DRAFT
FIFTH FIVE-YEAR REVIEW FOR
FAA WILLIAM J. HUGHES TECHNICAL CENTER SUPERFUND SITE
ATLANTIC COUNTY, NEW JERSEY

Prepared by

Federal Aviation Administration
William J. Hughes Technical Center
Atlantic City International Airport, New Jersey

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LIST OF ABBREVIATIONS & ACRONYMS

ACMUA	Atlantic City Municipal Utilities Authority
AFFF	Aqueous film-forming foams
AGWQMN	Ambient Ground Water Quality Monitoring Network
AOC	Area of concern
ARARS	Applicable or relevant and appropriate requirements
AVGAS	Aviation gasoline
BTEX	Benzene/toluene/ethylbenzene/xylene
CEA	Classification exception area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-Dichloroethene
COC	Contaminants of concern
CTP	Central Treatment Plant
CVOC	Chlorinated volatile organic compounds
1,1-DCA	1,1-Dichoroethane
1,1-DCE	1,1-Dichloroethene
1,2-DCA	1,2-Dichloroethane
DGM	Digital geophysical mapping
EHQ	Ecological hazard quotients
EI	Environmental Investigation
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environmental Protection Agency
ERA	Ecological risk assessment
ESD	Explanation of Significant Differences
FAA	Federal Aviation Administration
FFA	Federal Facility Agreement
FUDS	Formerly Used Defense Sites
FYR	Five-Year Review
GIS	Geographic Information System
GWQS	Groundwater Quality Standards
gpm	Gallons per minute
HHRA	Human health risk assessment
IGW	Impact-to-groundwater
ISA	In situ adsorption
ISCO	In situ chemical oxidation
ISCR	In-situ chemical reduction
ISO	International Standards Organization
ISTR	In situ thermal remediation
LNAPL	Light non-aqueous phase liquid
LUC	Land use controls
LUCAP	Land Use Control Assurance Plan

LIST OF ABBREVIATIONS & ACRONYMS (continued)

MASP	Modified Fenton's reagent Activated Sodium Persulfate
MCL	Maximum contaminant levels
MEK	Methyl ethyl ketone
µg/L	Micrograms per liter
mg/kg	Milligrams per kilogram
MIP	Membrane interface probe
MMRP	Military Munitions Response Program
MNA	Monitored natural attenuation
NBAC	North Branch of Absecon Creek
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ng/L	Nanograms per liter
NJAC	New Jersey Administrative Code
NJANG	New Jersey Air National Guard
NJDEP	New Jersey Department of Environmental Protection
NJSCC	New Jersey soil cleanup criteria
NJSRS	New Jersey Soil Remediation Standards
NPL	National Priorities List
O&M	Operation and maintenance
ORC	Oxygen release compound
OU	Operable unit
PAH	Polynuclear aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
PCE	Tetrachloroethene
PFAS	Per- and polyfluorinated substances
PFNA	Perfluorononanoic acid
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctyl sulfonate
PP	Priority Pollutant
PQL	Practical quantitation limit
PRB	Permeable reactive barrier
R&D	Research and Development
RAO	Remedial action objectives
RI	Remedial Investigation
ROD	Record of Decision
RSL	Regional screening levels
SBAC	South Branch of Absecon Creek
SPLP	Synthetic precipitation leaching procedure
SVE	Soil vapor extraction
SVOC	Semi-volatile organic compounds
TBC	To-be-considered
TCA	1,1,1-Trichloroethane
TCE	Trichloroethene
TCDD	2,3,7,8-Tetrachloro-p-dioxin
TEQ	Toxicity Equivalent
TPH	Total petroleum hydrocarbon

LIST OF ABBREVIATIONS & ACRONYMS (continued)

USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish & Wildlife Service
USGS	United States Geological Survey
UTL	Upper tolerance limit
UU/UE	Unlimited use and unrestricted exposure
UXO	Unexploded ordnance
VI	Vapor intrusion
VOC	Volatile organic compounds

EXECUTIVE SUMMARY

This is the fifth Five-Year Review (FYR) for the FAA Technical Center Superfund site, which covers portions of Egg Harbor, Hamilton and Galloway Townships in Atlantic County, New Jersey, as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), in accordance with CERCLA §121(c), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Part 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR). The FYR reviews information obtained over the past five years relative to remedies that resulted in hazardous substances, pollutants, or contaminants remaining at Operable Units (OUs) above levels that allow for unlimited use and unrestricted exposure (UU/UE), and for which there is a Record of Decision (ROD) in place This FYR specifically addresses 11 OUs and 16 associated areas of concern, as outlined in Table ES-1. The purpose of the FYR is to determine if the remedies are and will continue to be protective of human health and the environment. The triggering action for this statutory FYR was the completion date of the previous FYR. The community was notified of the performance of the FYR through a notice placed in the Press of Atlantic City. A copy of the notice is included in Appendix C.

TABLE ES-1
SUMMARY OF OPERABLE UNITS ADDRESSED WITHIN THIS FIVE-YEAR REVIEW

Operable Unit	Name
OU1	Area D, Jet Fuel Farm
OU2	Area 20A, Salvage Yard Area
OU3	Area G, Transformer Storage Area
OU4	Area C, Butler Aviation Fuel Spill
OU6	Areas 29/K, Fire Training Area and Storage Area
OU7	Area 41, Fuel Farm & Photo Lab
OU8	Area B, Navy Fire Test Facility
OU9	Area A, Navy R&D Landfill
OU11	Areas 27, 56, R, S, F: Fuel Mist Test Area, Abandoned Navy Landfill, Air Blast Facility, Trash Dump, Excavation Area West of Tilton Road
OU12	New Jersey Air National Guard Sites (Site 3, Old Aircraft Washrack)
OU13	Area E, Building. 11 Tank Excavation

According to the data reviewed and the site inspection, where remedies are in place, they are functioning as intended by the ROD and/or the existing conditions remain protective of human health. Where applicable, on-going remedial operation, maintenance and monitoring activities include periodic evaluations of the effectiveness of the remedies and additional investigations, pilot testing, and/or system adjustments to optimize system operations. There have been no changes in site use or in physical conditions that would affect the protectiveness of the remedies. ARARs cited in the RODs remain protective of human health and changes in toxicity information do not impact the protectiveness of the remedies.

Table ES-2 summarizes the findings of this FYR.

- All of the OUs evaluated herein are found to be protective or protective in the short-term, with the exception of OU12, Site 3.
- OU12, Site 3, which has a newly finalized ROD, is designated as “will be protective,” pending the design and implementation of the remedy described in the ROD.
- For most of the OUs, a determination of the means of formally documenting land use controls is the main issue identified in the five-year review.

Formal protectiveness statements are provided in the respective sections of the FYR.

TABLE ES-2

SUMMARY OF OUs, REMEDIES, RECOMMENDATIONS, OTHER FINDINGS, AND PROTECTIVENESS SUMMARIES

Operable Unit	Area Identifier	Site Name	Date of ROD/*ESD*	Suitable for UU/UE?	Remedy in Place?	FYR Recommendations/ Comments	Other Findings	Protectiveness Determination
OU01	D	Jet Fuel Farm	9/29/1989 / *ESD: add*	No	Yes	Document LUCs.	Determine source/extent of PCE in well D-MW4D.	Short-Term Protective
OU02	20A	Salvage Yard Area	9/28/1990 / *6/19/1995*	No	Yes	Document LUCs.	Pursue implementation of remedial enhancements. Resample groundwater to verify that 1,4-dioxane is not present above current health-based screening levels.	Short-Term Protective
OU03	G	Transformer Storage Are	9/30/1992	No	Yes	Document LUCs.	--	Short-Term Protective
OU04	C	Butler Aviation Fuel Spil	9/30/1994	Yes	LTGW	None	This OU should undergo partial deletion, when appropriate.	Protective
OU06	29/K	Fire Training Area and Storage Area	9/20/1996	No	Yes	Document LUCs.	Given the lack of groundwater remediation discharge to the Areas 29/K infiltration gallery, will discontinue monitoring of the surrounding wells (29-MW16S through 29-MW19S) immediately. Pending a demonstration that the soil excavation activities at Area 29 have achieved the ROD groundwater cleanup levels, the FAA will request a cessation of all future groundwater monitoring activities relative to the existing ROD.	Short-Term Protective
OU07	41	Fuel Farm and Photo Lab	9/27/2000	No	Yes	Given continued biofouling of groundwater extraction wells, identify and implement remedial system	Coordinate with the FUDS program to encourage the timely progress of actions associated with the benzo(a)pyrene impacts to be addressed under OU 07A.	Short-Term Protective
OU08	B	Navy Fire Test Facility	9/20/1996	No	Yes	Document LUCs.	Continue to pursue the identification of the source of the CVOCs detected in Area B groundwater, including potential upgradient sources, to assist in the timely achievement of ROD cleanup goals. Resample groundwater to verify that 1,4-dioxane is not present above current health-based screening levels.	Short-Term Protective
OU09	A	Navy R&D Landfill	7/22/1997	Yes	LTGW	None	Based on the re-evaluation of risks associated with Area A under unrestricted site use, which shows that LUCs are not necessary, it is recommended that Area A undergo partial deletion and/or the EPA approve a discontinuation of the groundwater monitoring currently required under the existing ROD.	Protective
OU11	27 56 F R S	Fuel Mist Test Area Abandoned Navy Landfill Air Blast Facility Trash Dump Excavation Area West of Tilton Road	9/28/1999	No	LTGW	Document LUCs.	For areas where protectiveness was not evaluated under UU/UE conditions during risk assessment activities, re-evaluate those scenarios to confirm that LUCs are needed to ensure long-term protection of human health.	Short-Term Protective
OU12	3	Old Aircraft Washrack		No	No	None	--	Will Be Protective
OU13	E	Building 11 Tank Excavation	9/26/2003	No	Yes	Document LUCs.	The implementation of enhancements to achieve cleanup goals in a more timely manner should continue to be pursued.	Short-Term Protective

LTGW = Long-term groundwater monitoring

FIFTH FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: FAA Technical Center		
EPA ID: NJ9690510020		
Region: 2	**State:** NJ	**City/County:** Egg Harbor Township/Atlantic County

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** No

REVIEW STATUS
Lead agency: Other Federal Agency Department of Transportation, Federal Aviation Administration (FAA)
Author name (Federal or State Project Manager): Thomas Roesch and Rebecca Piotti
Author affiliation: FAA William J. Hughes Technical Center
Review period: 9/29/2014 - 9/29/2019
Date of site inspection: 4/24/2019
Type of review: Statutory
Review number: 5
Triggering action date: 9/29/2014
Due date *(five years after triggering action date)*: 9/29/2019

1.0 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 five-year review reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The Federal Aviation Administration (FAA) is preparing this five-year 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 or CFR Section 300.430(f)(4)(ii)), and considering U.S. Environmental Protection Agency (EPA) policy.

CERCLA and the National Contingency Plan require that the FYR process begin with the initiation of a selected RA. As a result, this is the fifth FYR for the FAA Technical Center Superfund Site. The triggering action for this statutory review is the date of the EPA's concurrence with the protectiveness determinations of the previous FYR submittal.

The FYR has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain above levels that allow for unlimited use and unrestricted exposure (UU/UE). The FAA has prepared this FYR pursuant to CERCLA Section 121 and the NCP. CERCLA Section 121 states the following:

> *"If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."*

EPA interpreted this requirement further in the NCP, as stated in 40 CFR 300.430 (f)(4)(ii):

> *"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."*

Although 16 Operable Units (OUs) have been identified at the FAA Technical Center, only 11 are the subject of this FYR due to the existence of signed Records of Decision (RODs) and the continued presence of contaminants that do not allow for UU/UE. The following table lists the OUs and/or individual areas of concern (AOCs) or sites included in this FYR.

Operable Unit	Name
OU1	Area D, Jet Fuel Farm
OU2	Area 20A, Salvage Yard Area
OU3	Area G, Transformer Storage Area
OU4	Area C, Butler Aviation Fuel Spill
OU6	Areas 29/K, Fire Training Area and Storage Area
OU7	Area 41, Fuel Farm & Photo Lab
OU8	Area B, Navy Fire Test Facility

Operable Unit	Name
OU9	Area A, Navy R&D Landfill
OU11	Areas 27, 56, R, S, F: Fuel Mist Test Area, Abandoned Navy Landfill, Air Blast Facility, Trash Dump, Excavation Area West of Tilton Road
OU12	New Jersey Air National Guard Sites (Site 3, Old Aircraft Washrack)
OU13	Area E, Building. 11 Tank Excavation

The following table presents the OUs and/or individual AOCs or sites that are not included in this FYR, and the basis for their exclusion.

Operable Unit	Name	Basis for Exclusion
OU4	Areas H and M: Salvage Yard, Bldg. 202/Gelled Fuel Test	No Further Action (suitable for UU/UE)
OU5	Areas I, Q: Incineration Bldg., Fire Station	No Further Action (suitable for UU/UE)
OU9	Areas J and N: Excavation and Catapult Test Bldg. 214	No Further Action (suitable for UU/UE)
OU10	Area P: Building 204 Fuel Spill	No Further Action (suitable for UU/UE)
OU12	New Jersey Air National Guard Sites (Sites 2, 5 & 6: Former Aircraft Defueling Area, Liquid Waste Storage Area Behind Building 56, and Drum Burial at Blast Pad Near Alert Area)	No Further Action (suitable for UU/UE)
OU14	Area U, Absecon Creek Watershed	Pre-ROD
OU15	Air Force Military Munitions Response Program (MMRP)	Pre-ROD
OU16	Area Y, Former Buildings 63 and 64	Pre-ROD

The FAA Technical Center Superfund Site FYR was performed on behalf of the FAA by TRC under Contract Number DTFACT-17-D-00008. Participants included the following:

Participant	Affiliation	Role
Thomas Roesch	FAA	Superfund Program Co-Manager
Rebecca Piotti	FAA	Superfund Program Co-Manager
Larry Butlien	TRC (subcontractor)	Remedial Investigation Manager
Jean Oliva	TRC (subcontractor)	Feasibility Study Manager
Barry Kline	TRC (subcontractor)	Senior Design Engineer

The FYR process began on 12/7/2018. References used in the preparation of this FYR are provided in Appendix A.

2.0 FACILITY-WIDE BACKGROUND

2.1 Physical Characteristics

The FAA William J. Hughes Technical Center is located eight miles northwest of Atlantic City, with the majority of the facility located within Egg Harbor Township, Atlantic County, New Jersey. The facility is approximately 5,052 acres in size, bordered by the Garden State Parkway to the east, the New Jersey Transit Authority Railroad and the White Horse Pike to the northeast, State Route 575 (Wrangleboro Road and Pomona Road) to the northwest, the Atlantic City Expressway to the southwest, and Westcoat Road to the southeast (See Figure 1).

Land use within one mile of the FAA Technical Center boundary includes open and forested lands, and commercial and residential areas. All residential areas in the vicinity appear to be upgradient or otherwise isolated from the groundwater flow at the FAA Technical Center. However, Atlantic City's municipal water supply is provided by nine production wells located on FAA property, along the northern edge of the Upper Atlantic City Reservoir. Water is also drawn directly from the Lower Atlantic City Reservoir, which is not on FAA property. In 2017, the Atlantic City Municipal Utilities Authority (ACMUA) processed 3,032 million gallons of water for the year, with a maximum daily demand of 11.25 million gallons per day in July and an average daily demand of approximately 8.3 million gallons per day. The Lower Atlantic City Reservoir is fed by the North Branch of Absecon Creek (NBAC) and Upper Atlantic City Reservoir is fed by the South Branch of Absecon Creek (SBAC), both of which traverse the FAA Technical Center grounds.

2.2 Geology/Hydrogeology

The FAA Technical Center is located within the New Jersey Coastal Plain, which extends from Delaware Bay in the southwest to Raritan Bay in the northeast, and from the Fall Line and the Delaware River in the west to the Atlantic Ocean. This region is part of the much larger Atlantic Coastal Plain Physiographic Province extending from Florida to Newfoundland and eastward to the edge of the continental shelf. The Atlantic Coastal Plain is a seaward/southeast-dipping and thickening wedge of unconsolidated sediments that range in age from Cretaceous to Holocene. These sediments consist of clay, silt, sand, and gravel deposited in beach and shelf environments. Interbedded fine-grained sediments are transgressive marine strata that were deposited during major incursions of the sea.

The FAA Technical Center property is underlain by the Miocene-age Bridgeton Formation. The Miocene Cohansey Sand lies beneath the Bridgeton Formation, which in turn is underlain by the Miocene Kirkwood Formation. The Bridgeton Formation is comprised of Miocene age fluvial or delta plain deposits of coarse-grained sand and gravel. The Bridgeton sediments in the vicinity of the ACMUA well field (along the northern edge of the Upper Atlantic City Reservoir) consist of sand, gravel, and clay ranging in thickness from 30 to 50 feet. Sand and gravel are the dominant sediments. Clay beds as thick as 10 feet have been encountered in the area, but the clay is laterally discontinuous.

The Upper Cohansey Clay locally separates the Cohansey Sand from Bridgeton deposits in the southeastern part of the FAA Technical Center, in the vicinity of the ACMUA well field and Area 20A (located south of the Upper Atlantic City Reservoir). The Upper Cohansey Clay is interbedded with Cohansey Sand under much of the eastern side of the FAA Technical Center. In the southeastern area of the FAA Technical Center, the Upper Cohansey Clay is a thick, vertically contiguous unit. The Upper Cohansey Clay pinches out between the Upper Atlantic City Reservoir and the Area B injection wells, which are located to the southwest of the Upper Atlantic City Reservoir.

The Cohansey Sand is generally a deltaic deposit, but it contains sediments from nearshore marine, fluvial, estuarine, lagoonal, and beach environments. The Cohansey Sand is composed of fine to coarse quartz sand, lenses of clay, and lenses of gravel. Some local clay beds within the Cohansey Sand are relatively thick, creating locally mounded water table conditions. Grain size varies both vertically and laterally, which is consistent with deposition within a coastal environment.

Shallow saturated sediments of the Bridgeton Formation are informally called the Shallow Aquifer beneath the FAA Technical Center. The Shallow Aquifer is unconfined, with local interbedded lenses of clay, and bounded below by the Upper Cohansey Clay under the southeastern area of the FAA Technical Center. Depth to groundwater seasonably ranges from 0 to 20 feet below the ground surface. Depth to groundwater varies during the year, rising during periods of heavy rainfall and falling during low rainfall or drought. Correspondingly, the unconfined aquifer periodically discharges to the upper reaches of the on-site streams (the SBAC and NBAC) and more consistently to the middle and lower reaches of the streams and the Upper Atlantic City Reservoir. The local term Intermediate Aquifer refers to a portion of the underlying Cohansey Sand Aquifer, which is semi-confined by occurrences of Upper Cohansey Clay. In general, the direction of groundwater flow in the Intermediate Aquifer is parallel to the direction of flow in the SBAC and Upper Atlantic City Reservoir. On the western half of the Technical Center, where the Upper Cohansey Clay is absent, the Shallow and Intermediate Aquifers are vertically contiguous.

The Cohansey Sand Aquifer is informally further subdivided into a Deep Aquifer. The Middle Cohansey Clay, 35 to 40 feet thick in the vicinity of the ACMUA well field and separating the Intermediate and Deep aquifers, is an aquitard that occurs throughout the subsurface beneath the FAA Technical Center, thinning westward. The Middle Cohansey Clay sediments generally consist of silty and clayey fine sands, silts, and clays, although northwest of the ACMUA well field, the Middle Cohansey Clay is sandier and less distinct as a discrete stratigraphic interval

The Shallow Aquifer and Cohansey Sand are part of the Kirkwood-Cohansey Aquifer, a major aquifer system in which groundwater generally occurs under water table conditions. In Cape May County, the Cohansey Sand is a confined aquifer. The confining clay extends into the southeastern area of the Technical Center (thick, vertically contiguous Upper Cohansey Clay). The Miocene Kirkwood Formation underlying the Deep Aquifer portion of the Cohansey Sand is finer-grained than the Cohansey Sand, consisting of very fine- to medium-grained sand and a thick, diatomaceous clay unit known as the Upper Kirkwood confining layer that extends inland from the coast for a short distance. The Deep Aquifer under the Technical Center is underlain by finer-grained Kirkwood Formation sand above the Upper Kirkwood confining layer. The Atlantic City 800-foot Sand occurs below Upper Kirkwood confining layer.

The Deep Aquifer is confined. The ACMUA wells are completed in the Deep Aquifer. Prior to ACMUA well field usage, heads in the Deep Aquifer were greater than heads in the Intermediate and Shallow Aquifers (upward vertical gradients). Results of analyses of pumping test data for the ACMUA well field indicated that the Middle Cohansey Clay is a leaky aquitard. Except in the vicinity of streams, vertical gradients across the Technical Center property are currently downward from the shallow unconfined groundwater into the Deep Aquifer. Pumping-induced head losses in the Deep Aquifer propagate through the Middle Cohansey Clay, influencing groundwater flow in the Intermediate Aquifer.

2.3 Land and Resource Use

In addition to the FAA facilities, major installations at the FAA Technical Center include the South Jersey Transportation Authority's Atlantic City International Airport, the New Jersey Air National Guard's (NJANG's) 177th Fighter Wing, the U.S. Coast Guard and elements of the Department of Homeland Security. As previously mentioned, Atlantic City's municipal water supply is provided by nine production wells located north of the Upper Atlantic City Reservoir on FAA Technical Center property and by water drawn directly from the Lower Atlantic City Reservoir, which is not on FAA Technical Center property. The ACMUA conducts monitoring as required for public water supplies. Appendix B includes the most recent annual water quality reports published by ACMUA in 2018. The FAA also obtains its potable water from on-site wells screened in the confined Deep Aquifer.

The area surrounding the FAA Technical Center is characterized by the Pinelands National Reserve (the Pinelands). The Pinelands is an important ecological region, characterized by pine, oak and cedar forests, swamps, and slow-moving, acidic streams. The physical characteristics of the region create a relatively harsh environment with generally low habitat diversity, thereby limiting the variety of animals. The acidic stream waters with low alkaline metals and high iron content support a unique fauna and flora dissimilar to most natural areas.

The FAA Technical Center maintains a Strategic Land Use Plan to guide future development. All development projects are approved by the Master Planning and Siting Board. Environmental reviews are incorporated into the FAA Technical Center's development project approval process.

2.4 History of Contamination

The FAA Technical Center property was first developed during the 1930s, when it was established as the Atlantic City Watershed, the main water supply for the city. In 1936, the City dammed both the SBAC and NBAC to create the Upper and Lower Atlantic City Reservoirs, respectively. In the 1940s, the Atlantic City Municipal Airport and a U.S. Naval Air Station were established at the site. It was during this time that contamination was first introduced to the site by Navy and airport operations. In 1958, the Naval facility was transferred to the Airways Modernization Board and the installation was designated the National Aviation Facilities Experimental Center. In 1958, the FAA was established and took over the operation of the Airways Modernization Board, including the National Aviation Facilities Experimental Center. FAA operations, especially during the 1960s and 1970s, involved releases that also resulted in site contamination. Site-specific contamination for each OU addressed within this FYR is described below beginning in Section 5.

Two constituents/constituent groups of interest impact the performance of the FYR at the FAA Technical Center. These are chloroform and per- and polyfluorinated substances (PFAS), as described in more detail below.

2.4.1 Chloroform

Throughout site investigations at the FAA Technical Center, chloroform has often been detected in groundwater, including groundwater at OUs that exhibit no other evidence of environmental impacts, and often at levels exceeding the New Jersey Groundwater Quality Standard (GWQS) practical quantitation limit (PQL) of 1 microgram per liter (µg/L). OUs at which chloroform has been detected include OU01 (Area D); OU02 (Area 20A); OU06 (Areas 29/K); OU07 (Area 41); OU08 (Area B); OU09 (Area A), OU11 (Area R); and OU13 (Area E). Chloroform has also been detected at other locations, including Area Y; various non-potable facility wells; upgradient perimeter wells; upgradient OU wells; and wells used to monitor the potential impacts of the Central Treatment Plant's (CTP's) discharge on surrounding groundwater quality. Chloroform detections at the Technical Center have all been in wells screened in the Shallow/Intermediate Cohansey Aquifer.

A statistical analysis was conducted in 2013 of chloroform groundwater data from monitoring wells used to establish background groundwater quality conditions prior to the use of three areas at the Technical Center (the Area B injection well area, the Area 41 injection well area and the recharge bed area) for the discharge of treated groundwater from the CTP. The analysis was based on background groundwater quality data from seven Area B monitoring wells, five Area 41 monitoring wells, and four recharge bed monitoring wells. While not representative of the entire FAA Technical Center property, these data are relevant because they provide a significant quantity of representative background chloroform concentration data for the Technical Center in general. The chloroform data for these background wells was subject to an outlier analysis, followed by the calculation of the 95% upper tolerance limit (UTL) in accordance with N.J.A.C. 7: 14A-7.7(b)(3). An upper tolerance limit represents a confidence limit of a percentile of the population for a constituent rather than a confidence limit on the mean. The statistical software program ProUCL version 4.10 was used to perform the analysis. The 95% UTLs for chloroform were calculated using various methods suitable for the actual data distributions and were found to range from 7.688 µg/L to 16.89 µg/L. The lowest 95% UTL (most conservative value) of 7.688 µg/L derived with the Kaplan-Meier Method, is significantly higher than the PQL of 1 µg/L.

A review of available literature has identified several studies that describe the general presence of chloroform in the Kirkwood-Cohansey Aquifer system. USGS studies on the presence of mercury in the groundwater of the Kirkwood-Cohansey Aquifer system describe the presence and potential source of chloroform in groundwater (specifically in Atlantic County) as follows:

> "The presence of chloroform, which was nearly ubiquitous in water samples from the Atlantic County sites (where it was most commonly measured) is believed to be related to inputs of chlorine to the ground water, where interactions with organic matter produce the compound. Chlorine can reach ground water through disinfection of wells and through septic systems." (USGS, 1997)

> "The nearly ubiquitous occurrence of chloroform in about 1,500 ground-water samples from sites in Atlantic County indicate that chlorine from septic-system effluent may have affected the water tapped by domestic wells in the residential neighborhoods. In addition, use of chlorinated solvents as septic-system cleaners may be the source of some of the VOCs measured in water from many wells at the 34 sites." (USGS, 2001)

These reports indicate the general presence of chloroform within the Kirkwood-Cohansey Aquifer system in the immediate vicinity of the Technical Center, which is further supported by data collected by the Atlantic County Health Department regarding the presence of chloroform in wells located within the county that documents widespread levels of chloroform above the PQL of 1 µg/L in both the Shallow and Intermediate Aquifers (see Figures 2 and 3).

A study of the presence of VOCs and other contaminants in groundwater samples from monitoring wells and public-supply wells screened in the surficial Kirkwood-Cohansey Aquifer system in the Glassboro area of southern New Jersey (USGS, 2000) evaluated the occurrence and movement of contaminants throughout the hydrologic system and the effects of their presence on the use of groundwater for domestic and public supplies in the Glassboro study area. The following statements from the USGS paper are particularly relevant:

> 1) "As discussed in the sections on nitrate and VOCs, water-quality data from public-supply wells sampled during this study are comparable to available water-quality data from public supply wells in the Kirkwood-Cohansey aquifer system outside the Glassboro study area. In addition, the general characteristics of the public-supply wells, as well as land-use, soil, and aquifer characteristics, in the Glassboro study area are comparable to those elsewhere in the Kirkwood-Cohansey aquifer system. Therefore, results of this study are considered to be transferable to the entire extent of the Kirkwood-Cohansey aquifer system." (page 42, first paragraph of "Transferability of water-quality results" section); and,

> 2) "Unlike other VOCs, chloroform and MTBE generally were detected frequently in samples from all three well networks, indicating widespread (nonpoint) sources."

Like the applicable monitoring wells at the FAA Technical Center, the monitoring and extraction wells included in the cited study were typically screened at varying intervals, described as falling within three well networks: 1) shallow wells (typically screened about 10 feet below the water table); 2) "moderate-depth" monitoring wells (screened at a depth to capture water that recharged the aquifer system about 15 years ago); and 3) public supply wells. The USGS paper indicated that chloroform was detected in 90% of the total wells sampled, with a median concentration of 0.098 µg/L and a maximum concentration of 5.6 µg/L. The chloroform detections occurred in more than 80% of the samples from each well network, so they were distributed vertically throughout the formation.

Potential sources of chloroform identified in the paper included industrial sources as well as the presence of chloroform as a byproduct of the chlorination of public drinking-water supplies. During chlorination, chlorine can react with naturally-occurring humic substances (e.g., humic and fulvic acids) to form chloroform in the treated water. Within the New Jersey Coastal Plain, dissolved organic carbon from fulvic and humic acids is present at elevated concentrations (greater than 2 milligrams per liter or mg/L) in many streams, with concentrations in groundwater generally below 1 mg/L (USGS, 2001). Other factors that can result in the generation of chloroform during the chlorination of water include the structure and concentrations of other precursor compounds, concentration of free chlorine, pH, bromide ion concentration, and temperature (USGS, 2004). The rate of production of chloroform has a complex dependence on pH that may vary among different precursor compounds, although yields increase with increased pH. Public-supply water can provide widespread (nonpoint-source) recharge of chloroform to surficial aquifer systems underlying urban areas through a variety of mechanisms,

including lawn sprinklers, swimming pools, leaking water and sewer lines, septic systems, and recharge basins. Chloroform has been shown to form naturally in some soil environments and this source also may contribute to the widespread (nonpoint-source), frequent occurrence of chloroform in all three well networks described in the Glassboro study (USGS, 2000). The Glassboro study concludes that:

> "Chloroform introduced to the aquifer system from point sources associated with the compound's various commercial and industrial uses may augment that derived from nonpoint sources and may explain the higher proportion of chloroform detections greater than 0.1 mg/L in samples from the public-supply wells than in samples from the monitoring wells… because public-supply wells have larger contributing areas, they are more likely to intercept water flowing from point sources of chloroform and other VOCs."

Given that many of the chloroform detections at the FAA Technical Center have been identified within developed areas that have active groundwater pumping from the deeper portions of the unconfined aquifer, chloroform concentrations would be expected to be similar to the maximum levels (e.g., 5 to 6 µg/L or higher) found in the Glassboro study.

Additional scientific/public outreach papers published by the New Jersey Department of Environmental Protection (NJDEP) (e.g., Ground Water Quality Environmental Trends Report 2017; New Jersey Geological and Water Survey Information Circular Rev. 2016) indicate that chloroform is the most widely detected VOC in the network of 150 shallow, statewide, periodically sampled monitoring wells known as the Ambient Ground Water Quality Monitoring Network (AGWQMN) (which includes several wells in Atlantic County, including one in the Pleasantville area.

The FAA is currently collecting additional chloroform data through the installation and sampling of perimeter monitoring wells around the FAA Technical Center property line. These wells will provide additional information on the presence of chloroform in background groundwater samples at the FAA Technical Center. However, based on currently available information, chloroform has been documented to be present within the groundwater of the Kirkwood-Cohansey aquifer, and specifically within Atlantic County, with the USGS describing its presence in the region as "nearly ubiquitous" (USGS, 2001). Therefore, its detection at the FAA Technical Center is not considered to be attributable to AOC-specific activities.

2.4.2 Per- and Polyfluorinated Substances (PFAS)

PFAS are considered by the EPA to be contaminants of emerging concern. PFAS are water soluble, persistent and bioaccumulative compounds that are found in many products, including aqueous film-forming foams (AFFF) used in firefighting foams. In 2013, the ACMUA participated in the EPA's Third Unregulated Contaminant Monitoring Rule sampling, and PFAS were detected in the ACMUA's public water system. As a result, the NJDEP requested that the FAA investigate potential sources of the PFAS detected in the ACMUA's public water system. This resulted in several rounds of PFAS sampling that have been performed at the FAA Technical Center. The results of PFAS sampling conducted by the ACMUA in 2016 are summarized in the 2017 Water Quality Report included in Appendix B.

A facility-wide PFAS Preliminary Assessment (TRC, 2018) was recently completed which recommended the performance of Site Inspections or Remedial Investigations at potential AOCs where PFAS were considered to potentially be present, based on historical site activities, or where the presence of PFAS has been identified through previous testing. The results of previous PFAS sampling and the recommendations of the PFAS Preliminary Assessment are briefly described on an OU-specific basis in Sections 5 through 15, as applicable. The preparation of a supplemental Site Inspection work plan is currently underway. Because the presence/absence and potential remediation of PFAS are being addressed separately from other remedial investigations/actions at the FAA

Technical Center, specific recommendations relative to PFAS are not included in the AOC-specific discussions beginning in Section 5.

2.5 Initial Response

In 1984, the NJDEP conducted an assessment of pollution sources that could impact the then-proposed Atlantic City municipal well field to be located on FAA property. The assessment included a review of data on possible contaminant sources in the area, limited field investigation of these sources, and soil and groundwater sampling at the five areas considered to pose the greatest potential threat to groundwater supplies in the area. The entire FAA Technical Center was included in the study and the five areas identified (referred to as Areas 20A, 27, 29, 41 and 56) were all located on FAA property. Hydrogeological studies of the five areas indicated that the development of the well field could proceed. As a result of the NJDEP assessment, FAA conducted a facility-wide environmental assessment between 1987 and 1990. The site was placed on the National Priorities List (NPL) in 1990. A Federal Facility Agreement (FFA) was signed between the Department of Transportation-FAA and the EPA in 1993.

The principal concern for site listing on the NPL was groundwater contamination. Consequently, the initial focus of site remediation was towards remediating impacted groundwater. Site remediation has also dealt with other contaminated media such as soil, surface water, and sediment. Numerous potential AOCs have been identified and investigated, and several of the AOCs are being addressed through remedies documented in completed RODs. However, most of the land at the FAA Technical Center is not covered by any of these RODs. This is because large portions of the facility have not been identified as a potential source of contamination under this CERCLA listing and are not addressed under the FFA. This does not necessarily mean that these areas are free of any environmental contamination, but that they do not have any record of site use which may have led to a contaminant release. Consequently, for the purposes of this review, these areas are not covered by CERCLA requirements and are not included in this FYR. Furthermore, as described in Section 1.0, areas that have been investigated but at which contaminants are not present at levels that prevent UU/UE and areas that are still undergoing investigation/evaluation are not included in this FYR.

2.6 Land Use Controls (LUCs)

LUCs are an integral part of many of the selected remedial actions at the identified OUs. While specific site LUC features are described in the individual OU discussions below, the FAA maintains other means of controlling land use on a more facility-wide basis, as described in the following paragraphs.

The FAA Technical Center is a secure property, with perimeter fencing and access-controlled gates limiting access to much of the facility. The majority of the facility is enclosed by 10-foot-high perimeter fencing. The FAA employs a security subcontractor to monitor site security and prevent unauthorized access on a 24/7 basis.

The FAA maintains a facility-wide Strategic Land Use Plan that identifies the presence of AOCs at the facility. The Strategic Land Use Plan notes that the transfer of any FAA Technical Center property or development of an AOC are prohibited without EPA approval. The only AOC addressed within this FYR at which potential additional development is currently proposed is Area F, the Air Blast Facility, at which the construction of a new facility building is proposed.

All proposed construction activities at the FAA Technical Center are monitored through the FAA's Master Planning and Siting Board. The Site Engineering Section is included in the review of all proposed construction projects, evaluating proposed activities with respect to potential impacts to AOCs or changes in the type of land use. If potential impacts to an AOC are identified, the Site Engineering Section ensures that any associated environmental concerns are addressed properly. The EPA has indicated (in correspondence dated May 29, 2002) that if property is developed adjacent to a CERCLA OU, it is the FAA's responsibility to ensure that unacceptable exposures attributable to that OU do not occur. Therefore, the FAA's review of proposed construction activities relative to environmental concerns and potential exposures also applies to the development of sites adjacent to AOCs.

The FAA also manages land use at CERCLA AOCs through the requirements of its International Standards Organization (ISO) 14001:2015-compliant Environmental Management System (EMS) and its associated EMS Procedures Book. Among other things, the EMS includes the following:

- Identification of the significant environmental aspects of the Technical Center's activities, operations, processes, products and services in order to set objectives and targets for the EMS;
- Guidance for selecting indicators of performance for the objectives and targets set in the EMS, for establishing performance baselines for those objectives and targets, and for selecting measuring methods to track progress in the attainment of those objectives and targets;
- Definition of the responsibility and authority for handling and investigating EMS nonconformances, for taking action to mitigate any impacts caused, and for initiating and completing corrective and preventive action;
- Definition of the Technical Center's communications needs pertinent to its EMS, including practices for communicating internally and for receiving, documenting and responding to relevant information and written requests from external interested parties; and
- Establishment of procedures for tracking environmental performance, including the establishment of Environmental Management Plans (EMPs).

EMPs developed by the Technical Center include an EMP that specifically addresses Superfund AOCs, including performance indicators, operational controls and records, and an associated Operational Management System Operational Control Form that provides more detailed requirements related to operational controls, maintenance plans, actions to be taken if controls fail, records and responsibilities.

The FAA's Geographic Information System (GIS) is used to maintain a database of information related to CERCLA investigations at the facility. The GIS system can be queried to obtain information on the historic use and previous environmental investigation results for the various AOCs.

Section XXVII of the FFA refers to compliance with CERCLA §120(h)(1) and §120(h)(3), should a property be transferred or sold by the FAA. The FFA also requires that notice of the existence of the FFA be provided in any document transferring ownership or operation of the property and requires continued operation and maintenance of response actions. Therefore, the FAA is legally obliged to meet these CERCLA requirements as a party to the FFA. Also, in accordance with Section XVII of the FFA, the FAA will request funds for maintaining land use controls through its budgetary process.

The FAA invites other interested parties (e.g., the NJANG, South Jersey Transit Authority and ACMUA) to attend regular Superfund technical meetings. These meetings are often the site of discussions regarding potential site development plans and are a means of informing other parties of potential restrictions on the development of AOCs at the FAA Technical Center.

Point-of-contact personnel responsible for monitoring, maintaining and enforcing the LUCs are as follows:

- Main Contact: John K. Floyd, John.Floyd@FAA.gov, (609) 485-6938, FAA William J. Hughes Technical Center; and
- Backup Contact: Joseph S. Cannizzaro, Joseph.Cannizzaro@FAA.gov, (609) 485-6255, FAA William J. Hughes Technical Center.

3.0 FIVE-YEAR REVIEW PROCESS

The Fifth FYR for the FAA Technical Center was conducted in accordance with the Comprehensive Five-Year Review Guidance (EPA, 2001) and supplements (EPA 2012a, 2012b).

3.1 Community Notification, Involvement & Site Interviews

A public notice of the preparation of the FYR was made available by the FAA Technical Center through the publication of announcement in The Press of Atlantic City on February 27, 2019. A copy of the notice is included in Appendix C at the end of this document. The public notice stated that there was a FYR and invited the public to submit any comments to the EPA. The results of the review and the report will be made available at the information repository located at the FAA Technical Center.

During the FYR process, interviews with EPA personnel were conducted to document any perceived problems or successes with the remedy that has been implemented to date**.** The results of these interviews are summarized below.

Ms. Jessica Mollin, EPA's Remedial Project Manager, generally did not indicate any concerns with existing remedial actions, monitoring programs, or project meetings at the FAA Technical Center. She indicated that PFAS need to be fully investigated before site closure can be achieved and recommended that the FAA's internal Superfund tracking system be updated more frequently.

Ms. Lora Smith, EPA's Human Health Risk Assessor, indicated the FYR should contain potential redevelopment plans (if any); cleanup goals and the routes of exposure upon which they were established; environmental data collected since the last FYR; the current O&M schedule for each OU/AOC/site and any plans for changes in the O&M plans; and any recent information, including information related to PFAS investigations and potential vapor intrusion (VI) exposure investigations conducted relative to the OUs/AOCs/sites addressed within the FYR. The FAA has addressed these items within the content of this FYR to the extent feasible.

3.2 Document Review

The FYR consisted of a review of site-specific documentation for each OU/AOC/site addressed within the FYR. Documents reviewed included, but were not limited to RODs, interim investigation reports, remedial enhancement reports, and long-term monitoring reports. The results of these evaluations are documented in the site-specific discussions beginning in Section 5. Appendix A includes a list of the documents reviewed for each site.

3.3 Site Inspection

The formal Site Inspection was conducted on 4/24/2019. In attendance were the following:

Site Inspection Participant	Affiliation	Role
Rebecca Piotti	FAA	Superfund Program Co-Manager
Chadd Fry	Leidos (subcontractor)	NISC Contract Support
Larry Butlien	TRC (subcontractor)	Remedial Investigation Manager
Jean Oliva	TRC (subcontractor)	Feasibility Study Manager
Barry Kline	TRC (subcontractor)	Senior Design Engineer
Jessica Mollin	EPA	Remedial Project Manager
Lora Smith	EPA	Human Health Risk Assessor

The purpose of the inspection was to assess the protectiveness of the remedies employed at the various OUs. The inspection is discussed in association with each of the OU descriptions, starting in Section 5 below. Photographs taken during the Site Inspection are provided in Appendix D.

4.0 NEXT REVIEW

The next FYR report for the FAA Technical Center Superfund Site is required five years from the completion date of this review.

5.0 OU01 - AREA D - JET FUEL FARM

5.1 History of Contamination and Initial Response

Area D, the Jet Fuel Farm, is located near the juncture of the access roads leading to the Atlantic City International Terminal and the FAA's Technical/Administrative Building. In the late 1980s, jet fuel was stored in two large aboveground bermed tanks. Prior to 1972, fuel was stored in two 567,000-gallon underground storage tanks. Dry wells, piping, the underground storage tanks and historic spills were suspected to be sources of contamination. In 1994, the pumping equipment was decommissioned and removed, interconnecting piping was drained, flushed and capped, and the underground storage tanks were cleaned. In 2000, the underground storage tanks, associated piping, ancillary structures, and underground piping associated with the former aboveground storage tanks were formally decommissioned. Jet fuel is now stored in two 420,000-gallon aboveground bermed tanks located at a replacement site within the NJANG portion of the FAA Technical Center facility.

The Environmental Investigation (EI) of Area D was conducted in two phases between December 1986 and December 1988. The most significant environmental problem identified at Area D during the EI was a hydrocarbon (JP-4 jet fuel) plume floating on the water table. Also identified during the EI was a groundwater plume located beneath the floating product, consisting primarily of organic compounds associated with jet fuel. Soil contamination was primarily limited to subsurface petroleum contamination.

5.2 Response Action Summary

5.2.1 Basis for Taking Action

Contaminants

Contaminants of concern (COCs), as identified in the Human Health Risk Assessment (HHRA) for Area D, in each medium include:

Soil	Groundwater
Benzene	Benzene
Toluene	Toluene
Ethylbenzene	Ethylbenzene
Xylene	Xylene
Phenol	Naphthalene
2-Chlorophenol	Phenol
Chromium	Chromium
Lead	Lead
	Nickel

Human Health Risk Assessment

Since use of Area D was expected to be limited to fuel transfer-type activities at the time the HHRA was prepared, the soil exposure frequencies used in the risk assessment were restrictive. For example, exposure to surface soil was based on a maximum exposure frequency of 24 times/year. Exposure to groundwater was based on a commercial/industrial exposure scenario, assuming a potable well was installed at the site, with a maximum

exposure frequency of 250 days/year. Exposure to groundwater at Area D is associated with significant human health risks due to exceedances of EPA's acceptable risk range (i.e., a probability in the range of one in one million (1×10^{-6}) to one in ten thousand (1×10^{-4}) of an individual contracting cancer due exclusively to exposure to site contaminants). Potential risks associated with groundwater are attributed to the presence of volatile organic compounds (VOCs) that exceed state and federal Maximum Contaminant Levels (MCLs). Risks due to exposure to soil were below EPA's risk range but total petroleum hydrocarbon (TPH) levels detected in subsurface soils exceeded the NJDEP total petroleum hydrocarbon soil action level of 100 milligrams per kilogram (mg/kg) applicable at the time the ROD was signed.

Ecological Risk Assessment

An ecological risk assessment (ERA) was not conducted as part of the EI activities at Area D. A qualitative evaluation of potential ecological risks was conducted in 1996 as part of a facility-wide ERA conducted by the U.S. Fish & Wildlife Service (USFWS). The evaluation concluded that potential risks to terrestrial receptors is minimal, although potential risks to aquatic receptors could occur as a result of the potential discharge of groundwater to the SBAC (the SBAC is being addressed as part of Area U under OU14).

5.2.2 Response Actions

Interim jet fuel removal actions were implemented from August 1988 until March 1989 with the installation of product recover pumps in three Area D monitoring wells.

The ROD for Area D was signed on September 29, 1989. The ROD does not list specific remedial action objectives (RAOs). The selected remedy for Area D included the following components:

- Free-product extraction and off-site incineration;
- Groundwater extraction, addition of nutrients, and subsequent re-injection upgradient of the contaminated area;
- Soil vapor extraction (SVE), a system which extracts gas from the soil pore space; and
- Treatment of off-gas from SVE consisting of a catalytic incinerator.

An Explanation of Significant Differences (ESD) is currently being finalized for Area D that addresses the installation of an in situ thermal remediation (ISTR) system (specifically thermal conductive heating) to accelerate remediation at Area D. The remedy described in the ESD will supplement and enhance the components of the original remedy, as follows:

- Free-product recovery will be thermally enhanced by the ISTR system. Free product will either be destroyed in situ or extracted, separated from the aqueous and vapor phases, and collected for off-site incineration.
- Groundwater that is extracted will be cooled and treated in the existing CTP. The treated water will follow the existing practice of reinjection into nearby wells and a 5-acre recharge bed.
- The ISTR system will capture vapors that are extracted from the soil pore space and evaporated from the light non-aqueous phase liquid (LNAPL) and groundwater phases.
- Treatment of off-gas from the ISTR system will include catalytic oxidation.
- Monitored natural attenuation (MNA) will be used to polish contaminants remaining after the ISTR system has removed the bulk of benzene/toluene/ethylbenzene/xylene (BTEX) mass.

In addition, the ESD removes TPH from further consideration as a metric for evaluation site cleanup, as NJDEP has determined that it is no longer applicable for the quantification of petroleum hydrocarbons in New Jersey.

Cleanup levels defined in the ROD, and as amended by the ESD, are summarized in Tables 1 and 2 for groundwater and soil, respectively.

5.2.3 Status of Implementation

Area D free product extraction and off-site incineration was initiated in 1988 as an interim removal action and continued until the fourth quarter of 2018, in preparation for the implementation of ISTR. The estimated total volume of product recovered by the product recovery system between 1995 (when recovery records were first maintained) and December 31, 2018 is 56,049 gallons. Recovery rates decreased from over 40 gallons per day in 1995 to less than 1 gallon per day in recent years. The SVE system operated from July 2001 until the fourth quarter of 2018 while groundwater extraction, treatment and reinjection have been operating continuously since February 1995. The groundwater remediation system includes treatment for both organics and inorganics.

Prior to February 17, 2009, the Area D treatment plant treated only groundwater extracted from Area D and treated groundwater was discharged to infiltration galleries located at Area D. Annual treatment volumes ranged from 15 to 33 million gallons. However, in 2009, the CTP began operating at Area D, treating groundwater from Areas B, D, and 41 at a combined rate of approximately 400 gallons per minute (gpm). Groundwater extracted from Area E was added to the CTP influent as of October 8, 2011. Recent combined treatment rates have been on the order of 10 million gallons per month. AECOM, under contract with the FAA Technical Center, currently operates the CTP.

With the construction of the CTP, other discharge options were also constructed, including injection wells at Areas B and 41 and a five-acre recharge bed located to the west-southwest of Area D. With the additional injection capacity offered by these features, the infiltration galleries at Area D were removed in 2012.

To improve the operation of the SVE system and reduce the overall remedial operation time frame, additional delineation of residual jet fuel contamination and the implementation of enhancements (e.g., catalytic oxidation unit replacement, the addition of extraction and SVE wells, and increased pumping rates) were conducted in the 2010 to 2012 time frame.

In 2013, the FAA ceased the operation of remedial systems at the FAA Technical Center under permit equivalencies issued by the NJDEP, per CERCLA's exemption of response actions from permit requirements. The FAA performed an assessment of the CERCLA substantive requirements applicable under the existing RODs of the operating remedial systems and developed an operational strategy plan (*CERCLA Substantive Requirements Evaluation and Operational Strategy Plan*, TRC Environmental Corporation, November 2013). FAA remedial systems, including the Area D remedial system, have since been operating under this plan. Figure 4 shows the locations of Area D extraction and monitoring wells, as well as piezometers and observation wells used to monitor the effectiveness of the groundwater extraction system.

To facilitate the implementation of additional remedial system enhancements to increase the rate of remediation at Area D, supplemental field investigations were conducted in 2015 to further define the presence of residual soil and groundwater impacts in the remedial area and the comprehensive site-wide groundwater model was updated to evaluate potential transport of groundwater contaminants at Area D. An evaluation of potential remedial enhancements was conducted and the use of ISTR was recommended to achieve remedial goals in a more timely manner. Prior to the design of the ISTR system, pre-construction investigations were conducted in 2018. The ISTR system will be implemented in two phases; Phase I operations began in March 2019.

On-going monitoring at Area D includes the following:

- Monthly CTP system sampling for VOC, SVOC, pesticide, and metals analyses;
- Area-specific quarterly CTP influent sampling for VOC, SVOC, pesticides and metals analyses; and
- Well-specific monitoring well sampling for VOC and metals analyses (quarterly) and SVOC analyses (annually).

Due to the required abandonment of some monitoring wells during the implementation of ISTR, the scope of the monitoring wells sampled during the well-specific quarterly sampling has changed. In addition to the monitoring program presented above, the FAA occasionally conducts site-wide sampling events to provide additional information on remedial system performance.

There are no specific LUCs in place at Area D. The HHRA for Area D was based on a restricted land use scenario and groundwater contaminant levels exceed MCLs. EPA requested in correspondence dated February 26, 2002 that the FAA develop a facility-wide land use control assurance plan (LUCAP) to address areas, such as Area D, where the presence of residual contamination and/or the lack of evaluation of an unrestricted (i.e., residential) use scenario in the HHRA requires the establishment and maintenance of site use restrictions. The FAA may consider addressing LUCs at FAA AOCs where there are currently no LUCs specified within the RODs through the preparation of an appropriate post-ROD enforceable document.

5.2.4 Systems Operations/Operation & Maintenance

During the period covered by this FYR, the Area D existing remedial system required on-going operation and maintenance of the groundwater, product and soil gas extraction systems, the groundwater treatment system including filtration and carbon adsorption units, the catalytic oxidation unit used to treat the extracted soil gas, and the treated groundwater discharge systems. Temporary system shutdowns were typically conducted each August to address normal operation and maintenance (O&M) activities that can only be conducted in a shutdown mode. Product level measurements were often conducted during the shutdown periods to determine product thicknesses (and therefore, the extent of the free product plume) under non-pumping conditions. Optimization testing was conducted in 2014 and 2015 that ultimately led to the discontinuation of the addition of sodium hydroxide and sulfuric acid during the treatment process, with no adverse impacts on treatment efficiency. Annual chemical cost savings were estimated at $129,000 per year. Other specific operational actions conducted since the last FYR include the replacement of granular activated carbon in one of the carbon vessels in September 2014 and the redevelopment of select Area D product recovery wells. Upgrades were also made to electrical systems, lighting, fire alarms, and software associated with the CTP and associated control systems. As part of the construction of the Phase I ISTR system, certain infrastructure in the treatment area was formally abandoned. Additional existing remedial system abandonment will occur when Phase II of the ISTR remedial program is implemented. Additional details are provided in Appendix E.

Benzene was detected in a downgradient sentinel monitoring well (D-MW20S) in 2004 at concentrations above practical quantitation limits (PQLs). As a result, extraction rates were increased and a downgradient Geoprobe® study of the extent of contamination was conducted. The study indicated that, while groundwater impacts were detected downgradient of well D-MW20S, they did not migrate beyond the facility's fence line. Additional Geoprobe® work was conducted in June and October 2005 to further define the extent of contamination in the immediate vicinity of well D-MW20S and two new downgradient sentinel wells D-MW25S and D-MW25D were installed in 2006. Since their installation, benzene has not been detected in wells D-MW25S and D-MW25D. The increased extraction rates successfully prevented further downgradient migration of the benzene and benzene has not been detected in well D-MW20S since April 2006.

In June 2006, September 2009 and September 2014, URS injected magnesium-based oxygen release compound (ORC) in the vicinity of monitoring well D-MW19S, after benzene was detected above the ROD cleanup goal of 1 µg/L downgradient (south) of recovery well D-R1. Upgradient groundwater extraction pumping rates were increased, with subsequent shallow groundwater contours indicating that the extraction system was successfully capturing the groundwater impacts in this part of Area D. Therefore, the benzene detected in wells D-MW19S and D-MW24S was expected to be a remnant of contamination that escaped capture prior to modification of the groundwater extraction system. Benzene was not subsequently detected in post-treatment monitoring conducted at well D-R1 or in quarterly samples collected at wells D-MW19S or D-MW24S.

The remedial enhancements implemented in 2010 to 2012 and increased pumping implemented in 2013 resulted in a relatively short-lived increase in vapor-phase, dissolved-phase and free-phase product recovery. The increased groundwater extraction and the removal of the infiltration galleries resulted in a lower water table; however, wet soil conditions attributable to precipitation continued to limit the effectiveness of the SVE system. As a result, the additional investigations and remedial evaluations described in Section 5.2.3 were conducted to evaluate other options for decreasing the remedial time frame for Area D. In preparation for the ISTR project, the free-phase product recovery system and vapor extraction system were taken off line in June 2018 and a number of Area D

monitoring wells, observation wells, groundwater extraction wells, vapor monitoring points, and vapor extraction wells were formally abandoned in August 2018.

Under the 2013 substantive requirements evaluation (TRC, 2013), the CTP effluent is currently sampled on a monthly basis for Priority Pollutant (PP) VOCs, semi-volatile organic compounds (SVOCs), pesticides and metals. Effluent goals are based on the more stringent of the ROD cleanup goals and the GWQS that were applicable at the time of ROD signature for the AOCs that send water to the CTP for treatment. The combined CTP influent is also characterized monthly on a voluntary basis for VOCs, SVOCs, pesticides and metals. Quarterly area-specific CTP influent sampling has been conducted since July 2012. During that time, total BTEX levels in the influent from Area D dropped from approximately 150 µg/L to approximately 40 µg/L, but have remained at the lower end of that range since the last FYR. Free-phase product extent maps for 2015 and 2018 are provided in Appendix E and indicate that the maximum measured product thickness decreased from 4.48 feet in 2015 to 0.58 feet in 2018.

5.3 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.

Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
01	Short-term Protective	The remedy at OU01 (Area D) currently protects human health and the environment because the existing remedy is controlling exposures to soil, groundwater and soil vapor. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: • Evaluation of the appropriate means of documenting LUCs at the FAA.

Status of Recommendations from the 2014 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
01	Lack of LUCs	Evaluate appropriate means of documenting LUCs	Under Discussion	The FAA is continuing its evaluation of how best to document LUCs.	Not applicable

In addition, the following recommendations were presented in the last FYR to improve the effectiveness of the remedy and accelerate site closeout but that did not affect current protectiveness:

- The continuation of groundwater monitoring following the application of additional ORC in the area of wells D-MW19S and D-MW24S where residual benzene had been identified in the groundwater.
- The performance of additional studies to determine the source and/or extent of PCE detected in well D-MW4D.

As discussed in Section 5.2.4, benzene has not been detected in post-treatment monitoring conducted at wells D-MW19S and D-MW24S, indicating that the ORC was successful in treatment the residual benzene. Since the last FYR, the FAA has primarily been focusing on other remedial efforts at Area D, including the implementation of ISTR. However, additional studies of the PCE impacts at well D-MW4D are currently underway.

5.3.1 Data Review

The scope of the Area D groundwater monitoring program currently reflects the *CERCLA Substantive Requirements Evaluation and Operational Strategy Plan* (TRC, 2013). The data review presented below is based primarily on the sampling conducted on a quarterly basis at Area D.

Area D extraction wells are not sampled on a quarterly basis, but the CTP influent from Area D is sampled regularly. Benzene is the only constituent detected in the CTP influent from Area D since the last FYR at a level exceeding the ROD cleanup criteria. Historically, xylenes were also detected in the influent at levels exceeding ROD criteria.

BTEX compounds continue to be detected in Shallow Aquifer groundwater monitoring wells located within the Area D treatment area at concentrations exceeding the ROD cleanup levels, although concentrations have decreased significantly since the ROD was signed. No exceedances of BTEX ROD cleanup levels are detected in the quarterly sampling of Intermediate Aquifer wells at Area D. Chromium was detected above the ROD cleanup level of 50 µg/L in monitoring well D-MW4D in February 2017, at a concentration of 62.2 µg/L.

For compounds without ROD cleanup values, tetrachloroethene (PCE) has consistently been detected in Intermediate Aquifer monitoring well D-MW4D at levels exceeding the current MCL of 1 µg/L since 2010. Concentrations rose to the 11.7 to 14.5 µg/L range over the February 2011 to October 2013 period and have fallen since then, with detected levels ranging from 1.4 to 2.9 µg/L since April 2015. PCE was not identified as a constituent of concern in the Area D HHRA or ROD, so the source of the PCE detected in well D-MW4D is unknown. Investigations are currently being performed at Area D to further define the extent of the PCE impacts.

Mercury, another analyte without a ROD cleanup level, has also been detected above the current New Jersey GWQS (the PQL) of 0.05 µg/L but generally below the MCL of 2 µg/L in several monitoring wells. Since 2014, the highest levels of mercury have been detected in Intermediate Aquifer monitoring well D-MW13D, located on the far eastern side of Area D, with detected levels ranging from 0.45 µg/L to 13.9 µg/L. The presence of mercury along the SBAC, which borders Area D to the south, and within its watershed is being investigated under a separate operable unit (OU14 - Area U). The FAA is committed to the continued identification and delineation of mercury source(s) at the Technical Center.

With respect to the discharge of treated groundwater from the CTP, Intermediate Aquifer groundwater quality upgradient of the recharge bed and downgradient of the Area B injection wells that receive effluent from the CTP is monitored to evaluate impacts of CTP effluent discharge on groundwater quality. Since quarterly sampling began in 2013, no parameters were consistently detected in the upgradient monitoring wells (PER-MW01I and PER-MW01D) at levels exceeding applicable discharge monitoring criteria with the exception of mercury at well PER-MW01I. Similarly, in the wells downgradient of the Area B injection wells that have been consistently sampled since 2010 (wells B-IMW1 through B-IMW4), no parameters were consistently detected at levels exceeding applicable discharge monitoring criteria with the exception of chloroform. As discussed in Section 2.4, chloroform has been detected in groundwater throughout the FAA Technical Center and has been reported to occur regionally in the Cohansey aquifer of southern New Jersey. Furthermore, a chloroform discharge monitoring criterion for the CTP was established at 7.7 µg/L based on a statistical analysis of background chloroform levels at the FAA Technical Center conducted in 2013. Chloroform has not been detected at a level exceeding this statistically-based background level in the monthly CTP effluent samples collected since the last FYR. Therefore, its presence in wells B-IMW1 and B-IMW3 is not expected to be related to the discharge of treated effluent from the CTP. Furthermore, the maximum level of chloroform detected in wells B-IMW-1 and B-IMW3 since the last FYR was 16 µg/L, which is well below the 80 µg/L MCL for total trihalomethanes (of which chloroform is one of four) and below the NJDEP generic VI screening level of 70 µg/L in groundwater (NJDEP, March 2013). The presence of mercury in upgradient monitoring well PER-MW01I is not attributable to the CTP discharge, as it has been detected above the PQL of 0.05 µg/L in only one monthly CTP effluent sample collected since the last FYR. Furthermore, while mercury has been detected in PER-MW01I at levels exceeding the 0.5 µg/L CTP discharge monitoring criterion, it has not been detected at levels exceeding health-based criteria (i.e., the federal or state MCLs).

Additional subsurface soil data was collected at Area D during the 2015 investigations and the ISTR pre-construction investigation . BTEX compounds were detected in subsurface soil (at depths of 12 feet or greater) at elevated levels within residual pockets of contamination. The maximum contaminant levels detected during these studies, as presented in Table 2, exceed ROD cleanup levels.

5.3.2 Site Inspection/Interview Findings

The Site Inspection was conducted on April 24, 2019 and included representatives of the FAA, EPA and the FAA's contractor, TRC. Phase I of the ISTR project was operating at the time of the inspection. The active ISTR area was fenced. No major issues were identified during the inspection of Area D.

5.4 Technical Assessment

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

Question A Summary:

Groundwater extraction, treatment and reinjection has continued since the last FYR. CTP effluent sampling has not exhibited exceedances of the substantive requirements that were applicable to discharges to groundwater at the time the ROD was finalized.

The implementation of enhancements to the Area D remedial system in 2010 – 2013 resulted in short-term increases in groundwater pumping rates and the removal of the infiltration galleries lowered the water table in the treatment area; however, significant improvements in the operation of the SVE system did not result. Therefore, additional studies were performed and the implementation of ISTR was proposed, with the first phase of the ISTR remedial system operational as of March 2019. The implementation of ISTR resulted in the discontinuation of the existing free product removal and SVE operations (groundwater extraction and treatment continue). The ISTR system has been designed to address residual areas of BTEX soil contamination. ISTR is efficient at removing the bulk of contamination from the subsurface but becomes less efficient and more expensive after concentrations decrease. BTEX compounds are well known to be susceptible to natural attenuation processes under a wide range of environmental conditions. Therefore, under the ESD, MNA is incorporated as a component of the remedy to reduce residual contaminant mass that remains when ISTR efficiency declines. ISTR combined with MNA is expected to significantly reduce the presence of residual contamination in the soil and improve groundwater quality in a timelier fashion than was being achieved by the existing remedial system.

Access to Area D continues to be limited by the FAA's security system to authorized FAA employees and contractors. The main changes in the physical conditions of Area D since the last FYR review are associated with the implementation of ISTR. Beyond the normal access controls in place at the FAA Technical Center, the ISTR treatment area is surrounded by a separate fence and the surface of the treatment area is covered by a geomembrane, providing even more stringent access controls during implementation of the ISTR remedy.

5.4.2 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?

Question B Summary:

The Area D remedial system is designed to attain the groundwater cleanup standards (applicable or relevant and appropriate requirements or ARARs) identified in the Area D ROD, which are based on drinking water standards and New Jersey GWQS that were applicable at the time of the ROD signature (September 29, 1989). Operation of the Area D remedial system also meets the substantive requirements of the action-specific ARARs that existed at the time of the ROD signature. Table 1 presents a comparison of the groundwater ARARs specified in the Area D ROD to current standards (i.e., drinking water and groundwater quality standards). The most-stringent of the

chemical-specific groundwater ARARs defined in the Area D ROD continue to be less than or equal to current state and federal MCLs, with the exception of lead. The only well monitored on a quarterly basis at which lead has been detected at a level greater than the federal action level of 15 µg/L at the tap since 2014 is well D-MW8S. Lead was detected at 18.8 µg/L in well D-MW8S, located in the western portion of Area D, in November 2015. Since the action level is based on water quality at the tap and since shallow groundwater is not used as a source of drinking water, the one-time detection of lead at well D-MW8S at a level exceeding the drinking water criterion is not considered to impact the protectiveness of the Area D remedy.

The current New Jersey GWQS are more stringent for some analytes than the ROD-based ARARs; however, the current GWQS are not health-based but are based on an antidegradation standard established for the Pinelands area. If only those groundwater quality standards that are not based on an antidegradation basis (i.e., the Class IIA GWQS) are considered, lead is the only constituent listed in Table 1 with a Class IIA GWQS that is more stringent than the ROD-based ARARs. Lead has been detected in various Area D monitoring wells at levels exceeding the current Class IIA GWQS of 5 µg/L, with well D-MW22S exhibiting the most frequent exceedances (five times since 2014). Given the infrequent detections of lead above the Class IIA GWQS and the exceedance of the health-based federal action level of 15 µg/L in only one recent groundwater sample, lead is not considered to pose a threat to human health. Also, the CTP effluent has not exhibited lead at levels exceeding 5 µg/L since the last FYR, so lead within the extracted groundwater is being treated. Therefore, even though the ROD-based criterion exceeds the current GWQS for lead, the remedy continues to be protective of human health. No new location-specific or action-specific ARARs have been identified that are not being met by the existing Area D remedial system. With respect to potential VI issues, none of the shallow or intermediate wells sampled on a quarterly basis exhibited exceedances of the NJDEP generic VI screening levels (NJDEP, March 2013) for BTEX compounds in groundwater since the last FYR.

With respect to the operation of the CTP, because the CTP treats groundwater from several AOCs, its operation meets the substantive requirements of the ARARs that existed at the time of the most recent ROD (i.e., as of September 26, 2003, the date of the Area E ROD signature). Therefore, discharges from the CTP meet the most stringent of the ROD-listed chemical-specific ARARs for Areas B, D, E and 41 or the action-specific ARARs relative to treatment plant discharges that were applicable as of September 26, 2003. The New Jersey GWQS (New Jersey Administrative Code or NJAC 7:9-6) applicable at the time of the Area E ROD signature consisted of natural background levels or PQLs. Therefore, the effluent from the CTP is meeting GWQS that are more stringent than health-based drinking water standards (both the drinking water standards defined in the Area D ROD and current drinking water standards) and the GWQS that were documented in the Area E ROD (see Table 18 for the applicable Area E ROD ARARs). Because the GWQS have been revised since the signature of the Area E ROD, some of the current PQL-based GWQS for metals are more stringent than those that were applicable at the time of the Area E ROD signature. The current PQL-based GWQS are not health-based but instead are based on an antidegradation standard established for the Pinelands area. As noted in the previous paragraph, lead is the only constituent of concern at Area D with a Class IIA GWQS that is more stringent than the ROD-based ARARs but the lead levels in the CTP effluent are well below the Class IIA GWQS. Therefore, the CTP effluent quality continues to be protective of human health.

The soil cleanup standards identified in the Area D ROD were based on New Jersey Soil Cleanup Action Levels applicable at the time the ROD was signed. These levels included 1 mg/kg for total VOCs and 100 mg/kg for TPH in soils. The current New Jersey Soil Remediation Standards (NJSRS) do not include comparable total VOC or TPH cleanup levels and the ESD that is currently being finalized removes TPH from further consideration as a metric for evaluation site cleanup, as NJDEP has determined that it is no longer applicable for the quantification of petroleum hydrocarbons in New Jersey. Therefore, the 100 mg/kg TPH cleanup level is not considered herein. The 1 mg/kg total VOC cleanup level remains below the comparable constituent-specific NJSRS and therefore continues to be protective of human health. While individual compounds were detected in soils during the EI at maximum concentrations that are below current NJSRS based on direct contact (residential and non-residential), subsequent sampling during the 2010 LIF study, the Supplemental Site Investigation and the Pre-Construction Investigation identified residual pockets of BTEX contamination at levels above the current non-residential NJSRS for benzene (see Table 2). The ISTR system has been designed to address these residual areas of benzene soil contamination.

No new location-specific or action-specific ARARs have been identified that are not being met by the existing remedial system.

For constituents monitored during quarterly groundwater sampling events for which no ROD cleanup levels are established, PCE has consistently been detected in one Intermediate Aquifer monitoring well, D-MW4D, at levels exceeding the current MCL of 1 µg/L since 2010. The maximum detected level of PCE since the last FYR, 14.5 µg/L, is well below the 31 µg/L NJDEP generic VI screening level (NJDEP, March 2013). PCE was not identified as a constituent of concern in the HHRA or ROD for Area D, so the source of the PCE detected in well D-MW4D is unknown. PCE has not been detected in FAA or ACMUA potable wells that are screened in the lower aquifer, which is separated from the Intermediate Aquifer by a 20 to 40-foot thick clay layer, so there is no immediate risk to human health posed by its presence in well D-MW4D.

Chloroform was often detected in quarterly samples collected from wells D-MW15S, D-MW18S, D-MW19S and/or D-MW24S at levels exceeding the current PQL of 1 µg/L, but not exceeding the calculated background level of 7.7 µg/L, the MCL for combined trihalomethanes of 80 µg/L, or the 70 µg/L NJDEP generic VI screening level (NJDEP, March 2013). Therefore, it is not considered to pose a risk to human health. It is also not considered to be attributable to Area D, as described in more detail in Section 2.4.

Mercury is present in several monitoring wells at levels generally below the MCL but greater than the current GWQS. Since 2014, the highest levels of mercury have been detected in Intermediate Aquifer monitoring well D-MW13D, located on the far eastern side of Area D, with detected levels ranging from 0.45 µg/L to 13.9 µg/L. This is the only monitoring well sampled on a quarterly basis that exhibits exceedances of the MCL. The presence of mercury along the SBAC is being investigated under a separate operable unit (OU14 - Area U). NJDEP has not established a groundwater-based generic VI screening level for mercury.

Other metals without ROD cleanup levels that were detected multiple times in quarterly groundwater samples at levels exceeding PQLs include arsenic (especially at wells D-MW8S and D-MW22S), copper (especially at wells D-MW8S, D-MW9S, D-MW20S, D-MW22S and D-MW25S), nickel (especially at wells D-MW4D, D-MW13D and D-MW22S) and zinc (especially at wells D-MW8S, D-MW9S, D-MW10S, D-MW18S and D-MW25S). However, with the exception of arsenic, none of these analytes was detected at concentrations exceeding Class II-A GWQS or MCLs. For arsenic the PQL equals the Class II-A GWQS (3 µg/L) while the New Jersey MCL is set at 5 µg/L. Since the third quarter of 2016, exceedances of the PQL/Class II-A GWQS have been limited to well D-MW8S, with a maximum concentration of 7.1 µg/L arsenic detected over that period. Given the general lack of MCL exceedances for the listed metals, they are not considered to present a potential risk; furthermore, they are typically detected in shallow or, in a few cases, intermediate wells and, as described for PCE above, present no immediate risk to human health.

In August 2014, a CTP effluent sample was analyzed for PFAS, which are considered by the EPA to be contaminants of emerging concern. No PFAS were detected in the CTP effluent. In November 2015, three extraction wells from the Area D groundwater remedial system were sampled and analyzed for PFAS. Perfluorooctanoic acid (PFOA) and perfluorooctyl sulfonate (PFOS) were detected in each of the samples at individual concentrations ranging from 46 nanograms per liter (ng/L) to 2,200 ng/L, with individual and/or combined concentrations exceeding the EPA Provisional Health Advisory level of 70 ng/L in each well. In addition, perfluorononanoic acid (PFNA) was detected in only one of the three wells at a concentration of 7 ng/L (with detection limits of 5 ng/L), which is below the New Jersey MCL of 13 ng/L. A facility-wide PFAS Preliminary Assessment recommended the performance of a Remedial Investigation (RI) at Area D to further evaluate the nature and extent of PFAS impacts. The RI will be performed following the completion of a Site Inspection at other areas of potential PFAS impacts. See Section 2.4 for further discussion.

No other new contaminants, contaminant sources or unanticipated toxic byproducts of the remedy have been identified.

Current toxicity values for the constituents evaluated in the human health risk assessment have not changed since the last FYR (when the remedy was found to be protective).

An ERA conducted by the USFWS in 1996 concluded that potential risks to terrestrial receptors were minimal. Because there is no new information contradicting these conclusions, and based on the effectiveness of the remedial system in addressing groundwater contamination, the remedy remains protective of the environment. Potential risks associated with the exposure of aquatic receptors to the SBAC is currently being evaluated within an ERA conducted as part of the Area U RI.

Land use at or near Area D has not changed since the last FYR and the potential routes of exposure generally remain the same. Groundwater has not been developed as a potable source of water at Area D and the SVE system and vapor extraction component of the ISTR system address the soil vapor exposure pathway. The exposure to surface soil pathway is likely not well represented by the exposure assumptions used in the original risk evaluation, since that evaluation was based on a worst-case scenario of 24 exposures per year, assuming periodic use of the fuel transfer facility that was previously located at Area D. Operators of the Area D treatment system are on-site on a daily basis, Monday through Friday; however, the temporary placement of a geomembrane over the ISTR area during treatment limits current exposures of operators to surface soil over a portion of the site. Risks associated with exposures to surface soils were conservatively estimated in the HHRA based on maximum subsurface soil contaminant concentrations, since subsurface impacts were greater than surface impacts (which led to a general lack of surface soil data). Since the risks estimated based on this conservative assumption were well below acceptable risk levels (in the 10^{-10} to 10^{-11} range for carcinogenic risks and hazard indices in the 10^{-4} to 10^{-11} range for noncarcinogenic risks), an increase in the exposure frequency would not be expected to result in unacceptable risk levels.

While land use has not changed, Area D does not currently have LUCs in place to protect against unacceptable exposures in the future. The HHRA for Area D was based on a restricted land use scenario and groundwater contaminant levels exceeds MCL. EPA requested in correspondence dated February 26, 2002 that the FAA develop a facility-wide LUCAP to address areas, such as Area D, where the presence of residual contamination and/or the lack of evaluation of an unrestricted (i.e., residential) use scenario in the HHRA requires the establishment and maintenance of site use restrictions. The FAA may consider addressing LUCs at FAA AOCs where there are currently no LUCs specified within the RODs through the preparation of an appropriate post-ROD enforceable document.

The implementation of ISTR is expected to speed the achievement of remedial action objectives at Area D. No additional contaminants have been identified that would impact the effectiveness of the remedial action.

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

No additional information has been identified that would call into question the protectiveness of the remedy.

5.5 Issues/Recommendations

Issues, recommendations and follow-up actions for OU01 are listed below.

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 01	Issue Category: Institutional Controls			
	Issue: Lack of LUCs			
	Recommendation: Evaluate appropriate means of documenting LUCs.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	8/31/2021

5.6 Other Findings

In addition, the following are recommendations that were identified during the FYR that may accelerate site close out, but do not affect current and/or future protectiveness:

- The performance of additional studies to determine the source and/or extent of PCE detected in well D-MW4D.

5.7 Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit: 01	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at OU01 (Area D) currently protects human health and the environment because the existing remedy is controlling exposures to soil, groundwater and soil vapor. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure protectiveness: • Evaluation of the appropriate means of documenting LUCs at the FAA.	

6.0 OU02 - AREA 20A - SALVAGE YARD AREA

6.1 History of Contamination and Initial Response

Area 20A, the Salvage Yard Area, is located in the Research and Development (R&D) portion of the FAA Technical Center, southeast of the Atlantic City International Terminal. It consists of two adjacent salvage yards associated with FAA Buildings 206 and 207. The area is approximately 1,600 feet south of the Upper Atlantic City Reservoir and was used for storage of old aircraft parts, trucks and cars, scrap metal, and empty 55-gallon drums. A site reconnaissance conducted in the early 1980s showed the presence of deteriorated and leaking drums in the northern half of the Salvage Yard area, with evidence of past spillage (visibly-stained surface soils).

The media of concern at Area 20A include contaminated soil and contaminated groundwater. A major area of soil contamination was identified along the western edge of the Building 206 Salvage Yard, where concentrations of polychlorinated biphenyls (PCBs) and VOCs in the surface soil exceeded NJDEP Soil Action Levels. An additional area of soil contamination was identified in December 1988, when two underground waste oil storage tanks were removed. Soil in the excavation was found to contain both PCBs and TPH at levels exceeding NJDEP Soil Action Levels.

Chlorinated VOCs (CVOCs) are present in the groundwater. When first identified, the contaminant plume in the shallow, unconfined aquifer was generally limited to the immediate Salvage Yard area. CVOCs were also found in the Intermediate Aquifer, in monitoring wells 80 to 100 feet deep located up to 1,500 feet from the Salvage Yard.

6.2 Response Action Summary

6.2.1 Basis for Taking Action

Contaminants

COCs, as identified in the HHRA for Area 20A, in each medium include:

Soil	Groundwater
1,1,1-Trichloroethane (TCA)	1,1-Dichloroethene (1,1-DCE)
PCE	TCA
Toluene	PCE
4,4-DDT	bis(2-Ethylhexyl)phthalate
Aroclor-1260 (PCB)	Cadmium
Cadmium	Chromium
Chromium	

Human Health Risk Assessment

Since Area 20A was not expected to be used for any scheduled activity, the exposure frequencies used in the HHRA were restrictive. For example, exposure to surface soil was based on a maximum exposure frequency of 24 times per year. Exposure to groundwater was based on a commercial/industrial maximum exposure frequency of 250 days/year, assuming a potable well was installed. Exposures to soil and groundwater at Area 20A were associated with significant human health risks, due to exceedances of EPA's risk-management criteria. PCBs in subsurface soil corresponded to noncarcinogenic risk exceedances while 1,1-DCE in groundwater resulted in carcinogenic risk exceedances.

Ecological Risk Assessment

A qualitative ERA was conducted on the basis of the same COCs as the HHRA. It was surmised that PCBs and 4,4-DDT concentrations in surface soils could be high enough to affect the reproduction or induce chronic toxic effects in some wildlife. An evaluation of potential ecological risks was also conducted in 1996 as part of a facility-wide ERA conducted by the USFWS. The evaluation included the collection of soil samples, earthworm bioassay samples and small mammal composite samples within the Salvage Yard area and an evaluation of a nearby surface water sample result. Soil sample results indicated that the extent of PCB soil contamination was greater than originally expected. PCBs were also detected in the biota samples at elevated levels. Endosulfan was detected in one of three soil samples at an elevated level. The risk assessment concluded that potential risks to aquatic receptors are minimal, although potential risks to terrestrial receptors could be associated with the presence of PCBs and endosulfan in surface soils.

6.2.2 Response Actions

The ROD for Area 20A was signed on September 28, 1990. The ROD does not list specific RAOs. The selected remedy for Area 20A included the following components:

- Excavation of approximately 930 cubic yards of PCB-contaminated soil and transport off-site for incineration;
- Extraction of contaminated groundwater from the unconfined aquifer (Upper Cohansey Sand), air stripping to remove organic compounds, and reinjection upgradient of the contaminated area; and
- Extraction of contaminated groundwater from the Intermediate Aquifer (Middle Cohansey Sand), air stripping to remove organic compounds, and discharge to an existing borrow-pit area.

An ESD was issued in June 1995. The primary changes documented in the ESD were:

- Revised soil cleanup criteria for PCBs; and
- Revised off-site treatment of PCB-contaminated soil from solely incineration to incineration in combination with land disposal.

Cleanup levels defined in the ROD, and as amended by the ESD, are summarized in Tables 4 and 5 for groundwater and soil, respectively.

6.2.3 Status of Implementation

An interim remedial measure consisting of pumping and treating groundwater from three extraction wells screened in the Intermediate Aquifer was implemented in February 1992. A Shallow Aquifer extraction system was constructed and began operation in September 1996. The extracted groundwater was originally treated with an air stripper and discharged to a recharge basin or injected back into the Intermediate Aquifer via a series of injection wells. In the 2013 to 2014 time frame, new shallow extraction and monitoring wells were installed, a new Intermediate Aquifer extraction well (20A-EW4) was installed, injection wells were redeveloped, and carbon adsorption was added to the treatment train as part of remedial system enhancements. As of March 1, 2019, approximately 3 billion gallons of groundwater had been treated by the Area 20A remedial system.

The PCB-contaminated soil removal action began in August 1998 and was completed in September 1999, with approximately 3,500 cubic yards of PCB-contaminated soil and debris transported off-site for disposal. Figure 5 shows the locations of extraction, observation, monitoring, and injection wells at Area 20A, as well as the locations of the Salvage Yard, air stripping tower, treatment trailers and Area 20A recharge basin.

Recent studies have indicated that the greatest mass of residual chlorinated solvents exists in the groundwater within two discrete areas: within the Shallow Aquifer in the source area within the Salvage Yard and in an elongated footprint at the approximate top of the Intermediate Aquifer. To facilitate the implementation of additional remedial system enhancements to increase the rate of remediation at Area 20A, additional field investigations were conducted in 2014 and 2015. These investigations were intended to further define the presence of residual soil and groundwater CVOC impacts in the Salvage Yard area and to provide additional information relative to the potential source of mercury detected in Area 20A groundwater. The initial soil characterization indicated that CVOCs and mercury typically are not present at levels that would result in impacts to groundwater quality. The initial groundwater characterization indicated the presence of CVOCs above ROD-based cleanup levels and mercury levels that were elevated relative to other available mercury data for Area 20A. Mercury was included in the scope of the investigations due to detections of mercury in treatment system effluent samples (see Section 6.2.4).

In January 2015, a field-scale pilot test was conducted to evaluate the effectiveness of in-situ chemical reduction (ISCR) and enhanced bioremediation augmentation to expedite the remediation of CVOCs. The testing focused on the potential use of these technologies in the Salvage Yard source area (in the vicinity of the 20A-MW27 well cluster) and within a permeable reactive barrier (PRB) approximately 500 feet downgradient of the Salvage Yard. The addition of sodium bicarbonate was required to increase the naturally low pH of the Pinelands area groundwater to levels that would support bioremediation. While environmental conditions in the PRB area were demonstrated to be conducive to bacterial growth, the preferred bacteria were not present at levels that would support reductive dichlorination, possibly due to relatively low CVOC levels.

Supplemental investigations of Area 20A included the collection of additional groundwater samples for VOC analysis and/or mercury analysis in January 2015, and the collection of additional saturated soil and groundwater data in November 2015 to determine if an ongoing source of CVOCs continues to contribute to the CVOC plume at the site. Mercury sampling and analysis of the soil and groundwater was also conducted to verify the absence of a mercury source in the Salvage Yard. The studies indicated that desorption from the finer-grained soils below the water table may act as a continued source of CVOCs in groundwater. No significant source of mercury was identified in the Salvage Yard area. Previously generated three-dimensional plume image models of CVOCs and mercury in Area 20A groundwater and the Area 20A portion of the comprehensive groundwater model were updated to reflect the 2014 and 2015 data. The groundwater modeling indicated that, assuming unchanged extraction well pumping rates and no remedial enhancements, PCE and 1,1-DCE will still remain in the shallow zone of the aquifer at concentrations exceeding the ROD-based cleanup levels in 40 years, as will PCE in the Intermediate Aquifer. The mercury simulation results suggested that very little mercury transport is occurring at all levels of the aquifer. The most rapid changes in concentrations are occurring in the vicinity of the extraction wells, where hydraulic gradients are steepest and associated advective transport velocities are greatest.

Concurrent with the additional site investigation work at Area 20A, the FAA further evaluated remedial enhancements to address residual CVOCs. The assessment included the performance of bench-scale treatability tests for the use of PlumeStop®, an in situ adsorption (ISA) technology. The potential use of in situ chemical oxidation (ISCO) technologies was also evaluated. Pilot scale testing of ISA using PlumeStop® and two ISCO pilot tests, one using Modified Fenton's reagent Activated Sodium Persulfate (MASP) and the second using Perozone®, were recently conducted. Each test was conducted in a separate area of Area 20A (a figure showing the pilot test areas is included in Appendix E). The PlumeStop® testing involved a total of 16 injection points, with injections in the upper 15 feet of the groundwater, and was intended to evaluate the use of the technology for source area treatment or as a permeable reactive barrier. The MASP pilot test injections involved injections of MASP into the subsurface to chemically oxidize shallow soil and groundwater contaminants in the source area. A total of 16 injection points were used, with injections occurring from 10 to 16 feet below ground surface. Perozone® pilot testing evaluated the use of two spargepoints to introduce peroxide-coated ozone bubbles into the subsurface to treat source area soil and groundwater, with operation occurring from August to October 2018. Based on the treatability study results, MASP appears to be more cost-effective than Perozone® as an ISCO treatment method. While both technologies were effective, MASP injection is a more passive process than the sparging that is required for the Perozone® application. Therefore, MASP will be evaluated for use in source area hot spot treatment in the Salvage Yard. The ISA/PlumeStop® pilot study is ongoing. Several additional rounds of soil and groundwater sampling are expected. Assuming that the ISA/PlumeStop® pilot test results indicate that ISA is a viable remedial technology, PlumeStop® will most likely be used within a permeable reactive barrier immediately downgradient of the Salvage Yard.

AECOM, under contract with the FAA Technical Center, currently operates the Area 20A groundwater remediation system.

On-going monitoring at Area 20A includes the following:

- Monthly groundwater remediation system sampling for VOC, SVOC, and metals analyses;
- Well-specific monitoring well sampling for VOC and mercury analyses (quarterly) and SVOC, PCB, 4,4-DDT and other metals analyses (annually); and
- Quarterly injection monitoring well sampling for VOC and mercury analyses and annual sampling for SVOC and other metals analyses.

In addition to the monitoring program presented above, the FAA occasionally conducts site-wide sampling events to provide additional information on remedial system performance.

There are no specific LUCs in place at Area 20A. The HHRA for Area 20A did not assess a residential land-use scenario, the soil removal that took place was based on non-residential New Jersey soil cleanup criteria (NJSCC), and groundwater contaminant levels exceed MCLs. As previously mentioned, EPA has requested that FAA develop a facility-wide LUCAP to address areas such as Area 20A where the presence of residual contamination and/or the lack of evaluation of an unrestricted (i.e., residential) use scenario in the HHRA requires the establishment and

maintenance of site use restrictions. The FAA may consider addressing LUCs at FAA AOCs where there are currently no LUCs specified within the RODs through the preparation of an appropriate post-ROD enforceable document.

6.2.4 Systems Operations/Operation & Maintenance

The Area 20A remedial system requires on-going operation and maintenance of the groundwater extraction, treatment and discharge systems. Temporary system shutdowns are conducted each August (as necessary) to address normal O&M activities that can only be conducted in shutdown mode.

As described previously for Area D, through 2012, the FAA operated the remedial systems at the Technical Center in accordance with permit equivalencies issued by the NJDEP. However, since 2013, the FAA has operated the Area 20A remedial system in accordance with an assessment of the CERCLA substantive requirements applicable under the existing ROD, as documented in an operational strategy plan (TRC, 2013)

Due to the Area 20A remedial system's relative simplicity, minimal operating problems have been experienced. Starting in November 2008, mercury was detected in Area 20A quarterly effluent samples at concentrations ranging as high as 0.76 µg/L. Sampling of the individual extraction wells indicated that extraction well 20A-EW3 was the primary contributor of mercury to the treatment system. While the Area 20A ROD does not include a chemical-specific cleanup level for mercury, extraction well 20A-EW3 was temporarily shut down until mercury treatment was added to the treatment system in 2014. Soil and groundwater investigations conducted from 2011 through 2015 have not identified any significant source of mercury and no connection between the mercury present at Area U and the Area 20A mercury detections has been established. Therefore, the source of the mercury in the groundwater at Area 20A remains unknown.

O&M activities conducted since the last FYR include the temporary shutdown of extraction wells due to equipment issues or treatability study testing. In April 2016, the extraction well pumps in 20A-EW1, 20A-EW2, 20A-EW3, and 20A-EW4 were replaced with pumps capable of operating at a lower pressure to reduce the operating pressure of the influent line piping and provide energy savings. Leaks have occurred in the carbon treatment vessels but have been repaired, with the vessels placed back into service. The Area 20A injection wells were redeveloped in October/November 2016 to improve performance.

Under the 2013 substantive requirements evaluation, the treatment system effluent is currently sampled for VOCs, SVOCs, and metals. Effluent goals are based on the more stringent of the ROD cleanup goals and the GWQS that were applicable at the time of ROD signature. The influent is also characterized on a voluntary basis for VOCs, SVOCs, and metals. VOC levels in the influent have been decreasing since 1997, when total VOCs were present in the influent at approximately 30 µg/L, to less than 10 µg/L currently. During monthly sampling over the last two quarters of 2018, PCE and 1,1-DCE comprised less than 20% of the total VOC concentration, with the remainder of the total VOC concentration consisting solely of chloroform. Chloroform has also been detected in the influent at low levels. As discussed in Section 2.4, chloroform has been detected in groundwater throughout the FAA Technical Center and has been reported to occur regionally in the Cohansey aquifer of southern New Jersey. Therefore, it is not expected to be site-related. Effluent results have consistently been below applicable discharge criteria over the operating period. Limited plume mapping is available for Area 20A. Plume maps for 1,1-DCE and PCE in the Shallow Aquifer based on data available in 2017 and 2018 and for the Intermediate Aquifer based on data available in 2014 and 2018 are provided in Appendix E. For the Shallow Aquifer, the 1,1-DCE detections are consistently detected in the northwest corner of the Salvage Yard, at 20A-MW27S and adjacent shallow wells. Due to the collection of additional shallow data during pilot testing in 2018 at Area 20A when compared to 2017, the 2018 mapping of the extent of PCE indicates a greater extent of shallow PCE impacts, with higher levels of PCE identified in the eastern portion of the Salvage Yard area, an area that was not sampled in 2017. For the Intermediate Aquifer, a comparison of 2014 and 2018 data indicates a reduction in the downgradient 1,1-DCE and PCE impacts (either in extent and/or concentrations). For 1,1-DCE, an increased area of intermediate groundwater upgradient impacts is observed in 2018, likely due to the collection of additional data points in 2018.

6.3 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.

Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
02	Short-term Protective	The remedy at OU02 (Area 20A) currently protects human health and the environment because the existing remedy is controlling exposures to soil and groundwater. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: • Evaluation of the appropriate means of documenting LUCs at the FAA.

Status of Recommendations from the 2014 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
02	Lack of LUCs	Evaluate appropriate means of documenting LUCs	Under Discussion	The FAA is continuing its evaluation of how best to document LUCs.	Not applicable

6.3.1 Data Review

The scope of the Area 20A groundwater monitoring program currently reflects the *CERCLA Substantive Requirements Evaluation and Operational Strategy Plan* (TRC, 2013) The data review presented below is based primarily on the sampling conducted on a quarterly basis at Area 20A.

Quarterly monitoring of the Intermediate Aquifer extraction wells (20A-EW1, 20A-EW2, 20A-EW3, and 20A-EW4) indicates that PCE is the only chlorinated VOC detected at levels exceeding the ROD-based cleanup criteria since the last FYR, with elevated levels generally limited to samples collected from extraction well 20A-EW2. The PCE levels at 20A-EW2 have been decreasing, from 6.9 µg/L in 2009 to less than 3 µg/L since September 2016. Shallow extraction wells were sampled two or less times since the last FYR. PCE was detected in five of the shallow extraction wells at levels exceeding ROD-based cleanup levels since the last FYR. Chromium was also detected in three Shallow Aquifer extraction wells (20A-EW14S, -EW16S and -EW19S) at levels exceeding ROD-based cleanup levels since the last FYR. These wells were previously analyzed for VOCs only. Area 20A treatment system influent samples are collected on a monthly basis. PCE was the only constituent detected above ROD cleanup levels in Area 20A influent samples collected since the last FYR and only one sample exhibited a slight exceedance (1.1 µg/L PCE detected in the influent sample collected in May 2016).

Intermediate aquifer monitoring wells 20A-MW21D, 20A-ACMUA8S and 20A-DMW2 have consistently exhibited the presence of PCE at levels exceeding the Area 20A ROD-based cleanup level for five or more years. 1,1-DCE has also periodically been detected in these wells at levels exceeding the ROD-based cleanup level. These wells are located within the capture zone of extraction wells 20A-EW2, 20A-EW3 and 20A-EW4. Other Intermediate Aquifer wells that have regularly exhibited PCE and/or 1,1-DCE above ROD-based cleanup levels over the past five years include 20A-MW22I and 20A-MW27I. Intermediate wells that exhibited PCE and/or 1,1-DCE ROD exceedances since the last FYR but that have not exhibited exceedances since at least November 2016 include 20A-MW10D, 20A-MW19I and 20A-MW25I.

Shallow aquifer monitoring well 20A-MW27S regularly exhibits exceedances of the ROD-based cleanup level for 1,1-DCE and occasionally exhibits exceedances of the PCE ROD-based cleanup level. This well is located along the northern edge of the Salvage Yard.

Shallow aquifer groundwater quality in the vicinity of the recharge basin and Intermediate Aquifer groundwater quality in the vicinity of the injection wells are also monitored, although some wells are not sampled on a quarterly basis. No parameters were consistently detected in the Shallow Aquifer monitoring wells (20A-SMW1, 20A-SMW2 and 20A-SMW3) or Intermediate Aquifer monitoring wells (20A-IAMW2, 20A-IAMW3, 20A-IAMW4 and 20A-IAMW5) at levels exceeding ROD-based discharge criteria since the last FYR, with the exception of mercury at 20A-IAMW4. Mercury was detected at 20A-IAMW4 at levels of 3 µg/L to 5.3 µg/L during each of the four 2018 quarterly sampling events, but generally did not exceed 2 µg/L in previous sampling events. This well is upgradient/sidegradient of the Salvage Yard, as indicated on Figure 5.

Soil and groundwater investigations conducted in 2014 and 2015 provided additional information on the nature and extent of residual soil and groundwater VOC impacts in the Salvage Yard area. The studies indicated that desorption of CVOCs from the finer-grained soils below the water table may act as a continued source of CVOCs in groundwater. Mercury sampling and analysis of the soil and groundwater did not identify the presence of a significant source of mercury in the Salvage Yard area.

6.3.2 Site Inspection/Interview Findings

The Site Inspection was conducted on April 24, 2019 and included representatives of the FAA, EPA and the FAA's contractor, TRC. No major issues were identified during the inspection of Area 20A.

6.4 Technical Assessment

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

Question A Summary:

The PCB soil remedial action is complete. Recent soil sampling suggests that CVOCs may continue to desorb from fine-grained saturated soils in the Salvage Yard area, impacting groundwater quality. Groundwater extraction, treatment and reinjection has continued since the last FYR. Pilot testing of supplemental in situ means of treating residual source area contamination has recently been conducted, with the intent of implementing the most promising technologies to treat the source area contamination and limit future groundwater impacts. The groundwater extraction wells are capturing the dissolved groundwater contamination plume in the Shallow and Intermediate Aquifers, and the air-stripping tower is effectively removing VOCs from the extracted groundwater. ROD-based cleanup levels are achieved by the treatment system. The addition of carbon adsorption to the Area 20A treatment train has resulted in the removal of mercury from the groundwater as well, although there is no ROD-based cleanup level for mercury.

Access to Area 20A continues to be limited by the FAA's security system to authorized FAA employees and contractors.

6.4.2 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?

Question B Summary:

The Area 20A remedial system is designed to attain groundwater ARARs defined in the Area 20A ROD, which are based on drinking water standards and New Jersey GWQS that were applicable at the time of the ROD signature (September 28, 1990). Operation of the Area 20A remedial system also meets the substantive requirements of the action-specific ARARs that existed at the time of the ROD signature applicable to discharges to groundwater. The

New Jersey GWQS (NJAC 7:9-6) applicable at the time of the ROD signature included references to "natural background" for cadmium, chromium and selenium only; all other identified analytes were assigned quantitative limits. Table 4 presents a comparison of the groundwater ARARs specified in the Area 20A ROD to current standards. The most stringent of the chemical-specific ARARs listed in the ROD continue to be less than or equal to state and federal MCLs, with the exception of toluene and cadmium. The current GWQS are more stringent for some analytes than the ROD-based ARARs; however, the current GWQS are not health-based but instead are based on an antidegradation standard established for the Pinelands area. If only those GWQS that were not developed based on an antidegradation basis (i.e., the Class IIA GWQS) are considered, 1,1-DCE, toluene, bis(2-ethylhexyl)phthalate and cadmium are constituents with ROD-based ARARs that are less stringent than the Class IIA GWQS. Each of these constituents is discussed in more detail below.

A groundwater ARAR for toluene was listed in the ROD because toluene was detected in soil and had the potential to impact groundwater; however, until the installation of additional monitoring wells in 2014, it was only detected once in the groundwater at a concentration of 0.51 µg/L, which is well below both the current MCL of 1,000 µg/L and the Class IIA GWQS of 600 µg/L. Well 20A-MW27S has exhibited toluene at a maximum level of 555 µg/L in quarterly sampling conducted since its installation in March 2014; however, no exceedances of the ROD-based or current standards for toluene have been detected. Cadmium has been detected in wells 20A-MW1S, 20A-MW2S, 20A-MW4S, 20A-MW12S and 27-MW27S at levels exceeding the current federal MCL of 5 µg/L or the Class IIA GWQS of 4 µg/L since the end of 2014. All of these wells are located near the Salvage Yard and upgradient of Area 20A extraction wells. Also, cadmium is either not detected or is present at levels less than 1 µg/L in the treatment system effluent. While 1,1-DCE has been detected in various Area 20A monitoring wells at levels exceeding the Class IIA GWQS of 1 µg/L, the wells are located within the capture zones of existing extraction wells and the air stripper successfully treats this compound. Bis(2-ethylhexyl)phthalate has not been detected in Area 20A monitoring wells at levels exceeding the Class IIA GWQS. Therefore, the remedy is considered to be protective relative to the presence of toluene, cadmium and 1,1-DCE in groundwater and bis(2-ethylhexyl)phthalate has not been detected in groundwater samples since the original site investigation. No new location-specific or action-specific ARARs have been identified that are not being met by the Area 20A remedial system. With respect to potential VI issues, none of the Area 20A monitoring wells sampled on a quarterly basis exhibited exceedances of the NJDEP generic VI screening levels (NJDEP, March 2013) in groundwater since the last FYR. While some elevated PCE levels (i.e., above the NJDEP generic VI screening level of 31 µg/L) were detected in groundwater samples collected from temporary sample points during recent remedial enhancement investigations, these elevated detections were not verified by permanent monitoring well results and in most cases were not located within 100 feet of permanent, occupied structures.

The soil cleanup standards identified in the Area 20A ROD are based on New Jersey Soil Cleanup Action Levels applicable at the time the ROD was signed. These levels included 1 mg/kg for total VOCs and 10 mg/kg for total SVOCs in soils, even though there were no SVOC COCs in soil identified in the HHRA. The current NJSRS do not include comparable total VOC or total SVOC cleanup levels. Individual compounds were detected in soils during the EI at maximum concentrations that are below current non-residential NJSRS (see Table 5). Note that the NJSRS for PCE has increased since the last FYR, with no detections of PCE above the current NJSRS. Therefore, the soil remedial action taken in accordance with the ROD relative to VOCs and SVOCs continues to be protective of human health.

The ROD also included PCB soil cleanup levels of 5 mg/kg for the 0- to 6-inch interval and 25 mg/kg for greater soil depths. The Area 20A ESD included a cleanup standard for PCBs in surface soil of 2 mg/kg for the upper two feet of soil based on the NJSCC that were applicable at that time. The current NJSRS for PCBs has not changed since the last FYR. The 2009 FYR documented that a re-evaluation of the site-specific human health risk based on current toxicity information indicated an overall decrease in risk due to ingestion and dermal exposure, primarily as a result of a decrease in the cancer slope factor for PCBs. The slope factor for PCBs in soil has not changed since the last FYR (see Table 6). Also, PCBs have not been detected in Area 20A groundwater, indicating that any residual PCBs in Area 20A soils are not adversely impacting groundwater quality. Due to the age of the PCB data for Area 20A, an analysis of dioxin-like PCB congeners was not previously conducted. However, as part of the last FYR process, a Toxicity Equivalent (TEQ) was estimated for dioxin-like PCBs based on information published in

Part 1, Volume 1 of EPA's *Exposure and Human Health Reassessment of 2,3,7,8-Tetrachloro-p-dioxin (TCDD) and Related Compounds* (Part 1: Estimating Exposure to Dioxin-Like Compounds, Volume 1: Sources of Dioxin-Like Compounds in the United States; EPA/600/P-00/001-Cb). Using the most health-protective estimated dioxin-like PCB TEQ (i.e., that estimated for Aroclor 1260), a carcinogenic risk was calculated for an industrial/commercial worker exposed to 2 mg/kg PCBs in the surface soil. The calculated risk based on surface soil exposure was within the acceptable risk range of 10^{-4} to 10^{-6}. Therefore, the soil standards presented in the ROD and ESD continue to be protective of human health under the current land use scenario.

Constituents that have been detected multiple times above PQLs during quarterly groundwater sampling events conducted since the last FYR and for which no ROD cleanup levels exist include chlorobenzene at well 20A-MW19S; TCE at well 20A-MW19D (detected through December 2015 only); acetone and methyl ethyl ketone (MEK) at wells 20A-MW26I, 20A-MW27S and 20A-MW27I; and ethylbenzene and cis-1,2-dichloroethene (cis-1,2-DCE) at well 20A-MW27S. Wells 20A-MW27S and 20A-MW27I are located near the Salvage Yard, in the area being evaluated for supplemental treatment. Well 20A-MW26I is located near the corner of Woods Road and Pangborn Road, to the north of the Salvage Yard. Acetone and MEK levels above PQLs have not been detected at this location since March 2016, and therefore, the previous detections are not considered to pose a potential risk. Monitoring wells 20A-MW19S and 20A-MW19D are located adjacent to the Upper Reservoir, approximately 2,000 feet northeast of the Salvage Yard. Chlorobenzene was detected twice in monitoring well 20A-MW19S but at levels well below the MCL of 100 µg/L. The detection of TCE exceedances at 20A-MW19D ceased in 2016, following the installation and operation of extraction well 20A-EW4. Chloroform has consistently been detected at levels exceeding the 1 µg/L PQL at 22 to 24 Area 20A monitoring wells per quarterly sampling round. Chloroform was detected multiple times at levels exceeding the previously calculated 7.7 µg/L background level in wells 20A-ACMUA8S, 20A-DMW1, 20A-DMW2, 20A-EW1, 20A-MW22D, 20A-MW24I, 20A-MW25I, and 20A-MW26I. It has not exceeded the MCL for combined trihalomethanes of 80 µg/L, however. Chloroform is not considered to be attributable to Area 20A, as described in more detail in Section 2.4.

As discussed in the Systems Operation/Operation and Maintenance section above, mercury was detected in Area 20A quarterly effluent samples in 2008 and sampling of the individual extraction wells indicated that extraction well 20A-EW3 was the primary contributor of mercury to the treatment system. While the Area 20A ROD does not include a chemical-specific cleanup level for mercury, extraction well 20A-EW3 was temporarily shut down until mercury treatment was added to the treatment system in 2014. Mercury levels were not historically reported for monitoring wells at Area 20A, since mercury was not an Area 20A COC and the Area 20A ROD did not include a chemical-specific cleanup level for mercury. With the addition of carbon treatment to the Area 20A treatment train in 2014, the treatment system effluent meets the applicable mercury discharge monitoring criterion, so there is no immediate or future risk associated with the presence of mercury in the groundwater at extraction well 20A-EW3.

1,4-Dioxane is a man-made compound used as a stabilizer in TCA that is very mobile in groundwater and is considered to be an emerging contaminant by EPA. At EPA's request, influent to the Area 20A air stripper was sampled in December 2009 and analyzed for the presence of 1,4-dioxane. It was not detected in the influent sample and therefore was not considered a potential contaminant of concern in the groundwater at Area 20A. The detection limit for 1,4-dioxane in the samples collected in 2009 was 10 µg/L, which met the then-applicable New Jersey Interim GWQS but exceeds the current health-based Class IIA New Jersey GWQS of 0.4 µg/L and the EPA Regional Screening Level for tap water of 0.46 µg/L. A federal or state drinking water standard has not been established for 1,4-dioxane. While not considered to be a COC at Area 20A, 1,4-dioxane was incidentally included as an analyte in several previous investigations. The 2012 Supplemental RI at Area 20A included 169 screenpoint groundwater samples and sampling of 47 wells. 1,4-Dioxane was detected in only one screenpoint sample (20A-GP-1201 (18-22), collected at a depth of 18 to 22 feet below ground surface) at a concentration of 110 µg/L; it was not detected in 12 deeper groundwater screenpoint samples collected at the same location or in any of the other groundwater samples collected during the investigation. Detection limits ranged from 36 to 50 µg/L. 20A-GP-1201 was located in the northwest portion of the Salvage Yard and exhibited other CVOCs that will be targeted for future treatment. During the Area 20A Expanded Supplemental Remedial Investigation (TRC, 2016a), 1,4-dioxane was detected in two soil samples (20A-GP-1409-15 (19.5-20) and 20A-GP-1413-15 (17-18)), both at concentrations

of 35 micrograms per kilogram (µg/kg). 1,4-Dioxane was not detected in screenpoint groundwater samples collected during that investigation, with a reported detection limit of 50 µg/L. The two soil samples that exhibited 1,4-dioxane also exhibited other CVOCs and therefore would be targeted for treatment during the implementation of future remedial enhancements at Area 20A.

In November 2015, four Area 20A extraction wells (20A-EW1, 20A-EW3, 20A-EW6S(R) and 20A-EW11S(R)) were sampled for PFAS analysis. PFAS compounds were detected in each of the extraction wells, with extraction well 20A-EW3 exhibiting PFOS and PFOS individually at levels exceeding the EPA Provisional Health Advisory level of 70 ng/L and well 20A-EW6S(R) exhibiting PFOS at a level exceeding 70 ng/L. In addition, PFNA was detected in well 20A-EW3 at a level of 7 ng/L, which is below the New Jersey MCL of 13 ng/L. In July 2017, a limited groundwater sampling event was conducted at Area 20A that also identified the presence of PFOS at a level exceeding the EPA Provisional Health Advisory level. A facility-wide PFAS Preliminary Assessment recommended the performance of an RI at Area 20A to further evaluate the nature and extent of PFAS impacts. The RI will be performed following the completion of a Site Inspection at other areas of potential PFAS impacts. See Section 2.4 for further discussion.

No other new contaminants, contaminant sources or unanticipated toxic byproducts of the remedy have been identified.

Current toxicity values for the constituents evaluated in the human health risk assessment have not changed since the last FYR (when the remedy was found to be protective).

Baseline ecological risks were evaluated based on pre-remedial concentrations of surface soil contaminants, with PCBs and endosulfan identified as potentially posing risk to ecological receptors. The potential endosulfan risk was based on the detection of endosulfan in one of three USFWS ERA soil samples that also exhibited PCBs at an elevated level. Endosulfan was not detected in the soil samples collected during the EI. Given that the PCB-contaminated soils were removed, the soil represented by the sample that contained the elevated level of endosulfan was remediated with the PCB-contaminated soils. While a specific evaluation of the ecological protectiveness of the soil cleanup standards was not conducted, the potential risks associated with these contaminants have been reduced through the implementation of the soil remedial action.

Land use at or near Area 20A has not changed since the last FYR and the potential routes of exposure and estimated exposure frequencies remain the same. Groundwater has not been developed as a potable source of water at Area 20A and no changes have occurred that would impact the soil vapor exposure pathway.

While land use has not changed, Area 20A does not currently have LUCs in place to protect against unacceptable exposures in the future. The HHRA for Area 20A did not assess a residential land-use scenario, the soil removal that took place was based on non-residential NJSCC, and groundwater contaminant levels exceed MCLs. As previously mentioned, EPA has requested that FAA develop a facility-wide LUCAP to address areas such as Area 20A where the presence of residual contamination and/or the lack of evaluation of an unrestricted (i.e., residential) use scenario in the HHRA requires the establishment and maintenance of site use restrictions. The FAA may consider addressing LUCs at FAA AOCs where there are currently no LUCs specified within the RODs through the preparation of an appropriate post-ROD enforceable document.

The FAA is currently evaluating the implementation of source area remedial actions to prevent continued groundwater impacts. When these actions are defined and employed, they are expected to reduce the time frame required to achieve groundwater remedial action objectives at Area 20A.

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

No additional information has been identified that would call into question the protectiveness of the remedy.

6.5 Issues/Recommendations

Issues, recommendations and follow-up actions for OU02 are listed below.

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 02	**Issue Category: Institutional Controls**			
	Issue: Lack of LUCs			
	Recommendation: Evaluate appropriate means of documenting LUCs.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	8/31/2021

6.6 Other Findings

In addition, the following are recommendations that were identified during the FYR and may improve performance of the remedy, reduce costs, and accelerate site close out, but do not affect current and/or future protectiveness:

- The potential implementation of enhancements to achieve cleanup goals in a more timely manner should continue to be pursued.
- Resample groundwater at Area 20A to verify that 1,4-dioxane is not present at levels exceeding current health-based screening levels.

6.7 Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit: 02	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at OU02 (Area 20A) currently protects human health and the environment because the existing remedy is controlling exposures to soil and groundwater. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: • Evaluation of the appropriate means of documenting LUCs at the FAA. • Performance of additional sampling for 1,4-dioxane in groundwater.	

7.0 OU03 - AREA G – TRANSFORMER STORAGE AREA

7.1 History of Contamination and Initial Response

A ROD was signed September 30, 1992 to document the decision of no further action at Area G. Two non-time critical removal actions of PCB-contaminated soil and concrete took place in the fall of 1989 and the spring of 1990. Approximately 62 tons of excavated soil and concrete were disposed of off-site in an approved Toxic Substances Control Act facility. The average concentration of PCBs in post-remediation samples was 0.479 mg/kg. This average is above the current residential direct contact NJSRS of 0.2 milligram per kilogram (mg/kg) but is below the non-residential direct contact NJSRS of 1.0 mg/kg. Consequently, Area G is suitable for non-residential use.

As discussed in Section 6.4.2 for OU02, an evaluation of potential risks based on a final cleanup level of 2 mg/kg and a TEQ estimated for dioxin-like PCBs resulted in an estimated risk to a commercial/industrial worker within the acceptable 10^{-4} to 10^{-6} risk range. The average PCB concentration in post-remediation samples collected at Area G was well below 2 mg/kg.

7.2 Issues/Recommendations

Issues, recommendations and follow-up actions for OU03 are listed below.

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 03	Issue Category: Institutional Controls			
	Issue: Lack of LUCs			
	Recommendation: Evaluate appropriate means of documenting LUCs.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	8/31/2021

7.3 Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit: 03	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at OU03 (Area G) currently protects human health and the environment because the completed remedial action has addressed potential exposures to soil. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: • Evaluation of the appropriate means of documenting LUCs at the FAA.	

8.0 OU04 – AREA C, H, AND M – BUTLER AVIATION FUEL SPILL, SALVAGE YARD NEAR SEWAGE TREATMENT PLANT, AND BLDG. 202 GELLED FUEL TEST AREA

OU04 consists of three separate AOCs: Area C, the Butler Aviation Fuel Spill; Area H, the Salvage Yard near the Sewage Treatment Plant; and Area M, the Building 202 Gelled Fuel Test Area. As previously described in Section 1.0, Areas H and M did not have any site use or exposure restrictions specified in the ROD that covered OU04 and are suitable for unlimited use and unrestricted exposure. Therefore, the following discussion focuses on Area C.

8.1 History of Contamination and Initial Response

Area C, referred to as the Butler Aviation Fuel Spill Area (although it is not the actual site of the spill), is located on FAA property. It is south of property owned by Atlantic City that was used by Butler Aviation as an underground

storage facility for jet fuel until 1993, at which time the underground storage tanks were removed and replaced with aboveground storage tanks. In 1984 and 1986, fuel spills occurred onto surface soil next to the filling pad at the Butler Aviation Fuel Farm. At that time, a soil and groundwater investigation at the Butler Aviation Fuel Farm indicated the presence of residual soil and groundwater contamination, including a free-floating fuel product on the groundwater surface. However, site investigation results indicated that groundwater contaminants had not been detected in the Butler monitoring wells located closest to Area C.

At the FAA's adjacent Area C, based on the results of the Phase I and II EI groundwater sampling conducted in June 1987 and December 1988, respectively, it was determined that hydrocarbon contamination had not migrated from the Butler Aviation area onto FAA property. Additional groundwater sampling in November 1992 confirmed these results. A ROD was signed for Area C on September 30, 1994 that required continued groundwater monitoring. Through 2009, with the exception of acetone (a common laboratory contaminant) in monitoring well C-MW2S during August 1994 and February 1995, no VOCs were detected above established PQLs in the Area C monitoring wells. Subsequent quarterly groundwater monitoring for VOCs at Area C verified that contamination has not migrated onto FAA property from the adjacent Butler Aviation area. A review of the soil samples collected at Area C indicates no exceedances of current Residential or Non-Residential Direct Contact NJSRS.

8.2 Response Action Summary

No response actions have been taken at Area C.

8.3 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.

Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
04	Protective	The remedy at OU04 (Area C) is protective of human health and the environment.

There were no formal recommendations for Area C in the 2014 FYR relative to maintaining the protectiveness of the remedy. However, the following recommendation was made relative to the acceleration of site closeout.

The ROD for Area C indicates that groundwater monitoring at Area C will continue until Butler Aviation is no longer a potential source of contamination to Area C. At the time of the 2014 FYR, the most recent groundwater data for the Butler Aviation site available to the FAA was dated 1991. This data was provided by NJDEP in 1994, at which time NJDEP documented that Butler Aviation was not currently and had not historically discharged contamination to Area C. The 2014 FYR recommended that the FAA should pursue additional site-specific information from NJDEP to determine if continued groundwater monitoring is necessary at Area C. If it could be documented that the Butler Aviation site is no longer considered a potential source of contamination to Area C and if groundwater monitoring data continue to demonstrate an absence of petroleum-related contaminants, the 2014 FYR recommended that the FAA request EPA's approval of the discontinuation of groundwater monitoring at Area C.

In accordance with this recommendation, the FAA obtained additional information from NJDEP on the Butler Aviation site since the last FYR. This information indicated that the bulk of the soil contamination that was responsible for groundwater impacts was removed while contaminant degradation modeling indicated that residual groundwater impacts would degrade to below detectable concentrations within three years. Subsequent filings with the NJDEP indicated that the residual groundwater impacts naturally attenuated to contaminant levels below the NJ

GWQS, allowing unrestricted use as an acceptable outcome for the site. In March 2019, the EPA issued a letter approving the cessation of groundwater monitoring at Area C.

8.3.1 Data Review

Since the last FYR, quarterly groundwater monitoring was performed until receipt of the March 2019 letter from EPA agreeing that monitoring could cease. During that period, there were a couple of instances where toluene, acetone and/or trichloroethene (TCE) were detected in monitoring well C-MW1S and acetone and/or cyclohexane were detected in monitoring well C-MW2S. None of the detected levels exceeded health-based criteria.

8.3.2 Site Inspection/Interview Findings

The Site Inspection was conducted on April 24, 2019 and included representatives of the FAA, EPA and the FAA's contractor, TRC. No major issues were identified during the inspection of Area C. The site is vacant with no current land use.

8.4 Technical Assessment

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

Question A Summary:

There is no remedy in place at Area C. Quarterly groundwater monitoring at Area C conducted since the last FYR confirmed that groundwater impacts from the adjacent Butler Aviation fuel spill have not impacted the site. The FAA was able to confirm that NJDEP has accepted the cleanup activities conducted at the Butler site, with unrestricted use an acceptable outcome for that site. In March 2019, the EPA approved the cessation of groundwater monitoring at Area C.

8.4.2 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?

Question B Summary:

There have been no changes in the physical conditions of Area C or in land use at or near Area C since the last FYR that would affect the protectiveness of the remedy.

Area C is a no further action area, with continued groundwater monitoring intended to simply verify the absence of contamination. Therefore, toxicity data, cleanup levels and RAOs are not a consideration. During the past five years, no groundwater constituents were detected at levels exceeding human-health based federal and state MCLs.

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

No additional information has been identified that would call into question the protectiveness of the remedy.

8.5 Issues/Recommendations

No issues, recommendations or follow-up actions were identified for OU04.

8.6 Other Findings

The following are recommendations that were identified during the FYR and may accelerate site close out, but do not affect current and/or future protectiveness:

- This OU should undergo partial deletion, when appropriate.

8.7 Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit: 04	*Protectiveness Determination:* Protective
Protectiveness Statement: The remedy at OU04 (Area C) is protective of human health and the environment.	

9.0 OU06 – AREAS 29 AND K – FIRE TRAINING AREA AND STORAGE AREA

9.1 History of Contamination and Initial Response

Area 29, Fire Training Area

Area 29, referred to as the Fire Training Area, is located northeast of the Atlantic City International Airport runways and southwest of White Horse Pike. Area 29 was constructed in the early 1970s for the training of airport fire-fighting personnel. The facility consisted of a circular burn area approximately 150 feet in diameter, a small concrete burn pad, two aboveground fuel tanks on a small hill, and two underground tanks for the collection of runoff from the burn pads. Full-scale aircraft test burns were conducted on the large circular burn area, while smaller fuel fires were extinguished on the concrete pad. An underground drain system was used to collect runoff from the circular burn area and to divert it to a 10,000-gallon underground circular storage tank. Runoff from the concrete pad was collected in a 5,000-gallon underground storage tank. Both of these tanks were emptied, removed, and disposed of off site in December 1988.

Area K, Storage Area

Area K, referred to as the Storage Area near Area 29, is located northwest of the test burn areas at Area 29. Aerial photographs taken in 1974 and 1983 show that drums and tanks were once stored in this area. The drums and tanks were removed by the fall of 1986 and were also disposed of off-site.

9.2 Response Action Summary

9.2.1 Basis for Taking Action

The EI identified the presence of contaminants in surface soil, subsurface soil, and groundwater at Areas 29 and K. PCBs and TPH were detected in surface and subsurface soils at levels exceeding non-residential NJSCC. Three areas of soils containing elevated PCB levels were identified: within the circular burn area, adjacent to the concrete burn pad, and in the former drum storage area (Area K). A total of 350 cubic yards of contaminated soil was estimated to exceed non-residential NJSCC for PCBs. A total volume of 50 cubic yards of contaminated subsurface soil was estimated to exceed the NJSCC for total VOCs.

VOCs were detected in perched groundwater at levels exceeding state or federal MCLs or New Jersey GWQS. Perched groundwater is located above a low-permeability clay layer that separates the perched groundwater from the true water table aquifer (Shallow Aquifer) in a portion of Area 29, as indicated in Figure 6.

Contaminants

COCs, as identified in the HHRA for Area 29 and Area K, in each medium include:

Soil	Groundwater
Benzene	Benzene
PCBs	1,1-Dichloroethane (1,1-DCA)
	Toluene
	bis(2-Ethylhexyl)phthalate

Human Health Risk Assessment

Since Areas 29 and K were not expected to be used for any scheduled activities, the exposure frequencies used in the risk assessment were restrictive. For example, exposure to surface soil was based on a maximum exposure frequency of 24 times/year. Exposure to groundwater was based on a commercial/industrial maximum exposure frequency of 250 days/year, assuming a potable well was installed. Exposures to soil and groundwater at Areas 29 and K were associated with significant human health risks, due to exceedances of EPA's risk-management criteria. Carcinogenic risk exceedances associated with exposure to groundwater were due primarily to benzene and 1,1-DCA, while noncarcinogenic risk exceedances were due primarily to benzene. Exposures to soil did not result in unacceptable risks.

Ecological Risk Assessment

A qualitative ERA was conducted on the basis of the same COCs as the HHRA. Since PCBs are persistent in the environment, tend to bioaccumulate, and can cause reproductive and behavioral changes in animals, it was surmised that concentrations of PCBs in surface soils may be high enough to affect the reproduction and behavior of some wildlife. An evaluation of potential ecological risks was also conducted in 1996 as part of a facility-wide ERA conducted by the USFWS. The evaluation included the collection of soil samples, earthworm bioassay samples and small mammal composite samples along the fringes of the areas of known contamination and the evaluation of a surface water sample collected near Areas 29/K. Cadmium and mercury were detected at elevated levels in earthworms collected from a drainage swale near a culvert and resulted in predicted risks to higher trophic species.

9.2.2 Response Actions

The ROD for Areas 29 and K was signed on September 20, 1996. The RAOs listed in the ROD are as follows:

- Eliminate exposures to PCB-contaminated soils at levels which exceed state or federal cleanup levels;
- Reduce concentrations of TPH in subsurface soils to prevent continued leaching of contaminants into groundwater;
- Prevent the migration of VOCs in perched groundwater to deeper aquifer systems;
- Reduce contaminant concentrations in the perched groundwater system to acceptable levels; and
- Reduce human health risks posed by the site in accordance with state and federal remediation goals.

The selected remedy for Areas 29 and K included the following components:

- Excavation of approximately 350 cubic yards of PCB-contaminated soil and transport off site for disposal at a licensed facility;
- Excavation of approximately 50 cubic yards of TPH-contaminated soil and transport off site for disposal at a licensed facility;
- Demolition and excavation of debris from the former circular burn area and concrete burn pad and transport off site for disposal;

- Extraction of perched groundwater and on-site treatment using carbon adsorption and/or other treatment processes to remove VOCs. Treated groundwater will be recharged to the subsurface in the vicinity of the site; and
- Establishment of a Declaration of Environmental Restrictions where constituents of concern in soil exceed the residential NJSCC, to prevent development of the site for residential use.

Cleanup levels defined in the ROD are summarized in Tables 7 and 8 for groundwater and soil, respectively.

9.2.3 Status of Implementation

Excavation and off-site disposal of 4,041 cubic yards of contaminated soils was completed in 2001. Demolition, removal and off-site disposal of debris from the circular burn pad and the former concrete pad were also completed. The groundwater treatment system, which consisted of extraction wells, the Areas 29/K groundwater treatment system, an infiltration gallery and sprinklers used for surface discharge within the perched treatment area, became operational in July 2004. Figure 6 shows the location of the infiltration gallery west of Areas 29/K.

After several years of operation of the perched groundwater extraction and treatment system, influent concentrations of BTEX remained above PQLs in certain perched aquifer monitoring wells and/or in the combined treatment plant influent. As a result, the potential use of surfactant as a remedial enhancement in the impacted perched groundwater area at Areas 29/K was evaluated. The evaluation included a December 2010 bench-scale treatability study and an October 2011 pilot test of surfactant application. In fall 2012, the phragmites root mat in the application area was removed and a second pilot study surfactant application was performed in June 2013. Total VOC influent levels to the Areas 29/K treatment system decreased from an average of approximately 150 µg/L prior to the pilot study to less than 50 µg/L in early 2014, after the completion of the second phase of the pilot study.

A remedial enhancement investigation was conducted in February and April 2014 to identify areas of residual subsurface soil contamination. Remaining data gaps were subsequently addressed through additional soil borings, a membrane interface probe (MIP) subsurface survey, and an ISCO bench-scale treatability study, the results of which were inconclusive. An engineering evaluation of possible remedial enhancements or alternatives identified excavation of the residual impacted soils, an action already addressed by the ROD, as an appropriate action to achieve groundwater remedial goals. The remedial design for the soil excavation action was prepared in 2015 and implemented from May 2016 to June 2017. The excavation was conducted in two phases, with approximately 14,916 tons of soil removed from the western lobe and 18,803 tons of soil removed from the eastern lobe. The lateral extent of excavation is indicated on Figure 6. In addition, approximately 7,000 pounds of ORC was applied to the entire bottom of the excavation (western and eastern lobes) to enhance the remediation of any remaining residual impacted soils as well as potentially-impacted groundwater. Groundwater collected during excavation dewatering was treated on site and discharged to the injection galleries. Additional carbon treatment was added to the Areas 29/K groundwater treatment system to address the potential presence of PFAS in the collected water. As a result of the excavation of remaining impacted soils, groundwater extraction was discontinued as of May 5, 2016. Operation of the treatment system continued through May 2017 to treat water generated during dewatering of the excavation.

Monitoring at Areas 29/K includes the following:

- Monthly groundwater treatment system sampling for VOC, SVOC, and metals analyses, with annual sampling for PCB analysis (until the treatment system was shut down);
- Well-specific quarterly monitoring well sampling for VOC analysis; and
- Quarterly injection monitoring well sampling for VOC, pesticides and metals analyses, with annual monitoring for PCB analysis.

Due to the required abandonment of some monitoring wells during the implementation of soil excavation in 2016 and 2017, the scope of the monitoring wells sampled during the well-specific quarterly sampling changed. In addition to the monitoring program presented above, the FAA occasionally conducts site-wide sampling events to provide additional information on remedial system performance.

Pending a demonstration that the soil excavation activities at Area 29 have achieved the ROD groundwater cleanup levels, the FAA will request a cessation of future groundwater monitoring activities relative to the existing ROD.

9.2.4 Systems Operations/Operation & Maintenance

When operating, the Areas 29/K remedial system required regular operation and maintenance of the groundwater extraction system, the groundwater treatment system including filtration, carbon adsorption and sludge dewatering units, the groundwater infiltration galleries, and the seasonally-operated sprinklers. In October 2015, holes were identified in the lead carbon vessel and the system was taken offline until a replacement was installed in December 2015. There were no other significant operational issues associated with the Areas 29/K groundwater remedial system between the last FYR and the treatment system shut down. Approximately 1.8 million gallons of water were treated in 2015 and 2016, prior to the extraction system shutdown in May 2016. The treatment system continued to be used from July 2016 through December 2016 and again from March 2017 through May 2017 for treatment of water generated as a result of dewatering during the soil excavation activities. Additional carbon vessels were added to treat PFAS in the extracted water during the soil excavation program. After the completion of the soil excavation program, all treatment system tanks were emptied and cleaned and lock out/tag out of all equipment was implemented.

9.3 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.

Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
06	Short-term Protective	The remedy at OU06 (Areas 29 and K) currently protects human health and the environment because the existing remedy is controlling exposures to soil and groundwater. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: • Evaluation of the appropriate means of documenting LUCs at the FAA.

Status of Recommendations from the 2014 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
06	Lack of LUCs	Evaluate appropriate means of documenting LUCs.	Under Discussion	The FAA is continuing its evaluation of how best to document LUCs.	Not applicable

9.3.1 Data Review

The scope of the Areas 29/K groundwater monitoring program currently reflects the *CERCLA Substantive Requirements Evaluation and Operational Strategy Plan* (TRC, 2013), modified as appropriate following the completion of the Areas 29/K excavation activities. Eight perched aquifer monitoring wells and seven Shallow Aquifer monitoring wells are currently included in the quarterly sampling program. All Areas 29/K monitoring well locations are shown on Figure 6. Because the excavation activities resulted in the abandonment of certain monitoring wells, replacement wells were installed at the conclusion of the excavation activities. The data review presented below is based primarily on the sampling conducted on a quarterly basis at Area 20A.

Area 29 extraction wells were not sampled as part of normal operations since the last FYR. Quarterly sampling of influent into the Areas 29/K groundwater remedial system consistently exhibited exceedances of the ROD cleanup levels for benzene and xylenes until May 2016, when groundwater extraction ended at the start of soil excavation. Occasional exceedances of the ROD cleanup level for ethylbenzene were also detected in the influent samples.

Since the last FYR and prior to the implementation of the soil excavation activities, BTEX compounds were consistently detected above ROD cleanup levels in perched monitoring well 29-MW7S. Following the completion of the excavation activities, BTEX compounds have not been detected above ROD cleanup levels in the perched and Shallow Aquifer monitoring wells, with the exception of Shallow Aquifer well 29-MW6S, where benzene was detected in February 2018 at an estimated level of 13 µg/L. The result was anomalous, as benzene had never been detected during quarterly sampling of this well, based on data collected since January 2005. Well 29-MW6S and neighboring observation well 29-OW4S were resampled two weeks after the original samples to verify the detection of benzene in 29-MW6S. Benzene was detected at 0.57 µg/L and 0.46 µg/L (both estimated J values) in the 29-MW6S sample and a field duplicate, respectively, while benzene was not detected in the adjacent observation well sample. Benzene was not detected in well 29-MW6S during the three subsequent quarterly sampling events. Therefore, the initial February 2018 result is considered to be anomalous and not representative of actual groundwater conditions.

Following the completion of additional soil excavation activities, confirmatory soil samples were collected and subject to synthetic precipitation leaching procedure (SPLP) BTEX analysis. The results were compared to the ROD cleanup levels. In the majority of instances, the SPLP analyses of the confirmatory soil samples met the ROD cleanup levels, In the few instances where the ROD cleanup levels were not achieved and where site conditions (e.g., the depth of excavation and/or the presence of the clay confining layer) prevented further excavation, the base of the excavation was subsequently treated with additional ORC to facilitate attenuation of potential residual hydrocarbons by enhanced aerobic biodegradation.

The last FYR noted that monitoring well 29-MW1S typically exhibits 1,2-dichloroethane (1,2-DCA) at levels less than 5 µg/L but above 2 µg/L (the current federal MCL is 5 µg/L, while the current New Jersey MCL and GWQS for 1,2-DCA are both 2 µg/L), with detected concentrations remaining steady. This well is located outside of the perched groundwater area and is screened in the Shallow Aquifer. 1,2-DCA was not identified as a COC at Areas 29/K, it has not been detected in other wells screened within the Shallow Aquifer, and a source of the 1,2-DCA contamination has not been identified. Sources of 1,2-DCA can include solvents and leaded gasoline, where it can be added to remove lead.

Monitoring wells 29-MW16S through 29-MW19S were used to monitor discharges to the infiltration gallery. Quarterly data collected through May 2016 (when the treatment system was shut down) did not exhibit any exceedances of the applicable discharge criteria (TRC, 2013).

9.3.2 Site Inspection/Interview Findings

The Site Inspection was conducted on April 24, 2019 and included representatives of the FAA, EPA and the FAA's contractor, TRC. The site is vacant, and the groundwater treatment building is no longer manned. The site is located within the Airport Operations Area of the facility, which requires special authorization to access. No major issues were identified during the inspection of Areas 29/K.

9.4 Technical Assessment

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

Question A Summary:

The soil excavation and demolition components of the remedy have been completed as described in the ROD for Areas 29/K. The groundwater remediation system operated from July 2004 to May 2016, at which time additional

soil excavation was conducted to assist in the achievement of groundwater remedial goals. An evaluation of the groundwater sampling results collected after the 2016 excavation activities were completed confirms the achievement of the Areas 29/K ROD remedial goals.

Access to Areas 29/K continues to be limited by the FAA's security system to authorized FAA employees and contractors.

9.4.2 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?

Question B Summary:

The Areas 29/K remedial system was designed to attain groundwater ARARs defined in the Areas 29/K ROD, which are based on drinking water standards and New Jersey GWQS that were applicable at the time of ROD signature. The New Jersey GWQS (NJAC 7:9-6) applicable at the time of the ROD signature consisted of natural background levels or PQLs. Table 7 presents a comparison of the groundwater ARARs specified in the Areas 29/K ROD to current standards. The most stringent of the chemical-specific ARARs listed in the ROD continue to be less than or equal state and federal MCLs. The current GWQS are more stringent for some analytes than the ROD-based ARARs; however, the current GWQS are not health-based but instead are based on an antidegradation standard established for the Pinelands area. As indicated in Table 7, the most stringent of the ROD-based ARARs for a given compound are less than the current Class IIA GWQS (i.e., those groundwater quality standards that were not developed based on an antidegradation basis). Therefore, the remedy continues to be protective of human health. No new location-specific or action-specific ARARs have been identified.

The soil cleanup standards identified in the Areas 29/K ROD were based on NJSCC applicable at the time the ROD was signed. These levels included 10,000 mg/kg for total organic compounds (including TPH) in soils. The current NJSRS do not include a comparable total organics cleanup level (see Table 8). A comparison of the individual constituents detected in surface and subsurface soils at Areas 29/K during the EI (as summarized in the ROD) to current constituent-specific NJSRS indicates that no individual constituents other than PCBs (discussed below) were detected at levels exceeding current NJSRS. Therefore, the remedial action taken in accordance with the ROD continues to be protective of human health.

The Areas 29/K ROD included a PCB cleanup level in soils of 2 mg/kg (based on non-residential exposures). The current NJSRS for PCBs has not changed since the last FYR, when the ROD-based cleanup level was determined to be protective of human health. The slope factor for PCBs in soil also has not changed since the last FYR (see Table 9). Also, PCBs have not been detected in Areas 29/K groundwater, indicating that any residual PCBs in Areas 29/K soils are not adversely impacting groundwater quality. As discussed in Section 6.4.2 for OU02, an evaluation of potential risks based on a final cleanup level of 2 mg/kg and a TEQ estimated for dioxin-like PCBs resulted in an estimated risk to a commercial/industrial worker within the acceptable 10^{-4} to 10^{-6} risk range. Therefore, the soil standards presented in the ROD continue to be protective of human health.

As discussed in the Data Review section above, 1,2-DCA has been detected in one monitoring well, 29-MW1S, at levels less than the federal MCL of 5 µg/L but generally exceeding the New Jersey MCL and GWQS of 2 µg/L. This well is screened in the Shallow Aquifer and therefore was not targeted by the perched groundwater extraction system. 1,2-DCA was not identified as a COC at Areas 29/K, it has not been detected in other wells screened within the perched or Shallow Aquifer, and a source of the 1,2-DCA contamination has not been identified. The Shallow Aquifer is not used as a source of drinking water. Therefore, the presence of 1,2-DCA at this shallow well does not pose a significant risk to human health.

Following the detection of PFAS emerging contaminants in surface water samples collected by the NJDEP from the Upper and Lower Atlantic City Reservoirs in 2009, the FAA authorized the collection of several rounds of surface water, groundwater and/or soil sampling for PFAS analysis at the FAA Technical Center in 2014, with samples collected at or near Areas 29/K during each event. During a February 2014 sampling event, PFAS were

detected in a sample collected from the NBAC at a location directly east of Areas 29/K. During an August 2014 sampling event, PFAS were detected in Areas 29/K extraction well and monitoring well samples, including samples collected from the unconfined aquifer. During an October 2014 sampling event, PFAS were detected in Areas 29/K soil samples.

In February 2016, additional soil and groundwater samples were collected from Areas 29/K to evaluate the horizontal and vertical distribution of PFAS in and near the petroleum-impacted soils that were about to be excavated and disposed of off-site. The highest levels of PFAS in soil were generally detected in shallow (0.5- to 1.0-foot bgs) soil, although PFAS impacts extended to the deepest samples collected (i.e. greater than 10 feet bgs). Groundwater PFAS impacts extended laterally to the outermost sample locations. The detection of PFAS in a groundwater sample collected beneath the confining layer suggested that the confining layer may not significantly impede the vertical migration of PFAS at Areas 29/K.

In response to a February 2016 request from the EPA, the FAA conducted a well survey to identify public and private wells within a 0.75-mile radius of Areas 29/K. The five non-potable wells (29-PW1, FAA-8, FAA-20, FAA-11, and FAA-K9) identified in the 0.75-mile radius search well survey of Areas 29/K were sampled for PFAS analysis. In addition, additional water samples were collected from Areas 29/K and the NBAC for PFAS analysis. Two of the non-potable wells (FAA-K9 and FAA-20) exhibited detections of PFAS above the EPA 70 ng/L Health Advisory Level and were subsequently shut down.

In July 2017, PFAS sampling was conducted at select Areas 29/K shallow monitoring wells and exceedances of the EPA's 70 ng/L Health Advisory Level were detected. In 2018, groundwater samples were collected from six shallow Areas 29/K monitoring wells, with PFOS, PFOA and PFNA all detected. A facility-wide PFAS Preliminary Assessment recommended the performance of an RI at Areas 29/K to further evaluate the nature and extent of PFAS impacts. The RI will be performed following the completion of a Site Inspection at other areas of potential PFAS impacts. See Section 2.4 for further discussion.

No other new contaminants, contaminant sources or unanticipated toxic byproducts of the remedy have been identified.

Current toxicity values for the constituents evaluated in the human health risk assessment have not changed since the last FYR (when the remedy was found to be protective).

Baseline ecological risks were evaluated based on pre-remedial concentrations of surface soil contaminants. While a specific evaluation of the ecological protectiveness of the soil cleanup standards was not conducted, the potential risks associated with these contaminants have been reduced through the implementation of the soil remedial action.

Land use at or near Areas 29/K has changed since the last FYR, with the elimination of on-site groundwater remediation activities that required treatment system operators to be on site. Groundwater has not been developed as a potable source of water and no land use changes have occurred that would impact the soil vapor exposure pathway. The exposure to surface soil pathway is likely not well represented by the exposure assumptions used in the original risk evaluation, since that evaluation was based on a worst-case scenario of 24 exposures per year, assuming infrequent visits to the site. The original risk assessment calculated that the carcinogenic risk associated with exposures to maximum soil concentrations of 30 mg/kg PCBs and 0.063 mg/kg benzene in surface soil was within the 10^{-4} to 10^{-6} risk range and was primarily attributable to PCBs. Recent investigations have not identified the presence of residual benzene levels above 0.063 mg/kg. Surface soils were remediated to a PCB level of 2 mg/kg or less during the original excavation activities and residual and subsequent excavation activities have removed residual petroleum-impacted soils. When the risk is re-evaluated using an industrial/commercial scenario and exposures to PCBs at 2 mg/kg PCBs and the maximum pre-excavation benzene concentration of 0.063 mg/kg, the resultant risk is still with the 10^{-4} to 10^{-6} risk range. Given that soil excavation activities conducted since the last FYR resulted in the removal of residual petroleum-contaminated soils, the actual risks are likely even less.

Areas 29/K does not currently have LUCs in place to protect against unacceptable exposures in the future. The HHRA for Areas 29/K did not assess a residential land-use scenario and the soil removal that took place was based on non-residential NJSCC. Also, the Areas 29/K ROD stipulated that a Declaration of Environmental Restrictions, in accordance with NJAC regulations that existed at the time, be established to prevent residential use; however, the requirement that the Declaration reflect post-remediation residual contamination levels resulted in a delay of its implementation, pending completion of the soil remedial action. EPA has requested that FAA develop a facility-wide LUCAP to address areas such as Areas 29/K where the presence of residual contamination and/or the lack of evaluation of an unrestricted (i.e., residential) use scenario in the HHRA requires the establishment and maintenance of site use restrictions.

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

No additional information has been identified that would call into question the protectiveness of the remedy.

9.5 Issues/Recommendations

Issues, recommendations and follow-up actions for OU06 are listed below.

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 06	Issue Category: Institutional Controls			
	Issue: Lack of LUCs			
	Recommendation: Evaluate appropriate means of documenting LUCs			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	8/31/2021

9.6 Other Findings

The following recommendation will reduce costs but do not affect current protectiveness and were identified during the FYR:

- Given the lack of groundwater remediation discharge to the Areas 29/K infiltration gallery, the FAA is no longer obligated to monitor the surrounding monitoring wells (29-MW16S through 29-MW19S) under the substantive requirements of New Jersey's groundwater monitoring program regulations for discharges to groundwater identified in the ROD and will discontinue such monitoring immediately.
- Pending a demonstration that the soil excavation activities at Area 29 have achieved the ROD groundwater cleanup levels, the FAA will request a cessation of all future groundwater monitoring activities relative to the existing ROD.

9.7 Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit:	*Protectiveness Determination:*
06	Short-term Protective
Protectiveness Statement: The remedy at OU06 (Areas 29 and K) currently protects human health and the environment because soil and groundwater have been remediated to achieve ROD-based cleanup levels. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: • Evaluation of the appropriate means of documenting LUCs at the FAA. • Performance of a remedial investigation of PFAS associated with Areas 29/K.	

10.0 OU07 – AREA 41 – FUEL FARM AND PHOTO LAB

10.1 History of Contamination and Initial Response

Area 41, referred to as the Fuel Farm and Photo Lab Area, is characterized by a former aviation gasoline (AVGAS) Fuel Farm and a former photographic laboratory area. The AVGAS Fuel Farm included five concrete underground storage tanks installed in the mid-1940s, of which three had a 50,000-gallon capacity and two had a 100,000-gallon capacity. All of the tanks were closed in-place in 1999.

Area 41 also featured an existing 6,200-square-foot depression area (a remnant of an historic impoundment area) and three drainage ditches referred to as Drainage Ditches 1, 2, and 3. Manmade wetland areas were delineated at Area 41 in the vicinity of the drainage ditches.

Historically, Area 41 has seen various uses. While originally used for the underground storage of AVGAS, the Fuel Farm at Area 41 was later used for stockpiling #2 and #4 fuel oil. A photographic laboratory was formerly located to the northwest of the Fuel Farm. The lab discharged process wastewater via an underground pipe to Drainage Ditch 1 until the mid-1970s. Historical aerial photographs indicate that an existing ponded area at the end of Drainage Ditch 1 may have been larger in the past and that, for a time, it may have drained into a larger impoundment (referred to as Former Impoundment B) to the east. In addition, a second impoundment area (referred to as Former Impoundment A) was historically located in the southern portion of Area 41, near the beginning of Drainage Ditch 2. Based on interviews of NJANG personnel conducted under a separate NJANG study, more than 10,000 gallons of jet fuel (JP 4) and AVGAS (115/145) may have been drained from tank trucks onto the ground in the vicinity of Former Impoundment A during truck washing activities. No visible evidence of the historic presence of Impoundments A and B currently exists at Area 41 and the 6,200-square-foot manmade depression was filled in as part of site remediation activities and is no longer visible.

10.2 Response Action Summary

10.2.1 Basis for Taking Action

Groundwater contamination, floating product, and surface soil, subsurface soil and sediment contamination were identified at Area 41. A floating hydrocarbon product was identified in a shallow monitoring well in the Former Impoundment A area during the EI. The detection of organic vapors and observed staining of subsurface soils at the soil boring locations allowed for the delineation of an area of subsurface contamination near Former Impoundment A. A floating product layer was also detected in a well in the Fuel Farm area in May 1993.

Contaminants

COCs, as identified in the HHRA for Area 41, in each medium include:

Soil	Groundwater
Chlorobenzene	Chlorobenzene
Ethylbenzene	Ethylbenzene
Toluene	Toluene
Benzo(a)anthracene	Bis(2-ethylhexyl)phthalate
Benzo(a)pyrene	2,4-Dimethylphenol
Benzo(b)fluoranthene	4,4-DDD
Bis(2-ethylhexyl)phthalate	Antimony
Butylbenzylphthalate	Arsenic
Chrysene	Beryllium
Di-n-butylbenzylphthalate	Cadmium
Fluoranthene	Chromium
Phenanthrene	Copper
Phenol	Lead
Pyrene	Mercury
PCBs (Aroclor 1248/1254)	Nickel
4,4-DDT	Selenium
Arsenic	Zinc
Chromium	
Copper	
Lead	
Mercury	
Nickel	
Silver	
Zinc	

Human Health Risk Assessment

Since Area 41 is not expected to be used for any scheduled activities, the exposure frequencies used in the risk assessment were restrictive. For example, exposure to surface soil was based on a maximum exposure frequency of 24 times/year. Exposure to groundwater was based on a commercial/industrial maximum exposure frequency of 250 days/year, assuming a potable well was installed and assuming ingestion of the floating hydrocarbon product that was characterized during the EI. Exposures to groundwater at Area 41 are associated with significant human health risks, due to exceedances of EPA's risk-management criteria. Both carcinogenic and noncarcinogenic risk exceedances associated with exposure to groundwater were due primarily to the presence of pesticides in the floating hydrocarbon product. Exposures to soil did not result in unacceptable risks.

Ecological Risk Assessment

The COCs identified for the ERA include 4,4-DDT, PCBs, TPH, and silver, each of which were detected in surface soil and/or sediment. Estimated chronic ecological hazard quotients (EHQs) exceeded criteria for the short-tailed shrew and broad-winged hawk, while acute EHQs exceeded criteria for the red fox and broad-winged hawk. The

elevated EHQs were primarily attributable to PCBs. An evaluation of potential ecological risks was also conducted in 1996 as part of a facility-wide ERA conducted by the USFWS. The evaluation included the collection of surface soil, sediment and surface water samples, bioassay tests on macrobenthic invertebrate and earthworm samples, and the collection of small mammal composite samples. Elevated levels of 4,4-DDT and PCBs were detected in earthworm and mammal samples in the drainage ditch near Former Impoundment A. In Drainage Ditch 1, polynuclear aromatic hydrocarbons (PAHs), 4,4-DDT, chromium, copper, lead, selenium, silver and zinc were detected in earthworm samples at elevated levels and PCBs and lead were detected at elevated levels in mammal samples. High risks were predicted to the American woodcock from 4,4-DDT and to the American robin from PCBs, with severe risks predicted to the long-tail shrew, short-tail shrew, and American woodcock from PCBs. In the pond area, the sediment bioassay exhibited acute mortality in each of the macroinvertebrates sampled and tadpole data predicted adverse impacts to higher trophic species. The findings confirmed that contamination of surface soil and sediment at Area 41, if not remediated, poses a risk to ecological receptors.

10.2.2 Response Actions

The ROD for Area 41 was signed on September 27, 2000. The RAOs listed in the ROD are as follows:

- Prevent exposure of humans and biota to TPH in Fuel Farm Area surface soils at levels exceeding the NJSCC, a to-be-considered requirement (TBC), of 10,000 mg/kg total organics;
- Prevent exposure of humans via groundwater ingestion to VOCs, pesticides and inorganics at levels exceeding state and federal drinking-water standards and New Jersey GWQS within the Fuel Farm and Former Impoundment A areas. Groundwater remediation levels will be the more stringent of state and federal drinking water standards or New Jersey GWQS;
- Prevent exposure of humans and biota to product contaminants, prevent migration of product contaminants, and prevent subsequent impacts to soil and groundwater quality;
- Prevent potential impacts to groundwater quality resulting from the presence of PCBs in Drainage Ditch 2 soils at levels exceeding the impact to groundwater NJSCC;
- Prevent the exposure of humans to PCBs and PAHs in drainage ditch surface soils at levels exceeding the non-residential direct-contact NJSCC, and prevent releases of these contaminants into surface waters during storm events; and
- Prevent the exposure of biota to 4,4-DDT, PCBs and inorganics in drainage ditch soils and pond sediments at levels which pose unacceptable environmental risks.

The selected remedy for Area 41 included the following components:

- Excavation of approximately 450 cubic yards of PCB-contaminated soil and sediment from two drainage ditches and transport off site for disposal at a licensed facility;
- Excavation of approximately 1 cubic yard of TPH-contaminated soil and transport off site for disposal at a licensed facility, provided the soil was not removed during tank-closure activities;
- Backfilling of a man-made depression area and associated drainage ditch with clean soils;
- Extraction of free petroleum product present on the water table in both a former impoundment area and the Fuel Farm area and transport off site for incineration at a licensed facility;
- Extraction of contaminated groundwater in the former impoundment and Fuel Farm areas with treatment using carbon adsorption and filtration; treated groundwater will be recharged to the subsurface in the vicinity of the site with possible partial discharge of treated groundwater to the sanitary sewer; and
- Establishment of residential site use restrictions.

Cleanup levels defined in the ROD are summarized in Tables 10 and 11 for groundwater and soil, respectively.

10.2.3 Status of Implementation

Construction of the Area 41 remedy commenced in June 2002. The discovery of ordnance (two live practice rockets) temporarily halted excavation activities. The ordnance was determined to be associated with a former linking/delinking facility located adjacent to Area 41. Following unexploded ordnance (UXO) clearance activities (which identified 24 training rounds), TPH- and PCB-contaminated soil excavation activities were completed, with approximately 9,500 tons of contaminated soil removed for off-site disposal. An engineered rock cover was constructed over the sediments in the man-made depression (pond) area in early 2011.

Soil sampling activities conducted during the implementation of the remedial action identified the widespread presence of benzo(a)pyrene in soil at Area 41 at levels exceeding the NJSRS of 0.2 mg/kg (based on direct contact). While benzo(a)pyrene was identified as a contaminant of concern within the ROD, during the EI it was only detected at elevated concentrations at locations that also exhibited elevated levels of other soil contaminants (e.g., PCBs) that were to be remediated. The pre-remedial sampling activities, however, indicated that the area of soil contaminated with benzo(a)pyrene was actually much larger than the area of other soil contaminants being remediated. Since this large area of contamination had not been accounted for in the ROD and is not intrinsic to the Area 41 remedy, it is being treated as a separate operable unit (OU7A). Because a former Navy skeet range was located at Area 41, and the FAA was able to forensically link remnants of the clay targets found at the site with the PAH contamination, the U.S. Army Corps of Engineers (USACE) agreed to investigate the nature and extent of the associated soil impacts under the Formerly Used Defense Sites (FUDS) program. A Site Inspection conducted in 2012 by the USACE recommended the performance of an RI/FS. Due to funding constraints, no additional work has been performed relative to this recommendation.

In April 2012, a Geoprobe® investigation was conducted at 13 locations at Area 41 to provide additional vertical delineation of subsurface contamination to be used in the evaluation of remedial enhancements. Residual BTEX contamination was identified at three of the Geoprobe locations. A subsequent subsurface investigation conducted in 2013 to determine if a subsurface water main that passes beneath Area 41 could be leaking and impacting contaminant migration did not identify the presence of a leak.

The groundwater extraction system constructed at Area 41 pumped the extracted groundwater to the CTP, where it was treated with groundwater from Areas B, D and E. Details about the CTP were previously provided in Section 4.1. Figure 7 shows the locations of extraction, monitoring and injection wells at Area 41. The current status of the groundwater extraction system is discussed in Section 10.2.4.

On-going monitoring at Area 41 includes the following:

- Area-specific quarterly CTP influent sampling for VOC, SVOC, pesticides and metals analyses;
- Well-specific quarterly monitoring well sampling for VOC, pesticides and metals analyses; and
- Quarterly injection monitoring well sampling for VOC, pesticides and metals analyses.

In addition to the monitoring program presented above, the FAA occasionally conducts site-wide sampling events to provide additional information on remedial system performance.

Because of the previous identification of UXO at Area 41 (attributable to the linking/delinking facility that was located near Area 41 during the Navy's occupation of the site), and to support the implementation of future investigations and remedial enhancements at Area 41, a new UXO survey involving the non-intrusive assessment of the distribution and spatial concentration of subsurface metallic anomaly sources was conducted in 2015. The work was performed by AECOM's MMRP group from Omaha. Digital geophysical mapping (DGM) was conducted within accessible areas, augmented by analog investigations in areas where site personnel could walk but not maneuver DGM equipment. The survey indicated the presence of widespread concrete debris overlying potential residual contamination areas.

10.2.4 Systems Operations/Operation & Maintenance

The Area 41 groundwater remediation system started full scale operation on February 17, 2009. The extraction rates at Area 41 dropped significantly after initial operations. The wells tend to become clogged with iron bacteria and have been cleaned with chlorine and redeveloped numerous times, but the resultant operational improvements are always temporary in nature. Downhole video camera inspections of the Area 41 extraction wells in May 2017 revealed the wells are grossly fouled. The individual wells were last operated as follows: 41-EW1S in March 2014, 41-EW2S in January 2018, 41-EW3S in April 2015, 41-EW4S in December 2014, 41-EW5S in April 2015, and 41-EW6S in January 2014. The total Area 41 extraction rate was less than 1.5 gpm in the months before the wells were completely shut down.

A bi-annual video inspection program of the Area 41 injection wells monitors the condition of the wells. Based on the results of that program, the Area 41 injection wells were redeveloped in December 2016/January 2017.

Through 2012, the FAA operated the remedial systems at the Technical Center in accordance with permit equivalencies issued by the NJDEP. However, since 2013, the FAA operated the Area 41 remedial system in accordance with the *CERCLA Substantive Requirements Evaluation and Operational Strategy Plan*, (TRC, 2013).

CTP influent monitoring was discussed in Section 5.2.4. Quarterly Area 41-specific CTP influent sampling was conducted from July 2012 until the extraction wells were taken off line in January 2018. Since the last FYR, no exceedances of ROD-based groundwater cleanup goals have been detected in the CTP influent samples from Area 41. Limited plume mapping is available for Area 41. Plume maps for shallow total xylenes based on monitoring well data available in 2015 and 2018 are provided in Appendix E. While xylenes remain detected in the same two shallow wells (41-MW7S and 41-MW8S) in the former underground storage area, the concentrations decreased from 2015 to 2018.

10.3 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.

Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
07	Short-term Protective	The remedy at OU07 (Area 41) currently protects human health and the environment because the existing remedy is controlling exposures to soil and groundwater. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: • Evaluation of the appropriate means of documenting LUCs at the FAA.

Status of Recommendations from the 2014 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
07	Lack of LUCs	Evaluate appropriate means of documenting LUCs.	Under Discussion	The FAA is continuing its evaluation of how best to document LUCs	Not applicable

10.3.1 Data Review

The scope of the Area 41 groundwater monitoring program currently reflects the *CERCLA Substantive Requirements Evaluation and Operational Strategy Plan* (TRC, 2013). The data review presented below is based primarily on the sampling conducted on a quarterly basis at Area 41.

Area 41 extraction wells are not sampled on a quarterly basis but the CTP influent from Area 41 was sampled regularly until the extraction wells were taken off line in January 2018. Since the last FYR, no exceedances of ROD-based groundwater cleanup goals have been detected in the CTP influent samples from Area 41. Two rounds of monitoring of the extraction wells were conducted since the last FYR, including one in December 2018 after pumping of the wells was discontinued. The sampling identified the following constituents at levels exceeding ROD-based cleanup criteria: 4,4-DDD in 41-EW6 (2017 only); arsenic in 41-EW4 (2017 and 2018) and 41-EW6 (2017 and 2018); and zinc in 41-EW1(2018 only), 41-EW3 (2017 only), and 41-EW4 (2017 only).

The FAA conducts regular monitoring of wells screened in the Shallow and Intermediate Aquifers in the vicinity of the Area 41 groundwater plume. Quarterly monitoring results indicate the fairly consistent presence of ethylbenzene and xylenes in shallow wells 41-MW7S and 41-MW8S at levels exceeding the ROD cleanup levels. These constituents are consistent with the petroleum contamination identified at Area 41. Xylene levels, as plotted for the fourth quarter of 2015 and the third quarter of 2018 in Appendix E, dropped appreciably over the monitoring period.

Other constituents have also been detected in quarterly groundwater samples at levels exceeding the ROD cleanup levels. 4,4-DDD continues to be detected at elevated levels in well 41-MW10S. This is not surprising, as 4,4-DDD was also present in the product that was identified in well 41-MW10S during the EI. 4,4-DDD was also detected in well 41-MW12D during a single sampling round at a level exceeding the ROD cleanup level Cadmium, chromium, lead and/or zinc also have been periodically detected above ROD-based cleanup levels in shallow wells 41-MW1S, 41-MW5S, 41-MW8S and 41-MW10S while Intermediate Aquifer wells 41-MW11D and 41-MW12D have consistently exhibited elevated chromium levels. The chromium detections are likely attributable to the stainless steel well construction materials. The age of the wells (over 30 years) and the low pH of the Pinelands groundwater may be causing a release of chromium from the stainless steel. No significant changes in groundwater quality have been identified since the discontinuation of groundwater extraction in January 2018.

With the exception of rare detections of chloroform, groundwater monitoring in the vicinity of the Area 41 injection wells did not identify the presence of any constituents above ROD cleanup levels since the last FYR. As discussed in Section 2.4, chloroform has been detected in groundwater throughout the FAA Technical Center and has been reported to occur regionally in the Cohansey aquifer of southern New Jersey.

A supplemental investigation is currently underway at Area 41 to address potential data gaps and further define the extent of contamination at Area 41 in support of the future implementation of remedial enhancements. The scope of work includes soil and groundwater sampling and analyses, as well as bench-scale studies to identify potential remedial alternatives to expedite site cleanup.

10.3.2 Site Inspection/Interview Findings

The Site Inspection was conducted on April 24, 2019 and included representatives of the FAA, EPA and the FAA's contractor, TRC. No major issues were identified during the inspection of Area 41, although it was noted that the groundwater extraction wells are inoperable due to continued clogging by iron bacteria. The area is currently vacant.

10.4 Technical Assessment

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

Question A Summary:

The PCB-contaminated soil excavation component of the remedy has been completed as described in the ROD for Area 41. TPH-contaminated soil removal has also been completed. The groundwater remedial system operated from February 2009 until January 2018, at which time groundwater extraction ceased, due to ongoing issues with iron fouling of the extraction system and associated limitations on groundwater extraction rates. Remediation of PAH-contaminated soils will be evaluated as a separate OU (OU7A) following the USACE's completion of an RI/FS. Additional subsurface investigations are currently underway to support the future evaluation of potential remedial enhancements that could address the groundwater contaminants while eliminating the historical difficulties associated with operating the groundwater remediation system. Due to the historically low groundwater extraction rates achieved by the groundwater extraction system, discontinuation of groundwater extraction has not significantly impacted the shallow groundwater contours at Area 41 and, therefore, no significant impact on potential impacted groundwater migration is anticipated. A comparison of October 2017 and October 2018 groundwater elevation contours is provided in Appendix E. Note that shallow groundwater elevations were elevated across the FAA Technical Center in 2018, when compared to 2017 elevations.

Access to Area 41 continues to be limited by the FAA's security system to authorized FAA employees and contractors.

10.4.2 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?

Question B Summary:

The Area 41 groundwater remedial system was designed to attain the groundwater ARARs defined in the Area 41 ROD, which are based on drinking water standards and New Jersey GWQS that were applicable at the time of ROD signature. Operation of the Area 41 remedial system was also designed to meet the substantive requirements of the action-specific ARARs that existed at the time of the ROD signature. The New Jersey GWQS (NJAC 7:9-6) applicable at the time of the ROD signature consisted of natural background levels or PQLs. Table 10 presents a comparison of the groundwater ARARs specified in the Area 41 ROD to current standards. The most stringent of the chemical-specific ARARs listed in the ROD continue to be equal to or less than state and federal MCLs, with the exception of arsenic. The current GWQS are more stringent for some analytes than the ROD-based ARARs; however, the current GWQS are not health-based but instead are based on an antidegradation standard established for the Pinelands area. If only those GWQS that were not developed based on an antidegradation basis (i.e., the Class IIA GWQS) are considered, arsenic and lead are the only constituents with ROD-based ARARs that are less stringent than the Class IIA GWQS. Arsenic has not been detected since the last FYR in quarterly monitoring at levels exceeding the state MCL and Class IIA GWQS. Lead is periodically detected in wells 41-MW1S and 41-MW7S and is more frequently detected in wells 41-MW8S and 41-MW10S at levels exceeding the Class IIA GWQS. Groundwater at wells 41-MW8S and 41-MW10S exhibits other constituents above ROD-based criteria and therefore will be targeted in additional remedial actions at Area 41. The shallow nature of the contamination does not pose any immediate threats to human health. Furthermore, the CTP effluent did not exhibit exceedances of the state MCL or Class IIA GWQS for arsenic or the Class IIA GWQS for lead since the last FYR. Therefore, even though the ROD-based criteria exceed the current state MCL for arsenic and the Class IIA GWQS for arsenic and lead, the remedy continued to be protective of human health. No new location-specific or action-specific ARARs have been identified that are not being met by the existing Area 41 remedial system.

The soil cleanup standards identified in the Area 41 ROD are based on NJSCC applicable at the time the ROD was signed. These levels included 10,000 mg/kg for total organic compounds (including TPH) in soils. The current NJSRS do not include a comparable total organics cleanup level (see Table 11). A soil cleanup standard for

benzo(a)pyrene was also included in the ROD. The current NJSRS for benzo(a)pyrene has increased since the last FYR, with the current non-residential NJSRS now greater than the ROD-based cleanup level. The presence of benzo(a)pyrene associated with the former skeet shooting range will be addressed as a separate operable unit (OU7A) under the FUDS program. Therefore, the remedial action taken in accordance with the ROD continues to be protective of human health.

The Area 41 ROD also included a PCB cleanup level in soils of 2 mg/kg (based on non-residential exposures). The current NJSRS for PCBs has not changed since the last FYR, when the ROD-based cleanup level was determined to be protective of human health. The slope factor for PCBs in soil also has not changed since the last FYR (see Table 12). Also, PCBs have not been detected in Area 41 groundwater, indicating that any residual PCBs in Area 41 soils are not adversely impacting groundwater quality. As discussed in Section 6.4.2 for OU02, an evaluation of potential risks based on a final cleanup level of 2 mg/kg and a TEQ estimated for dioxin-like PCBs resulted in an estimated risk to a commercial/industrial worker within the acceptable 10^{-4} to 10^{-6} risk range. Therefore, the soil standards presented in the ROD continue to be protective of human health.

As discussed in the Data Review section above, 4,4-DDD has been detected in groundwater samples collected from well 41-MW10S, which previously exhibited a free petroleum product that contained 4,4-DDD. When the groundwater remediation system was operating, the CTP was capable of treating the 4,4-DDD, so the presence of 4,4-DDD in the well did not impact the protectiveness of the remedial system. As stated above, groundwater at well 41-MW10S exhibits other constituents above ROD-based criteria and will be targeted in additional remedial actions at Area 41. The shallow nature of the contamination does not pose any immediate threats to human health.

For constituents monitored during quarterly sampling events for which no ROD cleanup levels are established, chlordane, 4,4-DDE, and heptachlor epoxide are the only constituents detected above both PQLs and human health-based MCLs and/or Class IIA GWQS since the last FYR. Heptachlor epoxide was detected several times in well 41-MW8S at levels exceeding 0.2 µg/L. This well exhibits other constituents above ROD-based criteria and will be targeted in additional remedial actions. 4,4-DDE and chlordane were each detected in only one sample since the last FYR above PQLs and Class IIA criteria (there are no MCLs for these compounds). Given their infrequent detection at elevated levels, they are not considered to pose a potential risk to human health. Mercury and nickel are the most commonly detected constituents at levels that exceed current PQLs but are less than human-health based criteria (MCLs and/or Class IIA GWQS). They are typically detected in wells 41-MW1S, 41-MW11D and 41-MW12D. Other constituents detected less frequently since the last FYR at levels exceeding PQLs but less than human-health based criteria (MCLs and/or Class IIA GWQS) include methylene chloride, chloroform, endosulfan-I, copper and silver. Given that these analytes do not exceed health-based criteria, they are not considered to pose a threat to human health.

No other new contaminants, contaminant sources or unanticipated toxic byproducts of the remedy have been identified.

The toxicity values for some of the contaminants of concern evaluated within the HHRA (carcinogenic PAHs and 4,4-DDD) have changed (see Table 12). No site-specific risk-based cleanup levels were used as the basis for the remedy, so the change does not directly impact the cleanup levels that are defined in the ROD. For the carcinogenic PAHs, the oral carcinogenic potency factor decreased, which would result in a decrease in associated cancer risk. EPA has established a non-cancer reference dose for benzo(a)pyrene and a screening non-cancer toxicity value for 4,4-DDD, neither of which would result in an increased total non-cancer hazard index greater than 1. Therefore, these changes are not expected to impact the protectiveness of the remedy.

Baseline ecological risks were evaluated based on pre-remedial concentrations of surface soil contaminants. While a specific evaluation of the ecological protectiveness of the soil cleanup standards was not conducted, the potential risks associated with the contaminated soils and sediments have been reduced through the implementation of the soil remedial action and capping of the pond sediments.

Land use at or near Area 41 has not changed since the last FYR and the potential routes of exposure and estimated exposure frequencies remain the same. Groundwater has not been developed as a potable source of water and no changes have occurred that would impact the soil vapor exposure pathway.

While land use has not changed, Area 41 does not currently have LUCs in place to protect against unacceptable exposures in the future. The HHRA for Area 41 did not include an unrestricted land-use scenario, the soil removal that took place was based on non-residential NJSCC, and groundwater contaminant levels exceed MCLs. Also, the Area 41 ROD stipulated that residential site use restrictions be established. EPA has requested that FAA develop a facility-wide LUCAP to address areas such as Area 41 where the presence of residual contamination and/or the lack of evaluation of an unrestricted (i.e., residential) use scenario in the HHRA requires the establishment and maintenance of site use restrictions. As owner of the property, the FAA is responsible for the implementation of LUCs; however, the FAA will coordinate the implementation of LUCs at Area 41 with the USACE in association with the investigation and remediation of PAH-contaminated soils at Area 41.

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

No additional information has been identified that would call into question the protectiveness of the remedy.

10.5 Issues/Recommendations

Issues, recommendations and follow-up actions for OU07 are listed below.

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 07	**Issue Category: Remedy Performance**			
	Issue: Biofouling of Area 41 Groundwater Extraction System			
	Recommendation: Identify and implement remedial system enhancements to address residual groundwater impacts.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	8/31/2022
	Issue Category: Institutional Controls			
	Issue: Lack of LUCs			
	Recommendation: Evaluate appropriate means of documenting LUCs.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	8/31/2021

10.6 Other Findings

In addition, the following are recommendations that were identified during the FYR that may improve the effectiveness of the remedy and accelerate site closeout but do not affect current protectiveness:

- Coordinate with the FUDS program to encourage the timely progress of actions associated with the benzo(a)pyrene impacts to be addressed under OU 07A.

10.7 Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit:	*Protectiveness Determination:*
07	Short-term Protective

Protectiveness Statement:
The remedy at OU07 (Area 41) currently protects human health and the environment because there are no exposures to impacted soil and groundwater. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure protectiveness:

- Remedial system enhancements must be identified and implemented to address residual groundwater impacts.
- Evaluation of the appropriate means of documenting LUCs at the FAA.

11.0 OU08 – AREA B – NAVY FIRE TEST FACILITY

11.1 History of Contamination and Initial Response

Area B, referred to as the Navy Fire Test Facility, is located near the former sewage treatment plant in the southwestern portion of the FAA property. The SBAC flows from west to east along the southern portion of the area. The area is currently grass-covered, with a wooded area along the SBAC. Byrd Highway traverses the central portion of the site. A running track constructed by the NJANG is located north of Byrd Highway. Area B was used during the late 1950s and early 1960s for aircraft fire training. A review of historical aerial photographs indicates that the highest level of activity occurred between 1957 and 1962. During this time frame, aircraft and sections of aircraft were located throughout the area and portions of the area's ground surface exhibited dark-colored stains. By 1965, the area had been graded over. A portion of the area was later used for General Services Administration motor-pool parking.

11.2 Response Action Summary

11.2.1 Basis for Taking Action

The original Area B investigations included six phases of investigation conducted between December 1986 and July 1993. No PP compounds were detected in surface water. In addition, no contaminants were detected in surface soil, subsurface soil and sediment above non-residential NJSCC. However, inorganics and VOCs were detected above MCLs/PQLs in groundwater.

Subsequent to the completion of the Phase I investigation of December 1986, the presence of an 8-inch thick, floating hydrocarbon product layer was identified in a monitoring well (B-MW3S). In late 1988, a sample of the product was collected. It exhibited an odor characteristic of a mixture of gasoline and kerosene. Chemical analysis of the mixture indicated that its chromatogram most closely resembles that of gasoline. Xylene, chlorobenzene, and ethylbenzene were identified as the main components in the PP analysis of the product sample. Ethylbenzene was the only VOC detected in a groundwater sample collected from beneath the product layer. Subsequent monitoring indicated that the presence of the product was variable, likely due to seasonal variations and the documented tendency for floating product to accumulate in wells to greater thicknesses than actually present in the surrounding aquifer (furthermore, as discussed in Section 11.2.3, the product has not been detected in this well since 1993). In August 1992, additional investigations were conducted to determine if the stained soils or aircraft areas

visible in the historic aerial photographs could be a potential source of contamination at Area B. No consistent pattern of contamination was noted, and no potential source of the floating product was identified.

Contaminants

COCs, as identified in the HHRA for Area B, in each medium include:

Soil	Groundwater
Arsenic	Arsenic
Cadmium	Chromium
Chromium	Copper
Copper	Lead
Lead	Mercury
Mercury	Zinc
Zinc	Acetone
Toluene	Bromochloromethane
bis(2-Ethylhexyl)phthalate	Chloroform
Butylbenzylphthalate	1,1-Dichloroethane
Di-n-butylphthalate	1,1-Dichloroethene
Di-n-octylphthalate	cis-1,2-Dichloroethene
Naphthalene	1,2-Dichloropropane
1,2,4-Trichlorobenzene	Ethylbenzene
4,4-DDE	Methylene Chloride
4,4-DDT	Tetrachloroethene
Aroclor 1242 (PCB)	Toluene
	1,1,1-Trichloroethane
	Trichloroethene
	Xylene (total)
	2-Methylnaphthalene
	4-Methylphenol
	Naphthalene
	Phenol
	4,4-DDE
	4,4-DDT
	Heptachlor epoxide

Human Health Risk Assessment

Potential risks associated with exposures to soil and groundwater at Area B were estimated assuming future development where workers would be at Area B on a daily basis and a potable well would be installed. Under these scenarios, exposures to soil and groundwater were based on an exposure frequency of 250 days/year. As modeled, exposures to soil and groundwater did not result in unacceptable risks. Exposure to Area B groundwater resulted in a risk level within EPA's carcinogenic risk range and below the noncarcinogenic risk criteria. Arsenic and methylene chloride were the primary contributors to carcinogenic risk. Exposure to soil resulted in risk levels below EPA's risk-management criteria.

Ecological Risk Assessment

The COCs identified for the ERA include trichlorobenzene, di-n-butylphthalate, 4,4-DDT, 4,4-DDE, arsenic, cadmium, chromium, copper, lead and zinc, all constituents which were detected in surface soil and/or sediment at Area B. The results of the ERA indicate that Area B poses a generally low order of risk for terrestrial receptors, with estimated risks below levels of concern for deer, fox, and hawk, and slightly elevated risks for the mouse and woodcock. Cadmium and chromium contributed most to the estimated risks for mouse and woodcock. Potential risks associated with exposures to the sediments of the nearby SBAC will be addressed as part of OU14 (Area U).

11.2.2 Response Actions

The ROD for Area B was signed on September 20, 1996. The RAOs listed in the ROD are as follows:

- Prevent exposure, due to groundwater ingestion, to groundwater contaminants which are present at levels exceeding state and federal drinking water standards and New Jersey GWQS. Groundwater remediation levels will be the more stringent of state and federal drinking water standards and New Jersey GWQS;
- Prevent migration and discharge of groundwater contaminants to the SBAC and restore groundwater quality; and
- Prevent exposure to and migration of free-product contaminants from the vicinity of well B-MW3S.

Based on subsequent investigation activities at Area B, the extent of the VOC plume was found to be more extensive than initial investigations had indicated. As a result, the cost of implementing the preferred remedy, consisting of air sparging and soil-vapor extraction, became prohibitive. Additionally, inorganic compounds, including mercury, were found to be present in groundwater at Area B. Air sparging and soil vapor extraction's inability to address metals contamination, along with cost concerns, led FAA to select the contingency remedy documented in the ROD. The contingency remedy for Area B includes the following components:

- Installation of additional monitoring wells;
- Continued groundwater and surface water monitoring;
- Installation and operation of product/groundwater extraction wells;
- Physical separation of product and off-site transport for incineration;
- On-site groundwater treatment; and
- Discharge of treated water back into the groundwater via injection wells and a seasonally-operated sprinkler system.

Cleanup levels defined in the ROD are summarized in Table 13 for groundwater. No ROD cleanup levels were established for soil at Area B.

11.2.3 Status of Implementation

Due to remedial funding limitations, the Area B design was completed in phases. Pre-design studies, including the performance of a pumping test and an injection test, were completed in December 2000 and the design for Phase I was completed in October 2001. Because free product had not been detected at Area B since 1993, extraction of a separate free-phase product was not included as a remedial component during the remedial design. The Phase II design effort was conducted in two sub-phases, with the second phase completed in 2005. Construction was conducted in two phases that extended from 2002 through 2007. Full-scale groundwater extraction from Area B began in February 2009, with groundwater from Area B Shallow and Intermediate Aquifer wells pumped to the CTP. Figure 8 shows the locations of extraction, observation, monitoring, and injection wells and piezometers at Area B.

Significant progress has been made in achieving remedial goals in downgradient monitoring wells using the groundwater extraction system. Pumping was discontinued at downgradient extraction wells B-EW2M and M-

EW4D in September 2014 because the ROD cleanup levels had been achieved. Quarterly monitoring of shallow/intermediate and intermediate wells in the area continues to ensure that no rebound of CVOC levels above ROD cleanup levels occurs. Mercury fate and transport modeling was conducted to ensure that the discontinuation of pumping would not adversely impact the extent of mercury in the groundwater at Area B that is attributed to adjacent Area U. The modeling indicated that discontinuation of pumping would not result in the expansion of the mercury plume. Currently groundwater is extracted at five shallow extraction wells (B-EW1S, B-EW2S, B-EW3S, B-EW5S and B-EW7S) and three Intermediate Aquifer extraction wells (B-EW1M, B-EW1D and B-EW2D). As of December 2018, the combined extraction wells were pumping approximately 140 gpm from Area B.

Studies and evaluations of potential upgradient sources of the Area B CVOC contamination have also been conducted. Additional investigations conducted in 2013 included the collection of vertical profile groundwater samples from eight Geoprobe locations upgradient of Area B representing both the Shallow and Intermediate Aquifers. The data were evaluated along with groundwater monitoring data from both Area B remedial system groundwater monitoring and NJANG groundwater monitoring activities associated with their investigations of another AOC (Site 3, part of OU12). Area B groundwater modeling suggested that upgradient NJANG Site 3 could be impacting the groundwater at Area B. In 2019, a comprehensive sampling event of upgradient NJANG and FAA monitoring wells was conducted to provide a complete and contemporaneous data set of upgradient groundwater quality. The study included compound-specific isotope analyses and updated groundwater modeling in an attempt to identify specific upgradient contaminant sources. The study also included the collection of subsurface soils samples at Area B. The results are currently being evaluated.

On-going monitoring at Area B includes the following:

- Area-specific quarterly CTP influent sampling for VOC, SVOC, pesticides and metals analyses;
- Well-specific quarterly monitoring well sampling for VOC and metals analyses; and
- Quarterly injection monitoring well sampling for VOC, SVOC, and metals analyses.

In addition to the monitoring program presented above, the FAA occasionally conducts site-wide sampling events to provide additional information on remedial system performance.

11.2.4 Systems Operations/Operation & Maintenance

The Area B groundwater remediation system started full-scale operation on February 17, 2009. Discussion of the overall CTP operation and maintenance was provided previously in the discussion for Area D in Section 5.

Due to potential changes in the water table that could result from the operation of the extraction wells at Area B or the seasonal operation of a sprinkler system to discharge treated groundwater from the CTP into the wetlands along the SBAC in the vicinity of Area B, biota and wetland hydrology monitoring are being conducted at Area B. Since the last FYR, neither of the monitoring programs have identified adverse environmental impacts attributable to the operation of the Area B remedial system.

Through 2012, the FAA operated the remedial systems at the Technical Center in accordance with permit equivalencies issued by the NJDEP. However, since 2013, the FAA has operated the Area B remedial system in accordance with the *CERCLA Substantive Requirements Evaluation and Operational Strategy Plan*, (TRC, 2013).

There have been no significant operational issues associated with the Area B extraction wells since the last FYR. CTP influent monitoring was discussed in Section 5.2.4. Extraction wells B-EW4S and B-EW6S have not operated since 2010 and 2013, respectively, due to elevated mercury levels (B-EW4S) and the presence of roots (B-EW6S). In April 2016, the extraction well pumps in B-EW1M, B-EW1D, and B-EW2D were replaced with pumps capable of operating a lower pressure to reduce the operating pressure of the influent line piping and provide energy savings. Bi-annual video inspections are conducted at the Area B injection wells to monitor the wells' conditions. As a result, the Area B injection wells were redeveloped in November/December 2016.

A single round of monitoring of the Area B extraction wells since the last FYR (conducted in September 2017) indicated that TCE was present in wells B-EW3S and B-EW3D at levels slightly exceeding the ROD-based cleanup

criteria. Mercury was also detected in extraction wells B-EW4S and B-EW6S at levels exceeding the ROD-based cleanup criterion of 0.6 µg/L. Limited plume mapping is available for Area B. Plume maps for shallow PCE based on monitoring well data available in 2017 and 2018 and for shallow mercury based on monitoring well data available in 2016 and 2018 are provided in Appendix E. PCE detections are limited to shallow wells near the SBAC while mercury is present near the former meanders of the SBAC that were abandoned when the stream was channelized. The mercury is believed to be attributable to the Area U mercury contamination, since the two areas physically overlap along the SBAC.

11.3 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.

Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
08	Short-term Protective	The remedy at OU08 (Area B) currently protects human health and the environment because the existing remedy is controlling exposures to soil and groundwater. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: • Evaluation of the appropriate means of documenting LUCs at the FAA.

Status of Recommendations from the 2014 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
08	Lack of LUCs	Evaluate appropriate means of documenting LUCs.	Under Discussion	The FAA is continuing its evaluation of how best to document LUCs	Not applicable

11.3.1 Data Review

The scope of the Area B groundwater monitoring program currently reflects the *CERCLA Substantive Requirements Evaluation and Operational Strategy Plan* (TRC, 2013) The data review presented below is based primarily on the sampling conducted on a quarterly basis at Area B.

Area B extraction wells are not sampled on a quarterly basis but the CTP influent from Area B is. Since the last FYR, no exceedances of ROD-based groundwater cleanup goals have been detected in the CTP influent samples from Area B. A single round of monitoring of the extraction wells since the last FYR (conducted in September 2017) indicated that TCE was present in wells B-EW3S and B-EW3D at levels slightly exceeding the ROD-based cleanup criteria. Other chlorinated VOCs are generally not detected at elevated levels in the extraction wells. Mercury was also detected in extraction wells B-EW4S and B-EW6S at levels exceeding the ROD-based cleanup criterion of 0.6 µg/L and chromium was detected slightly above the ROD-based cleanup criterion of 21.5 µg/L in well B-EW4S.

The FAA conducts regular monitoring of Shallow and Intermediate Aquifer groundwater in the vicinity of the Area B groundwater plume. Quarterly monitoring results indicate the chlorinated VOC plume is being captured by the groundwater extraction system. The quarterly results indicate that PCE continues to be detected at levels exceeding the ROD cleanup levels on a fairly consistent basis in shallow wells B-MW5S and B-MW6S. TCA and 1,1-DCE are also regularly detected in well B-MW5S at levels exceeding their ROD-based cleanup criteria, a

change from the last FYR, when these compounds were rarely detected at levels exceeding ROD-based criteria in this well. TCE was also detected in three 2016 sampling rounds at levels exceeding the ROD cleanup level at shallow well B-MW11S, but it has not been detected since then. PCE and TCE continue to be detected above their ROD cleanup levels in well B-MW7I and TCE is periodically detected in well B-MW15I above its ROD cleanup level. The four wells that consistently or periodically exhibit CVOCs above ROD-based cleanup levels (B-MW5S, B-MW6S, B-MW7I and B-MW15I) are all located in the upgradient portion of Area B, which continues to be impacted by VOC-contaminated groundwater emanating from an upgradient source. Mercury has also been detected periodically in the following wells at levels exceeding the ROD cleanup level of 0.6 µg/L: B-MW5S, B-MW11S, B-MW12S, B-MW22I, B-MW22D, B-MW23I and B-MW23D. Zinc has also been detected above its ROD cleanup level in wells B-MW22D and B-MW23D.

The free product historically identified in well B-MW3S was detected only once during the quarterly groundwater monitoring conducted since 2009. A very thin layer (0.01 feet thick) of product was identified during the March 2013 monitoring event. Free product has not been detected in the well at a thickness greater than 0.10 feet since October 1995.

Groundwater monitoring conducted in the vicinity of the Area B injection wells since the last FYR did not identify the presence of any constituents above ROD cleanup levels.

11.3.2 Site Inspection/Interview Findings

The Site Inspection was conducted on April 24, 2019 and included representatives of the FAA, EPA and the FAA's contractor, TRC. There is no current land use and the area is fenced with a locked gate. No major issues were identified during the inspection of Area B.

11.4 Technical Assessment

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

Question A Summary:

The groundwater remediation system has successfully captured much of the chlorinated groundwater contamination present at Area B, leading to the discontinuation of the operation of downgradient extraction wells B-EW2M and B-EW4D in 2014. However, ongoing groundwater monitoring indicates the presence of a continued upgradient source of contamination, possibly associated with the NJANG Site 3 (see OU12 discussion). To achieve cleanup goals, the upgradient source of the groundwater impacts will need to be remediated.

Access to Area B continues to be limited by the FAA's security system to authorized FAA employees and contractors.

11.4.2 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?

Question B Summary:

The Area B groundwater remedial system is designed to attain the groundwater ARARs defined in the Area B ROD, which are based on drinking water standards and New Jersey GWQS that were applicable at the time of ROD signature. Operation of the Area B remedial system also meets the substantive requirements of the action-specific ARARs that existed at the time of the ROD signature. The New Jersey GWQS (NJAC 7:9-6) applicable at the time of the ROD signature consisted of natural background levels or PQLs. Table 13 presents a comparison of the groundwater ARARs specified in the Area B ROD to current standards. The most stringent of the chemical-specific ARARs listed in the ROD continue to be equal to or less than current state and federal MCLs. The current GWQS are more stringent for some analytes than the ROD-based ARARs; however, the current GWQS are not health-

based but instead are based on an antidegradation standard established for the Pinelands area. If only those groundwater quality standards that were not developed based on an antidegradation basis (i.e., the Class IIA GWQS) are considered, 1,1-DCE and lead are the only constituents with ROD-based ARARs that are less stringent than the Class IIA GWQS. 1,1-DCE has recently been detected at levels exceeding both the ROD-based ARAR and the Class IIA GWQS at well B-MW5S. This well also exhibits PCE at levels exceeding ROD-based criteria and is located within the capture zone of the Area B extraction wells, so remediation of the PCE is expected to also result in remediation of the 1,1-DCE. Lead has not been detected in Area B wells sampled on a quarterly basis at levels exceeding the Class IIA GWQS. Neither lead nor 1,1-DCE have been detected in CTP effluent at levels exceeding the Class IIA GWQS. Therefore, the remedy continues to be protective of human health. No new location-specific or action-specific ARARs have been identified that are not being met by the existing Area B remedial system.

As no soils exhibited contaminant levels exceeding NJSCC during the EI and no unacceptable risks were associated with the modeled exposures to soils, no ARARs were defined for Area B soils.

For constituents monitored during quarterly sampling events for which no ROD cleanup levels are established, beryllium was the only constituent detected above both its PQL and human health-based MCLs and/or Class IIA GWQS since the last FYR. Beryllium was most commonly detected above Class IIA GWQS at wells B-MW22D and B-MW23D. Beryllium was detected only two times at levels exceeding MCLs: once at well B-MW22D and once at well B-MW17I. These wells are located near the historical downgradient extent of the Area B groundwater plume and, given the lack of elevated beryllium levels in wells closer to Area B, it is unlikely that Area B is the source of the beryllium. Given the general lack of exceedances of the beryllium MCL, the presence of beryllium in these wells is not considered to pose a threat to human health.

In December 2009, the FAA conducted sampling of the CTP influent for 1,4-dioxane and 1,4-dioxane was not detected. While the influent to the CTP at that time reflected groundwater extracted from multiple areas-of-concern (i.e., Areas B, D and 41), approximately 86% of the CTP influent originated from Area B. The detection limit for 1,4-dioxane in the sample collected in 2009 was 10 µg/L, which met the then-applicable New Jersey Interim GWQS but exceeds the current health-based Class IIA New Jersey GWQS of 0.4 µg/L and the EPA Regional Screening Level for tap water of 0.46 µg/L. A federal or state drinking water standard has not been established for 1,4-dioxane. While 1,4-dioxane is not a COC at Area B, it has been included as an incidental groundwater sample analyte in prior Area B investigations (e.g., low-flow sampling of monitoring wells in July 2012 and March 2014, and source area groundwater sampling conducted during 2013 source area investigations). In these investigations, which included analysis of over 30 Area B groundwater samples, 1,4-dioxane was not detected at a detection limit of 50 µg/L. Additional characterization of 1,4-dioxane at a lower detection limit may be appropriate to confirm its absence in groundwater at Area B.

Following the detection of PFAS in surface water samples collected by the NJDEP from the Upper and Lower Atlantic City Reservoirs in 2009, the FAA collected surface and groundwater samples in February 2014 to determine if the FAA could be a source of the PFAS detected in the reservoirs. Based on the detection of PFAS in SBAC surface water samples and due to the historic use of Area B for fire-fighting training activities, additional sampling of groundwater was conducted at Area B in August 2014. Groundwater sampling conducted at Area B indicated the presence of PFAS in shallow extraction wells, but at levels below the current guidance levels. On November 9, 2015, several extraction wells at Area B were sampled and analyzed for PFAS, with PFAS detected in each of the wells. A facility-wide PFAS Preliminary Assessment recommended the performance of an RI at Area B to further evaluate the nature and extent of PFAS impacts. The RI will be performed following the completion of a Site Inspection at other areas of potential PFAS impacts. See Section 2.4 for further discussion.

No other new contaminants, contaminant sources or unanticipated toxic byproducts of the remedy have been identified.

Toxicity values for some of the contaminants of concern evaluated within the human health risk assessment have changed (see Table 14). Constituents with toxicity value changes that would result in increased carcinogenic or non-carcinogenic risk estimates include 1,2-dichloropropane and 4,4-DDE. However, the change in the toxicity

factors still results in associated carcinogenic and non-carcinogenic risk estimates within acceptable values (i.e., within the 10^{-4} to 10^{-6} risk range for carcinogenic risks and/or a hazard quotient less than 1 for non-carcinogens) for both soil and groundwater exposures. Additionally, the CTP is capable of treating both of these COCs. Therefore, these changes do not impact the protectiveness of the remedy.

Baseline ecological risks were evaluated based on existing surface soil and sediment contaminant levels. A low order of risk was identified for terrestrial receptors. There is no new information to suggest that the soils do not continue to be protective of ecological receptors. Potential risks to aquatic receptors within the SBAC will be further evaluated and addressed, as appropriate, as part of the Area U ERA. On-going monitoring of the adjacent wetlands (both baseline and during operation of the remedial system) and biota has not indicated any adverse impacts to the wetland community associated with either groundwater extraction or the operation of the sprinkler system.

Land use at or near Area B has not changed since the last FYR and the potential routes of exposure and estimated exposure frequencies remain the same. Therefore, the remedy continues to be protective. Groundwater has not been developed as a potable source of water and there is currently no soil vapor exposure pathway.

Area B does not currently have LUCs in place to protect against unacceptable exposures in the future. The HHRA for Area B did not include an unrestricted land-use scenario and groundwater contaminant levels exceed MCLs. EPA has requested that FAA develop a facility-wide LUCAP to address areas such as Area B where the presence of residual contamination and/or the lack of evaluation of an unrestricted (i.e., residential) use scenario in the HHRA requires the establishment and maintenance of site use restrictions. The FAA may consider addressing LUCs at FAA AOCs where there are currently no LUCs specified within the RODs through the preparation of an appropriate post-ROD enforceable document.

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

No additional information has been identified that would call into question the protectiveness of the remedy.

11.5 Issues/Recommendations

Issues, recommendations and follow-up actions for OU08 are listed below.

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 08	Issue Category: Institutional Controls			
	Issue: Lack of LUCs			
	Recommendation: Evaluate appropriate means of documenting LUCs			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	8/31/2021

11.6 Other Findings

In addition, the following are recommendations that were identified during the FYR that may improve the effectiveness of the remedy and accelerate site closeout but do not affect current protectiveness:

- Continue to pursue the identification of the source of the CVOCs detected in Area B groundwater, including potential upgradient sources, to assist in the timely achievement of ROD cleanup goals.
- Resample groundwater at Area B to verify that 1,4-dioxane (at lower laboratory detection limits) is not present at levels exceeding current health-based screening levels.

11.7 Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit: 08	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at OU08 (Area B) currently protects human health and the environment because the existing remedy is controlling exposures to soil and groundwater. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: • Evaluation of the appropriate means of documenting LUCs at the FAA. • Performance of additional sampling for 1,4-dioxane in groundwater.	

12.0 OU09 - Areas A, J, and N - Navy R&D Landfill, Excavation Area near Runway, and Catapult Test Area near Bldg. 214

OU09 consists of three separate AOCs: Area A, the Navy R&D Landfill; Area J, the Excavation Area near the Runway; and Area N, the Catapult Test Area near Building 214. As previously described in Section 1.0, Areas J and N did not have any site use or exposure restrictions specified in the ROD that covered OU09. Therefore, the following discussion focuses on Area A.

12.1 History of Contamination and Initial Response

Area A is located south of the Upper Atlantic City Reservoir, in the R&D portion of the FAA Technical Center. While Area A is referred to as the R&D Navy Landfill, it consists of two separate investigation areas: the former R&D Navy landfill area, and a former borrow pit area. The R&D Navy landfill area, located north of Card Road, was originally developed prior to 1940 and was used as a dumping area during the 1940s and 1950s. The former borrow pit area, located south of Card Road, was historically the site of a Civil Aviation Security firing range and is currently used for Federal Air Marshal training facilities. Northeastern portions of the former borrow pit area were used for the disposal of construction debris. At the time of the initial Area A investigations, a groundwater production well (FAA-224) was located immediately west of Area A. It provided non-potable water to Building 224, located along Card Road just west of the former borrow pit area. Building 224 is a relatively small structure used for the storage of electronic equipment. However, current FAA records indicate that the well has been formally abandoned.

12.2 Response Action Summary

12.2.1 Basis for No Action with Continued Monitoring

Results of surface and subsurface soil sampling at Area A did not indicate the presence of any contaminant levels greater than the non-residential NJSCC. However, inorganics and chloroform were detected above MCLs and/or PQLs in groundwater.

Contaminants

COCs, as defined in the HHRA for Area A, in each medium include:

Soil	Groundwater
n-Nitrosodiphenylamine	bis(2-Ethylhexyl)phthalate
Cadmium	Cadmium
Chromium	Chromium
Lead	Lead
Aroclor 1242 (PCB)	Mercury
Phenol	

While bis(2-ethylhexyl)phthalate was evaluated as a potential groundwater COC in the risk assessment because it was detected in three of five wells at levels ranging from 11 to 36 µg/L, it was also detected in a laboratory blank at a concentration of 6 µg/L, indicating the presence of this compound is likely due to the contamination of the samples within the laboratory. Since Area A was not expected to be used for any scheduled activity, the exposure frequencies used in the HHRA were restrictive. For example, exposure to surface soil was based on a maximum exposure frequency of 24 days/year. Exposure to groundwater was based on a commercial/industrial maximum exposure frequency of 250 days/year, assuming a potable well was installed. Exposure to Area A groundwater resulted in an estimated risk level within EPA's carcinogenic-risk range, primarily due to the detection of bis(2-ethylhexyl)phthalate, which was thought to be a laboratory contaminant. Inorganics were also detected in groundwater above MCLs or PQLs, but they either were not confirmed at those levels in subsequent sampling events or, in the case of zinc, are consistent with regional background levels as defined by the USGS (Water-Resources Investigations Report 92-4144). The subsequent consistent detection of chloroform in groundwater at Area A led to the performance of a limited HHRA for chloroform (included as an attachment to the May 1994 Quarterly Ground Water Sampling Results report). The results of the limited HHRA indicated that chloroform in groundwater was not considered to pose a significant human health concern at Area A. Non-carcinogenic risk hazards due to exposure to groundwater were below EPA criteria. Exposure to soil resulted in estimated risk levels within EPA's carcinogenic-risk range and below the non-carcinogenic criteria. The carcinogenic risk was attributable to the detection of PCBs in subsurface soil which could not be duplicated in subsequent sampling.

Construction of a Federal Air Marshal training center was completed in 2003 on part of the borrow pit portion of Area A. Because the original HHRA exposure assumptions did not reflect the proposed land use, the original HHRA was updated to reflect a more extensive exposure to surface soils under a commercial/industrial use scenario. Risks associated with the surface soil COCs at Area A were estimated using the standard commercial/industrial exposure frequency of 250 days per year. The revised risk assessment did not predict excessive risk levels.

In 2012, a second risk assessment update was performed to evaluate the potential risks associated with development of the site for a potential Federal Air Marshal Service equipment storage facility (TRC, 2012). This update reflected changes to the toxicity criteria used to evaluate risk from exposure to soils that had occurred since the 2002 revisions. Specifically, USEPA withdrew the toxicity criteria for total chromium and classified hexavalent chromium as carcinogenic by the oral route of exposure. Therefore, the risk to on-site workers was conservatively evaluated for their exposure to hexavalent chromium. The calculated cancer risk for the standard commercial/industrial worker potentially exposed to hexavalent chromium was within the 1E-04 to 1E-06 risk range that USEPA has identified in the NCP as representing an acceptable exposure level, while the calculated HQ for hexavalent chromium was 9.1E-03, which is well below the non-cancer target HQ of 1. Also, the maximum detected concentration of lead in Area A soils was 9.3 mg/kg, which is well below the USEPA industrial and NJDEP non-residential soil clean-up level of 800 mg/kg. Therefore, the revised risk assessment demonstrated that surface and subsurface soils at this site do not pose a level of concern under current standard commercial/industrial site use risk assumptions.

12.2.2 Response Actions

The ROD for Areas A, J and N was signed on July 22, 1997. The selected remedy for Area A is no further action with groundwater monitoring. Because of the no further action decision, no cleanup levels were defined within the ROD.

12.2.3 Status of Implementation

Implementation activities are limited to the quarterly groundwater sampling for VOC analysis conducted at Area A.

12.2.4 Systems Operations/Operation & Maintenance

Not applicable; no active remedy.

12.3 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.

Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
09	Short-term Protective	The remedy at OU09 (Area A) currently protects human health and the environment because the existing remedy is controlling exposures to soil and groundwater. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: • Evaluation of the appropriate means of documenting LUCs at the FAA.

Status of Recommendations from the 2014 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
09	Lack of LUCs	Evaluate appropriate means of documenting LUCs.	Under Discussion	The FAA is seeking partial deletion of Area A or a formal acknowledgement that groundwater monitoring may cease based on the results of long-term groundwater monitoring and subsequent risk assessment evaluations	Not applicable

To address the LUC issue at Area A, the FAA conducted a revised risk evaluation to evaluate potential human health risks under an unrestricted site use scenario and demonstrate that LUCs are not required, in support of the potential future partial deletion of Area A. This risk assessment re-evaluation was conducted in 2016 and revised in 2018 using the most current methods accepted by the USEPA and it evaluated potential exposures to both soil and groundwater at Area A. The results of the risk assessment indicated that there are no unacceptable human health risks associated with potential exposures to surface soils, combined surface/subsurface soils and groundwater usage and therefore support the partial deletion of Area A. Given the results of the risk assessment, the FAA demonstrated that LUCs are not required at Area A.

12.3.1 Data Review

Two monitoring wells, A-MW3S and A-MW4S, are routinely sampled as part of quarterly groundwater monitoring at Area A. Low levels of chloroform (13 µg/L or less) have historically been detected at these two monitoring wells during the quarterly groundwater sampling that has been conducted since 1996. No other constituents have been detected in the groundwater samples at levels exceeding current New Jersey GWQS (i.e., PQLs). In 2019, all five of the Area A monitoring wells were sampled, with no VOCs detected in wells A-MW1S, A-MW2S, A-MW3S and A-MW5S. Consistent with previous groundwater sampling, well A-MW4S exhibited chloroform at a concentration of 3.8 µg/L. The levels of chloroform historically detected at Area A are below the NJDEP generic VI groundwater screening level of 70 µg/L (NJDEP, March 2013). As discussed in Section 2.4, chloroform has been detected in groundwater throughout the FAA Technical Center and has been reported to occur regionally in the Cohansey aquifer of southern New Jersey. The FAA has recently installed perimeter monitoring wells around the Technical Center, the data from which will be used to further demonstrate that chloroform is a regional groundwater issue and not attributable to Area A. The construction and expansion of the Federal Air Marshal training facility at Area A in the early 2000s appears to have slightly altered the shallow groundwater flow direction, from east-northeasterly to more northerly/northeasterly.

12.3.2 Site Inspection/Interview Findings

The Site Inspection was conducted on April 24, 2019 and included representatives of the FAA, EPA and the FAA's contractor, TRC. No major issues were identified during the inspection of Area A.

12.4 Technical Assessment

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

Question A Summary:

Quarterly groundwater monitoring at Area A has been effective in monitoring long-term groundwater quality trends.

Access to Area A is limited by the FAA's security system to authorized employees and contractors. Recent risk re-evaluations of residential site use at Area A have indicated that the site is protective under UU/UE future use scenarios.

12.4.2 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?

Question B Summary:

Land use at or near Area A has not changed since the last FYR and the potential routes of exposure remain the same. Groundwater has not been developed as a potable source of water and no changes have occurred that would impact the soil vapor exposure pathway. No new contaminants or contaminant sources have been identified.

The FAA updated the Area A risk assessment in 2016 (revised in 2018) to reflect current UU/UE exposure assumptions and other changes in risk assessment procedures since the previous risk assessments were performed. The results of the updated risk assessment indicate that there are no unacceptable human health risks associated with potential exposures to surface soils, combined surface/subsurface soils, and groundwater usage under an unrestricted site use scenario. Therefore, there is no need for LUCs at Area A.

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

No additional information has been identified that would call into question the protectiveness of the remedy.

12.5 Issues/Recommendations

Issues, recommendations and follow-up actions for OU09 are listed below.

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU 09: None

12.6 Other Findings

The following recommendation could accelerate site closeout but does not affect current protectiveness and was identified during the FYR:

- Based on the re-evaluation of risks associated with Area A under unrestricted site use, which shows that LUCs are not necessary, it is recommended that Area A undergo partial deletion and/or the EPA approve a discontinuation of the groundwater monitoring currently required under the existing ROD.

12.7 Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit: 09	*Protectiveness Determination:* Protective
Protectiveness Statement: The remedy at OU09 (Area A) is protective of human health and the environment.	

13.0 OU11 - AREAS 27, 56, F, R, AND S - FUEL MIST TEST AREA, ABANDONED NAVY LANDFILL, AIR BLAST FACILITY, TRASH DUMP, AND EXCAVATION AREA WEST OF TILTON ROAD

13.1 History of Contamination and Initial Response

Area 27, Fuel Mist Test Area

Area 27 is located south of the Upper Atlantic City Reservoir, in the R&D portion of the FAA Technical Center. Area 27 includes an area located adjacent to Building 211, as well as downgradient portions of a storm drain and drainage swale which received runoff from the Building 211 area, encompassing approximately 4 acres. At Area 27, a fuel mist test facility was used for the testing of anti-misting additives for jet fuel until the practice was discontinued in 1986. The test procedure involved spraying the jet fuel and burning it in the open. Fuel mist tests were first conducted in 1979 over an unlined open area. Approximately 25 tests were run before the January 1980 installation of a Mylar liner for the collection of unburned fuel. In September 1985, a second Mylar liner was installed above the original.

In 1986, approximately 100 gallons of jet fuel were apparently spilled into a storm drainage piping system at Area 27 due to the malfunction of an oil/water separator at Building 211. This drainage system leads to a small, unlined drainage swale north of Area 27. At the time of the 1986 spill, jet fuel passed through the drainage system and contaminated soil in the swale. The contaminated soil was removed from the swale areas in the spring of 1986 and disposed of off site. An additional removal action took place in 1989 in which contaminated soils were removed

from a catch basin and associated piping was flushed out. Also, based on a soil gas survey, three hot spots were excavated from the swale.

Area 56, Abandoned Navy Landfill

Area 56, the Abandoned Navy Landfill, is located near the current FAA hangar, south of the major east-west runway. The 11-acre area is currently characterized by the presence of a softball field and a parking area over portions of the former disposal area. The landfill was operated by the Navy between 1943 and 1958. The nature and total volume of material disposed of at Area 56 are unknown.

Area F, Air Blast Facility

Area F is located north of the major east-west runway, in the airport operations area of the FAA Technical Center. The Building 311 complex, consisting of buildings and trailers, is located at Area F, as are the air blast test facilities, including a large concrete pad used in testing activities. Area F comprises approximately 4 acres. The air blast facility at Area F included a large exhaust duct which was used to route air at high velocity to a jet fuselage located on a concrete pad. During historic site use, ethylene glycol and jet fuel may have spilled onto the concrete pad during testing activities. Three JP-4 jet-fuel underground storage tanks were historically located in the southwestern portion of Area F and were removed prior to the initiation of site investigations. Three replacement underground storage tanks were installed within 50 feet and south of the original tank locations. While these replacement tanks were present at the time the site investigations were conducted, they have since been removed. An unexplained apparent loss of 11,000 gallons of jet fuel from the fuel storage area (based on written fuel-storage records) prompted the performance of site investigations to determine if a subsurface leak was a potential explanation for the discrepancy.

Area R, Trash Dump

Area R is a former trash dump located west of Tilton Road. Approximately 7 acres in size, Area R currently consists of a cleared area surrounded by low trees. A portion of the eastern part of the area which did not undergo significant filling is considerably lower than the rest of the area and occasionally contains ponded water. The higher elevations in the western part of the area are covered with broken concrete and asphalt fragments. The area is accessed by a dirt road off of English Creek Road. The former trash dump area at Area R was reportedly used as a borrow pit until about 1958, when the Area 56 landfill was closed. At that time, Area R began to be used as a landfill for wood, brush, paper, and construction debris. In 1978 or 1979, a fire at the area prompted FAA to close the dump and use off-site landfills for trash disposal. The basic stratigraphy of Area R consists of fine to coarse sands overlain by fill. Where fill material was encountered, it consisted of concrete, sand, asphalt, wood, metal and plastic and ranged in thickness from 2 to 12 feet, with the thickest portion in the western part of Area R. The water table was encountered at depths of 19 to 22 feet, with the groundwater flow direction to the southeast.

Area S, Excavated Area West of Tilton Road

Area S is located west of Tilton Road and approximately 1,300 feet south of Area R. The 11-acre area is currently overgrown with trees, with edges of former excavation areas and small piles of soil material and debris evident. Areas of 1 to 4 feet of standing water are also present. The SBAC is approximately 200 feet to the southwest. The historic use of Area S is unknown. Area S was identified in a 1988 EPA historic aerial photograph review as an area of "possible liquid impoundments and solid waste disposal." Aerial photographs taken over a period spanning from 1947 to 1987 indicate the presence of dark-toned material at the surface beginning in 1957. Subsequent photos show excavation areas, areas of standing liquid, and the presence of trenches and mounds of material at the site. One observed trench appears to drain toward the SBAC.

13.2 Response Action Summary

13.2.1 Basis for Taking Action

Area 27, Fuel Mist Test Area

Results of post-removal-action soil sampling at Area 27 did not identify the presence of any contaminants at levels exceeding the residential NJSCC. In groundwater, chloroform and PCBs were the only organics detected at levels exceeding MCLs and/or PQLs. However, each constituent was detected in only one groundwater sample and the presence of PCBs in the groundwater was not verified when the well was resampled. Beryllium, chromium, mercury, lead and zinc were the only inorganics detected at levels exceeding MCLs/PQLs. However, the presence of chromium, lead and zinc in the upgradient monitoring well and the infrequency of detection of the other inorganics (beryllium and mercury) in site wells indicated that past activities at Area 27 have not impacted groundwater quality. Furthermore, the unfiltered samples were collected before low-flow sampling methods were developed, so they may not be representative of actual groundwater quality as would be defined by current investigation methods. Beryllium and mercury would not be expected to be associated with jet fuel, which was the potential source of contamination that the site investigation was designed to evaluate.

Contaminants

COCs, as defined in the HHRA for Area 27, in each medium include:

Soil	Groundwater
4,4-DDT	Aroclor 1242 (PCB)

Human Health Risk Assessment

Since Area 27 was not expected to be used for any scheduled activity, the exposure frequencies used in the risk assessment were restrictive. For example, exposure to surface soil was based on a maximum exposure frequency of 20 days/year. Exposure to groundwater was based on a commercial/industrial maximum exposure frequency of 250 days/year, assuming a potable well was installed. Exposure to Area 27 groundwater is associated with an estimated risk level within EPA's carcinogenic risk range due to the maximum detected concentration of PCBs. However, detection of PCBs in groundwater could not be replicated in subsequent sampling efforts and carcinogenic risk based on an average PCB level fell below EPA's risk range. Potential noncarcinogenic risks due to the ingestion of groundwater were below EPA criteria. Exposure to soil is associated with estimated risk levels below EPA's risk management criteria.

Ecological Risk Assessment

A qualitative ERA was conducted on the basis of the same soil COC as the HHRA. Small mammals and earthworms could be exposed to 4,4-DDT via soil contact. However, given the detection of 4,4-DDT in only one surface soil sample and the relatively low level detected, major toxic effects associated with the presence of 4,4-DDT in Area 27 surface soils are unlikely. Based upon the results of bioassays conducted within the Area 27 drainage swale, the USFWS facility-wide ERA also concluded that Area 27 is not presenting unacceptable risks to ecological receptors.

Area 56 Abandoned Navy Landfill

Results of soil sampling at Area 56 did not identify the presence of any contaminants at levels exceeding the residential NJSCC. In groundwater, TCA and, to a lesser extent, 1,1-DCE were detected in an Intermediate Aquifer monitoring well at levels exceeding MCLs/PQLs. Inorganics were detected in a shallow monitoring well at levels exceeding MCLs/PQLs, although concentrations appeared to be decreasing with time. As a result of the detection

of VOCs and inorganics in groundwater, it was recommended that select monitoring wells at Area 56 be incorporated into an on-going quarterly groundwater sampling program.

Contaminants

COCs, as defined in the HHRA for Area 56, in each medium are as follows:

Soil	**Groundwater**
bis(2-Ethylhexyl)phthalate	bis(2-Ethylhexyl)phthalate
Chromium	Chromium
Lead	Lead
	Cadmium
	Mercury

Human Health Risk Assessment

Since Area 56 was not expected to be used for any scheduled activity, the exposure frequencies used in the risk assessment were restrictive. For example, exposure to surface soil was based on a maximum exposure frequency of 20 days/year. Exposure to groundwater was based on a commercial/industrial maximum exposure frequency of 250 days/year, assuming a potable well was installed at the site. The estimated risks associated with exposures to Area 56 groundwater and soil are below EPA's risk management criteria.

Ecological Risk Assessment

A qualitative ERA was conducted on the basis of the same COCs as the HHRA. Potential risks to wildlife associated with the presence of chromium and lead in surface soils would not be considered to be significant, as the detected levels of these constituents were not elevated above state background levels. Therefore, it is unlikely that Area 56 would be associated with adverse impacts to ecological receptors. Based on a review of available contaminant data and site inspection, the USFWS also concluded that no exposure concern exists for terrestrial receptors at Area 56.

Area F, Air Blast Facility

Soil sampling at Area F did not identify the presence of any contaminants at levels exceeding the residential NJSCC. In groundwater, benzene was detected in one well at a level exceeding the PQL, but its presence was not verified in subsequent resampling of the well. Inorganics were detected at levels exceeding MCLs/PQLs but were not consistently present at elevated levels.

Contaminants

COCs, as defined in the HHRA for Area F, in each medium include:

Soil	**Groundwater**
Cadmium	Cadmium
Chromium	Chromium
Acetone	Copper
Ethylbenzene	Lead
2-Hexanone	Mercury
4-Methyl-2-pentanone	Selenium
Methylene chloride	Zinc
Xylene	Acetone

Soil	Groundwater
bis(2-Ethylhexyl)phthalate	Benzene
Naphthalene	Ethylbenzene
Phenol	Xylene
PCB (Aroclor 1242)	Phenol

Human Health Risk Assessment

Risks due to exposure to surface soil and groundwater at Area F were based on a standard commercial/industrial exposure frequency of 250 days/year. Exposures to groundwater were evaluated based on the assumed installation of a potable well. The estimated risks associated with exposures to Area F groundwater and soil resulted in risk levels below EPA's risk-management criteria.

Ecological Risk Assessment

A quantitative ERA was conducted on the basis of the following soil COCs: acetone, phenol, cadmium, chromium, lead and zinc. The ERA for Area F indicated EHQ exceedances for all five indicator species evaluated and indicated that a potential for adverse ecological effects exists. The EHQs for the mouse and deer are primarily attributable to cadmium, while the EHQ for the fox is primarily due to cadmium and zinc. Zinc is also the primary contributor to the EHQs for the robin and hawk. Key uncertainties in risk characterization, as reported in the ROD, are that the subject inorganic contaminants are below maximum state background levels reported by NJDEP and the incorporation of uncertainty factors ranging from 8 to 800 into the species-specific benchmark doses for the subject contaminants. The USFWS conducted a site inspection which indicated the presence of poor foraging habitat at Area F. Based on this evaluation, the USFWS concluded that Area F does not pose much, if any, threat of exposure to fish and wildlife.

Area R, Trash Dump

PAHs were identified in Area R soils at levels exceeding residential NJSCC. The detection of PAHs was thought to be attributable to the presence of asphalt fragments over the surface, however. Beryllium was detected in a single subsurface soil sample (20 to 22 feet deep) at a level exceeding the residential NJSCC, but its depth minimizes potential concerns associated with direct exposure. Chloroform and chlorobenzene were consistently detected at levels exceeding PQLs in shallow groundwater. Zinc was also present above the PQL but at levels less than the average zinc level in upgradient wells at the FAA Technical Center.

Contaminants

COCs, as defined in the HHRA for Area R, in each medium include:

Soil	Groundwater
Arsenic	Chromium
Beryllium	Copper
Chromium	Lead
Copper	Nickel
Cyanide	Zinc
Lead	Acetone
Mercury	Benzene
Nickel	2-Butanone
Silver	Chlorobenzene

Soil	Groundwater
Zinc	Chloroform
Acenaphthene	1,2-Dichlorobenzene
Anthracene	1,3-Dichlorobenzene
Benzo(a)anthracene	1,4-Dichlorobenzene
Benzo(b)fluoranthene	cis 1,2-Dichloroethene
Benzo(a)pyrene	cis 1,2-Dichloroethene
Benzo(g,h,i)perylene	Ethylbenzene
Benzo(k)fluoranthene	Vinyl chloride
Chrysene	Xylene (total)
Dibenzo(a,h)anthracene	Acenaphthene
Fluoranthene	bis(2-Ethylhexyl)phthalate
Fluorene	Naphthalene
Indeno(1,2,3-c,d)pyrene	4,4-DDD
Naphthalene	4,4-DDT
Phenanthrene	
Phenol	
Pyrene	
4,4-DDE	
4,4-DDT	
Aroclor 1242	
Aroclor 1254	

Human Health Risk Assessment

Risks due to exposures to surface soil and groundwater at Area R were estimated based on a standard commercial/industrial maximum exposure frequency of 250 days/year. Exposures to groundwater were evaluated based on the assumed installation of a potable well. The estimated risks associated with exposures to Area R groundwater and surface soil were near the upper end of EPA's carcinogenic risk range and below the noncarcinogenic criteria. It should be noted that the detection of PAHs in surface soil samples, which contributed the majority of the carcinogenic risk at Area R, may be attributable to asphalt fragments located over the ground surface. In addition, vinyl chloride, which contributed the majority of carcinogenic risk due to exposures to groundwater, was detected infrequently.

Ecological Risk Assessment

A quantitative ERA was conducted on the basis of the same COCs as the HHRA. As indicated in the previous FYR report, the estimated EHQs exceeded criteria for three indicator species, the deer mouse, grasshopper sparrow and broad-winged hawk, indicating a potential for adverse ecological effects. The EHQ for the mouse was primarily attributable to copper, lead and zinc, the EHQ for the sparrow was primarily due to copper and zinc, and the EHQ for the broad-winged hawk was primarily due to zinc. The USFWS conducted a qualitative review of available Area R contaminant data and site inspections and concluded that Area R does not pose much, if any, threat of exposure to fish and wildlife.

Area S, Excavated Area West of Tilton Road

Results of soil sampling at Area S did not identify the presence of any contaminants at levels exceeding the residential NJSCC. In groundwater, lead and bis(2-ethylhexyl)phthalate were the only constituents detected at levels exceeding MCLs/PQLs. However, due to their infrequent detections, presence in an upgradient well or presence in a laboratory method blank, it was thought to be unlikely that they were site-related.

Contaminants

COCs, as defined in the HHRA for Area S, include:

Groundwater
Lead
Chloroform
bis(2-Ethylhexyl)phthalate
Butylbenzylphthalate
Phenol
Pyrene

Human Health Risk Assessment

Based on a qualitative risk assessment, it was determined that contaminants in soil and groundwater at Area S do not pose unacceptable risks based on a commercial/industrial land use scenario. This was based on the fact that, of the two constituents detected at levels exceeding groundwater criteria, lead was detected at higher levels upgradient of the area and bis(2-ethylhexyl)phthalate, a common laboratory contaminant, was detected in a method blank.

Ecological Risk Assessment

The potential for adverse impacts at Area S was evaluated by comparing the estimated surface soil exposure point concentrations to the surface soil criteria used by the USFWS in conducting their facility-wide ERA. The comparison indicated that all of the surface soil exposure point concentrations are at least an order of magnitude less than the selected criteria concentrations. Potential risks associated with the nearby SBAC will be addressed in OU14 (Area U).

13.2.2 Response Actions

The ROD for Areas 27, 56, F, R and S was signed on September 28, 1999. The remedies for Areas 27, 56, F, R and S are as follows:

- Area 27 - Residential Site Use Restrictions;
- Area 56 - Residential Site Use Restrictions, Continued Groundwater Monitoring and Establishment of a Groundwater Classification Exception Area (CEA);
- Area F - Residential Site Use Restrictions;
- Area R - Residential Site Use Restrictions, Groundwater Use Restrictions Including the Establishment of a CEA and Continued Groundwater Monitoring; and
- Area S - Residential Site Use Restrictions.

While no soil contaminants were detected at levels exceeding the residential NJSCC at Areas 27, 56, F, and S, residential site use restrictions were included in the remedy due to the fact that the HHRA did not evaluate risks associated with residential use of these areas.

13.2.3 Status of Implementation

Land use at Areas 27, 56, F, R, and S remains non-residential. Groundwater monitoring at Areas 56 and R continues on a quarterly basis. Area 56 quarterly groundwater samples are analyzed for VOCs and/or metals and Area R quarterly groundwater samples are analyzed for VOCs. Exposure to groundwater in those areas is not occurring.

13.2.4 Systems Operations/Operation & Maintenance

Not applicable; no active remedy.

13.3 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.

Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
11	Short-term Protective	The remedy at OU11 (Areas 27, 56, F, R and S) currently protects human health and the environment because exposures to soil and groundwater are controlled. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: • Evaluation of the appropriate means of documenting LUCs at the FAA.

Status of Recommendations from the 2014 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
11	Potential construction of a South Jersey Transportation Authority facility adjacent to Area 56	Before the FAA provides final comments on the project, the FAA's GIS Group should carefully review their library of historic aerial photographs to confirm that the western boundary of the landfill does not extend into the proposed project area.	Considered but not implemented	Project was abandoned; no longer presents a concern	Not applicable
11	Lack of LUCs	Evaluate appropriate means of documenting LUCs	Under Discussion	The FAA is continuing its evaluation of how best to document LUCs.	Not applicable

13.3.1 Data Review

Area R

During the period following the last FYR, groundwater quality at Area R has remained fairly constant. Chlorobenzene continues to be consistently detected above the current New Jersey GWQS at monitoring well R-MW1S and periodically above the current New Jersey GWQS at monitoring well R-MW2S. Well R-MW2S also continues to exhibit periodic detections of 1,4-dichlorobenzene above the current New Jersey GWQS. Both of these

monitoring wells are located in the fill area. Historic (pre-2003) detections of chlorobenzene in downgradient monitoring well R-MW5S have been followed by 16 years of quarterly sampling rounds of non-detections. Therefore, previously suspected downgradient migration of contamination from the fill area is not supported by the quarterly groundwater monitoring results.

Chloroform continues to be detected in all of the Area R monitoring wells, including two upgradient wells, on either a consistent or periodic basis. As discussed in Section 2.4, chloroform has been detected in groundwater throughout the FAA Technical Center and has been reported to occur regionally in the Cohansey aquifer of southern New Jersey. The FAA has recently installed perimeter monitoring wells around the Technical Center, the data from which will be used to further demonstrate that chloroform is a regional groundwater issue and not attributable to Area R.

Area 56

In the two wells monitored at Area 56, groundwater quality has remained fairly constant or has improved slightly since the last FYR. At well 56-MW4S, metals (especially nickel and chromium) have been detected at levels exceeding current GWQS (i.e., PQLs). The nickel and chromium detections are likely attributable to the stainless steel well construction materials. The age of the wells (over 30 years) and the low pH of the Pinelands groundwater may be causing a release of nickel and chromium from the stainless steel. While VOCs were historically detected in wells 56-MW4S and 56-MW4D, they have not been detected in either of the two wells since the last FYR.

In November 2018, wells 56-MW1S, 56-MW2S, 56-MW2D, 56-MW3S, and 56-MW5S, which are not part of the quarterly monitoring program, were sampled and analyzed for VOCs. Wells 56-MW2S and 56-MW3S exhibited VOCs but at levels below New Jersey GWQS. VOCs were also detected at well 56-MW2S during sampling conducted in support of proposed no action determinations in 1992.

13.3.2 Site Inspection/Interview Findings

These areas were not included in the formal Site Inspection conducted on April 24, 2019, although Areas F and 56 were informally identified. Areas 27, 56, R and S are not currently in use. Area F continues to be used for FAA research activities. No issues have been identified with these sites.

13.4 Technical Assessment

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

Question A Summary:

Quarterly groundwater monitoring is continuing at Areas R and 56 and has been effective in evaluating long-term groundwater quality trends. Areas 27, F and S are "no further action" areas. While the ROD for Areas 27, 56, F, R, and S calls for residential site use restrictions at each of the areas, such restrictions have not yet been formally implemented.

13.4.2 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?

Question B Summary:

Exposure assumptions are still valid as land use has not changed and exposure to groundwater at Areas R and 56 is not occurring. Land use at Area F has also remained the same, so previous human health risk assessment assumptions and USFWS conclusions that Area F does not pose much ecological risk due to poor foraging habitat are still applicable. No changes in land use have been identified at Areas 27 and S, so original exposure assumptions

are still valid. No significant changes in human health risk were identified during this FYR at Areas 27, 56, F, R or S.

A facility-wide PFAS Preliminary Assessment has recommended the performance of a Site Inspection at the following areas, for the listed reasons:

- Area 27 due to the outdoor testing of anti-misting fuel additives involving open burning at Area 27, in association with nearby Building 211;
- Area F due to the use of AFFF at the site to suppress fires during demonstrations since as early as 1983-1984.
- Area R because a fire occurred there in the late 1970s and it is unknown if AFFF was used to respond to the fire.

Area 56 and Area S were not considered to be likely candidates for PFAS contamination as the areas were active before PFAS were developed and will not be evaluated further in the PFAS Site Inspection. See Section 2.4 for further discussion.

The ROD for Areas 27, 56, F, R, and S calls for residential site use restrictions at each of the areas, with groundwater use restrictions and monitoring for Areas 56 and R. EPA has requested that FAA develop a facility-wide LUCAP that would document the LUCs necessary for these and other AOCs.

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

The last FYR described the South Jersey Transportation Authority's proposed construction of a Quick Turnaround facility for cleaning/washing/fueling rental cars, which would be located at the former Airfield Rescue and Fire Fighting Building (Building 302), adjacent to Area 56. The project was subsequently abandoned.

No additional information has been identified that would call into question the protectiveness of the remedy.

13.5 Issues/Recommendations

Issues, recommendations and follow-up actions for OU11 are listed below.

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 11	**Issue Category: Institutional Controls**			
	Issue: Lack of LUCs			
	Recommendation: Evaluate appropriate means of documenting LUCs.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	8/31/2021

13.6 Other Findings

In addition, the following are recommendations that were identified during the FYR and may accelerate site close out but do not affect current and/or future protectiveness:

- For areas where protectiveness was not evaluated under UU/UE conditions during risk assessment activities, re-evaluate those scenarios to confirm that LUCs are needed to ensure long-term protection of human health.

13.7 Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit:	*Protectiveness Determination:*
11	Short-term Protective
Protectiveness Statement: The remedy at OU11 (Areas 27, 56, F, R and S) currently protects human health and the environment because exposures to soil and groundwater are controlled. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: • Evaluation of the appropriate means of documenting LUCs at the FAA.	

14.0 OU12 – NEW JERSEY AIR NATIONAL GUARD SITES 2, 3, 5 AND 6

OU12 consists of four separate AOCs: Site 2, Aircraft Defueling Area; Site 3, Old Aircraft Washrack; Site 5, Liquid Waste Holding Area; and Site 6, Drum Burial at Blast Pad near Alert Area. As previously described in Section 1.0, Sites 2, 5 and 6 did not have any site use or exposure restrictions specified in the ROD that covers OU12. Therefore, the following discussion focuses on Site 3. The investigation and subsequent remediation, as appropriate, of the OU12 Sites is being conducted by the National Guard Bureau under the terms of a Memorandum of Agreement between the NJANG and the FAA.

14.1 History of Contamination and Initial Response

Site 3, the Old Aircraft Wash Rack, is located in the central portion of the NJANG operations area along the northern portion of Earhart Drive, west of Building 40 and southeast of Building 249, as indicated in Figure 9, and consists of a former washrack and adjacent area. The area of the former washrack is covered with concrete pavement, which slopes toward Earhart Drive. A concrete retaining wall and two catch basins are positioned on the downgradient end of this paved area. A second retaining wall, perpendicular to the first, separates a third catch basin or drain to the east from the other two drains. This third drain is positioned at a slightly higher elevation than the two western drains. The majority of the adjacent paved parking area also slopes toward these drains and Earhart Drive. A concrete vault and manholes associated with the drains are located south of the paved area adjacent to Earhart Drive.

The former washrack associated with Site 3 was reportedly used from 1942 until 1974. It was the primary location of aircraft cleaning for the Naval Air Station (1942 to 1958) and the NJANG (1958 to 1974). Historic washrack operations included the storage of waste oils and the potential use of chlorinated compound-based cleaners/solvents. Two former buildings, 53 and 54, existed within the boundaries of Site 3 and southeast of the former washrack area, as shown on Figure 9. Building 53 was designated as the Parachute Shop and reportedly contained a dry cleaning room and a laundry room. Building 54 was located directly south of Building 53 and was designated as the Bombsite Shop/Storage Facility and Building. Building 54 reportedly contained areas labeled as Laundry Racks and Slop Sinks.

Based upon site investigation results, sediment within the catch basins at Site 3 were found to contain contaminant concentrations exceeding residential NJSRS and were subsequently removed from the site in late 2014. Sediment within one catch basin (3CB-3) was found to be hazardous and will be addressed as part of the final response action.

A VI investigation was conducted in June 2014 that included the collection of 29 sub-slab soil gas samples from six buildings (ANG 52, ANG 440, ANG/AAFPS G30, FAA 28, FAA 33, and FAA 56) located within 100 ft of the

currently known extent of PCE- and TCE-impacted groundwater at Site 3. Analytical results indicated that PCE and TCE were below their respective New Jersey non-residential soil gas screening levels (NJDEP, March 2013). Chloroform was detected at concentrations exceeding the NJDEP non-residential soil gas screening level in sub-slab samples collected at building FAA 33; however, chloroform is a common by-product of the drinking water disinfection that occurs at Building FAA 33 and is also a regional contaminant in groundwater in this area of New Jersey (see Section 2.4.1). No other Site 3 COCs were detected at levels exceeding screening levels during the VI investigation.

14.2 Response Action Summary

14.2.1 Basis for Taking Action

Contaminants

At the time the HHRA was completed in 2011, no constituents were detected in soils above EPA regional screening levels (RSLs); therefore, no constituents for soil were carried forward to the HHRA. As a result of a data gap investigation that was subsequently conducted between December 2012 and September 2014 at Site 3, PCE was identified in soil at concentrations above the NJSRS. Although not addressed through the risk assessment process, a pre-design investigation will be implemented to refine the extent of impacted soil and develop a site-specific soil impact-to-groundwater (IGW) NJSRS. The IGW NJSRS represents the constituent concentration above which PCE presents an unacceptable risk via leaching of constituents from soil into groundwater. The more stringent of the Residential NJSRS and IGW NJSRS will serve as the soil cleanup criteria and guide the extent of remedial action. Therefore, PCE in soil was not evaluated further within the Site 3 HHRA.

COCs, as defined in the HHRA for Site 3, in the groundwater include:

Groundwater
Chloroform
1,2-Dichloroethene
Naphthalene
Tetrachloroethene
Trichloroethene

Human Health Risk Assessment

Risks due to exposures to groundwater at Site 3 were estimated based on a future adult residential exposure frequency of 24 years at 350 days/year and current/future adult worker exposure frequency of 5/25 years at 250 days/year. A future child residential exposure was based on 6 years at 350 days/year. Exposures to groundwater assumed the use of untreated groundwater as potable water. VOC concentrations in groundwater did not exceed the EPA target groundwater concentrations that correspond to target indoor air concentrations, so inhalation of vapors was not evaluated within the risk assessment, although exposures during showering were considered. Risk estimates incorporated default exposure factors as presented in EPA's on-line RSL calculator as of 2018. Estimated risks based on potential exposures to Site 3 groundwater were within EPA's acceptable risk management criteria for carcinogens and exceeded EPA's acceptable risk management criteria for noncarcinogens. The total cumulative carcinogenic risk of 1×10^{-4} is at the upper end of the acceptable risk range. Carcinogenic risks associated with exposures to groundwater were mainly attributable to TCE, naphthalene and chloroform, while elevated noncarcinogenic risks were mainly due to PCE, TCE and naphthalene.

Ecological Health Risk Assessment

A screening level ecological risk assessment found that residual concentrations in groundwater at Site 3 did not pose an ecological risk since the groundwater discharge to surface water pathway is not complete. The fate and transport evaluation indicated that organic compounds either do not exceed surface water benchmarks or concentrations would attenuate to levels below the surface water benchmarks prior to discharge to water bodies. No other ecological pathways were identified for ecological habitat because the entire site is developed.

14.2.2 Response Actions

The ROD for Site 3 was signed on [INSERT DATE]. The RAOs listed in the ROD are as follows:

Site 3 Soils:

- Reduce the contaminant levels in soil to the most stringent NJDEP soil remediation standards by removing impacted soil from the site;
- Prevent exposure to contaminated soil that could be harmful to human health and the environment; and,
- Eliminate future risk to human health by mitigating potential migration of COCs at concentrations above human health risk standards to surrounding environmental media.

Site 3 Groundwater:

- Reduce the contaminant levels in groundwater to below NJDEP GWQS;
- Prevent exposure to contaminated groundwater that could be harmful to human health and the
- environment; and,
- Minimize further migration of contaminated groundwater[1].

The selected remedy for Site 3 includes the following components:

- Excavation and Off-site Disposal will include the physical removal of impacted soil from areas identified to contain PCE at concentrations greater than NJSRS. A pre-design soil investigation will be implemented to refine the extent of impacted soil and develop a site-specific IGW NJSRS value. The IGW NJSRS value will serve as the soil cleanup criteria and guide the extent of excavation. The vertical extent of soil impacted by PCE is assumed to be limited by a fine-grained silt and clay lens (0.5 to 1 ft in thickness) that is present within the hotspot area at depths ranging from 1.5 to 4 ft bgs. Since the complete horizontal and vertical extent of impacts was not previously delineated, the area of impact is approximate and will be confirmed as part of the remedial action. Excavated soil will be disposed at an appropriately permitted off-site facility. As part of the remedial action, sediment within Catch Basin 3CB-3 previously classified as hazardous waste will be physically removed and disposed at a permitted off-site disposal facility.

- ISCO plus MNA will include the injection of a chemical oxidant into injection wells drilled into the impacted zone of the groundwater aquifer to reduce constituent concentrations through the oxidation of VOCs. Injection wells will be installed within the contaminant plume area where concentrations are greater than or equal to 5 µg/L. Injections will be conducted during two full-scale injection events. Once COC concentrations have been reduced to below 5 µg/L, MNA will be implemented in accordance with EPA and NJDEP requirements until COC concentrations are confirmed to be below 1 µg/L.

[1] The RAO to "minimize further migration of contaminated groundwater" at Site 3 refers to the potential horizontal downgradient movement of the plume as well as the potential vertical downward migration of the plume through the leaky clayey layer separating the Shallow/Intermediate Cohansey Aquifer from the Deep Cohansey Aquifer.

Cleanup levels defined in the ROD are summarized in Tables 15 and 16 for groundwater and soil, respectively. As described above, the soil cleanup level will be determined as part of the pre-design soil investigation. A figure indicating the extent of soil impacts at Site 3 is included in Appendix E.

14.2.3 Status of Implementation

Given the recent finalization of the ROD for Site 3, remedial actions have not yet been initiated.

14.2.4 Systems Operations/Operation & Maintenance

Not applicable; no active remedy.

14.3 Progress Since the Last Review

There were no issues or recommendations in the last FYR, as a ROD for Site 3 had not yet been finalized.

14.3.1 Data Review

Given the recent finalization of the ROD for Site 3, no additional data have been collected that would impact this FYR.

14.3.2 Site Inspection/Interview Findings

The Site Inspection was conducted on April 24, 2019 and included representatives of the FAA, EPA and the FAA's contractor, TRC. Site 3 is located within the active leasehold area of the NJANG. No major issues were identified during the inspection of Site 3.

14.4 Technical Assessment

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

Question A Summary:

Given the recent finalization of the ROD for Site 3, the remedy has not yet been implemented.

14.4.2 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?

Question B Summary:

Numeric cleanup goals are not specified in the ROD; rather, the regulatory citations that are the sources of numeric cleanup values are cited within the ROD. Therefore, there is no difference between the ARARs specified in the ROD and current standards, unless new regulatory criteria are promulgated outside of the specific regulations cited in the ROD. Tables 15 and 16 provide the current regulatory criteria applicable to the contaminants of concern for groundwater and soil, respectively, although the specific soil cleanup values will be determined during the pre-design investigation.

No other new contaminants, contaminant sources or unanticipated toxic byproducts of the remedy have been identified. The toxicity values have not changed (see Table 17) from the ROD, when the remedy was found to be protective. Potential exposure pathways at Site 3 have not changed since the risk assessment was performed.

Given the recent finalization of the ROD for Site 3, the remedy has not yet been implemented. Therefore, there has been no significant progress to date in meeting RAOs. There is no new information that indicates the RAOs should be revised or that remedy protectiveness has changed.

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

No additional information has been identified that would call into question the protectiveness of the remedy.

14.5 Issues/Recommendations

No issues, recommendations or follow-up actions for OU12 were identified.

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU12: None

14.6 Other Findings

No other recommendations were identified during the FYR.

14.7 Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit: 12	*Protectiveness Determination:* Will be Protective
Protectiveness Statement: The remedy at OU12 is expected to be protective of human health and the environment upon implementation of the ROD. In the interim, no current exposure pathways have been identified that could result in unacceptable risks. The remedy at OU12 is expected to be protective of human health and the environment upon implementation of the ROD. In the interim, no current exposure pathways have been identified that could result in unacceptable risks.	

15.0 OU13 - AREA E – BUILDING 11 TANK EXCAVATION

15.1 History of Contamination and Initial Response

Area E is located adjacent to the facilities of the NJANG operations area. Area E is currently grassed-covered, with no visible evidence of previous use. A small telephone-switching building is presently located at Area E. Langley Road borders the area to the south. Two FAA production wells are located in the vicinity of Area E. Production well FAA-2R is located approximately 600 feet west-northwest of Area E, while production well FAA-5 is located approximately 1,500 feet southeast of Area E. The NJANG headquarters building is located immediately to the east of Area E.

Area E was formerly the location of a heating plant that supplied heat to many of the buildings in the adjacent portion of the FAA Technical Center. The location of the existing telephone-switching building overlaps a corner of the former heating plant building location. The heating plant building was demolished in 1985 and a 20,000-gallon underground No. 6 fuel-oil storage tank was removed. During removal, some fuel oil was reported to have

leaked from the tank. Based on a review of historic aerial photographs, other structures located north of Langley Road, presumed to be Naval Air Station barracks, apparently were demolished in the same general time frame as the former heating plant.

15.2 Response Action Summary

15.2.1 Basis for Taking Action

Contaminants

COCs, as defined in the HHRA for Area E, in each medium include:

Soil	Groundwater
Arsenic	Antimony
Chromium	Arsenic
Copper	Beryllium
Lead	Cadmium
Mercury	Chromium
Selenium	Copper
Toluene	Lead
Xylene (total)	Mercury
Benzo(a)anthracene	Nickel
Benzo(a)pyrene	Selenium
Benzo(b)fluoranthene	Thallium
Benzo(k)fluoranthene	Zinc
Bis(2-ethylhexyl)phthalate	Tetrachloroethene
Chrysene	Toluene
Fluoranthene	1,1,1-Trichloroethane
Phenanthrene	Xylene (total)
Pyrene	Acenaphthene
alpha-Chlordane	Bis(2-ethylhexyl)phthalate
gamma-Chlordane	Fluorene
Dieldrin	2-Methylnaphthalene
4,4-DDE	Phenanthrene
4,4-DDT	Pyrene
	beta-BHC
	alpha-Chlordane
	gamma-Chlordane
	Chlordane (total)

Human Health Risk Assessment

Risks due to exposures to surface soil and groundwater at Area E were estimated based on a standard commercial/industrial maximum exposure frequency of 250 days/year. Exposures to groundwater assumed the installation of a potable well. Estimated risks based on potential exposures to Area E groundwater exceeded EPA's acceptable risk management criteria for carcinogens and noncarcinogens. Elevated carcinogenic risks associated

with exposures to groundwater were mainly attributable to arsenic while elevated noncarcinogenic risks were mainly due to antimony and arsenic. Estimated risks associated with exposures to soil at Area E did not exceed EPA's risk-management criteria.

Ecological Risk Assessment

A quantitative evaluation of ecological risks was originally conducted in 1995, based on site-specific soil data available at that time. After the collection of additional soil data, a supplemental qualitative assessment was conducted that included a limited quantitative evaluation of chlordane in surface soil. The soil COCs used in conducting the ecological risk assessment included arsenic, chromium, copper, lead, mercury, selenium, 4,4-DDE, 4,4-DDT, alpha-chlordane, gamma-chlordane and total chlordane. In the original quantitative risk assessment, exposures of the deer mouse and grasshopper sparrow, representing small mammals and avian primary consumers, respectively, to Area E soils were found to result in a low potential for ecological effects, with EHQs slightly exceeding criteria. For the mouse, copper, selenium and lead contributed most to the total EHQ while for the grasshopper sparrow, lead was the primary contributor to the EHQ exceedance. The qualitative supplemental assessment conducted after the collection of additional soil data indicated that there was little potential for ecological risk in association with the new data, including the detection of chlordane in surface soils.

15.2.2 Response Actions

The ROD for Area E was signed on September 26, 2003. The RAOs listed in the ROD are as follows:

- Prevent human exposure due to direct contact with soil contaminants that are present at levels exceeding non-residential direct contact NJSCC;
- Prevent exposure to and migration of free product from the vicinity of the former underground storage tank location;
- Prevent existing soil contaminants from adversely impacting groundwater quality (i.e., causing exceedances of state and federal drinking water standards and New Jersey GWQS) in the future;
- Prevent exposure, due to groundwater ingestion, to contaminants that are present at levels exceeding acceptable state and federal drinking water standards and New Jersey GWQS; and
- Prevent the migration of groundwater contaminants from the existing area of groundwater contamination.

The selected remedy for Area E included the following components:

- Free product extraction and off-site treatment;
- Excavation of petroleum-contaminated soils which exceed non-residential direct contact NJSCC and off-site beneficial reuse or off-site disposal;
- Excavation of pesticide-contaminated soils which exceed non-residential direct contact NJSCC and off-site disposal;
- Groundwater extraction;
- On-site groundwater treatment using filtration and carbon adsorption, if necessary;
- Reinjection of treated groundwater;
- Implementation of a deed notice to prevent future residential development of the site, unless the site is remediated to the standards of residential NJSCC; and
- Implementation of well restrictions and a groundwater CEA to prevent future potable use of the impacted water.

Cleanup levels defined in the ROD are summarized in Tables 18 and 19 for groundwater and soil, respectively.

15.2.3 Status of Implementation

The majority of the Area E remedy was implemented in 2010 and 2011, with the excavation and off-site disposal of pesticide-contaminated soil, the installation of a product extraction well, and the installation and operation of groundwater extraction wells. Extracted groundwater is pumped to the CTP for treatment and treated groundwater is discharged at the Area B or Area 41 injection wells or at the recharge bed. More information on the CTP and discharges from the CTP is provided in Section 5.2.

The feasibility of using in situ chemical reduction to treat residual pesticide contamination in the saturated zone was evaluated through the performance of bench-scale and pilot-scale studies in 2010 and 2012, respectively. The studies utilized a proprietary mixture of controlled-release carbon and zero valent iron, known commercially as EHC®. While the bench-scale tests provided positive results, they indicated that additional treatment would be required to neutralize the acidic pH of the groundwater. While the pilot test was modified to address this concern and resulted in a significant reduction in the oxidation-reduction potential, the pH was not increased to the range in which significant biological activity could result in substantial in-situ chemical reduction and destruction of the residual pesticides.

The component of the remedy involving excavation of petroleum-contaminated soil was implemented in 2015. To support the design of the remedy, a supplemental field investigation was conducted in December 2013 to further define the volume of soil exhibiting petroleum impacts and the nature of those impacts. TPH-impacted, stained soil was found to be present in an irregularly shaped area approximately 80 feet long (east to west) by 60 feet wide (north to south) and to depths of 18 to 19 feet below ground surface. Chemical analysis of the soil samples identified the presence of petroleum hydrocarbons; however, no pesticides were detected in the soil samples. Based on the additional information as well as post-excavation sampling, approximately 3,190 tons of TPH-impacted soil was removed from Area E site in 2015. Figures showing the extent and depth of the TPH-impacted soil removal project are included in Appendix E.

In late 2015, a supplemental remedial investigation was performed at Area E, including the collection of groundwater screenpoint, monitoring well and extraction well samples and the revision of the comprehensive site groundwater model to better reflect Area E and evaluate potential chlordane transport in the groundwater. The investigations indicated that chlordane groundwater impacts extended further north and south of Area E than expected, with several hotspot areas identified. Based on the results of the study, additional chlordane hotspot investigations were conducted, including geoprobe sampling and the installation and sampling of three new monitoring wells (E-MW10S, E-MW11S and E-MW12S) in January 2018. Chlordane was detected in soil and groundwater samples but not in the SPLP analyses of soil samples. The new monitoring wells confirmed the presence of chlordane in groundwater to the northwest of well E-MW2S and confirmed that chlordane groundwater impacts do not extend south of Langley Road. Limited additional Geoprobe baseline sampling was conducted in September 2018 to further evaluate variability detected in groundwater samples from monitoring wells located in the central portion of the site. A supplemental remedial action consisting of the injection of PlumeStop®, an in situ adsorption amendment, in the three residual chlordane hotspot areas began in April 2019, to be followed by post-injection groundwater monitoring. The PlumeStop® is intended to provide in-place absorption of the chlordane and to enhance potential subsequent biological breakdown of the chlordane.

On-going monitoring at Area E includes the following:

- Area-specific quarterly CTP influent sampling for VOC, SVOC, pesticides and metals analyses; and
- Well-specific quarterly monitoring well sampling for VOC, SVOC, pesticides and metals analyses.

In addition to the monitoring program presented above, the FAA occasionally conducts site-wide sampling events to provide additional information on remedial system performance.

Figure 10 shows the locations of extraction, monitoring, and observation wells at Area E, as well as the location of the adjacent NJANG Headquarters Building. AECOM, under contract with the FAA Technical Center, currently operates the Area E groundwater extraction system.

15.2.4 Systems Operations/Operation & Maintenance

Groundwater extraction at Area E began on October 8, 2011. Discussion of the overall CTP operation and maintenance was previously provided for Area D in Section 5.2. The Area E extraction wells were redeveloped in March 2016 to improve their performance. Extraction wells EW1 through EW4 were taken offline on April 1, 2019 as part of the PlumeStop® injection program.

Following the installation of the product extraction well (E-EW6) at Area E as part of the initial remedial actions, the product's high viscosity prevented the accumulation of a sufficient volume of product in the well to support separate-phase extraction. However, the implementation of the soil excavation activities in 2015 eliminated the zone where free product was detected. Therefore, product removal is no longer a concern and extraction well E-EW6 was formally abandoned in March 2015. Monitoring well E-MW3S, which historically exhibited the presence of free-phase petroleum, was also formally abandoned during the soil excavation project with a replacement well, designated as E-MW3S(R), installed near the center of the former petroleum-impacted soil footprint.

CTP influent monitoring was discussed in Section 5.2. Quarterly area-specific CTP influent sampling has been conducted since July 2012. During that time, exceedances of ROD-based groundwater cleanup goals in CTP influent from Area E have been primarily limited to chlordane. Quarterly groundwater sampling at Area E indicates that chlordane is present in monitoring wells at levels exceeding the ROD cleanup criterion. During individual extraction wells sampling conducted in 2015, 2017 and 2018, chlordane was detected above the ROD cleanup criterion (0.5 µg/L) in extraction wells E-EW1, E-EW2 and E-EW3, which accounted for approximately half of the Area E influent flow volume during the months those sampling events were performed. This is a change from the last FYR, where wells E-EW4 and E-EW5 accounted for the majority (66%) of the Area E influent flow volume but did not exhibit the presence of chlordane. The change may be attributable to the redevelopment of the Area E extraction wells in spring 2016, which resulted in increases in the extraction rates at the wells that exhibit chlordane. The shallow chlordane plume has been consistently mapped since the last FYR. Chlordane plume maps for 2014 and 2018 are provided in Appendix E. Due to the collection of additional data prior to the design of the in situ adsorption program at Area E, the 2018 shallow chlordane mapping presents a more vigorous definition of the extent of chlordane and therefore does not necessarily indicate a reduction in the extent of impacts from 2014 to 2018 (note that the 2018 plume map is plotted at a different scale than the 2014 map), although monitoring well concentrations are generally lower in 2018.

15.3 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.

Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
13	Short-term Protective	The remedy at OU13 (Area E) currently protects human health and the environment because existing site conditions are controlling exposure to soil and the existing remedial system is controlling exposures to groundwater. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: • LUCs need to be formally implemented.

Status of Recommendations from the 2014 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
13	Site-specific LUCs have not been implemented yet	Implement LUCs when appropriate	Under Discussion	The FAA is continuing its evaluation of how best to implement LUCs.	Not applicable

15.3.1 Data Review

The scope of the Area E groundwater monitoring program currently reflects the *CERCLA Substantive Requirements Evaluation and Operational Strategy Plan* (TRC, 2013). The data review presented below is based primarily on the sampling conducted on a quarterly basis at Area E.

Area E extraction wells are not sampled on a quarterly basis but the CTP influent from Area E has been sampled on a quarterly basis since July 2012. During that time, exceedances of ROD-based groundwater cleanup goals in CTP influent from Area E have been limited to chlordane During sampling events of select individual extraction wells in 2015, 2017 and 2018, chlordane was detected at levels exceeding the ROD cleanup criterion (0.5 µg/L) in extraction wells E-EW1, E-EW2 and E-EW3. Bis(2-ethylhexyl)phthalate was also detected in one sample from well E-EW1 at a level 0.1 µg/L above the ROD cleanup level and nickel was detected in one sample from well E-EW5 at a level 1.3 µg/L above the ROD cleanup level.

The FAA conducts regular monitoring of wells screened in the Shallow and Intermediate Aquifers in the vicinity of the Area E groundwater plume. Quarterly groundwater monitoring conducted since September 2011 indicates that the monitoring wells located in the center of the area (wells E-MW2S, E-MW3S(R), E-MW4S and E-MW5S) exhibit the highest levels of chlordane, generally in the 1 to 13 µg/L range. The upgradient monitoring well, E-MW6S, exhibited chlordane above the ROD-based cleanup criterion in one sampling round (May 2012) at a concentration of 2.68 µg/L, but has not exhibited detectable levels of chlordane since then. Newly installed well E-MW10S, which is located approximately halfway between well E-MW2S and upgradient well E-MW6S, exhibited 5.4 µg/L chlordane when it was sampled in November 2018, confirming the identification of this area as a chlordane "hot spot" area during the 2015 supplemental remedial investigation. New wells E-MW11S and E-MW12S, both located south of Langley Road, did not exhibit the presence of chlordane, and thereby define the southerly extent of the chlordane impacts. Since the last FYR, arsenic, mercury, nickel and zinc were also periodically detected in the Area E monitoring wells sampled on a quarterly basis at levels exceeding the ROD-based cleanup criteria. Bis(2-ethylhexyl)phthalate was also detected in three monitoring wells during the 2015 supplemental remedial investigation sampling event at levels exceeding the ROD-based cleanup criterion. Screenpoint groundwater sample data collected from Area E during the 2015 supplemental remedial investigation was consistent with the quarterly groundwater monitoring data, with chlordane, bis(2-ethylhexyl)phthalate, mercury, nickel and/or zinc detected at levels exceeding ROD-based cleanup criteria.

15.3.2 Site Inspection/Interview Findings

The Site Inspection was conducted on April 24, 2019 and included representatives of the FAA, EPA and the FAA's contractor, TRC. In situ injections of adsorption amendment were being conducted on the date of the inspection. No major issues were identified during the inspection of Area E.

15.4 Technical Assessment

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

Question A Summary:

The pesticide and petroleum soil remediation actions are complete. The groundwater remediation action is operating as designed. An in situ adsorption amendment (PlumeStop®) is currently being used to treat areas of residual chlordane groundwater impacts to reduce the time frame needed to achieve groundwater remedial goals.

Access to Area E continues to be limited by the FAA's security system to authorized FAA employees and contractors.

15.4.2 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?

Question B Summary:

The Area E groundwater remedial system is designed to attain the groundwater ARARs defined in the Area E ROD, which are based on New Jersey GWQS (PQLs) that were applicable at the time of ROD signature. Operation of the Area E remedial system also meets the substantive requirements of the action-specific ARARs that existed at the time of ROD signature. Table 18 presents a comparison of the groundwater ARARs specified in the Area E ROD, which were based on New Jersey GWQS (PQLs), to the current standards. The most stringent of the chemical-specific ARARs listed in the ROD continue to be equal to or less than state and federal MCLs, with the exception of antimony, where the ROD-based criterion is 20 µg/L but the MCL is 6 µg/L, and arsenic, where the ROD-based criterion is 8 µg/L but the New Jersey MCL is 5 µg/L. The current GWQS are more stringent for some analytes than the ROD-based ARARs; however, the current GWQS that are based on PQLs are not health-based but instead are based on an antidegradation standard established for the Pinelands area. If only those groundwater quality standards that were not developed based on an antidegradation basis (i.e., the Class IIA GWQS) are considered, antimony and arsenic are the only constituents listed in Table 18 with Class IIA GWQS that are more stringent than the ROD-based ARARs. Antimony was detected in only one well in one round of sampling during pre-remediation sampling. It has rarely been detected in the extraction wells or monitoring wells subsequent to the initiation of groundwater remediation, with a maximum detected concentration during quarterly sampling of 1.1 µg/L at well E-MW7D in May 2018, which is less than currently applicable health-based criteria. Arsenic has periodically been detected in wells E-MW3S(R), E-MW5S and E-MW6S at levels exceeding the New Jersey MCL and the Class IIA GWQS. Well E-MW6S is the upgradient background well while wells E-MW3S(R) and E-MW5S are located in the central portion of the site, all within the capture zone of the Area E extraction wells. Monitoring of the CTP effluent has not indicated the presence of either antimony or arsenic at levels exceeding the MCLs or Class IIA GWQS. Therefore, the remedy continues to be protective of human health. No new location-specific or action-specific ARARs have been identified that are not being met by the existing Area E groundwater remedial system.

PCE is the only VOC that has been detected in Area E remedial monitoring groundwater samples since the last FYR. The maximum concentration at which it was detected, 0.91 µg/L, is well below the NJDEP generic VI groundwater screening level of 31 µg/L (NJDEP, March 2013), indicating that potential VI is not a concern relative to current groundwater quality at Area E.

For constituents monitored during quarterly sampling events for which no ROD cleanup levels are established, there were several analytes detected infrequently above both their PQL and human health-based Class IIA GWQS since the last FYR. They include 4,4-DDD, benzo(b)fluoranthene, indeno(1,2,3-c,d)pyrene, pentachlorophenol, arsenic, and lead. None of the constituents exceeded these screening levels more than twice in any individual well since the last FYR. Of these constituents, only pentachlorophenol, arsenic and lead have promulgated MCLs (or in the case of lead, an action level at the tap). MCLs were not exceeded by any of the detected concentrations. Given the lack

of frequency at which each of these compounds has been detected above screening levels and the absence of MCL exceedances, they are not considered to pose a threat to human health.

The soil cleanup standards identified in the Area E ROD are based on NJSCC applicable at the time the ROD was signed. These levels included 10,000 mg/kg for total organic compounds (including TPH) in soils. The current NJSRS do not include a comparable total organics cleanup level (see Table 19). Soil cleanup standards for benzo(a)anthracene and heptachlor were also included in the ROD. The current NJSRS for benzo(a)anthracene are less stringent than they were during the last FYR. The 2010-2011 pesticide-impacted soil and 2015 petroleum-impacted soil excavation activities achieved the ROD-based standards, which are more stringent than the current non-residential NJSRS (the 2015 petroleum-based excavation activities achieved a remedial goal of 10,000 mg/kg extractable petroleum hydrocarbons, since NJDEP no longer recognizes TPH as an appropriate analytical method for confirming cleanup). Therefore, the protectiveness determination presented in the last FYR is unchanged.

No new contaminants, contaminant sources or unanticipated toxic byproducts of the remedy have been identified.

The toxicity values for some of the contaminants of concern evaluated within the HHRA (carcinogenic PAHs and 4,4-DDE) have changed (see Table 20). No site-specific risk-based cleanup levels were used as the basis for the remedy. Therefore, these changes do not directly impact the cleanup levels that are defined in the ROD. An evaluation of exposures to soils at Area E using these new toxicity values and current risk assessment parameters does not change the previous risk assessment conclusions (i.e., risks associated with soil exposures are still within the acceptable risk range of 10^{-4} to 10^{-6} or are less than the hazard index value of 1). Groundwater remedial goals are based on PQLs which, with the exception of antimony, are more stringent than current human-health-based drinking water standards. As described above, antimony is rarely detected and has not been detected at levels exceeding currently applicable health-based criteria. Therefore, the use of the PQLs defined in the ROD as the groundwater cleanup standards is not expected to adversely impact the protectiveness of the remedy.

No unacceptable ecological risks were identified in the baseline ecological risk assessment based on exposures to Area E soils. No new information has come to light that would change this conclusion.

Land use at or near Area E has not changed since the last FYR and potential routes of exposure at Area E remain the same. Groundwater has not been developed as a potable source of water. A site-specific land use control plan was attached to the Area E ROD per EPA specifications. However, a deed notice and CEA have not been established.

The implementation of in situ adsorption to address residual chlordane in the groundwater is expected to reduce the groundwater remedial time frame and enhance the achievement of the groundwater RAOs. Actions taken since the last FYR have achieved the soil RAOs.

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

No additional information has been identified that would call into question the protectiveness of the remedy.

15.5 Issues/Recommendations

Issues, recommendations and follow-up actions for OU13 are listed below.

Issues and Recommendations Identified in the Five-Year Review:

OU(s): 13	**Issue Category: Institutional Controls**
	Issue: Site-specific LUCs have not been implemented yet

	Recommendation: Implement LUCs when appropriate.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	Federal Facility	EPA	8/31/2021

15.6 Other Findings

In addition, the following are recommendations that were identified during the FYR and may reduce costs and accelerate site close out, but do not affect current and/or future protectiveness:

- The implementation of enhancements to achieve cleanup goals in a more timely manner should continue to be pursued.

15.7 Protectiveness Statement

Protectiveness Statement(s)	
Operable Unit: 13	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at OU13 (Area E) currently protects human health and the environment because existing site conditions are controlling exposure to soil and the existing remedial system is controlling exposures to groundwater. However, in order for the remedy to be protective in the long-term, the following action needs to be taken to ensure protectiveness: • LUCs need to be formally implemented.	

TABLE 1
COMPARISON OF ROD GROUNDWATER ARARs TO CURRENT DRINKING WATER AND GROUNDWATER QUALITY STANDARDS
AREA D - JET FUEL FARM
FAA William J. Hughes Technical Center

Contaminant	Max. Conc. Detected in Groundwater[1] (ug/L)	ARARs Specified in ROD (ug/L)			Current Standards (ug/L)			
		NJ MCL	Federal MCL	NJ Ground Water Quality Standard[2]	NJ MCL[3]	Federal MCL	NJ Ground Water Quality Standard[4,7]	
							PQL	Class IIA
Benzene	4,000	1			1	5	1	1
Ethylbenzene	767		700[8]	50[5]		700	2	700
Toluene	3,400		2,000[8]	50[5]		1,000	1	600
Xylene	4,700	44			1,000	10,000	2	1,000
Naphthalene	1,000			50[5]	300	--	2	300
Phenol	361			300		--	10	2,000
Chromium	192	50				100	1	70
Lead	68	50				15[6]	5	5

[1] Includes EI results, not including free product concentrations, 2015 Supplemental RI Results, 2018 Pre-Construction Investigation, and quarterly monitoring results for ROD COCs.
[2] At the time the ROD was signed.
[3] NJAC 7:10-5.2; last amended September 4, 2018; Federal MCLs incorporated by reference for all other compounds.
[4] GWQS for Class I-PL (Protection Area) are non-degradation standards based on background groundwater quality or PQLs, whichever are higher; PQLs are listed here. Human-health-based Class IIA standards are also provided for reference purposes.
[5] Combined total not to exceed 50.0 ug/L.
[6] Action level for lead.
[7] NJAC 7:9C, last amended August 9, 2018, Subchapter 1, Appendix Table 1.
[8] Proposed at time of ROD.
Note: The values of current standards are unchanged from the 2014 FYR.

TABLE 2
COMPARISON OF ROD SOIL ARARS/TBCs TO CURRENT SOIL REMEDIATION STANDARDS
AREA D - JET FUEL FARM
FAA William J. Hughes Technical Center

			New Jersey Soil Remediation Standards September 18, 2017 (mg/kg)[4]	
Contaminant	**Max. Concentration Detected in Soil[1] (mg/kg)**	**ARAR/TBC in ROD (mg/kg)**	**Residential Direct Contact**	**Non-Residential Direct Contact**
Benzene	24		2	5
Ethylbenzene	74		7,800	110,000
Toluene	130		6,300	91,000
Xylenes (total)	420		12,000	170,000
Total VOCs	1,761	1	NA[5]	NA[5]
Total Organics	18,500[2]	100[3]	NA[5]	NA[5]

[1] Reflects maximums of EI results, 2010 LIF confirmatory sample results, 2015 Supplemental RI Results, and 2018 Phase I Pre-Construction Investigation for ROD COCs.
[2] Represents maximum total petroleum hydrocarbons measurement in subsurface soils.
[3] Basis of ARAR/TBC not known due to the age of the criterion. Note that the 2019 ESD eliminates the 100 mg/kg total petroleum hydrocarbon cleanup level.
[4] NJAC 7:26D, last amended September 18, 2017, Appendix 1, Tables 1A and 1B.
[5] Not available in the September 18, 2017 New Jersey Soil Remediation Standards.

Note: The values of current standards are unchanged from the 2014 FYR, with the exception of the noted elimination of the 100 mg/kg total petroleum hydrocarbon cleanup goal within the Area D Explanation of Significant Differences.

TABLE 3
COMPARISON OF TOXICITY VALUES USED IN HHRA TO CURRENT VALUES FOR COCs
AREA D - JET FUEL FARM
FAA William J. Hughes Technical Center

Contaminant	Oral Carcinogenic Potency Factor $(mg/kg/day)^{-1}$		Reference Dose (mg/kg/day)	
	Value used in HHRA	Current Value	Value used in HHRA	Current Value
Benzene	2.9E-02	5.5E-02	NA	4.00E-03
Ethylbenzene	NA	1.1E-02	1.00E-01	1.00E-01
Toluene	NA	NA	3.00E-01	8.00E-02
Xylene	NA	NA	2.00E+00	2.00E-01
Naphthalene	NA	NA	4.00E-01	2.00E-02
2-Chlorophenol	NA	NA	1.73E-05	5.00E-03
Phenol	NA	NA	6.00E-01	3.00E-01
Chromium (as Chromium VI)	NA	5.0E-01	5.00E-03	3.00E-03
Nickel	NA	NA	2.00E-02	2.00E-02
Lead	NA	NA	1.40E-03	NA

Note: Current toxicity values are unchanged from the 2014 FYR.

TABLE 4
COMPARISON OF ROD GROUNDWATER ARARS TO CURRENT DRINKING WATER AND GROUNDWATER QUALITY STANDARDS
AREA 20A - SALVAGE YARD AREA
FAA William J. Hughes Technical Center

Contaminant	Max. Concentration Detected in Groundwater[1] (ug/L)	ARARs Specified in ROD (ug/L)			Current Standards (ug/L)			
		NJ MCL	Federal MCL	NJ Ground Water Quality Standard[2]	NJ MCL[3]	Federal MCL	NJ Ground Water Quality Standard[4, 6]	
							PQL	Class IIA
1,1-Dichloroethene	180	2	7	2	2	7	1	1
1,1,1-Trichloroethane	2,300	26	200	26	30	200	1	30
Tetrachloroethene	120	1	5[7]	1	1	5	1	1
Toluene	555		2,000[7]			1,000	1	600
Bis(2-ethylhexyl)phthalate	11,000			5		6	3	3
4,4-DDT	ND[5]			0.001		--	0.1	0.1
PCBs	ND[5]	0.5		0.001		0.5	0.5	0.5
Cadmium	24.7	10	10	10		5	0.5	4
Chromium	1,040	50	50	50		100	1	70

[1] Includes EI results, quarterly monitoring results and results of 2014 and 2015 investigations for ROD COCs.
[2] At the time the ROD was signed.
[3] NJAC 7:10-5.2 last amended September 4, 2018; Federal MCLs incorporated by reference for all other compounds.
[4] GWQS or Class I-PL (Protection Area) are non-degradation standards based on background groundwater quality or PQLs, whichever are higher; PQLs are listed here. Human-health-based Class IIA standards are also provided for reference purposes.
[5] ND = not detected; ARARs for these compounds and toluene were included in the ROD because they were detected in soil and had the potential to impact ground water quality.
[6] NJAC 7:9C, last amended August 9, 2018, Subchapter 1, Appendix Table 1.
[7] Proposed at the time of the ROD.

Note: The values of current standards are unchanged from the 2014 FYR.

TABLE 5
COMPARISON OF ROD & ESD SOIL ARARS TO CURRENT SOIL REMEDIATION STANDARDS
AREA 20A - SALVAGE YARD AREA
FAA William J. Hughes Technical Center

			New Jersey Soil Remediation Standards September 18, 2017 (mg/kg)[4]	
Compound	**Max. Detected Soil Conc.[1] (mg/kg)**	**ARAR in ROD/ESD (mg/kg)**	**Residential Direct Contact**	**Non-Residential Direct Contact**
Toluene	1.3		6,300	91,000
Tetrachloroethene	3.8		43 (2)	1,500 (5)
Total VOCs		1	NA[3]	NA[3]
Total SVOCs		10		
PCBs	1,400	2 (0 - 24 inches) 25 (> 24 inches)	0.2	1
Total Organics		100[2]	NA[3]	NA[3]

[1] Includes EI results, and results of 2014 and 2015 investigations for ROD COCs.
[2] Basis of ARAR/TBC not known due to the age of the criterion. Represents maximum total petroleum hydrocarbons action level.
[3] Not available in the New Jersey Soil Remediation Standards.
[4] NJAC 7:26D, Appendix 1, Tables 1A and 1B, last amended September 18, 2017.
Note: New Jersey Soil Remediation Standard values from the 2014 FYR are provided in parentheses where they differ from current values.

TABLE 6
COMPARISON OF TOXICITY VALUES USED IN HHRA TO CURRENT VALUES FOR COCs
AREA 20A - SALVAGE YARD AREA
FAA William J. Hughes Technical Center

Contaminant	Oral Carcinogenic Potency Factor $(mg/kg/day)^{-1}$		Reference Dose (mg/kg/day)	
	Value used in HHRA	Current Value	Value used in HHRA	Current Value
1,1-Dichloroethene	5.80E-01	NA	1.00E-02	5.00E-02
1,1,1-Trichloroethane	NA	NA	5.40E-01	2.00E+00
Tetrachloroethene	5.10E-02	2.1E-03	2.00E-02	6.0E-03
Toluene	NA	NA	3.00E-01	8.00E-02
Bis(2-ethylhexyl)phthalate	NE	1.40E-02	NE	2.00E-02
4,4-DDT	3.40E-01	3.40E-01	NA	5.00E-04
PCBs (Aroclor 1260)	4.34E+00	Soil (high risk): 2.00E+00 Water (low risk): 4.00E-01	3.00E-4	NA
Cadmium	6.10E+00	NA	5.00E-04	Soil: 1.00E-03 Water: 5.00E-04
Chromium (as Chromium VI)	NA	5.0E-01	2.10E-03	3.00E-03

Note: Current toxicity values are unchanged from the 2014 FYR

TABLE 7
COMPARISON OF ROD GROUNDWATER ARARS TO CURRENT DRINKING WATER AND GROUNDWATER QUALITY STANDARDS
AREA 29 - FIRE TRAINING AREA AND AREA K - STORAGE AREA
FAA William J. Hughes Technical Center

Contaminant	Max. Conc. Detected in Groundwater[1] (ug/L)	ARARs Specified in ROD (ug/L)			Current Standards (ug/L)			
		NJ MCL	Federal MCL	NJ Ground Water Quality Standard (PQL)[2]	NJ MCL[3]	Federal MCL	NJ Ground Water Quality Standard[2,4]	
							PQL	Class IIA
Benzene	1,900	1	5	1	1	5	1	1
Ethylbenzene	1,100		700	5		700	2	700
Methylene Chloride	56	2		2	3	5	1	3
Toluene	1,900		1,000	5		1,000	1	600
Xylene (total)	3,500	44	10,000	2	1,000	10,000	2	1,000
Tetrachloroethene	3	1	5	1	1	5	1	1
1,1,1-Trichloroethane	100	26	200	1	30	200	1	30

[1] Includes EI monitoring results, quarterly monitoring results and NJPDES-DGW baseline sample results.
[2] GWQS for Class I-PL (Protection Area) are non-degradation standards based on are background groundwater quality or PQLs, whichever are higher; PQLs are listed here. Human-health-based Class IIA standards are also provided for reference purposes.
[3] NJAC 7:10, 5-2 last amended September 4, 2018; Federal MCLs incorporated by reference for all other compounds.
[4] NJAC 7:9C, last amended August 9, 2018, Subchapter 1, Appendix Table 1.

Note: The values of current standards are unchanged from the 2014 FYR.

TABLE 8
COMPARISON OF ROD SOIL ARARS TO CURRENT SOIL REMEDIATION STANDARDS
AREA 29 - FIRE TRAINING AREA AND AREA K - STORAGE AREA
FAA William J. Hughes Technical Center

Compound	Max. Concentration Detected in Soil[1] (mg/kg)	ARAR in ROD[3] (mg/kg)	New Jersey Soil Remediation Standards September 18, 2017 (mg/kg)[5]	
			Residential Direct Contact	Non-Residential Direct Contact
PCBs	24	2	0.2	1
Total Organics	14,000[2]	10,000[3]	NA[4]	NA[4]

[1] Includes EI results.
[2] Represents maximum detected level of total petroleum hydrocarbons.
[3] ROD ARARs/TBCs were based on NJDEP non-residential soil cleanup criteria applicable at the time of the ROD.
[4] Not available in the New Jersey Soil Remediation Standards.
[5] NJAC 7:26D, Appendix 1, Tables 1A and 1B, last amended September 18, 2017.

Note: The values of current standards are unchanged from the 2014 FYR.

TABLE 9
COMPARISON OF TOXICITY VALUES USED IN HHRA TO CURRENT VALUES FOR COCs
AREA 29 - FIRE TRAINING AREA AND AREA K - STORAGE AREA
FAA William J. Hughes Technical Center

Contaminant	Oral Carcinogenic Potency Factor $(mg/kg/day)^{-1}$		Reference Dose (mg/kg/day)	
	Value used in HHRA	Current Value	Value used in HHRA	Current Value (chronic)
1,1-Dichloroethane	5.80E-01	5.70E-03	9.00E-03	2.00E-01
Benzene	5.20E-02	5.50E-02	7.00E-04	4.00E-03
Toluene	NA	NA	3.00E-01	8.00E-02
Bis(2-ethylhexyl)phthalate	6.84E-04	1.40E-02	6.00E-01	2.00E-02
PCBs (Aroclor 1260)	4.34E+00	Soil (high risk): 2.00E+00 Water (low risk): 4.00E-01	3.00E-04	NA

Note: Current toxicity values are unchanged from the 2014 FYR.

TABLE 10
COMPARISON OF ROD GROUNDWATER ARARS TO CURRENT DRINKING WATER AND GROUNDWATER QUALITY STANDARDS
AREA 41 - FUEL FARM AND PHOTO LAB AREA
FAA William J. Hughes Technical Center

Contaminant	Max. Conc. Detected in Groundwater[1] (ug/L)	ARARs Specified in ROD (ug/L)			Current Standards (ug/L)			
		NJ MCL	Federal MCL	NJ Ground Water Quality Standard (PQL)[2]	NJ MCL[3]	Federal MCL	NJ Ground Water Quality Standard[2,5]	
							PQL	Class IIA
Benzene	230	1	5	1	1	5	1	1
Chlorobenzene	2.9	50		2	50	100	1	50
Chloroform	14			1		80	1	70
4,4-DDD	35.4			0.1		--	0.02	0.1
4,4-DDT	0.9			0.1		--	0.1	0.1
Ethylbenzene	1,000		700	5		700	2	700
Toluene	16,000		1,000	5		1,000	1	600
Xylene (total)	11,000	1,000	10,000	2	1,000	10,000	2	1,000
1,1,2-Trichloroethane	3	3	5	2	3	5	2	3
Arsenic	26		50	8	5	10	3	3
Cadmium	38		5	2		5	0.5	4
Chromium	230		100	10		100	1	70
Lead	286		15[4]	10		15[4]	5	5
Zinc	200			30		--	10	2,000

[1] Includes EI monitoring results and quarterly monitoring results.
[2] GWQS for Class I-PL (Protection Area) are non-degradation standards based on background groundwater quality or PQLs, whichever are higher; PQLs are listed here. Human-health-based Class IIA standards are also provided for reference purposes.
[3] NJAC 7:10-5.2 last amended September 4, 2018; Federal MCLs incorporated by reference for all other compounds.
[4] Action level for lead.
[5] NJAC 7:9C, last amended August 9, 2018; Subchapter 1, Appendix Table 1.
Note: The values of current standards are unchanged from the 2014 FYR.

TABLE 11
COMPARISON OF ROD SOIL ARARS TO CURRENT SOIL REMEDIATION STANDARDS
AREA 41 - FUEL FARM AND PHOTO LAB AREA
FAA William J. Hughes Technical Center

Compound	Max. Concentration Detected in Soil/Sediment (mg/kg)[1]	ARAR in ROD (mg/kg)[3]	New Jersey Soil Remediation Standards September 18, 2017 (mg/kg)[5]	
			Residential Direct Contact	Non-Residential Direct Contact
Benzo(a)pyrene	250	0.66	0.5 (0.2)	2 (0.2)
PCBs	350	2	0.2	1
Total Organics	18,100[2]	10,000	NA[4]	NA[4]

[1] Includes EI data and USFWS ERA data. Benzo(a)pyrene concentration also reflects pre-remediation soil characterization.
[2] Represents maximum total petroleum hydrocarbons concentration.
[3] ROD ARARs/TBCs were based on NJDEP non-residential soil cleanup criteria applicable at the time of the ROD.
[4] Not available in the September 18, 2017 New Jersey Soil Remediation Standards.
[5] NJAC 7:26D, Appendix 1, Tables 1A and 1B, last amended September 18, 2017.

Note: New Jersey Soil Remediation Standard values from the 2014 FYR are provided in parentheses where they differ from current values.

TABLE 12
COMPARISON OF TOXICITY VALUES USED IN HHRA TO CURRENT VALUES FOR COCs
AREA 41 - FUEL FARM AND PHOTO LAB AREA
FAA William J. Hughes Technical Center

Contaminant	Oral Carcinogenic Potency Factor $(mg/kg/day)^{-1}$		Reference Dose (mg/kg/day)	
	Value used in HHRA	Current Value	Value used in HHRA	Current Value (chronic)
Chlorobenzene	NA	NA	2.0E-02	2.00E-02
Ethylbenzene	NA	1.10E-02	1.0E-01	1.00E-01
Toluene	NA	NA	2.0E-01	8.00E-02
Benzo(a)anthracene	1.15E+01	1.0E-01 (7.30E-01)	NA	NA
Benzo(b)fluoranthene	1.15E+01	1.0E-01 (7.30E-01)	NA	NA
Benzo(a)pyrene	1.15E+01	1.0E+00 (7.30E+00)	NA	3.0E-04 (NA)
Chrysene	1.15E+01	1.0E-03 (7.30E-03)	NA	NA
Fluoranthene	NA	NA	4.0E-02	4.00E-02
Phenanthrene	NA	NA	NA	NA
Pyrene	NA	NA	3.0E-02	3.00E-02
2,4-Dimethylphenol	NA	NA	7.0E-03	2.00E-02
Phenol	NA	NA	6.0E-01	3.00E-01
Di-n-butylphthalate	NA	NA	1.0E-01	1.00E-01
Bis(2-ethylhexyl)phthalate	1.40E-02	1.40E-02	2.0E-02	2.00E-02
Butylbenzylphthalate	NA	1.90E-03	2.0E-01	2.00E-01
4,4-DDD	2.40E-01	2.40E-01	5.0E-04	3E-05[2] (NA)
4,4-DDT	3.40E-01	3.40E-01	5.0E-04	5.00E-04
PCBs (Aroclor 1260)	4.34E+00	Soil (high risk): 2.00E+00 Water (low risk): 4.00E-01	3.00E-4	NA

TABLE 12
COMPARISON OF TOXICITY VALUES USED IN HHRA TO CURRENT VALUES FOR COCs
AREA 41 - FUEL FARM AND PHOTO LAB AREA
FAA William J. Hughes Technical Center

Contaminant	Oral Carcinogenic Potency Factor $(mg/kg/day)^{-1}$		Reference Dose (mg/kg/day)	
	Value used in HHRA	Current Value	Value used in HHRA	Current Value (chronic)
PCBs (Aroclor 1248)	7.70E+00	Soil (high risk): 2.00E+00 Water (low risk): 4.00E-01	NA	NA
PCBs (Aroclor 1254)	7.70E+00	Soil (high risk): 2.00E+00 Water (low risk): 4.00E-01	NA	Soil: 2.00E-05 Water: 2.00E-05
Antimony	NA	NA	4.0E-04	4.00E-04
Arsenic	1.75E+00	1.50E+00	1.0E-03	3.00E-04
Beryllium	4.30E+00	NA	5.0E-03	2.00E-03
Cadmium	NA	NA	1.0E-03	Soil: 1.00E-03 Water: 5.00E-04
Chromium (as Chromium VI)	NA	5.0E-01	5.00E-03	3.00E-03
Copper	NA	NA	4.0E-02	4.00E-02
Lead	NA	NA	NA	NA
Mercury	NA	NA	3.0E-04	3.00E-04
Nickel	NA	NA	2.0E-02	2.00E-02
Selenium	NA	NA	5.0E-03	5.00E-03
Silver	NA	NA	3.0E-03	5.00E-03
Zinc	NA	NA	2.0E-01	3.00E-01

1. 2014 FYR values are provided in parentheses.
2. The RfD for 4,4-DDD is a screening provisional value and is based upon the use of 4,4-DDT as a surrogate with additional uncertainty factors applied.

TABLE 13
COMPARISON OF ROD GROUNDWATER ARARS TO CURRENT DRINKING WATER AND GROUNDWATER QUALITY STANDARDS
AREA B - FIRE TRAINING AREA
FAA William J. Hughes Technical Center

Contaminant	Max. Conc. Detected in Groundwater[1] (ug/L)	ARARs Specified in ROD (ug/L)			Current Standards (ug/L)			
		NJ MCL	Federal MCL	NJ Ground Water Quality Standard (PQL)[2]	NJ MCL[3]	Federal MCL	NJ Ground Water Quality Standard[2, 6]	
							PQL	Class IIA
Chlorobenzene	(in product only at 11,000,000)	4		2	50	100	1	50
1,1-Dichloroethene	16	2	7	2	2	7	1	1
Ethylbenzene	340		700	5		700	2	700
Methylene Chloride	2,500	2		2	3	5	1	3
Toluene	26		1,000	5		1,000	1	600
Xylene (total)	3,700	44	10,000	2	1,000	10,000	2	1,000
Tetrachloroethene	100	1	5	1	1	5	1	1
1,1,1-Trichloroethane	6	26	200	1	30	200	1	30
Trichloroethene	8	1	5	1	1	5	1	1
Chromium	41.4		100	21.5[4]		100	21.5[4]	70
Lead	28.1		15[5]	25[4]		15[5]	25[4]	5
Mercury	51.6		2	0.6[4]		2	0.6[4]	2
Zinc	92.8			64.5[4]		--	64.5[4]	2,000

1 Includes EI/FS monitoring results and quarterly monitoring results.
2 GWQS for Class I-PL (Protection Area) are non-degradation standards based on background groundwater quality or PQL, whichever are higher; PQLs are listed here for all constituents except metals, where background values are listed. Human-health-based Class IIA standards are also provided for reference purposes.
3 NJAC 7:10-5.2 last amended September 4, 2018; Federal MCLs incorporated by reference for all other compounds.
4 Background levels, as defined at the time the ROD was signed, were listed as GWQS in the ROD.
5 Action level for lead.
6 NJAC 7:9C, last amended August 9, 2018, Subchapter 1, Appendix Table 1.
Note: The values of current standards are unchanged from the 2014 FYR.

TABLE 14
COMPARISON OF TOXICITY VALUES USED IN HHRA TO CURRENT VALUES FOR COCs
AREA B - FIRE TRAINING AREA
FAA William J. Hughes Technical Center

Contaminant	Oral Carcinogenic Potency Factor $(mg/kg/day)^{-1}$		Reference Dose (mg/kg/day)	
	Value used in HHRA	Current Value	Value used in HHRA	Current Value (chronic)
Acetone	NA	NA	1.0E+00	9.00E-01
Bromochloromethane	NA	NA	NA	NA
Chloroform	6.1E-03	3.1E-02	1.0E-02	1.00E-02
1,1-Dichloroethane	NA	5.7E-03	NA	2.00E-01
1,1-Dichloroethene	NA	NA	9.0E-03	5.00E-02
cis-1,2-Dichloroethene	NA	NA	1.0E-01	2.00E-03
1,2-Dichloropropane	NA	3.7E-02 (3.6E-02)	NA	4.0E-02 (9.0E-02)
Ethylbenzene	NA	1.1E-02	1.0E-01	1.00E-01
Methylene chloride	7.5E-03	2.0E-03	6.0E-02	6.00E-03
Tetrachloroethene	NA	2.1E-03	1.0E-01	6.00E-03
Toluene	NA	NA	2.0E+00	8.00E-02
1,1,1-Trichloroethane	NA	NA	NA	2.00E+00
Trichloroethene	1.1E-02	4.6E-02	NA	5.00E-04
Xylene (total)	NA	NA	2.0E+00	2.00E-01
Bis(2-ethylhexyl)phthalate	1.4E-02	1.40E-02	2.0E-02	2.00E-02
Butylbenzylphthalate	NA	1.9E-03	2.0E+00	2.00E-01
Di-n-butylphthalate	NA	NA	1.0E-01	1.00E-01
Di-n-octylphthalate	NA	NA	2.0E-02	1.00E-02
2-Methylnaphthalene	NA	NA	4.0E-02	4.00E-03

TABLE 14
COMPARISON OF TOXICITY VALUES USED IN HHRA TO CURRENT VALUES FOR COCs
AREA B - FIRE TRAINING AREA
FAA William J. Hughes Technical Center

Contaminant	Oral Carcinogenic Potency Factor (mg/kg/day)$^{-1}$		Reference Dose (mg/kg/day)	
	Value used in HHRA	Current Value	Value used in HHRA	Current Value (chronic)
4-Methylphenol	NA	NA	5.0E-02	1.00E-01
Naphthalene	NA	NA	4.00E-02	2.00E-02
Phenol	NA	NA	6.00E-01	3.00E-01
1,2,4-Trichlorobenzene	NA	2.9E-02	1.0E-02	1.00E-02
4,4-DDE	3.4E-01	3.40E-01	NA	3.0 E-04[2] (NA)
4,4-DDT	3.4E-01	3.40E-01	5.0E-04	5.00E-04
Heptachlor epoxide	9.1E+00	9.10E+00	1.3E-05	1.30E-05
PCBs (Aroclor 1242) (soil only)	7.7E+00	2.00E+00	NA	NA
Arsenic	3.0E-04	1.50E+00	1.8E+00	3.00E-04
Cadmium (soil only)	NA	NA	1.0E-03	1.00E-03
Chromium III	NA	NA	1.0E+00	1.50E+00
Chromium VI	NA	5E-01	5.0E-03	3.00E-03
Copper	NA	NA	3.7E-02	4.00E-02
Lead	NA	NA	NA	NA
Mercury	NA	NA	3.0E-04	3.00E-04
Zinc	NA	NA	3.0E-01	3.00E-01

1. 2014 FYR values are provided in parentheses.
2. The RfD for 4,4-DDE is a screening provisional value.

TABLE 15
COMPARISON OF ROD GROUNDWATER ARARS TO CURRENT DRINKING WATER AND GROUNDWATER QUALITY STANDARDS
SITE 3 – OLD AIRCRAFT WASHRACK
FAA William J. Hughes Technical Center

Contaminant	Max. Conc. Detected in Groundwater[1] (ug/L)	ARARs Specified in ROD (ug/L)[2]		
		NJ MCL[3]	Federal MCL[3]	NJ Ground Water Quality Standard[4]
Chloroform	5.10		80	1
Naphthalene	6.40	300		2
Tetrachloroethene	69.0	1	5	1
Trichloroethene	26.0	1	5	1

[1] Based on 2011 RI Report data, per Table 2-5 of the Site 3 ROD, and Tables 5-4, 5-5 and 5-6, Final Data Gap Investigation Report, June 2015.
[2] Numeric cleanup goals are not specified in the ROD; rather, the regulatory citations that are the sources of numeric cleanup values are cited. Therefore, there is no difference between the ARARs specified in the ROD and current standards, unless new chemical-specific regulatory criteria are promulgated outside of the regulations cited in the ROD.
[3] NJAC 7:10-5.2 last amended September 4, 2018; Federal MCLs incorporated by reference for all other compounds.
[4] NJAC 7:9C, last amended August 9, 2018, Subchapter 1, Appendix Table 1. GWQS are background groundwater quality or PQLs, whichever are higher; PQLs are listed here.

TABLE 16
COMPARISON OF ROD SOIL ARARS TO CURRENT SOIL REMEDIATION STANDARDS
SITE 3 – OLD AIRCRAFT WASHRACK
FAA William J. Hughes Technical Center

		New Jersey Soil Remediation Standards September 18, 2017 (mg/kg)[2]		
Contaminant	**Max. Concentration Detected in Soil (mg/kg)[1]**	**Site-Specific Soil Impact to Groundwater[3]**	**Residential Direct Contact**	**Non-Residential Direct Contact**
Tetrachloroethene	55	TBD	43[4]	1,500[4]

[1] Based on Table 5-3, Final Data Gap Investigation Report, June 2015.
[2] NJAC 7:26D, Appendix 1, Tables 1A and 1B, last amended September 18, 2017.
[3] To be determined (TBD) during pre-design investigation.
[4] Note that the Residential and Non-Residential NJSRS have increased in value since the June 2015 Data Gap Investigation was completed, when they were 2 mg/kg and 5 mg/kg, respectively.

TABLE 17
COMPARISON OF TOXICITY VALUES USED IN HHRA TO CURRENT VALUES FOR COCs
SITE 3 – OLD AIRCRAFT WASHRACK
FAA William J. Hughes Technical Center

Contaminant	Cancer Slope Factor $(mg/kg\text{-}d)^{-1}$		Unit Risk Factor $(ug/m^3)^{-1}$		Reference Dose (mg/kg/day)		Reference Concentration (mg/m^3)	
	Oral/Dermal[1] value used in HHRA	Current Oral/Dermal[1] Value	Value used in HHRA	Current Value	Oral/Dermal[1] Value used in HHRA	Current Oral/Dermal[1] Value (chronic)	Value used in HHRA	Current Value (chronic)
Chloroform	3.1E-02	3.1E-02	2.3E-05	2.3E-05	1E-02	1E-02	9.8E-02	9.8E-02
Naphthalene	NA	NA	3.4E-05	3.4E-05	2E-02	2E-02	3E-03	3E-03
Tetrachloroethene	2.1E-03	2.1E-03	2.6E-07	2.6E-07	6E-03	6E-03	4E-02	4E-02
Trichloroethene	4.6E-02	4.6E-02	4.1E-06	4.1E-06	5E-04	5E-04	2E-03	2E-03

1. Dermal Slope Factor = Oral Slope Factor/GIABS; Dermal RfD = Oral RfD x GIABS. GIABS = 1 for all COCs.

TABLE 18
COMPARISON OF ROD GROUNDWATER ARARS TO CURRENT DRINKING WATER AND GROUNDWATER QUALITY STANDARDS
AREA E - BUILDING 11 TANK EXCAVATION AREA
FAA William J. Hughes Technical Center

Contaminant	Max. Conc. Detected in Groundwater[1] (ug/L)	ARARs Specified in ROD (ug/L)	Current Standards (ug/L)			
		NJ Ground Water Quality Standard[2]	NJ MCL[3]	Federal MCL	NJ Ground Water Quality Standard[2, 4] PQL	NJ Ground Water Quality Standard[2, 4] Class IIA
Tetrachloroethene	2	1	1	5	1	1
1,1,1-Trichloroethane	9	1	30	200	1	30
Bis(2-ethylhexyl)phthalate	310	1		6	3	3
Beta-BHC	0.29	0.04		--	0.04	0.04
Chlordane	13	0.5		2	0.5	0.5
Heptachlor epoxide	0.23	0.2		0.2	0.2	0.2
Antimony	61.6	20		6	3	6
Arsenic	120	8	5	10	3	3
Cadmium	7.5	2		5	0.5	4
Mercury	9.96	0.5		2	0.05	2
Nickel	46.3	10		--	4	100
Selenium	29.9	10		50	4	40
Zinc	459	30		--	10	2,000

[1] Includes EI results, quarterly monitoring results and Chlordane Remedial Action Confirmation Sampling conducted by AECOM in January and September 2018.
[2] GWQS for Class I-PL (Protection Area) are non-degradation standards based on background groundwater quality or PQLs, whichever are higher; PQLs are listed here. Human-health-based Class IIA standards are also provided for reference purposes.
[3] NJAC 7:10-5.2 last amended September 4, 2018; Federal MCLs incorporated by reference for all other compounds.
[4] NJAC 7:9c, last amended August 9, 2018, Subchapter 1, Appendix Table 1.
Note: The values of current standards are unchanged from the 2014 FYR.

TABLE 19
COMPARISON OF ROD SOIL ARARS TO CURRENT SOIL REMEDIATION STANDARDS
AREA E - BUILDING 11 TANK EXCAVATION AREA
FAA William J. Hughes Technical Center

Compound	Max. Concentration Detected in Soil/Sediment (mg/kg)[1]	ARAR in ROD[2] (mg/kg)	New Jersey Soil Remediation Standards – September 18, 2017 (mg/kg)[4]	
			Residential Direct Contact	Non-Residential Direct Contact
Benzo(a)anthracene	11	4	5 (0.6)	17 (2)
Heptachlor	1.6	0.65	0.1	0.7
Total Petroleum Hydrocarbons	141,000	10,000	NA[3]	NA[3]

[1] Includes EI data.
[2] ROD ARARs/TBCs were based on NJDEP non-residential soil cleanup criteria applicable at the time of the ROD.
[3] Not available in the New Jersey Soil Remediation Standards, last amended September 18, 2017.
[4] NJAC 7:26d, Appendix 1, Tables 1A and 1B, last amended September 18, 2017.

Note: New Jersey Soil Remediation Standard values from the 2014 FYR are provided in parentheses where they differ from current values.

TABLE 20
COMPARISON OF TOXICITY VALUES USED IN HHRA TO CURRENT VALUES FOR COCs
AREA E - BUILDING 11 TANK EXCAVATION AREA
FAA William J. Hughes Technical Center

Contaminant	Oral Carcinogenic Potency Factor (mg/kg/day)-1		Reference Dose (mg/kg/day)	
	Value used in HHRA	Current Value	Value used in HHRA	Current Value (chronic)
Tetrachloroethene	5.2E-02	2.1E-03	1.0E-02	6.00E-03
Toluene	NA	NA	2.0E-01	8.00E-02
1,1,1-Trichloroethane	NA	NA	2.8E-01	2.00E+00
Xylene (total)	NA	NA	2.0E+00	2.00E-01
Bis(2-ethylhexyl)phthalate	1.4E-02	1.40E-02	2.0E-02	2.00E-02
Acenaphthene	NA	NA	6.0E-02	6.0E-02
Benzo(a)anthracene	7.3E-01	1.0E-01 (7.3E-01)	NA	NA
Benzo(a)pyrene	7.3E+00	1.0E+00 (7.3E+00)	NA	3.0E-04 (NA)
Benzo(b)fluoranthene	7.3E-01	1.0E-01 (7.3E-01)	NA	NA
Benzo(k)fluoranthene	7.3E-02	1.0E-02 (7.3E-02)	NA	NA
Chrysene	7.3E-03	1.0E-03 (7.3E-03)	NA	NA
Fluoranthene	NA	NA	4.0E-02	4.0E-02
Fluorene	NA	NA	4.0E-02	4.0E-02
2-Methylnaphthalene	NA	NA	2.0E-02	4.0E-03
Phenanthrene	NA	NA	2.0E-02	NA
Pyrene	NA	NA	3.0E-02	3.0E-02
beta-BHC	1.8E+00	1.8E+00	NA	NA
Chlordane (total)	3.5E-01	3.5E-01	5.0E-04	5.0E-04
4,4-DDE	3.4E-01	3.40E-01	NA	3.0E-04[2] (NA)
4,4-DDT	3.4E-01	3.40E-01	5.0E-04	5.00E-04
Dieldrin	1.6E+01	1.6E+01	5.0E-05	5.0E-05

TABLE 20
COMPARISON OF TOXICITY VALUES USED IN HHRA TO CURRENT VALUES FOR COCs
AREA E - BUILDING 11 TANK EXCAVATION AREA
FAA William J. Hughes Technical Center

Contaminant	Oral Carcinogenic Potency Factor (mg/kg/day)-1		Reference Dose (mg/kg/day)	
	Value used in HHRA	Current Value	Value used in HHRA	Current Value (chronic)
Heptachlor epoxide	9.1E+00	9.10E+00	1.3E-05	1.30E-05
Antimony	NA	NA	4.0E-04	4.0E-04
Arsenic	1.5E+00	1.50E+00	3.0E-04	3.00E-04
Beryllium	NA	NA	2.0E-03	2.0E-03
Cadmium (soil only)	NA	NA	1.0E-03	1.00E-03
Chromium III	NA	NA	1.5E+00	1.50E+00
Chromium VI	NA	5.0E-01	3.0E-03	3.00E-03
Copper	NA	NA	3.7E-02	4.00E-02
Lead	NA	NA	NA	NA
Mercury	NA	NA	3.0E-04	3.00E-04
Nickel	NA	NA	2.0E-02	2.0E-02
Selenium	NA	NA	5.0E-03	5.0E-03
Thallium	NA	NA	7.0E-05	1.00E-05[2] (salts)
Zinc	NA	NA	3.0E-01	3.00E-01

1. 2014 FYR values are provided in parentheses.
2. The RfD is a screening provisional value.

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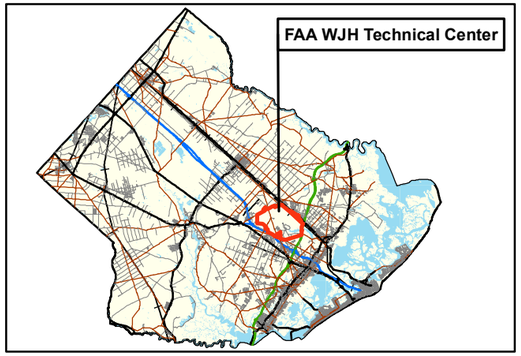
William J. Hughes Technical Center

Figure 1
Locations of Superfund Areas of Concern Addressed in the Five-Year Review



Atlantic County, NJ

Map Legend

Superfund Areas of Concern

- Active Remediation
- Long Term Monitoring
- No Action
- Remedial Investigation

FAA Property Boundary

N
W E
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ATLANTIC CITY, NEW JERSEY 08405

- The NJ Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS) orthophotography shown on this map was taken in 2015.

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MC		SITE ENGINEERING SECTION ANG-E343 - GIS PROGRAM	
			APPROVED J. Floyd
		DESIGNED U. Duffy	DATE 04/16/2019
		CHECKED M. Cicali	MAP #

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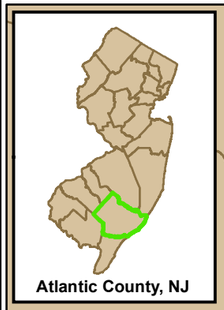

CAMDEN

BURLINGTON

GLOUCESTER

OCEAN

CUMBERLAND

CAPE MAY

CAPE MAY

Atlantic Ocean

5 2.5 0 5 10 Miles

Federal Aviation Administration
William J. Hughes Technical Center

Figure 2
Atlantic County Chloroform Analysis with FAA Shallow Wells 2019

Legend

Sampled Wells

Chloroform (µg/l)

- < 1.0 (below MCL)
- 1.000000 - 2.000000
- 2.000001 - 3.000000
- 3.000001 - 4.000000
- 4.000001 - 6.000000
- 6.000001 - 7.000000
- 7.000001 - 9.000000
- 9.000001 - 14.000000
- 14.000001 - 77.080000

MCL Boundaries

- Chloroform ≥ 1.0 µg/l (FAA)
- Chloroform ≥ 1.0 µg/l (County)

Estimated Chloroform (µg/l)

Value

High : 77.08

Low : < 1.00

FAA Superfund PER Wells

Water Features

- Streams
- Waterbodies
- Atlantic Ocean

NJ County Jurisdiction

- Atlantic County Boundary
- FAA Property Boundary
- NJ Counties

N W E S

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ATLANTIC CITY, NEW JERSEY 08405

- The orthophotography shown on this map was taken in 2015.
- Well sample data was provided by the Atlantic County Health Department and the FAA (for samples inside the FAA boundary). Earth Volumetric Studio 2019.5, was used to estimate the extent of chloroform with 2d kriging.

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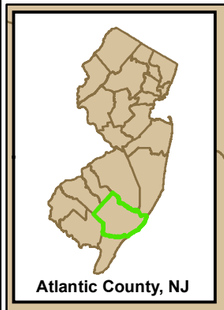
TG		DESIGNED M Jenkins	DATE 6/19/2019
		CHECKED M Cicali	MAP #

FILE PATH : J:\projects\superfund_proj\General_superfund_proj\apr\Five_Year_Review_Maps_2019\Atlantic_County_Health_Dept_Well_Data_Chloroform_Analysis_1ug_Shallow.mxd

Federal Aviation Administration
William J. Hughes Technical Center

Figure 3
Atlantic County Chloroform Analysis with FAA Intermediate Wells 2019



CAMDEN
BURLINGTON
GLOUCESTER
OCEAN
CUMBERLAND
CAPE MAY
CAPE MAY
Atlantic Ocean

5 2.5 0 5 10 Miles

Legend

Sampled Wells
Chloroform (µg/l)
- < 1.0 (below MCL)
- 1.000000 - 2.000000
- 2.000001 - 3.000000
- 3.000001 - 4.000000
- 4.000001 - 6.000000
- 6.000001 - 7.000000
- 7.000001 - 9.000000
- 9.000001 - 14.000000
- 14.000001 - 77.080000

MCL Boundaries
- Chloroform ≥ 1.0 µg/l (FAA)
- Chloroform ≥ 1.0 µg/l (County)

Estimated Chloroform (µg/l)
Value
High : 77.08
Low : < 1.00

FAA Superfund PER Wells

Water Features
- Streams
- Waterbodies
- Atlantic Ocean

NJ County Jurisdiction
- Atlantic County Boundary
- FAA Property Boundary
- NJ Counties

N
W E
S

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- The orthophotography shown on this map was taken in 2015.
- Well sample data was provided by the Atlantic County Health Department and the FAA (for samples inside the FAA boundary). Earth Volumetric Studio 2019.5, was used to estimate the extent of chloroform with 2d kriging.

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Federal Aviation Administration
William J. Hughes Technical Center

Figure 4
Area D
Groundwater Well Locations and Groundwater Flow Directions

Legend

Area D Wells
- Monitoring Well
- Piezometer
- Observation Well
- Extraction Well

Natural Features
- Streams
- Water Bodies

Building Footprint

Shallow Groundwater Flow Direction (pumping conditions)

Intermediate Groundwater Flow Direction (pumping conditions)

W E S

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- The orthophotography shown on this map was taken in April, 2015.

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TG		DESIGNED M Jenkins	DATE 2/1/2019
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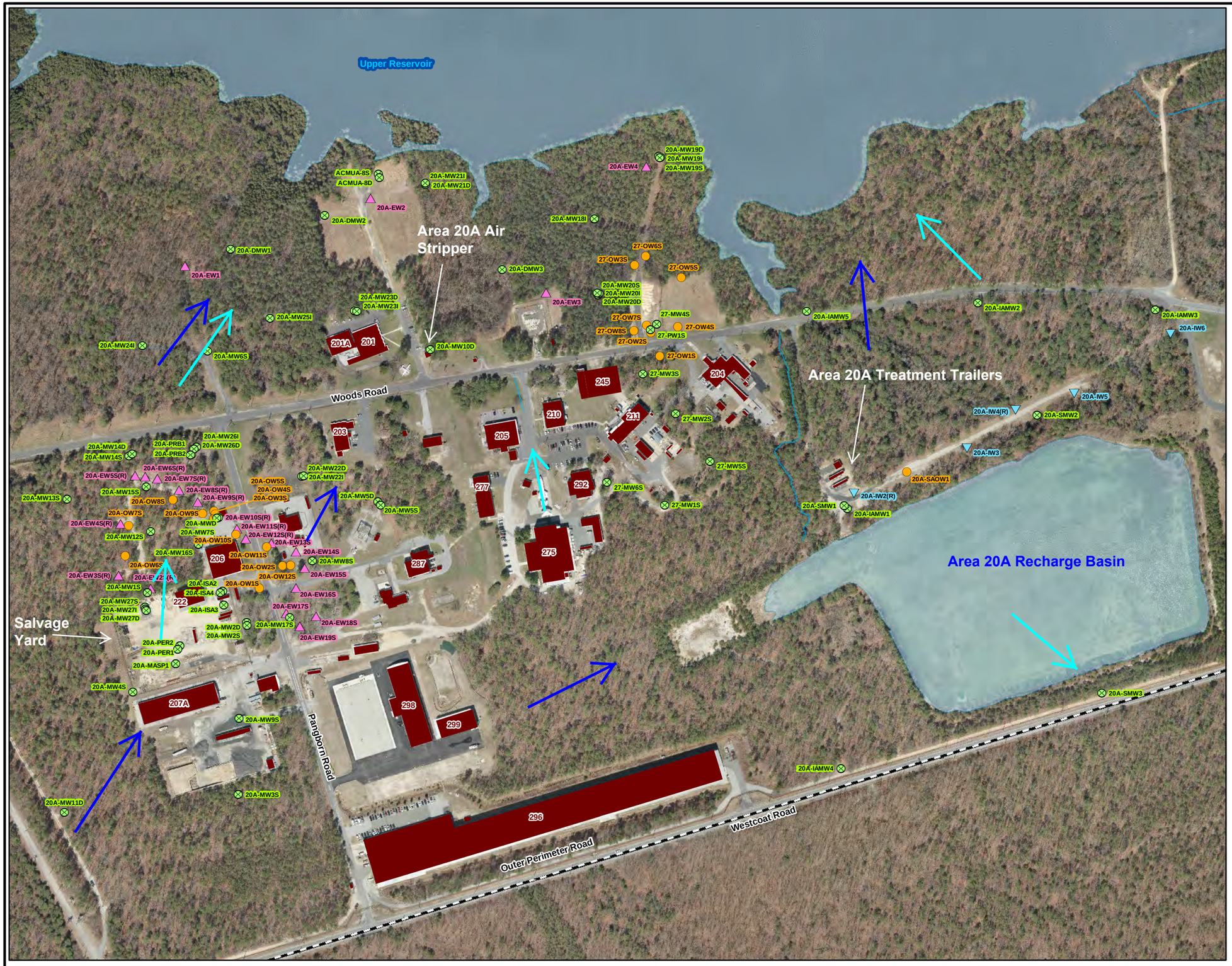
Federal Aviation Administration
William J. Hughes Technical Center

Figure 5
Area 20A Extraction and Monitoring Well Locations and Groundwater Flow Directions

Note: Figure also shows Area 27 monitoring and observation well locations.



Legend

Area 20A Wells

- Monitoring Well
- Observation Well
- Extraction Well
- Injection Well

Natural Features

- Streams
- Water Bodies

FAA Boundary

Building Footprint

Shallow Groundwater Flow Direction (pumping conditions)

Intermediate Groundwater Flow Direction (pumping conditions)

W E S

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- The orthophotography shown on this map was taken in April, 2015.

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TG		DESIGNED M Jenkins	DATE 2/1/2019
		CHECKED M Cicali	MAP #

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Federal Aviation Administration
William J. Hughes Technical Center

Figure 6
Area 29/K Monitoring Well Locations and Groundwater Flow Directions

Legend

Area 29 Wells

- Monitoring Well
- Non-Potable Water Well
- Observation Well

Building Footprint

Miscellaneous Features

- Injection Gallery
- Approximate Extent of Confining Layer
- 2017 Excavation Boundary

Shallow Groundwater Flow Direction

N W E S

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- The orthophotography shown on this map was taken in April, 2015.

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TG		DESIGNED M Jenkins	DATE 2/1/2019
		CHECKED M Cicali	MAP #

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Federal Aviation Administration
William J. Hughes Technical Center

Figure 7
Area 41 Monitoring, Extraction and Injection Well Locations and Groundwater Flow Directions

Legend

Area 41 Wells

- Monitoring Well
- Extraction Well
- Injection Well
- Injection - Monitoring

Natural Features

- Streams
- Water Bodies

Building Footprint

Shallow Groundwater Flow Direction

Intermediate Groundwater Flow Direction

N
W E
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- The orthophotography shown on this map was taken in April, 2015.

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TG		DESIGNED M Jenkins	DATE 2/1/2019
		CHECKED M Cicali	MAP #

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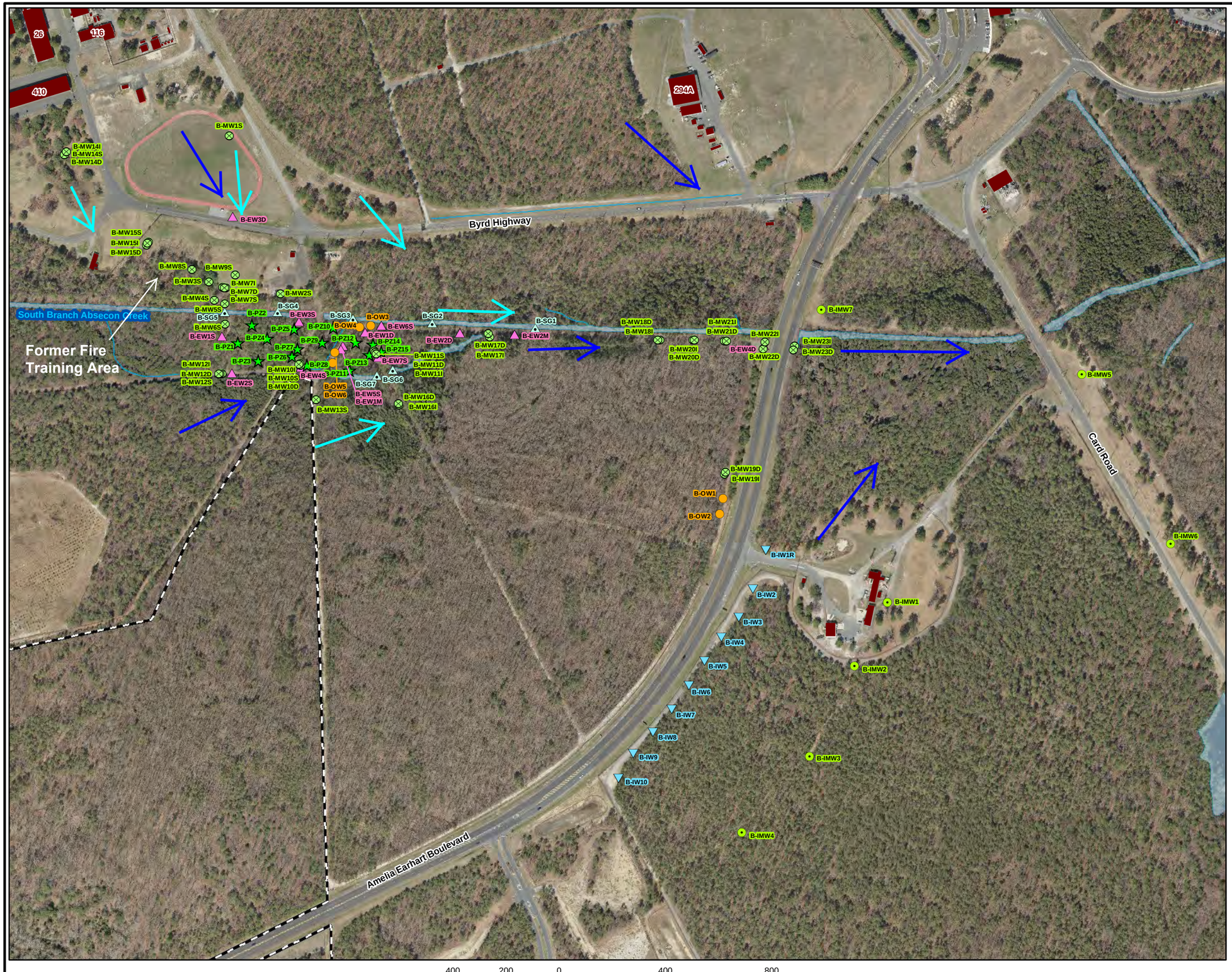
Federal Aviation Administration
William J. Hughes Technical Center

Figure 8
Area B Monitoring, Extraction and Injection Well Locations and Groundwater Flow Directions



Legend

Area B Wells

- Monitoring Well
- Piezometer
- Observation Well
- Extraction Well
- Injection Well
- Injection - Monitoring
- Stream Gage

Natural Features

- Streams
- Water Bodies

FAA Boundary

Building Footprint

Shallow Groundwater Flow Direction (pumping conditions)

Intermediate Groundwater Flow Direction (pumping conditions)

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- The orthophotography shown on this map was taken in April, 2015.

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TG		DESIGNED M Jenkins	DATE 2/1/2019
		CHECKED M Cicali	MAP #

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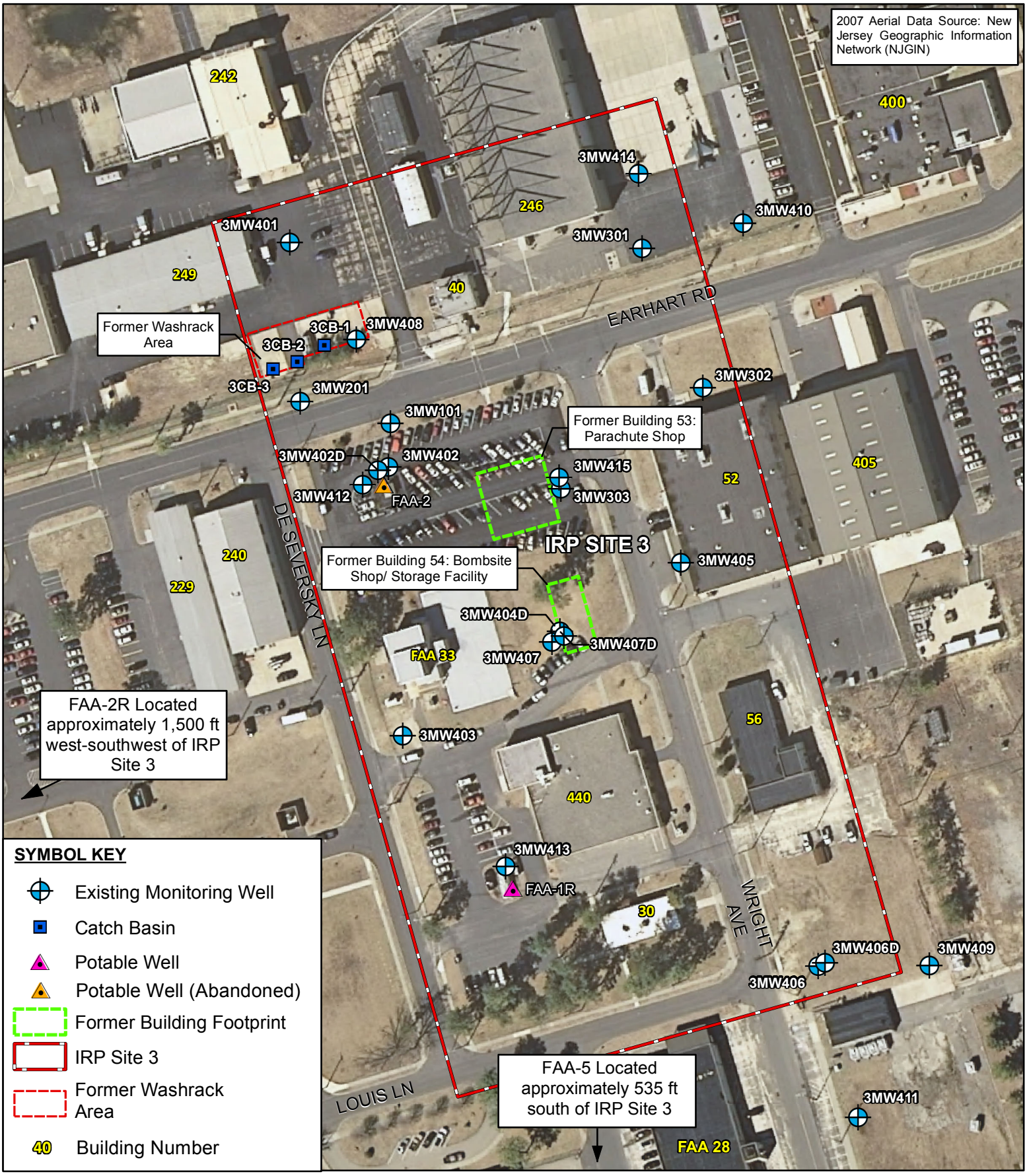

From Record of Decision
New Jersey Air National Guard 177th Fighter Wing, Egg Harbor Township, New Jersey
Groundwater flow direction is to the southeast.

N

Figure 9
NJANG Site 3 Layout and Monitoring Well Locations

0 25 50 75 100 125 Meters
0 100 200 300 400 Feet

05/29/2018

Federal Aviation Administration
William J. Hughes Technical Center

Figure 10
Area E Monitoring and Extraction Well Locations and Groundwater Flow Directions

Legend

Area E Wells

- Monitoring Well
- Observation Well
- Extraction Well

Building Footprint

Shallow Groundwater Flow Direction

N
W E
S

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- The orthophotography shown on this map was taken in April, 2015.

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UD			APPROVED
TG		DESIGNED M Jenkins	DATE 2/1/2019
		CHECKED M Cicali	MAP #

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APPENDIX A - REFERENCE LIST

GENERAL REFERENCES:

RI/FS Reports (including human health and ecological risk assessments) (TRC Environmental Corporation, various dates).

Records of Decision for FAA AOCs (various dates).

Superfund Technical Meeting Minutes and Associated Presentation Documents (various dates, 2014-2019).

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Area C

TRC, 2018. *Draft Final Site Summary In Support Of Partial Deletion, Area C, Butler Aviation Fuel Spill Area*. TRC Environmental Corporation, July 2018.

Areas 29/K

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Area B

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Area A

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Area E

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APPENDIX B - ACMUA DATA

The most recent available ACMUA Water Quality Report is attached. Additional water quality data were requested of ACMUA for the purposes of preparing this report but were not provided.

ANNUAL WATER QUALITY REPORT

WATER TESTING PERFORMED IN 2017

Chi tiết này thật quan trọng.
Xin nhờ người dịch cho quý vị.

この情報は重要です。
翻訳を依頼してください。

此份有關你的食水報告,
內有重要資料和訊息,請找
他人為你翻譯及解釋清楚。

此份有关你的食水报告,
内有重要资料和讯息,请找
他人为你翻译及解释清楚。

यह सूचना महत्वपूर्ण है ।
कृपा करके किसी से :सका अनुवाद करायें ।

"هذا ألتقرير يحتوي على معلوماً ت مهّمة تتعلق بمياه ألشفة (أو ألشرب).
ترجم ألتقرير , أو تكلم مع شخص يستطيع أن يفهم ألتقرير."

Este informe contiene información muy importante sobre su agua potable. Tradúzcalo o hable con alguien que lo entienda bien.

Mahalaga ang impormasyong ito. Mangyaring ipasalin ito.

ATLANTIC CITY MUNICIPAL UTILITIES AUTHORITY 1978

Presented By

Atlantic City Municipal Utilities Authority

PWS ID#: 0102001

Quality First

Once again, the Atlantic City Municipal Utilities Authority is pleased to present our annual water quality report. As in years past, we are committed to delivering the best-quality drinking water possible. To that end, we remain vigilant in meeting the challenges of new regulations, source water protection, water conservation, and community outreach and education while continuing to serve the needs of all our water users. Thank you for allowing us the opportunity to serve you and your family.

We encourage you to share your thoughts with us on the information contained in this report. After all, well-informed customers are our best allies. If you have any health concerns relating to the information provided in this report, we encourage you to contact your health care provider. For more information about the contents of this report or for any questions relating to your drinking water, please contact Anthony Palombi at (609) 641-0024, ext. 323.

Where Does My Water Come From?

The ACMUA's water supply system consists of surface and ground water resources, a water filtration facilities that treats raw water from both sources, transmission facilities from the treatment plant to Atlantic City, distribution facilities throughout the city, reservoirs at the surface sources, one standpipe, two elevated storage tanks, and one aquifer storage recharge (ASR) well in the city. In 2017, the system processed 3,031.7980 million gallons (mg) of water for the year, with a maximum daily demand of 11.2500 million gallons per day (mgd) in the month of July and an average daily demand of approximately 8.3003 million gallons per day (mgd). The ACMUA water source comes from two surface water reservoirs (Kuehnle Pond Dam and Doughty Pond Dam) and 13 wells. Eleven of these wells are located in the Cohansey Aquifer and two are located in the Kirkwood Aquifer. Well water collected from the well fields is transported to the ACMUA's Water Treatment Plant Facility. The treatment process includes pretreatment with sodium hypochlorite solution for disinfection and sodium permanganate and poly aluminum chloride addition for turbidity removal, aeration, mixing, settling, and filtration with mixed media including sand, gravel, and granular activated carbon. Posttreatment includes disinfection, pH adjustment with lime, fluoride addition, and corrosion inhibitor chemical addition. After the water is treated at the plant, it is transported to Atlantic City via two (2) large transmission mains to be used by all our customers.

Tip Top Tap

The most common signs that your faucet or sink is affecting the quality of your drinking water are discolored water, sink or faucet stains, a buildup of particles, unusual odors or tastes, and a reduced flow of water. The solutions to these problems may be in your hands.

Kitchen Sink and Drain

Hand washing, soap scum buildup, and the handling of raw meats and vegetables can contaminate your sink. Clogged drains can lead to unclean sinks and backed up water in which bacteria (i.e., pink and black colored slime growth) can grow and contaminate the sink area and faucet, causing a rotten egg odor. Disinfect and clean the sink and drain area regularly. Also, flush regularly with hot water.

Faucets, Screens, and Aerators

Chemicals and bacteria can splash and accumulate on the faucet screen and aerator, which are located on the tip of faucets, and can collect particles like sediment and minerals resulting in a decreased flow from the faucet. Clean and disinfect the aerators or screens on a regular basis.

Check with your plumber if you find particles in the faucet screen as they could be pieces of plastic from the hot water heater dip tube. Faucet gaskets can break down and cause black, oily slime. If you find this slime, replace the faucet gasket with a higher-quality product. White scaling or hard deposits on faucets and shower heads may be caused by hard water or water with high levels of calcium carbonate. Clean these fixtures with vinegar or use water softening to reduce the calcium carbonate levels for the hot water system.

Water Filtration/Treatment Devices

A smell of rotten eggs can be a sign of bacteria on the filters or in the treatment system. The system can also become clogged over time so regular filter replacement is important. (Remember to replace your refrigerator filter!)

Lead in Home Plumbing

If present, elevated levels of lead can cause serious health problems, especially for pregnant women and young children. Lead in drinking water is primarily from materials and components associated with service lines and home plumbing. We are responsible for providing high-quality drinking water, but cannot control the variety of materials used in plumbing components. When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline or at www.epa.gov/lead.

Source Water Assessment

The New Jersey Department of Environmental Protection (NJDEP) has prepared Source Water Assessment Reports and Summaries for all public water systems. The table below illustrates the susceptibility ratings for the seven contaminant categories (and Radon) for each source in the system. The table shows the number of wells and intakes that rated high (H), medium (M), or low (L) for each contaminant category.

		TOTALS FOR EACH RATING	
CONTAMINANT CATEGORY	SUSCEPTIBILITY RATING	17 WELLS	1 SURFACE WATER INTAKE
Pathogens	H		1
	M	13	
	L	4	
Nutrients	H		
	M	12	1
	L	5	
Pesticides	H		
	M		
	L	17	1
VOCs	H	10	
	M		1
	L	7	
Inorganics	H	3	
	M	9	1
	L	5	
Radionuclides	H	1	
	M	13	
	L	3	1
Radon	H		
	M	14	
	L	3	1
DBPs	H	14	1
	M	3	
	L		

Community Participation

The Atlantic City Municipal Utilities Authority Board of Directors meets every third Wednesday of the month at 10:00 a.m. in the first floor conference room at our offices located at 401 N. Virginia Avenue, Atlantic City, NJ.

Substances That Could Be in Water

To ensure that tap water is safe to drink, the U.S. EPA prescribes regulations limiting the amount of certain contaminants in water provided by public water systems. U.S. Food and Drug Administration regulations establish limits for contaminants in bottled water, which must provide the same protection for public health. Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of these contaminants does not necessarily indicate that the water poses a health risk.

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals, in some cases, radioactive material, and substances resulting from the presence of animals or from human activity. Substances that may be present in source water include:

Microbial Contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations, or wildlife;

Inorganic Contaminants, such as salts and metals, which can be naturally occurring or may result from urban stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, or farming;

Pesticides and Herbicides, which may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses;

Organic Chemical Contaminants, including synthetic and volatile organic chemicals, which are by-products of industrial processes and petroleum production and may also come from gas stations, urban stormwater runoff, and septic systems;

Radioactive Contaminants, which can be naturally occurring or may be the result of oil and gas production and mining activities.

For more information about contaminants and potential health effects, call the U.S. EPA's Safe Drinking Water Hotline at (800) 426-4791.

Count on Us

Delivering high-quality drinking water to our customers involves far more than just pushing water through pipes. Water treatment is a complex, time-consuming process. Because tap water is highly regulated by state and federal laws, water treatment plant and system operators must be licensed and are required to commit to long-term, on-the-job training before becoming fully qualified. Our licensed water professionals have a basic understanding of a wide range of subjects, including mathematics, biology, chemistry, and physics. Some of the tasks they complete on a regular basis include:

- Operating and maintaining equipment to purify and clarify water;
- Monitoring and inspecting machinery, meters, gauges, and operating conditions;
- Conducting tests and inspections on water and evaluating the results;
- Maintaining optimal water chemistry;
- Applying data to formulas that determine treatment requirements, flow levels, and concentration levels;
- Documenting and reporting test results and system operations to regulatory agencies; and
- Serving our community through customer support, education, and outreach.

So, the next time you turn on your faucet, think of the skilled professionals who stand behind each drop.

Benefits of Chlorination

Disinfection, a chemical process used to control disease-causing microorganisms by killing or inactivating them, is unquestionably the most important step in drinking water treatment. By far, the most common method of disinfection in North America is chlorination.

Before communities began routinely treating drinking water with chlorine (starting with Chicago and Jersey City in 1908), cholera, typhoid fever, dysentery, and hepatitis A killed thousands of U.S. residents annually. Drinking water chlorination and filtration have helped to virtually eliminate these diseases in the U.S. Significant strides in public health are directly linked to the adoption of drinking water chlorination. In fact, the filtration of drinking water plus the use of chlorine is probably the most significant public health advancement in human history.

How chlorination works:

Potent Germicide Reduction in the level of many disease-causing microorganisms in drinking water to almost immeasurable levels.

Taste and Odor Reduction of many disagreeable tastes and odors like foul-smelling algae secretions, sulfides, and odors from decaying vegetation.

Biological Growth Elimination of slime bacteria, molds, and algae that commonly grow in water supply reservoirs, on the walls of water mains, and in storage tanks.

Chemical Removal of hydrogen sulfide (which has a rotten egg odor), ammonia, and other nitrogenous compounds that have unpleasant tastes and hinder disinfection. It also helps to remove iron and manganese from raw water.

Test Results

Our water is monitored for many different kinds of substances on a very strict sampling schedule. The information in the data tables shows only those substances that were detected between January 1 and December 31, 2017. Remember that detecting a substance does not necessarily mean the water is unsafe to drink; our goal is to keep all detects below their respective maximum allowed levels. The State allows us to monitor for certain substances less than once per year because the concentrations of these substances do not change frequently. In these cases, the most recent sample data are included, along with the year in which the sample was taken.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immunocompromised persons such as persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS or other immune system disorders, some elderly, and infants may be particularly at risk from infections. These people should seek advice about drinking water from their health care providers. The U.S. EPA/CDC (Centers for Disease Control and Prevention) guidelines on appropriate means to lessen the risk of infection by *Cryptosporidium* and other microbial contaminants are available from the Safe Drinking Water Hotline at (800) 426-4791.

REGULATED SUBSTANCES [1]

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	MCL [MRDL]	MCLG [MRDLG]	AMOUNT DETECTED	RANGE LOW-HIGH	VIOLATION	TYPICAL SOURCE
Arsenic (ppb)	2017	5	0	<0.0003	NA	No	Erosion of natural deposits; Runoff from orchards; Runoff from glass and electronics production wastes
Barium (ppm)	2017	2	2	0.0488	NA	No	Discharge of drilling wastes; Discharge from metal refineries; Erosion of natural deposits
Beryllium (ppb)	2017	4	4	<0.0002	NA	No	Discharge from metal refineries and coal-burning factories; Discharge from electrical, aerospace, and defense industries
Cadmium (ppb)	2017	5	5	<0.0002	NA	No	Corrosion of galvanized pipes; Erosion of natural deposits; Discharge from metal refineries; Runoff from waste batteries and paints
Chlorine (ppm)	2017	[4]	[4]	0.82	0.36–1.35	No	Water additive used to control microbes
Fluoride (ppm)	2017	4	4	0.43	ND–1.02	No	Erosion of natural deposits; Water additive which promotes strong teeth; Discharge from fertilizer and aluminum factories
Nickel (ppb)	2017	100	NA	3	NA	No	Pollution from mining and refining operations; Natural occurrence in soil
Selenium (ppb)	2017	50	50	<0.0009	NA	No	Discharge from petroleum and metal refineries; Erosion of natural deposits; Discharge from mines
Turbidity[2] (NTU)	2017	TT	NA	0.93	0.02–0.93	No	Soil runoff
Turbidity (Lowest monthly percent of samples meeting limit)	2017	TT = 95% of samples meet the limit	NA	99.9	NA	No	Soil runoff

Distribution System

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	MCL [MRDL]	MCLG [MRDLG]	AMOUNT DETECTED	RANGE LOW-HIGH	VIOLATION	TYPICAL SOURCE
Chlorine [Distribution] (ppm)	2017	4	4	0.73	0.40–1.12	No	Water additive used to control microbes
Haloacetic Acids [ACMUA Office] (ppb)	2017	60	NA	2.35	1.30–4.30	No	By-product of drinking water disinfection
Haloacetic Acids [Bella Condominium] (ppb)	2017	60	NA	1.08	0.00–1.50	No	By-product of drinking water disinfection
Haloacetic Acids [Jefferies Towers] (ppb)	2017	60	NA	1.40	0.00–3.00	No	By-product of drinking water disinfection
Haloacetic Acids [Southern Cafe] (ppb)	2017	60	NA	1.20	0.00–3.20	No	By-product of drinking water disinfection
TTHMs [ACMUA Office] (ppb)	2017	80	NA	27.9	13.6–49.0	No	By-product of drinking water disinfection
TTHMs [Bella Condominium] (ppb)	2017	80	NA	16.60	9.9–34.0	No	By-product of drinking water disinfection
TTHMs [Jefferies Towers] (ppb)	2017	80	NA	22.4	8.9–35.0	No	By-product of drinking water disinfection
TTHMs [Southern Cafe] (ppb)	2017	80	NA	22.30	10.2–35.0	No	By-product of drinking water disinfection

Tap water samples were collected for lead and copper analyses from sample sites throughout the community

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	AL	MCLG	AMOUNT DETECTED (90TH%TILE)	SITES ABOVE AL/TOTAL SITES	VIOLATION	TYPICAL SOURCE
Copper (ppm)	2017	1.3	1.3	0.312	0/30	No	Corrosion of household plumbing systems; Erosion of natural deposits
Lead (ppb)	2017	15	0	0	1/30	No	Corrosion of household plumbing systems; Erosion of natural deposits

SECONDARY SUBSTANCES

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	RUL	MCLG	AMOUNT DETECTED	RANGE LOW-HIGH	VIOLATION	TYPICAL SOURCE
Sodium (ppm)	2017	50	NA	0.0113	NA	No	Naturally occurring

UNREGULATED SUBSTANCES

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	AMOUNT DETECTED	RANGE LOW-HIGH	TYPICAL SOURCE
Chromium (ppb)	2017	<0.002	NA	Discharge from steel and pulp mills; Erosion of natural deposits

UNREGULATED SUBSTANCES - PERFLUORINATED COMPOUNDS (PFCS)

SUBSTANCE (UNIT OF MEASURE)	YEAR SAMPLED	AMOUNT DETECTED	RANGE LOW-HIGH
Perfluorobutanesulfonic Acid [PFBS] (ppb)	2016	0.003	NA
Perfluoroheptonic Acid [PFHpA] (ppb)	2016	0.0042	NA
Perfluorohexanesulfonic Acid [PFHxS] (ppb)	2016	0.027	NA
Perfluorohexanoic Acid (ppb)	2016	0.013	NA
Perfluorononanoic Acid [PFNA] (ppb)	2016	0.00069	NA
Perfluorooctanesulfonic Acid [PFOS] (ppb)	2016	0.028	NA
Perfluorooctanoic Acid [PFOA] (ppb)	2016	0.024	NA

[1] Under a waiver granted on December 30, 1998, by the State of New Jersey Department of Environmental Protection, our system does not have to monitor for synthetic organic chemicals/pesticides because several years of testing have indicated that these substances do not occur in our source water. The SDWA regulations allow monitoring waivers to reduce or eliminate the monitoring requirements for asbestos, volatile organic chemicals, and synthetic organic chemicals. Our system received monitoring waivers for synthetic organic chemicals and asbestos.

[2] Turbidity is a measure of the cloudiness of the water. We monitor it because it is a good indicator of the effectiveness of our filtration system. The turbidity rule requires that 95% or more of the monthly samples must be less than or equal to 0.3 NTU (no sample may exceed 1 NTU).

Definitions

AL (Action Level): The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.

LRAA (Locational Running Annual Average): The average of sample analytical results for samples taken at a particular monitoring location during the previous four calendar quarters. Amount Detected values for TTHMs and HAAs are reported as the highest LRAAs.

MCL (Maximum Contaminant Level): The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

MCLG (Maximum Contaminant Level Goal): The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

MRDL (Maximum Residual Disinfectant Level): The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

MRDLG (Maximum Residual Disinfectant Level Goal): The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

NA: Not applicable

ND (Not detected): Indicates that the substance was not found by laboratory analysis.

NTU (Nephelometric Turbidity Units): Measurement of the clarity, or turbidity, of water. Turbidity in excess of 5 NTU is just noticeable to the average person.

ppb (parts per billion): One part substance per billion parts water (or micrograms per liter).

ppm (parts per million): One part substance per million parts water (or milligrams per liter).

RUL (Recommended Upper Limit): RULs are established to regulate the aesthetics of drinking water like appearance, taste and odor.

TT (Treatment Technique): A required process intended to reduce the level of a contaminant in drinking water.

APPENDIX C - PUBLIC NOTICE INFORMATION

NOTICE:

The FAA is conducting a five-year review of the activities at the FAA William J. Hughes Technical Center Superfund Site located at the Atlantic City International Airport, Atlantic County, New Jersey

The purpose of the five-year review is to ensure that the actions taken in response to Superfund investigations and assessments are protective of public health and the environment.

To meet this goal, the FAA is reviewing remedial operations, maintenance, and monitoring information, as well as land use and associated controls. The public is welcome to comment on or contribute information on site activities.

The results of the five-year review will be made available upon its completion, estimated for late September 2019, at the offices of the EPA and in the site repository located at:

FAA Technical Center, Building 305
Atlantic City International Airport, NJ 08405
(609)485-5999

For additional information, please contact:

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COMMUNITY CALENDAR

Events

WEDNESDAY, FEB. 27

AFRICAN-AMERICAN GENEALOGY: 7 to 9 p.m.; join Dawn Heyson to learn some tips to search African-American genealogy; Ocean County Library, 290 Mathistown Road, **Little Egg Harbor Township**, registration requested. 609-294-1197.

ATLANTIC AUDUBON SOCIETY MEETING: 6:30 to 9 p.m.; social hour followed by a presentation by Jesse Amesbury on Hawk Mountain; light refreshments; Public Library, 306 E. Jimmie Leeds Road, **Galloway Township**, free. AtlanticAudubonSociety.com.

KIWANIS CLUB OF CAPE MAY: 5:30 to 8 p.m. Wednesdays; meeting, dinner; Kiwanis Club of Cape May, 1041 Beach Ave., **Cape May**. 609-972-6710 or CapeMayKiwanis.com.

RECYCLING PRESENTATION: 6 to 8 p.m.; "The Problem with Plastics: Changes in the Recycling Industry"; Atlantic County Utilities Authority, 6700 Delilah Road, **Egg Harbor Township**. 609-272-6950.

VHS POETRY SLAM PERFORMANCE: 5 to 6:30 p.m.; enjoy performances of original poetry by members of the Vineland High School Poetry Club; Public Library, 1058 E. Landis Ave., **Vineland**. 856-794-4244, ext. 6.

WALK-IN JOB SKILLS LAB: 11 a.m. to 1 p.m.; provides assistance to Atlantic City Library members who need help with job-related tasks; Public Library, 1 North Tennessee Ave., **Atlantic City**, free. 609-345-2269 or ACFPL.org.

THURSDAY, FEB. 28

'ABRAHAM LINCOLN: A HISTORICAL PERSPECTIVE': 5:30 to 7:30 p.m.; learn about the life of Abraham Lincoln; Public Library, 9516 Second Ave., **Stone Harbor**. 609-463-6386.

BALLROOM DANCE LESSONS: 7:30 to 9 p.m. Mondays and Thursdays; all welcome; Seashore Gardens Living Center, 22 W. Jimmie Leeds Road, **Galloway Township**, $6. 609-645-3269.

EMPLOYMENT DEVELOPMENT SERIES: JOB NAVIGATION: noon to 1 p.m.; for those looking for a job but not sure where to start; Inland Family Success Center, 3050 Spruce Ave., **Egg Harbor Township**. 609-569-0376 or EventBrite.com.

GAME DAY: 1 to 4 p.m. Feb. 28, March 14, 28; includes snacks and beverages; Shirat Hayam, 700 N. Swarthmore Ave., **Ventnor**, $8. 609-822-7116, ext. 105.

GAME NIGHT: 6 to 8 p.m. Thursdays; learn new games, play your favorites; for ages 18 and older; Cape May Court House Library, 30 Mechanic St., **Cape May Court House**. 609-463-6386.

'INTO THE WOODS': 7 to 9 p.m. Feb. 28, March 1, 2; 1 p.m. March 2; special dinner and show package March 1, $30 adults, $25 ages 10 and younger; Atlantic County Institute of Technology Performing Arts Center, 5080 Atlantic Ave., **Mays Landing**; advance: $11 adults, $9 students; at the door: $12 adults, $10 students. 609-625-2249.

MOMS NIGHT OUT: 5 to 6 p.m.; open to all families living in Atlantic County; night celebrating self-care with a guest speaker and fun activities; New Day Family Success Center, 622-624 S. New York Road, **Galloway Township**, pre-registration required. 609-652-0230.

RECIPE RENOVATIONS: 5 to 7 p.m.; learn how to make Greek specialties including homemade pita bread, Tzatziki sauce and crust-less quiche; Public Library, 9516 Second Ave., **Stone Harbor**. 609-463-6386.

Dining out

FRIDAY, MARCH 1

SPAGHETTI DINNER: 5 to 7 p.m.; proceeds benefit mission projects including Family Promise, Habitat for Humanity and UMCOR; Petersburg Wesley Methodist Church, 400 Route 610, **Petersburg**, $12 adults, $6 ages 11 and younger. 609-628-2224.

VFW FRIDAY NIGHT DINNERS: 4:30 to 7:30 p.m.; Salisbury steak; Belleplain VFW Post, 556 Woodbine Ave., **Belleplain**, $10. 609-861-2298.

SATURDAY, MARCH 2

PRINCESS AND SUPERHERO PANCAKE BREAKFAST: 9:30 to 11:30 a.m.; for ages 3 to 5; dress up as a super hero or princess; costumed characters, face painting, basket raffle, kid tattoos; St. Vincent de Paul Regional School, 5809 Main St., **Mays Landing**, free. 609-625-1565 or SVDPRS.com.

SPAGHETTI SUPPER: 4 to 7 p.m.; take-outs available; Moravian Church, 235 Boston Ave., **Egg Harbor City**, $12 adults, $6 ages 12 and younger. 609-829-2832.

SUNDAY, MARCH 3

BLINI BLAST 2019: 12:30 to 3:30 p.m.; Russian cuisine, coffee, tea, dessert; Holy Trinity Russian Orthodox Church, 2211 W. Landis Ave., **Vineland**, $15. 856-696-1579.

'BROADWAY BRUNCH BY THE BEACH' FUNDRAISER: 10 a.m. to 2 p.m.; hosted by the Ocean City High School Drama Guild Theatre Boosters; live auction and gift basket raffles; Avalon Links Restaurant and Golf Club, 1510 Route 9, **Cape May Court House**. FMcCarty@comcast.net.

MEAT FARE SUNDAY DINNER: 11:45 a.m. to 1:45 p.m.; traditional Slavic foods; Church of the Mother of God, 115 Hudson St., **Mays Landing**, $10. 609-625-1184.

PASTA DINNER: noon to 5 p.m.; hosted by the Greater Atlantic City Chapter of Unico National and St. Michael's Church; Quaremba Hall, 15 N. Georgia Ave., **Atlantic City**, $10 adults, $5 ages 3 to 10, free ages 2 and younger. 609-823-5757.

COMMUNITY HELPERS

SUSAN KRYSIAK, COURTESY OF MAC / SUBMITTED

MAC staff join church volunteers to offer hot lunch at First Baptist Church of Wildwood

Staff members of the Mid-Atlantic Center for the Arts & Humanities in Cape May joined church volunteers on Feb. 21 to prep, cook and serve a free hot lunch as part of the Thursday Community Lunch program at the First Baptist Church of Wildwood. MAC staff made homemade cornbread, chili, salad and desserts and served meals to approximately 36 people. Shown from left are Anna Marie Leeper and Cathy Baldacchini, from MAC; church volunteers Michael Celinski, Floss Stingel and Judi Kiniry; and Melissa Palmer, Barbara Hubmaster and Eliza Lotozo, from MAC. To volunteer your group for the Thursday Community Lunch program, call 609-522-2981 or email philheck@access4less.net.

IN YOUR COUNTY

Atlantic

Women's Founders Day awards luncheon: The Atlantic City Club of the National Association of Negro Business and Professional Women's Clubs will host its annual luncheon beginning at noon Saturday at Atlantic City Country Club, 1 Leo Fraser Drive, Northfield. The event is the group's major fundraiser and proceeds benefit the scholarship program and community support programs. Tickets are $50. For information, call 609-645-2239.

International Women's Day dinner: The 11th annual South Jersey celebration of International Women's Day will be held March 8 at Sofia Restaurant, 9314 Amherst Ave., Margate. A reception with appetizers starts 5 p.m., followed by sit-down dinner at 6 p.m. Seating is limited. Free parking is available. Tickets are $25. RSVP by March 5. For information, call Svetlana Fenichel at 609-214-5199 or email svetlanafenichel@gmail.com.

Diabetes boot camp: Shore Physicians Group endocrinologist Dr. Matthew Corcoran will host a Diabetes Training/Boot Camp for people living with Type 2 and pre-diabetes to be held March 29-31 at the Milton and Betty Katz Jewish Community Center in Margate. Breakfast and lunch are included each day. The cost is $325. To RSVP, visit diabetestrainingcamp.com.

ArtsTank grant competition: The South Jersey Cultural Alliance is calling for entries in the first-ever ArtsTank placemaking grant competition. Municipalities in Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Ocean and Salem counties are invited to apply. Placemaking uses arts, history and culture to engage a community in addressing a local challenge. The winning municipality will receive $5,000. Letters of intent are due by March 8, followed by a completed application by April 1. For information, visit sjca.net/artstank or call Karen Pinzolo at 609-626-3630.

Cape May

Utility Assistance Day: NJ SHARES is hosting a Utility Assistance Day in in Cape May County on Tuesday at Cape May Convention Hall. The event will be held from 9 a.m. to 2 p.m. in the Community Room and will feature representative from NJ SHARES as well as local utility companies Atlantic City Electric and South Jersey Gas. Representatives will be available to answer questions and provide guidance to those looking for assistance with their utility bills. For more information, call 609-323-1315 or visit NJShares.org.

Coffee Fridays for grandparents: The Rutgers Cooperative Extension of Cape May County Family and Community Health Sciences Grandparents Raising Grandchildren Support Group invites grandparents who are raising their grandchildren to come to the next Coffee Fridays program on March 22. The program takes place from 10 to 11 a.m. at Extension Building, 355 Court House-South Dennis Road, Cape May Court House. New families are encouraged to come and learn more about the program. There is no charge for this program, but reservations are needed. For information, call 609-465-5115, ext. 3609.

Cumberland

Diamond in the Rough talent competition: Auditions for Main Street Vineland's second annual Diamond in the Rough talent competition will be held from 6 to 9 p.m. March 20 and 21 at the Landis Theater, 830 E. Landis Ave., Vineland. Walk-ins are welcome, but pre-registration is recommended. The show will take place 7 p.m. April 5. Rehearsals are from 6 to 9 p.m. April 2 and 4. For information, visit TheAve.biz or call 856-794-8653.

Legends Award ceremony: The Cumberland County Legends committee will hold its 2019 event March 30 at The Grove at Centerton in Pittsgrove Township. The honorees are Paul J. Ritter III, Dr. Satish Shah and Jennifer Webb-McCraw. The event includes dinner, music and raffles. Tickets are $50. Proceeds benefit the Complete Care Family Health Foundation. For information, call Karla Laws at 856-451-4700, ext. 2071.

Southern Ocean

Prom dress drive: All branches of the Ocean County Library are collecting new or gently used formal dresses, party dresses, evening gowns and tuxedos to donate to area high school students who need something to wear to spring proms. Larger sizes are especially needed. Donations will be accepted through April 1. For information, call any branch library.

APPENDIX D - SITE INSPECTION PHOTOGRAPHIC LOG

Photographic Log – Site Inspection
FAA William J. Hughes Technical Center
Atlantic City International Airport, New Jersey
April 24, 2019

OU01 - Area D, Phase I Thermal Conductive Heating System

OU02 - Area 20A Recharge Basin, looking southeast

Photographic Log – Site Inspection
FAA William J. Hughes Technical Center
Atlantic City International Airport, New Jersey
April 24, 2019

OU02 - Area 20A treatment trailers

OU02 - Area 20A Salvage Yard, looking south

Photographic Log – Site Inspection
FAA William J. Hughes Technical Center
Atlantic City International Airport, New Jersey
April 24, 2019

OU02 - Area 20A Salvage Yard treatability study area, looking southwest

OU04 - Area C, view from Area D of Area C, looking northeast

Photographic Log – Site Inspection
FAA William J. Hughes Technical Center
Atlantic City International Airport, New Jersey
April 24, 2019

OU06 - Areas 29/K, looking north across former burn pad area

OU06 - Areas 29/K, looking northeast

Photographic Log – Site Inspection
FAA William J. Hughes Technical Center
Atlantic City International Airport, New Jersey
April 24, 2019

OU07 - Area 41, looking north towards former impoundment area

OU07 - Area 41, looking northeast across PCB soil remediation area

Photographic Log – Site Inspection
FAA William J. Hughes Technical Center
Atlantic City International Airport, New Jersey
April 24, 2019

OU07 - Area 41, looking southeast towards pistol range area

OU08 - Area B, view looking west at Area B

Photographic Log – Site Inspection
FAA William J. Hughes Technical Center
Atlantic City International Airport, New Jersey
April 24, 2019

OU08 - South Branch of Absecon Creek at Area B, looking east

OU08 - South Branch of Absecon Creek at Area B, looking west

Photographic Log – Site Inspection
FAA William J. Hughes Technical Center
Atlantic City International Airport, New Jersey
April 24, 2019

OU09 - Area A, looking southeast from Card Road

OU12 - ANG Site 3, looking north towards former washrack area from Earhart Drive

Photographic Log – Site Inspection
FAA William J. Hughes Technical Center
Atlantic City International Airport, New Jersey
April 24, 2019

OU12 - ANG Site 3, looking southeast

OU13 - Area E In Situ Adsorption injections, looking northwest

Photographic Log – Site Inspection
FAA William J. Hughes Technical Center
Atlantic City International Airport, New Jersey
April 24, 2019

OU13 - Area E, looking to the southwest

OU13 - Area E, looking south towards Langley Road

Photographic Log – Site Inspection
FAA William J. Hughes Technical Center
Atlantic City International Airport, New Jersey
April 24, 2019

Typical ACMUA well location along north edge of Upper Reservoir

View downstream of Upper Reservoir spillway, looking east towards Lower Reservoir

APPENDIX E - AOC-SPECIFIC BACKUP INFORMATION

GENERAL O&M INFORMATION, CTP AND INDIVIDUAL REMEDIAL AREAS

AECOM Five-Year Review Information

Date Period: October 2014 to April 2019

Central Treatment Plant

CTP Optimization

The CTP optimization activities are summarized in the CTP Optimization Report dated February 2015. A brief summary of the CTP optimization activities is described below.

A phased-pilot test was performed from November 2014 to November 2015 to evaluate an alternative to the greensand filtration system. Phase 1 tested the use of a bag filter assembly. Phase 2 tested the effects of a reduction in chemical addition at Tank 1. Phase 3 tested the effects of no chemical addition at Tank 1. Some landmark dates during the pilot study included:

- 11/26/2014 - Bag filter skid placed online and the tank 1 pH is 9.0
- 2/17/2015 - Tank 1 pH lowered to 8.4
- 3/23/2015 - Tank 1 pH is lowered to 7.4
- 5/26/2015 - Tank 1 pH lowered to 6.4
- 5/27/2015 – The bag filter skid was taken offline and disassembled. The clarifier effluent water is going directly to the lead carbon unit.
- 7/06/2015 – The chemical addition of Sodium Hydroxide to Tank 1 and Sulfuric Acid to Tank 2 was discontinued.

Based on the results of the CTP optimization testing, there were no changes in the chemical removal efficiency during the 12 months of testing. Phase 3 proved to be successful by maintaining treatment effectiveness, improving equipment performance, improving safety conditions, and improving cost-effectiveness. The total annual chemical cost savings were estimated to be approximately $129,000 per year.

In 2014, the granular activated carbon media change out schedule was modified so that only the lead vessel was changed out instead of both the lead and lag vessel. The lag vessel was then moved to the lead vessel process position. This was a modification of the previous schedule where both the lead and lag vessels were changed out when there was a breakthrough in the lead vessel. Based on the projected GAC media use, the cost of the GAC system was reduced by $37,000 per year. The following controls were implemented to monitor future potential iron fouling concerns:

- Iron levels continue to be monitored throughout the treatment train to alert AECOM to any developing negative trends.
- Bi-annual video inspection of the Area B and Area 41 injection wells continue to be performed to monitor the condition of the discharge systems.
- GAC media changeout frequency is monitored to warn is there is any increased iron loading.

Based on the changes in the CTP operation activities, the total annual cost savings were estimated to be approximately $166,000 per year.

Also included in the report was a discussion of the below items:

- Injection Well Drop Tube Replacement – During the redevelopment of the injection wells in 2013, the carbon steel down piping in all the injection wells at Area 41 and Area B were replaced with schedule 80 PVC piping to reduce the growth of iron forming bacteria. A summary of the activities was provided to the FAA in the Redevelopment Report for Area B and Area 41 Injection Wells report dated May 2014.
- Air Relief Valve Replacement – During the second quarter 2014 lateral video inspection, the nipples on the air relief valves on the effluent line were observed to be significantly corroded. During December 2014 to April 2015, all galvanized/steel fittings were replaced on all air relief valves at all AOCs with PVC air relief valves and fittings to reduce the growth of iron forming bacteria.
- Implementation of Downhole Video Survey – Following the redevelopment effort in the fourth quarter 2013, a bi-annual video inspection program of the Area B and Area 41 injection well fields were subsequently implemented to monitor the condition of the wells.

AECOM Five-Year Review Information

Date Period: October 2014 to April 2019

Injection Wells Redevelopment

After the injection well redevelopment effort in the fourth quarter of 2013, pressure increase was observed in the spring of 2016 in the Area B injection wells. The semi-annual downhole video inspection confirmed the presence of fouling in the injection wells. The Area B injection wells were redeveloped in November/December 2016. The Area 41 injection wells were redeveloped in December 2016/January 2017. A description of the redevelopment procedure was included in the Redevelopment Report for Area B and Area 41 Injection Wells report dated May 2014.

Injection Wells Testing

In October 2018, the Area B injection wells were tested due to the presence of increased pressure at B-IW7 to B-IW10. After review of the test results, TRC determined that the test will be repeated in six months if the pressure continues to increase at B-IW10. A summary of the testing results was reported in the Fourth Quarter 2018 Discharge Monitoring Report and ROD Cleanup Monitoring Report dated February 2019.

Electrical Upgrades

AECOM conducted an electrical inspection of Building 294 and 294A. This inspection identified seven areas where upgrades were required in regards to OSHA compliant use of the proper electrical outlets and the related use of extension cords. Based on the inspection, the below upgrades were performed in 2016:

1. Installation of a dedicated outlet for the manlift.
2. Installation of two duplex receptacles in the sample table area to eliminate extension cord use.
3. Installation of one two gang wiremold extension box with two duplex receptacles adjacent to the door of the CTP Operator Office to eliminate extension cord use.
4. Installation of one duplex receptacle adjacent to the electrical panel located in the CTP Operator's Office to eliminate extension cord use.
5. Installation of one six foot plug mold strip and one double duplex receptacle in the Building 294 workbench area.
6. Installation of one GFI receptacle in the Building 294 restroom.
7. Installation of one duplex receptacle for the chemical feed pump.

Lighting Upgrades

Five high bay light fixtures in the CTP had become inoperable. The cost to replace the fixtures in place versus installing new LED lighting on the underside of the process pipe rack would be a significant one-time fee, and future replacements would be necessary. This new LED lighting location has made the fixtures accessible to the O&M manlift allowing AECOM personnel to change out the lights. Also, the use of this new LED lighting resulted in an energy cost savings of $76k over the next 10 years.

Fire Alarm Upgrades

Following a smoke incident in January 2017, the Building 294A fire alarm was integrated into the CTP programming so that a fire alarm would shut down the CTP and all associated systems. An emergency stop was also installed in Building 294 so that the CTP Treatment System could be shut down from outside of Building 294A should there be remote communication issues with the CTP Treatment System. Electrical work associated with the air compressor replacement was also included in this Unscheduled Repair.

Software Issues

Following the overflow of Tank 1 in 2015 after an electrical outage at the CTP, a heartbeat was added to the CTP programming. The heartbeat enabled two-way communication between the CTP and the remote PLCs at the various Area of Concern control buildings. Before this upgrade, the outbuilding PLCs was not signaled that the CTP was offline. This control stopped extraction wells from pumping when the CTP was not operational. The second phase of the heartbeat logic made the heartbeats two-way. The CTP HMI displays an alarm not only when the remote PLC loses communication with the CTP PLC, but also when the CTP PLC loses communication with the remote PLC. The two-way heartbeat alerts the operators to any power failures at any of the AOC control buildings. This work also included a 'toggle" switch to disarm the alarm for any planned shutdowns, such as maintenance work, as well as an upgrade to the alarm notification system. The system as configured before utilized an autodialer that sends a pre-recorded voice message alerting the user that an alarm has occurred. The autodialer used a common voice

message regardless of the particular alarm being generated. Implementation of the Win-911 Pro alarm notification software provided smart alarm messaging. Descriptive alarm messages are now e-mailed to the users. Each e-mail includes a description of the particular alarm(s) that are active.

Software and IP update

In 2017, FAA IT changed all the network switches to accommodate the new phone system. This change required baseline changes to the FAA network addressing that affected the operations of the SCADA/HMI control systems running the CTP and extended remote areas (Area B, Area D, Area E, Area 29, Area 41 and Area 20A). This required all the IP addresses used in the control systems to be reset to modify the control systems PLC IP address assignment to address the new IP addresses. This also required changes to the Rockwell systems SCADA/HMI code running these control systems.

OU01 - Area D - Jet Fuel Farm

Area D VES System

Updates to the FAA networking scheme required Kruse to modify the CTP and CatOx systems to allow full communication. The FAA changed the network addressing scheme at the CTP. In doing so, the thermal oxidizer control devices could no longer communicate with the CTP control system. While the oxidizer was capable of running without this CTP interface, it was preferable not to operate in this fashion as alarms that occur on the oxidizer would not be displayed on the CTP graphics and would not automatically send alarm messages to support personnel. They would only be displayed at the oxidizer itself. Kruse Integration provided on-site modification and configuration services to integrate the backup files with the new network addressing scheme. Kruse Integration also modified the CTP system to communicate with the oxidizer PLC system properly.

The system was taken offline in June 2019 in advance of the TCH construction. Additional details are provided in the "Area D TCH" section.

Free-Phase Product Extraction/Gauging

D-R19 was added to daily extraction well gauging in March 2016 due to the presence of product detected in the well. This was the first time product was detected in this well during monthly gauging. Product continues to be detected in the well.

The system was taken offline in June 2019 in advance of the TCH construction. Additional details are provided in the "Area D TCH" section.

Area D Extraction Wells

Prior to TCH system construction activities, the Area D groundwater extraction well network consisted of the 21 shallow wells (D-R1 to D-R21). Extraction well D-R10 was abandoned and replaced in June 2015. The replacement well was identified as D-R10R.

Following the start of the TCH construction activities in August 2018, the Area D groundwater extraction well network consists of the 14 shallow wells (D-R1 to D-R9, D-R10R, D-R16, and D-R19 to D-R21). Extraction wells D-R11 to D-R15, D-R17, and D-R18 were located within the TCH footprint and were abandoned in July/August 2018 prior to the start of TCH system construction activities.

Since the last 5-year review, the below groundwater extraction wells were not operated:

- D-R1 was not operated because the well is not needed to capture downgradient dissolved hydrocarbons.
- D-R12 to D-R14 were not operated since the well recharge rates were below the minimum pump extraction rate of 1 gpm.
- D-R16 was not operated since the well was designed as dewatering well for the subsurface pipe bedding and operation of the well has not been necessary.

Groundwater extraction wells D-R2, D-R9 and D-R21 were redeveloped in March 2016 due to decline in performance since the wells were redeveloped in first quarter 2013.

Area D TCH

The FAA determined that there was a need to supplement the remediation of soil and groundwater at Area D following the decline of performance of the existing systems subsequent to the system enhancements in 2012. In 2018, an Explanation of Significant Differences (ESD) was prepared to document changes to the remedy established in the 1989 ROD. The two modifications included: (1) addition of an in-situ thermal remediation (ISTR) technology specifically thermal conductive heating (TCH) to accelerate Area D remediation, followed by monitored natural attenuation) and (2) amendment of the Applicable or Relevant and Appropriate Requirements (ARARs) to remove total petroleum hydrocarbon (TPH) because it is no longer an appropriate method in New Jersey, and its replacement method is not appropriate to evaluate petroleum hydrocarbons at jet fuel releases.

Due to funding and electrical limitations, the TCH project will be phased. Phase 1 was placed online on March 21, 2019, and will be operated for 270 days. The TCH system a thermal heater well network temporarily raises the subsurface temperature. The soil and groundwater within the thermal treatment zone (TTZ) is heated to the boiling point of water using 303 heaters. The in-situ ground temperature is monitored using 28 temperature monitoring points. Organic chemicals are mobilized, volatilized, and steam stripped from the soils and recovered via a network of 66 multi-phase extraction wells (MPE) wells. Extracted vapors and liquids are subsequently treated using the remedies identified in the ROD. Additional equipment is used to cool the aqueous phase, equalize flow, and convey the extracted groundwater to Building 294B and vapors to Building 293. Recovered free-phase product is collected in a 1,000-gallon tank within the TCH compound. The design, installation, operation, maintenance, decommissioning, and removal of the TCH system are included in Deliver Order 262. All costs to treat the recovered vapor is included in Delivery Order 262. All costs to process the water once the water has entered Building 294B are included in Deliver Order 1. All costs to dispose of LNAPL recovered are shared between Deliver Order 262 and Delivery Order 1.

In July 2018, the VES and the free phase product recovery system were taken offline in advance of the construction of the TCH system. In addition, two monitoring wells (D-MW3S and D-MW5S), four observation wells (D-OW11, D-OW21, D-OW22, and D-OW23), seven groundwater extraction wells (D-R11 to D-R15, D-R17, and D-R18), six vapor monitoring points (D-VP22, D-VP37, D-VP38 to D-VP41), and 22 vapor extraction wells (D-VW23, D-VW24, D-VW27, D-VW46 to D-VW64) were abandoned.

The temporary TCH well network consists of 303 vertical heater wells, 66 multiphase extraction (MPE) wells, and 28 temperature monitoring points (TMPs). A 40-mil high-density polyethylene (HDPE) liner over the treatment area to create a barrier between rainwater and other precipitation and the underlying TTZ, and to help control fugitive emissions from the treatment zone. The groundwater and vapor generated during the treatment period treated using process equipment at the temporary TCH treatment system and existing Area D infrastructure to treat recovered groundwater and vapors and contain recovered product.

The hot groundwater and vapor generated during heating, including steam and vaporized COCs, are collected in 66 MPEs. The wellfield vapor conveyance piping consists of a main header trunk line with branches extending to the individual MPE wells. Vapors extracted from the wellfield first enter a condensate sump located at a low point within the wellfield to manage condensate production from the manifold. Hot vapors then enter the first moisture separator, are drawn through a heat exchanger, and into a second moisture separator located within the temporary TCH treatment system. Vapors are then conveyed from the temporary TCH treatment system to the existing SVE (Building 293) for using the existing CatOx system. The vapor piping is above ground and ties into the existing vapor piping header just west of Building 293.

During the final design of the TCH, it was determined that the existing CatOx was not sufficient to treat vapors during the peak loading period. A thermal oxidizer rated for 2,200 ppmv and 2,000 scfm was added to the vapor treatment train, so the operational period did not have to be extended to due to the operating limits of the CatOx. The CatOx will serve as the primary backup for the ThermOx during non-peak operating periods.

During detailed design, it was determined that the existing SVE blowers were inadequate for the anticipated operating conditions based on the capacity of the blower at peak conditions. The existing blowers would also need to be operated very close to the operating limits of the units to process vapor without any dilution air. If the required flow from the wellfield was higher than anticipated or if dilution air needed to be added to prevent LEL conditions/overloading of the oxidizer, the vapors would have to be treated using the backup GAC train. Additionally, during Phase 2 of TCH, the flow may increase by about 15 to 25%, and the existing blower would not be capable of processing the higher flow. Two new blowers capable of approximately 2,000 scfm at 10 in-Hg differential pressure were installed. A redundant blower was installed since an equipment failure would necessitate the use of backup vapor carbon. In the event that the both the CatOx and ThermOx are offline due to mechanical issues or a power outage, the vapor stream will be temporarily processed through a set of two bypass vapor carbon vessels in series. During peak operations, it was estimated that 5,000 lbs of VGAC would be used per day during continuous operations.

The existing vapor/liquid separator was also upgraded to a 250-gallon unit with a transfer pump. The transfer pump is utilized to transfer liquid collected in the vapor/liquid separator into Building 294 for treatment using the organoclay filter before the water is sent to the CTP for final treatment. Additional upgrades included the in-line filter, air dilution valve, gate valve, and larger diameter piping. The existing flammability analyzer for lower flammable limit monitoring (LFL/LEL) for the SVE system was also upgraded since the existing unit was not adequate for the TCH application since the TCH vapor waste stream temperature exceeds the ability of the existing model. Two new redundant units were installed. The redundant units would facilitate one unit being online at all times during calibration and maintenance on the units. The existing FID analyzer was re-used. However, it was relocated into the VES Building blower room. The shorter length of the FID sample line will prevent moisture build-up, decrease the reaction time of the FID analyzer, and also allow for needed space in the VES Building control room for the additional blower VFDs.

Groundwater from the MPEs, entrained liquids, and condensate generated is treated using the liquid pre-treatment system by cooling, phase separation, and filtration prior to being transfer to the Area D groundwater extraction building (Building 294B). The conveyance line for abandoned extraction well D-R12 was used to transfer that water to Building 294. The tie-in of the temporary TCH treatment system into the existing conveyance lines is in the vicinity of the temporary TCH treatment system. The temporary TCH treatment system consists of liquid pretreatment system components that are skid mounted. The TCH liquid treatment train consists of the following major equipment:

- Weir tank and pumps.
- Bag filters.
- Liquid heat exchanger.
- Oil/water separator and pumps.
- Sludge pumps.
- Sludge drum.
- Existing Area D product tank.
- Effluent equalization tank and pumps.

LNAPL that accumulates in the weir tank or oil/water separator is skimmed off and transferred by gravity to a 1,000-gallon double-walled NAPL storage tank. The original Area D 1,000-gallon tank was re-located and re-purposed for use in the TCH system.

The existing 7,500 lb organoclay filter located in Building 294 provides the third level of protection to mitigate the introduction of free phase product from the Area D wellfield into the CTP process stream. The first level of protection is the product sensors present in the groundwater extraction wells. The second level of protection is the transducer located well above the extraction pump intact. It takes approximately three weeks to drain and dry the water-soaked media from the existing organoclay unit prior to a media change out. During this draining period, the organoclay filter is bypassed, and the CTP process stream is protected from the introduction of free phase product by the first and second levels of protection discussed above. TerraTherm has determined that the TCH system will contain 24 mg/l of

free phase hydrocarbons. As a result, continuous pre-treatment with organoclay filtration is required to protect the CTP t. To eliminate TCH system downtime during media change out, two 5,000 lb vessels plumbed in series with two additional 5,000 lb vessels on-site to allow for a nearly instantaneous switch-over during peak operating periods of TCH system operation. Following switch out of the initial two vessels, the media in the two used vessels will be replaced. The two 5,000 lb vessels were placed online in March 2019 prior to the start of the TCH system.

In order to facilitate the backwashing of the organoclay units without taking Area D offline, flexible and hard piping were installed to allow discharge to a 10,000 gallon frac tank staged along the south side of Building 294. Process water from the Clearwell Tank T-4 is used to backwash the organoclay units. The original 7,500-pound organoclay vessel is placed online and the valves to the 5,000 pound vessels are closed to isolate the vessels. The vessels are backwashed one at a time. The flexible hoses connected to the two vessels are disconnected and 2-inch lay flat hoses are connected to both the inlet and outlet connections on the vessel. The process water from Clearwell Tank Tank 4 (old gallery process line in Building 294) flows through the vessel in reverse and exits the vessel through 2-inch lay flat hose to a 10,000 gallon frac tank located outside Building 294. After both vessels are backwashed, the 2-inch lay flat hoses are disconnected and the flexible hoses are reconnected to the vessels. The valves to the 5,000 pound vessels are opened and the valves to the 7,500 pound vessel are closed. The backwash water in the frac tank is settled and later transferred via a sump pump in the frac tank to the CTP through the Area D Main Control Building header.

OU02 - Area 20A - Salvage Yard Area

Area 20A Deep Extraction Wells

In March 2015, B-EW1D was shut off due to the “O” ring was passing and water is flowing back into the well. The well was placed back online in March 2016.

In April 2016, the extraction well pumps in 20A-EW1, 20A-EW2, 20A-EW3, and 20A-EW4 were replaced with pumps capable of meeting the extraction requirement at a lower pressure to reduce the operating pressure of the influent line piping and energy savings.

Area 20A Shallow Extraction Wells

In January 2015, shallow extraction wells 20A-EW2S and 20A-EW3S were taken offline for the ISCR injection in the Salvage Yard which was performed as part of the Area 20A Enhancement project. The wells were placed back online in December 2015.

Injection Wells Redevelopment Area 20A

The Area 20A injection wells were redeveloped in October/November 2016 due to diminished performance in the wells.

Area 20A Temporary Carbon Filters

In July 2018, leaks were discovered in four carbon filters. The vessels were taken offline while a permanent solution to repair or replace the vessels is determined. Four additional carbon vessels were identified to be leaking in April 2019. Pig Multi-Purpose Epoxy Putty was applied to all eight leaking vessels which were then returned to service. The FAA is currently evaluating a permanent solution for the treatment trailers currently located at Area 20A.

AECOM Five-Year Review Information

Date Period: October 2014 to April 2019

OU06 - Areas 29 and K - Fire Training Area and Storage Area

Area 29 GWRS

In October 2015, holes were identified in the lead carbon vessel. The system was taken offline until the replacement skid was installed in December 2015.

The GWTS was taken offline for the soil excavation project in May 2016. All groundwater extraction wells were subsequently abandoned prior to the soil excavation projection. The GWTS was used to treat water from the soil excavation project for both Phase 1 and Phase 2 of the soil excavation. Two additional carbon vessels were added to the GWTS in June 2015 to remove PFAS.

In May 2017, the dewatering of the soil excavation project was completed, and shortly after that all tanks were emptied and cleaned and lock out/tag out of all equipment was implemented. The GWTS is offline, and the AOC is currently in the post-construction monitoring phase.

OU07 - Area 41 - Fuel Farm & Photo Lab

Area 41 Extraction Wells

Extraction at Area 41 has diminished since the last 5-year review since the wells cannot maintain the minimum flow rate. Development efforts have only extended the operation of the wells a few months at a time. Downhole video camera inspections of the Area 41 extraction wells in May 2017 revealed the wells are grossly fouled. The wells were last operated: 41-EW1S in March 2014, 41-EW2S in May 2016 and January 2018, 41-EW3S in April 2015, 41-EW4S in December 2014, 41-EW5S in April 2015, and 41-EW6S in January 2014.

OU08 - Area B - Navy Fire Test Facility

Area B Shallow Extraction Wells

B-EW4S was not operated since the last 5-year review at the FAA direction due to the presence of elevated mercury. The well was last operated in June 2010.

B-EW6S was not operated since the last 5-year review due to the presence of roots in the well. The well was last operated in May 2013.

Area B Deep Extraction Wells

Extraction well B-EW3D has not been used because groundwater modeling indicated that capture of the plume could be maintained without operating that well. Groundwater extraction was discontinued at the two most downgradient extraction wells B-EW4D and B-EW2M in September 2014 since dissolved CVOCs were below the Area B ROD Cleanup Criteria. Quarterly monitoring of shallow/intermediate and intermediate wells in the area continues to ensure that no rebound of CVOC levels above ROD cleanup levels occurs.

In April 2016, the extraction well pumps in B-EW1M, B-EW1D, and B-EW2D were replaced with pumps capable of meeting the extraction requirement at a lower pressure to reduce the operating pressure of the influent line piping and energy savings.

OU13 - Area E - Bldg. 11 Tank Excavation

Area E Extraction Wells

E-EW6S were abandoned as part of the Area E Number 6 oil impacted soil removal in March 2015.

The Area E extraction wells were redeveloped in March 2016 due to diminished performance in the wells.

Extraction wells EW1 through EW4 were taken offline for PlumeStop injections on April 1, 2019. The FAA will determine after the completion of the injection project if the wells need to be placed back online.

AREA D

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LEGEND

- Area D Well ID with Free Product Product Thickness (feet)
- Area D Well
- Free Product Extent (December 2015)

D-OW11
0.14

D-OW2
0.14

D-OW1
0.80

D-OW14
0.06

D-OW10
0.10

D-R9
0.73

D-R6
4.48

D-OW9
1.22

D-R4
0.80

N
W E
S

0 100 200 400 Feet

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AREA D
Free-Phase Product Observation Map
December 2015

AECOM

FIGURE
2-9

Federal Aviation Administration
William J. Hughes Technical Center

Area D
December 2018
Free-Phase Product Observation Map
Figure 2-9

Legend

Free-Phase Product Present
- Vapor Extraction Well
- Observation Well
- Extraction Well

Free-Phase Product Thickness
Feet
- High : 0.58
- Low : 0.015

Wells Sampled
- Monitoring Well
- Piezometer
- Vapor Extraction Well
- Observation Well
- Extraction Well
- Synthetic Point

Natural Features
- Streams
- Water Bodies

Building Footprint

N
W E
S

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- The orthophotography shown on this map was taken in April, 2015.
- The approximate limits of free-phase product were estimated by the kriging method in Earth Volumetric Studio 2017.6 using the LNAPL thickness sampling data from December, 2018.
- Synthetic points are assumed to augment measured data in a manner consistent with site knowledge.

REVIEWED BY		ISSUED BY	APPROVED BY
MC		SITE ENGINEERING SECTION ANG-E343 - GIS PROGRAM	J Floyd
UD			APPROVED
TG		DESIGNED M Jenkins	DATE 2/1/2019
		CHECKED M Cicali	MAP #

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AREA 20A

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LEGEND

- Pilot Test Area
- Area of Concern

Area 20A IRM

Area 20A

PlumeStop Pilot Test Area

MASP Pilot Test Area

Perozone Pilot Test Area

201A, 201, 215, 245, 204, 274, 213, 273, 276, 210, 211, 211B, 211A, 203, 236, 208A, 208, 205, 209, 212, 217, 292, 277, 288, 275, 202, 202A, 216, 206, 287, 222, 214, 214A, 207, 207A, 298, 299, 296

N W E S

0 150 300 600 Feet

REFERENCES:
Mapping coordinate system: New Jersey State Plane NAD 1983
Elevation datum: NAVD88.
Aerial Orthophotography: Provided by Merrick and Co dated April 2015.
Planimetric Features: Provided by Merrick and Co dated April 2015.
Well Features: Obtained from FAA GIS database.

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AREA 20A

2018 Pilot Study Areas

AECOM

FIGURE 1

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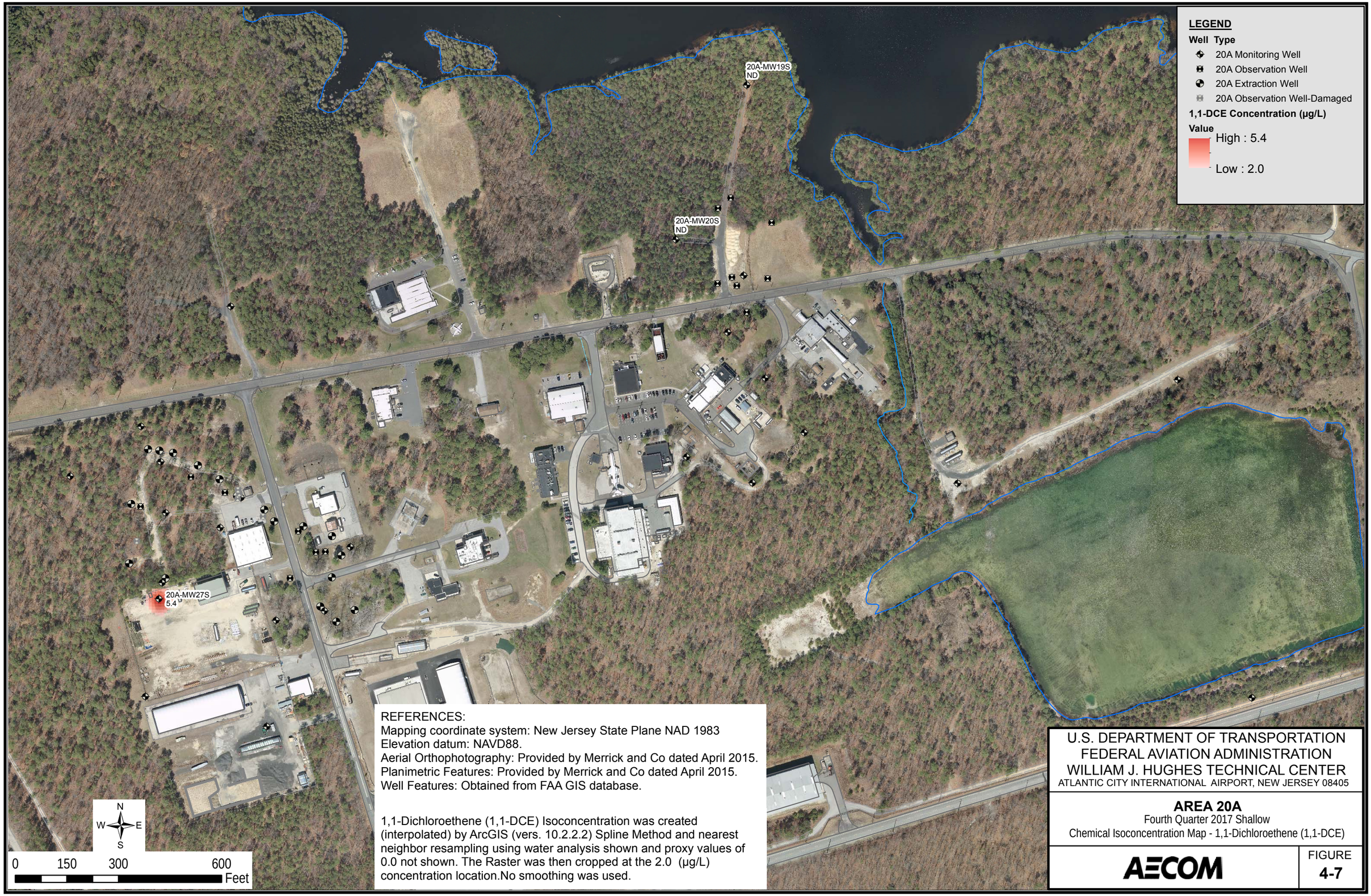

LEGEND

Well Type

- 20A Monitoring Well
- 20A Observation Well
- 20A Extraction Well
- 20A Observation Well-Damaged

1,1-DCE Concentration (µg/L)

Value

High : 5.4

Low : 2.0

REFERENCES:
Mapping coordinate system: New Jersey State Plane NAD 1983
Elevation datum: NAVD88.
Aerial Orthophotography: Provided by Merrick and Co dated April 2015.
Planimetric Features: Provided by Merrick and Co dated April 2015.
Well Features: Obtained from FAA GIS database.

1,1-Dichloroethene (1,1-DCE) Isoconcentration was created (interpolated) by ArcGIS (vers. 10.2.2.2) Spline Method and nearest neighbor resampling using water analysis shown and proxy values of 0.0 not shown. The Raster was then cropped at the 2.0 (µg/L) concentration location.No smoothing was used.

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AREA 20A

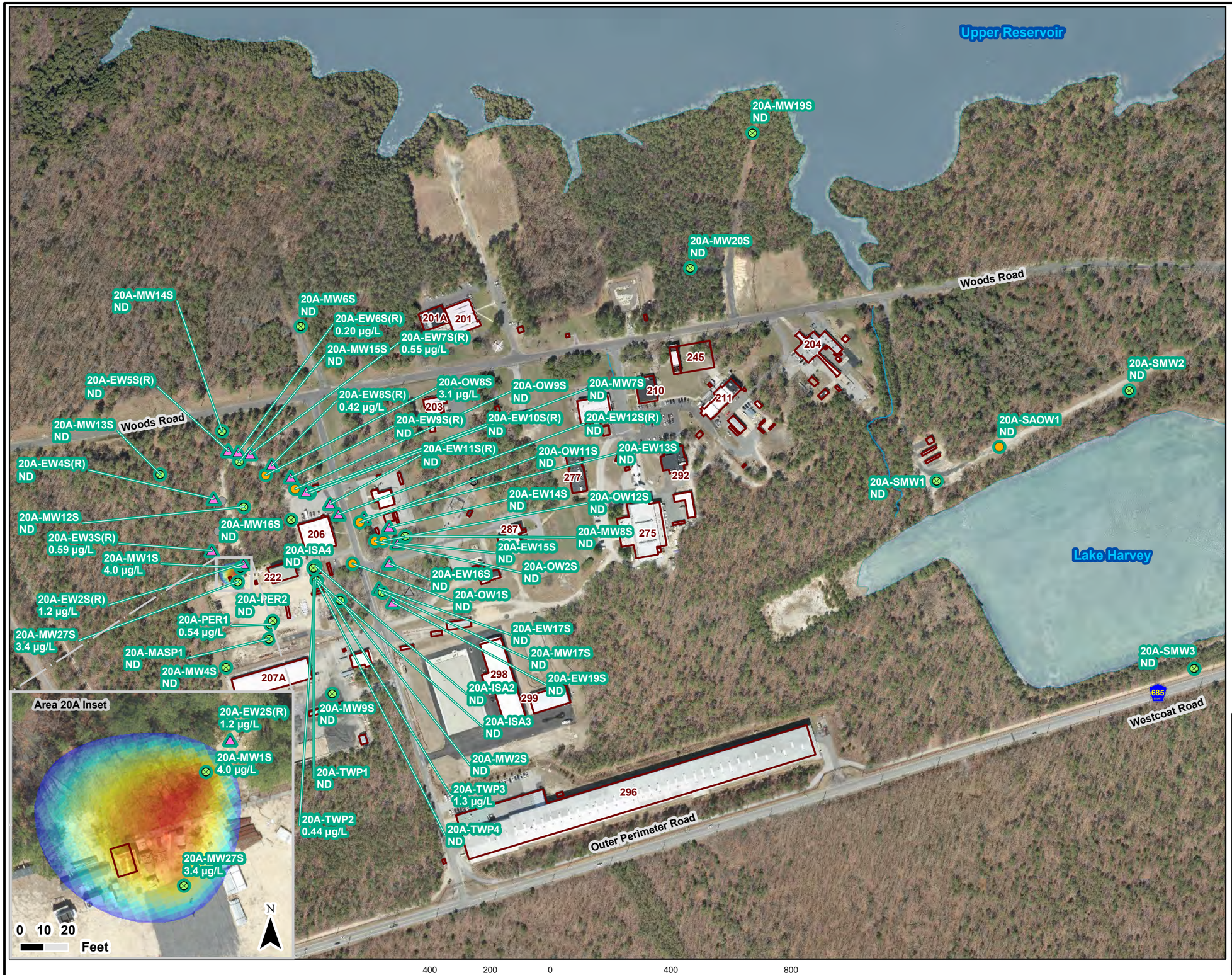
Fourth Quarter 2017 Shallow
Chemical Isoconcentration Map - 1,1-Dichloroethene (1,1-DCE)

AECOM

FIGURE
4-7

Federal Aviation Administration
William J. Hughes Technical Center

Area 20A
Fourth Quarter 2018
Estimated Shallow Chemical Isoconcentration Map – 1,1-DCE
Figure 4-7



Legend

Sampled Locations
- Monitoring Well
- Observation Well
- Extraction Well

Abandoned or Damaged Wells
- Other
- Monitoring Well
- Extraction Well

Natural Features
- Streams
- Water Bodies

Building Footprint

Shallow DCE (µg/L)
Value
High : 4.0
Low : 2.0

N
W E
S

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ATLANTIC CITY, NEW JERSEY 08405

- The orthophotography shown on this map was taken in April, 2015.
- The estimated 1,1-DCE plume extent was created in Earth Volumetric Studio (2017.6) using 2D Kriging with max values. The outer limits of the plume represent a 2.0 µg/L concentration.

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MC		SITE ENGINEERING SECTION ANG-E343 - GIS PROGRAM	J Floyd
UD			APPROVED
TG		DESIGNED M Jenkins	DATE 2/1/2019
		CHECKED M Cicali	MAP #

FILE PATH : J:\projects\superfund_proj\Quarterly_Reports\apr\2018_4Q\Figure_4_7_Area20A_Shallow_DCE.mxd

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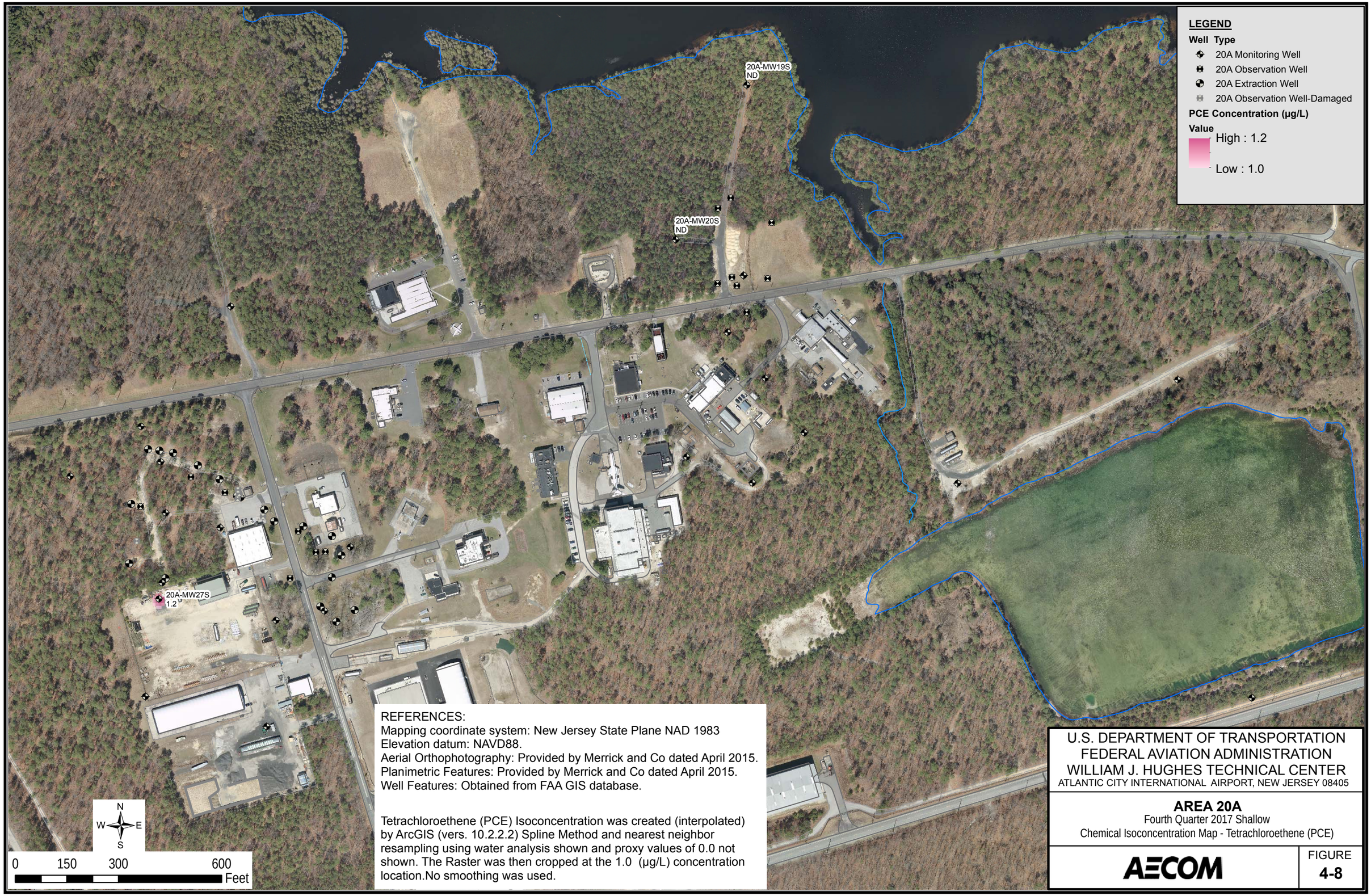
Author: K-Gardner

Path: J:\ArcGIS\Projects\FAA_GIS\AtlanticCity\Area_20A\deliverables\aprs\2017_chem\Area20A_S_4th_2017_PCE.mxd



LEGEND

Well Type

- 20A Monitoring Well
- 20A Observation Well
- 20A Extraction Well
- 20A Observation Well-Damaged

PCE Concentration (µg/L)

Value

High : 1.2

Low : 1.0

REFERENCES:
Mapping coordinate system: New Jersey State Plane NAD 1983
Elevation datum: NAVD88.
Aerial Orthophotography: Provided by Merrick and Co dated April 2015.
Planimetric Features: Provided by Merrick and Co dated April 2015.
Well Features: Obtained from FAA GIS database.

Tetrachloroethene (PCE) Isoconcentration was created (interpolated) by ArcGIS (vers. 10.2.2.2) Spline Method and nearest neighbor resampling using water analysis shown and proxy values of 0.0 not shown. The Raster was then cropped at the 1.0 (µg/L) concentration location.No smoothing was used.

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AREA 20A

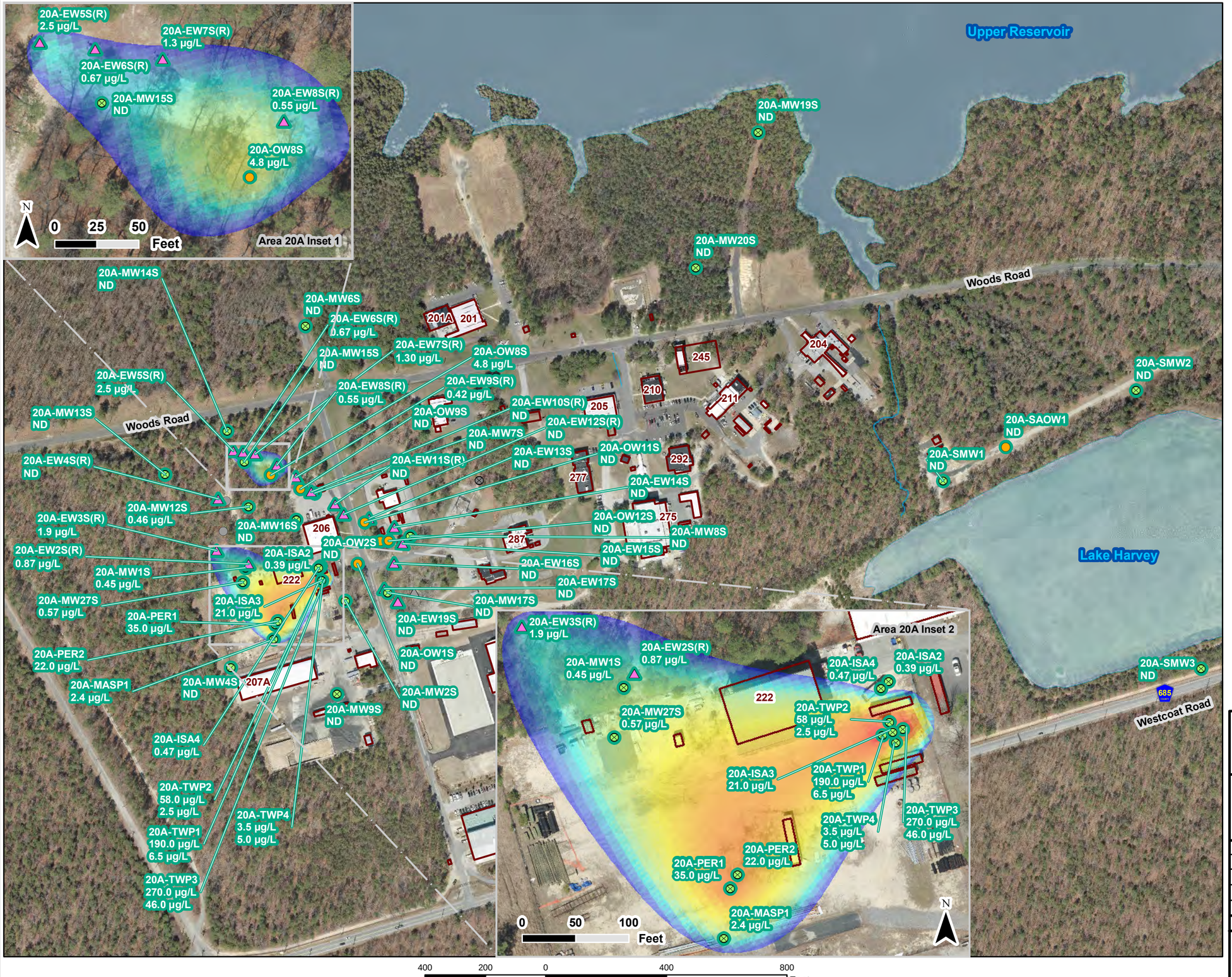
Fourth Quarter 2017 Shallow
Chemical Isoconcentration Map - Tetrachloroethene (PCE)

AECOM

FIGURE
4-8

Federal Aviation Administration
William J. Hughes Technical Center

Area 20A
Fourth Quarter 2018
Estimated Shallow Chemical Isoconcentration Map – PCE
Figure 4-8



Legend

Sampled Locations
- Monitoring Well
- Observation Well
- Extraction Well

Abandoned or Damaged Wells
- Other
- Monitoring Well
- Extraction Well

Natural Features
- Streams
- Water Bodies

Building Footprint

Shallow PCE (µg/L)
Value
High : 270
Low : 1.0

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- The orthophotography shown on this map was taken in April, 2015.
- The estimated PCE plume extent was created in Earth Volumetric Studio (2017.6) using 2D Kriging with max values. The outer limits of the plume represent a 1.0 µg/L concentration.

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MC		SITE ENGINEERING SECTION ANG-E343 - GIS PROGRAM	J Floyd
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TG		DESIGNED M Jenkins	DATE 2/1/2019
		CHECKED M Cicali	MAP #

FILE PATH : J:\projects\superfund_proj\Quarterly_Reports\apr\2018_4Q\Figure_4_8_Area20A_Shallow_PCE.mxd

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Author: K-Gardner

Path: J:\ArcGIS\Projects\FAA_GIS\AtlanticCityArea_20A\deliverables\aprs\2014_chemArea20A_2014_10int11DCE.mxd

20A-ACMUA8S 4.7
20A-MW21I ND
20A-DMW2 1.6
20A-EW2 1.1
20A-MW21D 2.6
20A-EW4 1.1
20A-MW19I 2.4
20A-MW19D ND
20A-MW18I ND
20A-DMW1 ND
20A-EW1 ND
20A-DMW3 ND
20A-EW3 0.61
20A-MW20D ND
20A-MW20I ND
20A-MW23D ND
20A-MW25I 2.5
20A-MW23I ND
20A-MW10D 0.92
20A-MW24I ND
20A-MW26D ND
20A-MW26I ND
20A-MW22I 3.7
20A-MW22D ND
20A-MW5D 1.1
20A-MW27D 0.38
20A-MW27I 1.0

LEGEND

- 20A WELL ID
  1,1-DCE Concentration
- 20A-WELL (Intermediate)
- Area 20A Injection Well

1,1-DCE Concentration (µg/L)

Value

High : 4.7

Low : 2.0

N
W E
S

0 150 300 600 Feet

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AREA 20A
Fourth Quarter 2014 Intermediate
Chemical Isoconcentration Map - 1,1-Dichloroethene (1,1-DCE)

AECOM

FIGURE
4-7

Federal Aviation Administration
William J. Hughes Technical Center

Area 20A
Fourth Quarter 2018
Estimated Intermediate Chemical Isoconcentration Map – 1,1-DCE
Figure 4-10

The intermediate aquifer is not hydraulically connected to the reservoir due to a strong downward gradient caused by the pumping of the ACMUA production wells. The actual downgradient extent of the plume is not known due the presence of the reservoir. Flow direction is based on modeled results using ModFlow when 20A-EW1 is operated at 36 gpm, 20A-EW2 is at 36 gpm, 20A-EW3 is at 121 gpm. Current pumping rates exceed previously modeled flow rates.

Upper Reservoir

ACMUA-8S 0.31 µg/L
20A-MW21D 1.1 µg/L
20A-MW21I ND
20A-EW4 0.51 µg/L
20A-MW19I 0.14 µg/L
20A-MW19D ND
20A-MW18I ND
20A-DMW2 1.9 µg/L
20A-EW2 0.83 µg/L
20A-DMW1 ND
20A-DMW3 0.26 µg/L
20A-EW1 ND
20A-MW23D ND
20A-MW23I ND
20A-EW3 0.57 µg/L
20A-MW20I ND
20A-MW20D ND
20A-IAMW5 ND
20A-IAMW2 ND
20A-IAMW3 ND
Woods Road
20A-MW25I 0.28 µg/L
20A-MW24I ND
201A
201
20A-MW10D 1.3 µg/L
204
245
20A-MW26I ND
20A-MW26D ND
20A-MW22I 5.8 µg/L
20A-MW22D ND
210
211
205
Woods Road
20A-MW14D ND
20A-PRB2 0.77 µg/L
20A-PRB1 0.21 µg/L
20A-MW5D 0.54 µg/L
292
277
20A-IAMW1 ND
20A-MWD 4 µg/L
20A-MW27D 0.87 µg/L
206
275
287
20A-MW27I 0.93 µg/L
20A-MW2D 0.72 µg/L
Lake Harvey
298
299
20A-IAMW4 ND
685
Westcoat Road
296
Outer Perimeter Road

Area 20A Inset
20A-MW22I 5.8 µg/L
20A-MW22D ND
20A-MWD 4 µg/L
Pangborn Road
N
0 60 120 Feet

400 200 0 400 800 Feet

Legend

Sampled Locations
- Monitoring Well
- Extraction Well

Active Wells
- Injection Well

Abandoned or Damaged Wells
- Other
- Monitoring Well
- Extraction Well

Natural Features
- Streams
- Water Bodies

Building Footprint

Intermediate 1,1-DCE (µg/L)

Value
High : 5.8
Low : 2.0

N
W E
S

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- The orthophotography shown on this map was taken in April, 2015.
- The estimated 1,1-DCE plume extent was created in Earth Volumetric Studio (2017.6) using 2D Kriging with max values. The outer limits of the plume represent a 2.0 µg/L concentration.

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MC		SITE ENGINEERING SECTION ANG-E343 - GIS PROGRAM	J Floyd
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FILE PATH : J:\projects\superfund_proj\Quarterly_Reports\apr\2018_4Q\Figure_4_10_Area20A_Intermediate_DCE.mxd

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Author: K-Gardner

Path: J:\ArcGIS\Projects\FAA_GIS\AtlanticCityArea_20A\deliverables\aprs\2014_chemArea20A_2014_10intPCE.mxd

20A-ACMUA8S 12.4
20A-MW21I ND
20A-DMW2 3.7
20A-MW21D 3.3
20A-EW2 2.6
20A-MW19I 1.7
20A-MW19D ND
20A-EW4 0.33
20A-MW18I ND
20A-DMW1 ND
20A-EW1 ND
20A-DMW3 ND
20A-EW3 ND
20A-MW20I ND
20A-MW20D ND
20A-MW23D ND
20A-MW25I 5.2
20A-MW23I ND
20A-MW24I ND
20A-MW10D ND
20A-MW26D ND
20A-MW26I 0.40
20A-MW22I ND
20A-MW22D ND
20A-MW5D ND
20A-MW27D ND
20A-MW27I 1.5

LEGEND

- 20A WELL ID
  PCE Concentration
- 20A-WELL (Intermediate)
- Area 20A Injection Well

PCE Concentration (µg/L)

Value

High : 12.4

Low : 1.0

N
W E
S

0 150 300 600 Feet

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AREA 20A
Fourth Quarter 2014 Intermediate
Chemical Isoconcentration Map - Tetrachloroethene (PCE)

AECOM

FIGURE
4-8

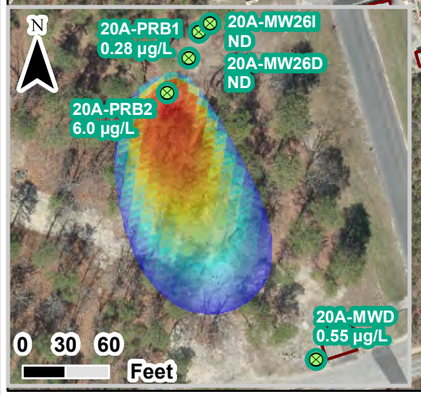
Federal Aviation Administration
William J. Hughes Technical Center

Area 20A
Fourth Quarter 2018
Estimated Intermediate Chemical Isoconcentration Map – PCE
Figure 4-11

The intermediate aquifer is not hydraulically connected to the reservoir due to a strong downward gradient caused by the pumping of the ACMUA production wells. The actual downgradient extent of the plume is not known due the presence of the reservoir. Flow direction is based on modeled results using ModFlow when 20A-EW1 is operated at 36 gpm, 20A-EW2 is at 36 gpm, 20A-EW3 is at 121 gpm. Current pumping rates exceed previously modeled flow rates.

Upper Reservoir

ACMUA-8S 2.1 µg/L
20A-MW21I ND
20A-MW21D 1.7 µg/L
20A-DMW2 3.2 µg/L
20A-EW2 1.5 µg/L
20A-DMW1 ND
20A-EW1 ND
20A-DMW3 ND
20A-EW4 0.26 µg/L
20A-MW19D ND
20A-MW19I ND
20A-MW18I ND
20A-EW3 ND
20A-MW20I ND
20A-MW20D ND
20A-IAMW5 ND
20A-IAMW2 ND
20A-IAMW3 ND
Woods Road
20A-MW25I 0.32 µg/L
20A-MW23D ND
20A-MW23I ND
20A-MW24I ND
20A-MW10D ND
201A
201
204
245
210
211
205
20A-MW26I ND
20A-MW26D ND
20A-MW22I 0.3 µg/L
20A-MW22D ND
Wood Road
20A-MW14D ND
20A-PRB1 0.28 µg/L
20A-PRB2 6.0 µg/L
20A-MW5D ND
277
292
20A-IAMW1 ND
20A-MWD 0.55 µg/L
206
287
275
20A-MW27I 1.2 µg/L
20A-MW27D ND
20A-MW2D ND
207A
298
299
Pangborn Road
Lake Harvey
Westcoat Road
685
20A-IAMW4 ND
296
Outer Perimeter Road
Area 20A Inset



400 200 0 400 800 Feet

Legend

Sampled Locations
- Monitoring Well
- Extraction Well

Active Wells
- Injection Well

Abandoned or Damaged Wells
- Other
- Monitoring Well
- Extraction Well

Natural Features
- Streams
- Water Bodies
- Groundwater Flow Direction (based on Compehensive Ground Model)

Building Footprint

Intermediate PCE (µg/L)
Value
High : 6.0
Low : 1.0

N W E S

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- The orthophotography shown on this map was taken in April, 2015.
- The estimated PCE plume extent was created in Earth Volumetric Studio (2017.6) using 2D Kriging with max values. The outer limits of the plume represent a 1.0 µg/L concentration.

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MC		SITE ENGINEERING SECTION ANG-E343 - GIS PROGRAM	J Floyd
UD			APPROVED
TG		DESIGNED M Jenkins	DATE 2/1/2019
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FILE PATH : J:\projects\superfund_proj\Quarterly_Reports\apr\2018_4Q\Figure_4_11_Area20A_Intermediate_PCE.mxd

AREA 41

Date Saved: 2/8/2016 10:49:51 AM

Author: K-Gardner

Path: J:\ArcGIS\Projects\FAA_GIS\AtlanticCityArea_41\deliverables\aprs\chem\2015\Area41_Xylenes_2015_10.mxd

41-MW1S
ND

41-MW4S
ND

41-MW7S
104.0

41-MW8S
9.3

41-MW9S
ND

41-MW5S
ND

41-MW6S
ND

41-MW12S
ND

41-MW10S
ND

LEGEND

Area 41 - WELL ID
Total Xylenes Result

Area 41 Well

Well Type

Area 41 Monitoring Well

Area 41 Extraction Well

Total Xylenes Concentration (µg/L)

Value

High : 104.0

Low : 2.0

N
W E
S

0 50 100 200
Feet

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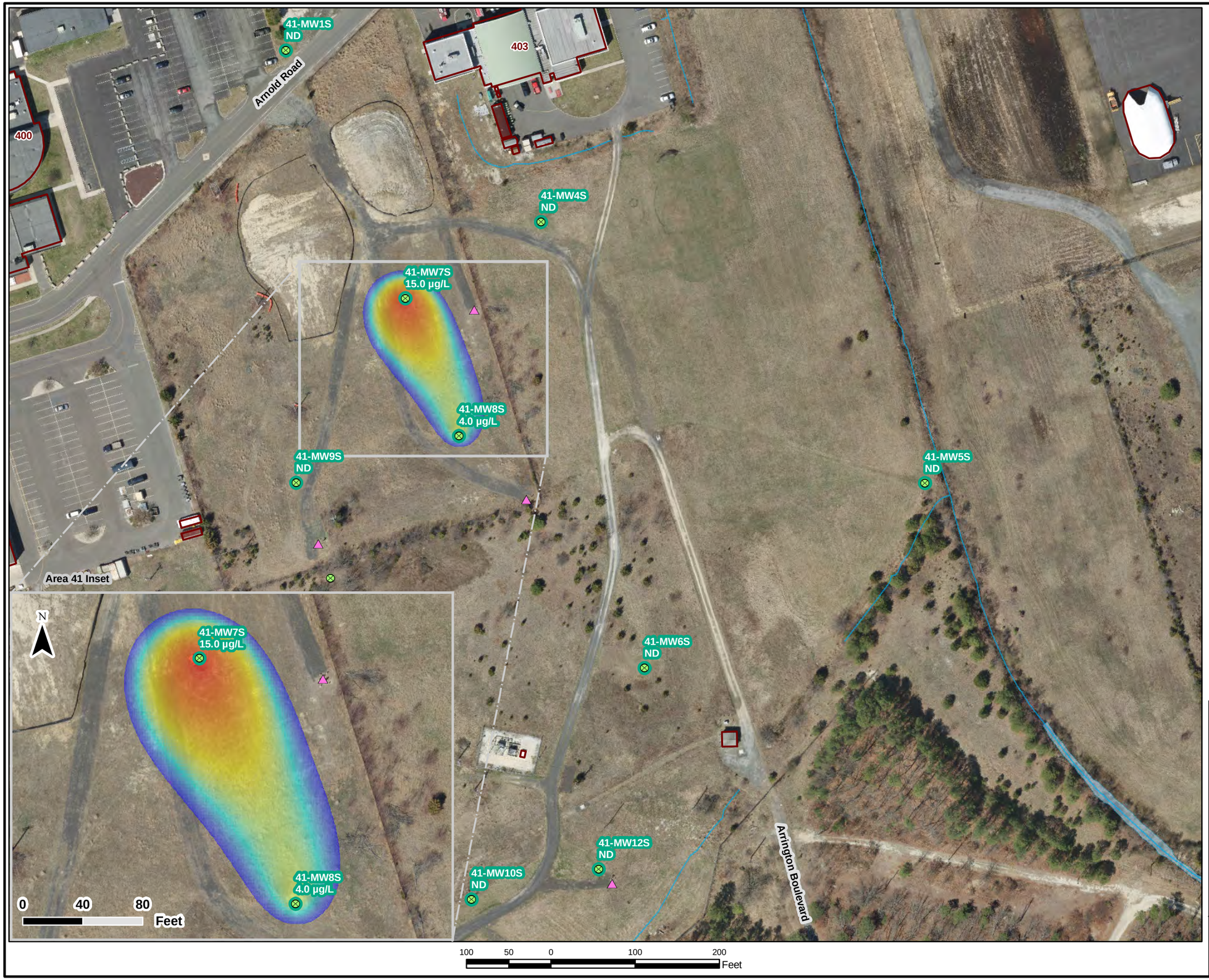
AREA 41
Fourth Quarter 2015 Shallow Chemical Isoconcentration Map
Total Xylenes

AECOM

FIGURE
2-26



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Area 41
Third Quarter 2018
Estimated Shallow Chemical
Isoconcentration Map - Total Xylenes
Figure 2-28

Legend

Sampled Locations
- Monitoring Well

Active Wells
- Monitoring Well
- Extraction Well

Natural Features
- Streams
- Water Bodies

Building Footprint

Shallow Xylene (µg/L)

Value
- High : 15.0
- Low : 2.0

N
W E
S

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- The orthophotography shown on this map was taken in April, 2015.
- The estimated Xylene plume extent was created in Earth Volumetric Studio (2017.6) using 2D Kriging with max values. The outer limits of the plume represent a 2.0 µg/L concentration.

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MC		SITE ENGINEERING SECTION ANG-E343 - GIS PROGRAM	J Floyd
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TG		DESIGNED M Jenkins	DATE 11/1/2018
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FILE PATH : J:\projects\superfund_proj\Quarterly_Reports\apr\2018_3Q\Figure_2_28_Area41_Shallow_Xylene.mxd

REFERENCES:
Mapping coordinate system: New Jersey State Plane NAD 1983
Elevation datum: NAVD88.
Aerial Orthophotography: Provided by Merrick and Co dated April 2015.
Planimetric Features: Provided by Merrick and Co dated April 2015.
Well Features: Obtained from FAA GIS database.

Groundwater Surface:
The Raster Surface was created (interpolated) by ArcGIS (vers. 10.2.2.2) Natural Neighbor Method and nearest neighbor resampling using water levels from the monitoring wells with the Groundwater elevations shown. Groundwater surface contours were then extracted and cropped using the Surface Boundary shown. No smoothing was used on GW contours shown.

LEGEND

Groundwater Elevation (feet NAVD 1988)

Well Type

- Area 41 Monitoring Well
- Area 41 Extraction Well
- Groundwater Flow Direction
- Potentiometric Surface Contour (Interval = 1 ft)
- Boundary used for limiting extent of GW Contours

41-MW1S 36.03
41-MW4S 42.07
41-MW7S 39.96
41-EW1
41-MW8S 40.86
41-MW9S 37.98
41-EW3
41-MW5S 36.73
41-EW2
41-MW2S DRY
41-MW6S 41.76
41-MW3S 37.04
41-MW12S 41.46
41-EW5
41-MW10S 42.38
41-EW4
41-EW6
41-MW11S NM

37 38 39 40 41

N W E S

0 50 100 200 Feet

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AREA 41
Shallow Aquifer Groundwater Elevation Contour Map
December 2017

AECOM

FIGURE
2-21

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Area 41
Shallow Aquifer
Groundwater Elevation Contour Map
December 2018
Figure 2-21

Legend

- Groundwater Flow Direction
- Extent of Model Boundary
- Potentiometric Surface Contour (Interval = 1 ft)

Groundwater Wells (NAVD 1988 ft)

- Monitoring Well
- Extraction Well

Natural Features

- Streams
- Water Bodies

Building Footprint

N
W E
S

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- The orthophotography shown on this map was taken in April, 2015.
- The groundwater contours were generated in Earth Volumetric Studio 2017.6 with the Natural Neighbors estimation method and a 20% boundary offset using water levels from the groundwater wells with elevations shown.

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MC		SITE ENGINEERING SECTION ANG-E343 - GIS PROGRAM	J Floyd
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FILE PATH : J:\projects\superfund_proj\Quarterly_Reports\apr\2018_4Q\Figure_2_21_Dec_41_Shallow_GW_Contours.mxd

AREA B

Date Saved: 2/12/2018 6:07:36 PM

Author: K-Gardner

Path: J:\ArcGIS\Projects\FAA_GIS\AtlanticCity\Area_B\deliverables\aprs\chem\2017\AreaB_4th_2017_S_PCE.mxd

LEGEND

Well Type

- Area B Monitoring Well
- Area B Observation Well
- Area B Extraction Well
- Area B Extraction Well-Damaged
- Area B Piezometer
- Stream Gauge

Tetrachloroethene Concentration (µg/L)

Value

High : 9.5

Low :1.0

B-MW7S
ND

B-MW2S
ND

B-MW5S
9.5

B-MW6S
8.6

B-MW11S
ND

B-MW12S
ND

B-MW13S
ND

N
W E
S

0 100 200 400 Feet

REFERENCES:
Mapping coordinate system: New Jersey State Plane NAD 1983
Elevation datum: NAVD88.
Aerial Orthophotography: Provided by Merrick and Co dated April 2015.
Planimetric Features: Provided by Merrick and Co dated April 2015.
Well Features: Obtained from FAA GIS database.

Tetrachloroethene Isoconcentration was created (interpolated) by ArcGIS (vers. 10.2.2.2) Spline Method and nearest neighbor resampling using water analysis shown and proxy values of 0.0 not shown. The Raster was then cropped at the 1.0 (µg/L) concentration location.No smoothing was used.

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AREA B

Fourth Quarter 2017 Shallow Chemical Isoconcentration Map
Tetrachloroethene (PCE)

AECOM

FIGURE
2-25

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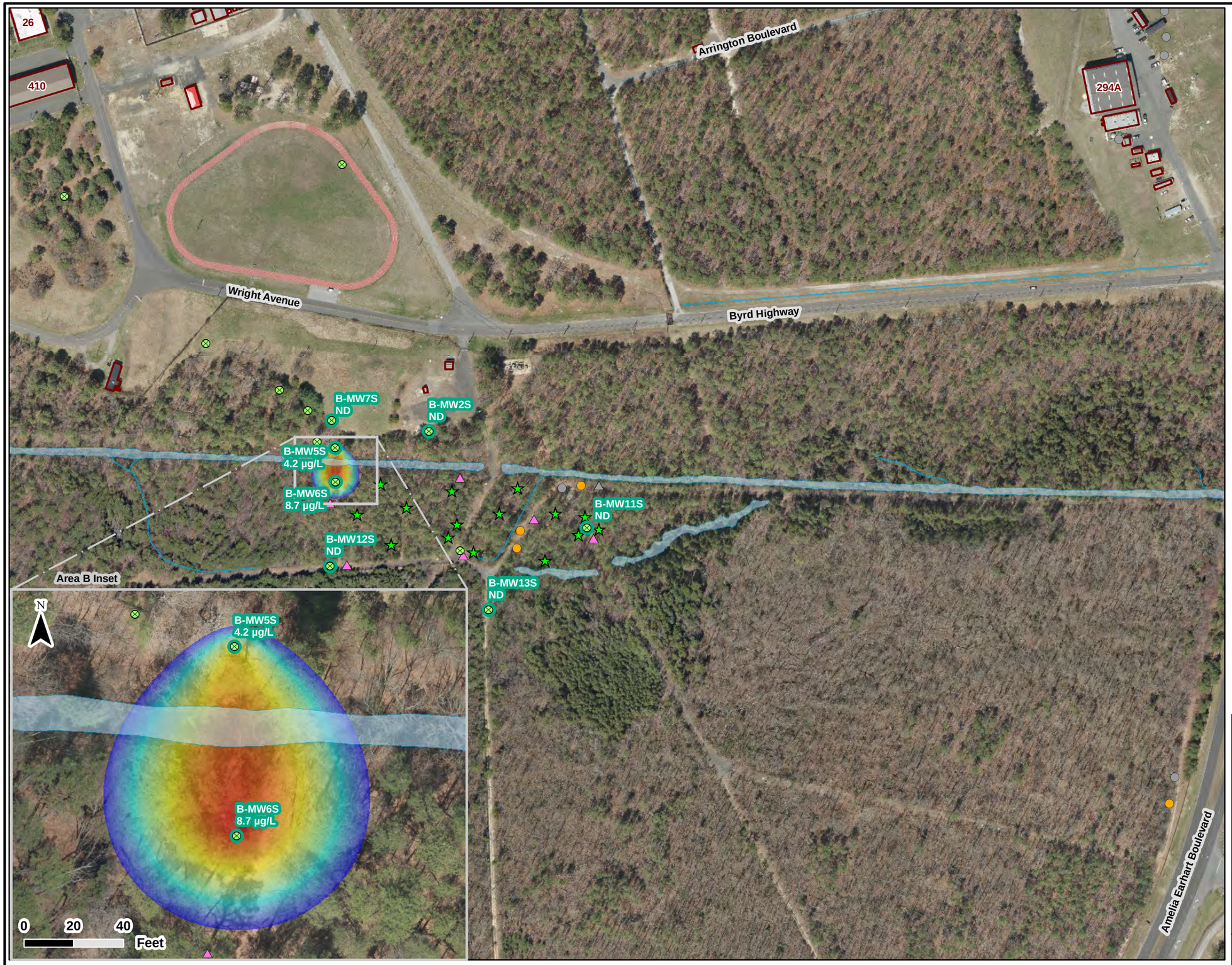
Area B
Fourth Quarter 2018
Estimated Shallow Chemical Isoconcentration Map - PCE
Figure 2-26



Legend

Sampled Locations
- Monitoring Well

Active Wells
- Monitoring Well
- Piezometer
- Observation Well
- Extraction Well

Abandoned or Damaged Wells
- Other
- Extraction Well

Natural Features
- Streams
- Water Bodies

Building Footprint

Shallow PCE (µg/L)
Value
High : 8.7
Low : 1.0

N
W E
S

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ATLANTIC CITY, NEW JERSEY 08405

- The orthophotography shown on this map was taken in April, 2015.
- The estimated PCE plume extent was created in Earth Volumetric Studio (2017.6) using 2D Kriging with max values. The outer limits of the plume represent a 1.0 µg/L concentration.

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MC		SITE ENGINEERING SECTION ANG-E343 - GIS PROGRAM	J Floyd
UD			APPROVED
TG		DESIGNED M Jenkins	DATE 2/1/2019
		CHECKED M Cicali	MAP #

FILE PATH : J:\projects\superfund_proj\Quarterly_Reports\apr\2018_4Q\Figure_2_26_AreaB_Shallow_PCE.mxd

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Author: K-Gardner

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LEGEND

Location

Area B Well - Result if sampled

Mercury Concentration (µg/L)

Value

High : 1.7

Low : 0.6

B-MW6S
ND

B-MW11S
1.5

B-MW12S
1.7

B-MW13S
ND

N
W E
S

0 100 200 400
Feet

REFERENCES:
Mapping coordinate system: New Jersey State Plane NAD 1983
Elevation datum: NAVD88.
Aerial Orthophotography: Provided by Merrick and Co dated April 2015.
Planimetric Features: Provided by Merrick and Co dated April 2015.
Well Features: Obtained from FAA GIS database.

Mercury Isoconcentration was created (interpolated) by ArcGIS (vers. 10.2.2.2) Spline Method and nearest neighbor resampling using water analysis shown and proxy values of 0.0 not shown. The Raster was then cropped at the 0.6 (µg/L) concentration location.No smoothing was used.

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AREA B

Fourth Quarter 2016 Shallow Chemical Isoconcentration Map
Mercury

AECOM

FIGURE
2-26

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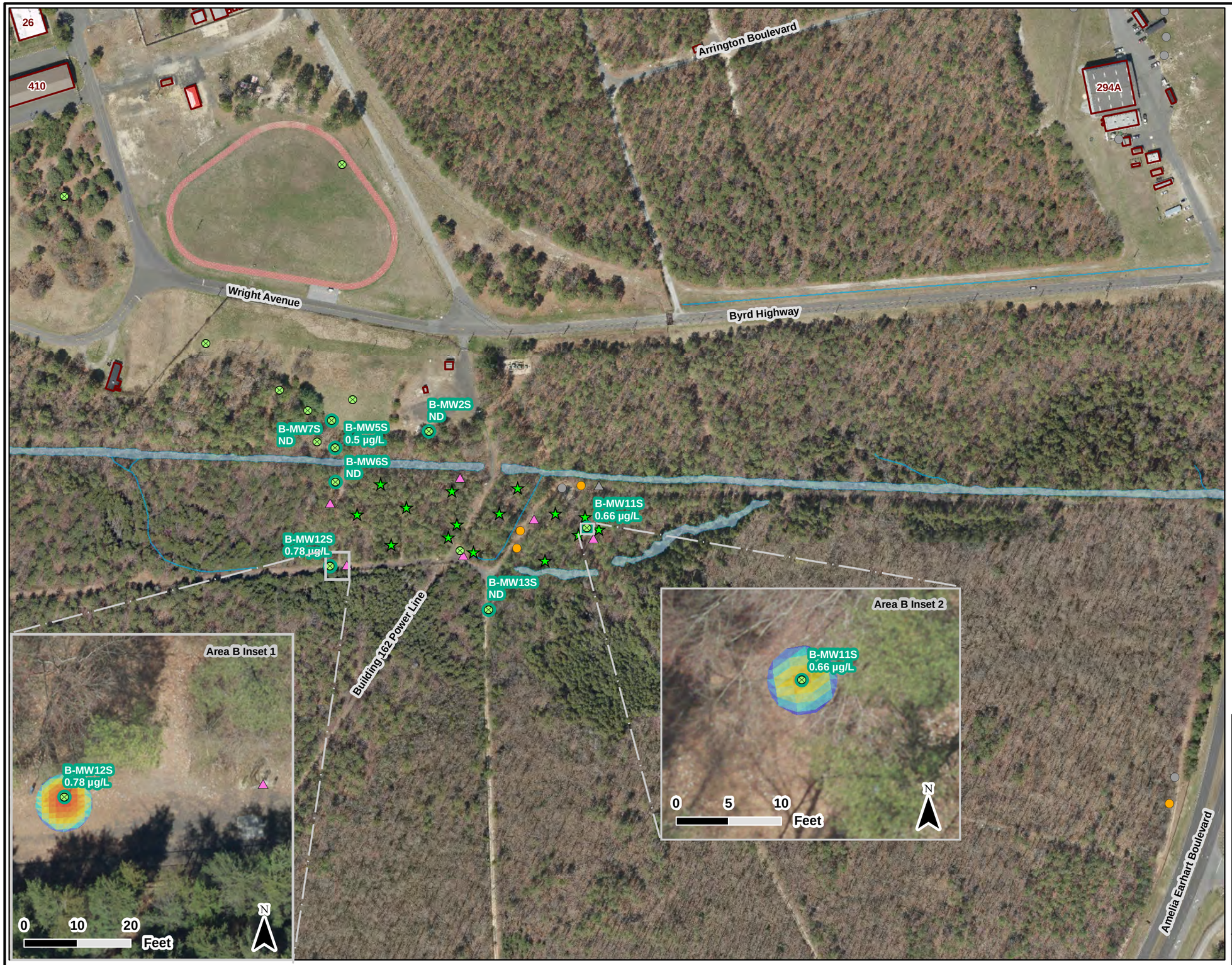
Area B
Fourth Quarter 2018
Estimated Shallow Chemical Isoconcentration Map - Mercury
Figure 2-27



Legend

Sampled Locations
- Monitoring Well

Active Wells
- Monitoring Well
- Piezometer
- Observation Well
- Extraction Well

Abandoned or Damaged Wells
- Other
- Extraction Well

Natural Features
- Streams
- Water Bodies

Building Footprint

Shallow Mercury (µg/L)

Value
High : 0.78
Low : 0.6

N
W E
S

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FEDERAL AVIATION ADMINISTRATION
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- The orthophotography shown on this map was taken in April, 2015.
- The estimated Mercury plume extent was created in Earth Volumetric Studio (2017.6) using 2D Kriging with max values. The outer limits of the plume represent a 0.6 µg/L concentration.

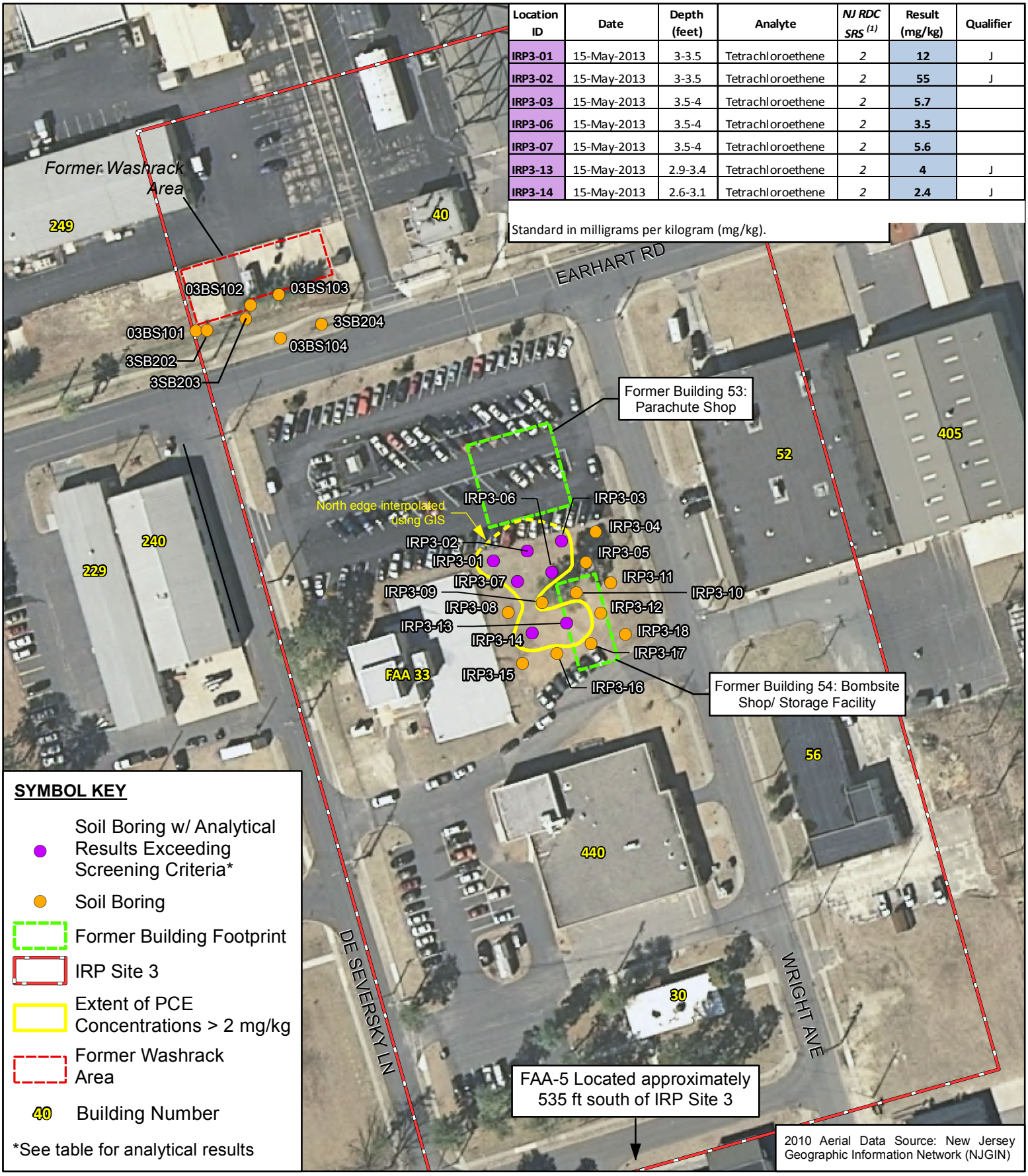
REVIEWED BY		ISSUED BY	APPROVED BY
MC		SITE ENGINEERING SECTION ANG-E343 - GIS PROGRAM	J Floyd
UD			APPROVED
TG		DESIGNED M Jenkins	DATE 2/1/2019
		CHECKED M Cicali	MAP #

FILE PATH : J:\projects\superfund_proj\Quarterly_Reports\apr\2018_4Q\Figure_2_27_AreaB_Shallow_Mercury.mxd

NJANG SITE 3

Location ID	Date	Depth (feet)	Analyte	NJ RDC SRS (1)	Result (mg/kg)	Qualifier
IRP3-01	15-May-2013	3-3.5	Tetrachloroethene	2	12	J
IRP3-02	15-May-2013	3-3.5	Tetrachloroethene	2	55	J
IRP3-03	15-May-2013	3.5-4	Tetrachloroethene	2	5.7	
IRP3-06	15-May-2013	3.5-4	Tetrachloroethene	2	3.5	
IRP3-07	15-May-2013	3.5-4	Tetrachloroethene	2	5.6	
IRP3-13	15-May-2013	2.9-3.4	Tetrachloroethene	2	4	J
IRP3-14	15-May-2013	2.6-3.1	Tetrachloroethene	2	2.4	J

Standard in milligrams per kilogram (mg/kg).



SYMBOL KEY

- Soil Boring w/ Analytical Results Exceeding Screening Criteria*
- Soil Boring
- Former Building Footprint
- IRP Site 3
- Extent of PCE Concentrations > 2 mg/kg
- Former Washrack Area
- 40 Building Number

*See table for analytical results

New Jersey Air National Guard
177th Fighter Wing
Egg Harbor Township, NJ

N

FIGURE 2-8
IRP Site 3 - Extent of Soil Impacts
Record of Decision
New Jersey Air National Guard 177th Fighter Wing
Egg Harbor Township, New Jersey

0 25 50 75 100 125 Meters
0 100 200 300 400 Feet

03/23/2018 | File: E_Harbor_NJ_ANG_Site_3_Extent_Soil_FS_2015.mxd
PROJ: 276220119 | Drawn: JBO

AREA E

Date Saved: 1/14/2015 1:18:23 PM

Path: J:\ArcGIS\Projects\FAA_GIS\AtlanticCity\AreaE_FES\AreaE_FES_MXDs\Area_E_SiteLocation_StagingAreas_AECOM_Titleblock.mxd

Perimeter Road

Site will be accessed via the NJANG commercial vehicle gate/Earhart Drive (Incoming Only)

Earhart Drive

248

272

Gravel Road/Haul Route

Clean Fill Stockpile Area

Decontamination Pad

Curtiss Street

Silt Fence

Noise Barrier

408

Contaminated Soil Stockpile Area

Petroleum-Impacted Soil Excavation Area

Equipment Staging/Storage Area

11

Main Control Building

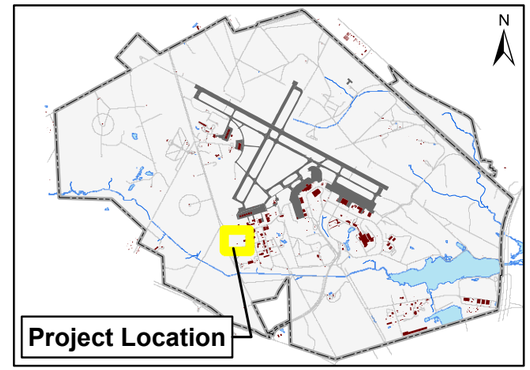
470

Tilton Road

Langley Road

401

Site exit will be via the NJANG Main Gate



FAA William J. Hughes Technical Center

Map Legend

Proposed Staging, Storage & Stockpile Locations

- Contaminated Soil Stockpile Area
- Clean Fill Stockpile Area
- Equipment Staging/Storage Area

Proposed Site Work Features (from TRC Bid Docs)

- Limit of Excavation
- Noise Barrier
- Silt Fence
- Gravel Road/Haul Route
- Decontamination Pad
- Frac Tank
- Water Tank/Trailer

Area E Boundary

Building Footprint

N
W E
S

0 50 100 200 Feet

- Proposed Site Work Features copied from: Area E & FES Bid Plans, C1-C7.dwg, TRC, 9/26/14
- The NJ Office of Information Technology (NJOIT), Office of Geographic Information Systems (OGIS) orthophotography shown on this map was taken in 2012 – 2013.

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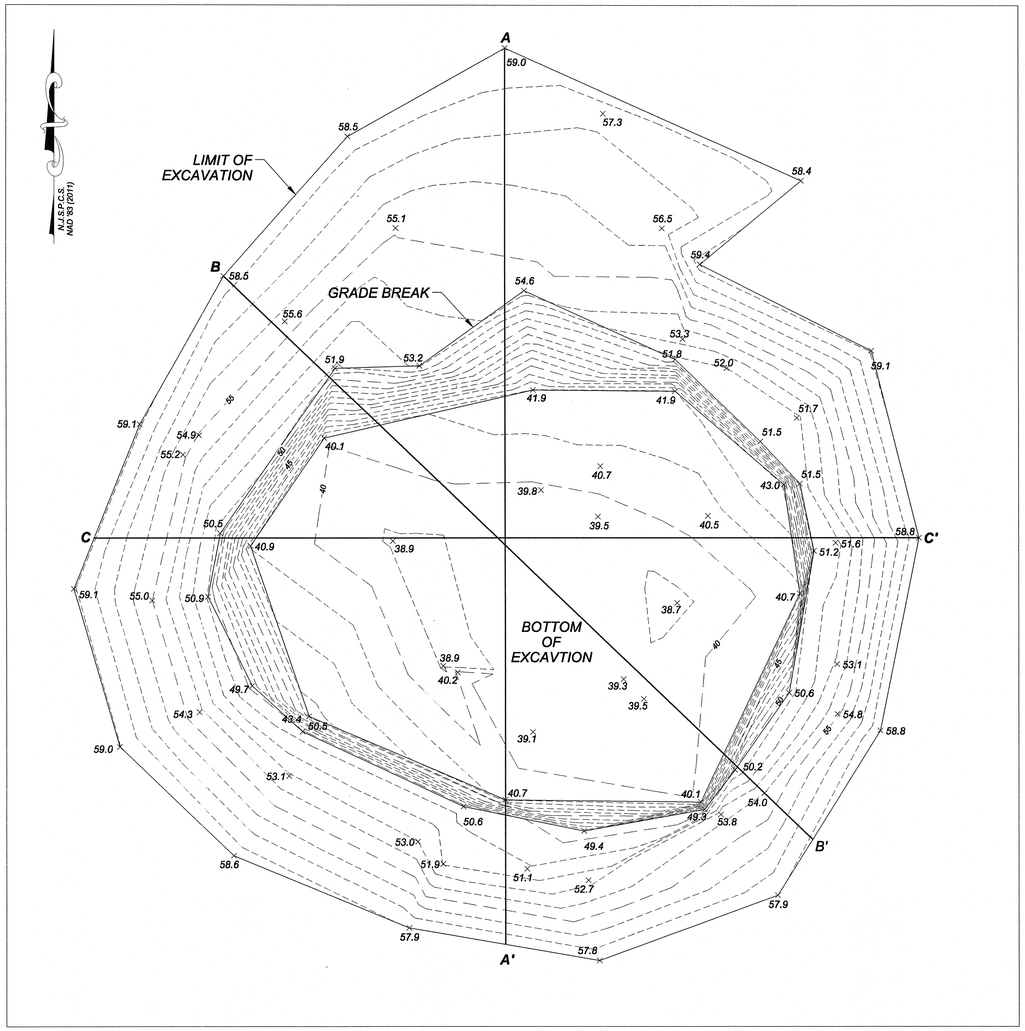
ATLANTIC CITY INTERNATIONAL AIRPORT, NEW JERSEY 08405

Superfund Area of Concern E

Petroleum-Impacted Soil Excavation Area

AECOM

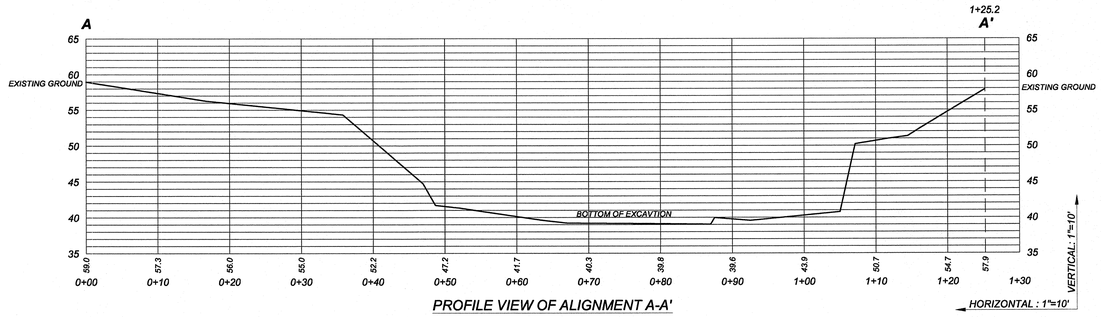
FIGURE
1



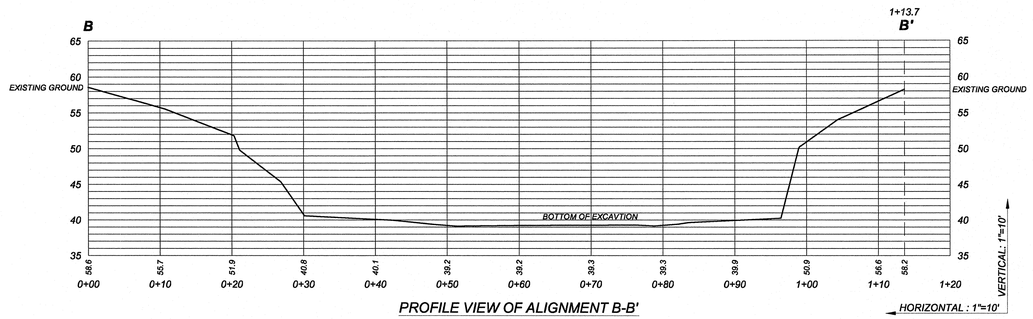
AS-BUILT TOPOGRAPHY OF EXCAVATION

SCALE: 1"=10'

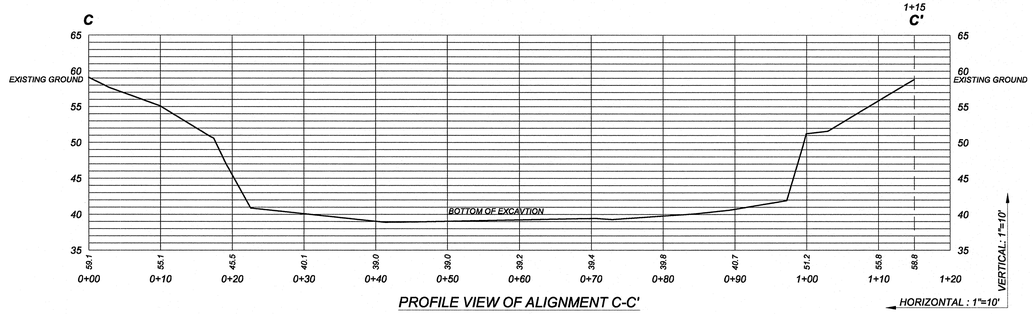
0' 10' 20' 30'



PROFILE VIEW OF ALIGNMENT A-A'



PROFILE VIEW OF ALIGNMENT B-B'



PROFILE VIEW OF ALIGNMENT C-C'

NOTES:

1. *TOPOGRAPHIC FEATURES SHOWN ARE TAKEN FROM AN ACTUAL FIELD SURVEY PERFORMED BY TAYLOR, WISEMAN & TAYLOR COMPLETED ON JUNE 29, 2015.*
2. *SURVEY BASED ON N.J.S.P.C.S. NAD 1983 (2011) VERTICAL DATUM: NAVD 1988*
3. *IT SHOULD NOT BE ASSUMED THAT ANY COPY OF THIS DRAWING WITHOUT A RAISED IMPRESSION OF THE SURVEYOR'S SEAL IS A TRUE COPY OF THE ORIGINAL AS ISSUED BY THE SURVEYOR.*

REV. 1 - REVISED BOTTOM OF EXCAVATION & CREATED NEW PROFILE VIEWS - RMR

THIS PLAN WAS PREPARED UNDER MY IMMEDIATE SUPERVISION.

SAMUEL S. PREVITERA
NJ LICENSED LAND SURVEYOR NO. - 24GS03697600

REVISIONS	
NO.	DATE
1	6/21/2016

CHECKED: LAW
DRAWN: RMR
CALC'D BY: LAW

AREA E POST EXCAVATION PLAN & PROFILE

WILLIAM J. HUGHES TECHNICAL CENTER
ATLANTIC CITY AIRPORT
EGG HARBOR TOWNSHIP, NEW JERSEY

Taylor Wiseman & Taylor
ENGINEERS / SURVEYORS / SCIENTISTS
124 GAITHER DRIVE, SUITE 150, MOUNT LAUREL, NJ 08054
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www.taylorwiseman.com
NJ CERTIFICATE OF AUTHORIZATION NO. 24GA28032900

SCALE:	DATE:	DRAWING NO.	SHEET:
AS NOTED	JUNE 29, 2015	015-06064-POST-EXC_Area_E	1 OF 1

Date: Sep 01, 2015, 7:50am

User ID: rrubano File: Q:\CAD\06064\Drawings\06064_Phase E TOB_Topo_150428.dwg Layout1

Date Saved: 2/24/2015 4:14:56 PM

Author: K-Gardner

Path: J:\ArcGIS\Projects\FAA_GIS\AtlanticCity\Area_E\deliverables\aprs\chem\2014AreaE_chlordane_10_2014.mxd

LEGEND

Area E - Monitoring Well
Chlordane Result

Chlordane Concentration (µg/L)

Value

High : 5.3

Low : 0.5

E-MW6S
ND

E-MW2S
5.3

E-MW8S
0.40

E-MW9S
ND

E-MW5S
0.73

E-MW4S
0.91

E-MW7S
ND

N
W E
S

0 50 100 200
Feet

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FEDERAL AVIATION ADMINISTRATION
WILLIAM J. HUGHES TECHNICAL CENTER
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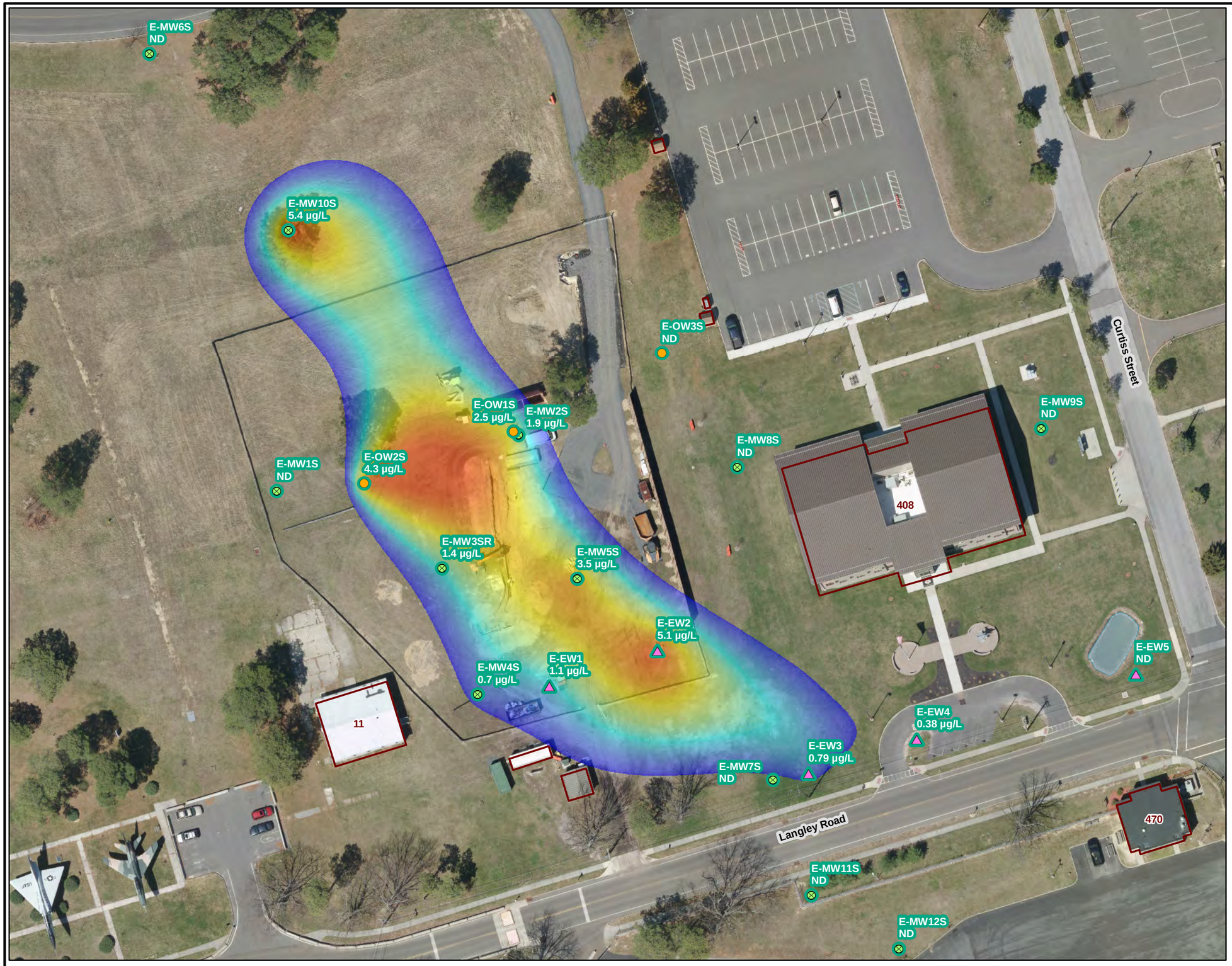
AREA E
Fourth Quarter 2014 Shallow Chemical Isoconcentration Map
Chlordane

AECOM

FIGURE
2-25



Federal Aviation Administration
William J. Hughes Technical Center

Area E
Fouth Quarter 2018
Estimated Shallow Chemical Isoconcentration Map - Chlordane
Figure 2-29

Legend

Sampled Locations

- Monitoring Well
- Observation Well
- Extraction Well

Building Footprint

Shallow Chlordane (µg/L)

Value

High : 5.4

Low : 0.5

N
W E
S

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WILLIAM J. HUGHES TECHNICAL CENTER
ATLANTIC CITY, NEW JERSEY 08405

- The orthophotography shown on this map was taken in April, 2015.
- The estimated Chlordane plume extent was created in Earth Volumetric Studio (2017.6) using 2D Kriging with max values. The outer limits of the plume represent a 0.5 µg/L concentration.

REVIEWED BY		ISSUED BY	APPROVED BY
MC		SITE ENGINEERING SECTION ANG-E343 - GIS PROGRAM	J Floyd
UD			APPROVED
TG		DESIGNED M Jenkins	DATE 2/1/2019
		CHECKED M Cicali	MAP #

FILE PATH : J:\projects\superfund_proj\Quarterly_Reports\apr\2018_4Q\Figure_2_29_AreaE_Shallow_Chlordane.mxd