+	-	-	+	+	N	+	+	+	N	-	N	N
MH.P.70	Subway Depths Mapping other natural hazards	OEM	-	N	+	-	N	+	-	+	+	+	N	+	+	+	N	-	N	N
MH.P.71	Vegetation Data	OEM	-	N	+	-	N	+	-	+	+	+	N	+	-	+	N	-	N	N

Potential Mitigation Actions STAPLEE Analysis Table																				
Index	Mitigation Action	Lead Agency	Social		Technical			Administrative			Political		Legal			Economic			Environment	
			Community Acceptance	Effect on Segment of Population	Technically Feasible	Long-Term Solution	Secondary Impacts	Staffing	Funding Allocation	Maintenance/Operations	Political Support	Public Support	State Authority	Existing Local Authority	Potential Legal Challenge	Benefit of Action	Cost of Action	Outside Funding Required	Effect on Land/ Water	Consistent with Community Environmental Goals
MH.P.72	Zoning for Hazard-Prone Areas	OEM	+	+	+	+	+	+	-	-	+	+	N	+	-	+	N	-	+	+
MH.P.73	Warning System/Environmental Protection	PANYNJ (Aviation)	+	N	+	+	N	N	+	-	+	+	N	+	+	+	+	+	N	N
MH.P.74	Green Roof Installation	Parks	+	+	+	+	+	+	-	-	+	+	N	+	+	+	+	-	+	+
MH.P.75	Green Streets	Parks	+	+	+	+	+	+	+	-	+	+	N	+	+	+	+	+	+	+
MH.P.76	Land Acquisition	Parks	+	+	+	+	+	+	-	-	+	+	N	N	-	+	-	-	+	+
MH.P.77	Seawall, Pier, and Marina Structural Repairs	Parks	+	+	+	+	+	+	+	-	+	+	N	+	+	-	+	-	+	+
MH.P.78	Infrastructure Upgrade	Verizon	+	+	+	+	-	+	+	-	N	N	-	-	+	+	+	+	-	N

Table 6: Mitigation Action STAPLEE Analysis Table

ii) HAZUS Case Studies

To explore further how HAZUS-MH can be applied to mitigation planning, the Planning Team chose to model two case studies. Each of the case studies explored mitigation actions identified in the table above and focused on mitigating against a 100-year flood. The goal was to demonstrate HAZUS-MH capabilities as a tool for mitigation planning efforts, as well as establish and quantify the effectiveness of these actions. Although both case studies are generalized due to data and technology constraints, they serve to demonstrate the cost effectiveness of a mitigation action.

(1) Case Study 1: Raising Critical Facilities in the 100-Year Floodplain

Case Study 1 is based on mitigation action F.E.18, a 2008 Construction Code revision that requires raising critical facilities above the base flood elevation (BFE) if the facility is built on or after July 1, 2008 and is located in a flood hazard area, or the A-Zones or V-Zones of the FEMA flood insurance rate map (FIRM). Specifically, Appendix G of the Construction Code requires raising the first floor of type III critical facilities, such as grade K-12 schools, one foot above BFE and type IV critical facilities, such as fire stations, two feet above BFE. This mitigation action will protect critical facilities from losing their ability to maintain operations and prevent building damage during a flood event.

To demonstrate the effectiveness of these new requirements, Case Study 1 estimates economic losses caused by a 100-year flood event to existing schools and fire stations located in the flood hazard area of Queens and Brooklyn. OEM's Hazard Impact Modeler ran a 100-year flood simulation for the two boroughs to determine the change in economic losses between the current BFE requirements and the new BFE requirements. These facilities are displayed in Figure 1. The mitigation action is used as a guideline for modeling and the case study does not fully capture the monetary benefit of implementing mitigation action F.E.18 for new facilities.

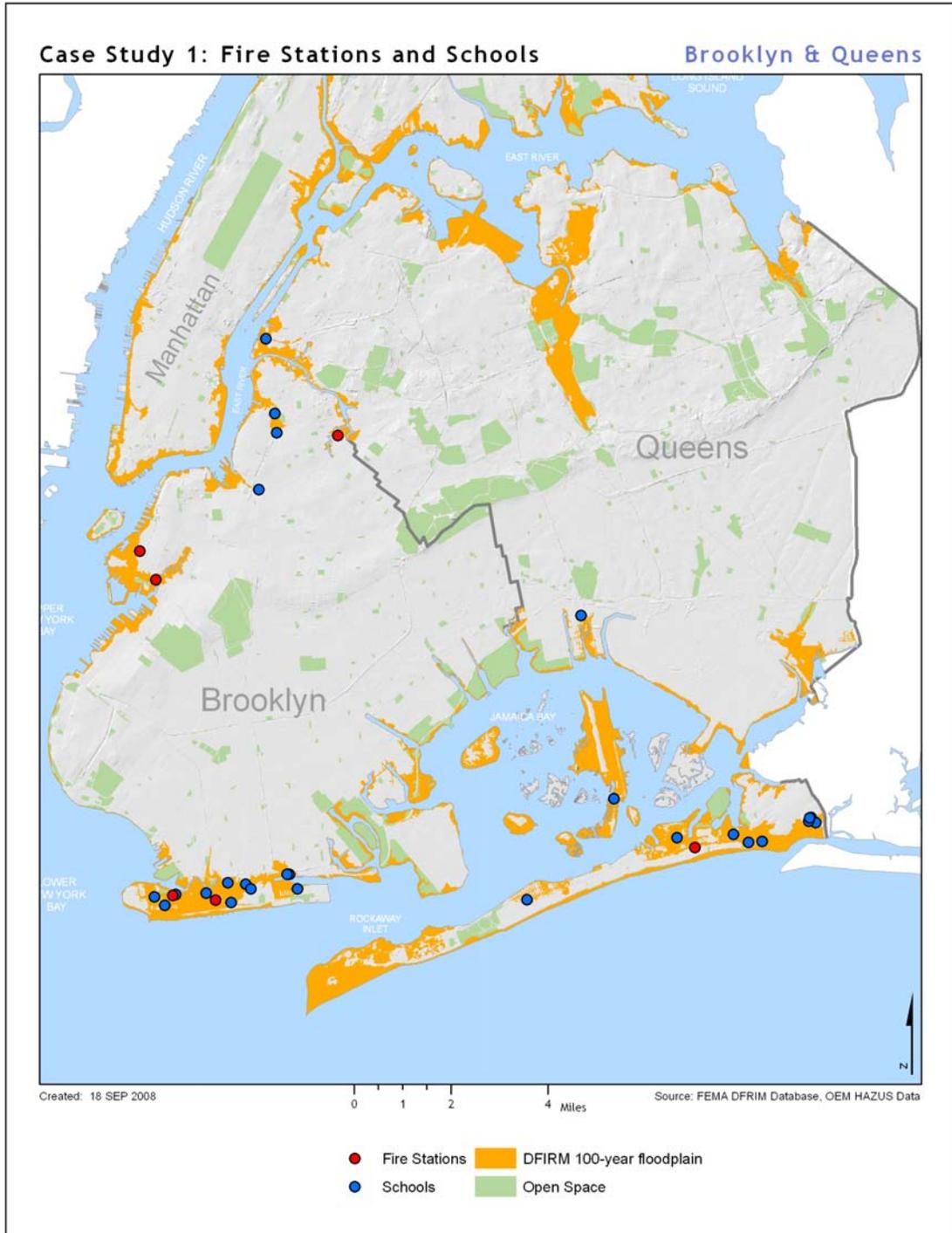


Figure 1: Fire Stations and Schools in Brooklyn and Queen's 100-Year Floodplain

OEM’s Hazard Impact Modeler ran two HAZUS-MH models: a 100-year flood event in Brooklyn and Queens using *existing building data* and a 100-year flood event in

Brooklyn and Queens using *modified building data* where schools and fire stations were raised one foot and two feet, respectively. The results are in Table 7 below.

Case Study 1 HAZUS-MH Results for 100-Year Flood					
Borough	Facility Information		Total Building Damage (\$)		
	Type	Count	Existing Building Data	Modified Building Data	% Change
Brooklyn	Schools	15	9,392,000	6,925,000	-26.3%
	Fire Stations	5	347,000	135,000	-61.1%
Queens	Schools	11	3,221,370	1,343,040	-58.3%
	Fire Stations	1	50,000	0	-100.0%
Total		32	13,010,370	8,403,040	-35.4%

Table 7: Case Study 1 HAZUS-MH Results

Overall, 32 schools and fire stations lie within the Brooklyn and Queens 100-year floodplain. The existing building data identifies these facilities as having a zero foot BFE. Under this condition, HAZUS-MH estimates \$13 million in damage from a 100-year flood event. Taking mitigation action F.E.18 into account, HAZUS-MH estimates only \$8.4 million in damages will occur from the same event, a 35% reduction in total building damage.

There is a clear economic benefit by implementing this mitigation action. The presumably small cost of raising a new facility one to two feet during construction could reduce 26% or more the cost of building damages from a 100-year flood event. While this case study does not model the exact mitigation action, the results strongly suggest this is a cost-effective mitigation action for protecting critical facilities in New York City.

(2) *Case Study 2: Open Space Initiatives*

There are various programs in the City that aim to increase open space, public space and protect the natural environment that also mitigate the affects of natural hazards. This case study aims to model the economic benefit of increasing open space and consequentially restricting development of homes and commercial space in Staten Island's 100-year floodplain. While not a specific mitigation action, this case study models multiple actions related to NYC Department of Environmental Protection's (DEP) Bluebelt program. (See F.E.10, F.E.11, and F.P.8 mitigation actions)

The Staten Island Bluebelt program began in 1991 and is an award winning, ecologically sound, and cost-effective storm water management program that preserves natural drainage corridors over one third of Staten Island. Preserving these natural corridors, or Bluebelts, allows them to perform their function of conveying, storing, and filtering storm water from normal rain events and extreme rain events such a coastal flood or a coastal storm. As of September 2008, the Bluebelt program has acquired 333 acres of property and has proposed acquiring an additional 141 acres.

Existing or proposed Bluebelt projects provide an opportunity to examine the benefits to natural hazard mitigation of retaining open space, especially in at-risk areas. While the mitigation actions undertaken by DEP focus on drainage and storm water, this analysis attempts to quantify the savings in property damage that result from leaving these areas as open space. For this study, the Planning Team looked at the 316 acres of South Beach, Oakwood Beach, and New Creek Bluebelts. Figure 2 displays where these Bluebelts are located on Staten Island.



Figure 2: Staten Island Bluebelts

The analysis simply compares the estimated damages from a 100-year flood event in Staten Island with the three Bluebelts and without the Bluebelts, treating the area as a residentially developed neighborhood. In order to model this analysis in HAZUS-MH, OEM’s Hazard Impact Modeler ran a 100-year flood model to identify damage estimates

for Staten Island using *existing building data*, or data presented in the Flood Vulnerability Assessment section. Next, the Modeler examined the General Building Stock data used in HAZUS-MH to determine what the built environment (building types, uses, and sizes) looks like in the developed areas surrounding these Bluebelts. The Modeler applied similar building data to the currently empty census blocks within the three Bluebelts. This allowed HAZUS-MH to simulate what the area might look like if the Bluebelt program did not exist and the areas were instead built out in a manner similar to the surrounding areas. Using this *modified building data* for the Bluebelt areas, the 100-year flood model was rerun to produce new, comparative damage estimates.

Table 8 displays the results of these two model runs. HAZUS-MH estimates more than \$493 million in building and contents damages to the 107,467 existing buildings in all of Staten Island. By mimicking development in the 316 acres of current Bluebelts, 111,197 buildings are estimated to experience \$661 million in damages, a \$168 million increase. A noticeable and important benefit of this model is that adding only 3.5% to the total buildings in Staten Island, increasing the building stock value by 1.5%, results in nearly a 34% increase in estimated damage.

Case Study 2 HAZUS-MH Results for 100-Year Flood (\$1,000s)					
Scenario	Total Buildings in Staten Island		Damage Estimates		
	Value	Count (#)	Building	Contents	Total
Existing Building Data	41,609,000	107,467	224,797	268,275	493,072
Modified Building Data	42,240,000	111,197	327,476	333,525	661,001
<i>% Difference</i>	<i>1.5%</i>	<i>3.5%</i>	<i>45.7%</i>	<i>24.3%</i>	<i>34.1%</i>

Table 8: Case Study 2 HAZUS-MH Results

This case study reinforces the concept that structural development in the 100-year floodplain can result in a disproportionately higher amount of damage from a flood. By restricting development in small, but vulnerable areas, a significant and costly amount of damage is prevented. Open space programs and related projects across the City, such as the Bluebelt program in Staten Island, provide benefits beyond their intended purposes. They provide an added mitigation component of protecting people and property from costly flood damage.

4) Prioritization

The Planning Team developed a methodology for prioritizing the mitigation actions using the STAPLEE criteria and implementation categories as presented above. By assigning a numerical value to each action based on a set of 10 criteria, the Planning Team was able to prioritize the 161 actions into a high, medium, and low ranking. Note the Planning Team did not prioritize existing mitigation actions because they have already secured funding and have been scheduled for implementation.

a) Methodology

The Planning Team established 10 criteria: the first seven based on the STAPLEE analysis and the remaining three based on (1) number of objectives the action meets, (2) projected costs, and (3) projected timeline. Each criterion was assigned a value of -1, 0, or 1. These values represent whether the criterion is unfavorable or negative (-1), neutral, not applicable, or moderate (0), or favorable or positive (1).

i) STAPLEE Criteria

To determine the value of the seven STAPLEE criteria, the Planning Team assessed each of the 18 measures addressed in the STAPLEE analysis. For each criteria (social, technological, administrative, political, legal, economic, and environmental), two to three measures are taken into consideration. The Planning Team used the matrix shown in Table 9 to determine the criteria’s overall value based off the number of -, +, or N assigned to the measures. For example, the administrative criterion has three measures: staffing, funding allocation, and maintenance/operations. If these three measure are given a value of +, +, and -, the administrative criterion’s overall value is a +. After each STAPLEE criteria received a new, overall, value of -, N, or +, the Planning Team assigned a prioritization value of -1, 0, or 1, respectively.

Applying STAPLEE Criteria to Prioritization					
		Number of measures with a "-"			
		0	1	2	3
Number of measures with a "+"	0	X	X	-	-
	1	X	N	-	X
	2	+	+	X	X
	3	+	X	X	X

Table 9: Applying STAPLEE Criteria to Prioritization

ii) Implementation Criteria

For the three remaining criteria (number of objectives met, projected cost, and projected timeframe), the Planning Team evaluated the distribution of each criteria’s values. Using this information, the Planning Team established quantifiable ranges for each criterion that met the parameters of the -1, 0, or 1 values. Table 10 presents the how the 10 criteria’s values were assigned a value of -1, 0, or 1.

Value	Criteria									
	S	T	A	P	L	Ec	Ev	# of Objectives	Project Cost	Project Timeframe
-1	-	-	-	-	-	-	-	1 objective	≥ \$100 million	≥ 10 years
0	N	N	N	N	N	N	N	2-3 objectives	TBD, ≥ \$10 million to <\$100 million	TBD, ongoing, ≥ 5 years to <10 years
1	+	+	+	+	+	+	+	4+ objectives	< \$10 million	≤ 5 years

Table 10: Values Assigned to 10 Criteria in Mitigation Action Prioritization

Summing the values of the 10 criteria was the next step in prioritizing the mitigation actions. The 161 potential mitigation actions received a cumulative value ranging from -10 to 10. These values were sorted in ascending order. Based on the overall value distribution, the Planning Team assigned a final prioritization value of “low” to actions with a final score of zero or lower because these actions have more or an equal amount of negative attributes than positive attributes. Actions with a final score of 1–5 were prioritized as “medium” while actions with a final score of 6–10 received a prioritization value of “high” because they have many positive attributes and few, if any, negative attributes.

Table 11 presents the distribution of action by final prioritization value. These final prioritization values are determined from very general criteria and additional information or data not included in this analysis could affect the prioritization results.

Summary Prioritization Table				
Hazard	Priority Ranking			
	Low	Medium	High	Total
Coastal Erosion	1	1	0	2
Coastal Storms	1	4	4	9
Drought	1	4	2	7
Earthquakes	1	6	5	12
Extreme Temperatures	0	5	4	9
Flood	1	23	15	39
Windstorms/Tornadoes	0	2	2	4
Winter Storms	0	0	1	1
Multi-Hazards	3	41	34	78
Total	8	86	67	161

Table 11: Summary of Mitigation Action Prioritization

b) Benefit-Cost Analysis for Specific Projects

A Benefit-Cost Analysis (BCA) is a method for determining the potential positive effects of a specific mitigation action and comparing them to the cost of the action. To assess and demonstrate the cost-effectiveness of mitigation actions, FEMA has developed a suite of BCA software, including hazard-specific modules. Agencies seeking funding

under one of FEMA's mitigation grant programs will perform a detailed BCA using this software prior to the submission the grant application. OEM and the Planning Team will assist agencies with this effort.

Potential Mitigation Action Prioritization Table															
Index	Mitigation Action & Description	Lead Agency	Prioritization	Total	Criteria										
					S	T	A	P	L	Ec	Ev	# of Objectives	Project Cost	Project Timeframe	
Coastal Erosion															
CE.P.1	Rikers Island Shoreline Protection	DOC	Low	1	0	1	-1	1	-1	1	-1	0	1	0	
CE.P.2	Beach Renourishment	USACE	Medium	3	1	1	-1	1	1	-1	0	0	1	0	
Coastal Storms															
CS.P.1	Facility Protection	DEP	High	6	1	1	1	1	1	1	1	0	-1	0	
CS.P.2	Hillview Reservoir Cover	DEP	Medium	3	1	1	1	1	-1	1	0	0	-1	0	
CS.P.3	Kensico Reservoir Turbidity Curtain	DEP	Medium	5	1	1	1	1	-1	1	-1	0	1	1	
CS.P.4	Property Protection	DEP	Low	-1	-1	1	1	0	-1	1	-1	0	-1	0	
CS.P.5	Computer Modeling	DOB	High	8	1	1	1	1	1	1	0	0	1	1	
CS.P.6	Protective Measures for Critical Facilities	DOC	Medium	4	1	1	-1	1	1	0	1	0	0	0	
CS.P.7	Infrastructure Improvements and Study	MTA (Bridges & Tunnels)	High	6	1	1	1	1	-1	1	1	0	0	1	
CS.P.8	Facility Protection	OEM	Medium	3	1	1	-1	1	1	0	0	0	0	0	
CS.P.9	HAZUS-MH Modeling	OEM	High	7	1	1	1	1	1	1	0	0	0	1	
Drought															
D.P.1	Water Conservation	DCAS	High	8	1	1	1	1	1	1	1	0	1	0	
D.P.2	Water Conservation	DCAS	High	8	1	1	1	1	1	1	1	0	1	0	
D.P.3	Aquifer Storage and Recovery	DEP	Medium	3	1	1	1	1	-1	1	-1	0	0	0	
D.P.4	Croton Falls and Cross River Pump Station Rehabilitation	DEP	Medium	4	1	1	1	1	-1	1	0	1	-1	0	
D.P.5	Delaware-Rondout Parallel Tunnel	DEP	Medium	3	1	1	1	1	-1	1	-1	1	-1	0	
D.P.6	Hydrant Locking Program	DEP	Medium	4	0	1	-1	1	1	1	1	0	0	0	
D.P.7	Increase Catskill Aqueduct	DEP	Low	-1	-1	1	1	0	-1	1	-1	0	-1	0	

Potential Mitigation Action Prioritization Table														
Index	Mitigation Action & Description	Lead Agency	Prioritization	Total	Criteria									
					S	T	A	P	L	Ec	Ev	# of Objectives	Project Cost	Project Timeframe
	Capacity													
Earthquake														
EQ.P.1	Mechanical Equipment Seismic Upgrade	DCAS	High	6	0	1	1	1	1	1	0	0	1	0
EQ.P.2	Construct Redundant Kensico City Aqueduct	DEP	Medium	3	1	1	1	1	-1	1	-1	1	-1	0
EQ.P.3	Hunt's Point Wastewater Treatment Plant Facility Seismic Retrofit	DEP	High	7	1	1	1	1	1	1	1	0	0	0
EQ.P.4	Rondout West Branch Tunnel Repair	DEP	Low	-3	1	1	1	-1	-1	-1	-1	-1	-1	0
EQ.P.5	Seismic Infrastructure Protection	DEP	High	7	0	1	1	1	1	1	1	0	0	1
EQ.P.6	Seismic Inspection and Retrofit Program	DEP	Medium	5	1	1	-1	1	1	1	1	0	0	0
EQ.P.7	Computer Modeling	DOB	High	8	1	1	1	1	1	1	0	0	1	1
EQ.P.8	Facility Retrofit	DOE	Medium	3	0	1	-1	1	1	1	1	0	0	-1
EQ.P.9	Rikers Island Bridge Seismic Retrofit	DOT	Medium	5	1	1	1	1	1	0	0	0	0	0
EQ.P.10	Facility Improvement	HPD	Medium	2	0	1	-1	1	1	-1	1	-1	0	1
EQ.P.11	Seismic Studies and Retrofit	MTA (Bridges & Tunnels)	Medium	4	1	1	1	1	-1	1	0	0	-1	1
EQ.P.12	HAZUS-MH Modeling	OEM	High	7	1	1	1	1	1	1	0	0	0	1
Extreme Temperatures														
ET.P.1	Power Conservation	DCAS	High	8	1	1	1	1	1	1	1	0	0	1
ET.P.2	Power Redundancy	DCAS	Medium	1	0	0	-1	1	1	-1	0	0	0	1
ET.P.3	Equipment Upgrade	DEP	High	9	1	1	1	1	1	1	1	1	1	0
ET.P.4	Facility Upgrade	DFTA	Medium	4	1	1	-1	1	1	0	0	0	0	1

Potential Mitigation Action Prioritization Table														
Index	Mitigation Action & Description	Lead Agency	Prioritization	Total	Criteria									
					S	T	A	P	L	Ec	Ev	# of Objectives	Project Cost	Project Timeframe
ET.P.5	Facility Upgrade	DFTA	Medium	5	1	1	-1	1	1	0	0	0	1	1
ET.P.6	Property Protection	DFTA	High	7	1	1	1	1	1	0	1	0	0	1
ET.P.7	Public Outreach	DFTA	Medium	5	1	1	1	1	1	0	-1	0	0	1
ET.P.8	Public Outreach	DFTA	High	7	1	0	1	1	1	1	1	0	0	1
ET.P.9	Health Education and Outreach	DOHMH	Medium	5	1	0	1	1	1	0	0	1	0	0
Flood														
F.P.1	Drainage Improvement	Amtrak	High	7	1	1	1	1	-1	1	1	0	1	1
F.P.2	Scour Protection	Amtrak	High	6	0	1	1	1	1	1	1	0	1	-1
F.P.3	Tunnel Structure Rehabilitation	Amtrak	Medium	2	0	1	-1	1	0	0	1	0	0	0
F.P.4	Facility Damage Prevention	DCAS	Medium	2	0	1	0	1	1	0	0	-1	0	0
F.P.5	Infrastructure Protection	DCAS	Medium	4	1	1	1	0	1	0	0	0	0	0
F.P.6	Check Valve Installation/ Plumbing Improvement Subsidies	DEP	Low	-1	1	1	-1	1	-1	-1	0	-1	0	0
F.P.7	Drainage Improvement	DEP	Medium	3	1	1	-1	1	1	0	1	0	0	-1
F.P.8	Drainage Improvement Plan and Design	DEP	High	6	1	1	1	1	1	1	0	0	0	0
F.P.9	Facility Protection	DEP	Medium	2	1	1	1	1	-1	1	-1	0	0	-1
F.P.10	Facility Redesign	DEP	High	6	1	1	1	1	1	1	1	0	-1	0
F.P.11	Infrastructure Protection	DEP	Medium	4	1	1	1	1	0	1	0	0	-1	0
F.P.12	Infrastructure Upgrade	DEP	Medium	4	1	1	1	1	-1	1	0	1	-1	0
F.P.13	Infrastructure Upgrade	DEP	High	8	1	1	1	1	1	1	1	1	0	0
F.P.14	Infrastructure Upgrade	DEP	Medium	4	1	1	1	1	-1	1	1	0	-1	0
F.P.15	Natural Resource Protection	DEP	Medium	5	1	1	1	1	-1	1	1	0	1	-1
F.P.16	Facility Improvement	DFTA	Medium	4	1	1	-1	1	1	0	1	0	0	0

Potential Mitigation Action Prioritization Table														
Index	Mitigation Action & Description	Lead Agency	Prioritization	Total	Criteria									
					S	T	A	P	L	Ec	Ev	# of Objectives	Project Cost	Project Timeframe
F.P.17	Facility Improvements	DHS	Medium	4	1	1	-1	1	1	1	0	0	0	0
F.P.18	Computer Modeling	DOB	High	7	1	1	0	1	1	1	0	0	1	1
F.P.19	Roadway Elevation and Regrade	DOC	Medium	2	0	1	-1	0	1	0	1	0	0	0
F.P.20	Wet/Dry Flood proofing	DOC	Medium	1	0	1	-1	0	1	0	0	0	0	0
F.P.21	Curb Repair and Installation	DOT	High	6	1	1	1	1	-1	1	1	0	1	0
F.P.22	Drainage Improvement	DOT	High	6	1	1	1	1	-1	1	1	0	0	1
F.P.23	Building Upgrade	HHC	High	7	1	1	1	1	1	1	1	0	0	0
F.P.24	Marine Parkway Bridge Protection	MTA (Bridges & Tunnels)	Medium	4	0	1	1	0	1	1	-1	0	0	1
F.P.25	Drainage Mitigation	MTA (LIRR)	Medium	3	1	1	-1	1	-1	1	1	0	0	0
F.P.26	Drainage Improvement	MTA (NYCT-Subway)	Medium	4	1	1	0	1	1	0	0	0	0	0
F.P.27	Basement/Cellar Equipment Safeguard	NYCHA	High	7	1	1	1	1	-1	1	1	0	1	1
F.P.28	Critical Infrastructure Protection	OEM	Medium	5	0	1	-1	1	1	1	1	0	0	1
F.P.29	HAZUS-MH Modeling	OEM	High	9	1	1	1	1	1	1	1	0	1	1
F.P.30	Property Protection	OEM	Medium	5	1	1	1	1	-1	1	1	0	0	0
F.P.31	Public Information and Guidance	OEM	High	8	1	1	1	1	1	1	1	1	0	0
F.P.32	Severe Repetitive Loss Outreach and Education	OEM	High	8	1	1	1	1	1	1	1	1	0	0
F.P.33	Drainage Improvement	PANYNJ (Aviation)	Medium	5	0	1	0	1	1	1	0	0	1	0

Potential Mitigation Action Prioritization Table															
Index	Mitigation Action & Description	Lead Agency	Prioritization	Total	Criteria										
					S	T	A	P	L	Ec	Ev	# of Objectives	Project Cost	Project Timeframe	
F.P.34	Facility Protection	PANYNJ (Aviation)	High	6	0	1	1	1	1	1	1	-1	0	1	1
F.P.35	Facility Protection	PANYNJ (Aviation)	Medium	5	-1	1	0	1	1	1	1	0	0	1	1
F.P.36	Facility Upgrade	PANYNJ (Aviation)	High	7	1	1	1	1	1	1	1	0	0	1	0
F.P.37	Facility Upgrade	PANYNJ (Aviation)	Medium	5	0	1	1	0	1	1	1	0	0	0	1
F.P.38	Facility Upgrade	PANYNJ (Aviation)	Medium	3	0	1	1	0	-1	1	1	0	0	0	1
F.P.39	Flood Proofing at Olmsted Site	Parks	Medium	5	1	1	1	1	1	-1	1	1	0	0	0
Windstorms / Tornadoes															
WT.P.1	Infrastructure Protection	DOT	High	6	1	1	1	1	-1	1	1	1	-1	1	1
WT.P.2	Building Retrofit	HHC	High	7	0	1	1	1	1	1	1	0	0	1	1
WT.P.3	Facility Protection	HRA	Medium	2	0	1	1	0	-1	1	1	0	-1	1	0
WT.P.4	Infrastructure Reinforcement	MTA (Bridges & Tunnels)	Medium	3	1	1	0	1	-1	1	1	0	0	0	0
Winter Storms															
WS.P.1	Public Outreach	OEM	High	8	1	1	1	1	1	1	1	1	0	0	1
Multi-Hazard															
MH.P.1	Danger Tree Program	Con Ed	Medium	4	1	1	1	1	-1	1	1	-1	0	1	0
MH.P.2	Building Retrofit	DCAS	Medium	5	0	1	1	1	1	1	1	1	0	0	-1
MH.P.3	Green Roof Installation	DCAS	High	7	1	1	0	1	1	1	1	1	1	0	0
MH.P.4	Bridge Reconstruction and Stabilization	DEP	Medium	4	1	1	1	1	-1	1	1	1	0	-1	0
MH.P.5	Combined Sewer Overflow Storage	DEP	Medium	1	1	1	-1	1	-1	-1	1	1	1	-1	0

Potential Mitigation Action Prioritization Table														
Index	Mitigation Action & Description	Lead Agency	Prioritization	Total	Criteria									
					S	T	A	P	L	Ec	Ev	# of Objectives	Project Cost	Project Timeframe
MH.P.6	Critical Facility Protection	DEP	Medium	4	1	1	1	0	1	0	1	0	0	-1
MH.P.7	Dam Reconstruction Program	DEP	Medium	5	1	1	1	1	-1	1	1	0	0	0
MH.P.8	Drainage Improvement	DEP	High	6	1	1	1	1	1	0	1	1	0	-1
MH.P.9	Facility and Infrastructure Protection	DEP	High	7	1	1	1	1	1	1	1	0	0	0
MH.P.10	Groundwater Development	DEP	Medium	5	1	1	1	1	-1	1	1	1	-1	0
MH.P.11	Groundwater Treatment Plant	DEP	Medium	5	1	1	1	1	-1	1	1	1	-1	0
MH.P.12	Mapping and Analysis Enhancement	DEP	High	7	1	1	1	1	1	1	1	0	0	0
MH.P.13	Wetlands Restoration	DEP	High	7	1	1	1	1	1	1	1	0	0	0
MH.P.14	Public Education	DFTA	Medium	5	1	1	-1	1	1	0	0	1	0	1
MH.P.15	Public Outreach	DFTA	High	7	1	1	1	1	1	1	0	0	0	1
MH.P.16	Building Upgrade	DHS	Medium	3	0	1	-1	1	1	0	1	0	0	0
MH.P.17	Communications Equipment	DHS	Medium	2	0	0	-1	1	0	1	0	0	1	0
MH.P.18	Facility Improvements	DHS	High	6	0	1	0	1	1	1	1	0	1	0
MH.P.19	Facility Retrofit	DHS	Medium	4	1	1	-1	1	0	1	1	0	0	0
MH.P.20	Power Redundancy	DHS	Medium	1	0	0	-1	1	1	-1	0	0	1	0
MH.P.21	Power Redundancy	DHS	Low	0	0	0	-1	1	1	-1	0	-1	1	0
MH.P.22	Property Protection	DHS	Medium	5	0	1	1	1	1	0	1	0	0	0
MH.P.23	Construction Code Revision	DOB	High	10	1	1	1	1	1	1	1	1	1	1
MH.P.24	Information Gathering	DOB	Medium	5	-1	0	1	1	1	1	0	0	1	1
MH.P.25	Information Gathering	DOB	Medium	5	-1	0	1	1	1	1	0	0	1	1
MH.P.26	Information Gathering	DOB	Medium	5	-1	0	1	1	1	1	0	0	1	1
MH.P.27	Stormwater Management	DOC	Medium	5	1	1	1	1	1	0	0	0	0	0
MH.P.28	Critical Equipment Redundancy	DOE	Medium	5	1	1	1	1	1	-1	1	-1	1	0

Potential Mitigation Action Prioritization Table														
Index	Mitigation Action & Description	Lead Agency	Prioritization	Total	Criteria									
					S	T	A	P	L	Ec	Ev	# of Objectives	Project Cost	Project Timeframe
MH.P.29	Facility Protection	DOE	Medium	5	1	1	1	1	1	0	0	0	0	0
MH.P.30	Green Roof Installation	DOE	Medium	4	1	1	-1	1	1	0	1	0	0	0
MH.P.31	Infrastructure Protection	DOE	Medium	5	1	1	1	1	1	0	0	0	0	0
MH.P.32	Power Redundancy	DOE	Low	0	0	0	-1	1	1	-1	0	-1	1	0
MH.P.33	Early Warning System	DoITT	Medium	4	1	1	1	1	1	-1	1	-1	0	0
MH.P.34	Bridge Inspections	DOT	High	9	1	1	1	1	1	1	1	0	1	1
MH.P.35	Critical Facility Loss Estimation	DOT	High	8	1	1	1	1	1	1	1	0	1	0
MH.P.36	Curb Repair and Installation	DOT	Medium	5	0	1	1	1	-1	1	1	0	1	0
MH.P.37	Drainage and Surface Improvement	DOT	High	6	1	1	1	1	-1	1	1	1	0	0
MH.P.38	East River Bridges Retrofit (Construction)	DOT	Medium	2	1	1	1	1	-1	-1	0	0	-1	1
MH.P.39	Information Update	DOT	High	6	0	1	1	1	1	1	-1	0	1	1
MH.P.40	Infrastructure Protection	DOT	High	7	1	1	1	1	1	1	0	0	0	1
MH.P.41	Critical Infrastructure Relocation	EDC	High	8	1	1	1	1	1	1	1	0	1	0
MH.P.42	Green Roof Installation	EDC	Medium	5	1	1	-1	1	1	0	1	1	0	0
MH.P.43	Back up Water Main System	FDNY	Medium	4	1	1	-1	1	1	0	1	0	0	0
MH.P.44	Public Awareness	HPD	High	7	1	1	-1	1	1	1	1	0	1	1
MH.P.45	Critical Facility Protection	HRA	High	7	1	1	1	1	1	1	1	0	0	0
MH.P.46	Explore Loss Reduction Actions	LPC	High	7	1	1	1	1	1	1	1	0	0	0
MH.P.47	Public Education and Outreach	LPC	High	7	1	1	1	1	1	1	0	1	0	0
MH.P.48	Technical Assistance	LPC	High	7	1	1	1	1	1	1	1	0	0	0
MH.P.49	Far Rockaway Depot Green Roof	MTA (Bus)	High	9	1	1	1	1	1	1	1	0	1	1

Potential Mitigation Action Prioritization Table														
Index	Mitigation Action & Description	Lead Agency	Prioritization	Total	Criteria									
					S	T	A	P	L	Ec	Ev	# of Objectives	Project Cost	Project Timeframe
MH.P.50	Advanced Warning	NWS	Medium	3	1	1	1	1	-1	-1	1	-1	0	1
MH.P.51	Dopler Radar Upgrade	NWS	Medium	3	1	1	-1	1	1	-1	1	-1	0	1
MH.P.52	Grounds, Pavements, and Drainage	NYCHA	High	7	1	1	1	1	-1	1	1	0	1	1
MH.P.53	Facility Protection	NYPD	High	6	1	1	1	1	1	0	1	0	0	0
MH.P.54	Facility Protection	NYPD	Medium	5	1	1	1	1	1	0	0	0	0	0
MH.P.55	Facility Protection	NYPD	High	6	1	1	1	1	1	0	1	0	0	0
MH.P.56	Advance Warning System Integration	OEM	Low	0	1	1	-1	1	-1	-1	1	-1	0	0
MH.P.57	Critical Facility Protection	OEM	Medium	5	1	1	1	0	1	0	1	0	0	0
MH.P.58	Educational Outreach	OEM	High	7	1	1	1	1	1	0	1	1	0	0
MH.P.59	Facility Protection	OEM	Medium	4	1	1	-1	1	1	0	1	0	0	0
MH.P.60	Facility Protection	OEM	High	7	1	1	-1	1	1	1	1	0	1	1
MH.P.61	HAZUS-MH Update	OEM	High	7	0	1	1	1	1	1	1	0	0	1
MH.P.62	Incorporate Hazard Mitigation into CERT curriculum	OEM	High	8	1	1	1	1	1	1	0	1	1	0
MH.P.63	Infrastructure Systems Modeling	OEM	High	6	1	1	1	1	1	0	0	0	0	1
MH.P.64	Loss Estimation Assistance	OEM	Medium	2	-1	0	1	1	1	0	0	0	0	0
MH.P.65	Natural Hazard Event Database	OEM	Medium	3	-1	0	1	1	1	1	0	0	0	0
MH.P.66	Partner with Community Groups	OEM	High	7	0	1	1	1	1	1	0	1	1	0
MH.P.67	Public Outreach	OEM	High	6	1	1	1	1	1	0	0	0	0	1
MH.P.68	Public/Private Mitigation Initiatives	OEM	High	6	1	1	1	1	1	0	0	1	0	0
MH.P.69	Regional Critical Infrastructure Mapping	OEM	Medium	1	-1	0	-1	1	1	0	0	0	0	1

Potential Mitigation Action Prioritization Table														
Index	Mitigation Action & Description	Lead Agency	Prioritization	Total	Criteria									
					S	T	A	P	L	Ec	Ev	# of Objectives	Project Cost	Project Timeframe
MH.P.70	Subway Depths Mapping other natural hazards	OEM	Medium	3	-1	0	1	1	1	0	0	0	0	1
MH.P.71	Vegetation Data	OEM	Medium	2	-1	0	1	1	0	0	0	0	0	1
MH.P.72	Zoning for Hazard-Prone Areas	OEM	Medium	5	1	1	-1	1	0	0	1	1	0	1
MH.P.73	Warning System/Environmental Protection	PANYNJ (Aviation)	High	7	1	1	0	1	1	1	0	0	1	1
MH.P.74	Green Roof Installation	Parks	High	8	1	1	-1	1	1	1	1	1	1	1
MH.P.75	Green Streets	Parks	High	10	1	1	1	1	1	1	1	1	1	1
MH.P.76	Land Acquisition	Parks	Medium	3	1	1	-1	1	-1	-1	1	1	1	0
MH.P.77	Seawall, Pier, and Marina Structural Repairs	Parks	Medium	5	1	1	1	1	1	-1	1	-1	1	0
MH.P.78	Infrastructure Upgrade	Verizon	Medium	4	1	1	1	0	-1	1	-1	0	1	1

Table 12: Mitigation Action Prioritization Worksheet

5) Implementation and Administration

The mitigation action table identifies the following categories of information for each action that will guide New York City in the implementation and administration of the actions: description, lead and supporting agencies, timeframe, cost, funding source, and priority. It also serves to coordinate the various agencies involved to avoid duplicating or conflicting efforts. The mitigation strategy tables contain a wide variety of prioritized actions that mitigate the effects of natural hazards on the population, economy, and property of New York City. Implementation of certain mitigation actions in this strategy can take as little as three months while some may take more than 50 years. Actions range from a \$25,000 training program to a \$20.5 billion tunnel project. The implementation strategy for existing and potential actions is located in Table 4 and Table 5, respectively. The table below explains the columns in the Implementation Strategy Table.

Implementation Key	
Column Header	Description
Mitigation Action & Description	Contains the title and description of the action.
Lead Agency	Lists the agency that has primary jurisdiction over the mitigation action. The listed agency will be the primary point of contact for the mitigation action.
Supporting Agency	Lists supporting entities that will assist in the implementation, funding, or maintenance of the mitigation action.
Project Timeframe/Duration	Estimates when the project will begin and approximately how long it will take to complete. "Ongoing" refers to actions that are either underway or have no definitive end date.
Estimated Project Cost	Estimates costs associated with implementing each mitigation action.
Possible Funding Source(s)	Identifies possible sources of funding including capital funding, grants, bonds, and other types of funding.
FEMA Category	Identifies the associated FEMA mitigation action category (Prevention, Property Protection, Public Education and Awareness, Natural Resource Protection, Emergency Services, and Structural Projects).
Goals and Objectives	Identifies the hazard mitigation goals and objectives addressed by the mitigation action.
Priority	Lists the results of the mitigation action prioritization.

Table 13: Implementation Key

a) Capability Assessment

New York City, through its various agencies and departments, has local policies, regulations, funding, and practices currently in place that will help facilitate this natural hazard mitigation strategy. These mechanisms include:

- Building and construction codes
- Floodplain management plans
- Land use plans
- Local laws and ordinances
- Master and comprehensive plans
- Zoning and land use regulations

The Steering Committee and Planning Team developed the following table to assess New York City current capabilities to implement mitigation actions. It contains the classification, agency responsible, and a description for each initiative or capability. In addition to OEM's hazard mitigation planning program, as outlined in the Plan Maintenance section of this plan, the following planning mechanisms will serve to implement many of the actions described in this section.

New York City Capability Assessment		
Capability	Agency	Description
Planning Mechanisms		
Capital Improvement or Development Plan – <i>Drainage Plan for Areas Lacking Sewers</i>	DEP	The Bureau of Water and Sewer Operations (BWSO) drainage plans are developed to provide adequate storm and sanitary infrastructure for areas of the City lacking a fully built-out sewer system. Build out is concentrated in populated areas lacking existing infrastructure and where improvements or a need is identified.
Capital Improvement or Development Plan – <i>Trunk Water Main Master Plans</i>	DEP	BWSO creates plans depicting water mains that will provide adequate water supply and fire protection for existing and future development.
Capital Improvement or Development Plan – <i>Agency Capital Budget</i>	DEP	DEP currently has a \$19.7B capital improvement plan to upgrade and bring the water and wastewater infrastructure into a state of good repair.
Capital Improvement or Development Plan – <i>Capital Projects</i>	DEP	The Bureau of Water Supply (BWS) maintains a 600+ line master list spreadsheet of capital and filtration avoidance determination projects; works with the BWS Directorates to develop project scope and cost estimates, obtain funding and registration; and works with IDC and Bureau of Engineering Design and Construction to commence design and construction work effort.
Capital Improvement or Development Plan – <i>Parks Department Capital Improvement Plan</i>	Parks	The Capital Projects division is responsible for capital improvements and reconstruction of playgrounds, structures, and parkland. The division currently has over \$1 billion in active restoration contracts underway. The Operations division assists with drafting of maintenance and operational agreements for new park developments such as the Highline.

New York City Capability Assessment		
Capability	Agency	Description
Land Use Plan – <i>DCP-Initiated Rezoning</i>	DCP	DCP is responsible for zoning amendments that change the applicable use, bulk, and density regulations for a location or area. Since 2002, DCP has sponsored 80 individual area-wide rezoning projects that are adopted into law, covering approximately 1/6 of the City. All re-zonings are required to pass through City Environmental Quality Review (CEQR) environmental review. Many of the re-zonings incorporate additional provisions for waterfront access and green space.
Land Use Plan – <i>Parks Department Parkland Plan</i>	Parks	The Planning Division coordinates specific plans for new uses of parkland and for remediation of environmental damage.
Local Waterfront Revitalization Plans – <i>Consistency Review</i>	DCP	Local discretionary actions, including those subject to land use (ULURP), environmental (CEQR) and Board of Standards and Appeals (BSA) review procedures, are reviewed for consistency with the New York City Waterfront Revitalization Program policies.
Local Waterfront Revitalization Plans – <i>Waterfront Parking and Recreational Areas</i>	Parks	The Planning Division coordinates new uses of waterfront areas and remediation of past environmental damage. The Operations Unit assists with the drafting of operational agreements and oversees municipal marinas such as the 79th Street Boat Basin and World's Fair Marina.
Local Emergency Plans – <i>Drought Operations Plan</i>	DEP	During drought, the BWSO procedures are modified to maximize different water sources, prioritize leak detection programs that minimize water losses, and review hydrant-locking procedures to ensure areas with illegal hydrant use are compliant with the water-use restrictions.
Master/Comprehensive Plan – <i>PlaNYC</i>	OLTPS	PlaNYC is the city's long-term, comprehensive sustainability plan that focuses on improving the city's environment while accommodating an increase in population of almost one million people by 2030.

New York City Capability Assessment		
Capability	Agency	Description
Other Hazard Mitigation Plan – <i>Downstream Flooding Reduction Program</i>	DEP	BWS provides for the reduction of downstream flooding through attenuation of runoff by lowering reservoir elevation at a controlled rate in anticipation of forecasted storms and snow pack melting.
Other Hazard Mitigation Plan – <i>Reservoir Release Notification Plan</i>	DEP	BWS provides notification of reservoir releases/spilling rates at predefined levels to all downstream counties' emergency management officials.
Other Hazard Mitigation Plan – <i>Coastal Storm Plan</i>	OEM	The Coastal Storm Plan describes the citywide efforts before, during, and after a coastal storm event, particularly a hurricane. The plan contains components relating to decisions-making, sheltering, advance warning systems, logistics, public information, debris management, and post-disaster reconstruction.
Other Hazard Mitigation Plan – <i>Flash Flood Plan</i>	OEM	The Flash Flood Plan contains detailed procedures to mitigate the effects of a flash flood event on people and property and guides agency stakeholders through the decisions and actions that will be required before, during, and after such an event.
Other Hazard Mitigation Plan – <i>Heat Emergency Plan</i>	OEM	The Heat Plan contains detailed procedures to mitigate the effects of extreme heat conditions on critical infrastructure, at-risk populations, and New York City operations. The contents of the plan guide New York City stakeholders (including city and state agencies, the private sector, non-profits and volunteer organizations) through the complex decisions that may be necessary during a heat emergency.
Policies/Ordinances/Regulations		
Codes Building Site/Design – <i>PlaNYC Green Building Task Force</i>	OLTPS	OLTPS will lead a task force that will develop amendments to the City's building code to incorporate climate change impacts.
Codes Building Site/Design Policies/Ordinances – <i>New York City Construction Codes</i>	DOB	The New York City Construction Codes enhances safety and encourages efficiency, cost savings and sustainable building. The Construction Codes enhance fire protection, construction safety and structural integrity in new buildings.
Land Use Regulations – <i>Recreational Land Use Regulations</i>	DEP	BWS maintains regulations for the public recreational use of New York City-owned lands and waters.

New York City Capability Assessment		
Capability	Agency	Description
Land Use – <i>City Environmental Quality Review</i>	Office of Environmental Coordination	CEQR identifies any potential adverse environmental effects of proposed actions, assesses their significance, and proposes measures to eliminate or mitigate significant impacts. Only certain minor actions identified by the state, known as Type II actions, are exempt from environmental review.
Property Set-Back Ordinance – <i>Wildland-Urban Interface</i>	DEP	BWSO enforces a 25-foot setback around vegetated areas where possible to help mitigate potential for wildfire in the Staten Island Bluebelt.
Site Plan Review Requirements – <i>Site Connection Applications for New Developments</i>	DEP	BWS issues certifications indicating the ability of existing sewers to accommodate increase usage to all new development projects. Certification is needed before a construction permit is issued.
Site Plan Review Requirements – <i>City Planning Commission Discretionary Review</i>	DCP	In cases where discretionary action by the City Planning Commission is necessary, various Borough and Technical staff reviews site plan applications for consistency with sound planning policy, environmental reviews consistent with CEQR guidelines, and any other relevant findings as applicable.
Site Plan Review Requirements – <i>Parks Department Site Plan Review</i>	Parks	The Forestry Division reviews site plans for capital work and ensures that all trees and horticulture are protected. Parks also reviews any work that might affect street trees and governs the removal or planting of any public tree in New York City.
Site Plan Review Requirements – <i>Site Plan Review</i>	DOB	DOB possesses an extensive plan review system to ensure lawful compliance with the City's Building Code, Electrical Code, Zoning Resolution, New York State Labor Law, and New York State Multiple Dwelling Law. Any person seeking a permit must meet with a plan examiner.
Steep Slope Ordinances – <i>Hillsides Preservation Districts; Special Natural Area Districts</i>	DCP	The City Planning Commission reviews site plans to maximize protection of natural areas, including the goals of "reducing hillside erosion, landslides and excessive storm water runoff associated with development. This is accomplished through conserving vegetation and protecting natural terrain.

New York City Capability Assessment		
Capability	Agency	Description
Storm Water Ordinances – <i>New York City Storm Water Regulations</i>	DEP	DEP is responsible for providing adequate draining services to the City. DEP also governs the construction of private sewers and drains to ensure compliance and adequate drainage capabilities.
Watershed Ordinance – <i>Watershed Rules and Regulations</i>	DEP	DEP enforces and develops regulations to protect New York City's reservoirs from contamination from human activity and storm water.
Zoning/Land Use Restrictions – <i>Zoning Resolution</i>	DCP	The Zoning Resolution sets forth the regulations governing land use and development. Articles I through VII contain the use, bulk, parking, and other applicable regulations for each zoning district.
Programs		
Anticipate Future Vulnerabilities and Needs – <i>DEP Long-term and Strategic Planning</i>	DEP	The Long-term and Strategic Plan assess and communicates DEP's long term and strategic goals, vulnerabilities and opportunities for management of the water supply system for optimal dependability/reliability.
Capital Improvement Program – <i>Sewer Construction</i>	DEP	DEP maps and studies flood prone areas to create a comprehensive plan for sewer upgrades.
Floodplain Maps/Flood Insurance Studies – <i>NFIP Compliance</i>	DOB	As part of the NFIP, New York City has adopted floodplain maps developed by FEMA.
Hazard Awareness Program – <i>Annual Right to Know and Hazardous Communication</i>	DEP	DEP conducts annual Right to Know and Hazard Awareness Communications with its employees and submits SARA III reports which informs the public of any hazardous and toxic chemicals at DEP facilities.
Hazard Awareness Program – <i>Ready New York</i>	OEM	OEM collaborates with City agencies to distribute Ready New York brochures at numerous occasions throughout the City.

New York City Capability Assessment		
Capability	Agency	Description
Local Waterfront Revitalization – <i>New York City Waterfront Revitalization Program</i>	DCP	The New York City Waterfront Revitalization Program is the city's principal coastal zone management tool. It establishes the City's policies for development and use of the waterfront and provides the framework for evaluating the consistency of all discretionary actions in the coastal zone with those policies.
NFIP – <i>Participation and Enforcement</i>	DOB	To maintain compliance with the program, flood zone building requirements are incorporated into the building code. DOB enforces these requirements to ensure that all new construction and significant alterations within flood zones are built in accordance with the flood zone design regulations.
Planning/Zoning Boards – <i>New York City Planning Commission</i>	DCP	The City Planning Commission is responsible for the conduct of planning relating to the orderly growth and development of the City, including adequate and appropriate resources for the housing, business, industry, transportation, distribution, recreation, culture, comfort, convenience, health and welfare of its population. The Commission meets regularly to hold hearings and vote on applications concerning the use, development and improvement of real property subject to City regulation.
Planning Programs Department – <i>Citywide Planning</i>	DCP	DCP serves as the lead agency on citywide planning initiatives.
Property Acquisition Programs – <i>Wetland Acquisition</i>	DEP	The Bureau of Water and Sewer Operations oversees Bluebelt property acquisition in Staten Island.
Property Acquisition Programs – <i>Parkland Conversion</i>	Parks	The Parklands division works with DCAS' real estate division to acquire a limited number of properties in the city for conversion to parkland.

New York City Capability Assessment		
Capability	Agency	Description
Public Education/Awareness Programs – <i>Recreation and Education Programming</i>	Parks	The Recreation Division runs 34 recreation centers and provides extensive recreation and education programming. The Urban Park Rangers provide classroom and on-site environmental programming and operate ten Nature Centers. The Operations division runs educational programs promoting the use of marinas and waterfront. Parks is also associated with non-profit partners such as the City Parks Foundation and Historic House Trust. These partners augment Parks' educational and cultural offerings.
Site Plan Review Program – <i>Discretionary Review of Jamaica Rezoning</i>	DEP	DEP reviews all site plans in the Downtown Jamaica Rezoning Area before a building permit is issued from DOB. DEP's review ensures that the existing sewer surcharge conditions are not exacerbated by the proposed project.
Site Plan Review Program – <i>City Planning Commission Discretionary Review</i>	DCP	The borough offices and technical staff review site plan applications for consistency with sound planning policy, environmental reviews consistent with CEQR guidelines, in cases where discretionary action by the City Planning Commission is necessary.
Site Plan Review Program – <i>Tree and Horticulture Protection</i>	Parks	The Forestry division reviews site plans citywide for capital work and ensures that all trees and horticulture are protected. The Capital division reviews plans for projects in parks to ensure the protection of trees and horticulture.
Storm Drainage Systems Maintenance Program – <i>Sanitary, Storm, and Combined Sewer Maintenance and Programmatic Catch Basin Inspection and Cleaning</i>	DEP	DEP's Bureau of Water & Sewer Operations is responsible for the maintenance of sanitary, storm and combined sewers. DEP inspects and cleans the city's 140,000 catch basins on a three-year cycle. The agency makes repairs to the sewer system as needed.
Storm Drainage Systems Maintenance Program – <i>City Park Drainage Maintenance</i>	Parks	The Central Technical Services Division and Borough Shops maintain catch basins and storm drains in all the city parks.
Stream Maintenance Program – <i>Bronx River Natural Resources Group</i>	Parks	The Natural Resources Group in conjunction with the Bronx River Alliance, an associated non-profit maintains and cleans rivers, other wetlands, and riparian areas in the city.

New York City Capability Assessment		
Capability	Agency	Description
Stream Maintenance Program – <i>Bluebelt Watersheds Stream Maintenance</i>	DEP	DEP maintains stream-bank stabilization and removes obstructions from Streams and Wetlands in the Staten Island Bluebelt.
Stream Maintenance Program – <i>Stream Rehabilitation and Stabilization Program</i>	DEP	DEP rehabilitates and stabilizes stream banks to mitigate turbidity as part of its filtration avoidance determination obligations, in New York City watershed areas.
Vegetation Maintenance Program – <i>Tree Pruning Program</i>	Parks	The Central Forestry division oversees the block pruning and commitment-pruning program. Block pruning is done by contractors on a 7-8 year schedule and involves pruning of all street trees on a block. Commitment pruning addresses emergency issues, such as tree limbs obscuring traffic signals. Parks also performs in-park pruning of trees.
Studies/Reports		
Floodplain Maps/Flood Insurance Studies – <i>Revision</i>	OLTPS	OLTPS is leading an interagency effort to work with FEMA to revise the Flood Insurance Rate Maps.
Hydrological/Hydraulic Studies – <i>Reservoir Basin Hydrologic/Hydraulic Study</i>	DEP	DEP conducts H&H studies to confirm probable maximum precipitation and probable maximum flood for reservoir basins.
Hydrological/Hydraulic Studies – <i>High Hazard Dams</i>	DEP	BWS maintains studies of its high hazard dams and dikes.
Hydrological/Hydraulic Studies – <i>Hydraulic Analyses of Problem Areas</i>	DEP	DEP performs hydraulic analyses of sewer systems in areas experiencing sewer problems determine the need for and scope of future capital projects. These studies often occur before a drainage plan is developed and guide the determination of where improvements will be focused.
Hydrological/Hydraulic Studies – <i>SLOSH Study</i>	OEM	OEM performs SLOSH modeling for New York City to determine what areas would be inundated in a coastal storm. These models guide planning and evacuation operations as outlined in the Coastal Storm Plan.

Table 14: Existing Planning Mechanisms for Hazard Mitigation

6) Bibliography

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