# SIXTH FIVE-YEAR REVIEW REPORT FOR IMPERIAL OIL/CHAMPION CHEMICALS COMPANY SUPERFUND SITE MONMOUTH COUNTY, NEW JERSEY

**Prepared by**

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

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January 21, 2025

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**Date**

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## LIST OF ABBREVIATIONS & ACRONYMS

| | |
|---|---|
| CEA | Classification Exception Area |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| EPA | United States Environmental Protection Agency |
| FYR | Five-Year Review |
| ICS | Institutional Controls |
| MNA | Monitored Natural Attenuation |
| µg/L | Micrograms per Liter |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NJDEP | New Jersey Department of Environmental Protection |
| NJGWQS | New Jersey Groundwater Quality Standard(s) |
| NPL | National Priorities List |
| O&M | Operation and Maintenance |
| PCBs | Polychlorinated Biphenyls |
| PRP | Potentially Responsible Party |
| RAO | Remedial Action Objective |
| ROD | Record of Decision |
| RPM | Remedial Project Manager |
| TCE | Trichloroethene |
| TPH | Total Petroleum Hydrocarbon |
| COC | Contaminant of Concern |

## 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 review for the Imperial Oil/Champion Chemicals Company (Imperial) Superfund Site (Site). The triggering action for this policy FYR is the fifth FYR for the Site completed on January 24, 2020. The FYR has been prepared due to the fact that the remedial action will not leave hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure, but requires five or more years to complete.

The Site consists of three operable units (OUs). OU1 addressed off-property areas of contamination including contaminated soil and sediment in and adjacent to wetlands, Off-site areas 1 & 2, the Birch Swamp Brook and its floodplain, and contaminated soil located on six residential properties near the Site. The OU1 remedial actions have been completed to levels that allow for unlimited use and unrestricted exposure and is therefore not part of this FYR. OU3 addressed contaminated soil and other materials, including the waste filter clay and floating product, at the Imperial Oil facility, as well as on-site structures and tank farms. Remedial actions for OU3 were completed in January 2012 and met cleanup levels that allow for unlimited use and unrestricted exposure and is therefore not part of this FYR. OU2 addresses the Site's contaminated groundwater. Semiannual sampling of the monitoring wells began in 2011, after the groundwater contaminant sources were removed as part of the OU3 Remedy. The OU2 remedy was modified in the 2020 ROD Amendment to Monitored Natural Attenuation (MNA). The MNA remedy has been implemented and semiannual monitoring of the wells is ongoing. OU2 is the sole operable unit being reviewed in this FYR.

The Imperial Oil Superfund Site FYR team was led by the EPA Remedial Project Manager (RPM), Michelle Granger. Participants included Rachel Griffiths (EPA-Geologist), Abbey States (EPA-Human Health Risk Assessor), Abigail DeBofsky (EPA-Ecological Risk Assessor) and Pat Seppi (EPA-Community Involvement Coordinator). This is a Fund-lead Site.

**Site Background**

The Site is in Marlboro Township, Monmouth County, New Jersey in a predominantly residential area (Appendix C Figure 1). Two areas, known as Off-Site areas 1 & 2, are located approximately 220 feet and 700 feet northwest of the facility, respectively. The soil in these areas was contaminated with arsenic, lead, and polychlorinated biphenyls (PCBs) from the Site.

The Site is currently zoned for industrial use and is expected to remain so into the future. However, the Site is primarily surrounded by residential properties. Therefore, in evaluating potential risks posed by the Site, the theoretical possibility of residential development was considered.

Industrial activities were conducted at the Site from 1912 through 2007. Improper disposal and storage of hazardous materials at the facility released several contaminants into the environment including, but not limited to, arsenic, lead, total petroleum hydrocarbons (TPHs) and PCBs. Operations at the facility resulted in the contamination of the facility property's soils and groundwater, off-property soils in Off-Site areas 1 & 2 and on six residential properties, sediment in the Birch Swamp Brook, and soils adjacent to the Birch Swamp Brook.

For more details related to the Site's background, physical characteristics, geology/hydrogeology, and land/resources please see the documents found in the Site repositories or at www.epa.gov/superfund/imperial-oil.

## FIVE-YEAR REVIEW SUMMARY FORM

| SITE IDENTIFICATION | | |
|---|---|---|
| **Site Name:** Imperial Oil/Champion Chemicals Company Superfund Site | | |
| **EPA ID:** NJD980654099 | | |
| **Region:** 2 | **State:** NJ | **City/County:** Marlboro Township/Monmouth County |

| SITE STATUS | |
|---|---|
| **NPL Status:** Final | |
| **Multiple OUs?**<br>Yes | **Has the site achieved construction completion?**<br>No |

| REVIEW STATUS |
|---|
| **Lead agency:** EPA |
| **Author name (Federal or State Project Manager):** Michelle Granger |
| **Author affiliation:** EPA |
| **Review period:** 05/20/2024 - 10/10/2024 |
| **Date of site inspection:** 06/18/2024 |
| **Type of review:** Policy |
| **Review number:** 6 |
| **Triggering action date:** 1/24/2020 |
| **Due date *(five years after triggering action date)*:** 1/24/2025 |

## II. RESPONSE ACTION SUMMARY

**Basis for Taking Action**

Based on the results of the human health risk assessment for the 1992 OU2 ROD and supported by the updated streamlined risk evaluation done for the 2020 OU2 ROD Amendment, EPA determined that the actual or threatened releases of hazardous substances (Table B1) in groundwater continue to present an unacceptable risk to human health if not addressed by the response action selected in the OU2 ROD Amendment. Therefore, the response action selected in the OU2 ROD Amendment is necessary to protect the public health or welfare or the environment from actual or threatened releases of contaminants into the environment.

During the initial RI, EPA conducted ecological investigations that indicated there was a potential for adverse ecological impacts in waterbodies due to overland flow of contaminants settling in the sediments. EPA completed the remedial actions to address the contaminated sediments. Given that the previous investigations did not identify groundwater as a source of contamination associated with adverse ecological impacts to surface water and sediment, and that current groundwater concentrations have decreased since the initial ecological investigations were completed, any residual contamination related to groundwater discharge to the surface water is not expected to cause impacts to ecological receptors.

**Response Actions**

EPA issued the OU2 ROD on September 30, 1992. The OU2 RAOs are to:

- Prevent further off-Site migration of contaminated groundwater; and
- Return the aquifer to its designated use as a source of drinking water by reducing contaminant concentrations in the groundwater to drinking water quality.

The major components of the remedy selected in the OU2 ROD include the following:

- Installation of extraction wells to extract the contaminated groundwater;
- Treatment of extracted groundwater via precipitation of inorganic contaminants and carbon adsorption of organic contaminants;
- Discharge of the treated groundwater to Birch Swamp Brook;
- Continuation of the floating product removal action that was initially undertaken by the EPA; and
- Appropriate environmental monitoring to ensure the effectiveness of the remedy.

EPA reviewed data from groundwater samples collected from 2011 to 2019 and determined that removal of the OU3 source area resulted in a decline of groundwater contamination levels. Ten of the fourteen contaminants of concern (COCs) identified in the 1992 OU2 ROD were below their remedial goals. Based on these findings, on September 29, 2020, EPA issue an amended ROD for OU2 in which the groundwater remedy was changed from extraction and treatment to MNA.

The amended OU2 ROD RAOs are to:

- Prevent or minimize unacceptable risk from exposure (via direct contact ingestion or inhalation) to contaminated groundwater attributable to the site;
- Prevent further off-site migration of contaminated groundwater; and
- Return the aquifer to its designated use as a source of drinking water by reducing the contaminant concentrations in the groundwater to drinking water quality.

The major components of the amended 2020 OU2 ROD include the following:

- Collection of groundwater samples from the monitoring well network; and
- Evaluation of the samples for COCs and MNA parameters.

**Status of Implementation**

In 2021, EPA approved the OU2 amended remedial design which continues semiannual groundwater sampling in the existing well network. Since all wells necessary for the MNA remedy are already in place and in good condition, no further construction was required for the amended OU2 remedy. EPA approved the OU2 Remedial Action Report in September 2023.

All remedial actions associated with OU1 and OU3 are complete, allowing for unrestricted use.

**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 | Impacted Groundwater Areas | Restrict installation of groundwater wells and groundwater use. | Classification Exemption Area, September 1998 |

**System Operations/Operation & Maintenance**

Operation and maintenance activities at the Site include groundwater sampling and monitoring as required by EPA's OU2 remedial design. The data collected since implementation of the design were evaluated as part of this FYR.

*Climate Change*

Potential Site impacts from climate change have been assessed (Appendix D), and the performance of the OU2 remedy, MNA, is not currently at risk due to the expected effects of climate change in the region and near 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 |
|---|---|---|
| 1 | Will be Protective | The remedy at OU1 is expected to be protective of human health and the environment upon completion. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in these areas. |
| 3 | Protective | The remedy at OU3 is protective of human health and the environment. |

There were no issues or recommendations included in the last FYR that would impact protectiveness. However, the following suggestion was provided to help improve O&M:

"In order to ensure appropriate long-term management of the site, wetland monitoring of invasive species and MNA monitoring of the groundwater should continue."

In the fifth FYR (January 2020), restoration of the affected wetlands was the only remaining RAO for OU1. EPA completed restoration of the wetlands in 2023. All OU1 remedial actions have been completed and are protective of human health and the environment, therefore, OU1 is not part of this FYR. MNA monitoring of the groundwater has continued in this FYR period.

## 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 Imperial Oil 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, or CIC for the site, Pat Seppi, posted a public notice on the EPA site webpage on October 28, 2024 and provided the notice to the Marlboro Township by email on October 15, 2024 with a request that the notice be posted in municipal offices and on the village/town webpages (clerk@marlboro.nj.gov). This notice indicated that a FYR would be conducted at the Imperial Oil site to ensure that the cleanup at the Site continues to be protective of people's health and the environment. Once the FYR is completed, the results will be made available at the following repository: Marlboro Township Municipal Building Mayor's Office, located at 1979 Township Drive, Marlboro, New Jersey. In addition, the final report will be posted on the following website: www.epa.gov/superfund/imperial-oil. Efforts will be made to reach out to local public officials to inform them of the results.

**Data Review**

EPA has been performing semiannual groundwater sampling at the Site since 2011. The results of groundwater sampling indicated that concentrations of the COCs identified in the OU2 ROD decreased to the point where many identified COCs were no longer detected above the ROD remedial goals. The OU2 ROD Amendment memorialized MNA as the remedy for groundwater, and updated the COC list to include arsenic, beryllium, benzene, and trichloroethene (TCE) and its degradation products. The remedial goals selected in the OU2 ROD Amendment are the New Jersey Groundwater Quality Standards (NJGWQS). Groundwater monitoring is conducted annually at nine monitoring wells and semiannually at 25 monitoring wells (Appendix C Figure 2). All monitoring wells are screened in the overburden Englishtown Formation, but are generally categorized as shallow, intermediate, and deep based on their depths. This FYR evaluates data collected since the last FYR, including 5 groundwater sampling events between August 2021 and May 2024. The groundwater results for this review period are summarized in Appendix B Table B-1.

Consistent with historic data, arsenic is the most prevalent COC in groundwater and exhibits the highest concentrations. As of the May 2024 sampling event, arsenic was either not detected or below the applicable remedial goal of 3 micrograms per liter (µg/L) at 16 monitoring locations (MW-05S, MW-06S, MW-06D, MW-10S, MW-11D, MW-11S, P-12, PZ-01, PZ-02, PZ-03, PZ-04, PZ-05, PZ-06, PZ-07, PZ-14, PZ-15). Arsenic is present above its remedial goal in background wells ranging from 1.49 µg/L to 6.4 µg/L, and concentrations in several monitoring locations are within the same order of magnitude as the background concentrations. Locations with arsenic concentrations that are significantly elevated above background and remedial goals include PZ-08 (maximum concentration of 128 µg/L in October 2023), MW-04D (maximum concentration of 113 µg/L in October 2023), and MW-110 (maximum concentration of 69.6 µg/L in May 2024). In general, data trends at monitoring wells with elevated arsenic concentrations are fluctuating or decreasing. Arsenic is expected to attenuate as more oxidized groundwater migrates through the Site and oxidizes arsenic, which will then adsorb to iron oxyhydroxides in the aquifer soil.

Beryllium is slightly less prevalent in groundwater than arsenic, and the maximum concentration detected during the review period (14.7 µg/L at MW-04S in October 2023) exceeds its remedial goal of 1 µg/L. 19 monitoring locations were below remedial goals during the May 2024 sampling event (MW-05S, MW-05I, MW-10S, MW-10D, MW-11S, MW-11D, MW-110, MW-118, MW-202, P-12, P-16, P-17, PZ-02, PZ-04, PZ-06, PZ-07, PZ-08, PZ-11, PZ-14). Most locations exceeding the remedial goals were only marginally higher than 1 µg/L, including a detection in upgradient MW-10S of 1.27 µg/L. The highest concentrations during the review period were observed in MW-04S (maximum concentration of 14.7 µg/L in October 2023), MW-06 (maximum concentration of 10.9 µg/L in August 2021), and MW-201 (maximum concentration of 9.03 µg/L in August 2021). Except for MW-04S, the locations with higher concentrations are exhibiting decreasing trends. Beryllium is expected to continue attenuating through dilution and dispersion.

Benzene exceeded its remedial goal of 1 µg/L in six wells during the review period (MW-05I, MW-06S, PZ-08, PZ-10, PZ-12, PZ-15). The maximum concentration of 2.74 µg/L was observed at MW-06S during the May 2024 sampling event. All benzene concentrations only marginally exceed the remedial goal and are generally decreasing. Benzene is expected to continue to attenuate with dilution and dispersion as the primary attenuation mechanisms, though there may also be a component of biodegradation.

TCE and its reductive dechlorination daughter products (cis-1,2-dichloroethene [cis-1,2-DCE] and vinyl chloride) were limited to 4 locations during the review period. TCE exceeded its remedial goal of 1 µg/L at MW-05, PZ-12, and PZ-14. The maximum TCE concentration of 5.45 µg/L was detected at PZ-14 in August

2021. Vinyl chloride was detected above its remedial goal of 1 µg/L in MW-202 with a maximum concentration of 2.98 µg/L in May 2024. Cis-1,2-DCE, which is an intermediate degradation product between TCE and vinyl chloride, was detected sporadically and did not exceed its remedial goal of 70 µg/L. The overall trend of TCE and its degradation products is decreasing, and the presence of cis-1,2-DCE and vinyl chloride indicates that there is a component of reductive dechlorination attenuating the contaminants in addition to dispersion and dilution.

**Site Inspection**

The inspection of the Site was conducted on June 18th, 2024. In attendance were Michelle Granger, Renee Gelblat and Abigail DeBofsky from EPA. The purpose of the inspection was to assess the protectiveness of the remedy. The fence surrounding the former Imperial Oil property was observed to be secure with no visible signs of trespassing. Planted vegetation within the property was in good condition. No specific issues were observed during the Site inspection.

## V. TECHNICAL ASSESSMENT

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

Based on groundwater data collected during the review period, the MNA remedy is functioning as intended. COC concentrations have decreased overall since the last FYR and within this review period. Arsenic is the most prevalent COC and has the highest concentrations, but concentrations continue to reduce via dilution, dispersion, and adsorption to aquifer solids. Most arsenic detections are only slightly higher than the remedial goal and upgradient groundwater concentrations. Beryllium concentrations only marginally exceed the remedial goal and have also decreased through dilution and dispersion mechanisms. Benzene and TCE exceedances are present in a small subset of monitoring wells, and both have continued to exhibit decreasing trends that can be attributed to biodegradation, dilution, and dispersion.

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

There are no changes in the physical conditions of the Site or Site uses that would affect the protectiveness of the selected remedies. The land use considerations and potential exposure pathways considered in the baseline human health risk assessment are still valid. 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 assessments were performed for each OU.

Cleanup levels selected at the time of the OU2 ROD for groundwater are still protective. Although specific parameters and toxicity values may have changed since that time, the risk assessment process that was used is still consistent with current practice and the need to implement a remedial action remains valid. The OU2 remedial action objectives of preventing further migration of contaminated groundwater and returning groundwater to its designated use as a source of drinking water are still valid.

Remedial actions for OU1 were completed in 2023. Detailed information on the remedy for OU1 and its implementation can be found in the last FYR. The OU1 cleanup goal for lead in the soil remediation areas is 400 parts per million (ppm). This level was based on the NJ Residential Direct Contact Soil Remediation Standards. On January 17, 2024, EPA OLEM released the "Updated Residential Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities," which updates the residential soil lead screening level (RSL) and removal management level (RML) for the CERCLA and RCRA programs and provides additional guidance for setting residential lead preliminary remediation goals (PRGs) and cleanup levels.

The 2024 Updated Soil Lead Guidance recommends that regions use the most current version of the Integrated Exposure Uptake Biokinetic (IEUBK) model, with 5 µg/dL as the 95th percentile target blood lead level and site-specific environmental data (e.g., lead concentrations in various media and bioavailability) to develop PRGs and cleanup levels for residential land use. If an additional source of lead (e.g., lead water service lines, lead-based paint, non-attainment areas where the lead concentrations exceed NAAQS) is identified, the 2024 Updated Soil Lead Guidance recommends 3.5 µg/dL as the 95th percentile target blood lead level. The 2024 Updated Soil Lead Guidance also recommends that the EPA region adjust PRGs and cleanup levels to account for uncertainty, technical limitations (i.e., detection/quantification limits), and site-specific soil lead background. The current EPA residential lead screening level based on a target blood lead level of 5 µg/dL, which is considered appropriate for this site, is 200 mg/kg. Available post-excavation and backfill sample results from the 2012 Remedial Action Reports (RARs) for the two Texas Road residential properties and the 1999 RAR for Orchard Road property 37 were reviewed in comparison to the new screening level. All backfill results and post-ex averages were below 200 mg/kg, therefore the OU1 remedy remains protective. Although not subject to this FYR, it should be noted that the updated lead screening level would not affect the protectiveness of the OU3 remedy either. Cleanup levels for all contaminants other than lead have remained protective since the time of OU1 remedy selection.

Several groundwater contaminants remain in excess of state and federal maximum contaminant levels (MCLs) both in the source area and downgradient of the former facility. The evaluation of the direct pathway (ingestion as a potable water source) showed that since there are no potable wells in the contaminated area, there is no exposure. Institutional controls are in place to restrict the installation of new wells in the groundwater contamination area. Continued groundwater monitoring will confirm whether concentrations decrease over time and contamination is contained.

The Site does not contain any buildings above the groundwater plume; therefore, the vapor intrusion pathway remains incomplete at this time. Maximum groundwater concentrations of trichloroethylene and cis-1,2-dichloroethylene exceeded EPA's upper-bound residential Vapor Intrusion Screening Level (VISL) set at a cancer risk of $10^{-4}$ and a HQ of 1. Maximum detected groundwater concentrations of benzene, 1,1-dichloroethane, vinyl chloride, and 1,2-dichloroethane fell within the residential acceptable risk range ($10^{-6}$ to $10^{-4}$ and HQ of 1). This indicates that further evaluation may be necessary if development were to occur on the Site and will be evaluated as part of the next five-year review.

Groundwater contamination in OU2 does not present an ecological risk. There is no exposure pathway for ecological receptors to groundwater itself, and while the shallow portion of the aquifer discharges into Birch Swamp Brook, the ecological risk at the surface water and sediment interface has been adequately addressed in the OU1 remedy.

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

Based on the evaluation of the potential human and ecological exposures at the Site there is no additional information that could call into question the protectiveness of this remedy.

## VI. ISSUES/RECOMMENDATIONS

| Issues/Recommendations |
|---|
| **OU(s) without Issues/Recommendations Identified in the Five-Year Review:** |
| OU2 |

There are currently no issues that would affect the protectiveness of the remedies.

## VII. PROTECTIVENESS STATEMENT

| Protectiveness Statement(s) | |
|---|---|
| *Operable Unit:* | *Protectiveness Determination:* |
| OU2 | Protective |
| The remedy for OU2 is protective of human health and the environment. | |

## VIII. NEXT REVIEW

The next five-year review report for the Imperial Oil Superfund site will be conducted as a matter of policy five years from the completion date of this review.

## APPENDIX A: Reference List

| Documents, Data, and Information Reviewed in Completing the Five-Year Review | |
|---|---|
| **Document Title, Author** | **Submittal Date** |
| OU1 Record of Decision, EPA | September 1990 |
| OU2 Record of Decision, EPA | September 1992 |
| Remedial Investigation Report, ABB Environmental Services, Inc. | December 1996 |
| OU1 Explanation of Significant Differences, EPA | September 1997 |
| OU3 Record of Decision, EPA | September 1999 |
| Birch Swamp Brook Sediment Focused Feasibility Study, EPA | July 2000 |
| Texas Road Residential Properties Focused Feasibility Study, EPA | July 2000 |
| First Five-Year Review Report, EPA | September 2000 |
| Second OU1 Explanation of Significant Differences, EPA | July 2002 |
| OU1 Post-Excavation Sampling Results, L. Robert Kimball & Associates, Inc. | September 2005 |
| Draft Remedial Action Report, Imperial Oil Off-Site Areas 1 & 2, Kimball & Associates | March 2006 |
| 100% Remedial Action Design Submittal, OU3, HDR | September 2008 |
| Final Remedial Action Report Submittal, OU3, HDR | March 2012 |
| Final Remedial Action Report, OU1 – Conomos Property | May 2013 |
| Supplemental OU1 Sampling and Investigation Report | September 2014 |
| EPA Groundwater Sampling Data | 2021-2024 |
| OU2 Record of Decision Amendment, EPA | September 2020 |
| 100% Remedial Design Report OU2, EPA | September 2021 |
| Final Remedial Action Work Plan OU2, EPA | April 2022 |
| Final Remedial Action Report OU2, EPA | September 2023 |

## APPENDIX B: Site COC Summary: OU2 Groundwater

**Table B-1:** Site COC Summary for OU2 Groundwater

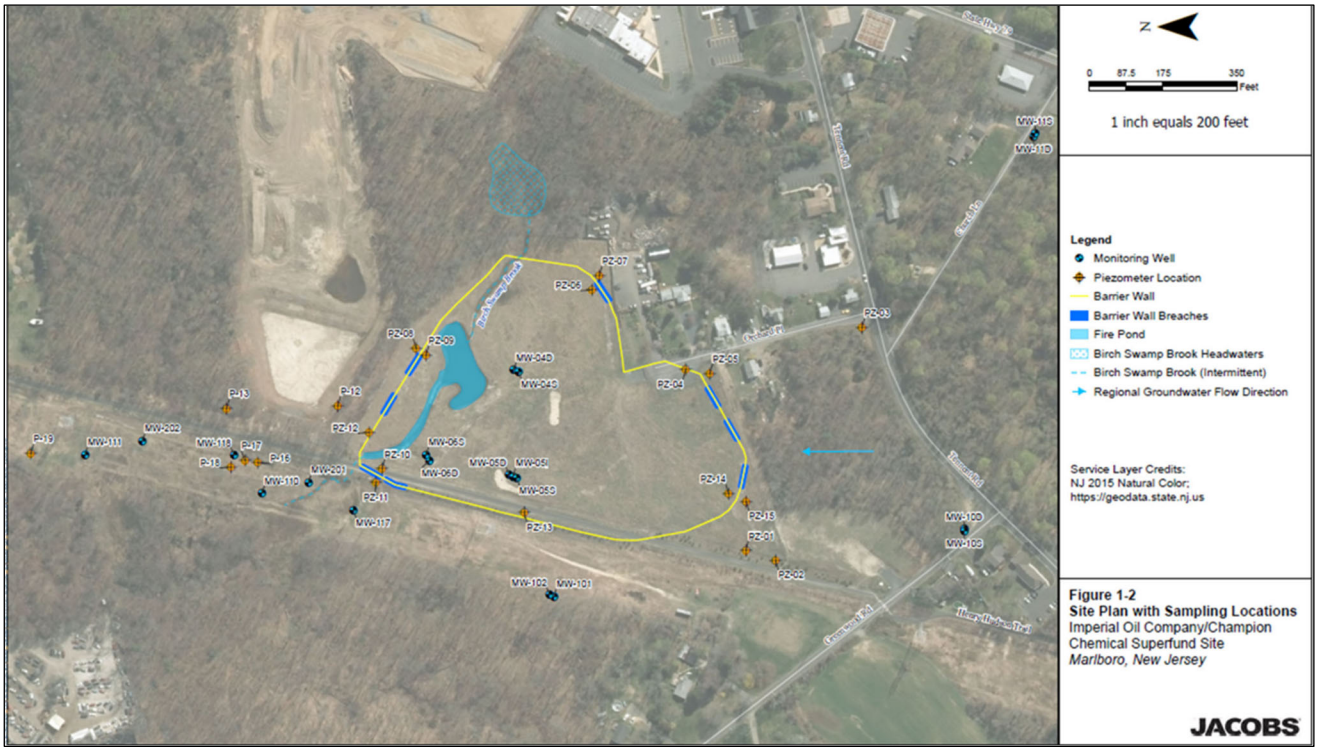
| COC | OU2 ROD Amendment RG (µg/L) | NJDEP GWQS (µg/L) | NJDEP MCL ./(µg/L) | USEPA VISL*** | Max Concentration 2021-2024 (µg/L) | Max Sample Date |
|---|---|---|---|---|---|---|
| Benzene | 1 | 1 | 1 | 140 | 2.74 | May 2024 |
| Trichloroethene | 1 | 1 | 1 | 5.2 | 5.45 | August 2021 |
| Arsenic | 8 | 3 | 5 | NA | 128 | October 2023 |
| Beryllium | 20 | 1 | 4 | NA | 14.7 | October 2023 |

***VISLs were calculated using a carcinogenic risk of $10^{-4}$ and a hazard index of 1.

## APPENDIX C: Figures

**Figure 1:** Site Location Map


**Figure 2:** Monitoring Well Locations



## APPENDIX D: Climate Change Analysis

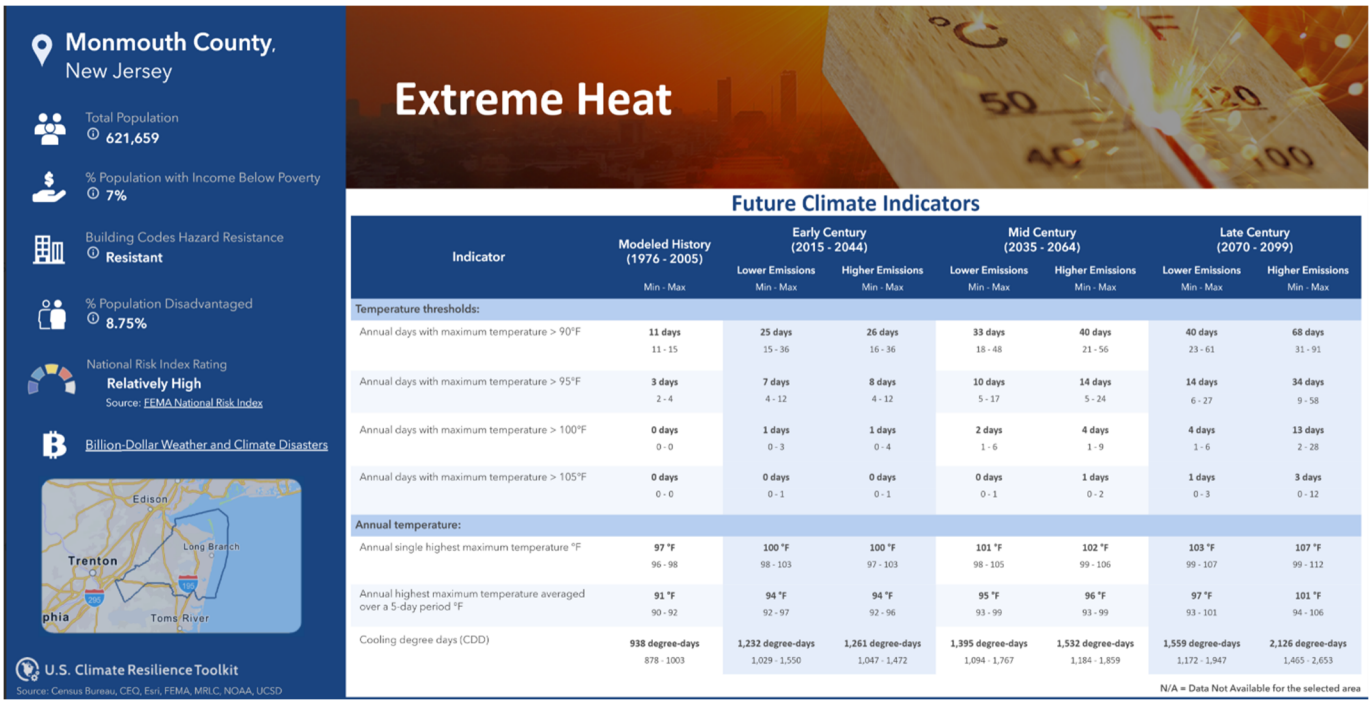
In accordance with the Region 2 Guidance for Incorporating Climate Change Considerations in the Five-Year Review process, two climate change tools were considered appropriate to assess the Imperial Oil Site. For the purpose of this analysis, the following address was used to screen the site: 48 Orchard Place, Morganville, NJ 07751. In addition, the remedies at OU1 and OU3 are complete. All the contamination has been removed and these areas no longer have any restriction on their use. Therefore, any climate changes will not have any effect on these remedies. As a result, this analysis focuses on OU2. Screenshots from each of the tools assessed are included below (Figures E-1 through E-7).

The first tool is the Temperature/Precipitation/Drought/Wildfire/Flooding–Climate Mapping for Resilience and Adaptation Sea Level Rise (CMRA) Run for Monmouth County in Marlboro Township, NJ. The second tool is called the *NOAA Sea Level Rise Viewer*. The CMRA Assessment Tool was used to examine five climate hazards for the county the Site falls within. According to this tool, the National Risk Index Rating for extreme heat is "Relatively High." The projected increase of days per year with maximum temperatures >100°F is shown in Figure E- 1. The risk for drought is relatively low (Figure E-2), for wildfire is relatively moderate (Figure E-3) for flooding is relatively moderate (Figure E-4) and for coastal inundation very high (Figure E-5). Even though the risk for coastal inundation within Monmouth County is very high, the NOAA Sea Level Rise Viewer shows that the site is not near the coast and will not be affected by a potential sea level rise of 10 feet (Figures E-6 and E-7).

OU2 addresses groundwater contamination. The remedy consists of MNA, which involves taking samples from the existing monitoring well network. All remaining contamination is underground and is, thus, unlikely to be significantly affected by storms, flood, drought, or fire. Currently, the sampling is performed by EPA personnel twice a year and during each event the condition of the Site is reported on.

Based on the information above, potential Site impacts from climate change have been assessed, and the performance of the OU2 remedy, MNA, is not currently at risk due to the expected effects of climate change in the region and near the Site.

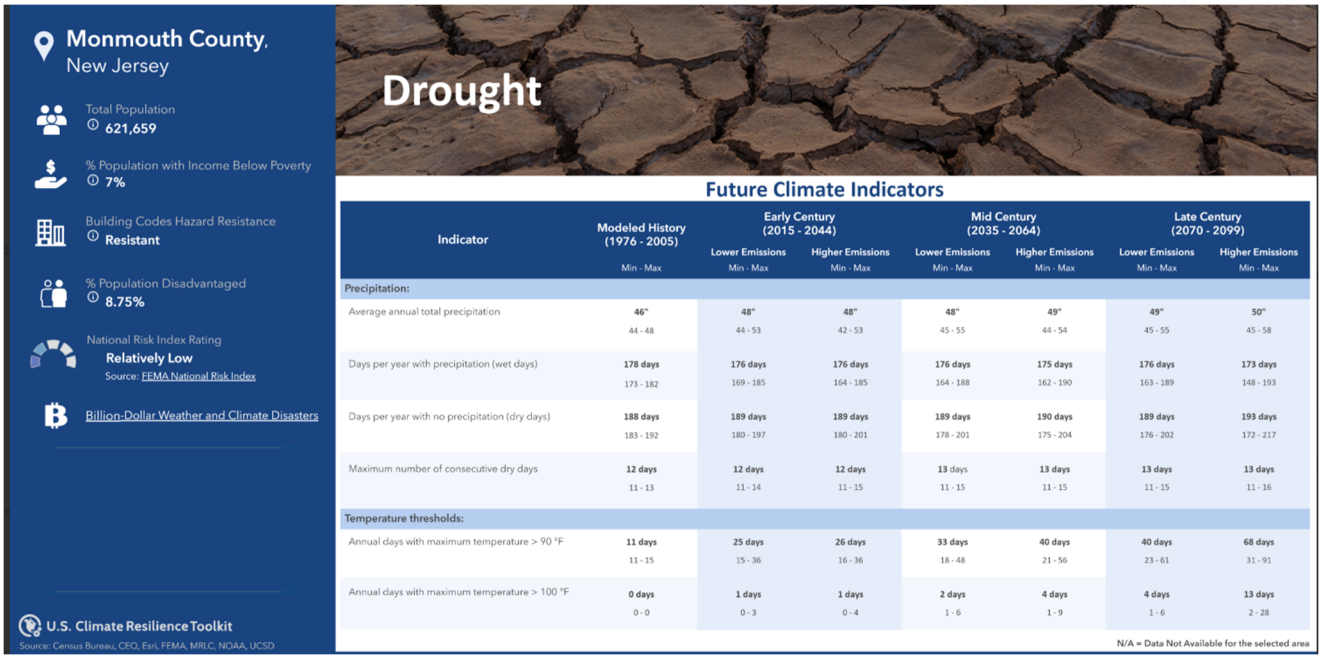
**Figure E-1: Extreme Heat**




| 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 | **11 days** 11 - 15 | **25 days** 15 - 36 | **26 days** 16 - 36 | **33 days** 18 - 48 | **40 days** 21 - 56 | **40 days** 23 - 61 | **68 days** 31 - 91 |
| Annual days with maximum temperature > 95°F | **3 days** 2 - 4 | **7 days** 4 - 12 | **8 days** 4 - 12 | **10 days** 5 - 17 | **14 days** 5 - 24 | **14 days** 6 - 27 | **34 days** 9 - 58 |
| Annual days with maximum temperature > 100°F | **0 days** 0 - 0 | **1 days** 0 - 3 | **1 days** 0 - 4 | **2 days** 1 - 6 | **4 days** 1 - 9 | **4 days** 1 - 6 | **13 days** 2 - 28 |
| Annual days with maximum temperature > 105°F | **0 days** 0 - 0 | **0 days** 0 - 1 | **0 days** 0 - 1 | **0 days** 0 - 1 | **1 days** 0 - 2 | **1 days** 0 - 3 | **3 days** 0 - 12 |
| **Annual temperature:** | | | | | | | |
| Annual single highest maximum temperature °F | **97 °F** 96 - 98 | **100 °F** 98 - 103 | **100 °F** 97 - 103 | **101 °F** 98 - 105 | **102 °F** 99 - 106 | **103 °F** 99 - 107 | **107 °F** 99 - 112 |
| Annual highest maximum temperature averaged over a 5-day period °F | **91 °F** 90 - 92 | **94 °F** 92 - 97 | **94 °F** 92 - 96 | **95 °F** 93 - 99 | **96 °F** 93 - 99 | **97 °F** 93 - 101 | **101 °F** 94 - 106 |
| Cooling degree days (CDD) | **938 degree-days** 878 - 1003 | **1,232 degree-days** 1,029 - 1,550 | **1,261 degree-days** 1,047 - 1,472 | **1,395 degree-days** 1,094 - 1,767 | **1,532 degree-days** 1,184 - 1,859 | **1,559 degree-days** 1,172 - 1,947 | **2,126 degree-days** 1,465 - 2,653 |

N/A = Data Not Available for the selected area

**Figure E-2: Drought**




| 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 | **46"** 44 - 48 | **48"** 44 - 53 | **48"** 42 - 53 | **48"** 45 - 55 | **49"** 44 - 54 | **49"** 45 - 55 | **50"** 45 - 58 |
| Days per year with precipitation (wet days) | **178 days** 173 - 182 | **176 days** 169 - 185 | **176 days** 164 - 185 | **176 days** 164 - 188 | **175 days** 162 - 190 | **176 days** 163 - 189 | **173 days** 148 - 193 |
| Days per year with no precipitation (dry days) | **188 days** 183 - 192 | **189 days** 180 - 197 | **189 days** 180 - 201 | **189 days** 178 - 201 | **190 days** 175 - 204 | **189 days** 176 - 202 | **193 days** 172 - 217 |
| Maximum number of consecutive dry days | **12 days** 11 - 13 | **12 days** 11 - 14 | **12 days** 11 - 15 | **13 days** 11 - 15 | **13 days** 11 - 15 | **13 days** 11 - 15 | **13 days** 11 - 16 |
| **Temperature thresholds:** | | | | | | | |
| Annual days with maximum temperature > 90 °F | **11 days** 11 - 15 | **25 days** 15 - 36 | **26 days** 16 - 36 | **33 days** 18 - 48 | **40 days** 21 - 56 | **40 days** 23 - 61 | **68 days** 31 - 91 |
| Annual days with maximum temperature > 100 °F | **0 days** 0 - 0 | **1 days** 0 - 3 | **1 days** 0 - 4 | **2 days** 1 - 6 | **4 days** 1 - 9 | **4 days** 1 - 6 | **13 days** 2 - 28 |

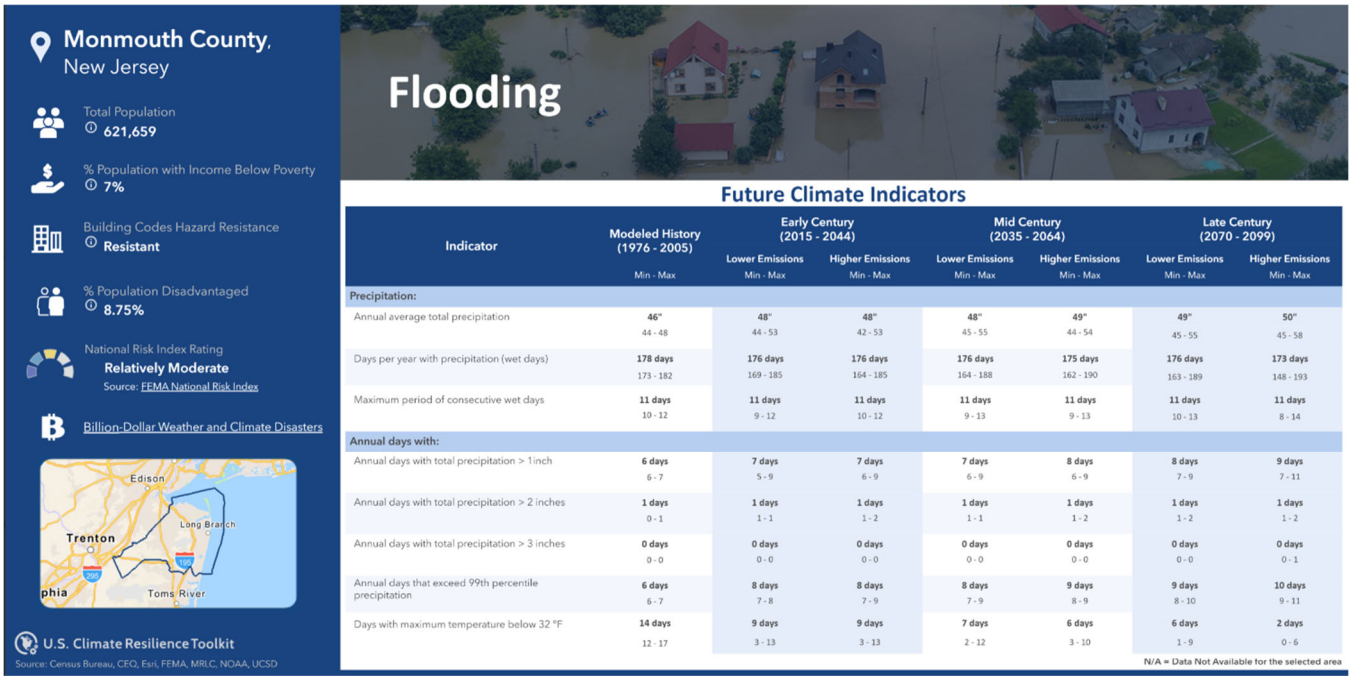
N/A = Data Not Available for the selected area

**Figure E-3: Wildfire**


| 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) | **188 days** 183 - 192 | **189 days** 180 - 197 | **189 days** 180 - 201 | **189 days** 178 - 201 | **190 days** 175 - 204 | **189 days** 176 - 202 | **193 days** 172 - 217 |
| Maximum number of consecutive dry days | **12 days** 11 - 13 | **12 days** 11 - 14 | **12 days** 11 - 15 | **13 days** 11 - 15 | **13 days** 11 - 15 | **13 days** 11 - 15 | **13 days** 11 - 16 |
| Days per year with precipitation (wet days) | **178 days** 173 - 182 | **176 days** 169 - 185 | **176 days** 164 - 185 | **176 days** 164 - 188 | **175 days** 162 - 190 | **176 days** 163 - 189 | **173 days** 148 - 193 |
| **Temperature thresholds:** | | | | | | | |
| Annual days with maximum temperature > 90°F | **11 days** 11 - 15 | **25 days** 15 - 36 | **26 days** 16 - 36 | **33 days** 18 - 48 | **40 days** 21 - 56 | **40 days** 23 - 61 | **68 days** 31 - 91 |
| Annual days with maximum temperature > 100°F | **0 days** 0 - 0 | **1 days** 0 - 3 | **1 days** 0 - 4 | **2 days** 1 - 6 | **4 days** 1 - 9 | **4 days** 1 - 6 | **13 days** 2 - 28 |

N/A = Data Not Available for the selected area

**Figure E-4: Flooding**




| 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 | **46"** 44 - 48 | **48"** 44 - 53 | **48"** 42 - 53 | **48"** 45 - 55 | **49"** 44 - 54 | **49"** 45 - 55 | **50"** 45 - 58 |
| Days per year with precipitation (wet days) | **178 days** 173 - 182 | **176 days** 169 - 185 | **176 days** 164 - 185 | **176 days** 164 - 188 | **175 days** 162 - 190 | **176 days** 163 - 189 | **173 days** 148 - 193 |
| Maximum period of consecutive wet days | **11 days** 10 - 12 | **11 days** 9 - 12 | **11 days** 10 - 12 | **11 days** 9 - 13 | **11 days** 9 - 13 | **11 days** 10 - 13 | **11 days** 8 - 14 |
| **Annual days with:** | | | | | | | |
| Annual days with total precipitation > 1 inch | **6 days** 6 - 7 | **7 days** 5 - 9 | **7 days** 6 - 9 | **7 days** 6 - 9 | **8 days** 6 - 9 | **8 days** 7 - 9 | **9 days** 7 - 11 |
| Annual days with total precipitation > 2 inches | **1 days** 0 - 1 | **1 days** 1 - 1 | **1 days** 1 - 2 | **1 days** 1 - 1 | **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 - 0 | **0 days** 0 - 0 | **0 days** 0 - 1 |
| Annual days that exceed 99th percentile precipitation | **6 days** 6 - 7 | **8 days** 7 - 8 | **8 days** 7 - 9 | **8 days** 7 - 9 | **9 days** 8 - 9 | **9 days** 8 - 10 | **10 days** 9 - 11 |
| Days with maximum temperature below 32 °F | **14 days** 12 - 17 | **9 days** 3 - 13 | **9 days** 3 - 13 | **7 days** 2 - 12 | **6 days** 3 - 10 | **6 days** 1 - 9 | **2 days** 0 - 6 |

N/A = Data Not Available for the selected area

**Figure E-5: Coastal Inundation**

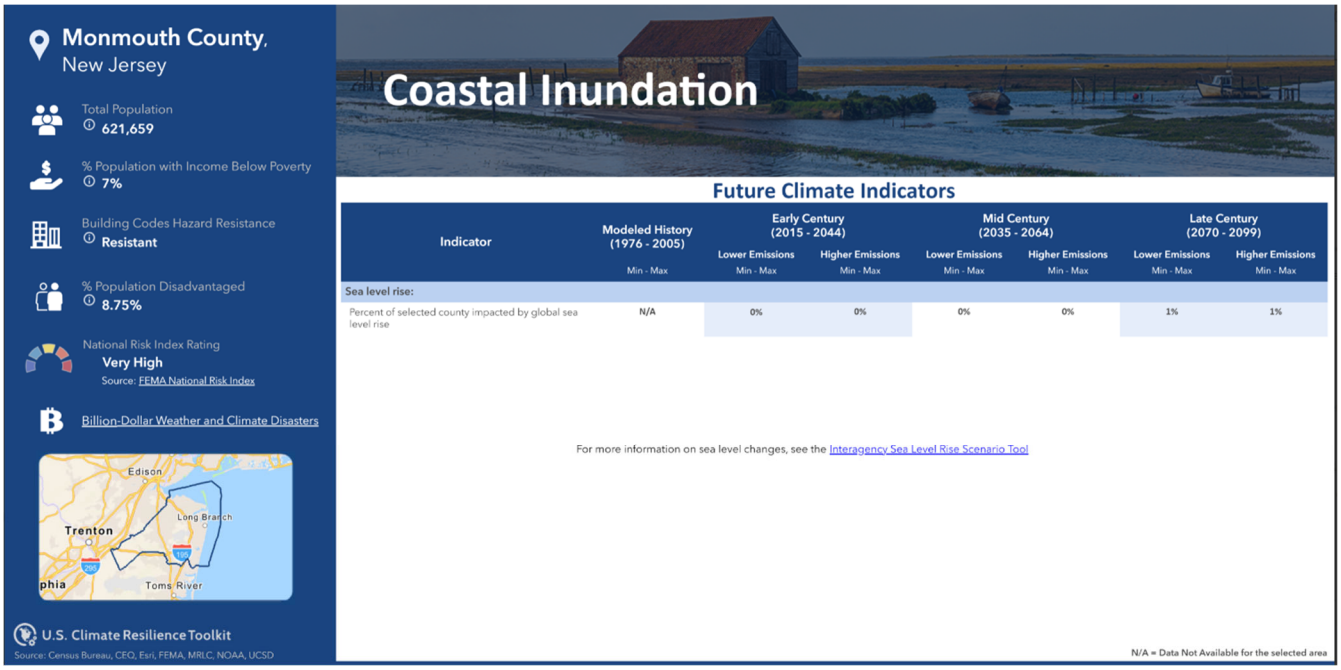



**Figure E-6: NOAA Baseline**

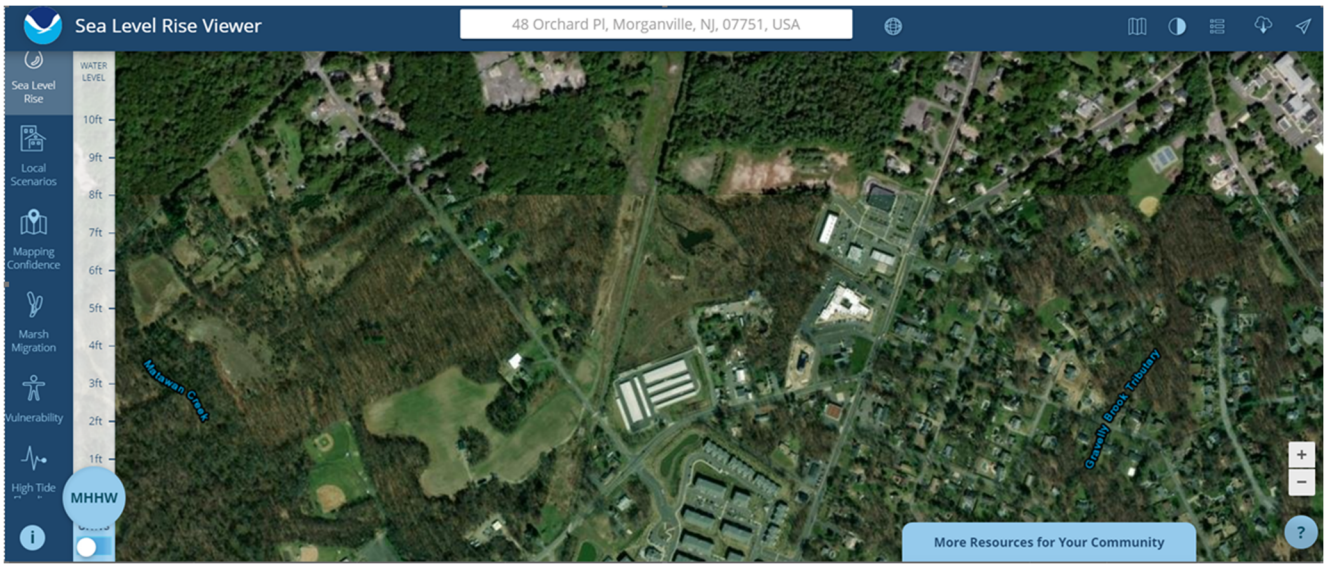


**Figure E-7: NOAA 10 Feet**