NYCEDC NYC Mayor's Office of Recovery & Resiliency HDR

Community Resiliency Assessments Applied Risk Management Tools for the Hunts Point Neighborhood in the Bronx, New York City NEWEA June 2017

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Presentation Overview

- The application of **Risk Informed Decision Making (RIDM)** and use of **Potential Failure Mode Analysis (PFMA)** has gained broad application in the management of diverse dam and levee portfolios. Life safety is the primary consequence. However, urban communities rely on diverse critical infrastructure systems to survive and prosper.
- Recognizing disasters are inevitable, some communities are focusing on response, recovery and protection of **critical infrastructure systems** as capital intensive risk reduction systems are also evaluated to support community functions.
- Building on work by US National Institute of Standards and Technology, HDR and New York City developed a RIDM process that applies more broadly to critical community infrastructure systems. This presentation will summarize the methodology and results of the **Community Resiliency Assessment for Hunts Point**.

01 **Hurricane Sandy & the Hunts Point Resiliency Project**

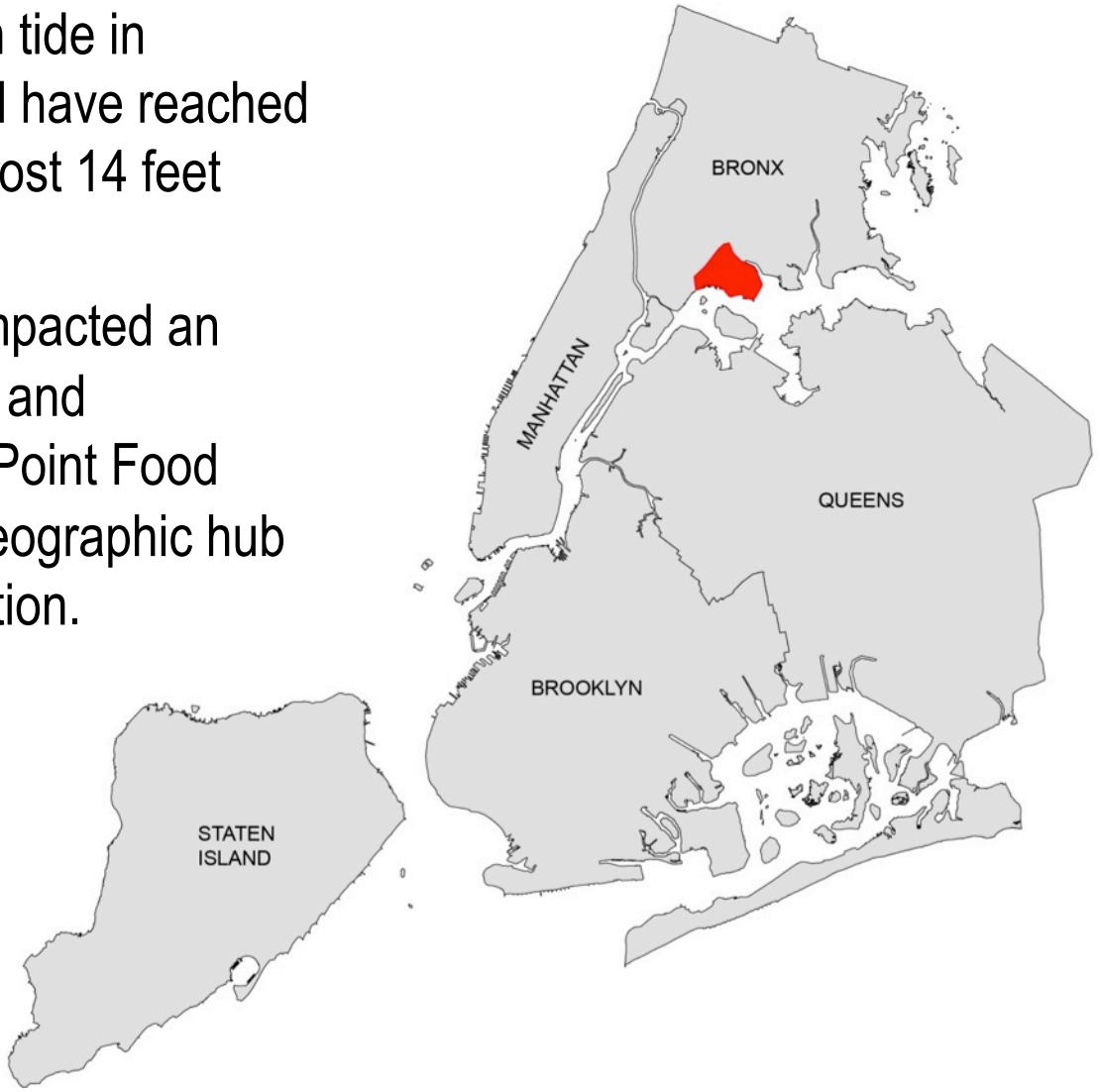
02 **Risk Management Approach & Community “Critical Facilities” Concepts**

03 **Key Findings & Conclusions**

01 Hurricane Sandy & the Hunts Point Resiliency Project

Hurricane Sandy & Hunts Point

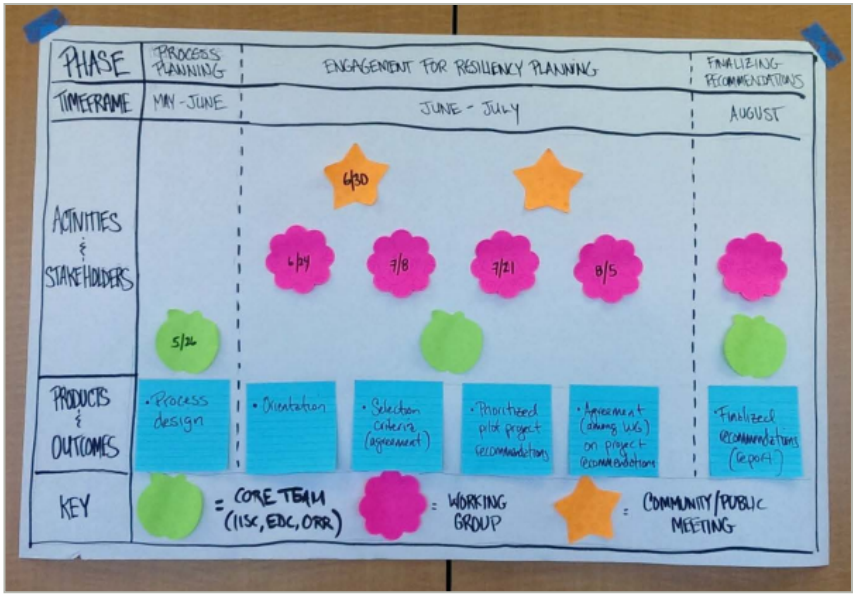
- If Sandy had arrived earlier –high tide in western Long Island Sound could have reached almost 18 feet above MLLW (almost 14 feet above NAVD88).
- Flooding could have adversely impacted an environmental justice community and overwhelmed parts of the Hunts Point Food Distribution Center, the largest geographic hub in New York City for food distribution.



Sources: Stevens Institute and NYC Special Initiative for Rebuilding and Resiliency, 2013; Five Borough Food Flow: 2016 New York City Food Distribution & Resiliency Study Results

Project Background

- US Department of Housing & Urban Development (HUD) launched the Rebuild by Design Competition in 2013, in response to Hurricane Sandy
- A total of $45 million was awarded to advance resiliency concepts from the Hunts Point proposal
- The City convened a Advisory Working Group to identify resiliency concepts to study and implement: **Energy Resiliency** *(pilot project to be funded)* and **Flood Risk Reduction**



Hunts Point Resiliency Project Overview

- The Project will result in the selection and design of a **Energy Resiliency** pilot project and the identification of feasible **Flood Risk Reduction** projects for which to seek additional funding.
- The project seeks to advance solutions that:
  - Address critical vulnerabilities for both community and industry
  - Protect important citywide infrastructure
  - Protect existing and future industrial businesses and jobs
  - Support the community's social, economic, and environmental assets
  - Use sustainable, ecologically sensitive infrastructure when feasible

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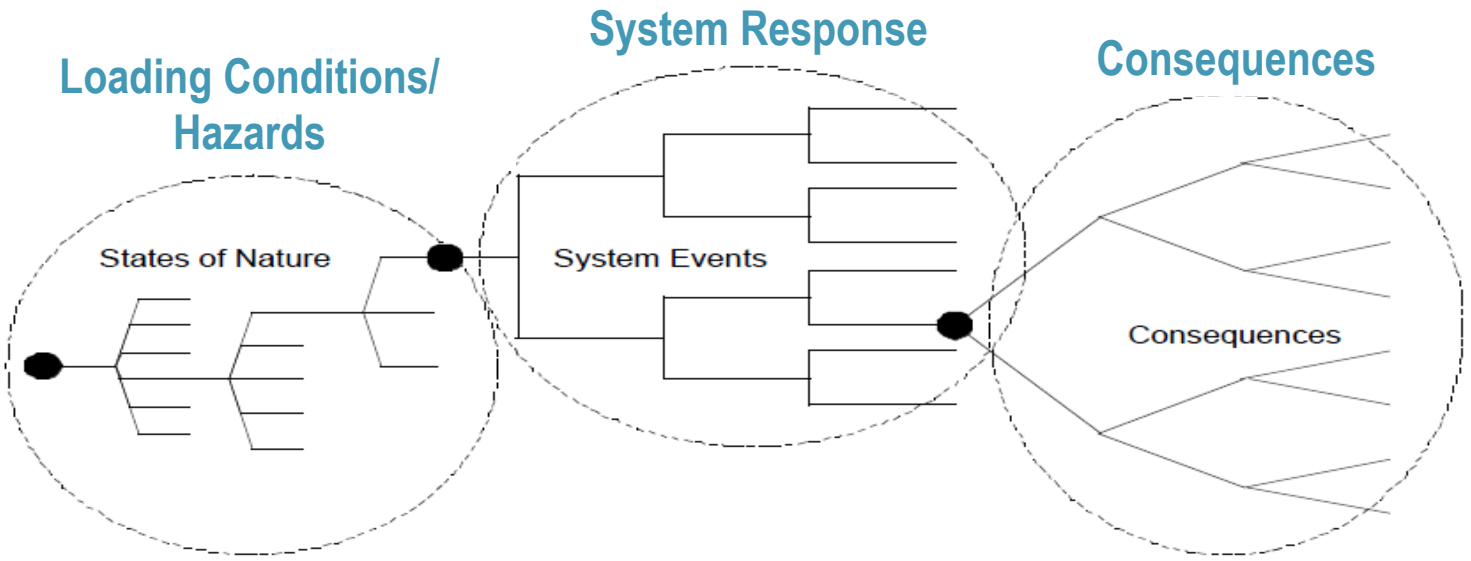
Risk Management Approach & Community “Critical Facilities” Concepts

Risk Informed Decision Making 101

- Event or Fault Trees
- Hazard-Response-Consequence Event Tree
- Loss of Life Risk
- Multi-Dimensional Consequences

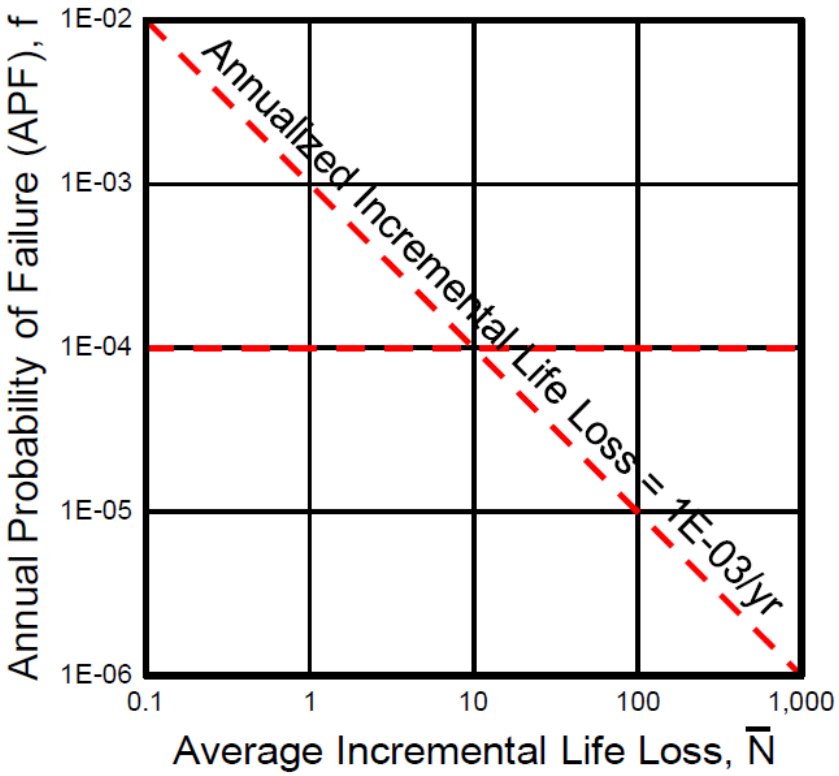
Project Examples (clockwise): Wanapum Dam Forensic Investigation and Root Cause Analysis (Grant County PUD and FERC); Nuclear Service Water Pond Seismic Fragility (Duke Energy); C-44 Embankment Design (USACE and SFWMD); Chehalis Basin Flood Reduction Planning Study (WA State); and, Chesapeake and Ohio Canal Flood Risk Examination (NPS).

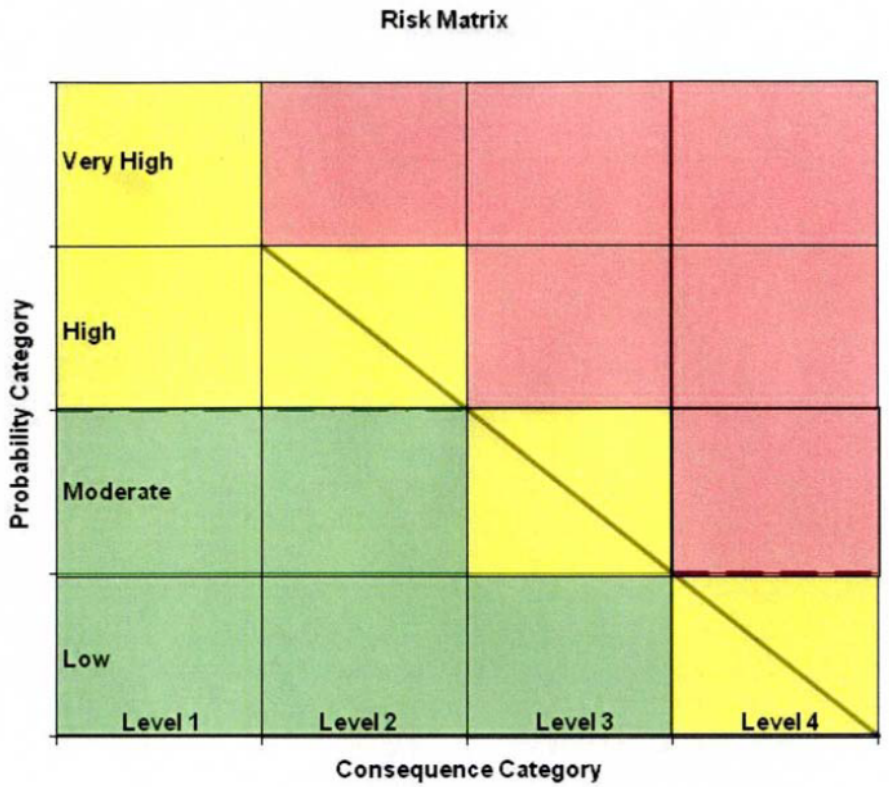
Hazard-Response-Consequence Event Tree



When both a range of causes (threats) and range of outcomes (consequences) are possible

Loss of Life Risk Guidance



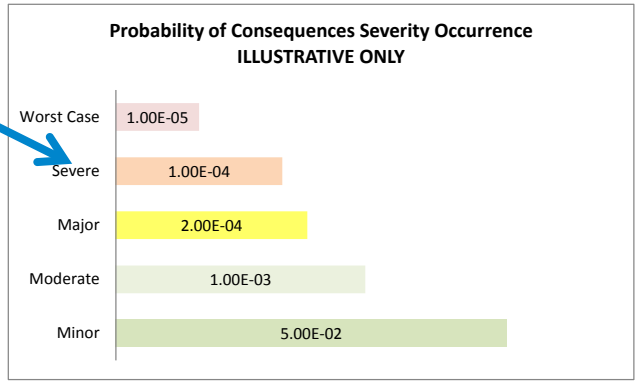


Multi-Dimensional Consequences

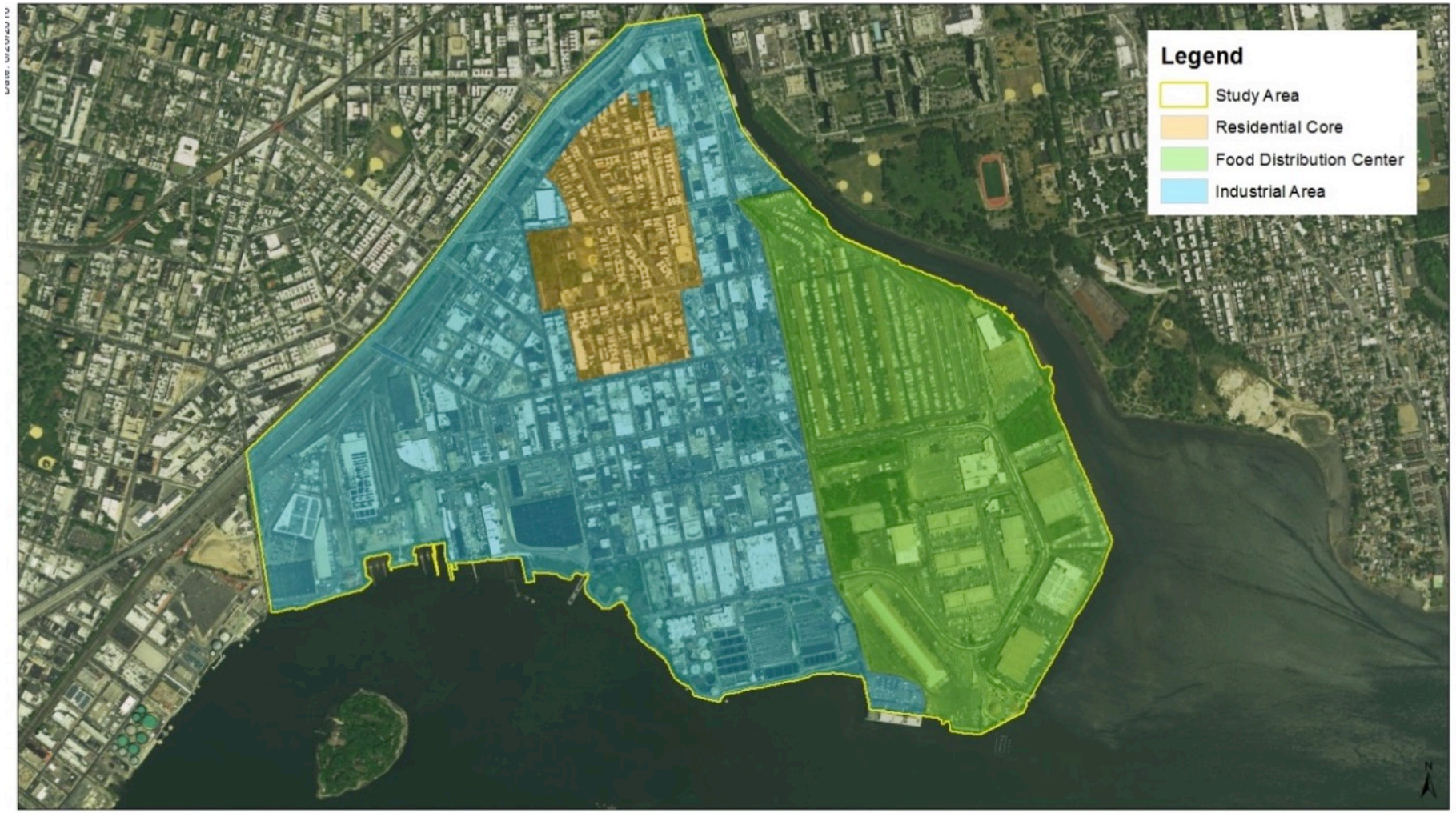
Types of Consequences

Severity of Consequences

Severity Scale Rating		Customer	People	Financial	Assets and Operations
		Public Image	Safety	Cash Flow Impact	Damage to Environment
5	Worst Case	International media attention nearly unanimous public criticism	Fatalities	>$1B	Widespread offsite impacts [1]
4	Severe	National media attention: federal, state officials, and customers publically critical	Permanent Disability	$500 - $1B	Significant quantity of hazardous material discharged: multiple offsite impacts [2]
3	Major	Regional/Local media attention: customers voice concern	Lost Work Time: Hospitalization	$100 - $500M	Significant localized offsite environmental impacts/damage [3], or Significant threat to human health and/or the environment on TVA property only
2	Moderate	Minimal media attention: letters/emails to executive leadership voicing concern	Lost Work Time: Non-Hospitalization	$25 - 100M	Minor localized offsite environmental impacts/damage [4]
1	Minor	No media attention: sparse criticism	First Aid	<$25M	Minor localized offsite environmental impacts/damage effecting TVA property only



Hunts Point Resiliency: Study Area



Study Area

0 250500 1,000 1,500 2,000 Feet

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Hunts Point RESILIENCY

Vulnerability Assessment Starting Point: Community Concerns

- Will residents be out of work if there is a coastal flood?
- Will people be displaced from their residences because of a lack of water or extreme heat?
- Will an extended energy outage jeopardize my food supply?
- Will emergency services, fire, ambulance, and police be able to respond?
- Will community centers and health facilities stay open?
- Will people or the environment become exposed to hazardous materials?

critical facilities

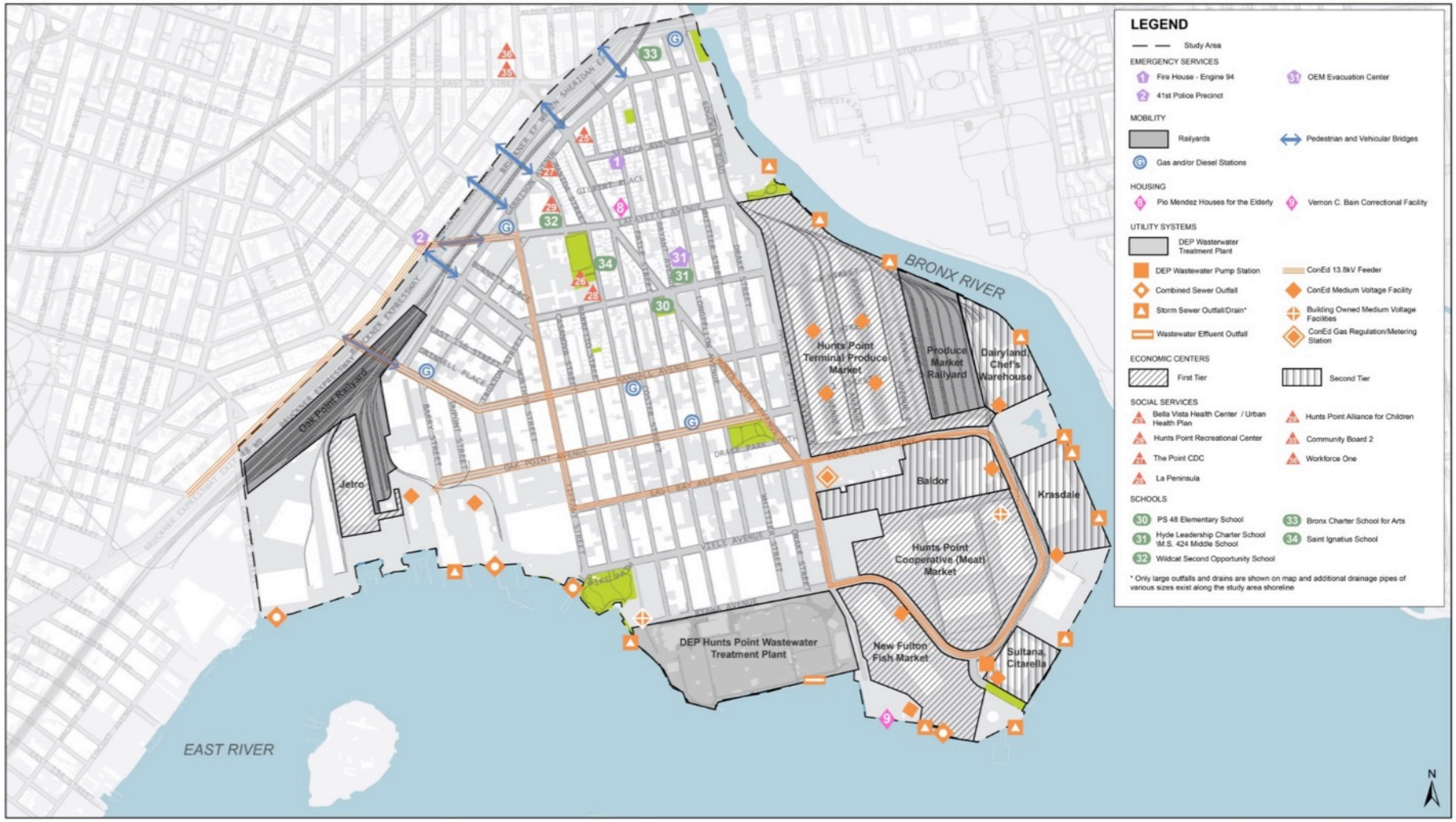
noun

- buildings, structures or infrastructure systems that provide essential services or supplies, and are vital to the City or community's resiliency and sustainability.

Hunts Point Resiliency: Critical Facilities

- Emergency Services
- Mobility
- Housing
- Utility Systems
- First Tier Citywide Economic Centers
- Second Tier Citywide Economic Centers
- Social Services

Hunts Point Resiliency: Critical Facilities



Critical Facilities

0 250500 1,000 1,500 2,000 Feet

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Hunts Point RESILIENCY

threat

noun

− extreme event that could cause harm.

Multiple Threats

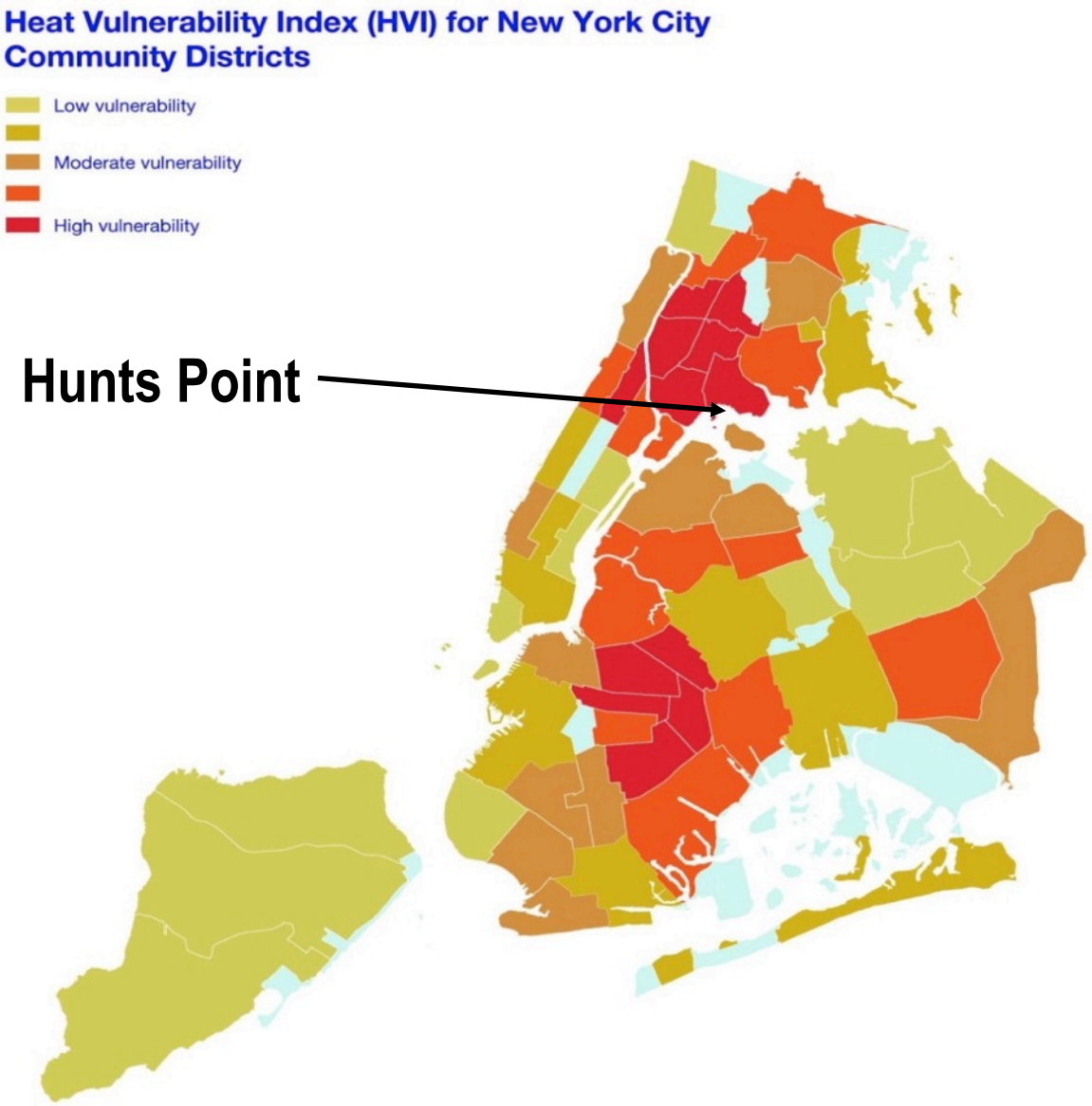
- Sea level rise
- Storm surge
- Extreme precipitation events
- System-wide infrastructure outages
- Building-level infrastructure outages
- Extreme heat events

New York City Panel on Climate Change 2015 Report Data

	10-Year	25-Year	50-Year	100-year	500-Year
Current-Day	9.6	11.0	12.0	13.0	15.1
2050s 90th Percentile Sea Level Projection	12.1	13.5	14.5	15.5	17.6

Other City-Specific Data & Reports

- Department of Health's Heat Vulnerability Index tracks multiple risk factors:
  - % or residents receiving public assistance
  - % of Hispanic / Black residents
  - Average surface temperature
  - % of vegetative cover



likelihood

noun

− probability that a threat will occur.

Likelihood Scale Descriptions

Score	Likelihood	Storm Surge	Precipitation	Outage	Heat
5	Almost Certain	50/100 to 99/100 (2-year event to 1-year event)	Maximum potential flooding due to rainfall that results in some ponding of runoff on site, typically on an annual basis	Building level outage that occurs at least once every year, function of significant age, poor condition, or complexity of building equipment	A prolonged heat wave will occur several times a year (e.g., NPCC predictions of >40 heat wave days per year in 2080)
4	Likely	5/100 to 49/100 (20-year event to 2-year event)	Maximum potential flooding due to rainfall that results in ponding depths up to 1 foot	Building level outage that occurs every 1 to 2 years, no backup generation, aged equipment, and complex electrical configuration	A prolonged heat wave will occur once or twice a year (e.g., NPCC predicts 30 to 40 heat wave days per year)
3	Possible	2/100 to 4.9/100 (50-year event to 20-year event)	Maximum potential flooding due to rainfall that results in ponding depths between 1 to 2 feet	Building level outage that occurs once every 2 to 5 years, no backup generation, moderately complex building level electrical infrastructure	A prolonged heat wave will occur every other year (e.g., NPCC predicts 20 to 30 heat wave days per year)
2	Unlikely	1/100 to 1.9/100 (100-year event to 50-year event)	Maximum potential flooding due to rainfallthat results in ponding depths between 2 and 3 feet	Building level outage that occurs every 5 to 10 years, limited backup generation, mildly complex building level electrical infrastructure	A prolonged heat wave will occur every 3-5 years(e.g., NPCC predictions of 10 to 20 heat wave days per year by the 2020s)
1	Rare	<1/100 (less frequent than 100 years)	Maximum potential flooding due to rainfall that results in ponding depths greater than 3 feet	Building level outage that occurs every 10 years or more, simple building electrical infrastructure and/or backup generation	A prolonged heat wave will occur every 5 years or more (e.g., current average of <10 heat wave days per year)

consequence

noun

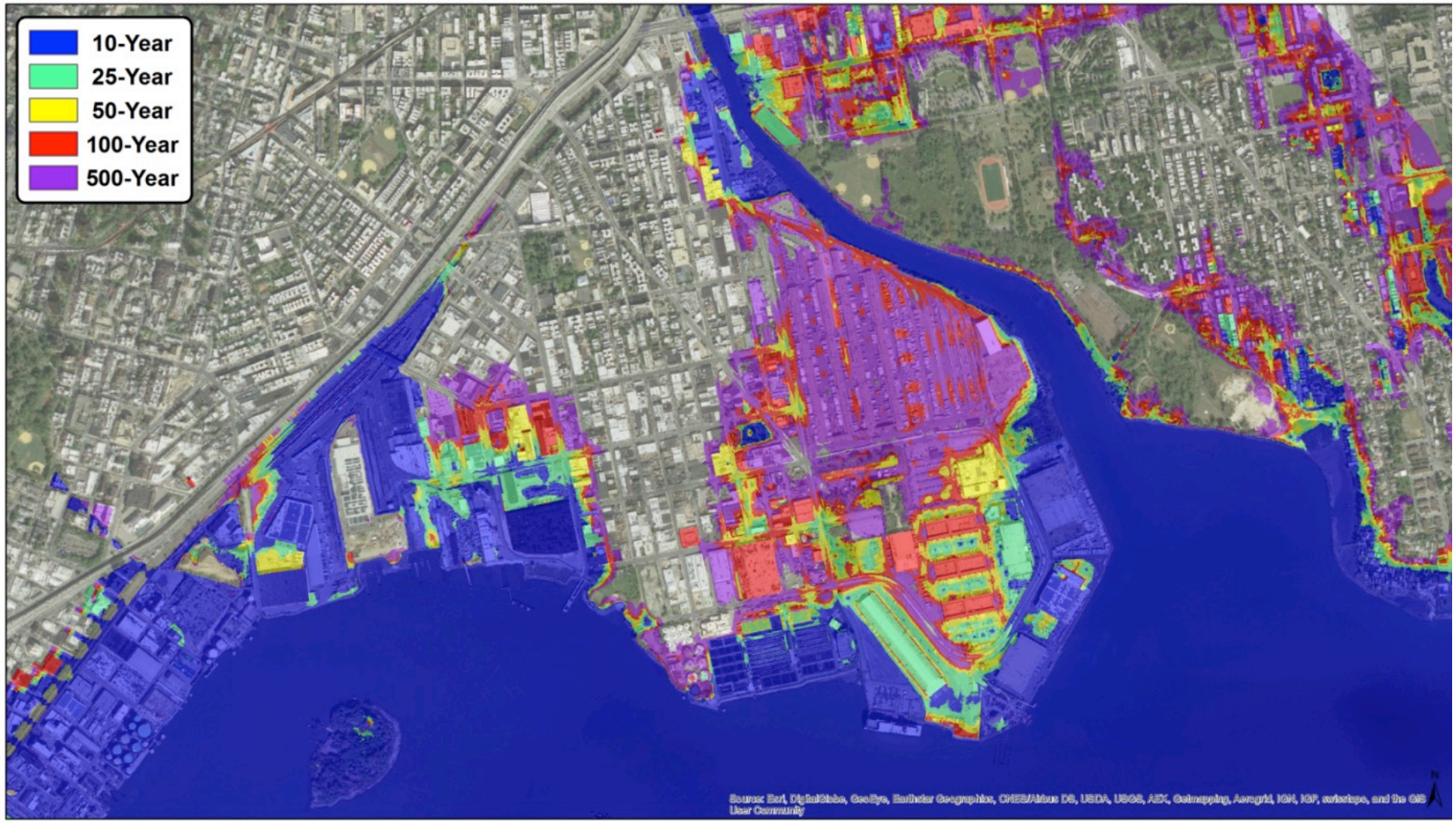
− harm or loss to life, property, infrastructure or any other negative impact that may result from a threat.

Consequence Scale Descriptions

Adapted from the City's narrative standards & scale used to rate conse-quences associated with risks to city-owned infrastructure

Score	Consequence	Facility Operations/ Costs	Community	Health	Economy
5	Significant	Significant building/ content/ infrastructure damages that prevent re-occupation without major re-construction (> 6 months)	Significant portion of city/ region affected, long-term displacement of significant number of people or entire communities (> 6 months)	Significant injuries or several fatalities, long term health impacts, widespread and significant hazardous waste releases with exposure	Significant impact on NYC's economy across many sectors and geographic areas
4	Substantial	Extensive building/ content/ infrastructure damages, repair (1-6 months)	Substantial portion of city/region affected, medium to long term displacement of substantial number of people or portions of communities (1-6 months)	Substantial injuries or any fatalities, long term health impacts, substantial hazardous waste releases	Substantial impact on NYC's economy across several sectors and geographic areas
3	Moderate	Building cleanup and minor repairs necessary to building and equipment. Some replacement of contents (2-4 weeks)	Entire neighborhood affected, temporary displacement of moderate number of people or portion of a community (2-4 weeks)	Moderate injuries, short term health impacts, moderate hazardous waste releases with limited exposure	Moderate impact on NYC's economy across many sectors and geographic areas
2	Minor	Minor impacts to building, and equipment, some replacement of contents (1 week)	Minor number of people affected, temporary displacement of minor number of people, community intact (1 week)	Minor injuries, short term health impacts	Minor impact on NYC's economy in a few sectors or geographic areas
1	Insignificant	Minor impacts to structures, and equipment, no contents damage (1 day)	Insignificant number of people affected, community intact (1 day)	Few injuries	Insignificant impact on NYC's economy, limited to a few businesses
0	No Impact	No flood damage to structures, contents, or equipment	No community affects	No injuries/fatalities	No impact on NYC's economy or businesses

Coastal Storm Surge: FEMA PFIRM Tide Extents + SLR



FEMA PFIRM Storm Tide Extents - 2050s 90th Sea Level

0 250500 1,000 1,500 2,000 Feet

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Hunts Point RESILIENCY

Coastal Storm Surge: Scoring Example 1 (Existing)

Analysis Step	Description	Score
Critical Facility	Meat Market transformer	
Threat	Coastal storm surge (flooding of electrical substations causes loss of refrigeration)	
Likelihood	500-year storm	1
Consequences	Flooding impacts on facility range from minor to moderate, however, loss of power and resultant loss in stock can have substantial economic impact	4
Coastal Flood Vulnerability Rating	Likelihood * Consequences = Vulnerability	4

Coastal Storm Surge: Scoring Example 2 (Future)

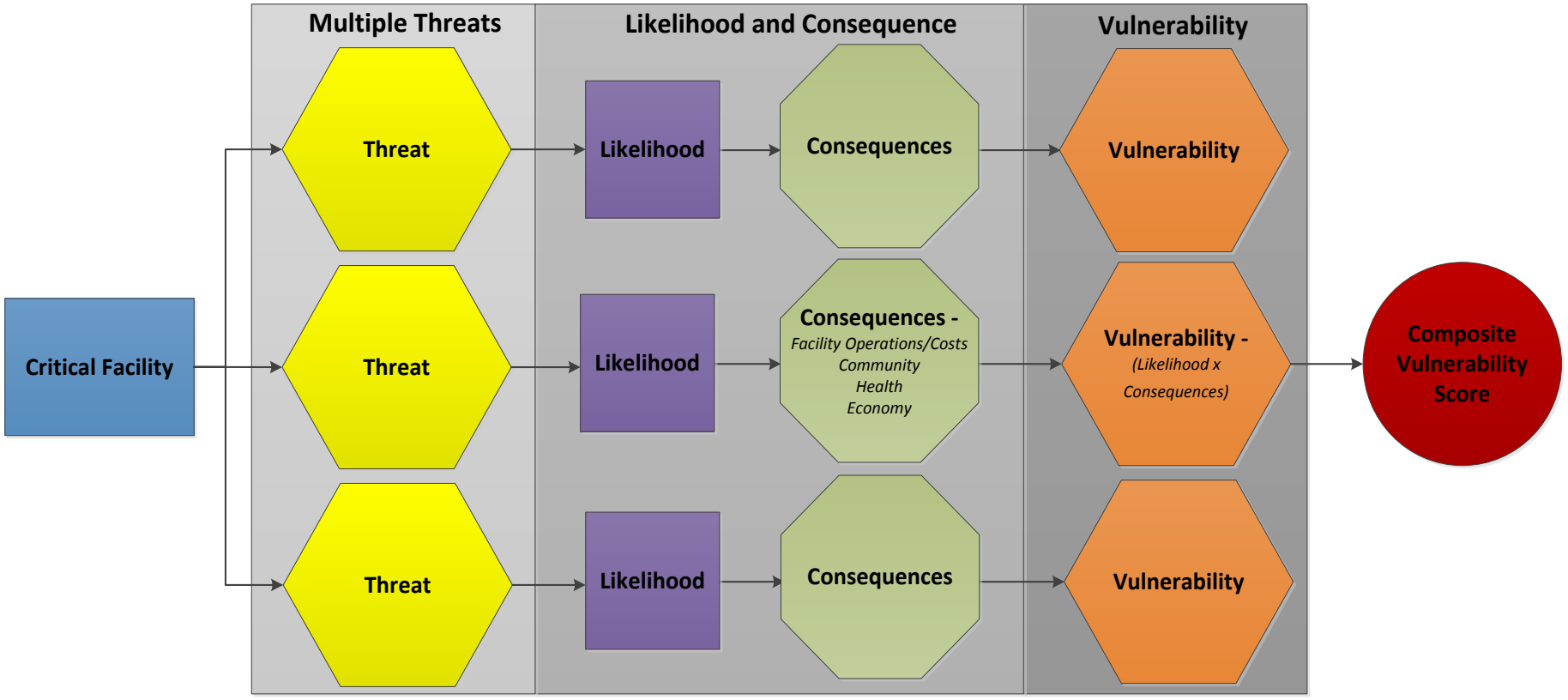
Analysis Step	Description	Score
Critical Facility	Meat Market transformer	
Threat	Coastal storm surge (flooding of electrical substations causes loss of refrigeration)	
Likelihood	50-year storm	2
Consequences	Flooding impacts on facility range from minor to moderate, however, loss of power and resultant loss in stock can have substantial economic impact	4
Coastal Flood Vulnerability Rating	Likelihood * Consequences = Vulnerability	8

composite vulnerability score

noun

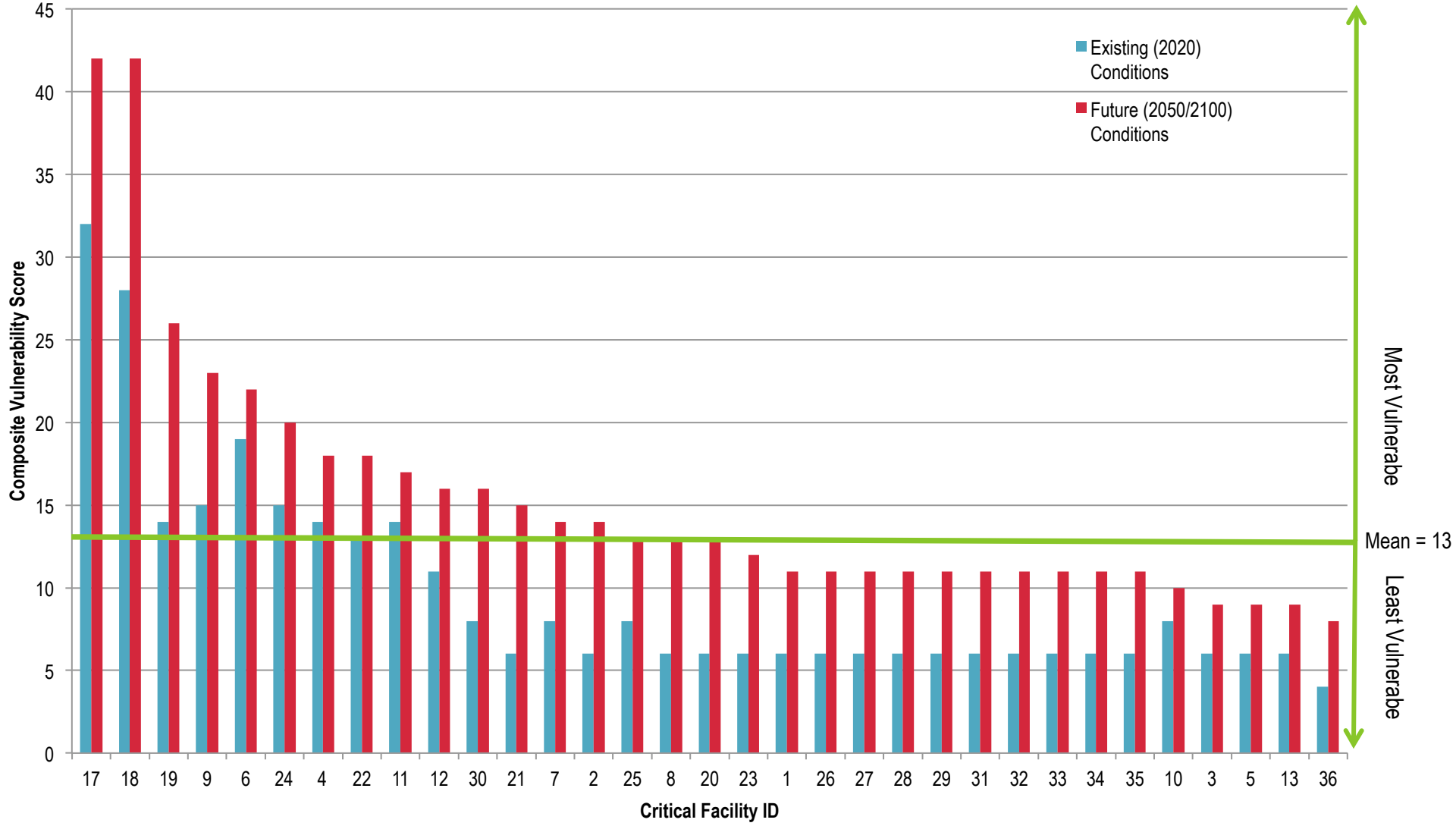
− a single measure of the likelihoods and consequences of multiple threats.

Vulnerability Assessment Approach



0 Key Findings & Conclusions

Ranking Critical Facilities by Composite Scores



Vulnerability Assessment: Key Findings (Overall)

1. Building-level power outages are a significant and shared threat to residents and businesses in Hunts Point.
2. Due to considerable elevation change, the low-lying areas face significant threats from coastal flooding while the upland residential area does not.
3. Extreme rain/snow storms are not a major threat in Hunts Point.
4. The number of community organizations and history of organizing in Hunts Point can lay the foundation for strong social resiliency.

Vulnerability Assessment: Key Findings (Facility-specific)

Facility	Threat	
Hunts Point Recreation Center	*Outage, Heat*	Community
Pio Mendez Housing for the Elderly	*Outage*	
Primary School (PS) 48	*Outage, Heat*	
Middle School (MS) 424	*Outage*	
Produce Market	*Outage, Heat*	Food Distribution Center
Meat Market	*Outage, Surge, Heat*	
Fish Market	*Outage, Heat*	
600 Food Center Dr (Citarella/Sultana)	*Surge*	
Krasdale	*Surge*	
Hunts Point Wastewater Treatment Plant	*Surge*	Infrastructure & Other Facilities
Oak Point Railyard	*Surge*	
Vernon C. Bain Correctional Facility	*Surge, Heat*	
Certain Road Intersections	*Surge, Outage*	
Certain Electrical Transformers	*Surge, Outage*	

Additional Observations

- Critical to have upfront community input and establish community specific consequences
- Critical to clearly define terms frequently used
- Data and method citations are important to provide analysis credibility (for Hunts Point, multiple risk management and resiliency guidance was used and cited)
- Methodology must be replicable across multiple community infrastructure systems and hazards
- Need to establish database of infrastructure systems
- Need to have subject matter experts that can develop failure modes and assign failure likelihoods or consequences

Questions?

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