

**Fourth Five-Year Review Report  
Higgins Farm Superfund Site  
Franklin Township, Somerset County, New Jersey**




**Prepared by**

**U.S. Environmental Protection Agency  
Region 2  
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**Approved by:**

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**9-28-18**

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## **LIST OF ABBREVIATIONS & ACRONYMS**

ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
ICs	Institutional Controls
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
ROD	Record of Decision
RPM	Remedial Project Manager
TBC	To be considered

## **I INTRODUCTION**

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

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

This is the fourth five-year review for the Higgins Farm Superfund Site (Site). The triggering action for this policy review is the completion date of the previous FYR, February 13, 2014. The FYR has been prepared due to the fact that, while the remedial action will not leave hazardous substances, pollutants or contaminants on Site above levels that allow for unlimited use and unrestricted exposure, it requires five or more years to complete.

The Site consists of 2 Operable Units (OUs), one of which is addressed in this FYR. OU1 was an interim action that provided an alternate water supply for nearby residents. The impacted residents were connected to the existing public water supply on May 11, 1993. This OU will not be addressed in this FYR. The OU2 Record of Decision (ROD) presented the final Site remedy and addresses the remediation of contaminated groundwater. The remedial action is ongoing and the focus of this review.

The Higgins Farm Superfund Site FYR was led by Ms. Pamela J. Baxter, Ph.D., CHMM, Remedial Project Manager. Participants included Mrs. Katherine Mishkin, Hydrogeologist; Mr. Charles Nace, Risk Assessor; and Ms. Wanda Ayala, Community Involvement Coordinator. The review began on January 18, 2018.

### **Site Background**

The Higgins Farm Site is located in a rural residential area on County Route 518 in Franklin Township, Somerset County, New Jersey. The Site, which is approximately 75 acres in size, is currently owned by the Higgins family and is operated as a cattle farm. The Site is primarily pasture land and is relatively flat and poorly drained. There are two residences on the property and other residences bordering the Site to the northeast and northwest. Trap Rock Industries Kingston Quarry borders the Site to the south.

Mr. Clifford Higgins, Sr., operated a disposal business on Laurel Avenue approximately one mile from the Site beginning in the latter 1950s. Mr. Higgins continued to own and operate the business until approximately 1985. According to local residents, Higgins Farm may have been used for disposal of wastes from this business. Aerial photographs covering the period of time from 1940 to 1983 show disturbed areas in the area of the New Jersey Department of

Environmental Protection (NJDEP) fenced area, east of the excavation pit area, and in the former drum area. During the 1960s, municipal sludge and penicillin wastes were also used as fertilizers on the farm.

The land use at the Site and in the vicinity of the Site is residential, agricultural and commercial. The Higgins Farm Site continues to be used for farming by the Higgins family except for portions of the property currently used for the remediation of groundwater.

Access to the groundwater remediation system at the Site is limited by fences. The remediation system includes groundwater extraction wells, underground conveyance piping to a treatment plant building, tanks, and groundwater extraction wells. In addition, an access road and groundwater monitoring wells are present on Site.

Groundwater flow occurs in two separate hydrologic units beneath the Site: the overburden unit and the bedrock aquifer. Groundwater flow in the overburden unit occurs under unconfined conditions within the unconsolidated sediments overlying the bedrock aquifer. Groundwater in the overburden discharges to streams, recharges the bedrock, or flows down the slope of the bedrock and discharges into seeps, streams, and wetlands. Groundwater flow in the bedrock occurs through secondary features such as fractures, joints, and cavities. The bedrock groundwater flow direction is very complex due to the infrequent fracturing in the bedrock. The shallow and deep aquifer potentiometric surfaces generally follow the topography of the Site under non-pumping conditions. Groundwater flow across the Site generally originates in a radial fashion from the area of highest topographic elevation in the north central part of the Site.

### Five-Year Review Summary Form

SITE IDENTIFICATION		
<b>Site Name:</b> Higgins Farm		
<b>EPA ID:</b> NJD981490261		
<b>Region:</b> 2	<b>State:</b> NJ	<b>City/County:</b> Franklin Township, Somerset County
SITE STATUS		
<b>NPL Status:</b> Final		
<b>Multiple OUs?</b> Yes	<b>Has the site achieved construction completion?</b> Yes	
REVIEW STATUS		
<b>Lead agency:</b> EPA If "Other Federal Agency" was selected above, enter Agency name		
<b>Author name (Federal or State Project Manager):</b> Pamela J. Baxter, Ph.D., CHMM		
<b>Author affiliation:</b> EPA		
<b>Review period:</b> February 2014 – June 2018		
<b>Date of Site inspection:</b> March 15, 2018		
<b>Type of review:</b> Policy		
<b>Review number:</b> 4		
<b>Triggering action date:</b> February 13, 2014		
<b>Due date (five years after triggering action date):</b> February 13, 2020		

## **II RESPONSE ACTION SUMMARY**

### **Basis for Taking Action**

EPA began a remedial investigation (RI) in late summer 1989. The purpose of the RI was to identify the nature and extent of contaminant source areas; to define contamination of groundwater, soil, surface water and sediment; characterize Site hydrogeology; and to determine the risk to human health and the environment posed by the Site. Contaminants found in soil and groundwater included volatile organic contaminants, base/neutral compounds, metals, pesticides, and dioxins.

A risk assessment was conducted to evaluate risks of these contaminants to human health and the environment. The human health risk assessment concluded that Site related contaminants in the groundwater posed an unacceptable risk based on current and future anticipated uses of the Site. Risks and hazards associated with exposure to soil were within or below EPA's acceptable values. In particular, the hazard index (HI) for non-carcinogenic effects from the ingestion, dermal contact and inhalation of ground water is 6.5 for adult residents and 10.3 for child residents. Therefore, noncarcinogenic effects may occur from the exposure routes evaluated in the Risk Assessment. The non-carcinogenic risk associated with exposure to contaminated ground water is attributable to several compounds including 1,1,2-trichloroethane and chlorobenzene. The HI for non-carcinogenic effects from ingestion and dermal contact with contaminants in soil is less than 1.0, indicating that the risk posed by the soils is below EPA's acceptable risk range. Under current land-use conditions, the risk characterization showed that cancer risks associated with each of the ground-water pathways (ingestion, inhalation and dermal contact) exceed Superfund acceptable risk levels for both adults and children. The total cancer risk posed by contaminated ground water from all pathways considered is  $3 \times 10^{-3}$  for residential adults and  $2 \times 10^{-3}$  for residential children. The cancer risk analysis indicates that 1,1,2-trichloroethane, benzene, vinyl chloride and 1,2-dichloroethane are the main contributors to the estimated cancer risk.

EPA also performed an Ecological risk assessment for the Higgins Farm Site. The following were determined to be chemicals of concern in the ecological risk assessment: total polycyclic aromatic hydrocarbons (PAHs); dioxins; and lead. The assessment concluded that surface water, sediments and soils on Site did not pose an unacceptable risk to ecological receptors present at or around the Site.

### **Response Actions**

In December 1985, the Franklin Township Health Department found that elevated levels of chlorobenzene existed in a residential well located on Route 518, adjacent to the Site. NJDEP investigated and discovered a drum burial dump at the Site approximately forty yards from the contaminated well.

During the spring and summer of 1986, NJDEP sampled residential wells and soils on and near the Site. Analysis of the soil samples indicated the presence of volatile organic compounds (VOCs), pesticides, metals, and dioxins. Analysis of samples taken from ten nearby residential wells revealed that the wells were contaminated with VOCs. As a result, in November 1986, NJDEP established a "well impact area" near the Higgins Farm Site, restricting installation of

new wells within the affected area. Thirty-one residences were included within the well impact area at Higgins Farm. EPA responded to the presence of contamination in drinking water wells near the Site by providing bottled water to the potentially impacted residents. Carbon filters were installed in the residences in the spring of 1989.

In August 1992, EPA's removal program completed the excavation of 94 drums and contaminated soils which were discovered during test pit excavation activities in the NJDEP fenced area. Other removal actions included the construction of a metal barn to house contaminated soil from the excavation pit area, drainage and backfilling of the excavation pit, and treatment and storage of the pumped liquids from the excavation pit. All known drums, hazardous waste and contaminated soils were removed from the Site and disposed of at an EPA-approved disposal facility. Post-excavation sampling was conducted to ensure that all contamination was removed, and the area was backfilled with clean material.

### **Selected Remedy**

On September 24, 1990, EPA issued the first ROD for OU1 which selected an interim remedy to connect the potentially affected residential properties to an existing potable water supply to prevent ingestion of contaminated groundwater.

A second ROD for OU2 was signed by EPA on September 30, 1992 which selected the long-term solution for the Higgins Farm Site. Specifically, the ROD outlined the remedial action objectives:

- To capture and treat the contaminated groundwater in an attempt to restore the aquifer to federal and state drinking water standards;
- To control or limit the future off-site migration of the contaminated groundwater; and
- To minimize the potential for direct exposure of the populace to the contaminated groundwater.

The remedy included the following activities:

- Construction of an on-site treatment plant to treat the contaminated groundwater;
- Discharge of the treated groundwater to an on-site surface water body;
- Implementation of a sampling program involving monitoring wells and downgradient residential wells to evaluate off-site migration and the effectiveness of the groundwater extraction system;
- Limited investigations to confirm that all sources of contamination were identified; and
- Removal and proper disposal of contaminated materials which were generated during previous Site stabilization and remedial investigation activities that were presently stored on the Site.

### **Status of Implementation**

The OU1 interim remedy included the design and construction by EPA of a potable water supply line extension system and connection to an existing potable water supply system; continued



operation and maintenance (O&M) of the existing carbon filter units until the potable water supply line was in place; environmental sampling of appropriate residential wells; and removal of carbon filter units and private well connections after the potable water supply line was installed.

Twenty-six residences were connected to the water main, which distributes potable water from South Brunswick's water supply system. Installation of the water line and the residential hook-ups was completed by EPA on May 11, 1993.

The OU2 groundwater remedy consisted of construction by EPA of a groundwater extraction and treatment system including 20 recovery wells, and associated piping, electrical and instrumental components. After clearing and grubbing activities for the construction of the groundwater treatment system had been completed, additional buried containers and drums were discovered at the Site and were removed by EPA in 1996. The groundwater treatment system began operations in May 1998. The effluent is discharged to a pond that eventually flows into Carters Brook.

In 1998, EPA filed a complaint in federal district court against potentially responsible parties (PRPs), Mrs. Lisbeth Higgins, the FMC Corporation and the NCH Corporations, seeking reimbursement of response costs incurred in connection with the release or threatened release of hazardous substances at the site. Consent decrees with the parties, valued at approximately \$31 million in work and reimbursement of response costs, were entered in October 2006 and August 2007. Also, as part of her settlement, Mrs. Higgins agreed to preserve her property as farmland. On October 2, 2017, an easement was issued on the property.

### **Institutional Controls**

Institutional controls were not required in the OU2 ROD. The Site is secured by fencing and all visitors are required to sign in. On March 13, 2017, a Classification Exception Area/Well Restriction Area (CEA/WRA) for contamination in groundwater associated with the Site was issued. This CEA/WRA is an institutional control that is used to restrict the use of groundwater within an area where groundwater contaminant concentrations exceed applicable GWQS. The CEA/WRA will expire on November 1, 2043, at which time it is expected that the GWQS will be attained. The attainment of GWQS will be confirmed through groundwater sampling with 180 days after the expiration date, pursuant to N.J.A.C. 7:26C-7.9(f). Consistent with N.J.A.C. 7:26C7-7.3, NJDEP can remove the CEA/WRA at any time in the interim on the basis of new groundwater data.

## IC Summary Table

Table1: Summary of Planned and/or Implemented ICs

<b>Media, engineered controls, and areas that do not support UU/UE based on current conditions</b>	<b>ICs Needed</b>	<b>ICs Called for in the Decision Documents</b>	<b>Impacted Parcel(s)</b>	<b>IC Objective</b>	<b>Title of IC Instrument Implemented and Date (or planned)</b>
Groundwater	Yes	Yes	G000005807	Restrict installation of groundwater wells and groundwater use	CEA/WRA March 13, 2017

## Operation and Maintenance

The groundwater extraction system (GWETS) began operations in May 1998 and the goal of the groundwater portion of the selected remedy is to control or limit off-site migration and restore the groundwater quality to drinking water standards.

As part of settlement, the NCH took over operation and maintenance of the groundwater pump and treat system beginning on September 9, 2006. NCH optimized the extraction and treatment system, as recommended in the Remediation System Evaluation (RSE) Report, dated May 2004, in an effort to operate the system more efficiently.

An off-site investigation was conducted to determine if the Site contaminants are migrating off-site in groundwater. This information is documented in the Off-Site Investigation Report, August 5, 2008. A review of the report indicated the presence of low levels volatile organic compounds located immediately downgradient of the Site, which warrant further evaluation.

In June 2009, a source area investigation was conducted in the area around the Former Drum Excavation Area. A localized depression in the bedrock was found and soil samples and grab groundwater samples revealed that residual VOCs may be contributing to ongoing contamination to the bedrock aquifer.

As a result of the source area investigation, an enhanced in-situ bioremediation (EISB) Pilot Study was conducted in 2010 and the full-scale implementation was initiated in late 2012. In total, three EISB injection events were conducted in 2010, 2012, and 2015 in the location of this bedrock depression. The amendment solution was injected at the soil/bedrock interface with the objective of introducing the material into the alluvium and potential fractures or other preferential pathways in the bedrock surface. Following each injection event, concentrations in the overburden appear to have increased. One possible explanation for the increase is the injections could have led to a mobilization and redistribution of source material. Injections are no longer being performed.

In 2012, influent groundwater prior to reaching the groundwater treatment system was sampled for 1,4-dioxane. This was requested by EPA since this contaminant was not previously sampled and was considered a potential concern. Sample results indicate that 1,4-dioxane levels are not a concern.

Surface water sampling of Carters Brook was conducted in 2012 to ensure that the plume was not discharging to the downgradient surface water body. Sample results indicate that this surface water body is not being impacted. Chronic toxicity testing is conducted semi-annually to test the surface water.

The PRP submitted a Phase I Extraction Well Shutdown and Monitoring Work Plan (Phase I Work Plan) to EPA on February 11, 2014 (SGI, 2014). The purpose of the Phase I Work Plan was to propose a Phase I extraction well shutdown program to discontinue operation of extraction wells in locations that the PRP considered to be only removing minimal contaminant mass from the aquifer. Phase I extraction wells: RW-6, RW-8, RW-8A, RW-9, RW-9A, RW-10 were turned off in June 2014 and monitored through March 2017. Results indicate that VOC concentrations remained stable in the Phase I monitoring wells despite shutting down the 6 extraction wells listed above. EPA agreed that the Phase I extraction wells could remain offline following the Phase I Extraction Well Program. Phase I extraction well monitoring results are presented in Semi-annual Monitoring Reports.

In May 2018, the PRP submitted a Phase II extraction well shutdown program with the goal of determining whether shutting down the remaining extraction wells will adversely impact volatile organic compounds (VOC) concentrations at the Site boundary. In this Work Plan, the PRP proposed to shut down the remaining extraction wells at the Site: RW-3, RW-4, RW-7, RW-10A, and RW-11. Based on the nature and extent of remaining contamination, a complete well shutdown program is premature at this time, even on a temporary basis, and EPA has not approved this plan. Currently, five of the twenty original extraction wells are operating: RW-3, RW-4, RW-7, RW-10A, and RW-11.

The primary COCs identified in the ROD include: perchloroethylene (PCE), trichloroethylene (TCE), cis-1,2-dichloroethylene (DCE), vinyl chloride, 1,1-DCE, 1,1,2,2-tetrachloroethane, 1,1,2-TCA, 1,1-DCA, 1,2,4-trichlorobenzene, bis(2-chloroethyl) ether, 1,2-DCA, isopropylbenzene, benzene, xylenes, and chlorobenzene; however, those that remain a concern are PCE, TCE, cis-1,2-DCE, vinyl chloride, TCA, 1,1,2-TCA, benzene, and chlorobenzene. Details of groundwater data are discussed in the Data Review section of this document.

Several monitoring wells were eliminated from the sampling program following multiple rounds of data with contaminant levels below the groundwater standards. The current sampling program includes 7 shallow wells screened in the overburden, 8 deep wells in the bedrock, 11 multi-level bedrock wells, and sampling from the effluent port of 8 existing bedrock extraction wells (8 non-operating bedrock extraction wells were most recently sampled via passive diffusion bags). The frequency of sampling is either semi-annual or annual depending on the well. Please refer to Table 4 in Attachment B for the current well inventory and monitoring frequency.

Potential Site impacts from climate change have been assessed, and the performance of the

remedy is currently not at risk due to the expected effects of climate change in the region and near the Site.

### **III      PROGRESS SINCE LAST REVIEW**

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

**Table 2:** Protectiveness Determinations/Statements from the 2014 FYR

<b>OU #</b>	<b>Protectiveness Determination</b>	<b>Protectiveness Statement</b>
2	Short-term Protective	The remedy currently protects human health and the environment because no exposures to residual groundwater contamination are occurring. However, in order to protective in the long term, of groundwater contamination be further evaluated, conceptual site model be updated, and modifications be made to monitoring well/extraction well network, as appropriate.
Sitewide	Short-term Protective	The remedy currently protects human health and the environment because no exposures to residual groundwater contamination are occurring. However, in order to be protective in the long term, groundwater contamination needs to be further evaluated, conceptual site model be updated, and modifications be made to monitoring well/extraction well network, as appropriate.

**Table 3:** Status of Recommendations from the 2014 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
OU2	Need to monitor the shallow bedrock component of the VOC plume near the downgradient property boundary.	Take steps to characterize shallow groundwater in the vicinity of RW-11 and update the conceptual site model.	Addressed in Next FYR	See status discussion below	Not Completed
OU2	Need to delineate the extent of the 1,1,2-trichloroethane (TCA) plume along the south-southwest property boundary in the bedrock aquifer.	Additional characterization of the 1,1,2-TCA plume should be conducted, and the conceptual site model should be updated accordingly.	Addressed in Next FYR	See status discussion below	Not Completed
OU2	Open bedrock boreholes are prevalent across the site. Groundwater samples from these wells do not adequately reflect aquifer conditions.	In compliance with NJ regulations, steps should be taken to reduce the open borehole length or replace wells with multi-level well systems, where appropriate.	Addressed in the Next FYR	See status discussion below	Not Completed

**Issue:** Need to monitor the shallow bedrock component of the VOC plume near the downgradient property boundary.

**Recommendation:** Take steps to characterize shallow groundwater in the vicinity of RW-11 and update the conceptual site model.

**Status:** To date, the conceptual site model has not been updated. The PRP has conducted periodic vertical sampling in the open hole extraction well RW-11 to monitor the plume at multiple depths, particularly the shallow bedrock (30 ft bgs) where the highest concentration of PCE (120 ug/L) was detected in 2012. Results of the vertical profiling conducted in 2017 indicate lower PCE concentrations in this shallow bedrock zone (16 ug/L) compared to the 2012 concentration. EPA believes that the conditions in the shallow bedrock in the area of RW-11 need to be monitored more frequently.

**Issue:** Need to delineate the extent of the 1,1,2- trichloroethane (TCA) plume along the south-southwest property boundary in the bedrock aquifer.

**Recommendation:** Additional characterization of the 1,1,2-TCA plume should be conducted, and the conceptual site model should be updated accordingly.

**Status:** In accordance with this recommendation, the residential well R-6 was sampled to help evaluate the plume along the south-southwest property boundary. The original recommendation was to evaluate 1,1,2-TCA concentrations. Sampling of well R-6 in May and December 2017

shows lower levels of 1,1,2-TCA compared to previous samples, but higher level concentrations of 1,2-dichloroethane (1,2-DCA), vinyl chloride, and chlorobenzene in deeper intervals (85, 115, 140, 185 ft bgs) with a maximum concentration of 1,2-DCA at 85 and 140 ft bgs of 310 ug/L in May 2017.

WB-16 is a multi-level monitoring well that is situated downgradient of R-6 and shows non-detect results in each of the three sampling intervals; however, note WB-16 is situated south-southwest of R-6 and while there appears to be a radial component to groundwater flow, the overall direction of groundwater flow is to the south-southeast. It is possible that WB-16 is sidegradient of the groundwater flowing from the R-6 direction. The issue remains that the source of these higher-level concentrations near the south-southwest edge of the plume remains unclear and additional investigations are warranted.

**Issue:** Open bedrock boreholes are prevalent across the Site. Groundwater samples from these wells do not adequately reflect aquifer conditions.

**Recommendation:** In compliance with NJ regulations, steps should be taken to reduce the open borehole length or replace wells with multi-level well systems, where appropriate.

**Status:** EPA identified 8 monitoring wells with an open borehole length ranging from 171.5-188 feet. In response to the recommendation to reduce the open borehole length, the PRP requested to abandon monitoring wells: MW-01D, MW-05D, MW-06D, and MW-08D. Given the location and the non-detect data, EPA agreed to the abandonment of only MW-01D and MW-05D. The PRP did not reduce the open borehole length in the remaining monitoring wells, but instead requested to conduct vertical profiling in MW-02D, MW-03D, MW-04D, MW-06D, MW-7D, and MW-8D. EPA initially agreed that vertical sampling could be conducted at least once every five years to ensure that groundwater contamination is not spread and made worse due to the open boreholes. Considering the results of recent sampling and the fact that the conceptual site model has not been updated, vertical profiling is insufficient as a long-term monitoring approach for understanding the status of groundwater contamination in this plume. Open hole wells should be retrofitted or replaced with multi-level monitoring wells.

#### Additional activities conducted since the last FYR

As mentioned in the O&M section, the extraction and treatment system is currently being operated pursuant to the EPA approved 2014 Phase I Extraction Well Shutdown and Monitoring Work Plan (Phase I Work Plan) (SGI, 2014). In addition, EISB injection occurred from 2010 through 2015.

EPA is aware that a proposed compressor station associated with a nearby Transco William Company gas pipeline will be located near the site. This planned activity is not expected to impact on-going cleanup activities.

## **IV FIVE-YEAR REVIEW PROCESS**

### **Community Notification Involvement & Site Interviews**

On October 2, 2017, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 31 Superfund sites in New York and New Jersey, including the Higgins Farm Superfund site. The announcement can be found at the following web address: [https://wcms.epa.gov/sites/production/files/2017-10/documents/five\\_year\\_reviews\\_fy2018\\_final.pdf](https://wcms.epa.gov/sites/production/files/2017-10/documents/five_year_reviews_fy2018_final.pdf). In addition, to this notification, a public notice was made available by posting on the Town's webpage on July 19, 2018, stating that there was a FYR and inviting the public to submit any comments to the U.S. EPA. The results of the review and report will be made available at the Site information repository located at Franklin Township Public Library located at 485 Demott Lane, Somerset, New Jersey.

### **Data Review**

#### *Overburden:*

MW-6S, a long-standing shallow well in the source area has shown all site-related VOCs to be below their respective criteria. During the previous five-year review, cis-1,2-DCE concentrations seemed to have increased in this monitoring well but during this review the concentrations of cis-1,2-DCE decreased to below the NJDEP GWQS of 70 ug/L. Benzene and chlorobenzene were not detected in 2016 and 2017 in MW-6S. However, in 2009 a limited source area investigation was conducted and temporary piezometer wells show concentrations of COCs are considerably higher than are being shown in the permanent monitoring wells near the source area. For example, while PCE, TCE, and cis-1,2-DCE are within the same order of magnitude in piezometer samples, benzene, which was not previously detected in MW-6S, was as high as 370 ug/L and chlorobenzene showed a concentration of 120 ug/L in 2016.

Monitoring in the source area has recently been enhanced with the installation of 3 new shallow injection wells, which are also serving the purpose as monitoring wells (MW-21S, MW-22S, MW-23S). During this review period, maximum concentrations are present in MW-21S, situated within the area of EISB injections, with cis-1,2-DCE concentrations as high as 4,700 ug/L. While PCE and TCE were found at low level concentrations previous to the 2012 injection events, concentrations steadily rose during this review period with PCE as high as 520 ug/L and TCE as high as 170 ug/L. In September 2017, concentrations of PCE and TCE were below detection limits and vinyl chloride peaked at 51 ug/L following the 2015 EISB injection event. MW-22S and MW-23S, which are located downgradient of the source area and bedrock depression do not reveal COCs at detectable concentrations. Shallow wells that are situated further downgradient of the source area all have consistently shown non-detectable concentrations of COCs.

#### **Overburden Summary**

The primary direction of groundwater flow in the overburden is from the north central portion of the Site to the south/southeast. While groundwater concentrations in the overburden are

significantly higher (up to two orders of magnitude) than found in the bedrock groundwater, the plume in the overburden is laterally less extensive when compared to the bedrock groundwater contaminant plume. The high-level concentrations present in the overburden are likely continuing to contribute to a dissolved phase plume in the bedrock, where a depression was identified in the bedrock and groundwater has a direct transport pathway from the overburden to bedrock. This information supports the conclusions that source material is still present and that the contaminant mass is largely entering the bedrock aquifer in the source area near the bedrock depression.

#### *Bedrock:*

The direction of groundwater flow is similar in the bedrock as the overburden where the flow is from the north central portion of the Site to the south/southeast. Groundwater monitoring in the fractured bedrock is conducted in open bedrock holes, conventional bedrock wells, multi-level wells, and recovery wells. In bedrock monitoring wells situated in close proximity to the northern source area (MW-06D, MW-07D, MW-19D, MW-20D, MW-24D, MW-25D, MW-26D, WB-11), the predominant compounds exceeding NJDEP GWQS are PCE, benzene, and chlorobenzene. In 2017, PCE was detected at 17 ug/L in WB-11 (170 ft bgs). Maximum concentrations of benzene and chlorobenzene were found in MW-26D at 15 ug/L (62.75 ft bgs) and 150 ug/L (28.25 ft bgs), respectively. Lower level concentrations of cis-1,2-DCE, vinyl chloride, and 1,2-DCA were also found in bedrock monitoring wells near the source area at concentrations just at or above their respective NJDEP GWQS.

Further downgradient, in bedrock monitoring wells and recovery wells situated along the property boundary, the main contaminants of concern exceeding their respective NJDEP GWQS are principally 1,2-DCA, 1,1,2-TCA, PCE and TCE with some lower level detections of vinyl chloride and benzene found just at or above the NJDEP GWQS of 1 ug/L. The groundwater plume consisting of PCE and its daughter products continues to migrate beyond the eastern property boundary, as maximum concentrations of PCE and TCE are found in recovery well RW-11 with estimated concentrations of 27 ug/L and 36 ug/L, respectively. PCE is also present in multi-levels wells just beyond the property boundary (WB-12, WB-13) but at relatively lower concentrations. RW-11 also showed concentrations of 1,1,2,2-tetrachloroethane (TeCA) and 1,1,2-TCA at 9.9 ug/L and 6.9 ug/L, respectively.

A vertical profile program using passive diffusion bags was designed for extraction wells RW-01, RW-02, RW-03, RW-03A, RW-04 and residential well R-6 in 2014. While 1,1,2-TCA was detected at one or more discrete depths in wells RW-02, RW-03, RW-03A, and RW-04, the highest concentration detected was 8.3 ug/L in RW-04 at a depth of 140 ft bgs, with exceedances observed in RW-03A as well. The higher-level concentrations of 1,1,2-TCA that were observed during the last five-year review were not observed during this review period, but concentrations of 1,2-DCA were notably higher. Concentrations of 1,2-DCA were detected at discrete depths in RW-02, RW-03, RW-03A, RW-04, and R-6. The highest concentrations were found in former residential well R-6 at 370 ug/L (140 ft bgs – June 2015). There is one multi-level monitoring well WB-16 situated downgradient or sidegradient of R-6. Concentrations of 1,2-DCA and 1,1,2-TCA in WB-16 are below detection limits. While information from WB-16 may suggest that the 1,2-DCA and 1,1,2-TCA plumes do not migrate far beyond the current monitoring well



network, it is not clear if WB-16 is intercepting the groundwater migrating beyond the southwest property boundary or if it is sidegradient of the potential plume (WB-16 is south-southwest of R-6 while the overall direction of groundwater flow is to the south-southeast). Additionally, given that the main contaminants of concern observed in the source area are principally PCE, PCE daughter products, benzene, and chlorobenzene, it is not clear where these higher concentrations of 1,2-DCA and 1,1,2-TCA are originating.

### Summary

The former excavation pit area in the northern portion of the Site is the main known source area from which a dissolved phase plume migrates in the overburden and the bedrock aquifers. While there appears to be a radial component to groundwater flow, the overall direction in both the overburden and bedrock aquifers is in the south-southeast direction. In close proximity and along the southwest property boundary, higher concentrations of 1,1,2-TCA and 1,2-DCA are found in bedrock groundwater. It is unclear if the presence of these contaminants is related to the source area at the excavation pit or if they are from a separate unknown source area.

### Site Inspection

There is one plant operator on site part time and representatives of the U.S. Army Corp of Engineers, on behalf of EPA, inspect the Site on a part-time basis. A Site inspection was conducted by the Five-Year Review Team on March 15, 2018. The Site was in order and there were no notable problems identified during the inspection.

### Interviews/Meetings

No specific interviews were conducted for the Five-Year Review.

## **V. TECHNICAL ASSESSMENT**

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

### Question A Summary:

The remedy is not functioning as intended by the decision documents. The goals of the remedy are both to control/limit off-site migration of the groundwater contaminant plume and to reduce contaminant levels to drinking water standards.

Data presented in this five-year review shows that while the majority of the mass remains in the source area in the overburden aquifer, it continues to feed groundwater contamination in the bedrock. If no further actions are conducted to address groundwater contamination in the source area, restoration will not be met within a reasonable timeframe. Although the remedy is not functioning as intended, the groundwater plume data provides assurance that no unacceptable exposure to contaminated groundwater is occurring.

The groundwater extraction wells that are currently being operated include: RW-3, RW-4, RW-7, RW-10A, and RW-11. Groundwater extraction wells: RW-1, RW-2, RW-3A, RW-5, RW-12, and RW-13 are permanently offline due to low VOC concentrations. Groundwater extraction wells: RW-14, RW-15, and RW-16 are offline due to their proximity to the former in-situ bioremediation injection area. Groundwater extraction wells: RW-6, RW-8, RW-8A, RW-9, RW-9A, and RW-10 remain offline following the Phase I Extraction Well Shutdown Program and results indicating that VOC concentrations remained stable following the shutdown of these extraction wells. Additionally, the results of the EISB injections were not positive and injections have been discontinued.

As noted in the previous five-year review (February 13, 2014), elevated concentrations of 1,2-DCA and 1,1,2-TCA and based on groundwater collection and analysis conducted over the last five years, contaminant concentrations persist at and beyond the southwest property boundary at multiple bedrock zones. It is unknown if the source of this contamination is originating from the northern excavation pit, but given that these contaminants have not been detected at similarly high levels in the area within and surrounding the excavation pit, it is possible that a separate, distinct source area exists. WB-16 is a downgradient multi-level bedrock monitoring well and shows non-detect concentrations; however, this well is situated south-southwest of R-6 where the groundwater flow is generally to the south-southeast direction. Thus, it is possible that the groundwater contaminant plume is bypassing this monitoring well both laterally and vertically and the plume is not fully delineated.

In the Recommendations Section below, it is recommended that the high-level concentrations remaining in the overburden and feeding the groundwater contaminant plume are further addressed. While recent efforts by the PRP to address this source area through in-situ enhanced bioremediation injections have led to some degradation of COCs in the source zone, it has not improved overall contaminant levels in the source area. Continued or amended extraction of groundwater in this area, or another in-situ treatment technology should be considered to address source area groundwater contamination.

Further, lack of wells at the edge of the plume showing concentrations below groundwater remediation goals, particularly in the south-southwestern, southern and south-southeastern directions, make it difficult to verify the estimated extent of the plume. Additionally, open hole wells do not adequately characterize the contamination in some parts of the plume. In updating the conceptual site model for the site, these wells should be replaced or retrofitted.

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

**Question B Summary:**

Currently, there are no known completed pathways for exposure to the contaminated groundwater for human health or ecological receptors. The RAOs are still valid although the current remedial approach is not anticipated to restore groundwater in a reasonable timeframe.

### *Human Health*

The exposure assumptions and toxicity data were evaluated and for this five-year review, they still remain valid. In addition, given the contaminated groundwater is not currently being utilized as a potable water source, there are currently no complete pathways for human exposure, thus the current remedy is protective of human health.

The cleanup levels for the groundwater were identified as the Federal and State drinking water standards (MCLs). These standards are still valid, although they have not been attained at this time. The remedial action objectives presented in the RODs are still valid.

Vapor intrusion was evaluated as part of the two previous five-year reviews (2008 and 2014) and it was concluded that the vapor intrusion pathway was incomplete due to no inhabitable buildings being over the groundwater plume. In the past five years, there have not been any buildings constructed within 100 feet of the plume, so the vapor intrusion pathway remains incomplete at this time. However, a proposed compressor station, associated with a nearby gas pipeline, is planned for construction near the Higgins Farm Site. If the proposed building will be occupied by workers, it would be beneficial to install a vapor barrier under the building as part of the construction to eliminate the potential for vapor intrusion. Future five-year reviews should evaluate this pathway as changes in land use or plume migration could affect the status of the vapor intrusion pathway.

### *Ecological*

The previous five-year review indicated that the contaminated groundwater at the Site was not discharging to the local wetlands or surface water, and therefore there was no exposure to ecological receptors. The report also indicated that the wetlands located above the plume have been monitored to ensure that the extraction wells were not impacting the water levels in the wetland. Based upon review of the current information, the previous conclusions are still valid.

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

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

## VI ISSUES/RECOMMENDATIONS

Issues/Recommendations				
<b>OU(s) without Issues/Recommendations Identified in the Five-Year Review:</b>				
<b>OU1</b>				
<b>Issues and Recommendations Identified in the Five-Year Review:</b>				
<b>OU(s): OU2</b>	<b>Issue Category: Operations and Maintenance</b>			
	<b>Issue:</b> Source area groundwater concentrations in the vicinity of the northern excavation pit remain high and continue to contribute to the bedrock groundwater contaminant plume.			
	<b>Recommendation:</b> Additional actions are needed to remediate source area contamination.			
<b>Affect Current Protectiveness</b>	<b>Affect Future Protectiveness</b>	<b>Implementing Party</b>	<b>Oversight Party</b>	<b>Milestone Date</b>
No	Yes	PRP	EPA	September 2023
<b>OU(s): OU2</b>	<b>Issue Category: Operations and Maintenance</b>			
	<b>Issue:</b> Need to improve the delineation of the edge of groundwater contaminant plume at the Site.			
	<b>Recommendation:</b> Install additional sentinel wells.			
<b>Affect Current Protectiveness</b>	<b>Affect Future Protectiveness</b>	<b>Implementing Party</b>	<b>Oversight Party</b>	<b>Milestone Date</b>
No	Yes	PRP	EPA	September 2023
<b>OU(s): OU2</b>	<b>Issue Category: Operations and Maintenance</b>			
	<b>Issue:</b> Open bedrock boreholes remain present at the Site. Groundwater samples from monitoring wells constructed in this manner do not adequately reflect aquifer conditions.			
	<b>Recommendation:</b> In compliance with NJ regulations, steps should be taken to reduce the open borehole length, retrofit, or replace monitoring wells with open borehole construction.			
<b>Affect Current Protectiveness</b>	<b>Affect Future Protectiveness</b>	<b>Implementing Party</b>	<b>Oversight Party</b>	<b>Milestone Date</b>
No	Yes	PRP	EPA	September 2023
<b>OU(s): OU2</b>	<b>Issue Category: Operations and Maintenance</b>			

<b>Issue:</b> Need to update CSM to reflect current Site conditions. <b>Recommendation:</b> Update the conceptual site model after additional monitor wells are installed.				
Affect Current Protectiveness	Affect Future Protectiveness	Implementing Party	Oversight Party	Milestone Date
No	Yes	PRP	EPA	September 2023

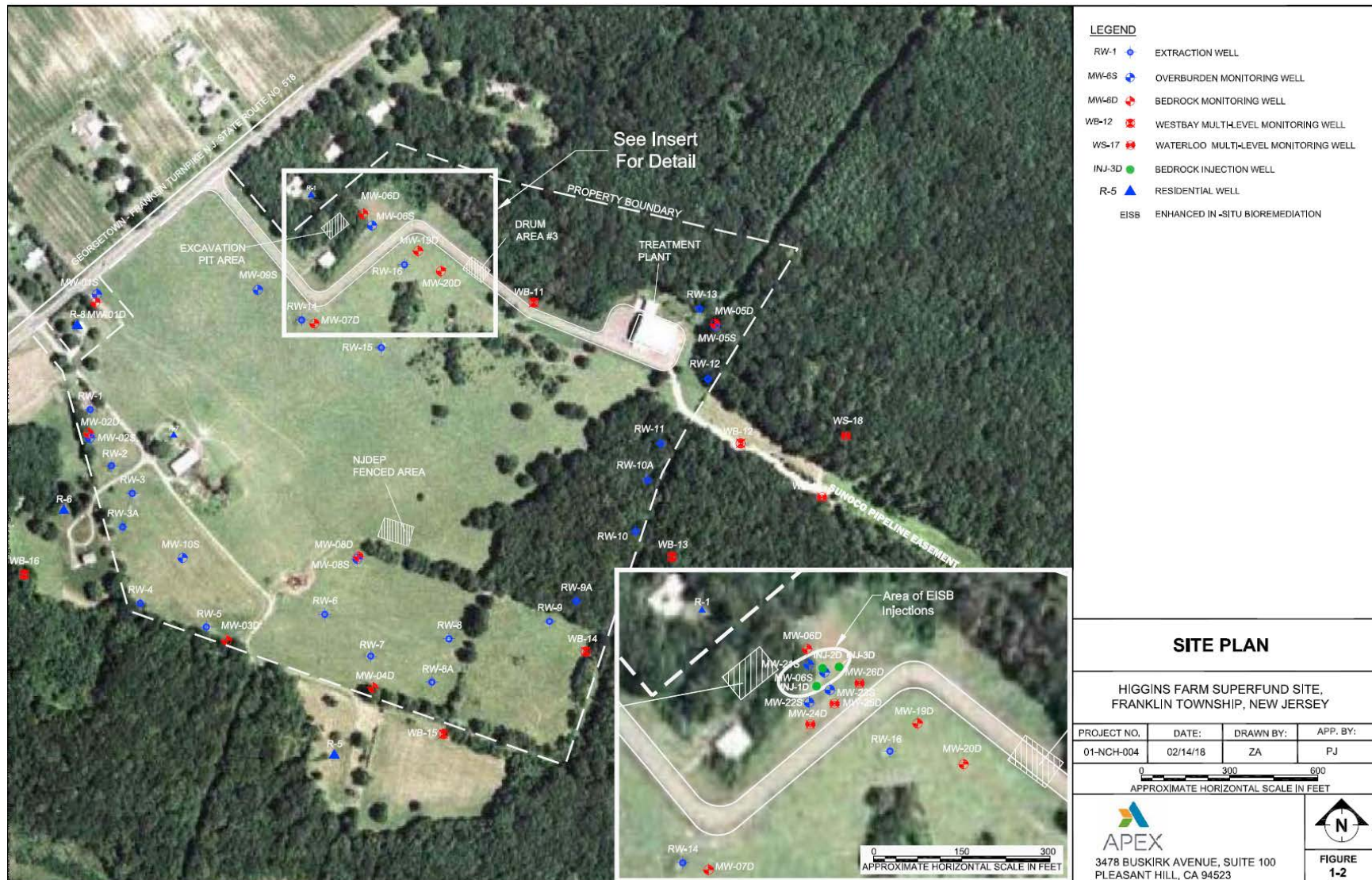
## VII PROTECTIVENESS STATEMENT

Protectiveness Statement(s)		
<i>Operable Unit:</i> OU2	<i>Protectiveness Determination:</i> Short-term Protective	<i>Due Date (if applicable):</i>
<p><b>Protectiveness Statement:</b>  The remedy currently protects human health and the environment because no exposures to groundwater contamination are occurring. However, in order to be protective in the long term, groundwater contamination must be further evaluated, the conceptual site model be updated, additional source area actions need to be considered and implemented, sentinel wells should be installed, and open hole monitoring wells need to be retrofitted or replaced.</p>		
Sitewide Protectiveness Statement (if applicable)		
<i>Protectiveness Determination:</i> Short-term Protective		<i>Due Date (if applicable):</i>
<p><b>Protectiveness Statement:</b>  The remedy currently protects human health and the environment because no exposures to groundwater contamination are occurring. However, in order to be protective in the long term, groundwater contamination must be further evaluated, the conceptual site model be updated, additional source area actions need to be considered and implemented, sentinel wells should be installed, and open hole monitoring wells need to be retrofitted or replaced.</p>		

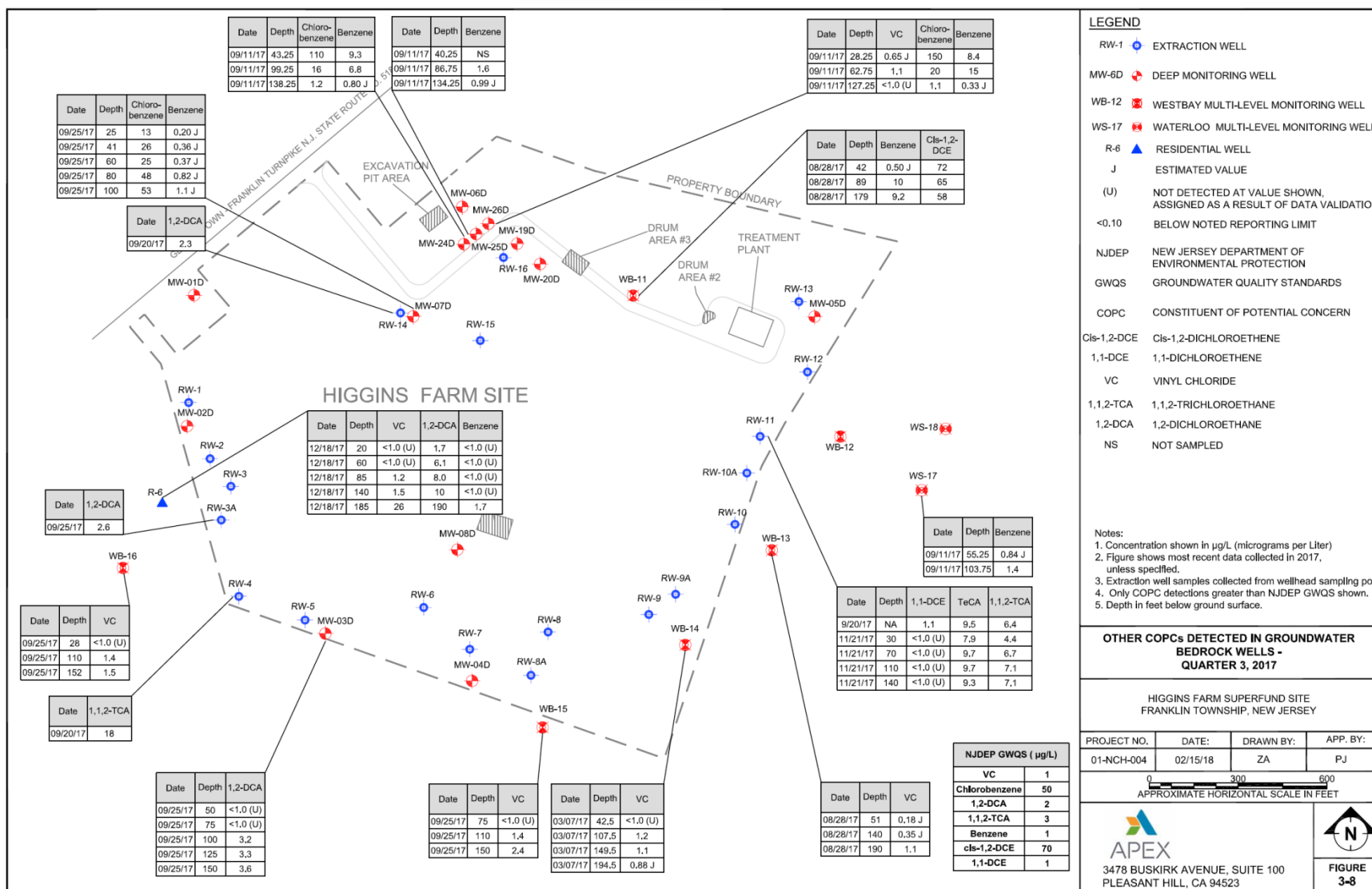
## VIII NEXT REVIEW

The next FYR report for the Higgins Farm Superfund Site is required in five years from the completion date of this review.

## **ATTACHMENT A - Site Maps**









## **ATTACHMENT B – Tables**

## Table 4 – Well Data

Current monitoring and sampling schedule for monitoring and extraction wells

**Shallow Wells:**

Well	Sampling Frequency	Screen Length (ft)
MW-6S	Semi-Annual	10
MW-8S	Semi-Annual	5
MW-9S	Semi-Annual	5
MW-10S	Semi-Annual	5
MW-21S	not determined	10
MW-22S	not determined	10
MW-23S	not determined	10

**Deep Monitoring Wells:**

Well	Sampling Frequency	Screen Length (ft)
MW-2D	Semi-Annual	200
MW-3D	Semi-Annual	200
MW-4D	Semi-Annual	200
MW-6D	Semi-Annual	200
MW-7D	Semi-Annual	112
MW-8D	Semi-Annual	201
MW-19D	Semi-Annual	25
MW-20D	Semi-Annual	25

**Westbay Wells:**

Well	Sampling Frequency	Screen Length (ft)
WB-11	Semi-Annual	3 ports - 15 ft
WB-12	Semi-Annual	2 ports - 15 ft
WB-13	Semi-Annual	3 ports - 15 ft

**Waterloo Wells:**

Well	Sampling Frequency	Screen Length (ft)
WS-17	Semi-Annual	2 ports - 15 ft
WS-18	Semi-Annual	2 ports - 15 ft 150.1 feet total;
MW-24D	Not determined	3 ports – 10.5 ft 150. 4 feet total;
MW-25D	Not determined	3 ports – 10.5 ft 147.5 feet total;
MW-26D	Not determined	3 ports – 10.5 ft 150.1 feet total

**Extraction/Former Extraction Wells:**

<b>Well</b>	<b>Sampling Frequency</b>	<b>Screen Length (ft)</b>
RW-3A	Annual	145
RW-4	Annual	145
RW-6	Annual	145
RW-7	Annual	145
RW-8	Annual	145
RW-8A	Annual	145
RW-9	Annual	145
RW-9A	Annual	145
RW-10	Annual	145
RW-10A	Annual	145
RW-11	Annual	145
RW-14	Annual	145
RW-15	Annual	145
RW-16	Annual	145

**Table 5 – Site Chronology**

<b>Event</b>	<b>Date(s)</b>
NJDEP investigated drum activities at the Site	January 2, 1986
NJDEP requested EPA to assume lead role in mitigating the Site	March 1987
Higgins Farm is placed on the National Priorities List	March 1989
EPA notified six PRPs of potential liability and offered them the opportunity to conduct or finance the RI and FS	March 1989
EPA offered the PRPs' the opportunity to install a potable water line along Route 518 to service impacted or potentially impacted residents	October 17, 1989
The PRPs were informed that EPA had not received an acceptable offer to install the public water line	February 1990
EPA released a Focused Feasibility Study report and Proposed Plan for alternate potable water supply line	June 1990
EPA issued interim ROD for waterline	September 24, 1990
Installation of potable waterline was completed by EPA	December 21, 1992
EPA issued a second ROD for groundwater extraction and treatment system	September 30, 1992
All potentially impacted residents were connected to the waterline	May 11, 1993
EPA completed Design Basis Report	December 1993
EPA signed Interagency Agreement with USACE to procure and manage a remedial design contractor	March 17, 1995
Remedial Action contract awarded to Dow Environmental Inc.	August 31, 1995
USACE issued Notice to Proceed to Remedial Action contractor	September 15, 1995
30-day Startup period commenced	December 1, 1997
Issuance of Certification of Compliance of Remedial Action activities	May 13, 1998
Construction Completion of Site activities	September 28, 1998
The commencement of the first of 10 years of the Long-Term Response Action under EPA	November 1999
First Five-Year Review completed	September 29, 2003
Remediation System Evaluation Final Report prepared by USACE-Hazardous, Toxic and Radioactive Waste Center of Expertise	May 2004
FMC and NCH Corporations' consent decrees were lodged into U.S. District Court, for the District of New Jersey	August 10, 2006
NCH took over long term remediation activities	September 9, 2006
FMC and NCH consent decree was entered into Court	October 26, 2006

<b>Event</b>	<b>Date(s)</b>
NCH paid EPA \$1,000,000 for past response costs	November 20, 2006
FMC paid EPA \$15,607,836.14 for response costs	November 21, 2006
NCH streamlined the pump and treat system	July 16, 2007
Mrs. Higgins' (owner of the Site) consent decree was entered into court	August 20, 2007
Mrs. Higgins paid EPA \$1,300,000 for response costs	September 17, 2007
A Franklin Township meeting was held to preserve the Higgins Farm Superfund Site as farmland	November 15, 2007
Second Five-Year Review completed	September 30, 2008
Limited Source Area Investigation	June 2009
Bedrock Monitoring Well Installation	June 2010
Sampling of 1,4 dioxane	April 2012
Surface Water Sampling	May 2012
Vertical Profiling of Extraction Wells	May 2012
In-Situ Bioremediation Pilot Study – Former Drum Excavation Area	November 2010 - November 2011
Groundwater Sampling in EOS Injection Pilot Test Area, Post Injection	August 2012
Bedrock Investigation and Well Installations	August 2012 – January 2013
Full Scale In-Situ Bioremediation – Former Drum Excavation Area	November and December 2012
Phase I Extraction Well Shutdown and Monitoring Work Plan submittal	February 11, 2014
NJDP established CEA/WRA for the Site	March 13, 2017
Work Plan for the 2013 Five-Year Review Recommendations submittal	August 18, 2017
Phase II Pilot Study submittal	May 16, 2018