SIXTH FIVE-YEAR REVIEW REPORT FOR HELEN KRAMER LANDFILL SUPERFUND SITE GLOUCESTER COUNTY, NEW JERSEY

Prepared by

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

Pat Evangelista Digitally signed by Pat Evangelista Date: 2025.08.27 16:55:00 -04'00'

August 27, 2025

Pat Evangelista, Director
Superfund and Emergency Management Division

Date

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LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	Contaminants of Concern
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
GCUA	Gloucester County Utilities Authority
gpm	Gallons per Minute
ICs	Institutional Controls
LCS	Leachate Collection System
MCL	Maximum Contaminant Level
µg/l	microgram per liter
MW	Monitoring Well
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ng/L	Nanogram per Liter
NJDEP	New Jersey Department of Environmental Protection
NPL	National Priorities List
O&M	Operation and Maintenance
PCOR	Preliminary Close-Out Report
PFAS	Per- and Polyfluoroalkyl Substances
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
POTW	Publicly Owned Treatment Works
PRP	Potentially Responsible Party
PTF	Pre-Treatment Facility
RAO	Remedial Action Objectives
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
TBC	To be considered
VOC	Volatile Organic Compound

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 sixth FYR for the Helen Kramer Superfund Site (Site). The triggering action for this statutory review is the previous FYR report, completed on September 30, 2020. The FYR has been prepared due to the fact that hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of 2 operable units (OUs) and OU1 will be addressed in this FYR. OU1 consists of the collection and treatment of shallow groundwater and leachate from the collection trench surrounding the landfill. Since the last five year review, another operable unit (OU2) was identified on September 30, 2022. OU2 addresses groundwater in the deep aquifer and is not addressed in this FYR as Site investigations are on-going.

The Site FYR was led by Brent Gaylord, the EPA Remedial Project Manager (RPM). Participants included Michael Scorca (Hydrogeologist), Sabrina Gonzalez (Hydrogeologist), Maya Greally (Community Involvement Coordinator), Joel Waddell (Community Involvement Coordinator), Julie McPherson (Ecological and Human Health Risk Assessor), Tara Bhat (Human Health Risk Assessor) and Emma Mendelsohn (Ecological Risk Assessor) of EPA. EPA notified the Settling Parties (PRPs) of the initiation of the FYR on 11/25/2024. This is a PRP-lead Site. The review began on 11/15/2024.

Site Background

The Site, located in Mantua Township, Gloucester County, New Jersey, encompasses a 66-acre refuse area, and an 11-acre area between the eastern limit of the refuse and Edwards Run that had contained stressed vegetation prior to EPA's remedial action (Appendix A: Figure 1). Edwards Run is a surface water tributary to Mantua Creek and the Delaware River. The Site is near Mantua's border with East Greenwich Township.

The landfill was originally a sand and gravel excavation operation; however, in the early 1960s, landfilling occurred simultaneously with sand excavation. During the 1970s, the landfill was estimated to have received several million gallons of chemical wastes, including waste solvents and paints. In addition, over two million cubic yards of solid waste were estimated to have been disposed of at the landfill. The waste is believed to be more than 50 feet deep in most areas. The wastes disposed of included hazardous, industrial, septic, municipal, and hospital wastes.

The landfill ceased operation in March 1981 as a result of a court-ordered closure because the landfill had exceeded its permitted elevations and capacity. During the summer and fall of 1981, several fires occurred at the Site. The New Jersey Department of Environmental Protection (NJDEP), with the assistance of the local fire department, extinguished all fires by November 1981. The Site was listed on EPA's National Priorities List (NPL) in September 1983.

There are no residences on the Site. Two private residences were permanently relocated prior to the remedial

construction. All residents in the area, with limited exceptions[1], are connected to the public water supply. Access to the Site is limited by a chain-link fence. The Site is bordered by woods, farmland, Edwards Run and private residences.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Helen Kramer Landfill Superfund Site		
EPA ID: NJD980505366		
Region: 2	**State:** NJ	**City/County:** Mantua/Gloucester County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Brent Gaylord		
Author affiliation: EPA		
Review period: 11/15/2024 – 4/24/2025		
Date of site inspection: 1/21/2025		
Type of review: Statutory		
Review number: 6		
Triggering action date: 9/30/2020		
Due date *(five years after triggering action date)*: 9/30/2025		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Following the NPL listing of the Site, EPA began a remedial investigation/feasibility study (RI/FS) in 1984 to delineate the nature, extent and impact of contamination at the Site, and to develop and evaluate remedial alternatives. The RI indicated that the landfill was not contained. The landfill was characterized by randomly

[1] All residents in the area are connected to the public water supply, except for one known property owner who refused connection in 2005. This resident has a private well which is located in the deeper Magothy Aquifer that is not known to be impacted by site-related contamination. Since all other residents in the area are connected to the public water supply, the exposure pathway via ingestion of the groundwater has been interrupted.

placed, uncompacted, and uncovered refuse, with numerous settlement cracks which vented methane and water vapor into the atmosphere.

To assist in determining the impact of the landfill on public health and the environment, a risk assessment was performed during the RI/FS for the conditions at the Site. Where possible, relevant standards were used to assess the impact of the Site. In most cases, no applicable standards existed, therefore, relevant or appropriate criteria and guidance were used.

Relevant criteria for airborne contaminants were based on the Occupational Safety and Health Administration's (OSHA) standards developed for workplace exposures. The ambient measured or calculated concentration of air contaminants at the landfill did not exceed the workplace standards. For some compounds, the workplace Threshold Limit Value (TLV) was used to develop a guidance level for non-workplace exposure. The concentrations of 1,1-dichloroethene and toluene at the Site exceeded these guidance levels. The potential increased cancer risk due to airborne contaminants from the Site, prior to implementation of the remedy, was estimated to be in excess of 1×10^{-6} up to a distance of five miles from the Site.

The RI/FS indicated that several of the maximum observed concentrations of contaminants in Edwards Run exceeded the water quality criteria for surface water that were developed pursuant to the Clean Water Act. For the inorganic contaminants, only nickel exceeded the criteria, and for the organic contaminants, seven compounds exceeded the criteria. The seven organic contaminants included chloroform, benzene, and several chlorinated ethenes. The potential increased cancer risk for ingestion of water from Edwards Run was estimated in the RI/FS to be 3.5×10^{-3}.

The RI/FS concluded that, in general, the leachate entering Edwards Run was considered to have rendered the stream unusable for its designated uses as an FW-2 non-trout surface water.

The RI determined that the underlying groundwater, Mount Laurel aquifer, was heavily contaminated with organic compounds including benzene, toluene, xylenes and phenols. Inorganic chemicals found in high levels in the groundwater included arsenic, cobalt, magnesium and sodium. It was also determined that the groundwater was discharging to Edwards Run.

An evaluation of ecological risks was not conducted as part of the RI/FS process.

Response Actions

Based upon the results of the RI/FS, a Record of Decision (ROD) was issued on September 27, 1985, which selected a containment remedy for the Site. The remedial action objective (RAO) for the Site was to prevent or mitigate the migration of hazardous substances. The selected remedy included:

- Construction of a clay cap over the Site;
- Dewatering, excavation, and filling of the leachate ponds and lagoons;
- Construction of an upgradient slurry wall;
- Construction of a groundwater/leachate collection trench;
- Collection and treatment of groundwater/leachate from the trench (the treatment preference for collected leachate was pretreatment and discharge to the publicly owned treatment works

(POTW). Implementation was contingent upon approval of the State of New Jersey and the local POTW. If such approval was not provided, the ROD called for on-Site treatment followed by discharge to local surface waters.);

- Construction of an active gas collection and treatment system;

- Implementation of surface water controls;

- Construction of a security fence surrounding the Site and work areas;

- Implementation of a monitoring program to assess the effectiveness and reliability of the remedial action (RA), and;

- Operation and maintenance (O&M), as required, to ensure the continued effectiveness of the remedy.

At this time, the 1985 ROD is the only response-action decision document for the Site.

During design activities, it was determined that the leachate from the collection trench could be pretreated and discharged to the Gloucester County Utilities Authority (GCUA) POTW as preferred in the ROD. During a Value Engineering evaluation, the slurry wall was expanded from only upgradient of the landfill to completely encircling it. The Value Engineering assessment showed that the extension of the slurry wall would allow for a decrease in the capacity of the leachate pretreatment facility (PTF) and an overall reduction in the volume of leachate requiring treatment and discharge to the POTW.

Status of Implementation

Remedial Action (RA) activities, which began on February 20, 1990 and were considered construction-complete on June 30, 1993, are described below.

Lagoons

Three lagoons were located at the Site between the landfill and Edwards Run. NJDEP interim action levels for soil which were in effect at the time of the cleanup of the lagoons in 1990 and 1991 were used as the basis for the excavation of sediments from lagoons identified as numbers 1 and 2. A third lagoon, lagoon number 3, had been lined with plastic, and, therefore, no excavation was deemed necessary prior to backfilling the lagoon to existing grade.

Contaminated water in Lagoon 1 was transferred to the PTF and the contaminated lagoon sediments were excavated in 1991 to a depth of five feet, in addition to excavation of all visibly contaminated sediments. No post-excavation samples were collected prior to backfilling. The excavated lagoon sediments were deposited in the landfill and were subsequently capped.

Contaminated water in Lagoon 2 was transferred to the PTF for treatment. Sampling of the sediments in Lagoon 2 showed that concentrations of contaminants in sediments below 2.5 feet did not exceed the NJDEP's interim action levels for soil. Accordingly, Lagoon 2 was excavated to a depth of 2.5 feet and the excavated sediments were deposited in the landfill for subsequent capping. Based on sampling results, EPA determined that the water in Lagoon 3 was not contaminated and did not require treatment prior to discharge to the landfill.

A total of 34,325 tons of clean soil were used to backfill the three lagoons. This work was completed in 1991.

Landfill Containment and Leachate Collection Activities

A six-layer cap was installed on an area of approximately 81.5 acres at the Site. The cap was constructed of stone, a fabric filter layer, a clay layer, followed by sand and topsoil. The subgrade of the cap required the placement of approximately 774,000 tons of common fill. An 8,350-foot slurry wall was installed to surround the entire landfill. The wall is three feet wide and varies in depth from 20 to 70 feet.

Landfill leachate is collected via a trench system utilizing perforated polyethylene drainage pipe. Three pumping stations are used to convey the collected leachate through a forcemain to the PTF. A 120-gallon per minute (gpm) capacity leachate PTF was constructed at the Site. The first discharge of pretreated leachate to the GCUA POTW occurred on April 1, 1992. The pretreatment process included chemical precipitation, air stripping and carbon adsorption to remove contaminants. During EPA's RA, the effluent from the PTF was stored and tested prior to disposal at the GCUA POTW. Presently, the effluent from the PTF is directly discharged to the POTW. The leachate pumping rate currently averages approximately 35 gpm; however, the current capacity of the leachate PTF is 120 gpm. Several investigations were performed in 2015 to assess the leachate collection system and its performance. The investigations led to the results that the Leachate Collection System (LCS) was operating below design capacity due to damages in the system. The LCS has the capacity to pump at 120 gpm but has only been pumping at an average of 35 gpm. One issue noted during the investigation was that no type of filter material or geotextile was installed to separate the sand from the LCS. Fine sand was able to migrate into the voids of the gravel pack and cause clogs. The investigation also led to the realization that the french drain was crushed in many areas and that the cleanouts needed to be operating as localized pumping stations.

A landfill gas collection system was installed circa 1991 and includes 73 gas collection wells. The gas treatment facility, which consists of a carbon adsorption system and a methane gas flare, has a design capacity to treat 1,000 cubic feet per minute. Due to the landfill gas generation rate diminishing, a new Landfill Gas Management Program has been operating under a September 2021 NJDEP air permit equivalence that consists of:

1) Solar powered, automated sparking landfill gas flares
2) Landfill Gas Management monitoring program
3) Flare operations and maintenance.

Each of the 6 flares are connected to a gas collection well that extends into the waste and the well screens are also connected to the gas collection gravel layer below the clay cap layer. The flare sparking element operates continuously and fires off every 0.9 seconds.

The Site's storm water management features include two drainage basins. The Site is surrounded by chain-link security fencing. A perimeter road, located within the security fence, was built to provide access to the entire Site. Nineteen groundwater monitoring wells were installed around the perimeter (200-foot buffer extending outward from the circumference of the slurry wall) of the Site.

In June 1993, EPA approved a Preliminary Close-Out Report (PCOR) for the Site, documenting that all construction activities had been completed. After the RA was completed, EPA transferred O&M responsibilities to the NJDEP. EPA and the NJDEP coordinated the effective transfer of Site responsibilities. On September 27, 1995, EPA issued a Remedial Action Report for the OU1 remedy. Since then, EPA identified the need to address deep aquifer contamination and has identified a new OU, OU2, at the site which is undergoing remedial investigation at this time.

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	No	The capped landfill and the area between the slurry wall and the West Branch of Edwards Run	Minimize the potential for exposure to contaminated groundwater until the aquifer meets cleanup goals	NJDEP established a CEA in 1996. (See Appendix C, Figures 1 & 2)
Soil	Yes	No	The capped landfill area	Prevent damage to the landfill cap system that reduces the infiltration of rainwater into the landfill and release of unmitigated landfill gas.	Operation, Maintenance and Monitoring Plan attached to Consent Decree between Helen Kramer Landfill Superfund Site Settling Work Defendants and the State of New Jersey.

Systems Operations/Operation & Maintenance

Construction of the OU1 remedy was completed in 1993. The project has been in the O&M phase since 1994. O&M activities include operation of the leachate and gas collection systems and the two associated treatment plants, maintenance of the cap and the surface water controls, and environmental monitoring. From May 1994 to May 1997, the O&M was performed by an NJDEP contractor. Under an agreement with NJDEP, the PRPs began performing the O&M in May 1997 and continue to perform the O&M activities.

Previously, the PRPs' long-term groundwater sampling network included eight wells, of which three were sampled semi-annually and five were sampled annually. The sampling also included collection of surface water and sediment samples from Edwards Run. In March 2020, NJDEP approved an application to modify the O&M Plan to include changes to the frequency and parameters of the groundwater monitoring plan. The modification to the O&M Plan provides for water quality monitoring at a total of 36 locations; 15 of which are sampled annually and 21 sampled biennially. The revised monitoring plan was developed to monitor the Englishtown aquifer; monitor the shallow groundwater; and monitor background conditions of upgradient groundwater flowing towards the Site.

Since the start-up of the leachate PTF in 1992, monitoring has been performed, as required by GCUA, to ensure that the PTF's effluent meets the discharge criteria. PTF effluent over the past five years has met the discharge criteria. The PRPs will continue to evaluate leachate volume and system performance. Approximately 21 million gallons of leachate are treated per year.

Remedy Resilience Assessment

Potential site impacts from severe weather events have been assessed, and the performance of the remedy may be impacted by landslides, which would negatively impact the marsh plants and/or adjacent surface waters. However, historically there have not been erosional problems with the Helen Kramer Landfill cap as it does not exhibit much relief in elevation (i.e., it's relatively flat). Weekly, monthly, quarterly, and annual inspections are in place to mitigate against any potential effects from weather or other naturally occurring events to the Roller-Compacted Concrete (RCC) Wall, which has the greatest potential stability or integrity risk.

Furthermore, in August of 2024, Liberty Engineering conducted an Annual Inspection Report which included inspections regarding burrowing mammals which can lead to erosional washouts if not maintained and reported out with inspection and maintenance recommendations for the RCC Wall. The maintenance services recommended in the Liberty Engineering August report were completed in the months following the report. Inspections and maintenance will continue at the Site.

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
Sitewide	Short-term Protective	The remedies at the Site protect human health and the environment in the short-term because all exposure pathways have been addressed. In order for the remedy to be protective in the long-term, additional leachate pumping/system optimization is needed to maintain an inward gradient inside the slurry wall; sampling for 1,4-dioxane and PFAS and other Site COCs to define the contaminant plumes in the shallow and deep aquifers needs to occur; and monitoring of surface water and sediments should continue.

Table 3: Status of Recommendations from the 2020 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
1	Groundwater contaminant concentrations outside the slurry wall exceed standards	Additional leachate pumping/system optimization is needed to maintain an inward gradient inside the slurry wall. Sampling for 1,4-dioxane and PFAS and other site COCs should be conducted by the PRPs to define the contaminant plumes in the shallow and deep aquifers. Monitoring of surface water and sediments should continue.	Ongoing	Investigations on the performance of the leachate collection system are on-going. On September 30, 2022, EPA entered Administrative Settlement Agreement and Order on Consent (ASAOC) with the Respondents to conduct an RI/FS for Operable Unit 2. The OU2 RI workplan includes sampling for emerging contaminants along with other known site related contaminants in the shallow and deep aquifers along with Edwards run surface water and sediment.	Click here to enter a date

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 Helen Kramer Landfill 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, Maya Greally, posted a public notice on the EPA site webpage https://www.epa.gov/superfund/helen-kramer-landfill and provided the notice to the Mantua Township by email on August 30, 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 Helen Kramer Landfill Site to ensure that the cleanup at the Site continues to be protective of human health and the environment. No comments or questions were received as a result of these notices . Once the FYR is completed, the results will be made available at the following repository/ies: West Deptford Free Public Library and EPA Region 2 office (290 Broadway, New York, New York 10007) . In addition, the final report will be posted on the following website: https://www.epa.gov/superfund/helen-kramer-landfill. Efforts will be made to reach out to local public officials to inform them of the results.

Data Review

Groundwater

Data was reviewed for the years 2019 through 2023 to support this FYR. The 2020 FYR documented decreasing/stable total VOC concentrations at shallow monitoring wells MW-11S and MW-13S. These wells are located downgradient of the landfill, between the slurry wall and Edwards Run (see Figure 2, Appendix A). Total

VOC concentrations remained stable at MW-11S during this current FYR period with concentrations of 1,030 micrograms per liter (µg/l) in March 2019 to 1,098 µg/l in September 2022. However, However, total VOC concentrations increased from 396 µg/l in March 2019 to 5,058 µg/l in September 2022 at MW-13S. At MW-11S, benzene and chlorobenzene are the highest concentration VOCs. The maximum benzene concentration during this review period, at MW-11S, was 630 µg/l in 2020. 1,1-Dichloroethene, cis-1,2-DCE, vinyl chloride, 1,2-dichloroethane, chlorobenzene, trichloroethylene, and benzene have been detected at MW-13S with the maximum concentration of cis-1,2-DCE at 2,600 µg/l in 2022. These two shallow wells also showed elevated concentrations of 1,4-dioxane (up to 300 µg/l) and arsenic (up to 89 µg/l) during this review period. Time series plots for wells MW-11S and MW-13S can be found in Appendix B.

Three deep groundwater wells, MW-3D, MW-10D and MW12D, are screened in the Englishtown formation (see Figure 2, Appendix A). They have historically been sampled annually during the previous review periods. MW-3D is located upgradient and MW-10D and MW12D are located east of Edwards Run. These wells did not show detections of VOCs or SVOCs in the previous review or during this review period. However, the off-site deep monitoring well X-7D has historically shown 1,2-dichloroethane (DCA) impacts. This well is north of MW-12D. The 1,2-DCA concentrations for well X-7D for this FYR period ranged from 1,800 µg/l in March 2019 to 2,200 µg/l in October 2019 and September 2022. Time series plots for X-7D can be found in Appendix B. Additional deep groundwater monitoring wells have been installed in the Englishtown formation and there is an ongoing OU2 remedial investigation (RI)to determine the extent of the deep groundwater plume.

Water level measurements on the western and the southern sides of the landfill indicated an inward gradient in these areas during this FYR period. Throughout this FYR period and during the most recent event in 2023, the shallow groundwater elevation measurements outside the slurry wall (north and eastern sides) were found to be significantly lower than the elevations inside, indicating an outward groundwater gradient towards Edwards Run. Five wells (X-7S, X-8S, X-9S, MW-12S, and MW-29S) were installed in the shallow aquifer on the east side of Edwards Run. The wells were sampled most recently in 2022 and show no indication of landfill derived contamination.

Numerous investigations were conducted from 2019 to 2022 in order to examine contamination downgradient of the slurry wall and near the former lagoons, specifically in the shallow aquifer (fill material or the Mount Laurel and alluvial units), deep aquifer (Englishtown Unit), and Edwards Run. In 2019, a groundwater seeps investigation concluded that groundwater flow in the shallow aquifer converges on the Edwards Run Valley from the western and eastern sides to a discharge point in Edwards Run and its associated marsh. Also in 2019, a groundwater chemical fingerprint analysis was completed and the data indicated that the deep aquifer plume is upwelling in two of the three transect areas tested. Investigations have shown that different areas of the landfill and aquifers have different chemical constituents and different geochemical and attenuation conditions. These areas include the landfill leachate, the shallow aquifer outside the slurry wall and near the former lagoons, and the deep aquifer. The majority of the leachate's contaminants consist of BTEX and chlorobenzene. The shallow aquifer exhibited a more diverse composition of chemicals. The main contaminants in the deep aquifer are 1,2-DCA and tert-butyl alcohol (TBA).

In 2020, an infrared survey (surface water thermal identification/or measurements) was completed at Edwards Run to identify potential areas of groundwater discharge. Three distinct areas adjacent to Edwards Run with suspected groundwater discharge were identified. Numerous monitoring wells and temporary well points have been installed in the shallow and deep aquifers since the last FYR and were analyzed for various constituents. Recent monitoring of these wells and temporary well points show exceedances of mainly VOCs, SVOCS, and metals. PFAS was also detected in the shallow aquifer (described further below).

The OU2 RI will include sampling to evaluate the performance of the leachate collection system and slurry wall. The OU2 RI will also include investigations to determine flow direction and plume extent in the shallow and deep aquifers.

Surface Water and Sediment

Surface water samples were collected from three locations (SW-1, SW-2 and SW-3) within the past 5 years (2020-2024). SW-3 is an upgradient location, SW-2 is adjacent to the landfill and SW-1 is downgradient from the landfill. The results were compared to NJDEP surface water and sediment screening criteria. The maximum concentrations of 1,2-DCA continue to exceed its respective human health screening criteria 0.29 micrograms per liter (ug/l) in SW-1. 1,2-DCA was not detected (ND) in SW-2 and SW-3. The concentrations ranged from 3.8 ug/l to 6.9 ug/l, which are consistent with historical concentrations of 1,2-DCA detected in surface water. Note that these concentrations are well below the chronic ecological surface water screening criteria of 910 ug/l. Vinyl chloride was detected above the human health surface water quality standard (0.082 ug/l) in sample locations SW-1 and SW-2 with concentrations ranging from 0.34 ug/l - 2.2 ug/l. These levels, however, are well below the chronic ecological surface water screening criteria of 930 ug/l. Arsenic concentrations exceeded its respective human health screening criteria (0.017 ug/l) in surface water sample locations SW-1 and SW-2. The concentrations ranged from 1.3 ug/l - 2.9 ug/l and are consistent with historical concentrations when detected. Similar to the VOCs mentioned above, these concentrations did not exceed the arsenic ecological screening criteria for acute (340 ug/L) or chronic (150 ug/l) exposures.

Sediments are sampled annually in the fall at the three original surface water locations. Arsenic was detected above its respective NJDEP ecological screening criteria lowest effects level (LEL) 10 mg/kg in the past 5 years. The maximum detected concentration in Marsh Sediment is 23.1 mg/kg and the maximum detected concentration of arsenic in riverine sediment is 27 mg/kg. However, these concentrations were below the severe effects level (SEL) of 33 mug/kg. In addition, 1,2-DCA was detected during the last two sampling events in SS-1. Historically, it has not been detected in sediment samples collected from Edwards Run.

Emerging Contaminants

<u>Per- and Polyfluoroalkyl Substances (PFAS)</u>

Between 2018 and 2021, emerging contaminant sampling was conducted in four events (two in 2018, one in 2019, and one in 2021) to evaluate the presence of per- and polyfluoroalkyl substances (PFAS) (EPA method 537M by ID) in the surface waters (October 2018 only) and the two aquifers. In April 2024, EPA finalized federal drinking water MCLs for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) at 4 nanograms per liter (ng/L). In June 2020, NJDEP established primary and secondary drinking water standards for PFOA at 14 ng/L, PFOS of 13 ng/L, and Perfluorononanoic acid (PFNA) at 13 ng/L. Revisiting the sampling results in the context of the state and federal MCLs and state guidance values, multiple locales have exceedances with respect to PFNA, PFOS and PFOA .

All three of the upgradient shallow monitoring wells (MW-1S, MW-3S, and MW-5S) exceeded the EPA levels for PFOA (33.9, 9.8, and 18.6 ng/L, respectively). Two of these wells had a higher PFNA count compared with NJDEP MCLs (MW-1 and MW-3 had 15.7 and 27.3 ng/L), and one monitoring well was above EPA MCLs for PFOS (MW-3 at 8.15 ng/L). Shallow wells on the perimeter of the landfill between the slurry wall and Edward's Run showed that 13 out of 14 monitoring wells had concentrations above the EPA MCL for PFOS ranging from the reporting limit of 4.0 ng/L in monitoring wells MW-12S and MW-34S to 1,060 ng/L in MW-11S. Regarding PFOA in this area, 13 out of 14 monitoring wells had concentrations above the EPA MCLs for PFOA, with concentrations ranging from 2.5 ng/L in well MW-34S to 381 ng/L in well MW-15S. MW-34S was the only monitoring well devoid of contamination from PFOA and PFAS located on the perimeter of the landfill. Across the stream, shallow monitoring wells X-8S and X9S also marginally exceeded the EPA MCLs for PFOA (12.6 and 12.4 ng/L, respectively), while only X-8S marginally exceeded the MCL for PFOS at 5.1 ng/L.

All deeper monitoring well sampling resulted in concentrations that were not detected above the reporting limits of the instrument used to measure them. However, some of these reporting limits were slightly above the EPA MCLs for PFOA and PFOS (i.e., 8.3 ng/L compared to 4 ng/L).

In 2018, eight surface water samples were collected and concentrations exceeded the EPA PFOA groundwater MCLs ranging from 7.12 ng/L in sample SW-2 to 8.55 ng/L in sample SW-7. Four surface water sample locations showed results above the EPA groundwater PFOS MCLs (with a range of 3.7 to 12.8 ng/L in SW-2 to SW-7, respectively). Surface water monitoring station SW-7 is located upriver of the landfill and had higher PFOA and PFOS concentrations observed than the average PFOA and PFOS surface water concentrations collected at monitoring stations that are adjacent to the Helen Kramer Landfill.

1,4-Dioxane

1,4-Dioxane has been sampled and analyzed in several wells at the Site. The shallow plume monitoring well (SGZ) MW-11S reported the maximum concentration of 300 ug/l in 2000. The 1,4-dioxane maximum concentration at MW-11S did, however, decrease to 25 ug/l in 2024. For the SGZ monitoring well MW-13S, the concentrations were relatively low prior to 2000, but increased to 170 ug/l in 2022 and then decreased to 61 ug/l in 2024. Concentrations of 1,4-dioxane in the deeper plume monitoring wells (MW-16D and MW-19D) have been steadily increasing since 2018 and exceed the NJGWQS of 0.4 mg/L. In 2023, two sentinel shallow groundwater wells were sampled (MW-33S and MW-34S) and 1,4-dioxane was not detected in these wells.

Site Inspection

A Site inspection was performed on January 21, 2025. The following parties were in attendance: Brent Gaylord, Julie McPherson, Maya Greally, Joel Waddell, Sabrina Gonzalez, Tara Bhat, EPA; Carly DeLucca and James Langschultz, NJDEP; Joe Cattafe and Jilian Troyer, HDR; and Bill Lee, de maximis. The purpose of the inspection was to assess the protectiveness of the remedy. During the inspection, the Site appeared to be in satisfactory condition.

The Site fencing and grass cover are in good condition. The landfill cover system (i.e., grass, riprap apron and access roads) is inspected by a PRP contractor several times per year for erosion, burrowing animals, and sparse vegetation.

A licensed treatment plant operator maintains an ongoing presence on the Site as noted in monthly reports that the PRPs' consultant submits to GCUA.

V. TECHNICAL ASSESSMENT

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

Currently, the remedy is not functioning as intended by the OU1 decision document. In summary, and as further supported by the details provided below, the LCS has collected on average 35 gallons per minute of leachate over the past 12 years of monitoring. Leachate levels and recovered volumes are monitored monthly and reported to NJDEP. The LCS has not been able to achieve the remedial design target leachate level of 20ft mean sea level (msl). The September 30, 2022, ASAOC provides for the performance of an RI/FS for Operable Unit 2 that will include an investigation of the contamination outside of the slurry wall.

The 1985 ROD called for groundwater/leachate collection and treatment, a clay cap, an upgradient slurry wall, active gas collection and treatment, dewatering, excavating, and backfilling lagoons, security fencing, and monitoring. While the landfill containment portion of the remedy called for a slurry wall on the upgradient side of the landfill, a decision was made during remedial design, based on value engineering, to extend the slurry wall to completely surround the landfill. The ROD indicated that the slurry wall and cap, in conjunction with the leachate collection system, would lower the water table such that the vertical hydraulic gradient would reverse direction

from the Englishtown aquifer up to the Mount Laurel aquifer. This reversal in direction of the hydraulic gradient will be further assessed in the OU2 remedial investigation.

Former lagoons located on the eastern side of the landfill (between the slurry wall and Edwards Run) have been drained and backfilled. As appropriate, any contaminated soils were excavated and placed on the landfill prior to capping. The landfill area is covered by a clay cap. The Site is fenced, which has prevented trespassing. A leachate collection system has also been constructed at the Site. Leachate is collected and treated at the on-site PTF and is then discharged for further treatment at the GCUA wastewater treatment plant. It appears that the leachate collection system, as currently configured, cannot keep the landfill leachate hydraulic head at an optimal level. Water levels in the wells around the downgradient slurry wall indicate an outward gradient. Thus, the leachate collection system has not been operating as intended. Data from the shallow monitoring wells located between the slurry wall and Edwards Run (the area of the former lagoons) indicate persistent high concentrations of VOCs. PFAS concentrations have been detected within this area at levels considerably higher than those identified upgradient of the landfill as well, suggesting the Site is a source of these contaminants. Additional groundwater monitoring wells have been installed by the PRPs to delineate the shallow and deep groundwater contamination. Further investigation work related to OU2 is ongoing to fully delineate groundwater contamination outside of the slurry wall.

Samples from Edwards Run frequently show VOC concentrations that exceed NJDEP screening criteria for surface water. Temporary well points installed in January 2019 identified areas of shallow groundwater discharge into Edwards Run. Since EPA notified the PRPs of concerns about insufficient containment of contaminated leachate, the PRPs are delineating the groundwater plume that is reaching Edwards Run. Also, the PRPs are investigating methods to lower the landfill head, some of which include upgrading portions of the leachate collection system. The increased pumping from the leachate collection system could potentially reduce the outward gradient from the landfill limiting migration to the Englishtown aquifer and the surface water of Edwards Run. EPA and NJDEP will review the results of these investigations to make a determination on how best to address groundwater contamination.

Currently, land use downgradient of the Site is primarily agricultural/rural. All residents in the area are connected to the public water supply, except for one known property owner who refused connection in 2005. This resident has a private well which is located in the deeper Magothy Aquifer that is located below the Woodbury Clay Formation (a major regional aquitard) which likely restricts vertical flow between the Englishtown and the Magothy. Since all other residents in the area are connected to the public water supply, the exposure pathway via groundwater ingestion has been interrupted. Groundwater use is not expected to change in this area within the next five years. Although the aquifer is considered Class IIA, ICs currently prevent drinking water well installation within the capped landfill and the area between the slurry wall and the West Branch of Edwards Run.

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?

The baseline risk assessment evaluated the health effects which could potentially result from exposure to various Site media. The exposure assumptions and the toxicity values that were used to estimate the potential risk 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 since then and specific parameters and toxicity values may have changed, the risk assessment process that was used is still consistent with current practice and the need to implement a remedial action remains valid. In order to account for changes in toxicity values and the risk assessment process, the maximum detected concentrations of the contaminants of concern (COCs) identified during the sampling period from 2019 - 2023 were compared to EPA's residential Regional Screening Levels (RSLs), National Primary Drinking Water Standard Maximum Contaminant Levels (MCLs) and their respective NJDEP groundwater and surface water quality standards. MCLs are promulgated standards that apply to public water systems and are intended to protect human health by limiting the levels of contaminants in drinking water. RSLs are a human health risk-based value that is equivalent to a cancer risk of 1×10^{-6} or a hazard quotient of 1.

Sampling results indicate that concentrations of multiple Site-related COCs continue to exceed their respective NJDEP GWQS and MCLs. Comparing Site data to these screening levels and/or criteria remains valid.

PFAS constituents were evaluated on-site and identified at levels above their respective MCLs and EPAs RSLs. Off-site investigations, as part of OU2, are ongoing and will delineate the nature and extent of contamination. Currently, residents in the area are connected to the municipal water supply and there are ICs in place. Therefore, exposure to contamination has been interrupted .

Although groundwater outside the slurry wall does not currently meet drinking water quality standards, a Classification Exception Area (CEA) prohibits the installation of wells in this area and nearby residents are either connected to the public supply or have not been impacted (Appendix C, Figures 1 & 2). Therefore, this exposure pathway is currently interrupted. According to the updated Conceptual Site Model, impacted groundwater is migrating further downgradient and partially discharging into Edwards Run. Surface water samples indicate that several Site-related COCs exceed their respective NJDEP surface water screening criteria and/or EPA MCL. Although the concentrations of these constituents exceed their respective screening criteria, Edwards Run is not used as a potable water source. Additional exposure pathways are currently being evaluated as part of OU2. The clay landfill cap, which was constructed as part of the remedial action, continues to eliminate direct exposure to Site-related contamination and is considered protective.

Previous five-year reviews evaluated soil vapor intrusion and indicated that further investigation would be necessary if a building were to be constructed over the contaminant plume. As of 2025, there are no buildings between the slurry wall and Edwards Run; therefore, the exposure pathway is incomplete. As part of the OU2 investigations, additional information will be collected to determine if this pathway is potentially complete.

Ecological Risk

An ecological risk assessment was not performed at the time of the ROD. However, the selected remedy called for a landfill cap which addressed the terrestrial exposure pathway by eliminating the direct contact pathway to ecological receptors. The leachate collection system was designed to protect Edwards Run by intercepting contaminated groundwater/leachate. However, the current remedy is not functioning as intended by the ROD due to contaminated groundwater migrating beyond the slurry wall. Although select Site-related COCs were detected in surface water and sediment during this FYR period, the concentrations identified were below ecologically relevant screening criteria and are consistent with historical data collected at the Site. Due to the developments of the site conceptual model, OU2 will further evaluate impacts to surface water and sediment of Edwards Run and monitoring will continue.

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 remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OU1	Issue Category: Remedy Performance			
	Issue: Groundwater and surface water contaminant concentrations outside of the slurry wall exceed standards.			
	Recommendation: Complete OU2 investigations and performance evaluations of the LCS.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	9/30/2027

OTHER FINDINGS

In addition, the following are recommendations that were identified during the FYR and may improve management of O&M but do not affect current and/or future protectiveness:

- ICs required for protectiveness for the groundwater were not identified as part of the OU1 ROD and need to be included in a decision document.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)	
Operable Unit:1	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedies at the Site protect human health and the environment in the short-term because there are no exposure pathways currently impacting human or ecological health. In order for the remedy to be protective in the long-term, ongoing OU2 investigations and performance evaluations of the LCS need to be completed.	

VIII. NEXT REVIEW

The next FYR report for the Helen Kramer Superfund Site is required five years from the completion date of this review.

APPENDIX A – SITE MAPS

FIGURE 1: SITE LOCATION MAP

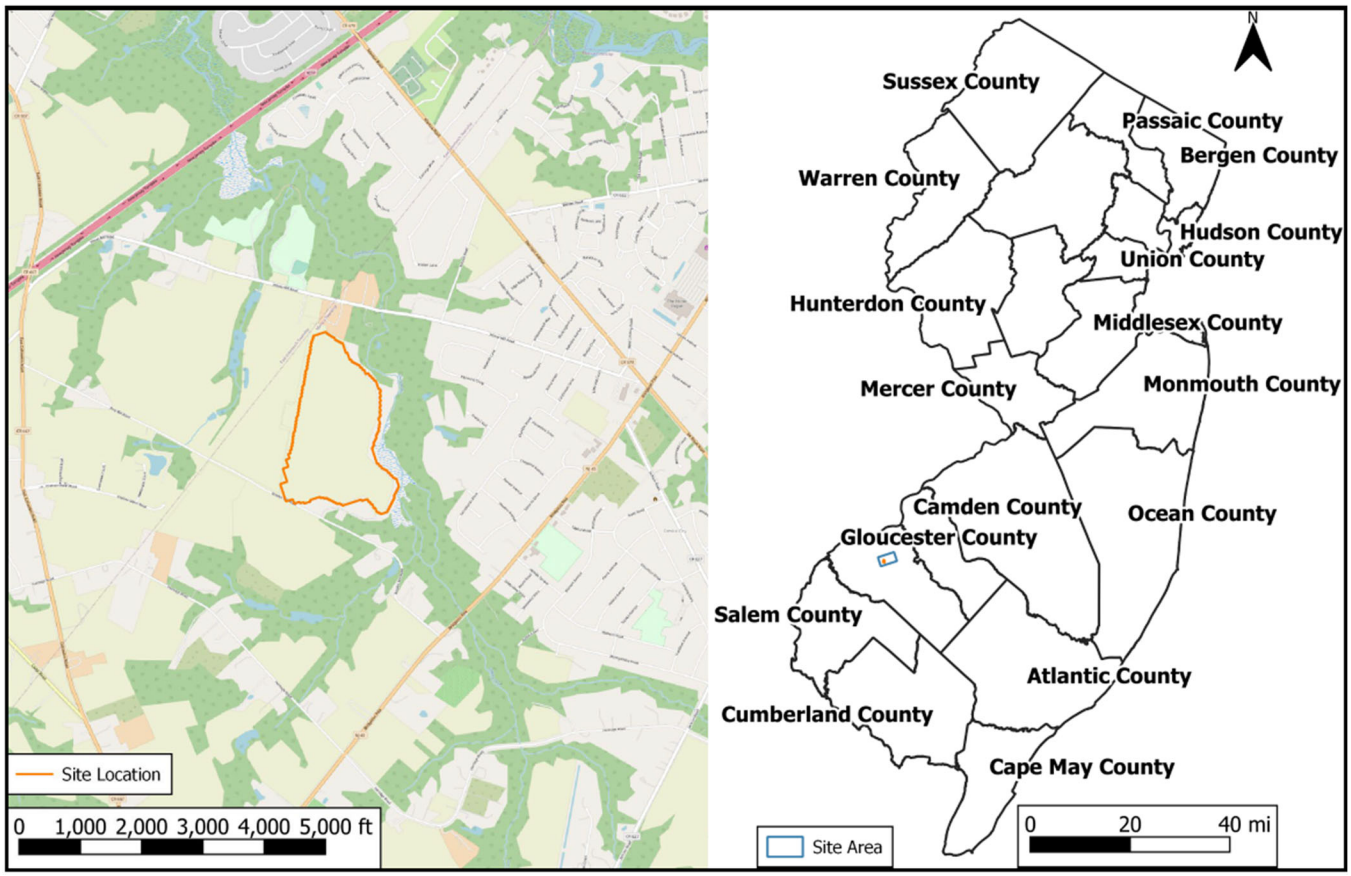
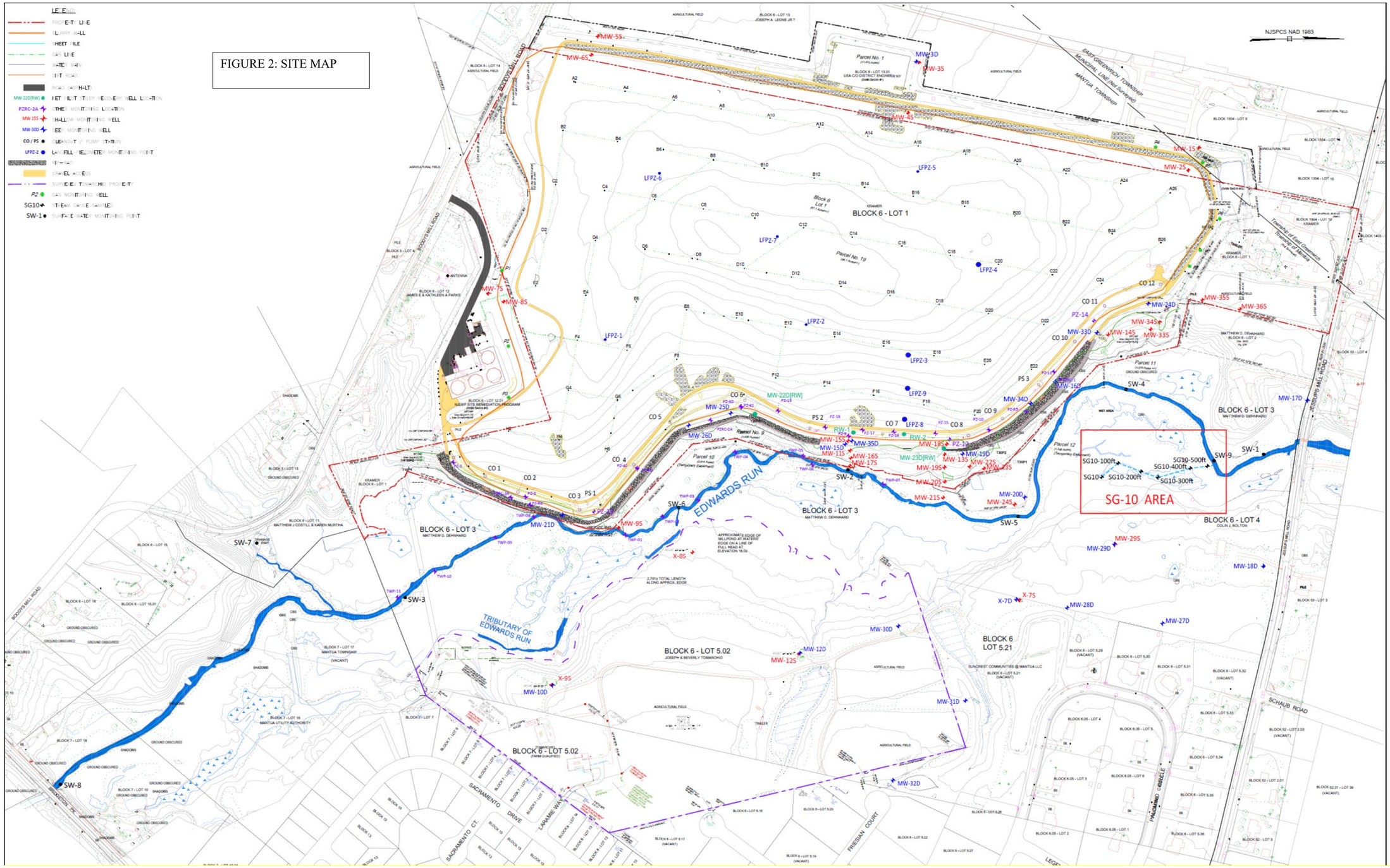
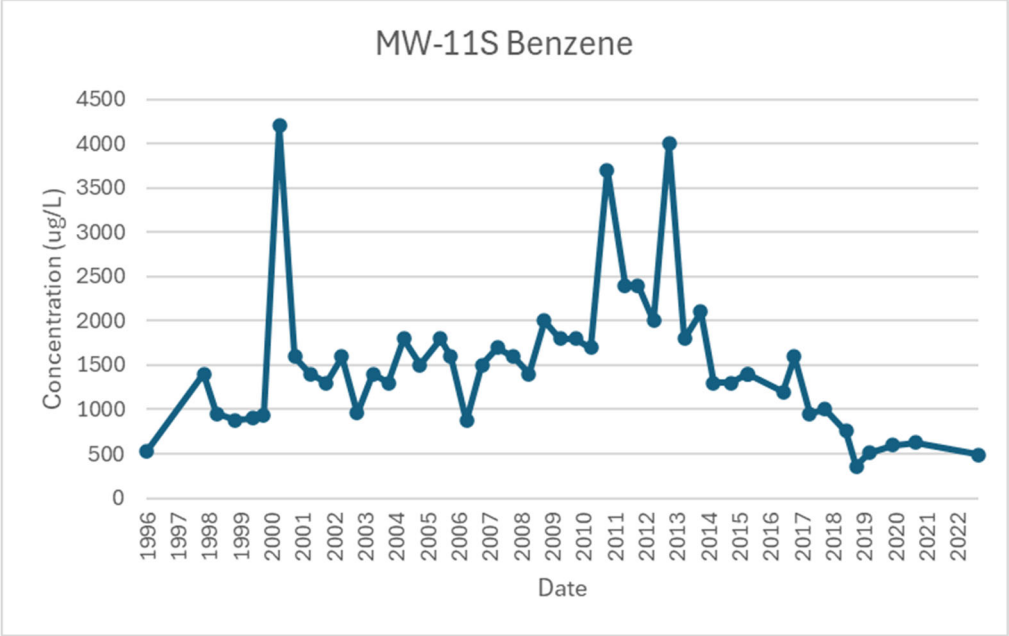


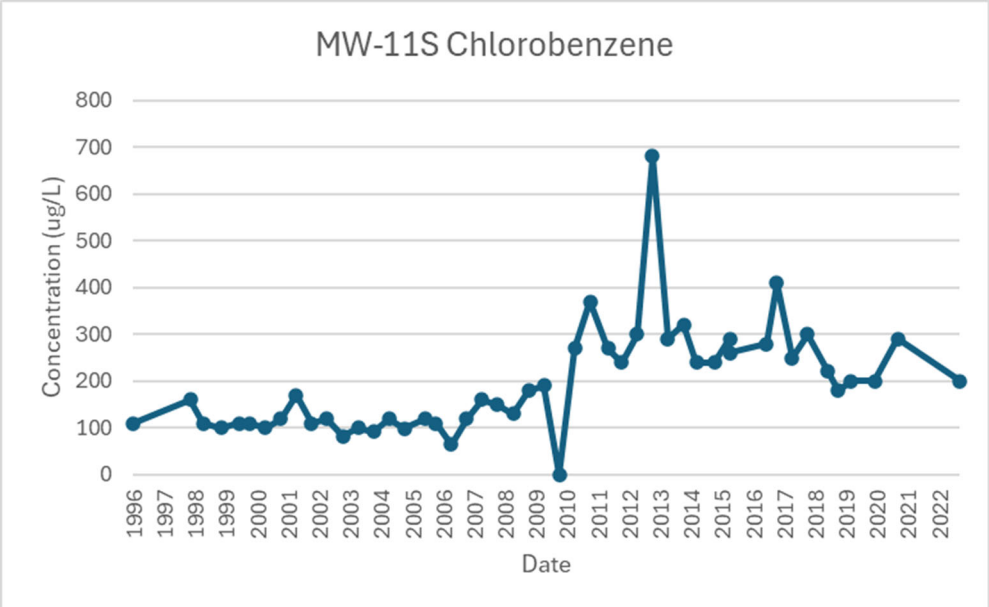
FIGURE 2: SITE MAP



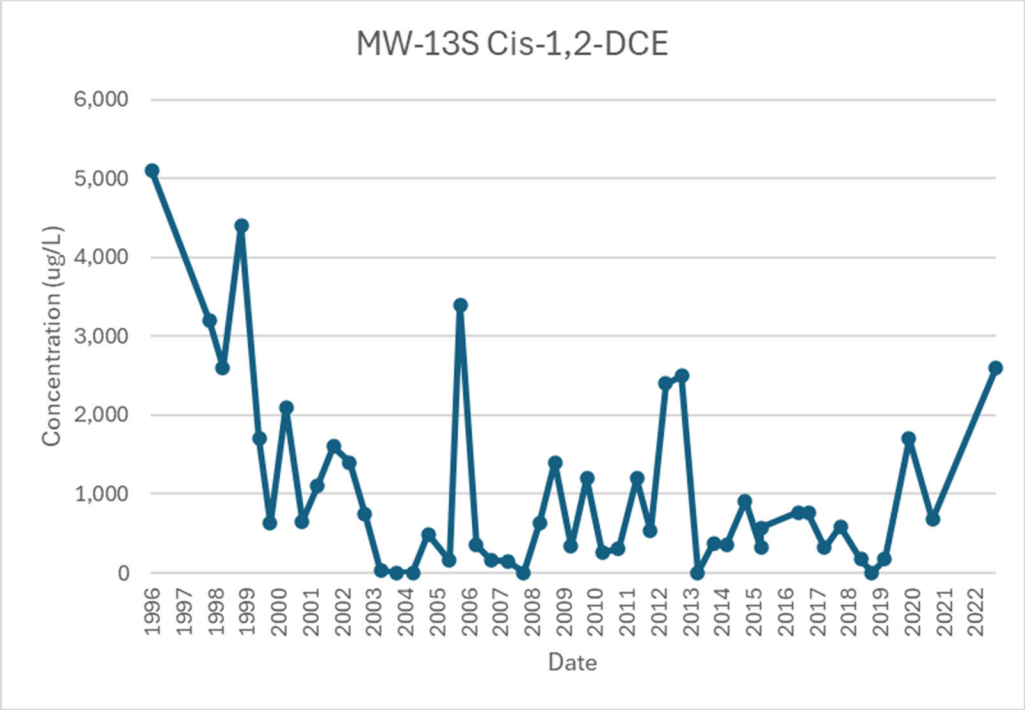
APPENDIX B: TIME SERIES PLOTS OF COCs



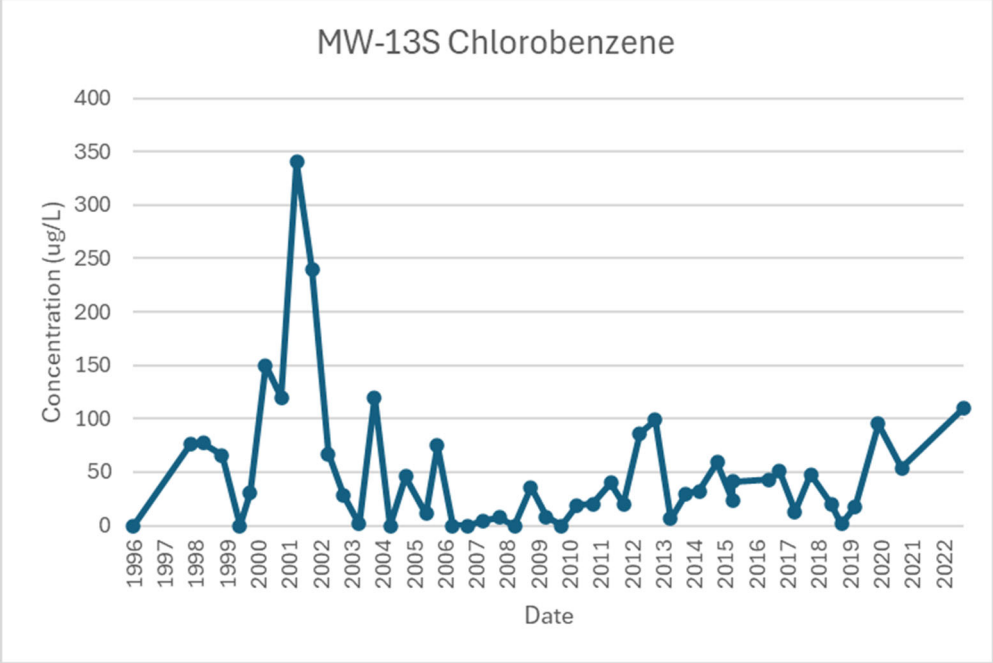
Note: NJ GQWS for benzene is 1 ug/L.



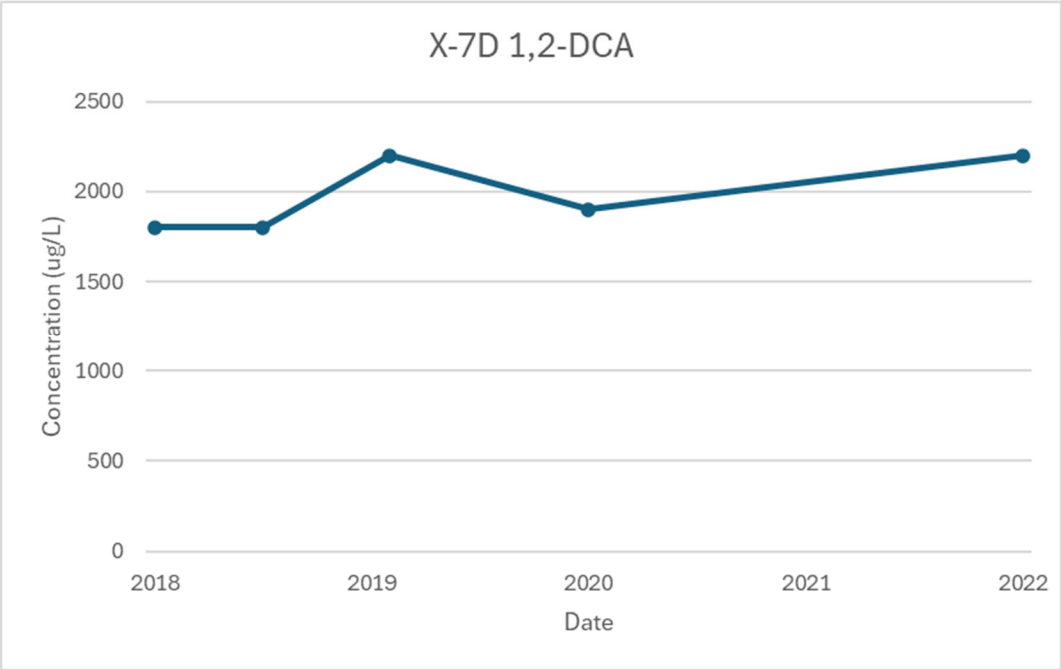
Note: NJ GWQS for chlorobenzene is 50 ug/L.



Note: NJ GWQS for cis-1,2-DCE is 70 ug/L.



Note: NJ GWQS for chlorobenzene is 50 ug/L.



Note: NJ GWQS for 1,2-DCA is 2 ug/L.

APPENDIX C: CLASSIFICATION EXCEPTION AREA (CEA) Maps

FIGURE 1: CEA Map for the Englishtown Aquifer (KET)

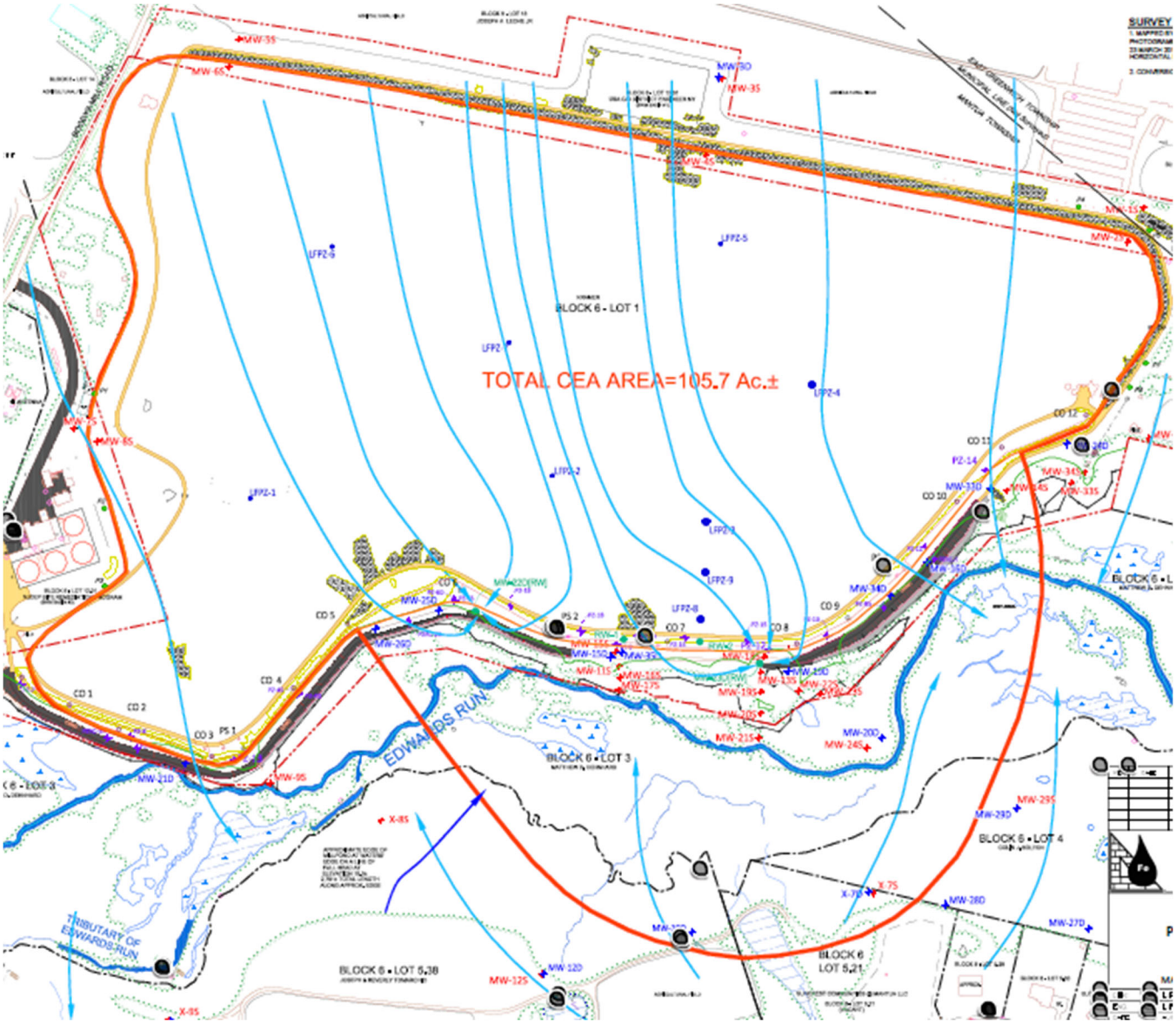
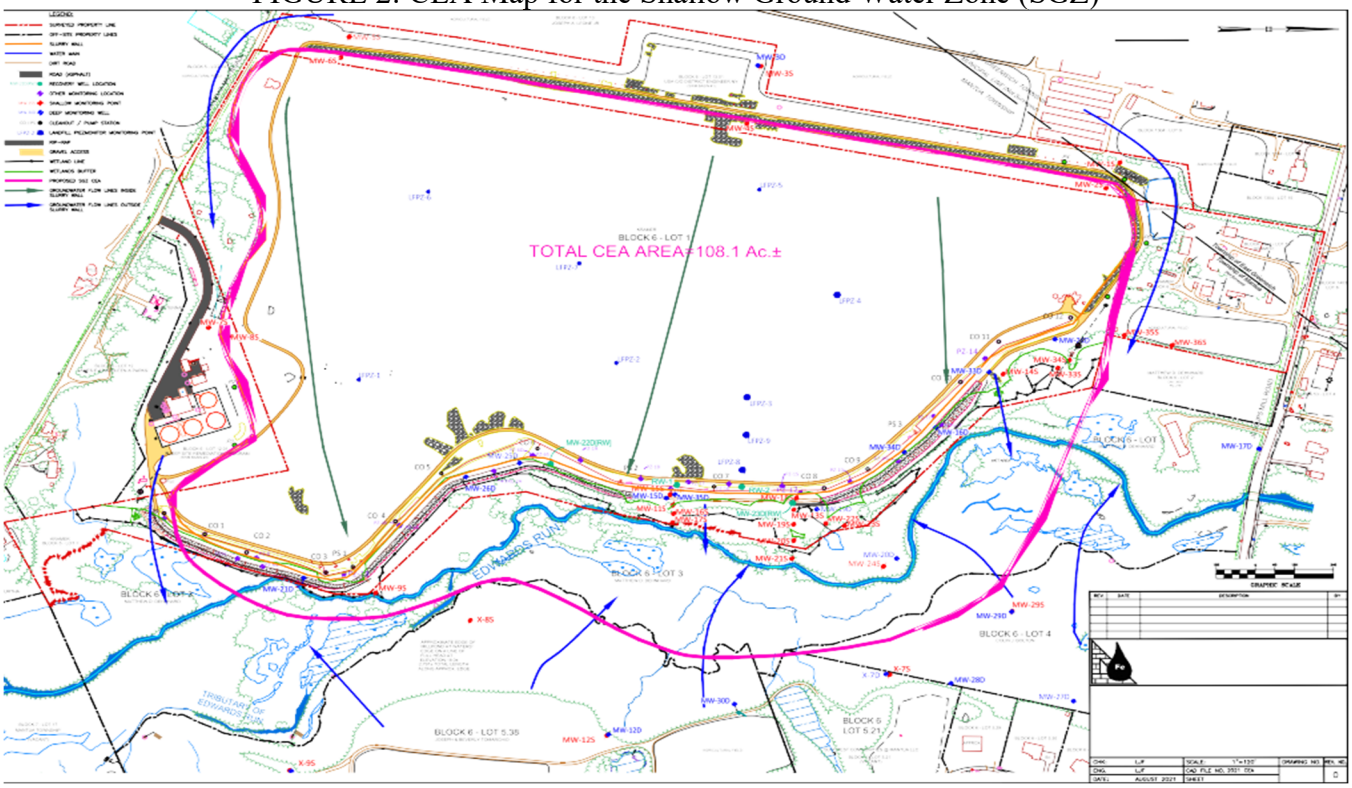


FIGURE 2: CEA Map for the Shallow Ground Water Zone (SGZ)



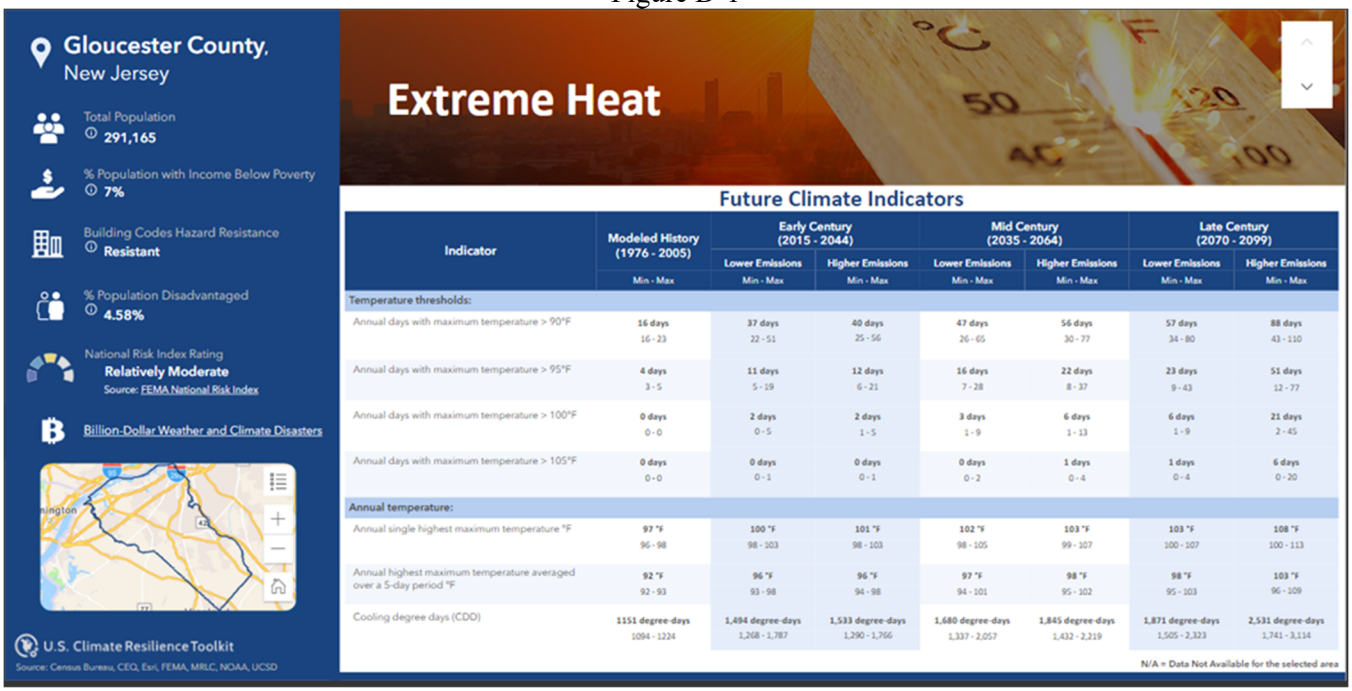
APPENDIX D: REMEDY RESILIENCE ASSESSMENT

Two tools were utilized to assess remedy resilience at the Helen Kramer Landfill Superfund Site. The first tool used to assess the Site was the CMRA Assessment Tool. The tool examined five climate hazards for the county the Site falls within. According to this tool, the National Risk Index Rating for extreme heat is "Relatively Moderate." There is a projected increase of days per year with maximum temperatures >100°F, as shown in Figure D-1. The next two climate hazards evaluated by this tool – drought, and wildfire– each have a National Risk Index Rating of "Relatively Low." The last two climate hazards evaluated by this tool – flooding and coastal inundation each have a National Risk Index Rating of "Relatively Moderate". Figures 2 and 3 show an increase in average annual total precipitation and an increase in days per year with precipitation. Figure 4 shows an increase in annual days with precipitation over one inch. Historically, flooding has not been an issue at the Site, however, flooding will continue to be monitored to ensure no impact on the remedy. Despite the "Relatively Moderate" risk rating for coastal inundation, as shown in Figure D-5, the percent of the county anticipated to be impacted by global sea level rise over the next 75 years is 2%. Coastal inundation is not expected to impact the Site, however, since it is located inland from the Delaware River.

The second tool utilized is called the USGS U.S. Landslide Inventory. As shown by Figure 6, there have likely been landsides recorded at or near the vicinity of the Site. Higher landslide susceptibility is also present toward the eastern side of the landfill, based on landscape topography. However, historically there has not been erosional problems with the Helen Kramer Landfill cap as it does not exhibit much relief in elevation (i.e., it's relatively flat). Weekly, monthly, quarterly, and annual inspections are in place to mitigate against any potential effects from weather or other naturally occurring events to the Roller-Compacted Concrete (RCC) Wall, which has the greatest potential stability or integrity risk. Furthermore, in August of 2024, Liberty Engineering conducted an Annual Inspection Report which included inspections regarding burrowing mammals which can lead to erosional washouts if not maintained and reported out with inspection and maintenance recommendations for the RCC Wall. The maintenance services recommended in the Liberty Engineering August report were completed in the months following the report. Inspections and maintenance will continue at the Site.

Based on this information, potential Site impacts from severe weather have been assessed, and the performance of the remedy may be impacted due to the expected effects of severe weather in the region and near the site. Specifically, the Site may be impacted by landslides, which would negatively impact the marsh plants and/or adjacent surface waters. However, as indicated above, the landfill is relatively flat, undergoes frequent inspection, and measures to decrease potential erosional washout have been completed. Inspections and maintenance at the Site will continue.

Figure D-1

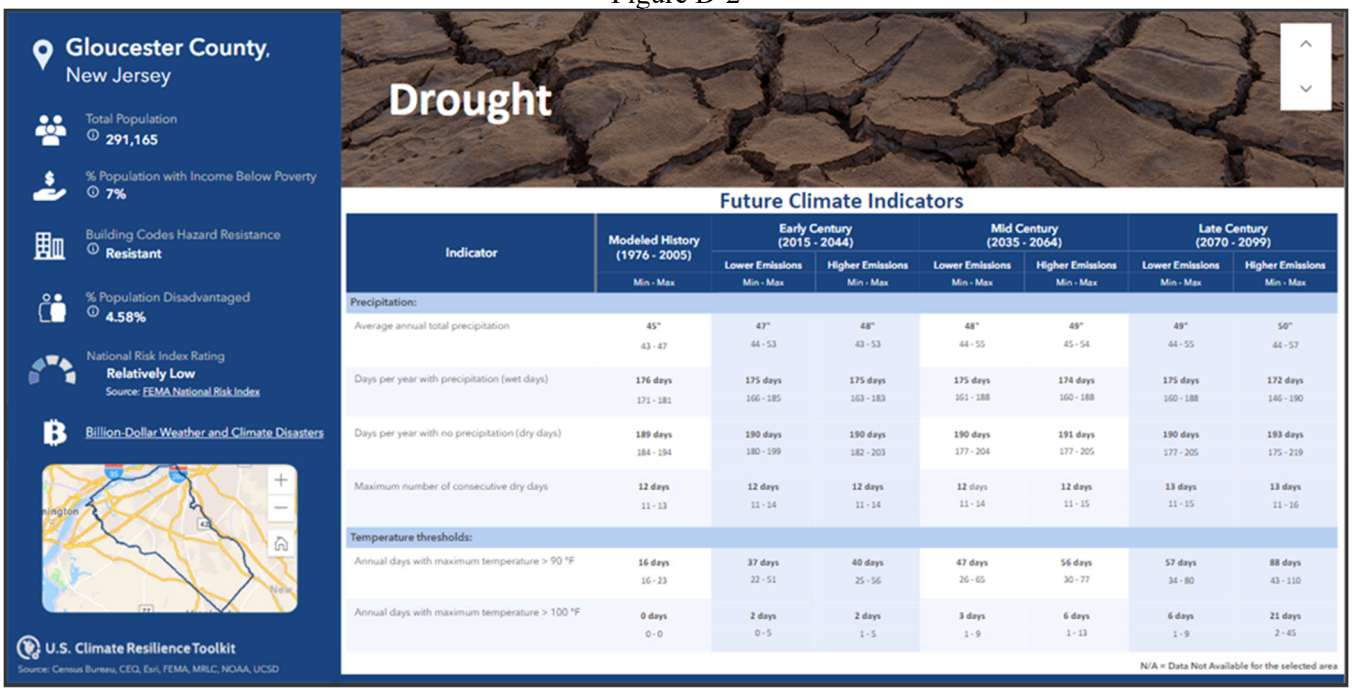


Future Climate Indicators

Indicator	Modeled History (1976 - 2005)	Early Century (2015 - 2044)		Mid Century (2035 - 2064)		Late Century (2070 - 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max
Temperature thresholds:							
Annual days with maximum temperature > 90°F	16 days 16 - 23	37 days 22 - 51	40 days 25 - 56	47 days 26 - 65	56 days 30 - 77	57 days 34 - 80	88 days 43 - 110
Annual days with maximum temperature > 95°F	4 days 3 - 5	11 days 5 - 19	12 days 6 - 21	16 days 7 - 28	22 days 8 - 37	23 days 9 - 43	51 days 12 - 77
Annual days with maximum temperature > 100°F	0 days 0 - 0	2 days 0 - 5	2 days 1 - 5	3 days 1 - 9	6 days 1 - 13	6 days 1 - 9	21 days 2 - 45
Annual days with maximum temperature > 105°F	0 days 0 - 0	0 days 0 - 1	0 days 0 - 1	0 days 0 - 2	1 days 0 - 4	1 days 0 - 4	6 days 0 - 20
Annual temperature:							
Annual single highest maximum temperature °F	97 °F 96 - 98	100 °F 98 - 103	101 °F 98 - 103	102 °F 98 - 105	103 °F 99 - 107	103 °F 100 - 107	108 °F 100 - 113
Annual highest maximum temperature averaged over a 5-day period °F	92 °F 92 - 93	96 °F 93 - 98	96 °F 94 - 98	97 °F 94 - 101	98 °F 95 - 102	98 °F 95 - 103	103 °F 96 - 109
Cooling degree days (CDD)	1151 degree-days 1094 - 1224	1,494 degree-days 1,268 - 1,787	1,533 degree-days 1,290 - 1,766	1,680 degree-days 1,337 - 2,057	1,845 degree-days 1,432 - 2,219	1,871 degree-days 1,505 - 2,323	2,531 degree-days 1,741 - 3,114

N/A = Data Not Available for the selected area

Figure D-2



Future Climate Indicators

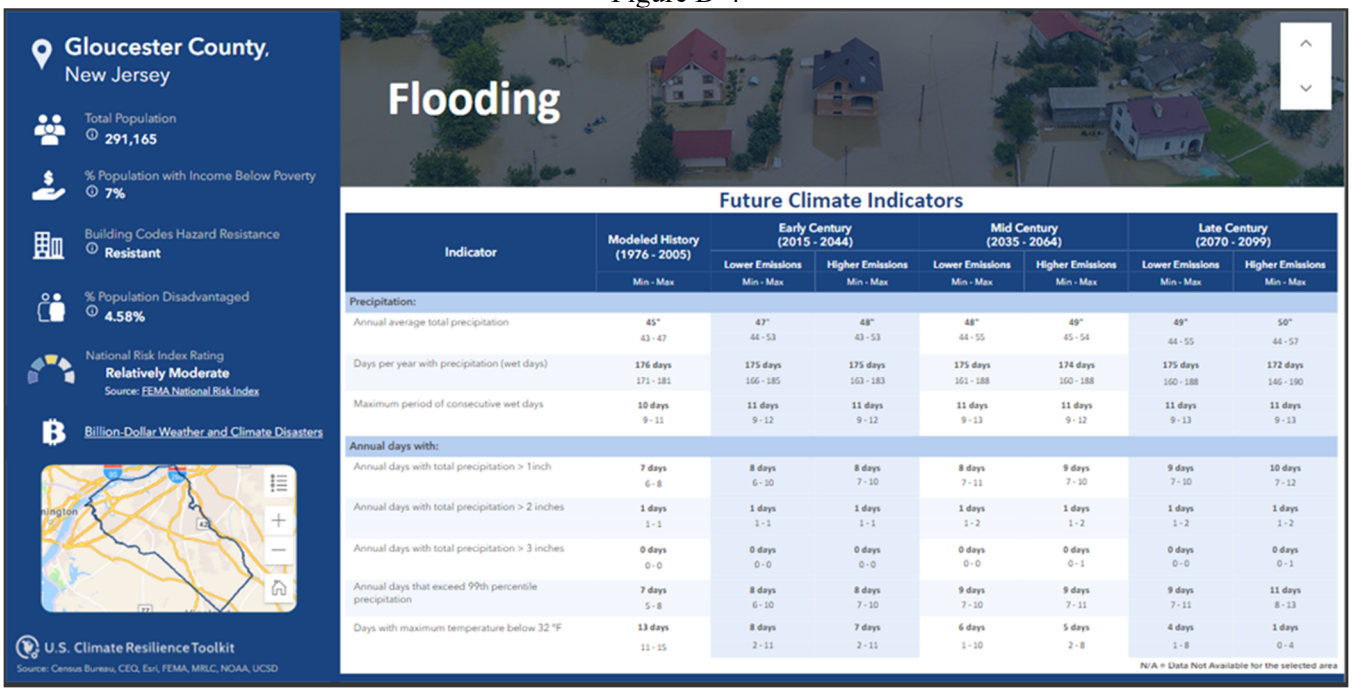
Indicator	Modeled History (1976 - 2005)	Early Century (2015 - 2044)		Mid Century (2035 - 2064)		Late Century (2070 - 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max
Precipitation:							
Average annual total precipitation	45" 43 - 47	47" 44 - 53	48" 43 - 53	48" 44 - 55	49" 45 - 54	49" 44 - 55	50" 44 - 57
Days per year with precipitation (wet days)	176 days 171 - 181	175 days 166 - 185	175 days 163 - 183	175 days 161 - 188	174 days 160 - 188	175 days 160 - 188	172 days 146 - 190
Days per year with no precipitation (dry days)	189 days 184 - 194	190 days 180 - 199	190 days 182 - 203	190 days 177 - 204	191 days 177 - 205	190 days 177 - 205	193 days 175 - 219
Maximum number of consecutive dry days	12 days 11 - 13	12 days 11 - 14	12 days 11 - 14	12 days 11 - 14	12 days 11 - 15	13 days 11 - 15	13 days 11 - 16
Temperature thresholds:							
Annual days with maximum temperature > 90 °F	16 days 16 - 23	37 days 22 - 51	40 days 25 - 56	47 days 26 - 65	56 days 30 - 77	57 days 34 - 80	88 days 43 - 110
Annual days with maximum temperature > 100 °F	0 days 0 - 0	2 days 0 - 5	2 days 1 - 5	3 days 1 - 9	6 days 1 - 13	6 days 1 - 9	21 days 2 - 45

N/A = Data Not Available for the selected area

Figure D-3

Indicator	Modeled History (1976 - 2005)	Early Century (2015 - 2044)		Mid Century (2035 - 2064)		Late Century (2070 - 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max
Precipitation:							
Days per year with no precipitation (dry days)	189 days 184 - 194	190 days 180 - 199	190 days 182 - 203	190 days 177 - 204	191 days 177 - 205	190 days 177 - 205	193 days 175 - 219
Maximum number of consecutive dry days	12 days 11 - 13	12 days 11 - 14	12 days 11 - 14	12 days 11 - 14	12 days 11 - 15	13 days 11 - 15	13 days 11 - 16
Days per year with precipitation (wet days)	176 days 171 - 181	175 days 166 - 185	175 days 163 - 183	175 days 161 - 188	174 days 160 - 188	175 days 160 - 188	172 days 146 - 190
Temperature thresholds:							
Annual days with maximum temperature > 90°F	16 days 16 - 23	37 days 22 - 51	40 days 25 - 56	47 days 26 - 65	56 days 30 - 77	57 days 34 - 80	88 days 43 - 110
Annual days with maximum temperature > 100°F	0 days 0 - 0	2 days 0 - 5	2 days 1 - 5	3 days 1 - 9	6 days 1 - 13	6 days 1 - 9	21 days 2 - 45

Figure D-4



Indicator	Modeled History (1976 - 2005)	Early Century (2015 - 2044)		Mid Century (2035 - 2064)		Late Century (2070 - 2099)	
		Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions	Lower Emissions	Higher Emissions
	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max	Min - Max
Precipitation:							
Annual average total precipitation	45" 43 - 47	47" 44 - 53	48" 43 - 53	48" 44 - 55	49" 45 - 54	49" 44 - 55	50" 44 - 57
Days per year with precipitation (wet days)	176 days 171 - 181	175 days 166 - 185	175 days 163 - 183	175 days 161 - 188	174 days 160 - 188	175 days 160 - 188	172 days 146 - 190
Maximum period of consecutive wet days	10 days 9 - 11	11 days 9 - 12	11 days 9 - 12	11 days 9 - 13	11 days 9 - 12	11 days 9 - 13	11 days 9 - 13
Annual days with:							
Annual days with total precipitation > 1inch	7 days 6 - 8	8 days 6 - 10	8 days 7 - 10	8 days 7 - 11	9 days 7 - 10	9 days 7 - 10	10 days 7 - 12
Annual days with total precipitation > 2 inches	1 days 1 - 1	1 days 1 - 1	1 days 1 - 1	1 days 1 - 2	1 days 1 - 2	1 days 1 - 2	1 days 1 - 2
Annual days with total precipitation > 3 inches	0 days 0 - 0	0 days 0 - 0	0 days 0 - 0	0 days 0 - 0	0 days 0 - 1	0 days 0 - 0	0 days 0 - 1
Annual days that exceed 99th percentile precipitation	7 days 5 - 8	8 days 6 - 10	8 days 7 - 10	9 days 7 - 10	9 days 7 - 11	9 days 7 - 11	11 days 8 - 13
Days with maximum temperature below 32 °F	13 days 11 - 15	8 days 2 - 11	7 days 2 - 11	6 days 1 - 10	5 days 2 - 8	4 days 1 - 8	1 days 0 - 4

Figure D-5

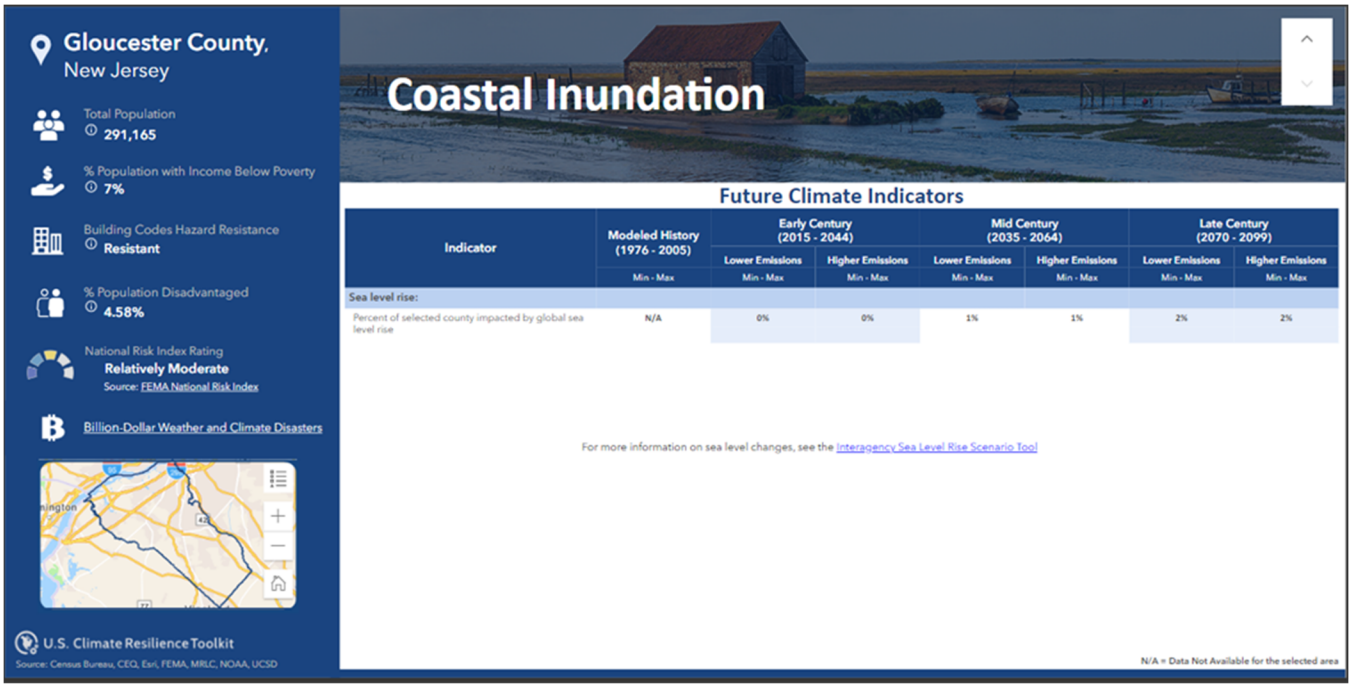
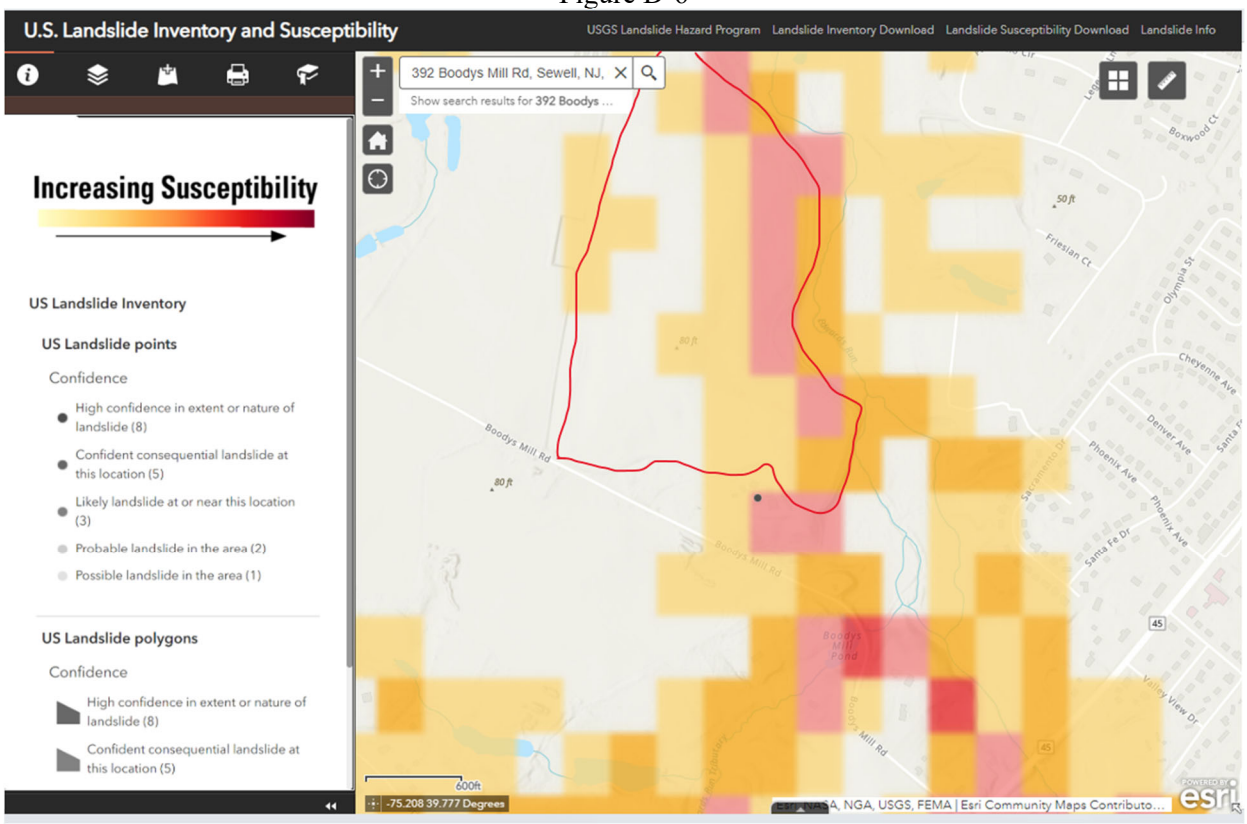

Gloucester County, New Jersey
Total Population
291,165
% Population with Income Below Poverty
7%
Building Codes Hazard Resistance
Resistant
% Population Disadvantaged
4.58%
National Risk Index Rating
Relatively Moderate
Source: FEMA National Risk Index
Billion-Dollar Weather and Climate Disasters
U.S. Climate Resilience Toolkit
Source: Census Bureau, CEQ, Esri, FEMA, MRLC, NOAA, UCSD
Coastal Inundation
Future Climate Indicators
Indicator
Modeled History (1976 - 2005)
Early Century (2015 - 2044)
Mid Century (2035 - 2064)
Late Century (2070 - 2099)
Lower Emissions
Higher Emissions
Min - Max
Sea level rise:
Percent of selected county impacted by global sea level rise
N/A
0%
1%
2%
For more information on sea level changes, see the Interagency Sea Level Rise Scenario Tool
N/A = Data Not Available for the selected area

Figure D-6


U.S. Landslide Inventory and Susceptibility
USGS Landslide Hazard Program
Landslide Inventory Download
Landslide Susceptibility Download
Landslide Info
Increasing Susceptibility
US Landslide Inventory
US Landslide points
Confidence
High confidence in extent or nature of landslide (8)
Confident consequential landslide at this location (5)
Likely landslide at or near this location (3)
Probable landslide in the area (2)
Possible landslide in the area (1)
US Landslide polygons
Confidence
High confidence in extent or nature of landslide (8)
Confident consequential landslide at this location (5)
392 Boodys Mill Rd, Sewell, NJ,
Show search results for 392 Boodys ...
Boodys Mill Rd
Boodys Mill Pond
Boxwood Ct
Friesian Ct
Olympia St
Cheyenne Ave
Denver Ave
Phoenix Ave
Santa Fe Dr
Valley View Dr
50 ft
80 ft
45
600ft
-75.208 39.777 Degrees
esri