Coastal Vulnerability Assessment
Newark City Riverfront
Essex County New Jersey

May 2017

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I.   Project Introduction

As stated in the 2011 NJDEP document New Jersey's Coastal Vulnerability Assessment and Mapping Protocol, vulnerability is defined as "the degree of exposure and inability of a human or natural system to cope with the effects of a natural hazard, including changing variability and extremes in weather and climate."

This report aims to assess vulnerabilities to enable communities in the planning for future exposures and develop strategies for mitigating long-term risk, making communities more resilient. To do so, this report assesses community vulnerability to sea level rise projected for the year 2050 along with a category 1 hurricane storm surge.

This report focuses on the Riverfront Area located in central Newark along the Passaic River.

Figure 1: Range of Sea Level Rise Estimates (Miller et.al)

	Sea-level rise (feet)		
	Global	Bedrock	Shore
2030 central	**0.5**	**0.7**	**0.8**
2030 low	0.3	0.5	0.6
2030 high	0.7	1.0	1.1
2030 higher	0.9	1.2	1.4
2050 central	**0.8**	**1.3**	**1.5**
2050 low	0.5	0.9	1.1
2050 high	1.3	1.8	1.9
2050 higher	1.6	2.1	2.3
2100 central	**2.5**	**3.1**	**3.5**
2100 low	1.4	2.2	2.5
2100 high	4.0	4.6	4.9
2100 higher	4.6	5.5	5.9
2100 collapse	8.7	9.7	10.1

Figure 1 illustrates the sea level rise range of estimates for 2030, 2050, and 2100.
This publication calls for a central projection of 1.5 feet of sea level rise along the shore in 2050 and is the projection used in this report.

Figure 2: Tide Gage Data (Miller et.al
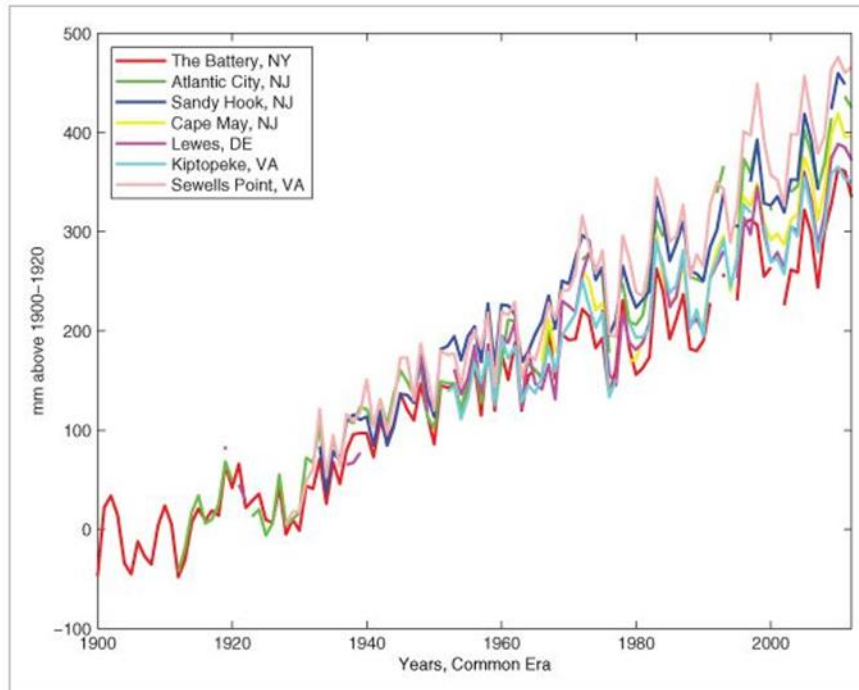
Figure 2 illustrates tide gage data taken along the Eastern seaboard from 1900 to past the year 2000. Miller et.al. attribute a higher rate of rise in the coastal plains to coastal subsidence and groundwater withdrawal and compaction.

Category 1 storm surge data was mapped using the Sea, Lake, and Overland Surge from Hurricanes (SLOSH) data developed by the National Weather Service/NOAA to estimate storm surge heights resulting from historical, hypothetical, or predicted hurricanes, taking into account the atmospheric pressure, size, forward speed, and track data of storms.
According to the National Hurricane Center, Category 1 storm characteristics include:
• Sustained winds of 74-95 mph
• Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters.
• Large branches of trees will snap and shallow rooted trees may be toppled.
• Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.

II.   Riverfront Area Profile

Graphic 1: Google Screenshot, Newark Riverfront Area
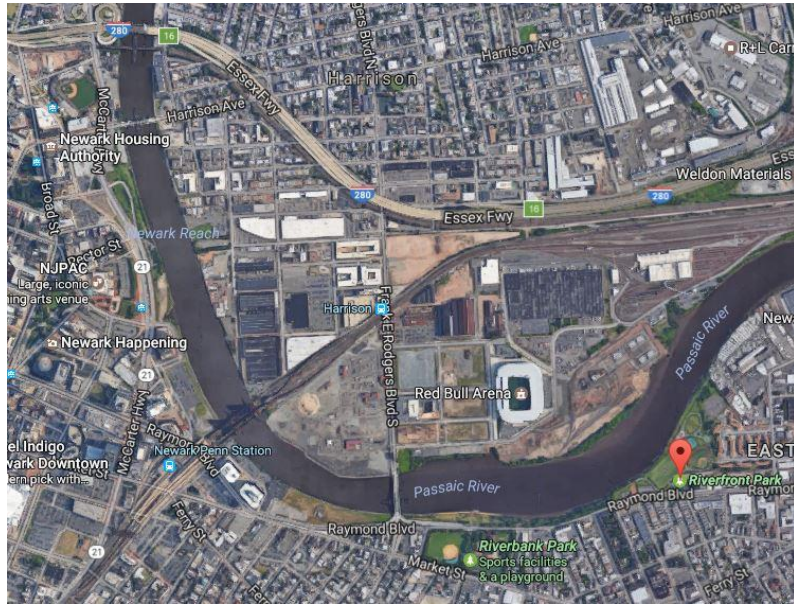
Located along the Passaic River in central Newark, the Riverfront area is home to the Waterfront Park. The park is the location of various public events, recreation opportunities, and offers access to and from various nearby restaurants and commercial locations. Aside from the social, cultural, and recreation opportunities, the Riverfront is also useful as a stormwater buffer. According to the USEPA, vegetated stream buffers help absorb water along streams and rivers, which also reduces flooding by holding excess water. These buffers are especially important in urban areas where significant amounts of stormwater runoff can inundate streams during precipitation events.[1]

Currently, the Riverfront Area consists of various types of land uses, with a nearly continuous green buffer, wider in some areas than in others, along the entire length.

According to the conceptual drawing, the Newark City Riverfront is approximately 2.64 miles long. (Refer to Map 1)

The community in the Riverfront Park Area is identified using 2010 U.S Census Blocks and Tracts that intersect with the parcels in the conceptual drawing (Refer to Map 2). According to the larger Census Tract data, in 2010 the total population was 16,151 and the average median household income was $41,135. Of the total population, 43% speak Spanish or Creole, 34% speak English, 21% speak an Indo-European language and 1% of the population speak an Asian or other language. Within the smaller Cenus Blocks the total population is 311 people and the median ages 26.4. Hispanic and African American residents account for the largest portion of the population at 9% and 72%, respectively.

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[1] https://www.epa.gov/enviroatlas/enviroatlas-benefit-category-natural-hazard-mitigation

According to FEMA, the Newark Riverfront consists of mostly Zone AE, meaning the area is subject to inundation by the 1% annual-chance flood event, Base Flood Elevations (BFEs) are shown, and mandatory flood insurance purchase requirements and floodplain management standards apply. A much smaller portion of the Riverfront is designated as the 2% Flood Hazard Zone. These are areas outside the 1% annual chance floodplain, there are no Base Flood Elevations or depths are shown within this zone and insurance purchase is not required. (Refer to Map 3)

According to storm surge modeling done by FEMA (Refer to Map 4), Superstom Sandy had much more of an impact in the Riverfront Area than Hurricane Irene, which mostly impacted small areas of the riverfront in Harrison Township to the north. According to the 2016 Essex County Hazard Mitigiation Plan Update, homes and public facilites were impacted by flooding in the East Ward (which contains the riverfront) during both storm events.

Siting serious erosion, the US Army Corps of Engineers has begun a bulkheading and riverbank restoration in the area. More information on the project can be found at http://www.nan.usace.army.mil/Missions/Civil-Works/Projects-in-New-Jersey/Joseph-G-Minish-Passaic-River-Waterfront-Park-and/ .

III.   Municipal Coastal Vulnerability Assessment Methodology

This CVA was completed by staff at Rutgers University in April of 2017.

The process for completing the CVA was done in three steps:

1.   Identify Community Assets
2.   Establish Vulnerabilities and Consequences
3.   Recommendations

CVA Step 1: Identifying Community Assets

When a CVA is completed, community assets from four general areas are indexed in a matrix and then used to support the development of asset mapping, identification of depth inundations, community-led findings, and eventual recommendations. These four asset areas include:

- **Community Resources**: Schools, shelters, storm-related retail, major employers, churches, food banks, etc.
- **Critical Infrastructure and Facilities**: Government operations, utilities, evacuation routes, emergency response
- **Natural and Ecosystem Resources**: Beaches, bayfronts, wetlands/critical habitat, parks

- **Vulnerable Sites and Populations**: Identifiable clusters of senior citizens, low income populations, limited English proficient populations, mobile home parks, contaminated/otherwise hazardous materials/sites

According to research done by Rutgers University, there were 17 vulnerable assets (listed below) found to be located at the Newark City Riverfront.

Table 1. Vulnerable Assets and Depth Projections

Asset #	Name	Asset Category	Function
1	250 Passaic, LLC (Commercial)	Community Resource	Multi commercial/wharehouse building
2	922-924 McCarter Highway (KCS)	Vulnerable Site	Undeveloped, listed by NJDEP as contaminated site
3	963 Raymond Blvd. (Commercial)	Community Resource	Multi commercial uses located across the street from Penn Station
4	997 Raymond Blvd. (Commercial and Govt)	Community Resource	Mix of Commercial and Govt use, located across the street from Penn Station
5	Bus Stop (Raymond Blvd. & Raymond Plaza East)	Critical Infrastructure and Facilities	NJ Transit bus stop
6	Colonial Concrete (Commercial)	Community Resource	Commercial mining site
7	Floating Boat Dock	Natural and Ecosystem Resources	County-owned dock/boardwalk
8	Industrial/ commercial Land	Community Resource	Industrial/commercial use
9	Jackson Street Bridge (KCS)	Vulnerable Site	Highway 697 – links Newark to Harrison, NJ over the Passaic River
10	M. Terrell Homes (NHA)	Vulnerable Population	Newark Housing Authority site, 12 buildings with various apartments and a small playground on site
11	Mechanical building (PSE&G)	Critical Infrastructure and Facilities	PSE&G owned and operated

12	Mechanical building (State of New Jersey)	Critical Infrastructure and Facilities	State owned and operated
13	Minish Passaic River Waterfront (KCS)	Natural and Ecosystem Resources / Vulnerable Site	State owned, listed by NJDEP as contaminated site
14	Newark Waterfront Center	Natural and Ecosystem Resources	Venue site available for rent to public
15	Riverbank Park	Natural and Ecosystem Resources	County owned. Baseball, soccer, tennis, basketball, lighting, seating, and bathroom facilities.
16	Riverfront Park	Natural and Ecosystem Resources	County owned. Baseball, soccer, tennis, basketball, lighting, seating, and bathroom facilities.
	Riverfront Path (Horizon Wellness Trail)	Natural and Ecosystem Resources	Starting at eastern end at the Riverfront Park and ending right before Prospect St., parallel to Raymond Blvd

* Red represents privately owned land, purple represents publicly owned land. Assets listed in alphabetical order. KCS = Known Contaminated Sites. KCS listed using PI_Name. NHA = Newark Housing Authority.

IV.   Findings and Recommendations

CVA Step 2: Establish vulnerability and consequences matrix

After identifying the assets, depth projections were mapped and listed using the chosen project scenario: combined data provided by the New Jersey Department of Protection for the storm surge from a category 1 storm coupled with sea level rise projected for the year 2050. (Refer to Map #5) *Note: projected depths are based on sea level.

Vulnerability was rated at a range from *N/A* to *High* based on the projected inundation depth. Consequences were rated from *N/A* to *High* based on how flood damage or loss of the asset might impact the Riverfront socially, environmentally, economically, etc. Ratings do not take into account community input.

Table 2: Vulnerability and Consequences Matrix

Asset #	Asset	Projected Depth (Ft.)	Vulnerability Rating	Consequences Rating
1	250 Passaic, LLC	3-6 in rear parking lot, 0-5 rear of building	Moderate/High	Low
2	922-924 McCarter Highway (KCS)	3-5 closest to water, 2-3 inland	Moderate	Moderate
3	963 Raymond Blvd.	3-5 in rear parking lot, 0-3 rear of building	Moderate	Moderate
4	997 Raymond Blvd.	3-6 in rear parking lot, 0-3 rear of building	Moderate	Moderate
5	Bus Stop (Raymond Blvd. & Raymond Plaza East)	0-2	Low	Low
6	Colonial Concrete	2-5 closest to River, 0-2 inland	Low	Low
7	Floating Boat Dock	6-10	High	Low
8	Industrial Land	4-6 closest to water		
9	Jackson Street Bridge (KCS)	5 at intersection with Raymond Blvd.	High	Hig
10	M. Terrell Homes (NHA)	0-2 throughout	Low/Moderate	Moderate
11	Mechanical building (PSE&G)	1-2 at water's edge	Low	Low/Moderate
12	Mechanical building (State of New Jersey)	4-5	High	High
13	Minish Passaic River Waterfront (KCS)	3-6 throughout	Low/Moderate	Moderate
14	Newark Waterfront Center	5-7 rear parking lot,	Low	Low

		1-3 rear building		
15	Riverbank Park	0-1 at corner of Market and Van Buren	Insignificant	Insignificant
16	Riverfront Park	3-5 at water's edge and 0-4 throughout	Moderate	Moderate
	Riverfront Park Path (Horizon Wellness Trail)	0-4 throughout	Low	Low

* Red represents privately owned land, purple represents publicly owned land (Refer to Map 6). Assets listed in alphabetical order. KCS = Known Contaminated Sites. KCS listed using PI_Name. NHA = Newark Housing Authority.

City parcel data illustrated that the majority of the parcels in the Riverfront Area are publicly owned. Based on the conceptual drawing of the Riverfront, the majority of the privately owned parcels are under industrial ownership. (Refer to Map 6)

Public ownership allows the City to make land use and design decisions that include more conservation and mitigation projects, including expansion of protected buffers, and green infrastructure such as permeable pavement in parking lots and sidewalks, as well as tree plantings. Natural and green design along the waterfront will also allow the City to maintain public access to the Passaic River.

There are seven Newark Housing Authority (NHA) properties within 1 mile (15-minute walk) of the Riverfront area (Refer to Map 7). Six of the properties are Family developments with two to four bedrooms and one is a one to two bedroom senior development. In total, there are 1,757 units. One of the NHA Properties is within the Riverfront Area and is vulnerable to the future projected flooding to sea level rise for the year 2050 along with a category 1 coastal storm surge.

A one-mile radius around the Riverfront Area was drawn to include the NHA Properties to determine the accessibility of low-income populations to the waterfront. According to the National Recreation and Park Association, usage of parks increases with accessibility. Usage of park facilities serves as opportunity for physical activity, combating obesity and associated chronic illnesses. According to the CDC the percentages of adults and children with obesity has been rising since 2011. For adults in 2011, 34.9% of the adult population and 16.9% of children were obese. In 2014 the rates increased to 37.7% of adults and 17.2% of children diagnosed as obese.

There are four contaminated sites within the parcels that make up the Riverfront Area (Refer to Map 8). All of the contaminated sites are within publicly owned parcels. Three are located within parks or open space and one is located on industrial land.

➤ *Conisder site remediation that also includes stormwater management*

Due to the probability for stormwater contamination, the City should take special consideration to mediate these sites to protect water quality and the public health in and around the Riverfront Area. New Jersey's Site Remediation Program offers technical guidance on stormwater management techniques that manage runoff that may become contaminated by contact with waste material. One example of where a contaminated waterfront has been reclaimed and used to mitigate stor water is the City of Camden Waterfront South Rain Gardens.

- Resource: [Camden Waterfront South Rain Gardens](#)

The Newark Riverfront contains areas of vacant and park land where shoreline stabilization projects could occur to assist with stormwater and flood mitigation on adjacent properties.

➤ *Where applicable, consider shoreline stabilization and restoration projects*

The Nature Conservancy's Restoration Explorer is a geospatial tool that recommends potential living shoreline techniques based on past and current conditions of the coastline.

In Newark, the Restoration Explorer identifies four techniques as being conducive to the Riverfront. The four different shoreline restoration project options include: a nature based living shoreline, a breakwater, ecologically enhanced revetment, and beach restoration.

- Resrouce: [The Restoration Explorer](#)

Graphic 2: Screenshot, Restoration Explorer Shoreline Techniques
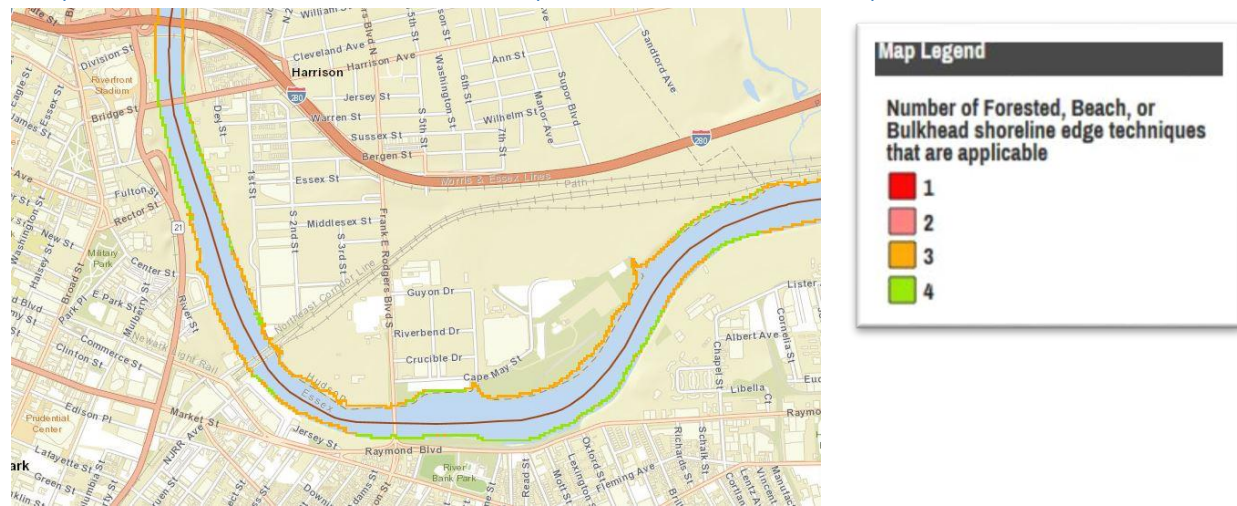
Recommendations from the Essex County Hazard Mitigation Plan that are in line with the CVA

According to the 2016 Essex County Hazard Mitigation Plan Update, Newark should consider the following actions related to their Riverfront:

➢ *Along the Passaic Riverfront, the city can mitigate flooding and damage to property through Green Infrastructure Implementation. Creating a buffer of vegetation between the Passaic River and inland development.*
➢ *Passaic River Acquisition*
➢ *Stormwater management through green infrastructure*

Community Rating System (CRS) and the National Flood Insurance Program (NFIP)

According to FEMA, as of 2016 Newark does not participate in the CRS Program. The City does, however, participate in the NFIP and according to the 2016 Essex County Hazard Mitigation Plan Update, has 264 policies in force. According to FEMA NFIP data, there are 12 Repetitive Loss Properties located in the City, all located on 10 streets throughout the City. Of these 10 streets, half (5) are located within a half mile radius of the Riverfront (Refer to Map 9).

These five Streets: Washington St., Adams St., Wilson Ave., Esther St., and Foundry St., could all be targeted for mitigation projects, flood prevention outreach, and would also benefit from future participation in the CRS Program through flood insurance discounts.
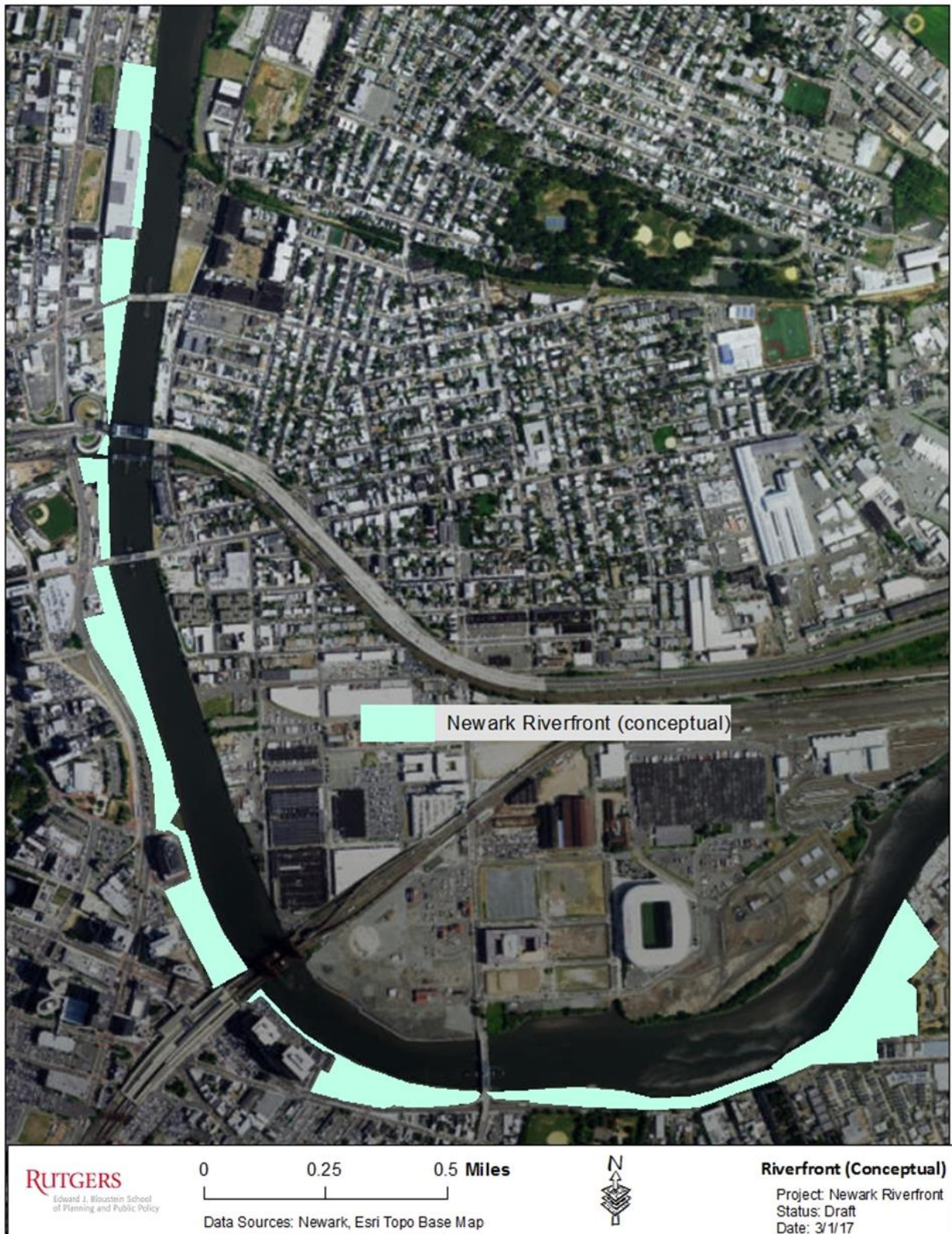
➢ Conduct a Repetitive Loss Area Analysis

To better assist in tareting these communities and mitigation strategies, the City of Newark could conduct a Repetetive Loss Analysis. An analysis consists of collecting the historic loss data from FEMA, mapping the properties, analyzing and detailing the nature of the losses, and undertaking annual outreach to impacted properties.

• Resource: Repetitive Loss Area Analysis

Appendices

Map 1. Newark Riverfront Park Expansion Concept (Source: City of Newark)
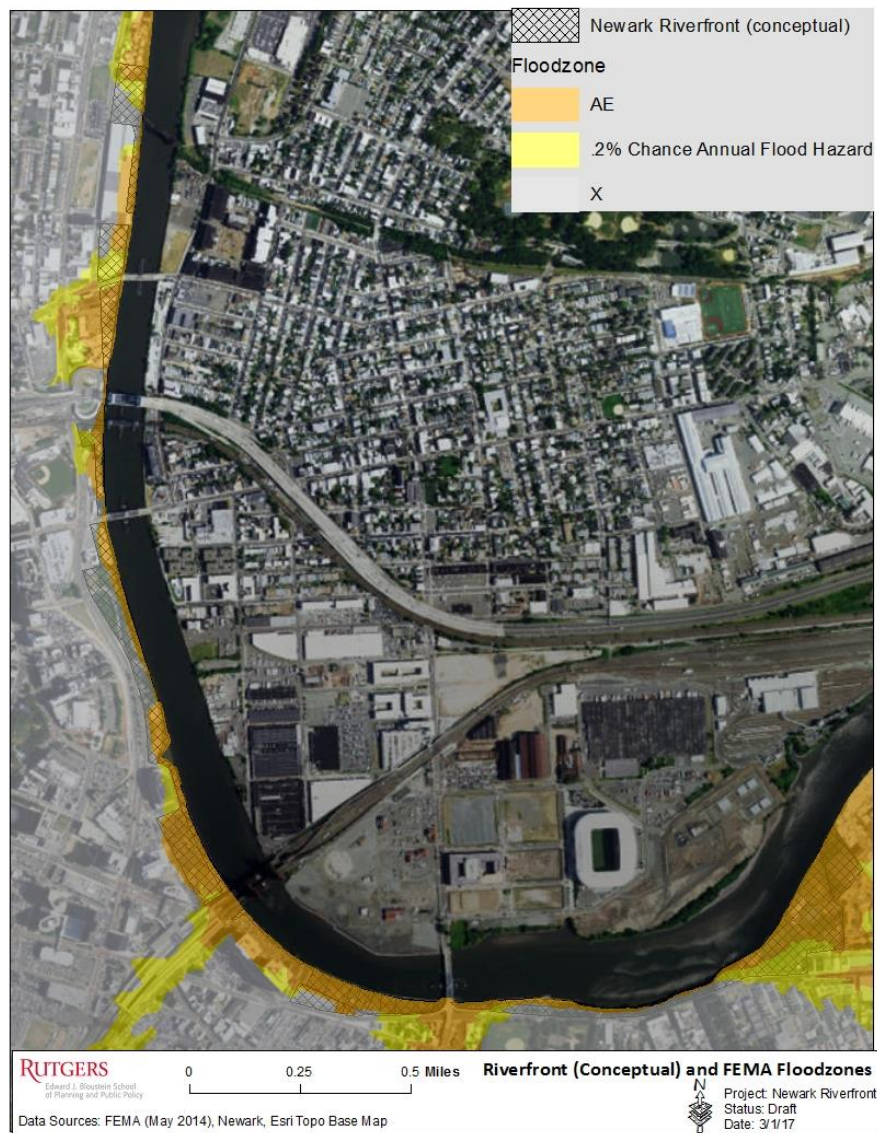
Map 2. Newark Riverfront and 2010 Census Data

Source: Esri, Digital Globe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, US and the GIS User Community
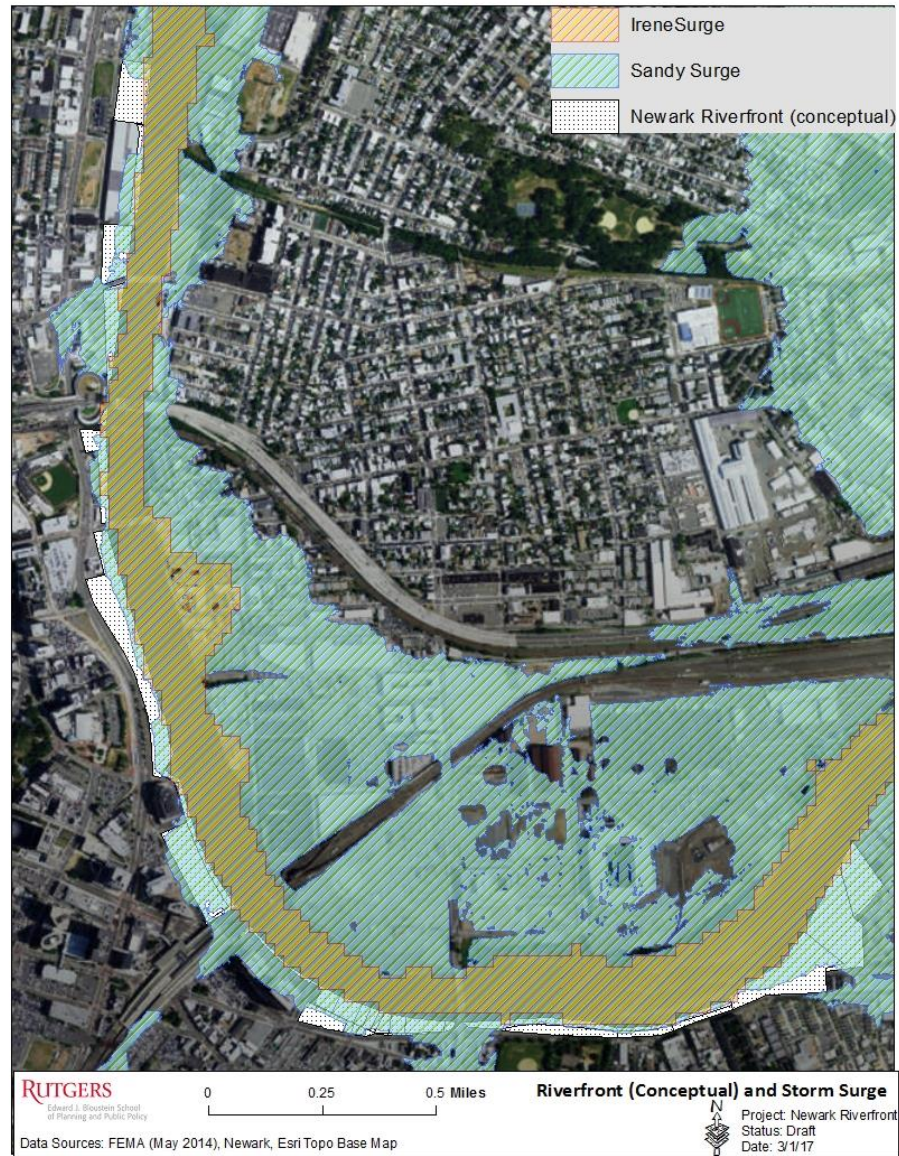
Census Blocks
Cenus Tracts
Riverfront Park Area

0   0.45   0.9
Miles

Project: Newark CVA
Map: Cenus Geography/ Riverfront Concept
Data Source: Newark, NJDEP
Map by EAC/Rutgers University Feb 2017

Map 3: FEMA Floodzones

Riverfront (Conceptual) and FEMA Floodzones

Legend:
- Newark Riverfront (conceptual)

Floodzone
- AE
- .2% Chance Annual Flood Hazard
- X

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0   0.25   0.5 Miles

Project: Newark Riverfront
Status: Draft
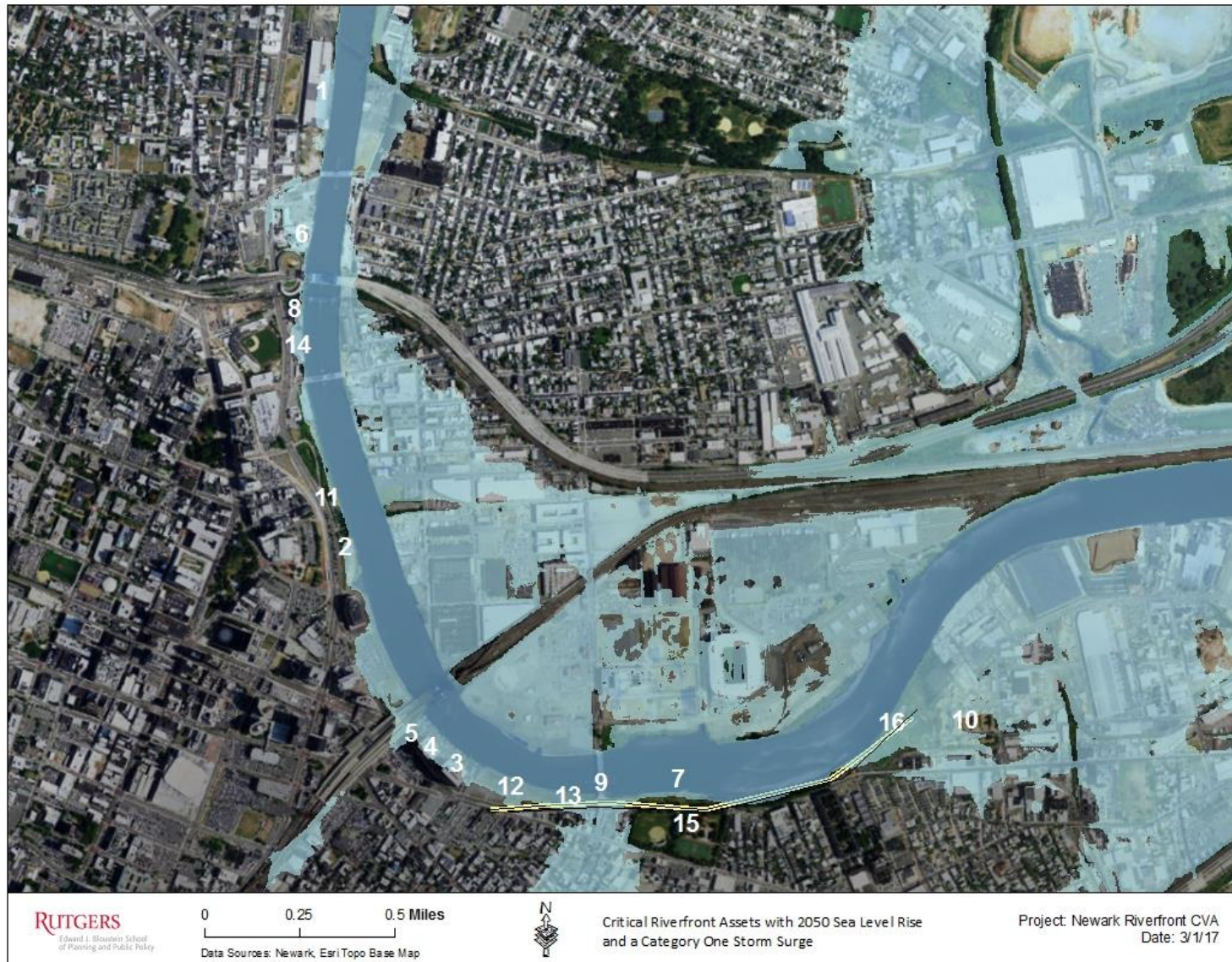Date: 3/1/17

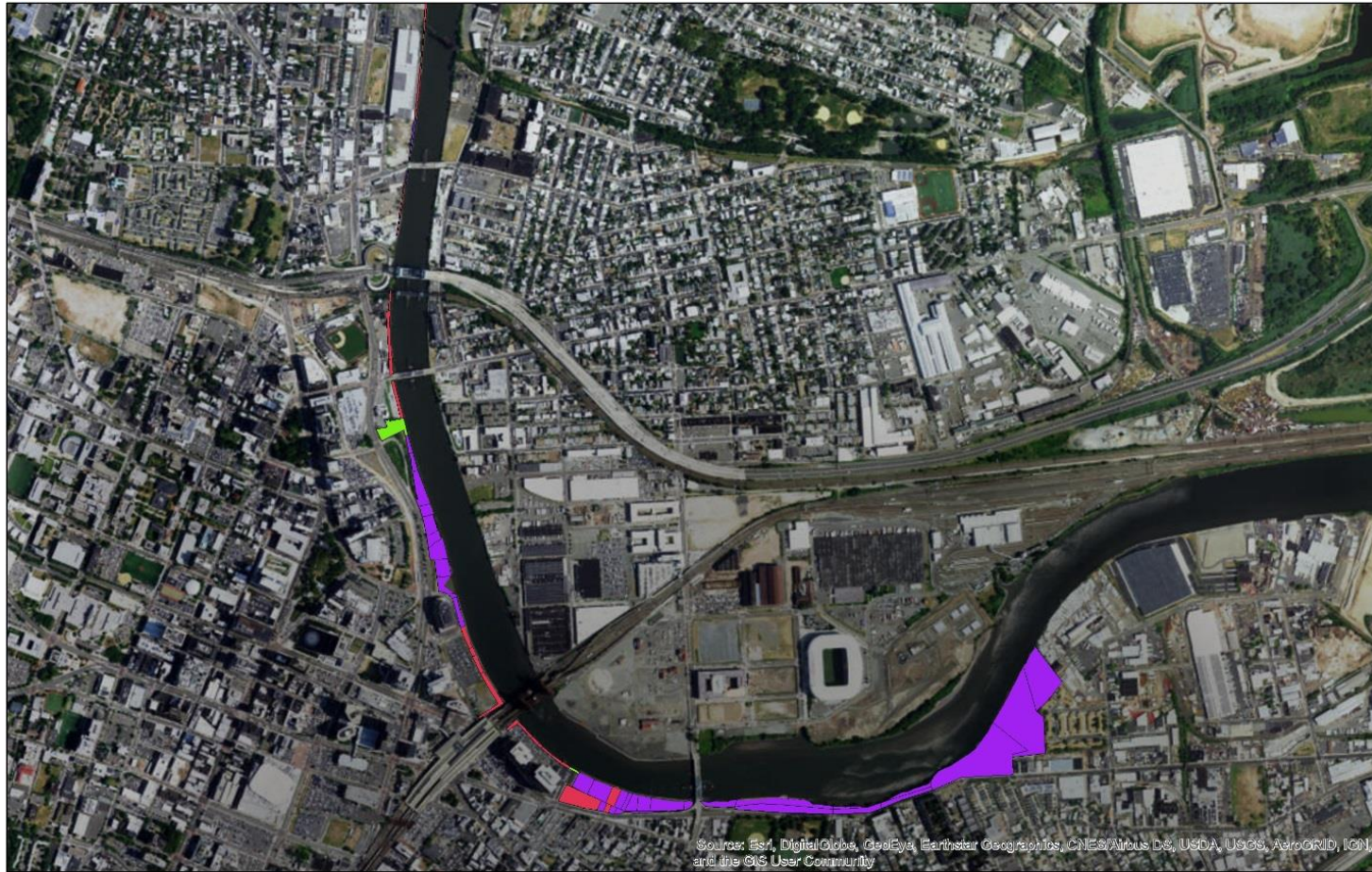Data Sources: FEMA (May 2014), Newark, Esri Topo Base Map

Map 4: Storm Surge, Hurricane Irene and Superstorm Sandy

Map 5: Vulnerable Assets with Sea Level Rise for 2050 and Category 1 Storm Surge

Map 6: Riverfront Lot Ownership/Accessibility

Legend:
- No Ownership Info
- Privately Owned Parcels
- Publicly Owned Parcels

Project: Newark CVA
Map: Parcel Ownership
Data Source: Newark Lot Assessments
Map by EAC/Rutgers University Feb 2017
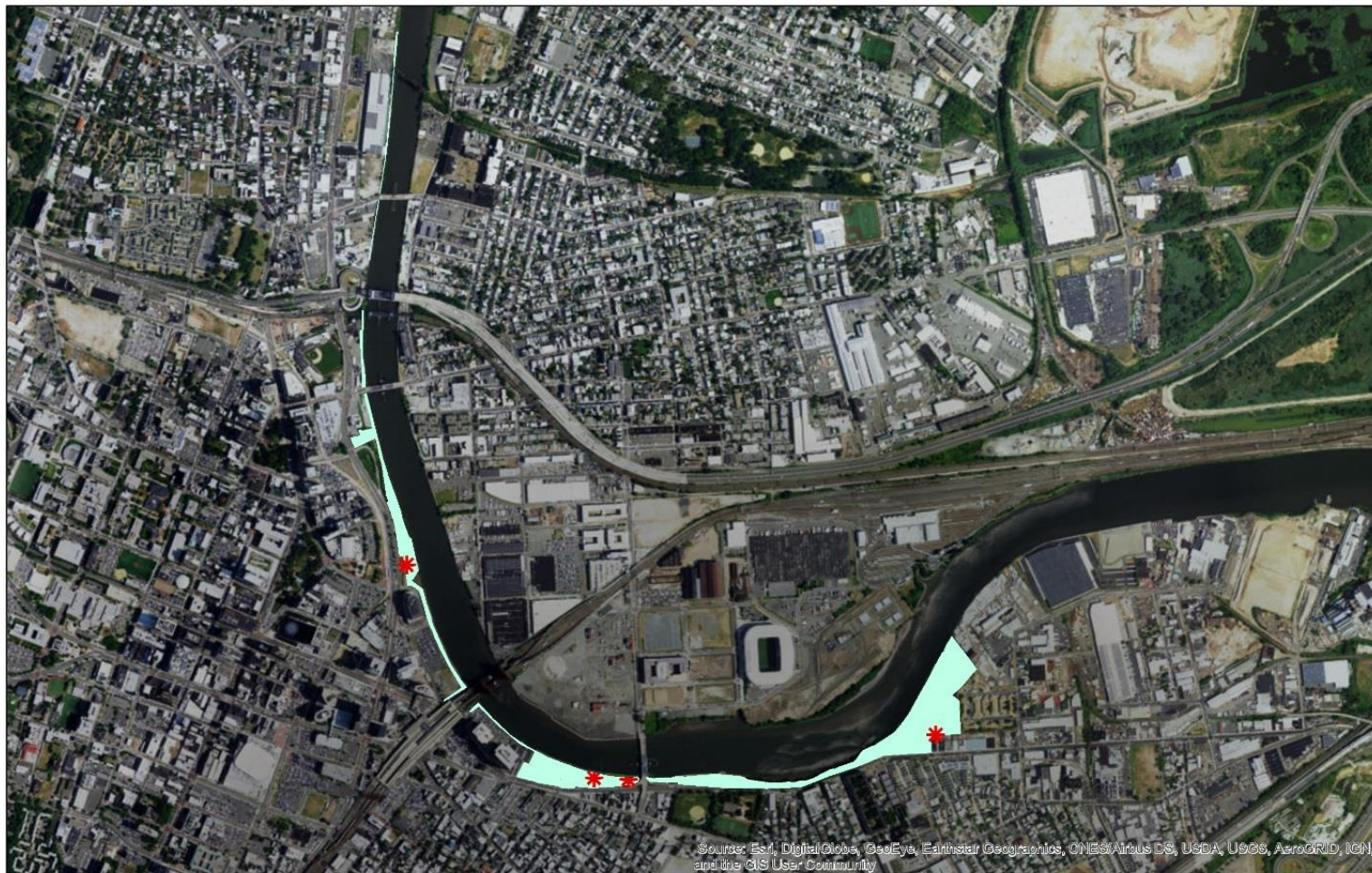
Map 7: Distance from Housing Authority Properties

Legend:
- Newark Housing Authority Properties
- Riverfront Park Area
- 1 Mile Radius

Project: Newark CVA
Map: NHA Properties and 1 Mile Walkability
Data Source: Newark, NJDEP
Map by EAC/Rutgers University Feb 2017

Map 8: Known Contaminated Sites

Known Contaminated Sites at Riverfront

Riverfront Parcels

0   0.35   0.7
Miles

Project: Newark CVA
Map: Riverfront/KCS
Data Source: Newark, NJDEP
Map by EAC/Rutgers University Feb 2017

Map 9: Riverfront Area and Repetitive Loss

Streets with RL Properties

Riverfront Area

1/5 Mile Buffer from Riverfront

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Data Sources: Newark, FEMA
Esri Topo Base Map

0   0.65   1.3 Miles

N

Riverfront Area and Repetitive Loss

Project: Neark Riverfront
Date: 3/1/17