FIRST FIVE-YEAR REVIEW REPORT FOR COROZAL WELL SUPERFUND SITE COROZAL, PUERTO RICO

Prepared by

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

Pat Evangelista Digitally signed by Pat Evangelista Date: 2025.03.11 16:15:30 -04'00'

Pat Evangelista, Director
Superfund and Emergency Management Division

March 11, 2025

Date

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List of Abbreviations & Acronyms

ALTMPR	Annual Long-Term Monitoring Progress Report
BHHRA	Baseline Human Health Risk Assessment
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
COPC	Contaminant of Potential Concern
1,1-DCE	1,1-Dichloroethylene
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FYR	Five Year Review
GAC	Granular Activated Carbon
GES	Groundwater & Environmental Services, Inc.
HI	Hazard Indices
IC	Institutional Control
IDW	Investigation-Derived Waste
LTMP	Long-Term Monitoring Plan
LTRA	Long-Term Response Action
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
Nobis	Nobis Engineering, Inc. (dba Nobis Group)
NCP	National Contingency Plan
NPL	National Priorities List
OU	Operable Unit
PCE	Tetrachloroethylene
PDI	Pre-design Investigation
PRASA	Puerto Rico Aqueduct and Sewer Authority
PRDNER	Puerto Rico Department of Natural and Environmental Resources
PRDOH	Puerto Rico Department of Health
PRP	Potentially Responsible Party
RA	Remedial Action
RAO	Remedial Actions Objectives
RI	Remedial Investigation
RD	Remedial Design
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager

SAMP	Sampling, Analysis and Monitoring Plan
Site	Corozal Well Site
TCE	Trichloroethylene
TCL	Target Compound List
USGS	United States Geological Survey
µg/l	Micrograms per Liter
VOC	Volatile Organic Compounds

I. Introduction

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy 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 Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] Section 300.430(f)(4)(ii)) and considering EPA policy.

This is the first FYR for the Corozal Well Superfund Site (Site) located in Corozal, Puerto Rico. The triggering action for this policy review is that it has been five years since the remedial action (RA) task order was awarded.[1] The EPA identification number assigned to the site is PRN000206452.

The Site consists of one operable unit (OU) that will be addressed in this FYR. This OU addresses the selected remedy of monitored natural attenuation (MNA), monitoring of the Santana well, and institutional controls (ICs).

The Corozal Well Superfund Site FYR was led by Carlos J. Colombani, Remedial Project Manager (RPM), Hermes Chacon, RPM; Will Yeung, Hydrogeologist; and Charles Nace, Human Health and Ecological Risk Assessor. Only the community was notified of the initiation of the FYR since there is no potentially responsible party (PRP) at the Site. The review began on October 1, 2024.

Site Background

The Corozal Well site consists of a groundwater plume with no identified source(s) of contamination, located in the Barrio Palos Ward, Corozal, a rural residential community in the interior north-central of Puerto Rico. The site straddles the border between the municipalities of Corozal and Naranjito (See Appendix B, Figure 1 for a Site Map). The groundwater plume affected the community Santana Well, which is the sole source of drinking water for a rural community of more than 200 people. Other community supply wells are located approximately one mile of the plume.

Sampling at the site found that the chemical tetrachloroethylene (PCE) and its breakdown product trichloroethylene (TCE) was contaminating a well that supplies drinking water to local residents. After discovering the contamination in 2010, the Puerto Rico Department of Health (PRDOH) ordered the well to be closed, and in response, EPA provided temporary water supply to the affected residents. In March 2011, EPA reconfigured the Santana Well and the shallow

[1] Because no construction was required to implement the remedy, a preliminary closeout report, which is typically the trigger for policy FYRs, was not required. The initiation of the remedial action is therefore the trigger date for this FYR.

bedrock zone was sealed with grout. Also, EPA installed a granular activated carbon (GAC) treatment system on the well to remove contaminants. Since 2011, PCE concentrations in the raw water extracted from the Santana Well have decreased, and it is currently below the remediation goal and maximum contaminant level (MCL) of 5 micrograms per liter (µg/L).

The GAC system was discontinued and removed in September 2018, since the remediation goal for the Santana Well had been met. PCE has not been detected in either of the next nearest municipal wells, the Don Antonio (La Riviera) Well or the Nieves-Sanchez Well. The Nieves-Sanchez Well is upgradient of the Santana Well along an unnamed stream, and the Don Antonio Well is downgradient along an unnamed stream.

Appendix A, attached, summarizes the documents utilized to prepare this FYR. Appendices B and C include site figures and data, respectively. Appendix D includes an assessment of remedy resilience for the Site. For more details related to background, physical characteristics, geology/hydrogeology, land/resource use, and history related to the Site, please refer to https://www.epa.gov/superfund/corozal-well.

Five Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Corozal Well Superfund Site		
EPA ID: PRN000206452		
Region: 2	State: PR	City/County: Corozal
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	Has the site achieved construction completion? Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal or State Project Manager): Carlos J Colombani		
Author affiliation: EPA		
Review period: 10/01/2024 – 12/03/2024		
Date of site inspection: 11/07/2024		
Type of review: Policy		
Review number: 1		
Triggering action date: 03/31/2020		
Due date *(five years after triggering action date)*: 03/31/2025		

II. Response Action Summary

Basis for Taking Action

In November 2010, PCE was detected in the Santana well at levels exceeding the EPA MCL of 5 µg/L. In December 2010, February 2011, and March 2011, the Puerto Rico Environmental Quality Board (PREQB), now the Puerto Rico Department of Natural and Environmental Resources (PR DNER), and EPA collected groundwater, surface water, and soil samples from the Site for volatile organic compound (VOC) analysis. Analytical results indicated that PCE contamination at concentrations in groundwater exceeding the MCL were limited to the Santana well. PCE was also detected in surface water and porewater samples in an unnamed stream adjacent to the Santana well at concentrations up to 2.6 µg/L, and 33 µg/L, respectively.

In March 2011, the Santana well was reconfigured, and the saprolite/highly weathered bedrock zone was sealed with grout as it was considered a likely source of the PCE contamination in the well. EPA listed the Corozal Well Site on the National Priorities List (NPL) in March 2012. The Remedial Investigation/Feasibility Study (RI/FS) conducted in 2015 (CDM Smith 2015a) identified evidence pointing to a likely former source of PCE contamination near the upper reach of an intermittent stream that feeds the unnamed stream. PCE was identified in two soil samples from the same borehole located near a passive soil gas sample location that contained elevated PCE concentrations. However, the soil data did not identify a specific point of the release and the relatively low levels of PCE observed in the soil samples did not suggest a source that would cause a significant, ongoing impact to groundwater.

The RI concluded that the saprolite/highly weathered bedrock zone at the Site is an important migration pathway for site-related contamination. PCE concentrations significantly decreased after the saprolite/highly weather bedrock zone was sealed off in the Santana Well. Within the saprolite/highly weathered bedrock zone, transmissivity increases with depth as the saprolite transitions from rock fragments in a silty clay matrix to cobble-sized rock fragments in a sand/gravel matrix and eventually to fractured volcanic bedrock. However, during monitoring well drilling, the lower zone of the saprolite/highly weathered bedrock was unstable, making the installation of saprolite wells challenging and leaving a gap in the data from this zone.

Multiple lines of evidence indicated that the saprolite/highly weathered bedrock zone and the deeper bedrock fracture network are hydraulically connected between the Santana well and site monitoring wells. PCE was detected in all bedrock wells during the RI, with a maximum concentration of 27 µg/L during the Round 1 groundwater sampling event (June 2014). Trichloroethene (TCE) was detected in only two wells during the RI, with a maximum concentration of 8.9 µg/L during the Round 2 groundwater sampling event (February 2015).

The baseline human health risk assessment (BHHRA) evaluated potential risks to populations associated with both current and potential future land use. Exposure pathways were identified for each potentially exposed population and each potential exposure scenario for exposure to surface soil, subsurface soil, surface water, sediment, air, and groundwater. However, groundwater was the only media that contained contaminants above screening values. The exposure pathways associated with groundwater included future ingestion, dermal contact, and inhalation of vapors from residential use of untreated groundwater.

Cancer risks for these residents were found to slightly exceed the EPA's target range, mainly due to arsenic. However, arsenic is not considered a site-related contaminant, as its levels only marginally exceeded screening criteria in one monitoring well and were not detected elsewhere. Total non-cancer hazards were slightly above the EPA hazard index threshold of 1 for residents due to arsenic and TCE, but the hazards associated with specific target organs was below. PCE, a site-related contaminant, was determined not to be a significant risk driver. Like arsenic, TCE levels slightly exceeded screening criteria in isolated samples but were detected infrequently overall. Both PCE and TCE concentrations in groundwater, however, exceeded EPA's MCLs of 5 µg/L.

The BHHRA also determined that future residents could potentially be exposed to volatile chemicals, including PCE and TCE, through vapor intrusion into homes or vaporization into the air. Both chemicals exceeded screening criteria for vapor risks, highlighting the need for continued monitoring and assessment.

Response Actions

The basis for EPA's clean-up decision is documented in its September 29, 2015, Record of Decision (ROD) for the Site. The remedial action objectives for groundwater are:

- Prevent human exposure to PCE and TCE concentrations in groundwater above levels that are protective of drinking water.
- Restore the groundwater to drinking water quality.

The remediation goals are to achieve federal MCLs (5 ug/L for PCE and 5 ug/L for TCE).

The remedy selected in the 2015 ROD included the following major components:

- **Monitored Natural Attenuation (MNA):** Decreasing VOC contamination trends in the aquifer, documented since 2010, are expected to continue, such that drinking water standards will be met throughout the aquifer within a reasonable time frame, conservatively estimated at 15 years. MNA requires a robust monitoring program to demonstrate that the conditions supporting natural attenuation continue to be present, and that decreasing plume trends perpetuate. Monitoring will continue until concentrations have achieved the remediation goals.

- **Monitoring of the Santana well:** The Santana well will be monitored to assure that this municipal water supply is protected.

- **Institutional Controls:** Institutional controls will assure that areas of the plume above the remediation goals are not used for drinking water purposes.

Status of Implementation

The MNA component of the selected remedy required installation of a long-term monitoring well network and the development of a robust long-term monitoring program to demonstrate that the conditions supporting natural attenuation continue to be present at the Site. Pursuant to the ROD, a pre-design investigation was performed in 2018 to fill in data gaps in the monitoring well network. An additional three monitoring wells (MW-5, MW-6, and MW-7) were installed as a part of the PDI in the saprolite to complete the long-term monitoring well network. One round of groundwater sampling was performed at all on-site wells as a part of the PDI. The sampling concluded that there is contamination in the saprolite; however, detections of PCE were all below the remediation goal of 5 µg/L.

As indicated under the selected remedy, long-term monitoring is required at the Site until groundwater cleanup criteria are met. The objective of the long-term monitoring is to collect the necessary data points to ensure achievement of the groundwater cleanup criteria. As indicated in the long-term monitoring plan, all monitoring events consist of a general condition assessment, synoptic water level measurements, and groundwater sampling of all on-site monitoring wells. Additionally, porewater/surface water sampling of nine co-located sample locations from the unnamed stream was required to be performed annually for the first two (2) years of the monitoring period.

The first sampling event performed under the RA was conducted in May 2019 (RA Round 1). Additionally, six (6) rounds of long-term response action (LTRA) sampling were conducted on November 18 through 22, 2019 (LTRA Round 1), June 10 through 17, 2020 (LTRA Round 2), June 14 through 15, 2021 (LTRA Round 3), November 15 through 16, 2021 (LTRA Round 4), March 28 through 29, 2022 (LTRA Round 5) and March 13 through 14, 2023 (LTRA Round 6) in accordance with the USEPA approved Revised Final Long-Term Monitoring Plan (CDM Smith, 2019). The results of these seven (7) events are summarized in the Annual Long-Term Monitoring Progress Reports (ALTMPR) and ALTMPR (Nobis, 2021, 2022, 2023, and 2024). The data is also discussed under Section IV below.

Institutional Controls

Table 1: Summary of 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	Corozal Well Site	Prohibit groundwater use.	The commonwealth rules and regulations prohibit groundwater use from impacted groundwater without a permit.

Remedy Resilience

Potential impacts from severe weather have been assessed, and the site may be impacted by more frequent and severe hurricanes. The potential exists for future power outages as the frequency and magnitude of storm events are increasing. However, there is no active remedy at this site, only groundwater well monitoring. This well system will continue to be monitored at the site. Further details are included in Appendix D.

III. Progress Since Last Review

Since this is the first FYR, there are no recommendations, protectiveness determinations and statements to review and update their status.

IV. Five-Year Review Process

Community Notification, Involvement & Site Interviews

On August 7, 2024, the 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 Corozal Well Superfund Site. The announcement can be found at the following web address: https://www.epa.gov/superfund/R2-fiveyearreviews.

In addition to this notification, the EPA Community Involvement Coordinator, or CIC for the site, Brenda Reyes, posted a public notice on the EPA site webpage. **https://www.epa.gov/superfund/corozal-well** and provided the notice to the town's mayor, Honorable Luis A. García Rolón, by email on February 20,2025 with a request that the notice be posted in municipal offices and on the village/town webpages. This notice indicated that a FYR would be conducted at the Corozal Well Superfund 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/ies: Corozal City Hall. In addition, the final report will be posted on the following website: https://www.epa.gov/superfund/corozal-well. Efforts will be made to reach out to local public officials to inform them of the results.

Data Review

Groundwater

Groundwater data has been collected for the Corozal Well Superfund Site from 2019 through 2024. Thirteen monitoring wells were sampled during each sampling event throughout this review period. Monitoring wells screened within bedrock include MW-1S, MW-1D, MW-2S, MW-2D, MW-3S, MW-3D, MW-4S, MW-4D, and Santana Well. Monitoring wells screened within the saprolite zone include MW-5, MW-6, MW-7, and PZ-1.

Monitoring wells screened within the bedrock zone have exhibited a decreasing trend of PCE and TCE during this review period. PCE concentrations were non-detect for all sampling events for MW-1D and MW-1S. PCE concentrations at MW-2S have been detected but were below the remediation goal during the 2019, 2020, and 2021 sampling events, with non-detectable levels during the 2022, 2023, and 2024 sampling events. MW-4S and MW-4D consistently had decreasing concentrations of PCE and TCE detected throughout the review period but below the remediation goal. PCE was not detected in MW-4D in March 2024. Within the Santana Well, PCE concentrations were detected during all sampling events from 2019 – 2022 but were below the remediation goal. PCE concentrations were non-detect for the 2023 and 2024

sampling events. The declining trends described above can be observed by the Mann-Kendall graphs provided in Appendix B. The highest levels of PCE and TCE detected during this review period were from MW-4D at concentrations of 1.8 µg/L (detected in May 2019) and 3.1 µg/L (detected in June 2020), respectively. Concentrations of TCE have been non-detect in all other monitoring wells.

Monitoring wells screened within the saprolite zone have also shown a decreasing trend of PCE and TCE during this review period. MW-5 and MW-6 regularly had concentrations of PCE detected throughout the review period but at levels below the remediation goal. Concentrations of PCE for MW-7 have been mostly non-detect except for the June 2020 sampling event where PCE was detected but still below the remediation goal with a concentration of 0.15 µg/L. Concentrations of PCE for PZ-1 below the remediation goal were detected in 2019, 2020, 2021, 2022, and 2023 and were non-detect in 2023 and 2024. These trends can also be viewed by the Mann-Kendall graphs in Appendix B. The highest concentration of PCE detected was 1.4 µg/L at MW-5 (detected in May 2019). Concentrations of TCE have been non-detect for all monitoring wells screened within the saprolite zone during this review period. Tables of PCE and TCE concentrations for all monitoring wells sampled during this review period can be found in Appendix C.

Additional analysis of PCE, cis-1,2-dichloroethene, and TCE were performed using the EPA Groundwater Statistical Tool for the samples collecting during this review period. The analysis focused on MW-2S, MW-4D, MW-4S, MW-5, MW-6, Pozo Santana, and PZ-1 since these monitoring wells have had four or more detectable concentrations for the tool to function. Concentrations of 1,1-dichloroethene and vinyl chloride could not be further assessed as each well did not have at least four detectable concentrations. However, all detectable concentrations of 1,1-dichloroethene and vinyl chloride were below their respective remediation goals. The tool confirmed that the concentrations for each of these compounds have followed decreasing trends except for MW-2S, which exhibited no trend for PCE. Nevertheless, all PCE detections were below the remediation goal with the highest concentration being 0.59 ug/L during this review period. The tool further confirmed that all compounds detected during this review period, including their 95% upper confidence limits (UCLs), have been below their respective remediation goals. As such, cleanup levels have been achieved.

Porewater and Surface Water

Per the long-term monitoring program, porewater and surface water samples were collected over 3 sampling events between 2019 and 2021. Nine porewater locations were sampled during these events and the concentrations of PCE and TCE were primarily non-detect. PCE was detected at location WP-06 (0.31 µg/L) and at WP-04 (0.19 µg/L) during the 2020 and 2021 sampling events, respectively; however, these concentrations were below remediation goal of 5 µg/L. TCE was not detected at any location. PCE and TCE were not detected in any of the surface water samples collected. As a result, porewater and surface water samples are no longer collected as part of long-term monitoring.

Overall, the data shows that the concentrations of PCE and TCE across all monitoring well, porewater, and surface water sampling locations are consistently below the remediation goal of 5 µg/L.

Site Inspection

A site inspection was conducted on November 7, 2024, as part of this FYR. In attendance were Carlos J Colombani, RPM, Hermes Chacon, RPM, and Carlos Huertas, On-Scene Coordinator. The purpose of the inspection was to assess the protectiveness of the remedy. During the Site visit, the groundwater monitoring wells and the Santana Well were observed to be in good condition. Institutional controls have also been effective in preventing any groundwater use. Therefore, no issues were observed.

V. Technical Assessment

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

The remedy included MNA, long-term monitoring and ICs. The primary goal for remediation is to reduce the concentrations of PCE and TCE below their respective MCLs (5 µg/L). Since the last FYR, groundwater sampling was conducted in 2019, 2020, 2021, 2022, 2023, and 2024 (with a total of 8 sampling rounds during this review period). Groundwater sampling data throughout this review period and additional statistical analysis (as described under Data Review) have indicated that PCE, TCE, cis-1,2-dichloroethene, 1,1-dichloroethene, and vinyl chloride have all been below their remediation goals at wells MW-2S, MW-4D, MW-4S, MW-5, MW-6, Pozo Santana, and PZ-1 with consistently decreasing or stable trends.

Additionally, PCE and TCE concentrations at both porewater and surface water sampling locations within the stream transecting the site were predominately non-detect. All PCE concentrations detected in porewater were below the remediation goal of 5 µg/L. Thus, sampling of these media has been discontinued.

Since EPA has achieved cleanup levels for soil, groundwater, and surface water, FYRs are no longer required for this site.

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?

Human Health Risk Assessment

The toxicity data, exposure assumptions, pathways, and receptors that were used to estimate the potential risks and hazards to human health followed the standard risk Baseline Human Health Risk Assessment (HHRA) and are still valid. There have some minor changes in the toxicity data and exposure assumptions, however, these changes would not have changed the remedial decision for the site. As indicated in the data summary section, the concentration of

site-related contamination in the groundwater is below the cleanup values chosen for the site. As indicated in the ROD, commonwealth regulations prevent the installation of groundwater extraction wells without government approval. Additionally, at current concentrations, vapor intrusion would not be a concern. The groundwater cleanup values identified, and standards, as well as the RAOs are still valid.

Ecological Risk Assessment
A screening-level ecological risk assessment (SLERA) was conducted to evaluate the potential for ecological risks from the presence contaminants in soil, sediment, surface water and porewater. The SLERA focused on evaluating the potential for impacts to sensitive ecological receptors to site-related constituents of concern through exposure to soil, sediment, surface water and porewater on the Corozal Well site. Concentrations in the media listed above were compared to ecological screening values as an indicator of the potential for adverse effects to ecological receptors.

The evaluation indicated that there was not a potential for adverse effects to ecological receptors (invertebrates, reptiles, amphibians, birds, and mammals) from exposure to contaminated soil, sediment, surface water or porewater. Comparison of the site related data to screening values, for all chemicals in all media, were below the acceptable hazard index of 1. Therefore, there were no chemicals of concern (COCs) identified for ecological receptors.

Given that there were no unacceptable ecological risks, the RAOs were not based on ecological concerns. The steps of the ecological evaluation, which included toxicity values, exposure parameters, pathways and receptors, as well as the conclusions of the evaluation remain valid. Thus, RAOs used at the time of the remedy selection are still valid and protective of the human health and the environment.

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 would call into question the protectiveness of the remedy.

VI. Issues/Recommendations

As can be seen in Table 2, below, there are no recommendations or follow-up actions for this FYR.

Table 2: Issues and Recommendations

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU1

VII. Protectiveness Statement

Table 3: Protectiveness Statements

Protectiveness Statement(s)	
Operable Unit: 1	*Protectiveness Determination:* Protective
Protectiveness Statement: The implemented actions at the Corozal Well site are protective of human health and the environment.	

Sitewide Protectiveness Statement (if applicable)
Protectiveness Determination: Protective
Protectiveness Statement: The implemented actions at the Corozal Well site are protective of human health and the environment.

VIII. Next Review

Based on the lines of evidence discussed earlier, the cleanup has achieved all RAOs identified and achieves unlimited use and unrestricted exposure (UU/UE). Hence, this will be the final FYR for the Corozal Well site.

Appendix A: References

Documents, Data, and Information Reviewed in Completing the Five-Year Review

Document	Date(s)
Remedial Investigation Report	July 2015
Remedial Feasibility Report	July 2015
Record of Decision for the Fibers Public Supply Wells Site, EPA	September 2015
Long-Term Monitoring Plan	September 2018
Work Plan, Volume I	January 2019
First Annual Long-Term 2021 Monitoring Progress Report	September 2023
Second Annual Long-Term 2022 Monitoring Progress Report	July 2024
Third Annual Long-Term 2023 Monitoring Progress Report	September 2023
Fourth Annual Long-Term 2024 Monitoring Progress Report	July 2024

Appendix B: Figures

Figure 1: Site Map

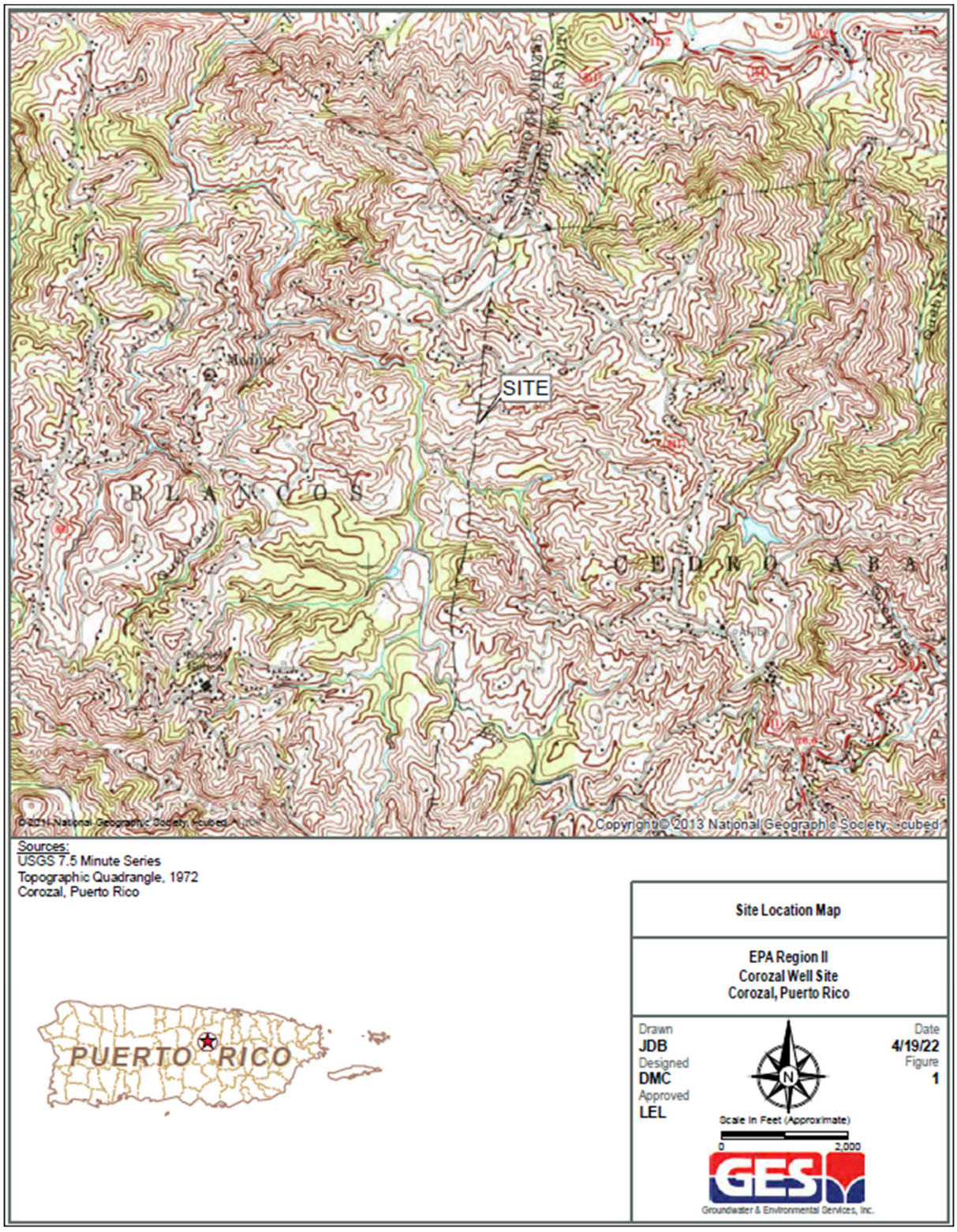


Figure 2: Long-Term Monitoring Plan Sampling Network

Figure 3: MW-2S PCE

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	25-Jun-24	Job ID:	Nobis
Facility Name:	Corozal Well Superfund	Constituent:	PCE
Conducted By:	Ginger Stewart	Concentration Units:	ug/L
Sampling Point ID:	MW-2S		

Sampling Event	Sampling Date	PCE CONCENTRATION (ug/L)	
1	22-May-19	0.53	
2	20-Nov-19	0.39	
3	15-Jun-20	0.49	
4	15-Jun-21	0.55	
5	16-Nov-21	0.59	
6	28-Mar-22	0.05	ND
7	14-Mar-23	0.05	ND
8	20-Mar-24	0.05	ND
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			NO TREND
Coefficient of Variation:		0.73	
Mann-Kendall Statistic (S):		-9	
Confidence Factor:		83.2%	
Concentration Trend:		Stable	

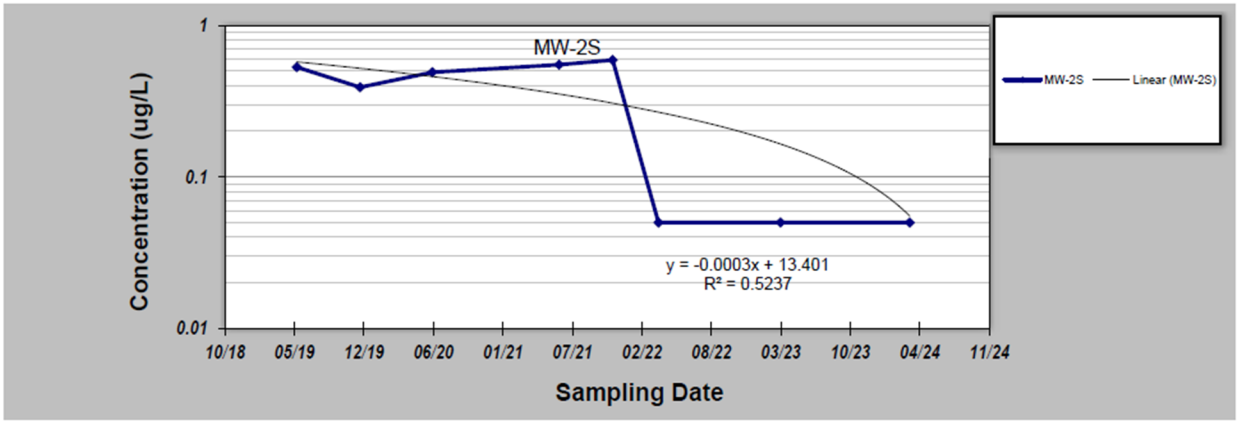


Figure 4: MW-4D PCE

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	25-Jun-24	Job ID:	Nobis
Facility Name:	Corozal Well Superfund	Constituent:	PCE
Conducted By:	Ginger Stewart	Concentration Units:	ug/L
Sampling Point ID:	MW-4D		

Sampling Event	Sampling Date	PCE CONCENTRATION (ug/L)						
1	22-May-19	1.8						
2	20-Nov-19	1.6						
3	12-Jun-20	1.5						
4	15-Jun-21	0.74						
5	15-Nov-21	0.79						
6	28-Mar-22	0.62						
7	14-Mar-23	0.62						
8	20-Mar-24	0.05	ND					
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.62						
Mann-Kendall Statistic (S):		-25						
Confidence Factor:		100.0%						
Concentration Trend:		Decreasing						

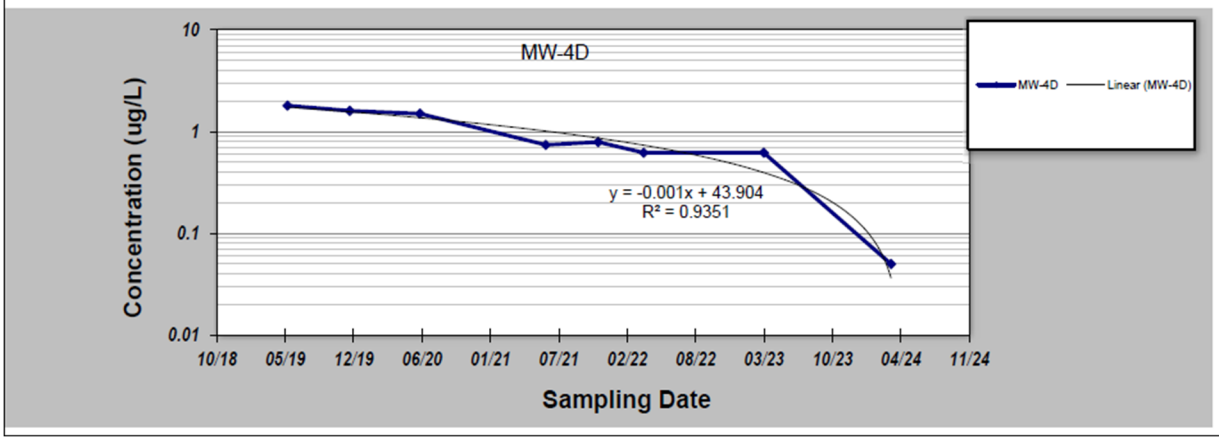


Figure 5: MW-4D TCE

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	25-Jun-24	Job ID:	Nobis
Facility Name:	Corozal Well Superfund	Constituent:	TCE
Conducted By:	Ginger Stewart	Concentration Units:	ug/L
Sampling Point ID:	MW-4D		

Sampling Event	Sampling Date	TCE CONCENTRATION (ug/L)
1	22-May-19	2.9
2	20-Nov-19	2.9
3	12-Jun-20	3.1
4	15-Jun-21	2
5	15-Nov-21	2.2
6	28-Mar-22	2
7	14-Mar-23	2.32
8	20-Mar-24	1.81
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
Coefficient of Variation:		0.21
Mann-Kendall Statistic (S):		-14
Confidence Factor:		94.6%
Concentration Trend:		Prob. Decreasing

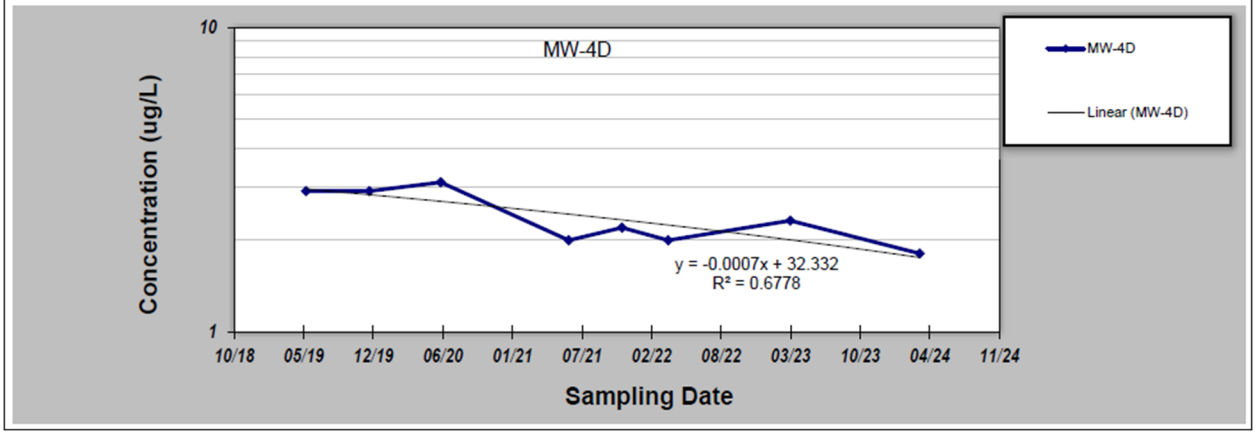


Figure 6: MW-4S PCE

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	25-Jun-24	Job ID:	Nobis
Facility Name:	Corozal Well Superfund	Constituent:	PCE
Conducted By:	Ginger Stewart	Concentration Units:	ug/L
Sampling Point ID:	MW-4S		

Sampling Event	Sampling Date	PCE CONCENTRATION (ug/L)	
1	22-May-19	1.1	
2	20-Nov-19	1.6	
3	12-Jun-20	1.3	
4	15-Jun-21	0.31	
5	16-Nov-21	0.49	
6	28-Mar-22	0.46	
7	14-Mar-23	0.05	ND
8	20-Mar-24	0.55	
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			NO TREND
Coefficient of Variation:		0.73	
Mann-Kendall Statistic (S):		-12	
Confidence Factor:		91.1%	
Concentration Trend:		Prob. Decreasing	

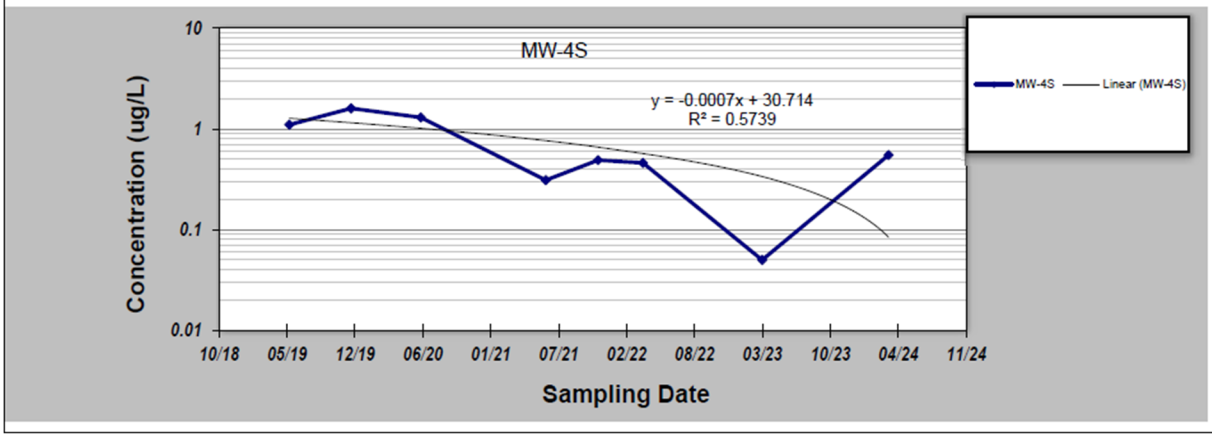


Figure 7: MW-5 PCE

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	25-Jun-24	Job ID:	Nobis
Facility Name:	Corozal Well Superfund	Constituent:	PCE
Conducted By:	Ginger Stewart	Concentration Units:	ug/L
Sampling Point ID:	MW-5		

Sampling Event	Sampling Date	PCE CONCENTRATION (ug/L)						
1	22-May-19	1.4						
2	20-Nov-19	1.3						
3	15-Jun-20	0.66						
4	15-Jun-21	0.62						
5	16-Nov-21	0.47						
6	28-Mar-22	0.05	ND					
7	14-Mar-23	0.05	ND					
8	20-Mar-24	0.05	ND					
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.94						
Mann-Kendall Statistic (S):		-25						
Confidence Factor:		100.0%						
Concentration Trend:		Decreasing						

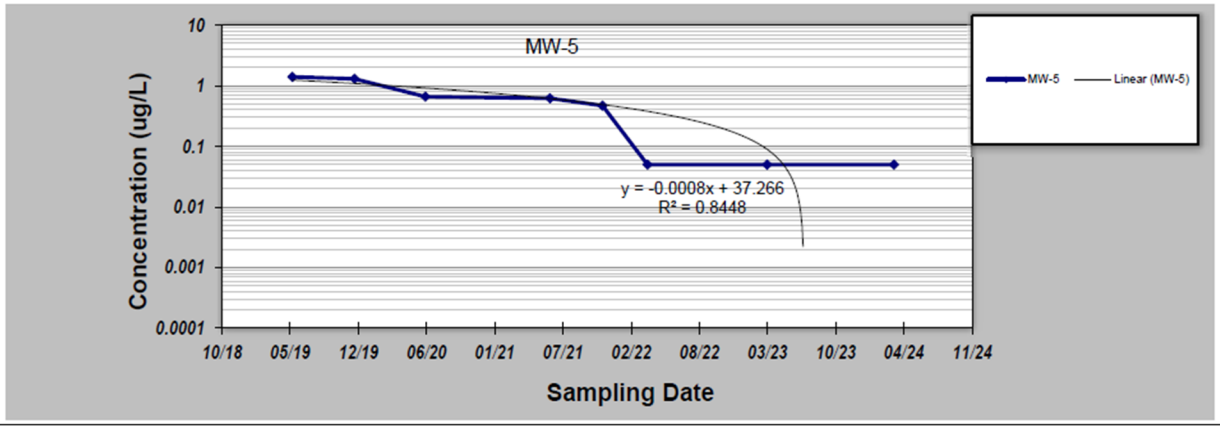


Figure 8: MW-6 PCE

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	9-May-24	Job ID:	Nobis
Facility Name:	Corozal Well Superfund	Constituent:	PCE
Conducted By:	Ginger Stewart	Concentration Units:	ug/L
Sampling Point ID:	MW-6		

Sampling Event	Sampling Date	PCE CONCENTRATION (ug/L)	
1	21-May-19	0.3	
2	19-Nov-19	0.43	
3	16-Jun-20	0.089	ND
4	14-Jun-21	0.095	
5	15-Nov-21	0.09	
6	29-Mar-22	0.05	ND
7	13-Mar-23	0.05	ND
8	19-Mar-24	0.05	ND
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
Coefficient of Variation:		0.98	
Mann-Kendall Statistic (S):		-19	
Confidence Factor:		98.9%	
Concentration Trend:		Decreasing	

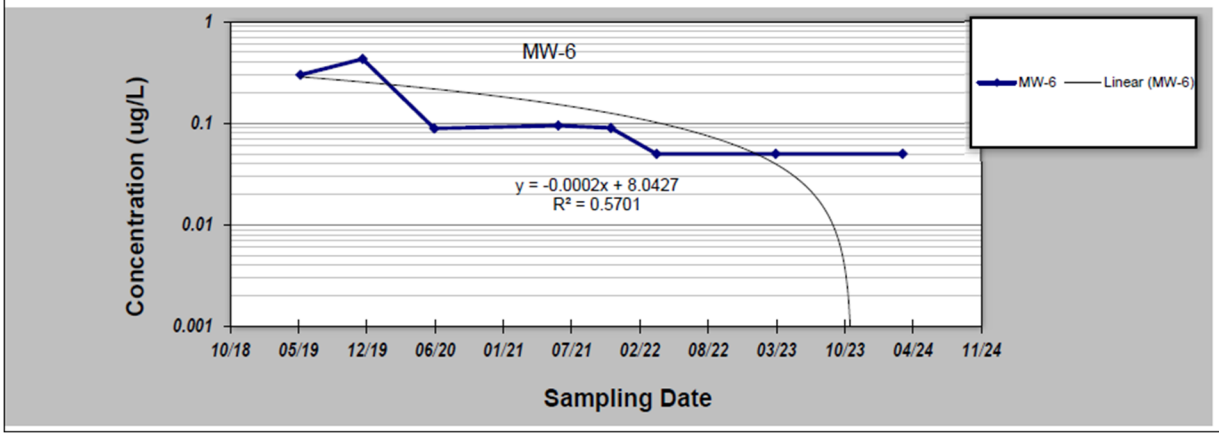


Figure 9: Santana Well PCE

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	9-May-24	Job ID:	Nobis
Facility Name:	Corozal Well Superfund	Constituent:	PCE
Conducted By:	Ginger Stewart	Concentration Units:	ug/L
Sampling Point ID:	SANTANA WELL		

Sampling Event	Sampling Date	PCE CONCENTRATION (ug/L)						
1	21-May-19	0.29						
2	19-Nov-19	0.39						
3	11-Jun-20	0.24						
4	14-Jun-21	0.31						
5	15-Nov-21	0.14						
6	28-Mar-22	0.33						
7	13-Mar-23	0.05	ND					
8	19-Mar-24	0.05	ND					
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Coefficient of Variation:		0.58						
Mann-Kendall Statistic (S):		-13						
Confidence Factor:		92.9%						
Concentration Trend:		Prob. Decreasing						

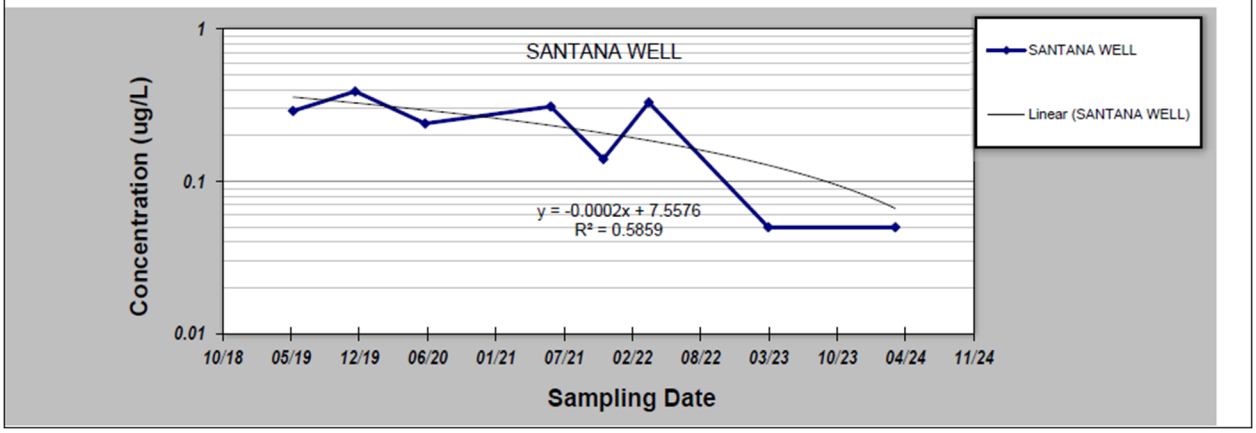
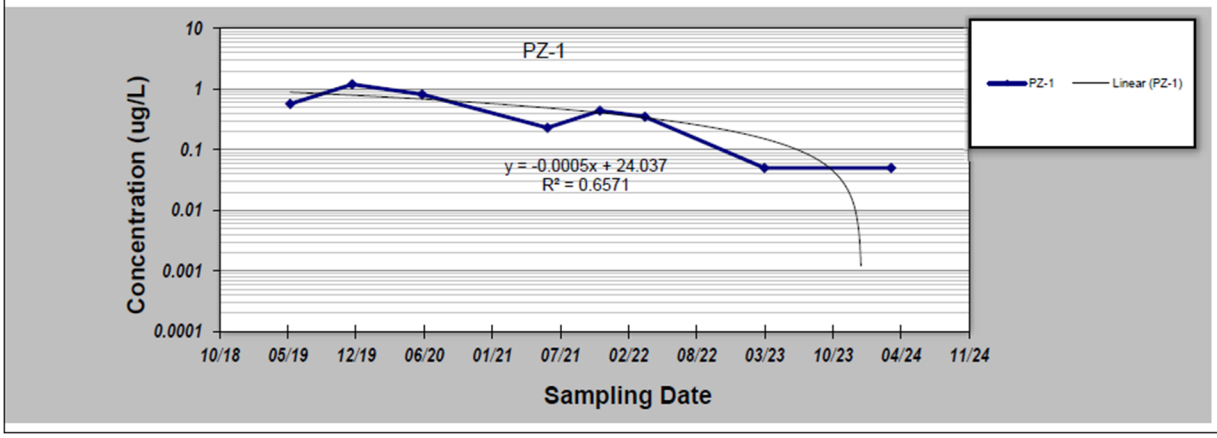


Figure 10: PZ-1 PCE

GSI MANN-KENDALL TOOLKIT
for Constituent Trend Analysis

Evaluation Date:	17-May-24	Job ID:	Nobis
Facility Name:	Corozal Well Superfund	Constituent:	PCE
Conducted By:	Ginger Stewart	Concentration Units:	ug/L
Sampling Point ID:	PZ-1		

Sampling Event	Sampling Date	PCE CONCENTRATION (ug/L)	
1	22-May-19	0.57	
2	20-Nov-19	1.2	
3	12-Jun-20	0.82	
4	15-Jun-21	0.23	
5	16-Nov-21	0.44	
6	28-Mar-22	0.35	
7	14-Mar-23	0.05	ND
8	20-Mar-24	0.05	ND
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
Coefficient of Variation:		0.85	
Mann-Kendall Statistic (S):		-19	
Confidence Factor:		98.9%	
Concentration Trend:		Decreasing	



Appendix C: TCE and PCE Concentrations from Groundwater Samples

MW-1D

Chemical	05/21/2019	11/19/2019	6/15/2020	6/14/2021	11/15/2021	3/29/2022	3/14/2023	3/20/2024
PCE	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TCE	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

U – the analyte was not detected at or above the reporting limit
J – the identification of the analyte is acceptable; the reported value is an estimate

MW-1S

Chemical	05/21/2019	11/19/2019	6/15/2020	6/14/2021	11/15/2021	3/29/2022	3/14/2023	3/20/2024
PCE	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TCE	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

U – the analyte was not detected at or above the reporting limit
J – the identification of the analyte is acceptable; the reported value is an estimate

MW-2D

Chemical	05/22/2019	11/20/2019	6/15/2020	6/15/2021	11/16/2021	3/28/2022	3/14/2023	3/20/2024
PCE	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TCE	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

U – the analyte was not detected at or above the reporting limit
J – the identification of the analyte is acceptable; the reported value is an estimate

MW-2S (See Appendix B, Figure 3 for trend analysis graph)

Chemical	05/22/2019	11/20/2019	6/15/2020	6/15/2021	11/16/2021	3/28/2022	3/14/2023	3/20/2024
PCE	***0.53***	0.39 J	0.49 J	***0.55***	0.5	***0.59*** U	0.5 U	0.5 U
TCE	0.5 U	0.5 U	0.5 UJ	0.5 UJ-	0.5 U	0.5 U	0.5 U	0.5 U

U – the analyte was not detected at or above the reporting limit
J – the identification of the analyte is acceptable; the reported value is an estimate

J- – estimated but biased low

MW-3D

Chemical	05/23/2019	11/21/2019	6/16/2020	6/14/2021	11/15/2021	3/29/2022	3/13/2023	3/19/2024
PCE	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TCE	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

U – the analyte was not detected at or above the reporting limit
J – the identification of the analyte is acceptable; the reported value is an estimate

MW-3S

Chemical	05/23/2019	11/21/2019	6/16/2020	6/14/2021	11/15/2021	3/29/2022	3/13/2023	3/19/2024
PCE	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
TCE	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

U – the analyte was not detected at or above the reporting limit
J – the identification of the analyte is acceptable; the reported value is an estimate

MW-4D (See Appendix B, Figures 4 and 5 for trend analysis graph)

Chemical	05/22/2019	11/20/2019	6/12/2020	6/14/2021	11/16/2021	3/28/2022	3/14/2023	3/20/2024
PCE	***1.8***	***1.6***	***1.5***	***0.7*** J-	***0.79***	***0.62***	***0.620***	0.5 U
TCE	***2.9***	***2.9***	***3.1***	***2.0*** J-	***2.2***	***2.0***	***2.32***	***1.81***

U – the analyte was not detected at or above the reporting limit
J- – estimated but biased low

MW-4S (See Appendix B, Figure 6 for trend analysis graph)

Chemical	05/22/2019	11/20/2019	6/12/2020	6/15/2021	11/16/2021	3/28/2022	3/14/2023	3/20/2024
PCE	***1.1***	***1.6***	***1.6***	0.31 J	0.49 J-	0.46 J	0.5 U	***0.550***
TCE	0.5 U	0.5 U	0.5 U	0.5 UJ-	0.5 UJ	0.5 U	0.5 U	0.5 U

U – the analyte was not detected at or above the reporting limit
J – the identification of the analyte is acceptable; the reported value is an estimate
J- – estimated but biased low

MW-5 (See Appendix B, Figure 7 for trend analysis graph)

Chemical	05/22/2019	11/20/2019	6/15/2020	6/15/2021	11/16/2021	3/28/2022	3/14/2023	3/20/2024
PCE	***1.4***	***1.3***	***0.66*** J	***0.6*** J	0.47 J	0.5	0.5 U	0.5 U
TCE	0.5 U	0.5 U	0.5 UJ	0.5 UJ-	0.5 U	0.5 U	0.5 U	0.5 U

U – the analyte was not detected at or above the reporting limit
J – the identification of the analyte is acceptable; the reported value is an estimate
J- – estimated but biased low

MW-6 (See Appendix B, Figure 8 for trend analysis graph)

Chemical	05/21/2019	11/19/2019	6/16/2020	6/14/2021	11/15/2021	3/29/2022	3/13/2023	3/19/2024
PCE	0.3 J	0.43 J	0.5 UJ	0.095 J	0.09 J	0.5 U	0.5 U	0.5 U
TCE	0.5 U	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

U – the analyte was not detected at or above the reporting limit

J – the identification of the analyte is acceptable; the reported value is an estimate

MW-7

Chemical	11/21/2019	06/16/2020	03/29/2022	03/13/2023	03/19/2024
PCE	0.5 U	0.15 J	0.5 U	0.5 U	0.5 U
TCE	0.5 U	0.5 UJ	0.5 U	0.5 U	0.5 U

U – the analyte was not detected at or above the reporting limit
J – the identification of the analyte is acceptable; the reported value is an estimate

Santana Well (See Appendix B, Figure 9 for trend analysis graph)

Chemical	05/21/2019	11/19/2019	6/11/2020	6/14/2021	11/15/2021	3/28/2022	3/13/2023	3/19/2024
PCE	0.29 J	0.39 J	0.24 J	0.31 J	0.14 J	0.33 J	0.5 U	0.5 U
TCE	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

U – the analyte was not detected at or above the reporting limit
J – the identification of the analyte is acceptable; the reported value is an estimate

PZ-1 (See Appendix B, Figure 10 for trend analysis graph)

Chemical	05/22/2019	11/20/2019	6/12/2020	6/15/2021	11/16/2021	3/28/2022	3/14/2023	3/20/2024
PCE	***0.57***	***1.2***	***0.82***	0.23 J	0.44 J	0.35 J	0.5 U	0.5 U
TCE	0.5 U	0.5 U	0.5 U	0.5 UJ-	0.5 U	0.5 U	0.5 U	0.5 U

U – the analyte was not detected at or above the reporting limit
J – the identification of the analyte is acceptable; the reported value is an estimate
J- – estimated but biased low

Many samples show 'U', indicating that the analyte was not detected at or above the reporting limit.

Values marked with 'J' indicate estimates that are accepted but can be biased low. This suggests caution in interpreting these values, particularly those that are close to the detection limit.

Appendix D: Remedy Resilience Assessment

In line with regional practice, three tools were utilized to assess the Corozal Well Superfund site. Screenshots from each of the tools assessed are included here.

The first tool used to assess the site was the *CMRA Assessment Tool*. The tool examined five hazards for the county the site falls within. As shown by Figures D-1 (Flooding) and D-2 (Drought), the annual average total precipitation over the next 75 years is expected to fluctuate between 20 and 24 inches, while the annual days with total precipitation > 1 inch are expected to stay within the 1-day timeframe. The other three hazards examined were wildfire, extreme heat, and coastal inundation. As shown in Figures D3 and D-4, the CMRA Assessment Tool did not have sufficient data to assign a National Risk Index Rating for wildfire and extreme heat. As shown in Figure D-5, the percent of the county impacted by global sea level rise is anticipated to be 0%. This is likely because the site is located in a mountainous region of the island inland from the coast.

The second tool utilized was the NOAA Sea Level Rise Viewer. Figure D-6 shows the site locality under current conditions. Figure D-7 shows the same area under a worst-case scenario assuming a 10-foot rise in sea level. As indicated by these figures, the in-land portion of Corozal where the site is located is not expected to be impacted by this rise in sea level.

The final tool utilized is called the *USGS U.S. Landslide Inventory*. As shown by Figure D-8, there have been several landslides recorded in the vicinity of the site. Figure D-9 shows that the site is extremely susceptible for future landslides.

Although these tools do not indicate the performance of the remedy is currently at risk due to flooding and sea level rise, the site has experienced power outages after major storm events. The potential exists for future landslides and power outages as the frequency and magnitude of storm events are increasing. However, there is no active remedy at the site, only groundwater well monitoring. This well system will continue to be monitored after storm events into the next FYR period.

Figure D-1 – CMRA, Flooding in the Vicinity of Corozal, PR

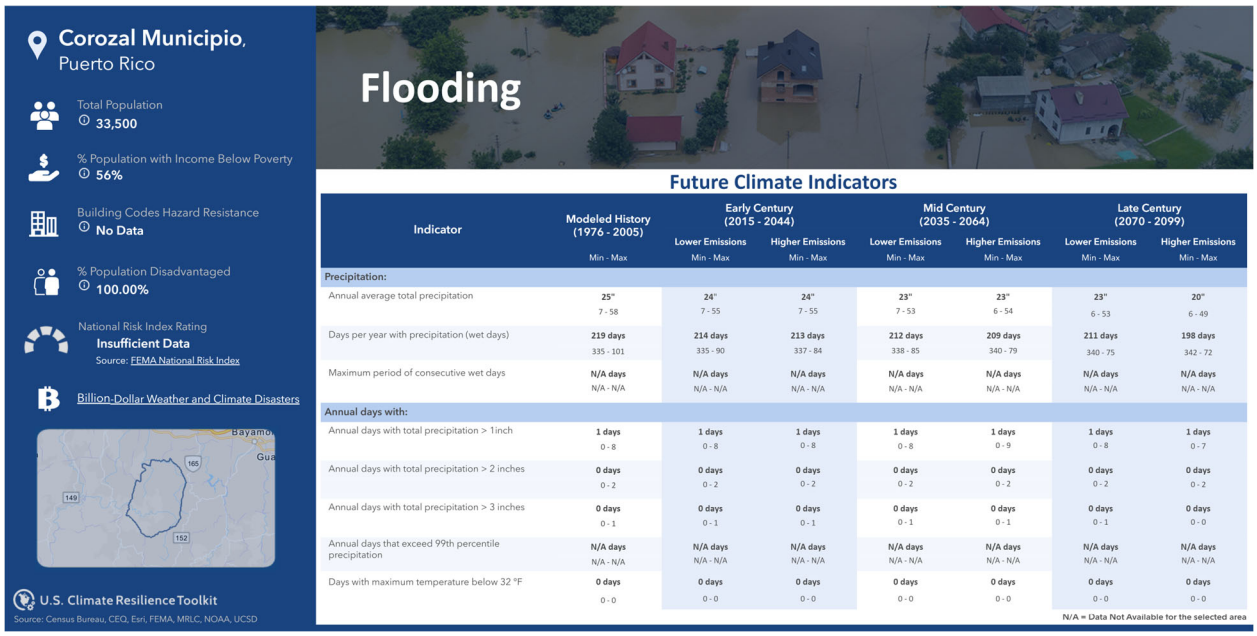


Figure D-2 – CMRA, Drought in the Vicinity of Corozal, PR

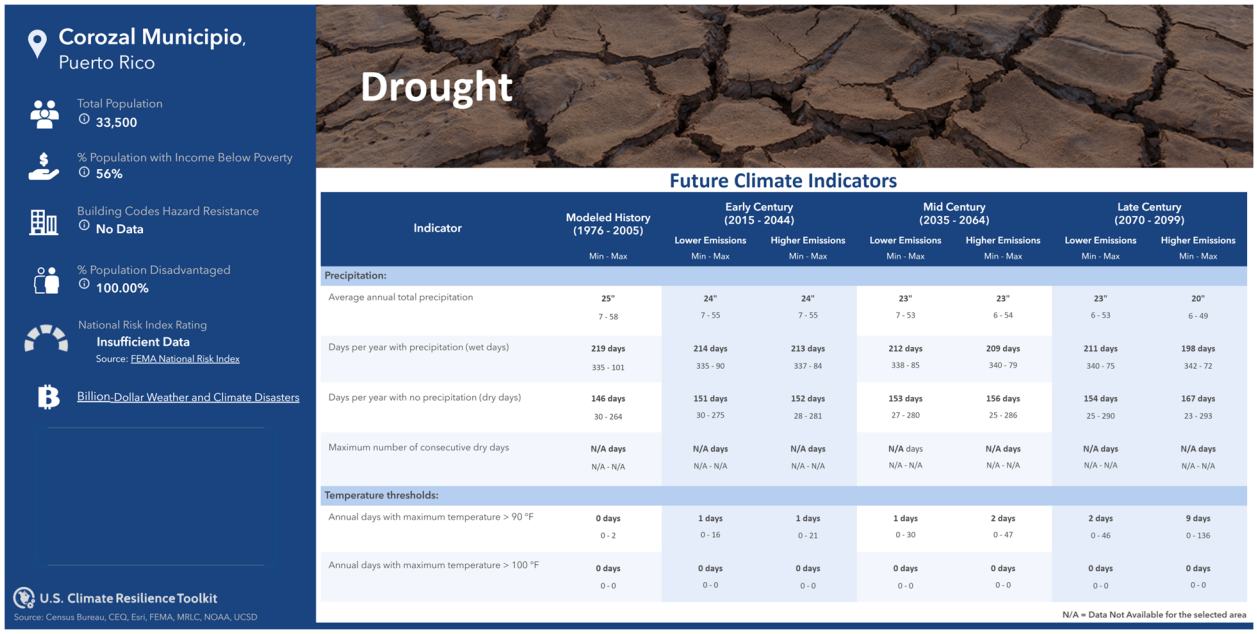
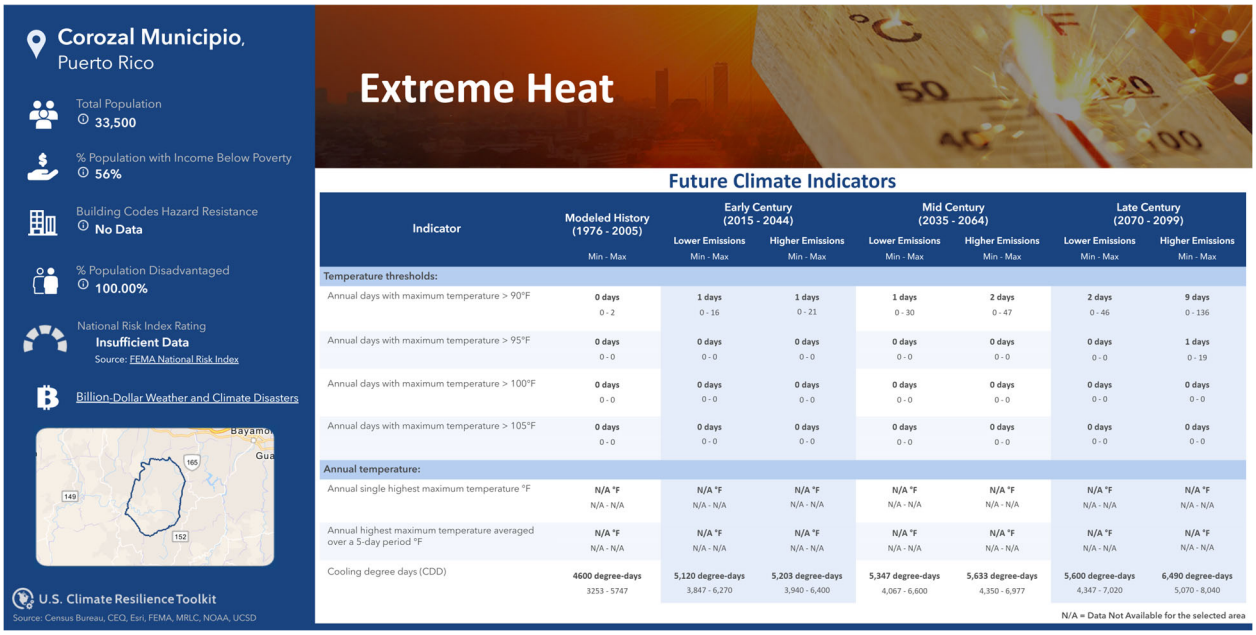


Figure D-3 – CMRA, Wildfire in the Vicinity of Corozal, PR

Figure D-4 – CMRA, Extreme Heat in the Vicinity of Corozal, PR



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	**0 days** 0 - 2	**1 days** 0 - 16	**1 days** 0 - 21	**1 days** 0 - 30	**2 days** 0 - 47	**2 days** 0 - 46	**9 days** 0 - 136
Annual days with maximum temperature > 95°F	**0 days** 0 - 0	**0 days** 0 - 0	**0 days** 0 - 0	**0 days** 0 - 0	**0 days** 0 - 0	**0 days** 0 - 0	**1 days** 0 - 19
Annual days with maximum temperature > 100°F	**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 - 0
Annual days with maximum temperature > 105°F	**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 - 0
Annual temperature:							
Annual single highest maximum temperature °F	**N/A °F** N/A - N/A	**N/A °F** N/A - N/A	**N/A °F** N/A - N/A	**N/A °F** N/A - N/A	**N/A °F** N/A - N/A	**N/A °F** N/A - N/A	**N/A °F** N/A - N/A
Annual highest maximum temperature averaged over a 5-day period °F	**N/A °F** N/A - N/A	**N/A °F** N/A - N/A	**N/A °F** N/A - N/A	**N/A °F** N/A - N/A	**N/A °F** N/A - N/A	**N/A °F** N/A - N/A	**N/A °F** N/A - N/A
Cooling degree days (CDD)	**4600 degree-days** 3253 - 5747	**5,120 degree-days** 3,847 - 6,270	**5,203 degree-days** 3,940 - 6,400	**5,347 degree-days** 4,067 - 6,600	**5,633 degree-days** 4,350 - 6,977	**5,600 degree-days** 4,347 - 7,020	**6,490 degree-days** 5,070 - 8,040

N/A = Data Not Available for the selected area

Figure D-5 – CMRA, Coastal Inundation in the Vicinity of Corozal, PR

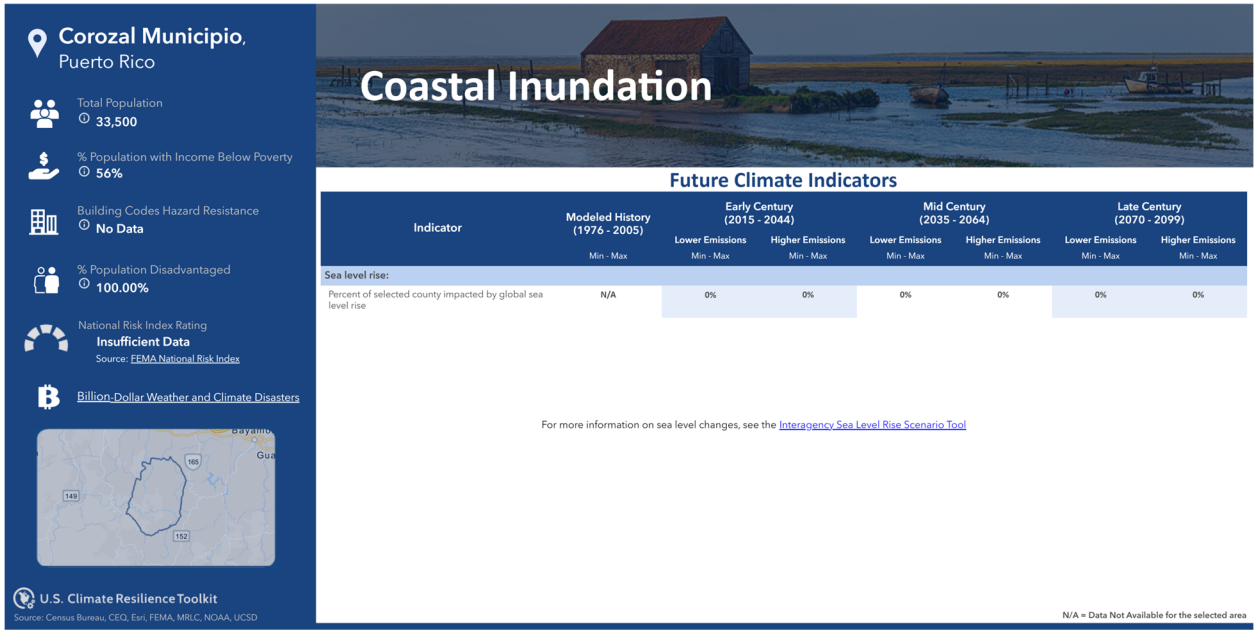


Figure D-6 – NOAA Sea Level Rise Viewer: Current Conditions

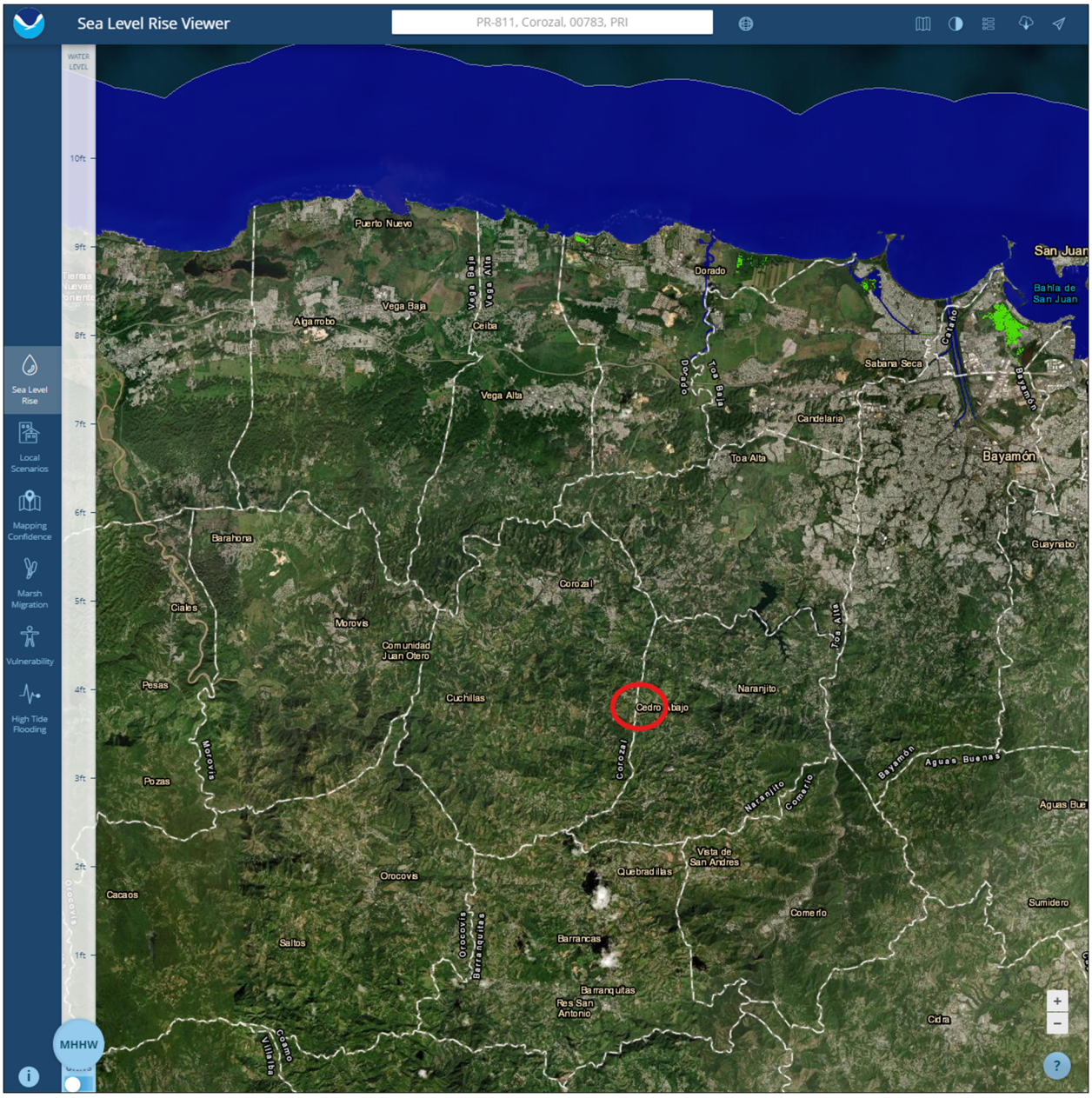


Figure D-7 – NOAA Sea Level Rise Viewer: 10 Foot Rise

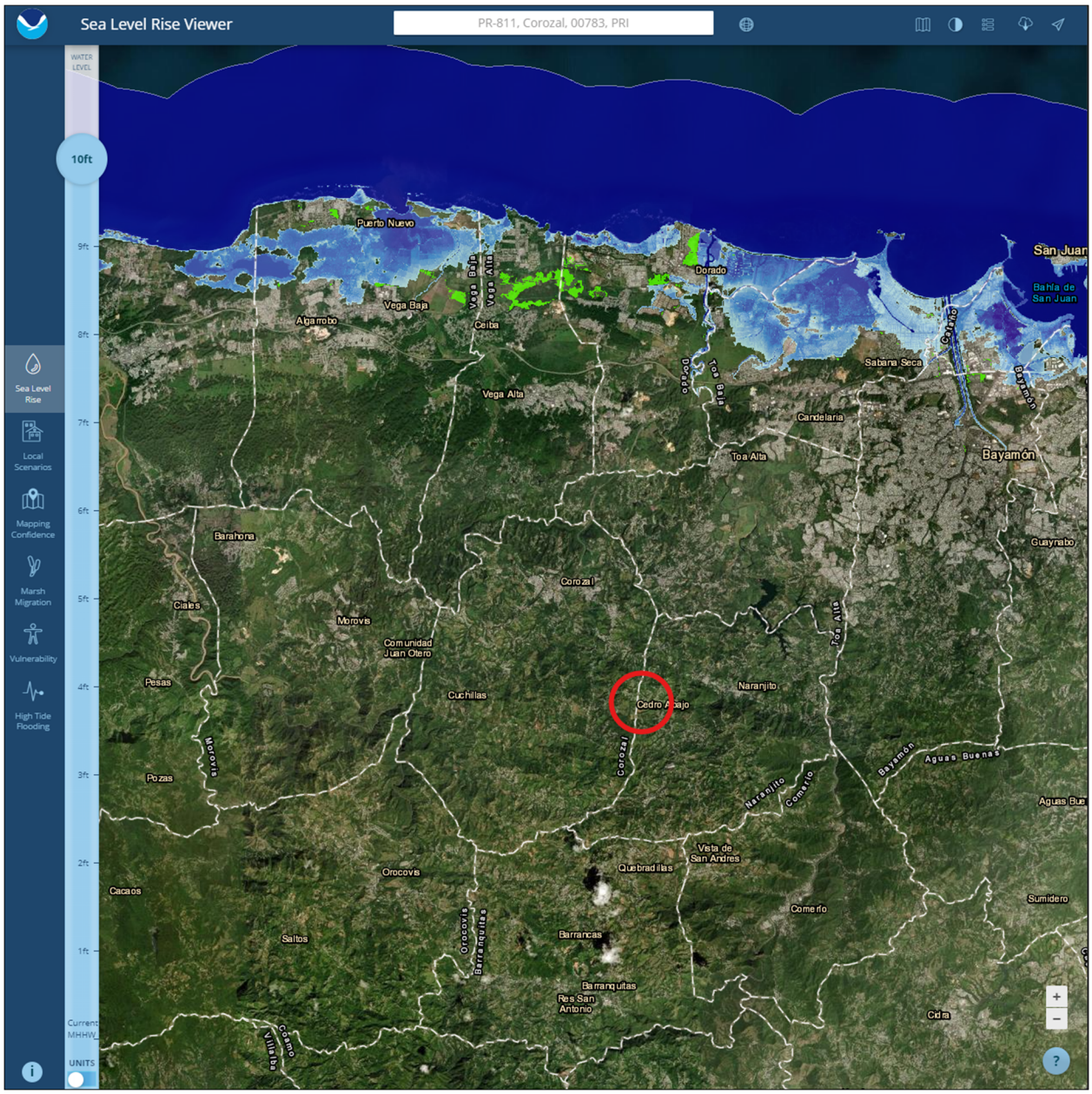


Figure D-8 – USGS U.S Landslide Inventory

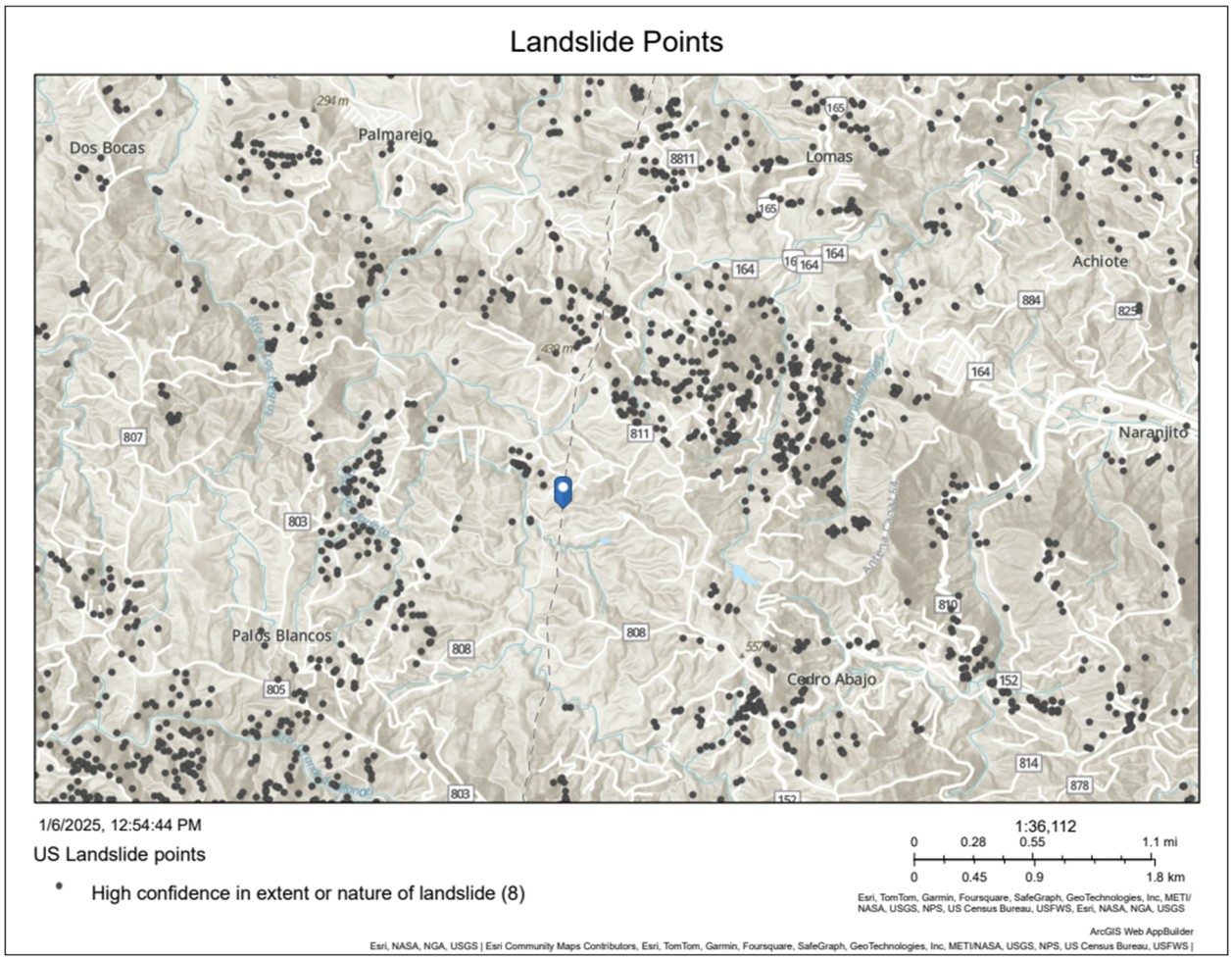


Figure D-9 – USGS U.S Landslide Inventory