

**SECOND FIVE-YEAR REVIEW REPORT FOR
ROCKAWAY BOROUGH WELLFIELD SUPERFUND SITE
ROCKAWAY BOROUGH, NEW JERSEY**



Prepared by

**U.S. Environmental Protection Agency
Region 2
New York, New York**

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LIST OF ABBREVIATIONS & ACRONYMS

ATK	Alliant Techsystems, Inc.
ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CVOC	Chlorinated Volatile Organic Compound
DNAPL	Dense Nonaqueous Phase Liquids
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FYR	Five-Year Review
ICs	Institutional Controls
ISCO	In-Situ Chemical Oxidation
K&K	Klockner & Klockner
MCL	Maximum Contaminant Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NJDEP	New Jersey Department of Environmental Protection
NPL	National Priorities List
O&M	Operation and Maintenance
PCE	Tetrachloroethylene
PRP	Potentially Responsible Party
RA	Remedial Action
RAO	Remedial Action Objectives
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SVE	Soil Vapor Extraction
TBC	To be considered
TCE	Trichloroethylene
VI	Vapor Intrusion
VOC	Volatile Organic Compound
WS/EM	Wall Street/East Main Street

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 CFR Section 300.430(f)(4)(ii)) and considering EPA policy.

This is the second FYR for the Rockaway Borough Wellfield Superfund Site. The triggering action for this policy review is the completion date of the previous FYR, on September 1, 2020.

The Site consists of four Operable Units (OUs). OU1 consisted of initial actions, including continued operation and maintenance by Rockaway Borough of liquid-phase granular activated carbon treatment of groundwater at municipal wells. OU2 addressed contaminated groundwater. OU3 addressed contaminated soils at the Klockner and Klockner (K&K) property that presented an unacceptable risk and a source of contamination to the groundwater. OU4 addressed contaminated soils at the Wall Street/East Main Street (WS/EM) properties that presented a source of contamination to the groundwater. All but OU1 are the subject of this FYR.

The Rockaway Borough Wellfield Superfund Site FYR was led by Brian Quinn, Remedial Project Manager (RPM). Participants included Urszula Filipowicz, risk assessor; Sabrina Gonzalez, hydrogeologist; Paul Zarella, hydrogeologist; Detbra Rosales, ecological risk assessor, and Patricia Seppi, community involvement coordinator.

Site Background

The Rockaway Borough Wellfield Site (Site) is located in Rockaway Borough in Morris County, New Jersey (Figure 1). Rockaway Borough is situated in the center of Morris County, approximately 10 miles north of Morristown and 20 miles northwest of Newark in the north-central portion of the state. The Site is located in a suburban residential setting and is surrounded by homes, businesses, and municipal property. The Borough of Rockaway's municipal wells supply potable water to about 11,000 people.

The Rockaway Borough Wellfield Superfund Site includes three municipal water supply wells (Nos. 1, 5, and 6), which are located off Union Street in the eastern section of the Borough. The groundwater at the municipal water supply wells was impacted primarily with tetrachloroethene (PCE) and trichloroethene (TCE). The three municipal water supply wells are located in an aquifer designated as the sole source aquifer for Rockaway Borough and the surrounding communities. The wells are approximately a quarter mile to the south-southeast of the Rockaway River, which runs through the Borough.

Based on early site investigations, the suspected sources of the TCE and PCE contamination included industrial and commercial operations within the Borough, including the K&K facility and the WS/EM

area (Figure 2). The K&K Source Area (Figure 3) is a portion of the larger Rockaway Borough Wellfield Superfund Site. Operations at the K&K Source Area included metal machining as well as the manufacturing of rocket components. The K&K Source Area is currently a primarily light industrial area in northwest Rockaway Borough. A metal fabrication facility and a landscaping company currently operate on the K&K source area property.

A number of past activities contributed to the contamination found at the WS/EM Source Area including, but not limited to, dry cleaning activities and automotive repairs. The WS/EM Source Area is primarily comprised of diverse businesses in a commercial area in the heart of downtown Rockaway Borough, Morris County, New Jersey.

In December 1982, the site was placed on EPA's National Priorities List of Superfund Sites.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Rockaway Borough Wellfield Superfund Site		
EPA ID: NJD980654115		
Region: 2	State: NJ	City/County: Rockaway Borough/Morris County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	Has the site achieved construction completion? No	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Brian Quinn		
Author affiliation: USEPA		
Review period: 8/1/2024 - 4/1/2025		
Date of site inspection: 11/19/2024		
Type of review: Policy		
Review number: 2		
Triggering action date: 9/1/2020		
Due date (five years after triggering action date): 9/1/2025		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

The presence of VOC contamination in the groundwater caused the Borough of Rockaway to construct a three-bed granular activated carbon adsorption treatment system to treat the municipal water supply. The system began operating in July 1981, treating approximately 900,000 gallons per day of contaminated groundwater pumped from the Borough's wells. Under a cooperative agreement with EPA, NJDEP initiated a Remedial Investigation/Feasibility Study (RI/FS) to determine the nature and extent of contamination. The RI/FS utilized a soil gas survey that identified three potential source areas within the Borough, although the horizontal and vertical extent of groundwater and soil contamination were not fully defined.

Based on these findings, EPA initiated a Phase II RI/FS to identify the potential sources of the groundwater contamination. This Phase II RI/FS was performed from September 1989 – October 1990 and included collection and analysis of numerous soil and groundwater samples that identified the sources of three contaminated groundwater plumes. Some of the major findings and conclusions of the Phase II RI/FS were as follows:

- PCE-contaminated groundwater emanating from the Wall Street/East Main Street (WS/EM) Source Area was impacting municipal wells No. 1 and 5;
- TCE-contaminated groundwater emanating from the K&K property was impacting municipal well No. 6; and
- Site related VOC-contaminated groundwater was present in the Roned Realty Industrial Area (an industrial park in Rockaway Borough).

A risk assessment was conducted as part of the groundwater RI/FS and addressed potential human health impacts associated with domestic use of untreated groundwater from the Rockaway Borough Wellfield. Results of the risk assessment indicated unacceptable cancer risk and noncancer hazard for future residents from consumption of PCE and TCE contaminated groundwater.

During the remedial investigations and feasibility studies for source areas (K&K and EM/WS), the nature and extent of the soil contamination was assessed through sampling of soils adjacent to and below the buildings in these areas. TCE, PCE and lead are the primary contaminants that exceeded health risk screening levels at the K&K Source Area. PCE is the primary contaminant that exceeded health risk screening levels at the WS/EM Source Area.

Response Actions

On September 29, 1986, at the conclusion of the NJDEP RI/FS, EPA issued a Record of Decision (ROD) for the first operable unit. The ROD called for the continued use of the existing carbon treatment system operated by Rockaway Borough, and directed the commencement of a supplemental RI/FS in order to identify the groundwater contaminant source(s), further delineate the full extent of the contamination, and evaluate additional remedial action alternatives to address those sources of groundwater contamination.

On September 30, 1991, EPA issued a ROD selecting a remedy for OU2 (contaminated groundwater),

which addressed the VOC plumes in groundwater that are migrating to the Borough Wellfield. The selected remedy called for:

- Extraction of contaminated groundwater and restoration of the groundwater to drinking water standards;
- Treatment of extracted groundwater to levels attaining drinking water standards;
- Reinjection of treated groundwater; and
- Appropriate environmental monitoring to ensure the effectiveness of the remedy.

The Remedial Action Objective (RAO) for the cleanup of the groundwater was to restore the groundwater to the NJDEP maximum contaminant levels (MCLs) of 1 µg/L for TCE and 1 µg/L for PCE.

The OU2 ROD also directed further investigation to identify and fully delineate the source areas of the groundwater contamination. In 1994, EPA entered into a Consent Decree with Alliant Techsystems (ATK), a Potentially Responsible Party (PRP) for the K&K groundwater plume, requiring ATK to undertake the Remedial Design (RD) for both contaminated groundwater plumes that comprise OU2 of the Rockaway Borough Wellfield site, and to perform the Remedial Action (RA) for the K&K contaminated groundwater plume.

In 2003, EPA began a RI/FS with respect to the WS/EM Source Area (OU4) which was completed in August 2006. A ROD was issued by EPA on September 29, 2006, that called for:

- Excavation of an estimated 40 cubic yards of soil contaminated with volatile organic compounds;
- Off-site treatment and/or disposal; and
- Soil Vapor Extraction (SVE), if necessary to augment the soil excavation.

The RAO for the contaminated soil at the WS/EM Source Area was to, “reduce the potential for further migration of PCE from the contaminated soil into groundwater.” The remediation goal for PCE in soil was identified from the New Jersey Impact to Groundwater Soil Criteria and is 1 milligram per kilogram (mg/kg).

On September 27, 2007, the OU3 ROD was issued by EPA. The selected OU3 remedy included:

- Soil Vapor Extraction (SVE) of soil contaminated with volatile organic compounds (VOCs) at the Building 12 property;
- Excavation and off-site treatment and/or disposal of an estimated 150 cubic yards (yd³) of VOC contaminated soil at the Building 13 property; and
- Excavation and off-site treatment and/or disposal of an estimated 27 yd³ of soil lead located near Building 12.

The RAOs for the contaminated soil at the K&K Source Area were to:

- Reduce the potential for further migration of TCE and PCE from the contaminated soil into groundwater.
- Remove Direct Contact exposure to lead-contaminated soil.

The Remediation Goal (RG) for TCE and PCE in soil was derived from the New Jersey Impact to Groundwater Soil Criteria and is 1 mg/kg for each of these contaminants. The RG for lead in soil was derived from the NJDEP Residential Direct Contact Criteria of 400 mg/kg at the time.

On March 23, 2015, an Explanation of Significant Differences (ESD) was issued by EPA for the OU2 ROD. The ESD described the decision to have two separate groundwater extraction and treatment systems instead of one; one for the K&K plume and one for the EM/WS plume, and also described the modification of the discharge of the treated groundwater to surface water rather than reinjection, as described in the OU2 ROD. Also, the ESD clarified and rectified accounting records to change the operable unit designation for the WS/EM source area from OU3 to OU4.

On September 29, 2021, a second ESD to the OU2 ROD was issued by EPA. The 2021 ESD stated that USEPA and NJDEP determined that a Classification Exception Area (CEA) be established for the Site. Further, it was found that there was a significant level of dense non-aqueous phase liquid (DNAPL) in the vadose zone, that it was a continuing source of contamination to the groundwater, and it was not being fully addressed by the current SVE system, as described in the OU4 ROD. EPA has determined that an expansion of the current SVE system and in-situ chemical oxidation (ISCO) injections near the current water table were required to address contamination in the vadose zone.

Status of Implementation

OU1

Since 1981, the Borough has been utilizing a granulated activated carbon treatment system for water treatment. This system was augmented with an air stripper a few years later and is effectively treating the water to drinking water standards prior to distribution.

OU2

Two RDs were completed to address the groundwater contamination (OU2). The K&K design was completed by ATK in July 2005 and the WS/EM design was completed in May 2005. ATK began operation of the groundwater treatment system (GWETS) in January 2006 and it continues to operate currently. EPA completed the RD for the WS/EM plume and began operation of the separate groundwater extraction and treatment system for the WS/EM contaminated groundwater plume in November 2010. EPA transferred responsibility for the treatment system to NJDEP in September 2022.

OU3

The initial extent of the VOC contamination in the vicinity of K&K Building 13 was approximately 775 square feet at a depth of 5 feet. Total soil excavated from this area was 27 cubic yards, which was disposed of off-site at an EPA approved disposal facility. Approximately 150 cubic yards of lead-impacted soil on the K&K Building 12 property were excavated and disposed of at an EPA approved disposal facility. The source area excavation and off-site disposal of VOC-contaminated soil at the K&K Building 13 property and excavation and off-site disposal of lead-contaminated soil located near K&K Building 12 occurred from February to June 2013.

The construction of the SVE system was completed in June 2013. To address the remainder of the

contaminated soils in the K&K Building 12 property, 12 soil vapor extraction wells were installed inside K&K Building 12. The SVE system operated from 2013-2015 and removed approximately 25 pounds of VOCs. Soil sampling after operation of the SVE system showed that the SVE system had met the goals of the ROD. However, due to elevated soil vapor levels in one of the soil vapor extraction wells nearest extraction well one (EW-1), a potential threat of vapor intrusion inside the building existed. As requested by EPA and NJDEP, supplemental soil samples were collected below the building slab in 2022. Upon review of the data, a shallow source of the soil vapors was discovered and new extraction trenches were installed in July 2023. Further, three pits found in Building 12 were sealed and sampled. The elevator shaft and various cracks in the concrete floor were sealed to help prevent any potential pathways for sub-slab vapors to enter the building as well. The SVE system was restarted in December 2023 to address the newly found soil contamination. Since then, sampling results from the SVE system indicate attenuation of TCE concentrations to levels close to meeting the New Jersey Impact to Groundwater Criteria in the OU3 ROD of 1 mg/kg. SVE system operations may be discontinued in the next year, provided remediation goals are met. Vapor intrusion sampling has also been performed, which is discussed under Data Review.

OU4

The WS/EM source area construction occurred from October 2009 to February 2010 and the system began operation in February 2010.

The September 2006 ROD identified PCE contaminated soils within the 2 Wall Street property area as a source of groundwater contamination at the Site and selected an OU4 RA that included the excavation and off-site disposal of contaminated shallow soil and installation of a SVE system to address deeper contamination. The OU4 RA was implemented between October 2009 and February 2010 and the SVE system is currently operating.

Approximately 506,080 pounds of PCE and 509,260 pounds of total VOCs have been removed from the subsurface to date through the operation of the SVE system at the WS/EM properties. The SVE system currently removes approximately one pound of PCE per month. Although approximately 50 cubic yards of soil were removed, and remaining soil contamination has been addressed by the OU4 RA in the subsurface down to approximately 30 feet below ground surface, elevated contaminant concentrations have been detected in the groundwater in monitoring well MW-1A. Based on the elevated contaminant concentrations, it was determined that a number of in-situ injections and the installation of an expanded SVE system would be required to fully remediate the WS/EM source area. The new injection wells and replacement SVE well were installed and the first of four ISCO injections began in August 2024. Subsequent injections will occur every 4-5 months for approximately two years until monitoring results indicate that further ISCO is not needed.

EPA is currently conducting an investigation of vapor intrusion into structures located above the contaminated groundwater plumes that could be potentially affected by the associated vapors, and will implement appropriate measures based on the investigation results. These measures may include a subslab ventilation system, if appropriate.

IC Summary Table

Table 1: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater	Yes	Yes	Sitewide	Restrict installation of groundwater wells and groundwater use.	Classification Exception Areas K&K (June 21, 2022) EM/WS(June 24, 2022)

Currently, goals for the cleanup of the groundwater and restoration of the aquifer as called for in the OU2 ROD have not been reached. Therefore, two CEAs were established by NJDEP for the K&K plume (June 21, 2022) and EM/WS plume (June 24, 2022) to ensure that no wells are installed within the area of the contaminated groundwater plume.

Systems Operations/Operation & Maintenance

OU2 East Main Street/Wall Street Portion

The remedy involves pumping groundwater from five extraction wells through 2- to 4-inch diameter double-containment high-density polyethylene force mains into the treatment building. The influent water treatment train consists of a bag filter and a low-profile air stripper. The vapor from the air stripper is treated by a vapor phase carbon system before being discharged to the atmosphere. The treated water is gravity-discharged through an 8-inch PVC storm sewer pipe to an existing storm sewer manhole located near the building. The existing storm sewer pipe at the connection point is reinforced concrete pipe and subsequently outfalls to the Rockaway River. Plant systems are monitored remotely by computer to ensure system is running efficiently. Extraction well rates are adjusted to optimize the removal of groundwater contamination.

Monitoring of the groundwater is accomplished by annual sampling of 36 monitoring wells. In September 2022, EPA transferred the responsibility for operation of the groundwater extraction system to the NJDEP.

OU2 Klockner & Klockner Groundwater Portion

Extracted water from groundwater extraction wells EW-1 and EW-4 is pumped via force main to a treatment building, which houses a low-profile air stripper along with ancillary mechanical and electrical components. Following treatment, the treated water discharges by gravity to a nearby existing storm sewer that outfalls to the Beaver Brook, which feeds into the Rockaway River. Monitoring of the groundwater is accomplished by annual sampling of approximately 30 monitoring wells.

Extraction well EW-4 was removed from the extraction well network in 2023 due to the fact that the casing had detached from the well screen. After two years of downgradient water quality monitoring, it was concluded that removing EW-4 from service did not negatively impact the groundwater remedy.

For groundwater sampling during this FYR period, a submersible pump was installed in EW-4 and pumped at 10 gallons per minute (gpm) for approximately 2 hours before a grab sample was collected.

OU3 Klockner & Klockner Source Area

Following the discovery of a shallow soil contamination source area in 2023, the PRPs installed new extraction trenches and reconfigured the SVE system. The SVE system was restarted in December 2023 to address the newly found soil contamination. Since then, sampling results from the SVE system indicate attenuation of TCE concentrations to levels close to meeting the New Jersey Impact to Groundwater Criteria in the OU3 ROD of 1 mg/kg. SVE system operations may be discontinued in the next year, provided remediation goals are met. Vapor intrusion sampling was also performed in K&K Building 12 in 2021, 2022, 2023, 2024 and 2025. The results are discussed under Data Review.

OU4 East Main Street/Wall Street Portion

The new injection wells and replacement SVE well have been installed and first of four ISCO injections took place in August 2024. Subsequent oxidant injections will occur every 4-5 months.

Remedy Resilience

Potential site impacts due to severe weather were assessed, and the performance of the remedy may be impacted in the future by increased flooding events (Appendix B). However, there have been no significant flooding events at the site, even following Hurricanes Sandy and Irene, and Tropical Storm Lee. Prior to each major storm, the project team takes precautionary actions to minimize the potential for damage by ensuring doors are fully closed, debris is removed around the building, sewer where treated effluent is discharged and related drains are clear.

Following each storm, the facility and site at large are inspected for damage. There have not been any significant impacts to the site from storms, other than temporary power outages. Future remedial decisions will take into account the potential for increased flooding.

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the **last** FYR as well as the recommendations from the **last** FYR and the current status of those recommendations.

Table 2: Protectiveness Determinations/Statements from the 2020 FYR

OU #	Protectiveness Determination	Protectiveness Statement
2	Short-term Protective	The OU2 remedy is protective of human health and the environment in the short term because all exposure pathways have been addressed. In order to be protective in the long term, an institutional control in the form of a Classification Exception Area to prevent use of groundwater is needed.
3	Protective	The OU3 remedy is protective of human health and the environment.
4	Protective	The OU4 remedy is protective of human health and the environment.
Sitewide	Short-term Protective	The remedies are protective of human health and the environment in the short term because all exposure pathways have been addressed. In order to be protective in the long term, an institutional control in the form of a Classification Exception Area to prevent use of groundwater is needed.

Table 3: Status of Recommendations from the 2020 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
2	No institutional control in place to prevent the use of groundwater.	Establish a Classification Exception Area (CEA)	Completed	NJDEP established two CEAs for the Klockner & Klockner plume and the East Main Street/Wall Street Plume.	6/24/2022

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On August 7, 2024, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at Superfund sites in New York, New Jersey, and Puerto Rico, including the Rockaway Borough Wellfield Superfund Site. The announcement can be found at the following web address: <https://www.epa.gov/superfund/R2-fiveyearreviews>.

In addition to this notification, the EPA Community Involvement Coordinator (CIC) for the site, Patricia Seppi, posted a public notice on the EPA site webpage www.epa.gov/superfund/rockaway-boro-wellfield and provided the notice to Rockaway Borough by email on January 25, 2025 with a request that the notice be posted in municipal offices and on the village/town webpages. This notice indicated that a Five-Year Review (FYR) would be conducted at the Rockaway Borough Wellfield Superfund Site to ensure that the cleanup at the site continues to be protective of human health and the environment. Once the FYR is completed, the results will be made available at the following repositories: 290 Broadway, 18th Floor, New York, New York 10007 and the Rockaway Borough Public Library, 82 Main Street, Rockaway, NJ 07866. In addition, the final report will be posted on the following website: www.epa.gov/superfund/rockaway-boro-wellfield. Efforts will be made to reach out to local public officials to inform them of the results.

Data Review

OU2 EM/WS

The OU2 EM/WS monitoring network includes 36 monitoring wells, five extraction wells, and the three municipal wells (Figure 1). The well network extends from the OU4 source area downgradient to the municipal pumping wells and the OU3 K&K area, and they are screened in all levels of the glacial aquifer. Groundwater is extracted from up to five extraction wells (EW-5A, EW-6, EW-8, EW-9, and EW-10). The GWETS is designed to treat a combined total VOC influent concentration of approximately 5,100 micrograms per liter (µg/L) under a combined flow of up to 210 gpm from the five extraction wells. Monitoring wells were sampled quarterly for VOCs until 2022 when annual sampling began. The most recent annual sampling events were completed in December 2022 and December 2023, where 36 monitoring wells, extraction wells, and piezometers across the Rockaway well field were sampled.

PCE is the main contaminant of concern in the OU2 EM/WS plume and TCE and other VOCs are also detected at low concentrations. Of the 36 wells sampled in 2022 and 2023, 18 were found to contain

PCE. Of these, 14 samples contained concentrations in exceedance of the remediation goal for PCE, 1 µg/L. The highest concentrations of PCE across both events were detected in the samples collected from MW-1A, in the OU4 Source Area. In 2022, PCE was detected at 13,600 µg/L in the MW-1A sample; in 2023 the concentration was 37,400 µg/L. PCE in MW-1A tends to fluctuate at very high concentrations due to changes in water levels and geochemical conditions with the maximum concentration during the review period of 134,000 µg/l in March 2020 at this location. TCE was not detected in samples collected from any sampling points in December 2022 and 2023.

At extraction well EW-5A near the source area, the maximum PCE concentration was 3,020 µg/l in 2022. TCE exceeded the remediation goal of 1.0 µg/l in four wells (EW-5A, EW-8, EW-9, and MW-1A) in the first three quarters of 2022 with a maximum concentration of 9.4 µg/l at MW-1A. TCE was not detected above the laboratory reporting limit in any wells in the December 2022 and December 2023 sampling events.

The highest PCE concentrations at MW-1A in the OU4 source area have not declined due to pumping at EW-5, however, contamination at this location is being addressed with ISCO injections. The areas around EW-8, EW-9, and EW-10 do show that the extraction wells removed significant PCE mass from the plume since 2011. Overall, PCE concentrations have generally shown stable or decreasing trends. The monitoring results from the municipal wells show variation related to periods when the extraction wells are out of service. Municipal well GW-5 met the remediation goal in 2021 through 2023. Results from municipal wells GW-1 and GW-6 continued to fluctuate/decrease from 2021 through 2023. These most recent results are typical and concentrations may continue to decline as routine operating conditions are maintained.

Regional groundwater flow is generally parallel to the river valley from southwest to northeast, but the EM/WS extraction wells and the municipal well field control groundwater flow in the area of the plume to ensure capture. The water levels in the OU2 EM/WS network can vary several feet due to cyclical pumping at municipal well GW-5. In 2011, groundwater elevations across the OU2 EM/WS area were unusually high due to precipitation and flooding associated with Hurricane Irene. The influx of recharge from the northern uplands area of the site caused a change in the shallow flow direction toward to the south. Groundwater elevations decreased from January 2012 to December 2012, then stabilized to gradually fluctuating levels during 2013 and 2014, and seemed to decrease slightly through 2018. Groundwater elevations are currently stabilized to gradually fluctuating through 2023.

Monitoring events include measurements of nested well pairs to evaluate vertical flow and measurements of surface water elevations to constrain flow around Foxes Pond and the Rockaway River. Wells MW-1D/1R at the source area have shown upward gradients since 2014 after extraction rates were optimized and the extraction rate at EW-5A increased.

EPA's contractor, CTI, conducted supplemental sampling for emerging contaminants at the OU2 EM/WS groundwater treatment plant in March 2020. Samples of the GWETS influent and effluent streams were analyzed for per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane. 1,4-Dioxane was not detected in the samples. PFOS levels in the influent and effluent samples were 7.69 nanograms per liter (ng/L) and 6.89 ng/L respectively, and PFOA levels were 11.7 ng/L and 12.2 ng/L, respectively. The method detection limit was reported as 0.17 ng/L. At the time of sampling, the results did not exceed the NJDEP MCLs for PFOS (13 ng/L) and PFOA (14 ng/L). These samples, notably the effluent, exceed the 2024 EPA MCLs for PFOS and PFOA (4 ng/L). EPA will continue to work with the state to determine future emerging contaminant sampling needs.

OU2 K&K

At the OU2 K&K plume, eleven monitoring wells and two extraction wells are sampled annually according to the 2006 Final Operation and Maintenance Plan. TCE is the contaminant of concern for the K&K plume, and it is the only compound consistently detected above the 1.0 µg/L remediation goal. In 2023, TCE was above the NJDEP standard at 3 of the 13 sampled wells (Figure 2).

TCE concentrations at the K&K wells have generally been stable or decreasing since 2006 when pumping started at the extraction system. In 2023, the maximum detected concentration of TCE was 161 µg/l at MW-2D. TCE detections in other wells are substantially lower. The SVE system operation in 2013-2014 seems to have contributed to a decline in TCE concentrations starting in 2015. Before the K&K system started pumping, groundwater flowed southwest toward the municipal pumping wells. Groundwater flow is now directed to the extraction wells EW-1 and EW-4.

The PRP's contractor, WSP, conducted supplemental sampling for emerging contaminants at the OU2 K&K groundwater treatment plant in July 2020. Samples of the GWETS influent and effluent streams were analyzed for PFAS and 1,4-dioxane. 1,4-dioxane was not detected in the samples. PFOS levels in the influent and effluent samples were 7.9 ng/L and 9.8 ng/L respectively, and PFOA levels were 17 ng/L and 21.2 ng/L, respectively. At the time of sampling, the results did not exceed the NJDEP MCLs for PFOS (13 ng/L) but did exceed for PFOA (14 ng/L). These samples, notably the effluent, exceed the 2024 EPA MCLs for PFOS and PFOA (4 ng/L). In February 2024, EW-1 was sampled for PFAS. Detections include PFOA at 3.3 ng/L, PFNA at 12.1 ng/L (above the EPA MCL of 10 ng/L) and PFOS at 7.4 ng/L (above the EPA MCL of 4 ng/L). EPA will continue to work with the state to determine future emerging contaminant sampling needs.

OU3 K&K

Analytical data collected from beneath the building slab (commonly referred to as “sub-slab” samples) and indoor air in K&K Building 12 were most recently taken during the 2021, 2022, 2023, 2024 and 2025 sampling rounds. While the 2021 to 2024 sub-slab samples were collected over a 30-min period, in 2025 a subset of sub-slab sample locations were re-sampled over a 24-hour period to be consistent with indoor air sampling locations taken to date. For the 30-minute sub-slab grab samples (collected during the 2021-2024 timeframes), elevated concentrations of PCE ranging from 19 ug/m³ to 24,100 ug/m³ were noted, while TCE concentrations ranged from 64.5 ug/m³ to 15,500 ug/m³. In comparison, the 2025 24-hour sub-slab results collected for a subset of locations with previously elevated concentrations showed much lower PCE and TCE results. PCE ranged from 8.1 ug/m³ to 44 ug/m³ and TCE ranged from non-detect to 5.9 ug/m³. These concentrations did not exceed EPA's risk based commercial VI screening levels for sub-slab and are considered more representative of sub-slab conditions as the longer time-weighted samples better account for temporal variability in vapor concentrations. However, detectable concentrations of both PCE and TCE were found in indoor air samples collected annually over a 24-hour period in K&K Building 12 from 2021 to 2025. Although indoor air detections of PCE and TCE were above EPA's conservative VI screening values for indoor air, they did not exceed screening values that indicate mitigation measures such as the installation of a sub-slab depressurization system would be necessary. To ensure these levels do not increase, indoor air monitoring will continue.

Site Inspection

The inspection of the Site was conducted on 11/19/2024. In attendance were Brian Quinn, EPA RPM; Sabrina Gonzalez, EPA Hydrogeologist; Urszula Filipowicz, EPA Risk Assessor and Detbra Rosales, EPA Eco-Risk Assessor. The purpose of the inspection was to assess the protectiveness of the remedy. All facilities appeared in good condition and have been maintained in accordance with the Operation & Maintenance plans. The wells are secure, accessible and well maintained. The fence around the treatment systems is secure.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

The remedies selected in the 1986, 1991, 2006 and 2007 RODs are operating effectively. Treatment on the impacted public supply wells continues to ensure that the public is receiving water that meets drinking water standards.

OU2

During the design of the remedy called for in the 1991 ROD, the PRP conducted a hydrogeological study. The results of the study led to a determination that the two plumes emanated from separate sources. It was determined that the WS/EM and K&K plumes should be addressed separately, with two separate GWETS. The K&K GWETS has been operational by the PRPs since December 2005 and contaminant concentrations in this plume have decreased significantly since operation of the extraction and treatment began. The WS/EM GWETS has been operational since November 2011 and contaminant concentrations have continued to decrease except in the WS/EM source area (MW-1A). EPA operated the system until September 2022 when operation of the treatment system was transferred to NJDEP.

OU3

The K&K source area remedy included the operation of an SVE system, excavation and off-site disposal of 150 cubic yards of VOC-contaminated soil at the Building 13 property and excavation and off-site disposal of 27 cubic yards of soil contaminated with lead located near Building 12. Sampling associated with the vapor intrusion pathway performed in 2016 and 2017 identified elevated levels of TCE in one SVE well above the water table. Although CVOC concentrations in indoor air samples were at or below state and EPA screening criteria, a comprehensive review of the SVE well data and groundwater monitoring well data was conducted. The source of the soil vapors could not be definitively linked to soil or groundwater contaminants. However, upon review of the SVE wells sampling data, new soil borings (that EPA and NJDEP requested) and groundwater monitoring well data, a shallow soil source of the soil vapors was identified and new extraction trenches were installed. The SVE system was restarted in December 2023 to address the newly found soil contamination. Since then, sampling results from the SVE system indicate attenuation of TCE concentrations to levels close to meeting the New Jersey Impact to Groundwater Criteria in the OU3 ROD of 1 mg/kg. SVE system operations may be discontinued in the next year, provided remediation goals are met.

OU4

The WS/EM source area remedy included the excavation of 40 cubic yards of contaminated soils and the operation of a SVE system to address the WS/EM source area contamination. EPA is continuing to

operate the SVE system and has completed the installation of new SVE well and injection wells that will optimize the SVE system with injections to treat the contamination in the vadose zone and groundwater.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Sitewide

There have been no physical changes to the Site that would adversely affect the protectiveness of the remedy. The exposure assumptions and the toxicity values that were used to estimate the potential risks and hazards to human health followed the general risk assessment practice at the time the risk assessment was performed. Although the risk assessment process has been updated and specific parameters and toxicity values may have changed, the risk assessment process that was used is consistent with current practice and the need to implement a remedial action remains valid.

OU2

A risk assessment was conducted as part of the OU2 ROD and addressed potential human health impacts associated with domestic use of untreated groundwater from the Rockaway Borough Wellfield. Results of the risk assessment indicated unacceptable cancer risk and noncancer hazard for future residents from consumption of PCE and TCE contaminated groundwater. The RAO identified in the 1991 OU2 ROD was to restore the groundwater to meet the more stringent of federal and state MCLs which have been developed to protect human health. This objective and the remediation goals are valid and protective of human health. Since everyone in the vicinity of the site is connected to the public water supply, which is treated before distribution, direct exposures related to potable use of groundwater continue to be an incomplete exposure pathway. Further, two CEAs were established for the K&K plume and EM/WS plume, ensuring that future use of groundwater remains an incomplete exposure pathway. In addition, the selected remedial actions in the OU2 ROD and modified by the 2015 ESD (pumping and treatment) has further reduced groundwater contamination emanating from the K&K and EM/WS source areas.

OU3

The 2007 OU3 ROD addressed the remediation of the identified contaminant source in the soil at the K&K source area that is adversely impacting the underlying groundwater. The risk assessment for OU3 concluded that cancer risks and noncancer hazards for the receptors most likely to encounter contaminated site soils (i.e., commercial industrial workers) were within or below EPA's threshold values. However, the decision document noted that the concentrations of TCE and PCE at K&K Building 12 and 13 were above concentrations associated with an adverse impact (i.e., a continuing source) to groundwater. Further, the noncancer HI for the hypothetical future child resident from ingestion of TCE-contaminated soil of 2 slightly exceeded EPA's threshold value of 1. Although exposure to this receptor is highly unlikely, given current and anticipated future land use, the noncancer hazard calculation further supported the need for a remedial action at the site.

The risk assessment also noted that lead was found in soil adjacent to Building 12. The maximum on-Site concentration of lead found (841 mg/kg) exceeded the NJDEP residential and industrial soil remediation standards at the time of 400 and 800 mg/kg, respectively. However, the average concentration of 174 mg/kg across the Site did not. Nonetheless, EPA decided to take an action due to the limited volume of lead contaminated soil present (approximately 27 cubic yards), and to avoid the need

for institutional controls at the site. The excavation of lead contaminated soils along with the use of the SVE system to treat VOCs in soils effectively ensures that direct contact exposures by nearby receptors are an incomplete exposure pathway.

The RAOs for the contaminated soil at the K&K source area were to reduce the potential for further migration of TCE and PCE from the contaminated soil into groundwater and to remove direct contact exposure to lead-contaminated soil. The cleanup goal for TCE and PCE in soil is 1 mg/kg for each contaminant and was based on New Jersey impact to groundwater soil criteria. These cleanup criteria are below NJ's current residential direct contact soil remediation standards for TCE and PCE and therefore, remain protective of human health. Even though the site is zoned a commercial/industrial property, the cleanup goal selected for lead in site soil was conservatively based on NJ's health based residential soil remediation standard of 400 mg/kg. The current NJDEP commercial/industrial soil remediation standard for lead is 800 mg/kg and 200 mg/kg for residential soils. The average lead concentration across the site post excavation was noted as being 147 mg/kg which is below the state lead standards, as well as EPA's current residential and nonresidential screening levels for lead. Hence, the lead cleanup goal is protective of human health.

OU4

The final operable unit for the site, OU4, addresses the remediation of the identified contaminant source in soil at the WS/EM source area that is adversely impacting groundwater. The risk assessment conducted as part of the RI for OU4 concluded that although risks and hazards associated with soil exposure via direct contact (ingestion, dermal contact and inhalation) were within or below EPA's threshold criteria, concentrations of PCE in soil were above those associated with an adverse impact to groundwater and hence a remedial action was warranted. To ensure the source area does not serve as an ongoing source to the groundwater contamination, the 2006 OU4 ROD called for the excavation and offsite disposal of approximately 40 cubic yards of PCE contaminated soil and if necessary, operation of a SVE system to augment the soil excavation.

The RAO for the contaminated soil at the WS/EM source area is to reduce the potential for further migration of PCE from contaminated soil into groundwater. This RAO remains valid and the remediation goal for PCE in soil of 1 mg/kg remains protective of human health.

Vapor intrusion (Sitewide)

Because soils and groundwater at the site are contaminated with VOCs, EPA initiated a subsurface vapor intrusion (VI) investigation in overlying buildings in 2006. To date, approximately 70 structures consisting of mostly residential structures, a school and several commercial/industrial buildings near the source areas have been sampled to ensure that vapors emanating from the site are not adversely affecting indoor air quality. EPA continues to periodically sample several residences overlying the site plumes to ensure that this pathway is not of concern. Based on analytical data collected to date, mitigation measures such as the installation of sub-slab depressurization systems were not needed in any homes sampled.

However, as previously described in the OU3 data review section of this document, a SVE system was installed to complete the OU3 remedial action at the K&K Building 12 property. The SVE system was recently upgraded in 2023 to target residual soil contamination found below the building slab. Analytical data results collected from below the slab and indoor air at Building 12 are discussed in more detail in

the Data Review section and show that detectable levels of both PCE and TCE are collecting below the slab of the building. However, the most recent round of sub-slab data collected over a 24-hour period in 2025 show PCE and TCE below EPA's VI screening levels for commercial use. Nonetheless, detectable concentrations of both PCE and TCE were found in indoor air samples collected annually from K&K Building 12 from 2021 to 2025. Although indoor air detections of PCE and TCE were above EPA's conservative VI screening values, they did not exceed screening values that indicate mitigation measures such as the installation of a sub-slab depressurization system would be necessary. Based on a detailed review and assessment of substances used indoors at Building 12 during daily operations conducted by the PRP, it is suspected that TCE is being used indoors as part of the regular operations and likely impacting the indoor air results. Continual monitoring of Building 12 to ensure indoor air levels do not increase above actionable benchmarks will be performed.

In summary, EPA's VI investigation at the site is ongoing since VOCs remain in groundwater above health-based VI screening values. The current tenant of Building 12 has made efforts to seal any potential pathways for the subsurface vapors as discussed above in the Data Review section. EPA will continue to assess the subsurface VI pathway into indoor air in future five-year reviews.

Ecological

The Screening Level Ecological Risk Assessment conducted in 2004 found a lack of usable terrestrial habitat and concentrations of contaminants in the soil were comparable to background or below screening level values. Therefore, the SLERA concluded low risk to ecological receptors from soil contaminants. Additionally, soil excavation and SVE has reduced any potential risk from surface soil contaminants to terrestrial receptors.

QUESTION C: Has any **other** information come to light that could call into question the protectiveness of the remedy?

No other information has come to light that could call into question the protectiveness of the remedies.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
All OU(s).

OTHER FINDINGS

Although no formal issues and recommendations are included in this review, the following are suggestions that were identified during the FYR and may improve performance of the remedy, reduce costs, improve management of O&M, accelerate site close out, conserve energy, promote sustainability, etc., but do not affect current and/or future protectiveness:

- Most recent sampling results show that extraction well pumping rates may need to be adjusted to address elevated PCE results at PZ-7 (8 µg/l) and PZ-10 (17.6 µg/l).

- The isoconcentration maps in the annual report need to include data from all wells to show extraction system efficiency.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)	
<i>Operable Unit:</i> 2	<i>Protectiveness Determination:</i> Protective
<i>Protectiveness Statement:</i> The OU2 remedy is protective of human health and the environment.	

<i>Operable Unit:</i> 3	<i>Protectiveness Determination:</i> Protective
<i>Protectiveness Statement:</i> The OU3 remedy is protective of human health and the environment.	

<i>Operable Unit:</i> 4	<i>Protectiveness Determination:</i> Protective
<i>Protectiveness Statement:</i> The OU4 remedy is protective of human health and the environment.	

Sitewide Protectiveness Statement	
<i>Protectiveness Determination:</i> Protective	
<i>Protectiveness Statement:</i> The remedies at the Rockaway Borough Wellfield Superfund Site are protective of human health and the environment.	

VIII. NEXT REVIEW

The next FYR report for the Rockaway Borough Wellfield Superfund Site is required five years from the completion date of this review.

REFERENCE LIST

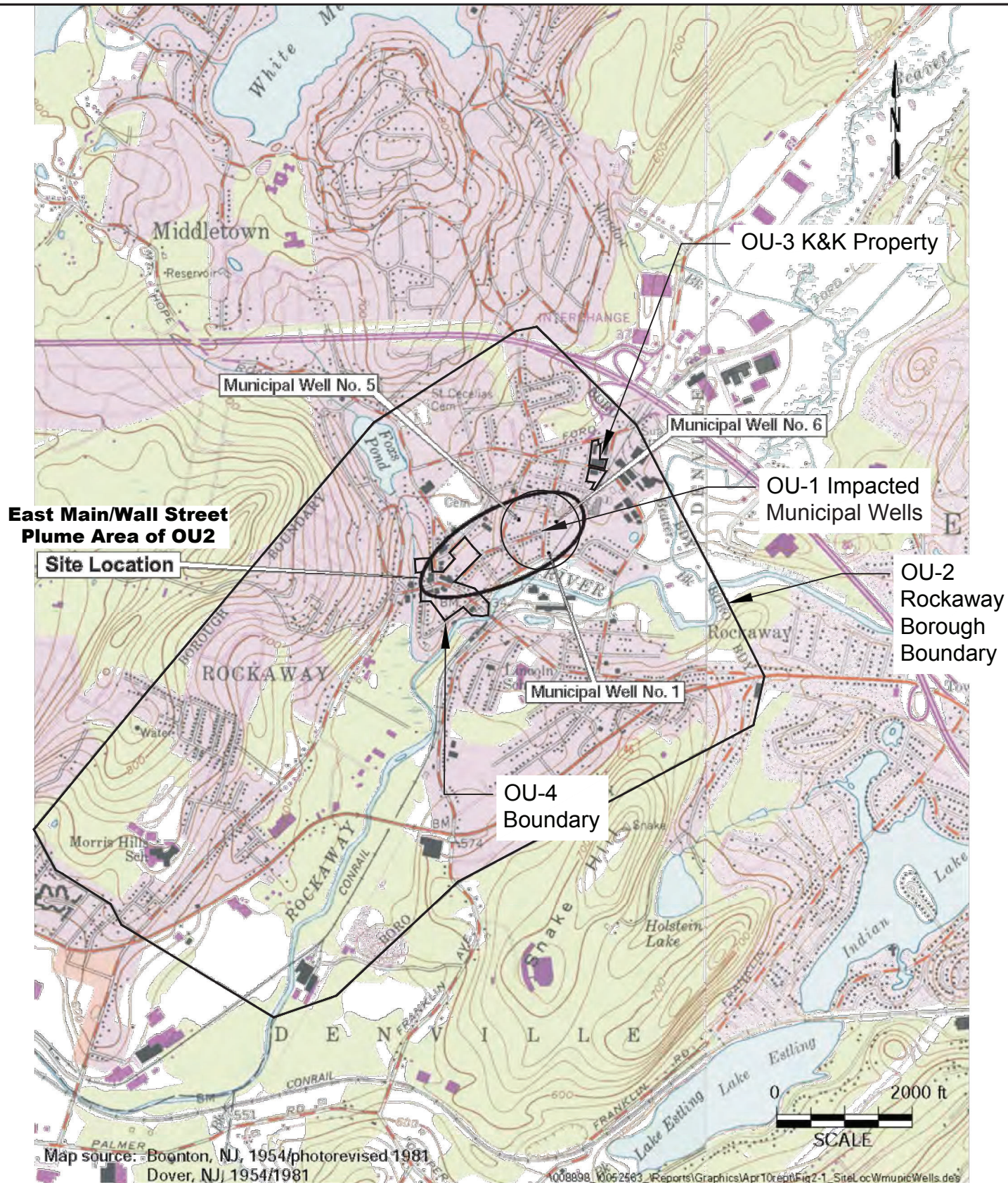
Record of Decision Sitewide	September 1986
Record of Decision OU2	September 1991
Record of Decision OU4	September 2006
Record of Decision OU3	September 2007
Explanation of Significant Difference	March 2015
Explanation of Significant Difference	September 2021
Annual Reports (Klockner & Klockner)	2019-2023
Annual Reports (East Main/Wall Street)	2019-2023
Vapor Intrusion Sampling Data	2022

APPENDIX A – Figures

Figure 1: Site Location Map

Figure 2: Wall Street/East Main Street Plume Map

Figure 3: Klockner & Klockner Plume Map

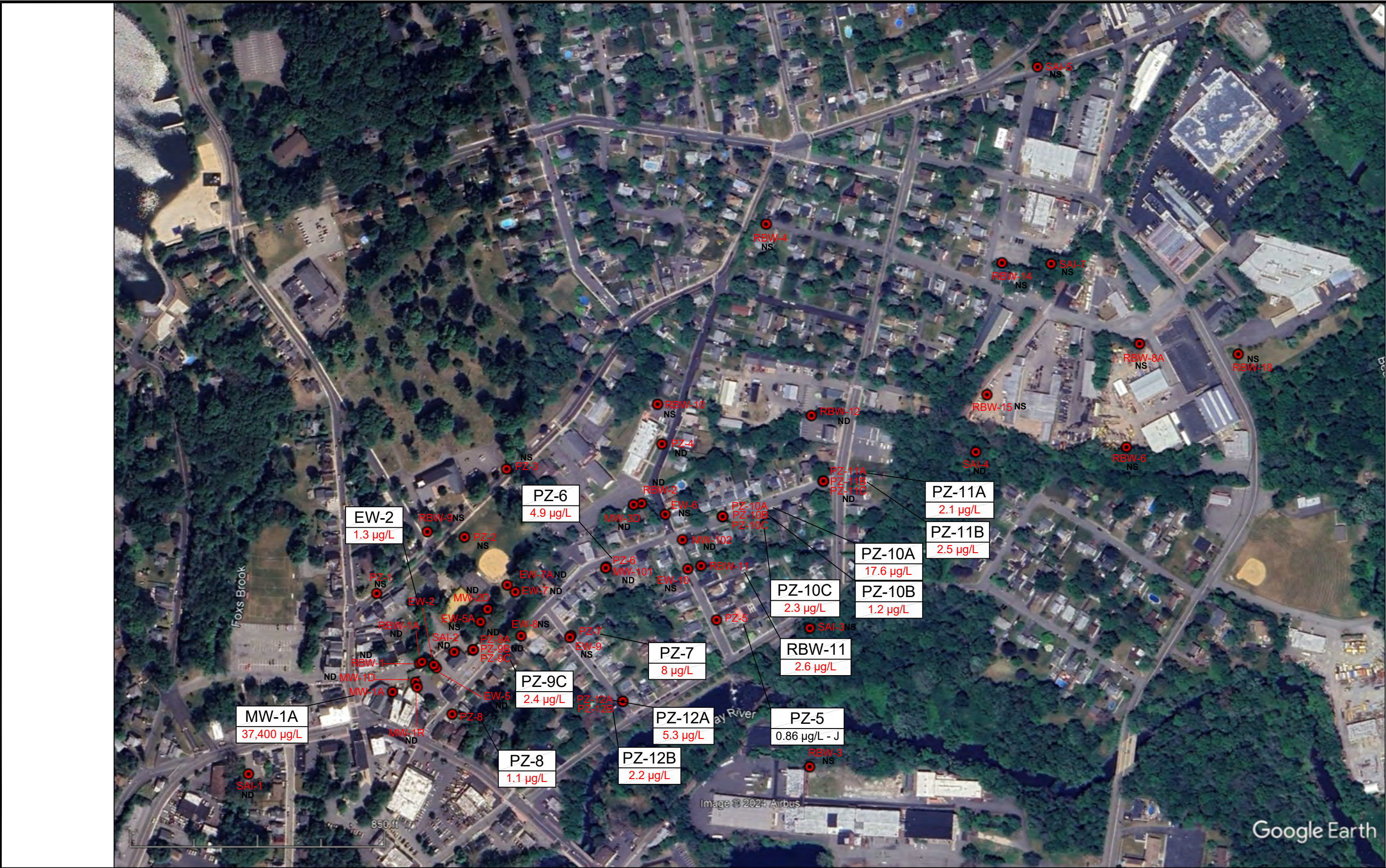


**US Army Corps
of Engineers®**

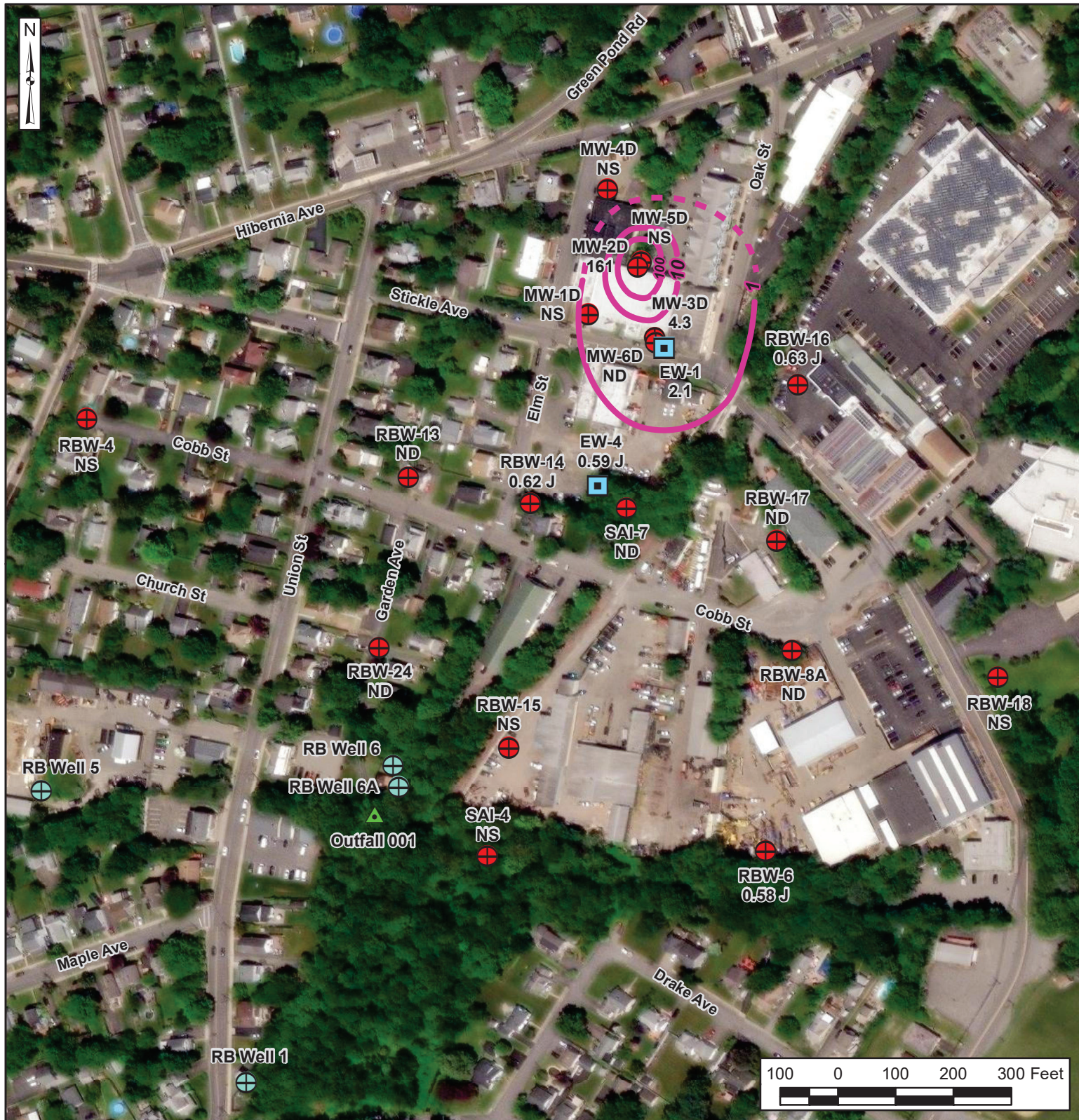
**Rockaway Borough Well Field
Superfund Site
OU2 East Main/Wall Street
Plume
Rockaway Borough,
New Jersey**



Figure 1
Site Location



NS- Not Sampled
ND- Compound not detected above MDL
PCE NJGWQS: 1 µg/L



BaseSource: Esri, Maxar, Earthstar Geographics, and the GIS User Community



New Jersey
Location

APPENDIX B – Remedy Resilience Analysis

Two tools were used to evaluate the Rockaway Borough Wellfield Superfund Site. Screenshots from each of the tools assessed are included here.

The first tool used to assess Morris County was CMRA. According to this tool, there is a relatively moderate risk of extreme heat (Figure B-1), but a relatively low risk of drought (Figure B-2). According to this tool, average daily temperatures are projected to increase by approximately 8 degrees by 2090 (Figure 1). In addition, there is a very low risk of wildfire (Figure B-3) and no risk of coastal inundation (Figure B-5) likely due to the distance from coastline. The tool did indicate a relatively high flood risk in the vicinity of the site (Figure B-4). This flood risk is likely attributed to the presence of the Rockaway River down the street. Flooding impacts to the area have been observed following significant storm events at the site such as Hurricanes Sandy and Irene, but not Tropical Storm Lee. However, the treatment plant doors are elevated and are flood resistant.

The second tool used was the United States Geological Society National Landslide Inventory and Susceptibility Map. The map shows the majority of the site has low landslide potential, but a small area on the west of the site area has an increasing landslide potential. However, there has not been any landslide disturbances in or around the site area after any seismic events that have occurred in recent years. The treatment systems are also located in areas deemed low potential for landslides and should be protected during any future seismic events.

Based on the information above, potential site impacts due to severe weather were assessed and the performance of the remedy may be impacted in the future by increased flooding events. Prior to each major storm, the project team takes precautionary actions to minimize the potential for damage and following each storm the facility and site at large are inspected for damage. There have not been any significant impacts to the site from storms, other than temporary power outages. Future remedial decisions will take into account the potential for increased flooding.

Figure B-1

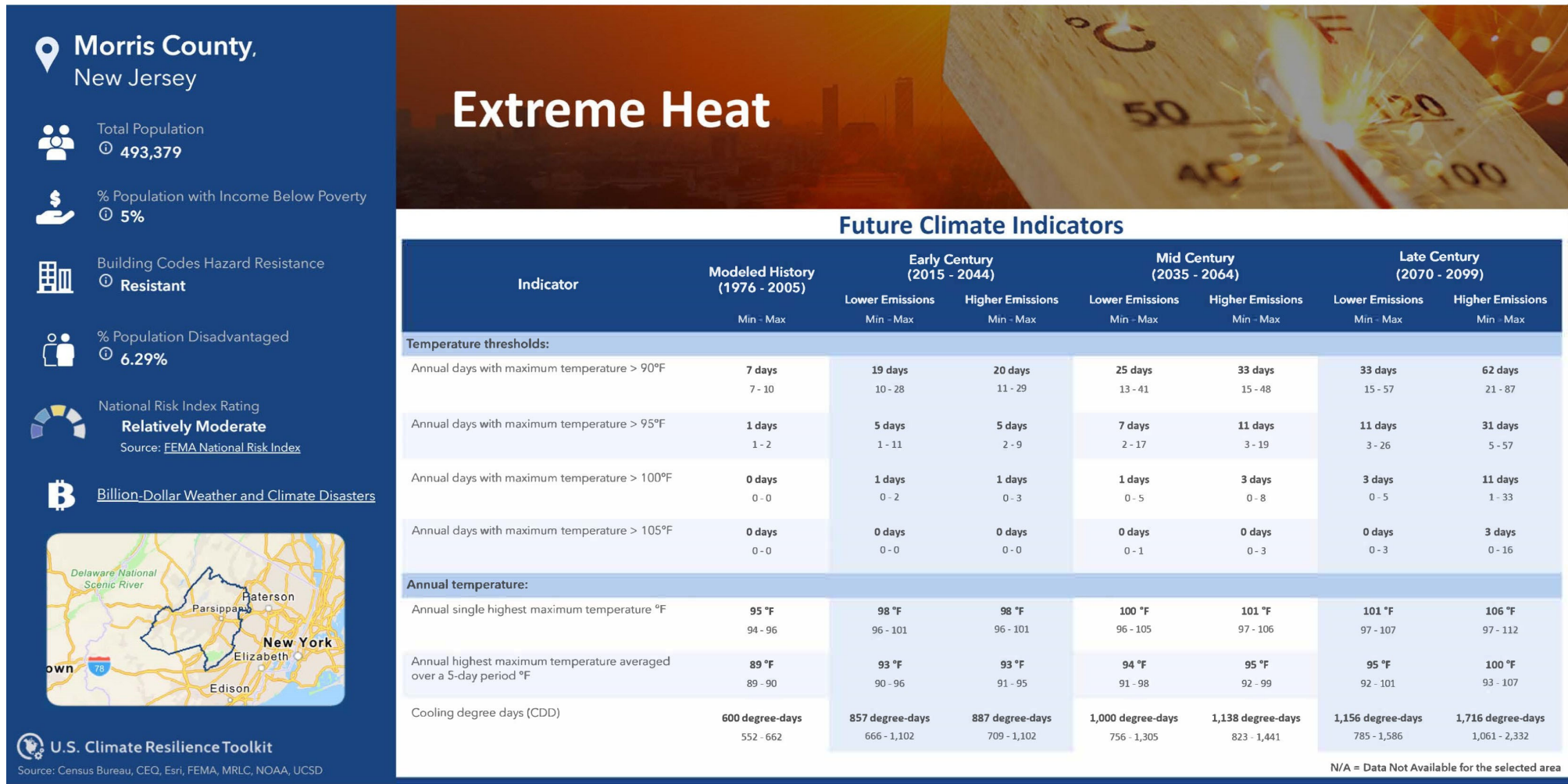
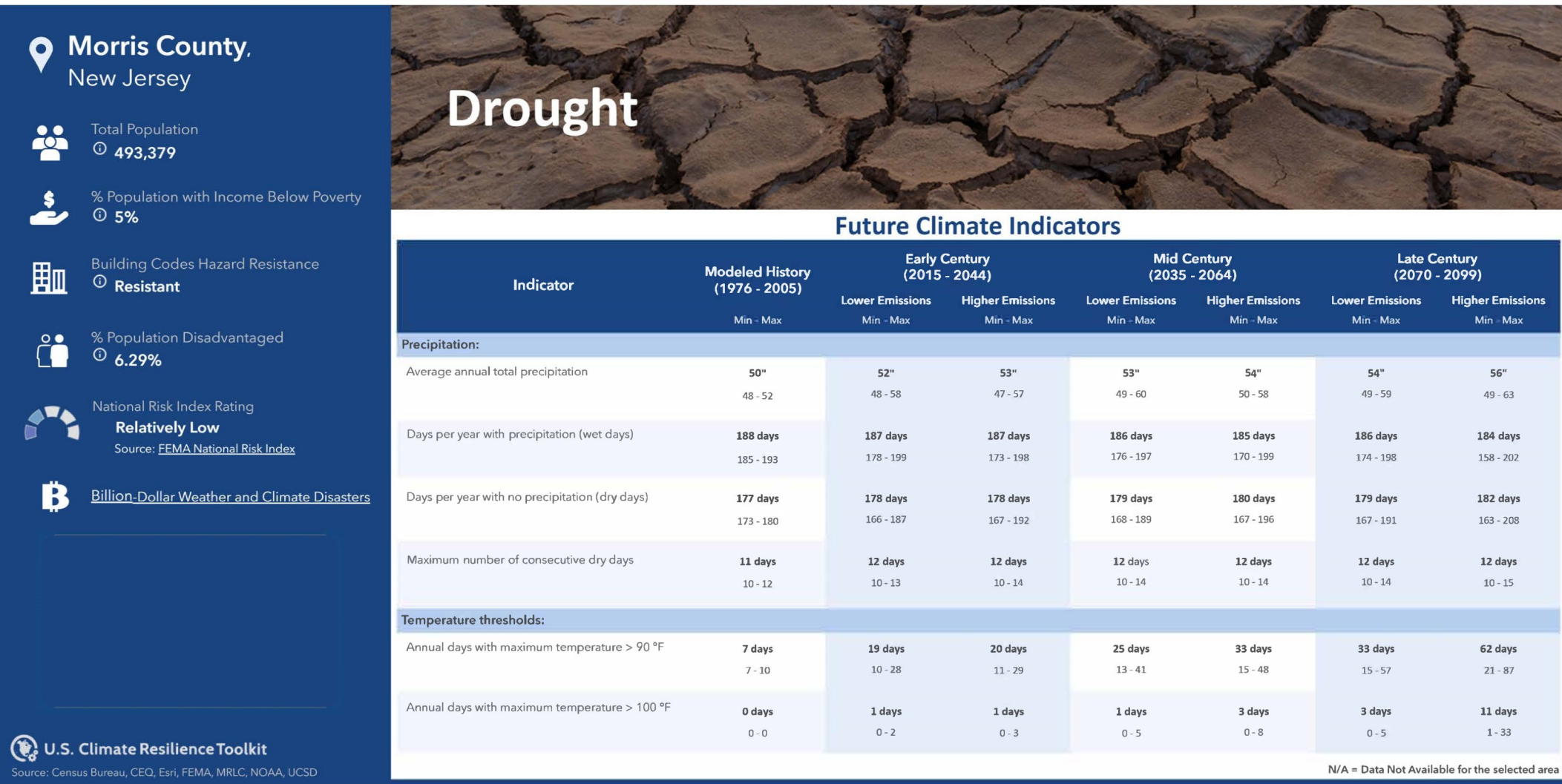


Figure B-2




Drought

Future Climate Indicators

Indicator	Modeled History (1976 - 2005) Min - Max	Early Century (2015 - 2044)		Mid Century (2035 - 2064)		Late Century (2070 - 2099)	
		Lower Emissions Min - Max	Higher Emissions Min - Max	Lower Emissions Min - Max	Higher Emissions Min - Max	Lower Emissions Min - Max	Higher Emissions Min - Max
Precipitation:							
Average annual total precipitation	50" 48 - 52	52" 48 - 58	53" 47 - 57	53" 49 - 60	54" 50 - 58	54" 49 - 59	56" 49 - 63
Days per year with precipitation (wet days)	188 days 185 - 193	187 days 178 - 199	187 days 173 - 198	186 days 176 - 197	185 days 170 - 199	186 days 174 - 198	184 days 158 - 202
Days per year with no precipitation (dry days)	177 days 173 - 180	178 days 166 - 187	178 days 167 - 192	179 days 168 - 189	180 days 167 - 196	179 days 167 - 191	182 days 163 - 208
Maximum number of consecutive dry days	11 days 10 - 12	12 days 10 - 13	12 days 10 - 14	12 days 10 - 14	12 days 10 - 14	12 days 10 - 14	12 days 10 - 15
Temperature thresholds:							
Annual days with maximum temperature > 90 °F	7 days 7 - 10	19 days 10 - 28	20 days 11 - 29	25 days 13 - 41	33 days 15 - 48	33 days 15 - 57	62 days 21 - 87
Annual days with maximum temperature > 100 °F	0 days 0 - 0	1 days 0 - 2	1 days 0 - 3	1 days 0 - 5	3 days 0 - 8	3 days 0 - 5	11 days 1 - 33

N/A = Data Not Available for the selected area

Figure B-3



Figure B-4

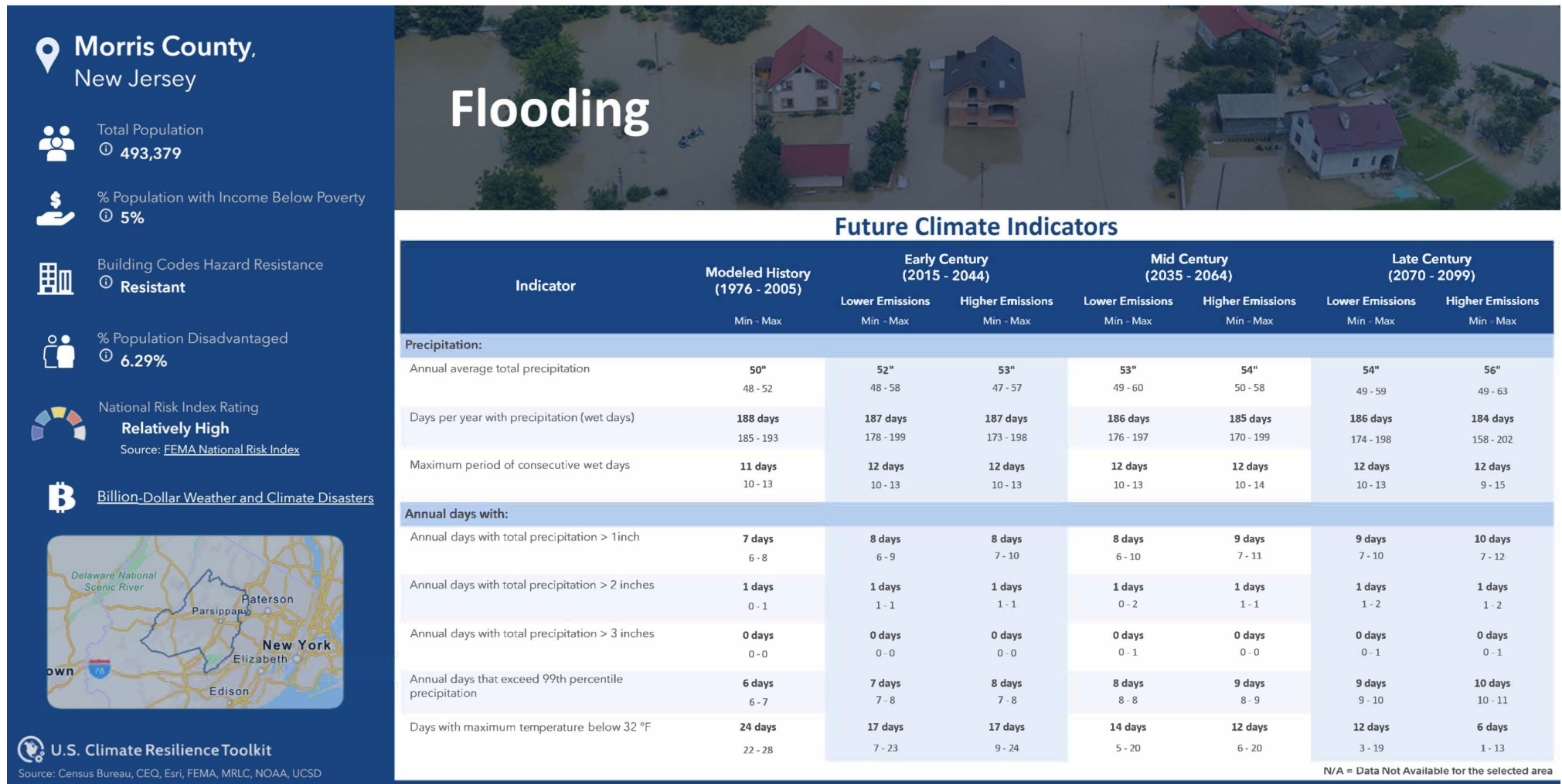


Figure B-5

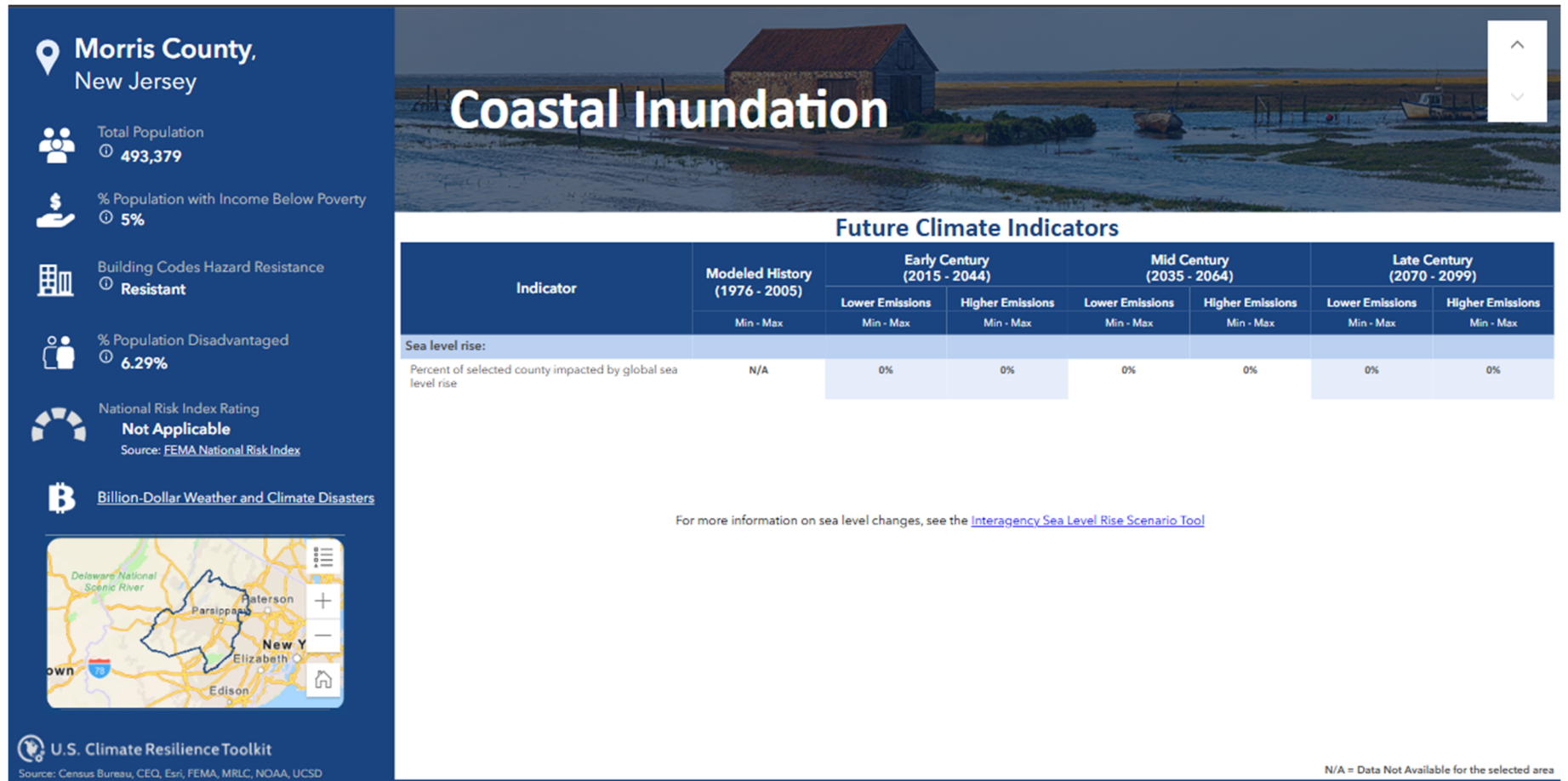


Figure B-6

