THIRD FIVE-YEAR REVIEW REPORT FOR D'IMPERIO PROPERTY SUPERFUND SITE ATLANTIC COUNTY, NEW JERSEY

Prepared by

U.S. Environmental Protection Agency
Region 2
New York, New York
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LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEA/WRA	Classification Exception Area/Well Restriction Area
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Difference
FYR	Five-Year Review
ICs	Institutional Controls
LCDP	Lower Cohansey Detached Plume
MEK	Methyl Ethyl Ketone (2-butanone)
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
RCRA	Resource, Conservation and Recovery Act
RIFS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
VOC	Volatile Organic Compound

I. INTRODUCTION

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

The U.S. Environmental Protection Agency (EPA) is preparing this FYR 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 third FYR for the D'Imperio Property Superfund Site (the Site). The triggering action for this **policy** review is the completion date of the previous FYR. The FYR has been prepared due to the fact that the remedial action will not leave hazardous substances, pollutants or contaminants on site above levels that allow for unlimited use and unrestricted exposure, but requires five or more years to complete.

The site consists of one site wide operable unit (OU1) to be addressed in this FYR. OU1 addresses the remediation of the contaminated site soils and groundwater.

The D'Imperio Property Superfund site FYR was led by Michael Zeolla, Remedial Project Manager. Participants included Michael Scorca (EPA-Hydrologist); Abbey States (EPA-Human Health Risk Assessor); Mindy Pensak (Ecological Risk Assessor); Pat Seppi (EPA-Community Involvement Coordinator); and Helen Dudar (NJDEP-Case Manager). The potentially responsible parties (PRPs) were notified of the initiation of the five-year review. The review began on 10/16/2018.

Site Background

The site is located in Hamilton Township, Atlantic County, New Jersey. The site is situated southeast of the intersection of U.S. Route 322 (Black Horse Pike) and Cologne Avenue and includes a 15-acre parcel of undeveloped property identified as Block 1134, Lot 3.03 on the Hamilton Township tax map. An area of approximately one and one-half acres was used as an unauthorized disposal area in the mid-1970's This unauthorized disposal area received drummed waste containing metals and various volatile organic compounds (VOCs). A trailer is utilized on the property and a private fence restricts access to the site.

The Site is located in a semi-rural region of Atlantic County within the New Jersey Pinelands National Reserve. The land use near the site is classified as a Regional Growth Area. This designation allows for commercial, industrial and moderately high residential development. Several commercial businesses surround the site and many residential developments exist in the area. One housing development is located approximately 300 feet west of the site. Two adjacent properties are being considered for development - one as a commercial strip mall to the northwest,

and the other for residential housing to the south. There are no current plans for reuse of the site property.

Site Hydrogeology

The site is situated on the Atlantic Coastal Plain and the hydrostratigraphic units of primary interest are the Tertiary-age Bridgeton, Cohansey, and Kirkwood Formations.

The Bridgeton Formation is the uppermost unit and extends to a depth of 40 feet below ground surface (bgs). It consists of interbedded sands and fine-grained units. An unconfined, water table aquifer exists within the Bridgeton Formation.

The Cohansey Formation has locally been divided into three (3) sub-units - the Upper Cohansey Sand, Middle Cohansey Clay, and Lower Cohansey Sand. The Upper Cohansey Sand consists of coarse to medium sand with traces of medium to fine gravel and silt. The depth to the base of the Upper Cohansey Sand is typically 60 feet bgs and it is semi-confined at the site by overlying fine-grained subunits of the Bridgeton Formation. The Middle Cohansey Clay generally extends from 60 to 80 feet bgs and serves as a confining unit between the Upper and Lower Cohansey Sand units. It consists of clayey silt to silt and clay, with little fine sand. The Lower Cohansey Sand extends from about 80 to 170 feet bgs and consists of fine to medium sand, with traces of silt. This unit forms a regionally-extensive aquifer that is confined by the overlying Middle Cohansey Clay and the underlying Kirkwood Formation.

The nearest surface water bodies are two wetlands to the north and south of the site, approximately 2,000 and 4,000 feet away, respectively. The northern wetland is named Babcock Swamp and is drained by Babcock Creek, which is tributary to the Great Egg Harbor River. The southern wetland is unnamed and is drained by Gravelly Run, which is also a tributary to the Great Egg Harbor River.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: D'Imperio Property		
EPA ID: NJD980529416		
Region: 2	**State:** NJ	**City/County:** May Landing/Atlantic
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		

Lead agency: EPA ***[If "Other Federal Agency", enter Agency name]*:**
Author name (Federal or State Project Manager): Michael Zeolla
Author affiliation: Remedial Project Manager
Review period: 7/31/2014 - 7/31/2019
Date of site inspection: 4/16/2019
Type of review: Policy
Review number: 3
Triggering action date: 7/31/2014
Due date *(five years after triggering action date)*: 7/31/2019

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Between September 1984 and February 1985, EPA performed a remedial investigation and feasibility study (RI/FS) to delineate the nature and extent of contamination at the site and develop remedial alternatives addressing the contamination found within the soils and groundwater. The investigation indicated that the waste disposal activities had resulted in groundwater contamination in the Bridgeton and Cohansey aquifers. The Cohansey aquifer is a source of drinking water for the area. In addition, the soils adjacent to and underlying the disposal area were also found to be contaminated. A human health risk evaluation was performed as part of the RI, and the results identified high levels of VOCs in groundwater, including: 1,2 dichloroethane (1,2-DCA); 1,2-dichloropropane (1,2-DCP); trichloroethene (TCE); 1,1-dichloroethane (1,1-DCA); chloroform; cis-1,2-dichloroethene (cis-1,2-DCE); 2-butanone (MEK); ethylbenzene; trichloroethene; toluene; and 1,4-dioxane. Metals, included as contaminants of concern impacting groundwater were arsenic, chromium, copper, iron, lead, manganese, mercury, zinc, chloride and sulfate. Base neutrals compounds, acid compounds, and volatile organics were the primary contaminants detected in soils. The risk assessment concluded that actions must be taken to reduce the potential risks of exposure to human health and the environment associated with the source material are direct contact with the contaminants elevated above standards in the soils as well as the continued migration of contaminants to the groundwater. Also, an ecological risk evaluation was completed as part of the remedial alternative screening process but was not used as a basis for taking a remedial action because ecological risk was not significant.

Response Actions

In the late 1970s, the Atlantic County Public Health Department learned of the illegal waste disposal area behind the Dennis Motel (a motel located east of the D'Imperio property) and informed the New Jersey Department of Environmental Protection (NJDEP) of its existence.

NJDEP directed the Dennis Motel to investigate and dispose of the waste material. The motel did not comply with this directive from NJDEP. In 1980, a limited field investigation conducted by a potential developer of the property indicated that the groundwater underlying the site was contaminated with VOCs. Subsequently, NJDEP performed a more thorough investigation. EPA was notified by the NJDEP of the existence of the waste disposal area in 1981. In early 1982, EPA began an investigation of the site and a remedial action master plan (RAMP) was completed in August 1982. This report summarized the existing data and identified tasks necessary to complete a RI/FS. EPA installed a security fence around the property in 1982 and the site was placed on the National Priorities List of Superfund Sites (NPL) on September 1, 1983.

Based on the findings of the RI and FS, a Record of Decision (ROD) selecting a remedy for the site was issued by EPA on March 27, 1985. The remedial action was conducted in one sitewide operable unit. The Remedial Action Objectives (RAOs) of the remedy include the following;

- Eliminate the future risk of contaminated groundwater ingestion by present and potential users near the site;
- Minimize the risk to the public from exposure to wastes and contaminated soils in the site area;
- Prevent the migration of contaminants from wastes left on the site; and
- Protect the public and on-site workers from health impacts resulting from the implementation of the remedial action.

The basic components of the remedy include the following;

- Excavation of 3,900 cubic yards of surface drums and contaminated soils for off-site disposal at a facility approved under the Resource, Conservation and Recovery Act (RCRA);
- Installation of a contaminated groundwater recovery and treatment system for the Bridgeton and Cohansey aquifers prior to reinjection or surface water discharge (determined during the design phase) with the goal to restore the groundwater to appropriate federal and state standards; and
- Construction of a RCRA Subtitle C cap over the excavated dump area.

Because there were no cleanup goals for many of the VOCs detected at the site, Attachment IV was inserted into the August 1993 Administrative Order (1993 Order) to provide a table of the performance standards that must be met to achieve cleanup (See Table 2).

After the removal of soils in 1987, and startup of the groundwater treatment system in 1997, the Potentially Responsible Parties (PRPs) performed several soil investigations in the former disposal area. In October 1998, the PRPs performed a soil study to determine if any source material remained on site that may pose a threat to human health and the environment. The soil sample results from this investigation are summarized in the May 1999 soils sampling report.

Following a review of the results of the soil sampling report, the PRPs performed additional soils sampling in June 2000 to delineate the nature and extent of the remaining source material found

in the subsurface soils at the former disposal area. The analytical data, presented in the May 1999 soil sampling report and August 2000 soils investigation report, were utilized to develop the soils evaluation (SE) report, dated September 2002. The SE Report provided a detailed analysis of the alternative methods to deal with the residual source material at the former disposal area, and the basis for modifying the soil remedy (RCRA cap) selected in the 1985 ROD. On July 3, 2003, EPA issued a ROD Amendment that changed the soils remedy from a RCRA cap to the treatment of contaminated subsurface soils by vapor extraction. The RAOs for the amended remedy include:

- Reduce or eliminate the risk of human exposure to the contaminated soils;
- Reduce or eliminate further contaminant migration from the soils to the groundwater; and
- Mass removal of contaminants in the site soils.

The major components of the amended soils remedy are as follows:

- Extraction of vapors contaminated with VOCs from the soils above the water table which exceed the cleanup levels;
- On-site treatment of extracted vapors prior to discharge to the environment; and
- Operation, maintenance and performance monitoring to ensure the effectiveness of the remedy. A monitoring program was developed to evaluate the effectiveness, optimize the operational parameters, determine the parameters for remedy closure, and confirm compliance with the cleanup goals.

The soil cleanup goals of the amended remedy are to reduce the threat by addressing the contaminated soils above the water table in excess of the more stringent of the New Jersey Soil Cleanup Criteria (NJSCC) for Impact to Groundwater or Residential Direct Contact (See Table 3).

On March 10, 2010, EPA issued an Explanation Significant Difference to incorporate the Classifiaction Exception Area/Well Restriction Area (CEA/WRA) as a component of the site selected remedy. The CEA/WRA was established at the site to restrict the construction of drinking water supply wells within the area of the contaminated plume(s).

Status of Implementation

Soil Removal:

From April to September 1985, EPA conducted remedial design activities for the excavation and removal of waste material from the former disposal area. EPA and the Army Corps of Engineers (ACE) began the on-site excavation and off-site disposal of buried drums and contaminated waste material on November 5, 1986. The removal of about 82 drums and 3,900 cubic yards of contaminated soils and disposal at an off-site, RCRA-approved facility, was completed in March 1987. The excavation area was subsequently backfilled, graded and vegetated with native plants.

Groundwater:

The groundwater extraction, treatment, and reinjection system consists of four extraction wells for the Bridgeton Sand Aquifer and five extraction wells for the Upper Cohansey Sand Aquifer has been operational since August 1997. This groundwater remediation system was expanded in April 1999 to include one extraction well in the Lower Cohansey Sand Aquifer. The system was constructed with a total design flow rate of 155 gallons per minute (gpm). Implementation of this remedial system was based on the results and conclusions contained in the documents titled "Phase I GWI Report"; "Phase II GWI Report"; and "Further Definition of the Lower Cohansey Plume", along with the design presented in "100% Design Review, Engineering Design Report for the Groundwater Extraction, Reinjection, and Treatment System."

Based on the findings of the ongoing groundwater monitoring program, the current nature and extent of the Lower Cohansey plume was delineated in a supplemental multi-phased groundwater investigation between August 2003 to March 2004. The Lower Cohansey plume was found to be migrating both laterally and vertically down gradient. The results of the investigation activities can be found in the Lower Cohansey Plume Delineation Report submitted in January 2005. Enhancements to the Lower Cohansey groundwater remediation system were constructed from May 2005 to January 2006, which is documented in the Lower Cohansey Extraction System Enhancement Certification Report submitted in April 2006. The enhanced Lower Cohansey groundwater extraction system provides hydraulic capture of the width and depth of the leading edge of the Lower Cohansey plume, within the capacity of the existing treatment plant, as described in the Revised Work Plan for Groundwater Extraction System Enhancements. Four new groundwater extraction wells (LC-2-E, LC-3-E, LC-4-E, and LC-5-E) were constructed with a total design average extraction rate of 75 gpm has been operational since February 2006. In addition, three new observation wells (OBW-61, OBW-62 and OBW-63) were installed downgradient of the extraction wells to monitor the remedial progress.

In 2005, a detached portion of the Lower Cohansey plume was identified near observation well OBW-63 and monitoring well MW-60 after completing construction of the Lower Cohansey plume enhancement activities. This detached plume developed because the groundwater flow velocity within the Lower Cohansey Aquifer was interpreted incorrectly for the final design of the enhancement system. A scope of work to characterize and delineate this detached portion of the Lower Cohansey plume was submitted in 2010. Several boreholes and monitoring wells were installed downgradient of the Lower Cohansey plume enhancement extraction wells and sampled for groundwater quality. Because of the delineation effort, new sentinel wells MW-64 and MW-65 were installed along Harding Highway (US Route 40). The Lower Cohansey Detached Plume (LCDP) is located downgradient of Route 40 and moving in a southwest direction. Additional pre-optimization investigation, design, and construction activities were performed to address the LCDP. Pre-optimization investigative activities were completed in May 2015. Investigation activities included the installation of six new monitoring wells (MW-75, MW-76, MW-77, MW-78, MW-79, and 80), pump test activities including transducer data and aquifer test analysis, design of the extraction well screen/filter pack, and additional groundwater monitoring. These activities are summarized in the "Lower Cohansey Detached Plume Pre-Optimization Investigation Report" (POI Report) dated September 2015. This investigation provides the data necessary for the final design and implementation of the LCDP remedial optimization.

The LCDP remedial optimization system was constructed in 2015 in accordance with the EPA approved December 2014 Revised LCDP optimization implementation work plan, the LCDP optimization engineering and construction drawings, May 2015 and June 2015, respectively, and the associated documents. The LCDP optimization system includes the following components; 1) three new Lower Cohansey extraction wells (LC-7-E, LC-8-E and LC-9-E) constructed to operate at a combine design flow rate of 36 gpm; 2) an extraction control and conveyance system; and 3) a new Lower Cohansey reinjection well, LC-3-R, to provide an additional 35 to50 gpm of groundwater injection capacity. The LCDP system began operating in October 2015, with full start-up in November 2015.

Contaminated Soil:

EPA approved a remedial design report for soil vapor extraction in May 2004. It called for a vacuum to be applied to the subsurface using a blower and extraction wells. Air is drawn from wells causing flow through the soil, into the wells and air collection system and finally to the blower. Air flow from the blower is directed to a two-stage vapor phase granular activated carbon (VGAC) system for treatment before discharging to the atmosphere.

The system consists of eight active extraction wells, five passive air inlet/contingency wells and a utility building that houses all treatment equipment such as the 15 horse power blower, knockout tank, piping manifolds/gauges, and carbon treatment units (See Figure 8). The five passive wells allow fresh air to be introduced in the soil to improve the subsurface flow, and if the performance monitoring indicates that the eight active wells are insufficient to achieve the design criteria, the passive wells would be operated as active extraction wells. Figure 4 shows the configuration of wells. The treatment area is about 70 feet long by 60 feet wide by a depth of 15 feet with a volume of about 153,000 cubic feet. The primary treatment goal is physical removal of contaminant mass from the subsurface, but some biological degradation occurs in the source area. The SVE system has been operational since August 2004 and has removed approximately 46,605 pounds of VOCs.

IC Summary Table

Table 1: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater	Yes	Yes	site-wide	Restrict installation of ground water wells and ground water use.	Classification Exception Area was established in 1997. To Be Revised, 2019

Systems Operations/Operation & Maintenance

Groundwater Remedy

The groundwater extraction, treatment and reinjection systems continue to be functional and operated by the PRP contractor *de maximis, inc*., and their subcontractors, Brown & Caldwell, and O&M, Inc. This system is currently treating (on average) approximately 170 gpm of contaminated groundwater through activated carbon units. The treated water is reinjected to groundwater under a permit equivalency issued by NJDEP which requires sampling of the treatment system on a monthly basis.

Groundwater monitoring is also performed quarterly to ensure that the groundwater remedy continues to be effective in capturing each part of the contaminated plume. The requirements of this sampling effort are found in the November 2007 long term groundwater monitoring LTGWM plan. Also, in accordance with the 2007 operation and maintenance plan, the system undergoes monthly and quarterly operation and maintenance activities to ensure cleanup of the groundwater. In addition, the 1997 CEA/WRA is scheduled to be updated in 2019 to reflect the current configuration of the plume, and then submitted to NJDEP for review and approval.

Soil Remedy

For the soil remedy to be considered complete, the remedial action objectives and soil cleanup goals must be achieved. To confirm whether the system has achieved these objectives and cleanup goals, a three-stage approach using performance monitoring requirements and verification sampling is being implemented. Stage 1 evaluates the total vapor stream concentration as it approaches stable levels. Stage 2 requires soil vapor samples to be collected during three separate shut down periods and the results compared to the remedy performance standards. Stage 3 calls for soil confirmation sampling. A more detailed description of these requirements can be found in the December 2004 operations and maintenance manual.

With vapor stream concentrations approaching stable levels, this first stage of performance monitoring is complete. In February 2014, the PRPs submitted an interim soil assessment work plan. Upon EPA approval in March 2014, a final interim soil assessment work plan was submitted to EPA in July 2014. This work plan consisted of collecting soil vapor and subsurface soil confirmation samples. These activities were performed in August 2014.

The results of the soil confirmation sampling activities are presented in an interim soils assessment report submitted to EPA in January 2015. This report concluded that a significant volume of mass was removed and soil contaminant concentrations in and around the former disposal area have declined since the start of the SVE system, but that some areas continue to harbor material, and that the system should continue operating to remove the remaining mass. In addition, future sampling was reduced from quarterly to semiannually.

Then, in May 2015, due to the decline in mass removal rates, the PRPs beagn operating the SVE system under a pulse pump mode to potentially enhance mass removal. As part of the month on-off operations (pulse pump), the PRPs began conducting the second stage of performance

monitoring by collecting soil vapor samples during the shutdown period. Data collected during the month after a shut down did not prove enhanced mass removal rates.

The PRPs submitted a performance evaluation (PE) report in November 2018. Activities to be conducted during September 2019 includes soil and vapor sampling consistent with Stage 3 of treatment verification.

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 changes in the region and near the site.

III. PROGRESS SINCE THE LAST REVIEW

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

Table 2: Protectiveness Determinations/Statements from the 2014 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The remedy at OU1 is protective of human health and the environment and in the interim, exposure pathways that could results in unacceptable risks are being controlled. Excavation and removal of waste material and contaminated soils have reduced the source of groundwater contamination. The groundwater plumes have been defined and no drinking water wells are installed within the area of the plumes. Long-term monitoring indicates that the groundwater extraction, treatment and reinjection system is remediating the three contaminated aquifers (Bridgton, Upper and Lower Cohansey including the Lower Cohansey Detached Plume). In addition, periodic performance monitoring indicates the vapor extraction and treatment of contaminates in the subsurface soil continues to reduce the source of the groundwater contamination.

There were no specific recommendations identified in the second FYR for the site. However, the design and construction of the LCDP optimization system has been completed since the last FYR, and a revised Long Term Groundwater Monitoring Plan (LTGWMP) has been submitted for review and approval, and later in 2019, a revised CEA/WRA.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On October 1, 2018, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 42 Superfund sites in New York and New Jersey, including the D'Imperio Property site. The announcement can be found at the following web address: https://www.epa.gov/aboutepa/fiscal-year-2019-five-year-reviews.

In addition to this notification, a public notice was made available to the Hamilton Township Clerks Office for posting on the township website as well as the EPA website, on 8/15/2019, 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 the report will be made available at: https://www.epa.gov/superfund/dimperio-property, as well as the Site information repository located at EPA Region 2, Superfund Records Center, 290 Broadway, 18th Floor, New York, New York 10007, and local repository located at Hamilton Township Clerk's Office, 6101 Thirteenth Street, Mays Landing, New Jersey 08330.

Data Review

Groundwater

The groundwater monitoring program includes monthly testing of the treatment system, and the collection of water levels and groundwater quality samples to ensure the effectiveness of the extraction, treatment and reinjection systems in removing contaminants from the ground water. The monitoring program has been updated, as needed, based on results and changing site conditions, and will be revised again within the upcoming year. All treated effluent discharge permit equivalency limits are consistently met, and the monitored contaminants of concern continue to be reduced.

The contaminated groundwater emanating from the D'Imperio disposal area created plumes that currently is about 6,700 feet long and as much as 450 feet wide. As the contamination has moved downgradient from the source area, it has also migrated vertically downward to as much as approximately 150 bgs. There are three aquifers (Bridgton Aquifer, Upper Cohansey Aquifer, and Lower Cohnasey Aquifer) impacted by the site groundwater and the plume is divided into four main parts 1) Bridgeton Aquifer, 2) Upper Cohansey aquifer, 3) Lower Cohansey aquifer, and the 4) Lower Cohansey detached plume.

The major chemical contaminants currently observed in the groundwater include 1,2-DCA, 1,2-DCP, TCE, 1,1-DCA, chloroform, cis-1,2-DCE, and 1,4-dioxane. Less frequent detections of benzene, 2-butanone, and 1,1-DCE have been observed, as well as sporadic detections of other VOCs. Total volatile organic compounds (TVOCs) are defined in this report as the total concentration of the VOCs at the site.

Currently, eight monitoring wells and three extraction wells that are screened in the Bridgeton Aquifer were sampled in 2018. Following a short-term increase in concentrations in 2010 (related to a period of high precipitation and groundwater levels), TVOC concentrations have declined to fairly low values and have remained mostly stable, with rare detections at higher values (Figure 1). During 2018, TVOC concentrations in the Bridgeton aquifer were highest in wells MW-43 (48.6

The current monitoring network for the Upper Cohansey aquifer consists of twelve monitoring wells and five extraction wells. Sampling results show that the TVOC concentrations in the Upper Cohansey aquifer have also declined with time. See Figure 2. In 2018, the maximum TVOC concentration in the Upper Cohansey was observed at well MW-24-2-R (77.8) and only nine wells had TVOC concentrations greater than 10 . Two chemical contaminants (chloroform and 1,2-DCA) exceeded their 1993 Order standard at six wells in the Upper Cohansey. Samples at ten wells contained 1,4-Dioxane concentrations greater than the NJGWQS (0.4). Figure 6 illustrates the 1,2 DCA concentrations decreasing in BR-2E (Bridgton Sand) and MW-28-1 (Upper Cohansey) while increasing in BR-3E.

The groundwater sampling network in the main body of the plume in the Lower Cohansey aquifer in 2018 consisted of ten monitoring, three observation, and four extraction wells. The observation wells are located downgradient of the extraction wells. Trends of TVOC concentrations during the last five years are generally decreasing, or stable with some variability. See Figure 3 and 4. The maximum TVOC concentration in 2018 was at well MW-45 (27.1). The migration of the core of the plume within the Lower Cohansey aquifer is shown by a general progression of maximum TVOC concentrations observed at further downgradient wells over time. Concentrations were observed to rise to a peak, which was then followed by a decreasing trend, at wells MW-29-2 during 1998, MW-33-2 during 2004, MW-46 during 2010, and MW-47 during 2007. The highest contaminant mass in the Lower Cohansey plume has migrated downgradient toward the line of pumping extraction wells. Only seven of the sampled wells within the main body of the Lower Cohansey plume in 2018 contained TVOC concentrations above 10 .

An additional portion of the Lower Cohansey plume is present downgradient of US Route 40 and is referred to as the LCDP. Temporary well borings and permanent wells were installed to complete delineation of the LCDP and three additional extraction wells were installed at downgradient locations to contain and capture the detached plume in 2015. The maximum TVOC concentration was observed at well MW-69 (90.5). The migration of the core of the detached plume could also be tracked by observing maximum concentrations at further downgradient wells. The peak TVOC concentration was observed at well MW-60 in 2010 and six years later at MW-69 in 2016. See Figure 5. Of the TVOCs, TCE was the most frequently detected contaminant in the LCDP. Figure 7 illustrates the TCE concentrations in MW-60, MW-66, MW-68, MW-69 and 70 moving across each well over time. The TCE concentrations are observed increasing and then decreasing. For example, MW-60 starts out around 1 , increases to above 20 , and then decreases to 1 . Whereas, the TCE concentrations in MW-69 are fluctuating over time.

1,4-dioxane has been detected frequently in the contaminant plume in all three aquifers, with a maximum concentration of 240 in 2014 and 180 in 2018. In addition, the effluent from the groundwater treatment plant was sampled and analyzed for 1,4-dioxane beginning in August 2014. In November 2015, the NJDEP GWQS for 1,4-dioxane was lowered from 10 to 0.4 . Subsequent sampling results detected 1,4-dioxane in the effluent, ranging from 27 ug/L in August 2015 to 5.8 ug/L in May 2019. This is about an 80 percent reduction in the effluent. While we see a reduction in the 1,4-dioxane concentrations due to treatment, the effluent results are continuously above the updated 2015 NJDEP GWQS. However, the effluent is reinjected within the boundaries of the captured groundwater plume from the ongoing extraction system to ensure containment of the 1,4-dioxane.

As of December 2018, roughly 1.25 billion gallons of water have been treated at the site. The treatment system is currently processing water at an average monthly pumping rate of about 170 gpm and is effectively capturing the contaminated groundwater plume(s). Monthly effluent testing of the treatment system ensures that the remedy consistently meets the performance criteria established in the 1986 ROD. In addition, the influent (untreated water coming into the treatment system) is sampled monthly. Generally, the influent concentrations have been reduced to below 50 /L which is one of the important criteria for assessing groundwater cleanup as specified in the 1986 ROD. The other criteria will be to compare concentrations to the Federal maximum contaminant level (MCL) and NJ GWQC.

In summary, the analytical data indicates that the TVOCs groundwater plumes for each of the three aquifers (Bridgeton, Upper and Lower Cohansey) continue to decrease in contaminant concentration and areal extent since the treatment operations began in August 1997. In addition, TVOCs continuously non detect in downgradient wells, MW-28-1, MW-29-1, and MW-80. Extraction wells in the three aquifers are containing the plume and reducing contaminant mass.

Subsurface Soils

As of April 2019, the SVE system has removed over 47,605 pounds (lbs) of VOCs from the subsurface soils at the former disposal area. Since operations began in September 2004, the total annual VOC removal rate has decreased yearly from about 22,874 lbs/month in 2005 to 13 lbs/month in 2018. Figure 9 shows total VOC mass removed from the subsurface soils. This trend is typical for vapor extraction systems. The initial years of operation show a significant rate of removal followed by smaller changes through the subsequent years. The system is currently in its fifteenth year of operation.

For the past fifteen years, air samples were collected monthly during the first year, quarterly for next nine years and semiannually over the past five years at eight vapor extraction wells and the treatment system. A review of the analytical data collected shows a significant decrease in total pre-treatment VOC concentration from 2,231,600 /m^3 in September 2005 to 29,487 /m^3 in September 2009 and 1,480 /m^3 in March 2014 to 147 /m^3 in January 2019. Table 5 shows the total vapor concentrations for each well, and pre and post treatment for select years. Overall, all 8 vapor extraction wells were observed to have significant reduction in vapor concentrations, and since September 2005, the treatment system has removed approximately 90 percent of the contaminant mass. In addition, Figure 9 illustrates the contaminant mass removal per year over a ten year period between 2007 and 2018. However, over the last few years, the system is not removing the volume of mass as in previous years.

Beginning in 2009, on-site groundwater elevations were observed rising during routine monitoring which caused the vapor extraction system to be temporarilly shut down. On several occasions when the system was restarted, the vapor concentrations had rebounded in the subsurface soils. The vapor concentration in the influent stream had increased to 29,490 /m^3 (in June 2010) from 20,058 /m^3 (in June 2009). A rebound in concentration is typical during any extended downtime for a vapor extraction system. However, the rise in water levels and system shutdown during the past five years has had little effect on vapor concentrations rebound because the average annual VOC mass removal rate had decreased from 138 lbs in 2014 to 13

lbs in 2018. The total vapor concentrations in the influent stream continues to show that the contaminant mass is being removed but approaching stagnant levels.

Based on the data from the interim assessment sampling and the past five years of minimal combined monthly contaminant mass removal from extraction wells, the PRP submitted a SVE system performance evaluation work plan in November 2018. The objectives of this work plan are to continue operating the SVE system while performing soil and vapor sampling consistent with the third stage of treatment verification outlined in the December 2004 operation and maintenance manual, and assess the effectiveness of the remediation and progress towards achieving the remedial objectives and cleanup criteria.

Site Inspection

The inspection of the site was conducted on 4/16/2019. In attendance were Michael Zeolla, EPA Project Manager, Mark Chamberlain, USACE; Helen Dundar, NJDEP Case Manager; Robert Darwin, Project Coordinator and Michael Miller, Senior Vice President, de maximis, inc; Scott McMillian and Charles Meyn, PRP Geologists, Brown and Caldwell; Janine Bauer and Lori Mills, PRP Lead Attorneys; Eric Frauen, PRP SVE Operator, O&M, Inc.; Steve Borton and Tom Thomas, PRP P&T Operator, O&M, Inc.; Dave Borton, PRP P&T Construction Manager, O&M, Inc; and Mickey Fagan, PRP Public Relations Consultant, Issues Management. The purpose of the inspection was to assess the protectiveness of the remedy.

A brief meeting was conducted inside the trailers. PRPs provided an overview on the status of the soil and groundwater remedies. This was followed by a tour of the SVE and groundwater pump and treat systems. In March 2016, the groundwater holding tank had to be replaced due to a steel structure leak with a 10,000 gallon frac tank. A visual inspection of the SVE and groundwater treatment buildings as well as the monitoring wells and extraction well steel vaults showed that the systems were in good shape. In addition, the fencing around the former disposal area requires repairs and maintenance and is planned for the upcoming year.

V. TECHNICAL ASSESSMENT

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

Question A Summary:

The site remedy (consisting of soil removal, groundwater treatment, soil vapor extraction, and institutional controls) continues to function as intended by the 1985 ROD, 2003 ROD Amendment, and 2010 ESD. The 1997 CEA/WRA requirement, which continues to protect against drinking water wells being installed within the boundaries of the contaminated groundwater plume, was established as part of the selected remedy in the 2010 ESD.

A review of the analytical data over the last five years indicates that the groundwater treatment system (operating since August 1997) continues to meet the performance standards established in the 1993 Order. The extraction, treatment and reinjection system has continued to reduce the

concentrations of contaminants within the plumes and the discovery of a small detached plume migrating from the larger Lower Cohansey plume was delineated and, in 2015, additional extraction and reinjection wells were constructed to treat the small detached plume. This remedy is being monitored through groundwater and effluent sampling.

Because the removal of contaminated soils and waste material did not completely eliminate the source of the groundwater contamination, a soil vapor extraction system over the former disposal area was installed in June 2004. Data collected since the last FYR indicates that the system continues to reduce the contaminant concentrations in the subsurface soils. Air samples collected over the past five years demonostrate that the vapor concentrations are approaching stagnate levels, indicating the system may be nearing the end of its usefulness. To verify that the system has achieved the remedial action objectives and soil cleanup goals established in the 1993 ROD Amendment, the first phase of a three phased approach to assess the system was conducted in the summer of 2014. The results indicated that the SVE system should not be shut down and that additional soil sampling should be conducted in the future. The remedy effectiveness continues to be monitored through air samples collected at the extraction wells and treatment system.

With the LCDP remedial construction activities completed in 2015, the CEA/WRA will be revised to include the current groundwater conditions at the site to ensure that drinking water wells are not drilled within the plume area. In addition, the security fence around the property and treatment systems continues to prevent trespassers from walking on the property and possible damaging treatment system equipment.

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

The original risk assessment in support of the 1985 ROD did not calculate cancer risks or health hazards according to the current methodologies, but the process did identify the potential for human health risk based on the contaminants of concern and their known toxicity at the time. Although specific parameters and toxicity values may have changed, the need to implement a remedial action remains valid. Soil and groundwater use, potential exposure routes, and physical site conditions have not changed during the five-year review period. The remedial action objectives of eliminating future risk to the public from contaminated groundwater, eliminating or reducing risk to the public from contaminated soils, and preventing the migration of contamination remaining on-site remain valid.

The remediation goal for soils is the lower of the New Jersey RDCSCC or the IGSCC. Groundwater restoration to NJGWQS is the goal of the pump and treat remedy. The area is supplied by public drinking water and there is no contact with subsurface soils, so there are currently no complete exposure pathways for remaining on-site contamination. An updated CEA/WRA restrict groundwater use and the installation of new wells. Therefore, the remedy remains protective despite continued on-site exceedances of soil and groundwater standards.

While most VOC and metal contaminants of concern (COCs) were non-detect during the FYR period, the 1993 Order performance standard for certain COCs were above applicable or relevant and appropriate requirements (ARARs). For example, arsenic was not detected above 50

established in the 1993 Order, however this exceeds the current NJGWQS (3). To determine if groundwater restoration has been achieved for contaminants that exceed the NJGWQS, the 1993 Order performance standards will need to be reassessed in the future.

1,4-dioxane was added to the constituent list in 2006, when it was first identified in the plume. In 2015, NJDEP promulgated the groundwater quality standard for 1,4-dioxane at 0.4 . The highest levels of 1,4-dioxane were found in the Lower Cohansey aquifer with a maximum of 240 at MW-45 in 2014, though exceedances of the groundwater standard occurred in all aquifers during the review period. While 1,4-dioxane was not detected in the furtherest downgradient wells, it will be monitored continuously at the site to confirm removal from the groundwater plume.

The shallow Bridgeton aquifer was screened for its vapor intrusion potential during the FYR period, comparing VOC concentrations with EPA's residential groundwater vapor intrusion screening levels (set at a cancer risk of 10^{-6} to 10^{-4} and a hazard quotient of 1). For several VOCs (1,1-DCA, 1,2-DCA, 1,2-DCP, ethylbenzene, and chloroform), concentrations detected in the shallow aquifer were within EPA's acceptable risk range. Maximum concentrations for all detected VOCs did not exceed the upper bound for acceptable risk (a cancer risk of 10^{-4} and hazard quotient of 1); therefore, the potential for vapor intrusion from these contaminants is unlikely. There is currently no development above the shallow groundwater plume, though vapor intrusion potential should be reassessed if any development is planned or the plume migrates significantly. Currently, the vapor intrusion pathway remains incomplete throughout the site.

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

At this time there is no information that could call into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

There are no issues and recommendations for this site.

VII. PROTECTIVNESS STATEMENT

Sitewide Protectiveness Statement	
Protectiveness Determination: Protective	*Planned Addendum Completion Date:* Click here to enter a date
Protectiveness Statement: The site wide remedy is protective of human health and the environment.	

VIII. NEXT REVIEW

The next FYR report for the D'Imperio Property Superfund site is required five years from the completion date of this review.

TABLES

Table 1: Chronology of Site Events	
Event	**Date(s)**
NJDEP notifies EPA of waste disposal area	1981
EPA installs a security fence around disposal area	1982
Site placed on NPL	1983
ROD issued by EPA	1985
Remedial Investigation/Feasibility Study completed by EPA	1986
EPA excavated and disposed of contaminated soils and waste material from former disposal area	1987
Groundwater design completed by EPA	1992
EPA issues UAO to PRPs to implement groundwater remedy	1993
EPA modified 1993 UAO for additional groundwater investigations	1993
Groundwater investigation completed by PRPs	1995
EPA issues supplemental UAO to additional PRPs	1995
Groundwater RA construction completion	1996
Groundwater treatment system is fully operational	1997
PRPs conducted subsurface soils investigation	1999
EPA modified 1993 UAO for additional subsurface soil investigations	2000
PRPs conducted subsurface soil delineation activities	2000
ROD Amendment issued by EPA	2003
EPA issues UAO to PRPs to conduct soil remedy	2003
PRPs soils remedy design/construction completed	2004
SVE system is fully operational	2004
Preliminary Close-out Report	2004
PRPs supplemental groundwater investigation completed	2005
Lower Cohansey extraction system enhancement is fully operational	2006
EPA issued initial five-year review	2009
ESD issued by EPA for inclusion of CEA	2010
EPA issued Second Five-Year Review	2014
PRPs delineate Lower Cohansey Detached Plume	2014
PRPs complete design/construction of Lower Cohansey Detach Plume Extraction System	2015
LCDP Extraction System is fully operation	2016

Table 2: Remediation Goals for Groundwater (all concentrations in µg/L)			
Contaminants of Concern	**National Primary Drinking Water Standards (Federal MCLs)**	**NJ Groundwater Quality Criteria (NJGWQC)**	**Performance Standards**
Volatile Organic Compounds			
Benzene	5	1	5(a)
2-Butanone	---	300	100
Chlorobenzene	100	50	(b)
Chloroform	80	70	5(a)
1,1-Dichloroethane	---	50	(b)
1,2-Dichloroethane	5	2	5 (a)
1,1-Dichloroethene	7	1	5 (a)
1,2-Dichloroethene(total)	70	70	(b)
1,2-Dichloropropane	5	1	(b)
Ethylbenzene	700	700	(b)
Methylene Chloride	5	3	5(a)
Tetrachloroethene	5	1	5(a)
Toluene	1000	600	(b)
1,1,1-Trichloroethane	200	30	200
Trichloroethene	5	1	5(a)
Semi Volatile Organic Compounds			
Phenol[(c)]			300
Inorganic Compounds			
Arsenic	10	3	50
Chromium	100	70	Background
Copper	1300	1300	1000
Iron	300	300	300
Lead	15	5	50
Manganese	50	50	20
Mercury	2	2	2
Zinc	5000	2000	5000
Chloride	250,000	250,000	10,000
Sulfate	250,000	250,000	15,000
Conventional			
Biological Oxygen Demand			8000-10,000

Notes:

(a) Compounds with limits in the Administrative Order, Attachment IV.

(b) Compounds with the sum of (a) and (b) that shall not exceed 50 .

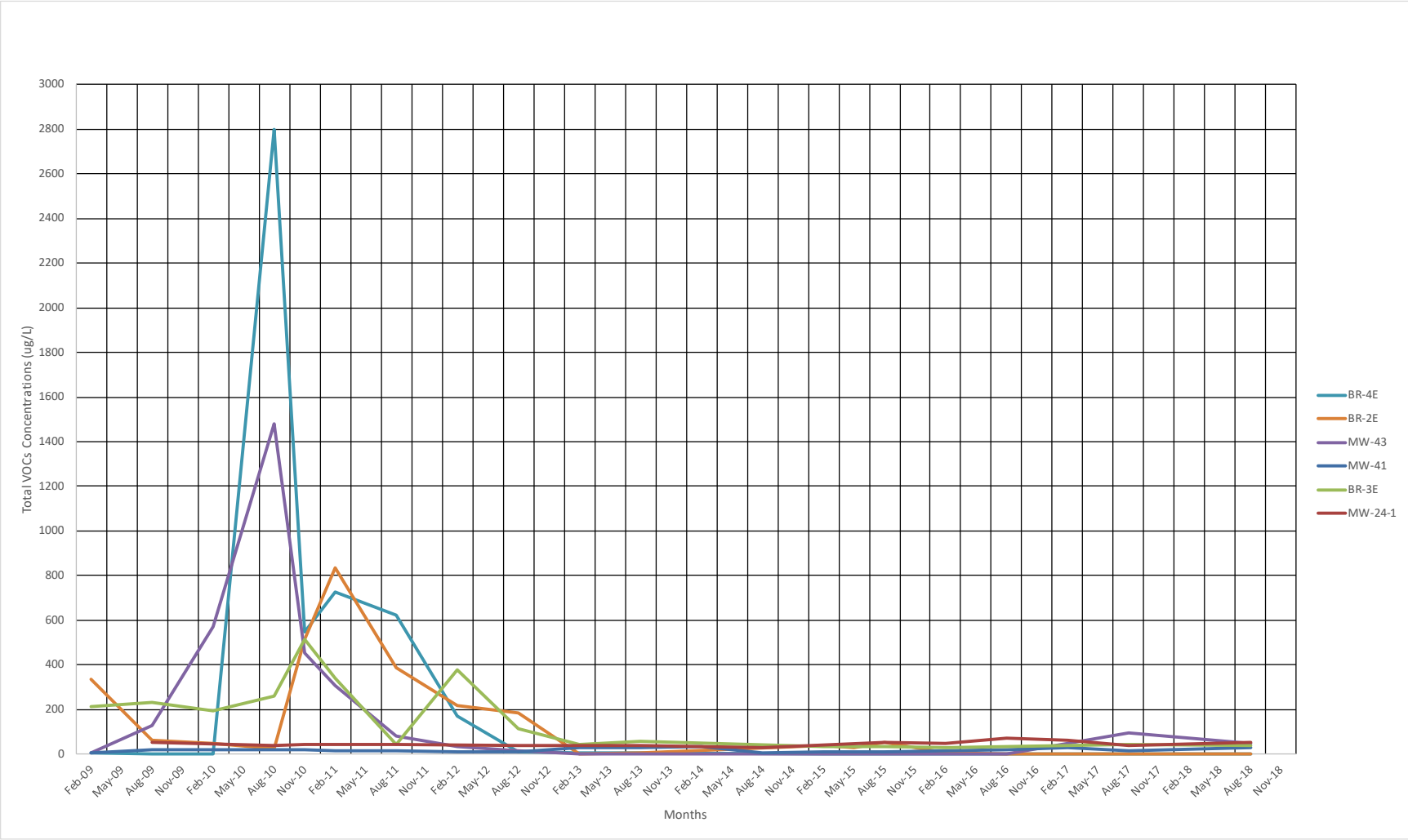
(c) Per agreement with EPA, this compound will only be monitored in the treatment effluent.

Table 3 NJDEP Soil Cleanup Criteria - Remediation Goals for Residual Source Contamination in Subsurface Soils (all values are in parts per million)			
Parameter	**Impact to Groundwater Soil Cleanup Criteria**	**Non-Residential Direct Contact Soil Cleanup Criteria**	**Residential Direct Contact Soil Cleanup Criteria**
Volatile Organic:			
Benzene	**1**	**13**	**3**
2 - Butanone	**50**	**1000**	**1000**
Chlorobenzene	**1**	**680**	**37**
Chloroform	**1**	**28**	**19**
1,1-Dichlorethane	**10**	**1000**	**570**
1,2-Dichloroethane	**1**	**24**	**6**
1,1-Dichloroethene	**10**	**150**	**8**
1,2-Dichloroethene	**1**	**1000**	**79**
1,2-Dichloropropane		**43**	**10**
Ethylbenzene	**100**	**1000**	**1000**
Methylene Chloride	**1**	**210**	**49**
Tetrachloroethylene	**1**	**6**	**4**
Toluene	**500**	**1000**	**1000**
1,1,1-Trichloroethane	**50**	**1000**	**210**
Trichloroethene	**1**	**54**	**23**
Vinyl Chloride	**50**	**1000**	**210**
Xylene (total)	**1**	**54**	**23**

Table 4: Documents, Data and Information Reviewed for this Five-Year Review	
Document Title, Author	**Submittal Date**
Record of Decision, EPA	March 1986
Record of Decision Amendment, EPA	September 2003
Long-Term Groundwater Monitoring Plan, Brown & Caldwell	November 2007
Groundwater Operations and Maintenance Plan, Brown & Caldwell	2007
SVE Operations and Maintenance Manual, O&M, Inc.	December 2008
1st Five Year Review, EPA	July 2009
Lower Cohansey Sentinel Wells Report, Brown and Caldwell	April 2011
Lower Cohansey Detach Plume Remedial Action Work Plan	July 2011
LCDP Delineation Work Plan	July 2013
SVE Interim Assessment Work Plan, O&M, Inc	March 2014
LCDP Delineation Report, Brown and Caldwell	July 2014
2nd Five Year Review, EPA	August 2014
LCDP Optimization Work Plan, Brown and Caldwell	November 2014
LCDP Optimization Implementation Work Plan, Brown and Caldwell	December 2014
SVE Interim Soil Assessment Report, O&M, Inc	February 2015
LCDP Pre-Optimization Investigation Report, Brown and Caldwell	September 2015
LCDP Construction Certification Report	November 2016
Annual Groundwater Monitoring Reports, Brown and Caldwell	2014-2019
Quarterly Groundwater Monitoring Reports, Brown and Caldwell	2014-2019
Operation and Maintenance Reports, Brown and Caldwell	2014-2019
Site Monthly Progress Reports, de maximis, inc.	2014-2019
SVE System Annual Operation Reports, O&M, Inc	2014-2019

	SVE-1	SVE-2	SVE-3	SVE-4	SVE-5	SVE-6	SVE-7	SVE-8	Pre-Treat	Post-Treat
Aug-04	37,965,000	12,741,000	1,136,610	6,598,900	827,600	830,060	28,010,300	34.318.000	39,226,000	117,286
Sep-04	8,746,400	496,200	68,506,000	1,910,000	3,523,300	6,123,000	3,910,300	9,284,300	67,083,000	19,650
Oct-04								1,610,360		
Nov-04								494,360		
Jan-05	817,170	681,262	9,215,400	987,500	34,936	585,300	3,042,500	328,070	220,470	11,692
Feb-05	806,100	1,135,200	2,983,200	887,820	35,042	424,810	602,800	3,048,800	2,855,900	28,210
Mar-05	231,170	595,920	79,140	441,400	23,314	380,000	3,149,600	350,000	919,630	32,557
Jun-05	1,149	2,356	24,924	652,870	90,650	57,667	7,900	10,312	147,430	
Sep-05	752,500	2,930,200	2,742,200	997,490	35,995	592,000	4,251,100	5,029,600	2,371,600	55,340
Dec-05	98,470	785,360	3,892,500	93,260	20,105	65,205	940,870	605,700	538,000	
Apr-06	43,494	448,850	662,280	14,320	7,725	382,160	2,540,000	593,190	505,190	2,007
Jun-06	27,375	338,167	501,300	68,883	1,476	490,430	634,850	898,910	601,680	
Sep-06	13,476	481,200	568,500	54,042	799	336,300	603,500	606,380	517,900	2,678
Dec-06	4,055	195,500	35,248	16,906	2,094	225,640	45,768	329,190	2,326	
Mar-07	328	78,140	52,675	2,590	694	156,439	137,240	386,970	125,957	113
Jun-07	1,434	130,110	4,549	1,294	237	7,280	222,270	183,520	137,660	
Sep-07	3,792	27,632	58,034	3,551	1,079	10,673	69,084	374,220	44,276	1,009
Dec-07	353	28,680	140,490	1,172	114	9,279	21,357	35,550	8,186	
Mar-08	125	79	5,014	390	229	6,777	991	770	2,145	
Jun-08	200	15,329	19	113	54	2,331	7,420	28,179	7	
Sep-08	237	8,488	26	44,713	375	9,143	7,037	564,824	90,656	680
Dec-08	897	28,854	555,350	37,353	1,651	126,010	29,088	417,640	214,540	
Mar-09	42	5,341	37,930	119,430	22	8,283	725	64,130	8,133	1,971
Jun-09	288	19,869	15,870	16,789	205	15,430	9,005	34,906	20,058	
Sep-09	313	38,840	38,792	1,549	230	21,509	15,515	35,186	29,487	7,910
Dec-09	341	27,180	2,938	71	211	4,055	110,220	18,620	13,885	
Mar-10		No Sampling Conducted. Heavy Precipitation caused High Water Table Above the Extraction Well Screen								
Jun-10	1,158	41,290	1,532	74	1,100	9,375	10,626	188,000	29,490	
Sep-10	591	14,734	18,869	330,700	2,372	33,210	7,504	77,510	28,730	1,986
Dec-10	695	12797	57440	95160	383	5813	53280	245700	65740	
Mar-11	262	18,440	99,334	103,730	345	18,770	13,072	155,520	48,950	4,089
Jun-11	208	4,539	105,560	86,490	534	4,932	31,650	78,500	44,880	
Sep-11	118	7,904	112,780	47,030	1,376	4,930	72,560	218,100	94,690	8499
Dec-11	193	9,030	63,060	12,223	169	18,210	13,767	66,740	6,420	
Mar-12	162	7,975	6,313	2,281	138	3,992	12,531	11,660	6,627	33,952
Jun-12	198	5,829	29,825	1,758	132	10,972	14,153	59,025	139	
Sep-12	222	4,345	30,738	13,119	447	6,878	5,524	58,960	50,759	147
Dec-12	518	7,433	22,041	11,425	359	5,276	10,466	91,914	20,030	
Mar-13	433	1,290	74	46	186	5,368	9,659	3,434	2,208	22
Jun-13	220	5,297	157	228	144	927	6,197	4,947	390	
Sep-13	172	4,123	4,726	16,792	443	2,629	656	20,103	2,893	144
Dec-13	223	3,564	20,337	519	170	2,134	3,308	48,433	15,480	
Mar-14	112	2,182	113	312	86	4,238	1,708	1,580	1,480	11
Jun-14	122	2,697	151	124	149	779	2,664	14,502	1,584	
Sep-14	206	2,576	16,790	519	411	938	821	24,130	11,660	116
Dec-14	259	1,888	9,349	233	209	1,034	1,582	3,410	2,035	
Mar-15	77	4,952	103	14	55	546	7,501	2,694	2,085	25
Jun-15										
Sep-15										
Dec-15	423	2,173	12,543	1,228	197	4,043	2,570	19,140	8,074	72
Mar-16										
Jun-16	149	901	382	92	90	680	2,329	224	721	207
Sep-16										
Dec-16	30	1,035	4,291	215	224	1,308	871	16,922	7,911	72
Mar-17										
Jun-17	142	912	3,164	62	131	206	1,759	502	1,036	262
Sep-17										
Dec-17	151	1,052	3,234	18,204	309	870	721	20,499	9,742	31
Mar-18										
Jun-18	116	828	296	79	208	412	4,871	704	600	157
Sep-18										
Jan-19	64	1018	172	19	141	416	5,184	759	147	20
Mar-19										

FIGURES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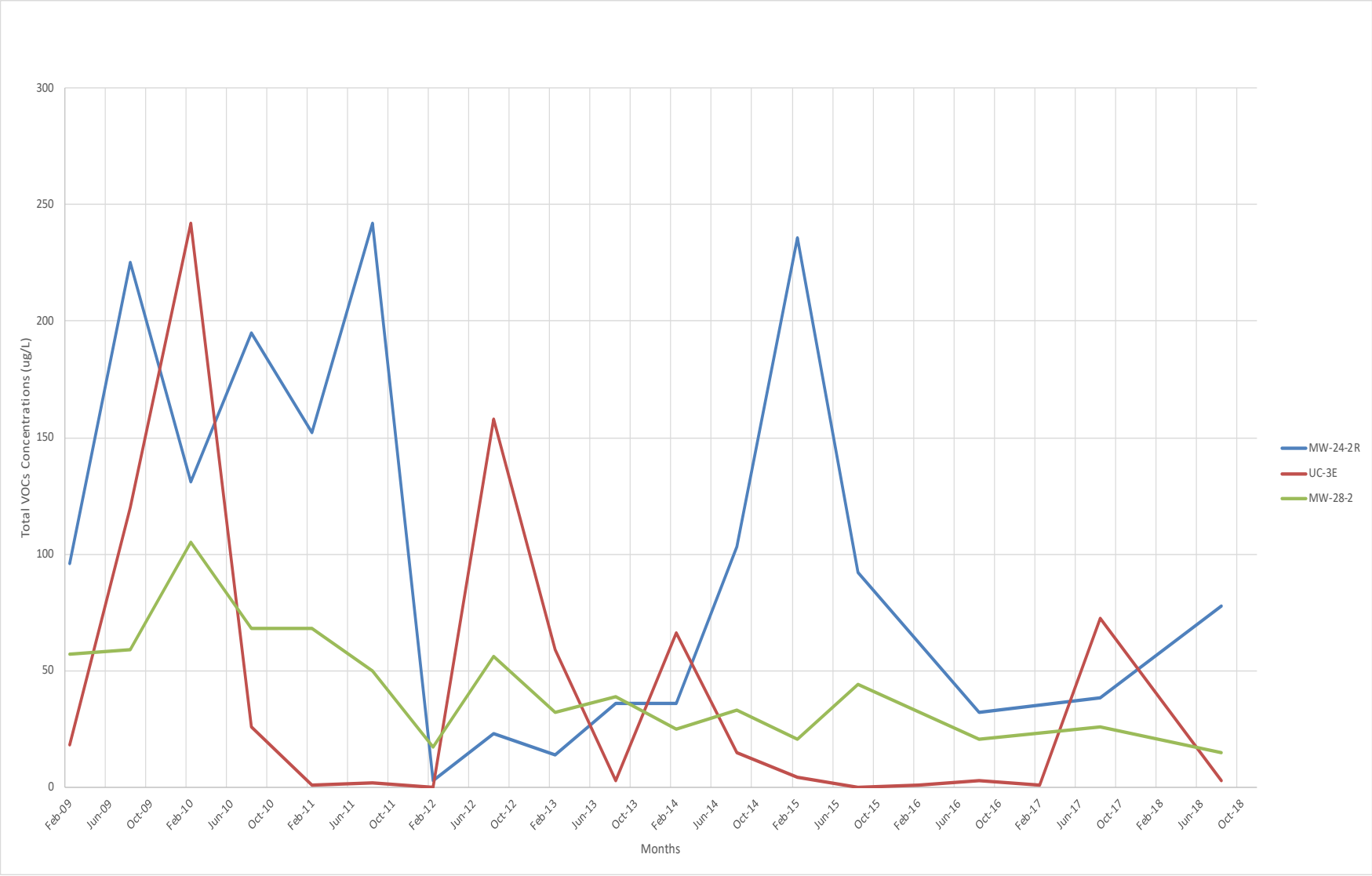
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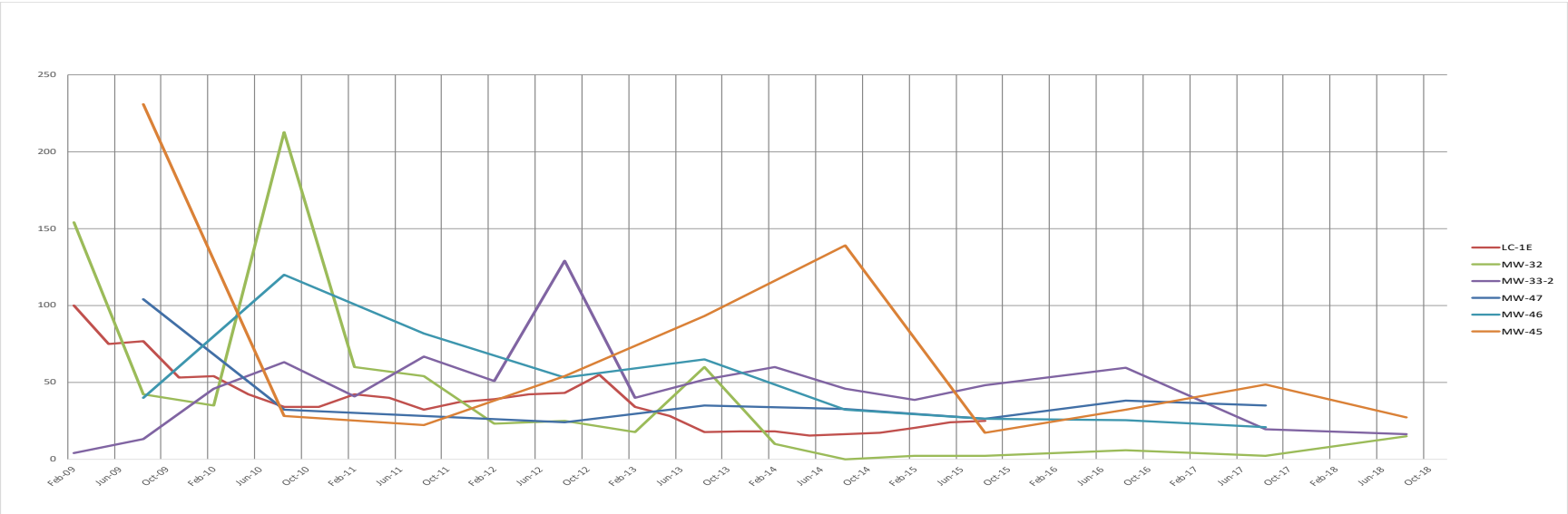
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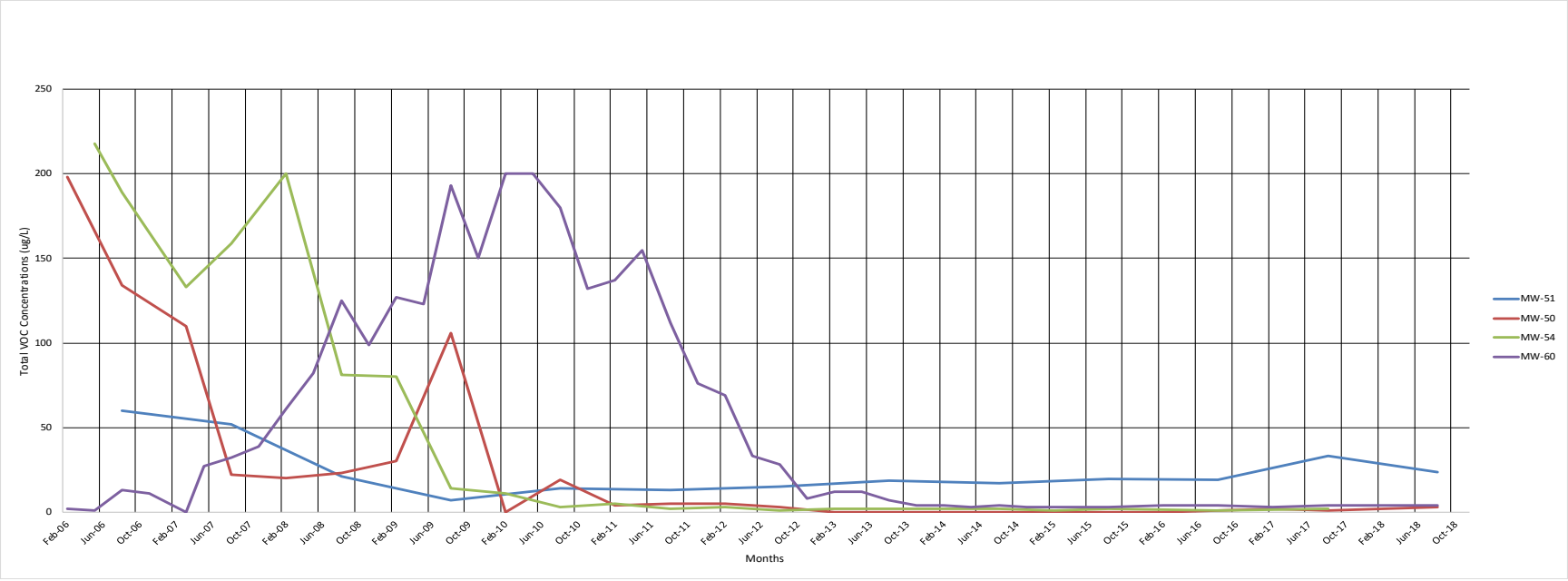
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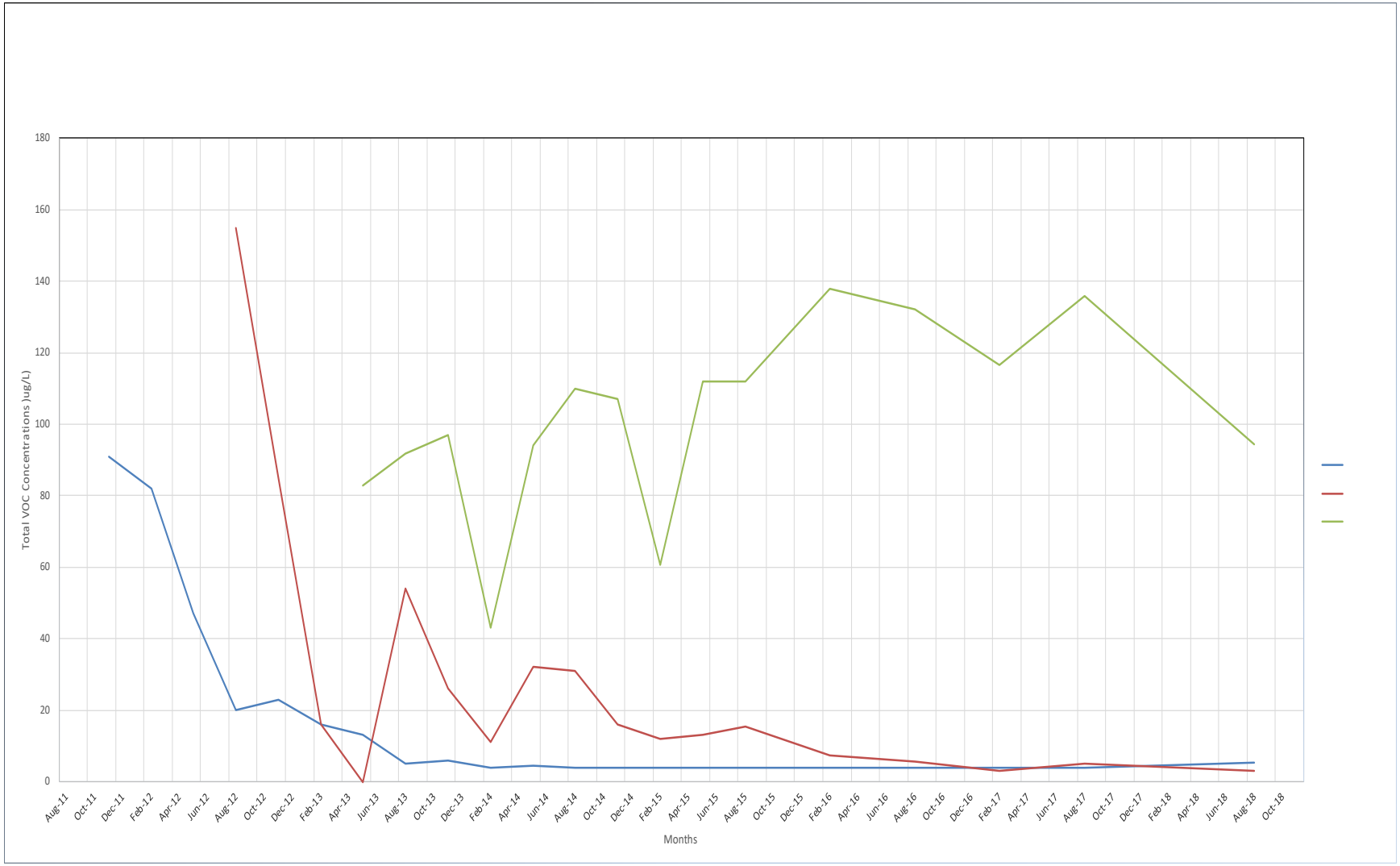
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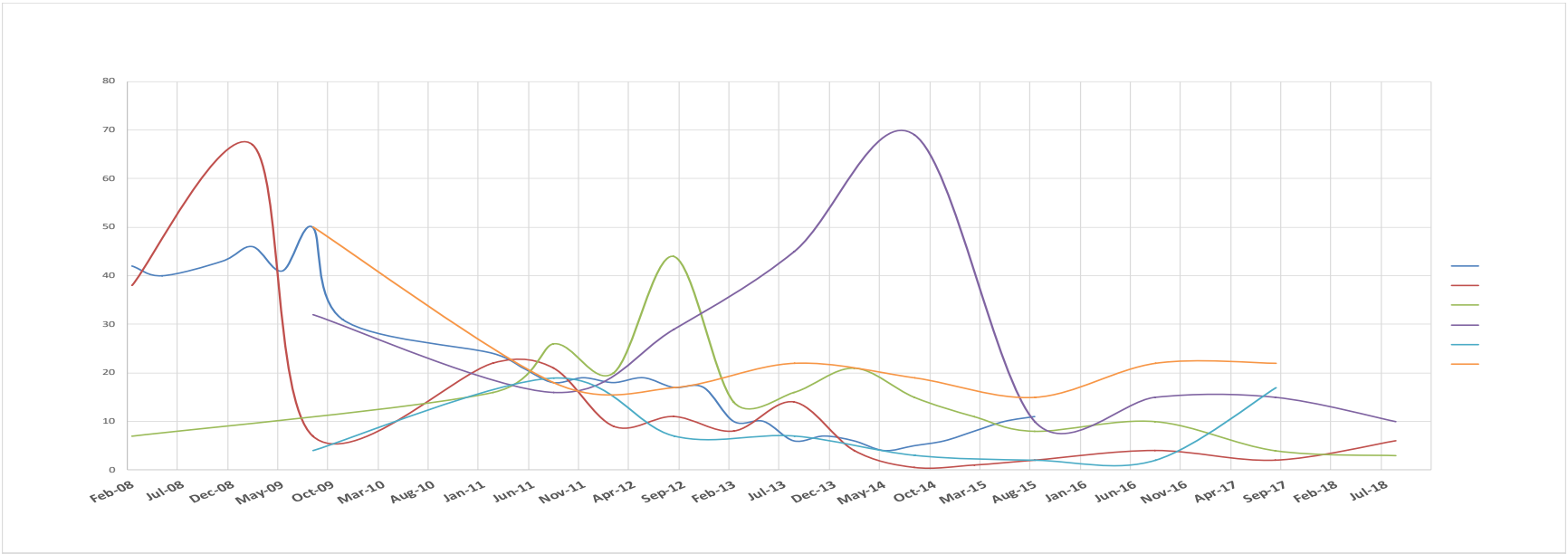
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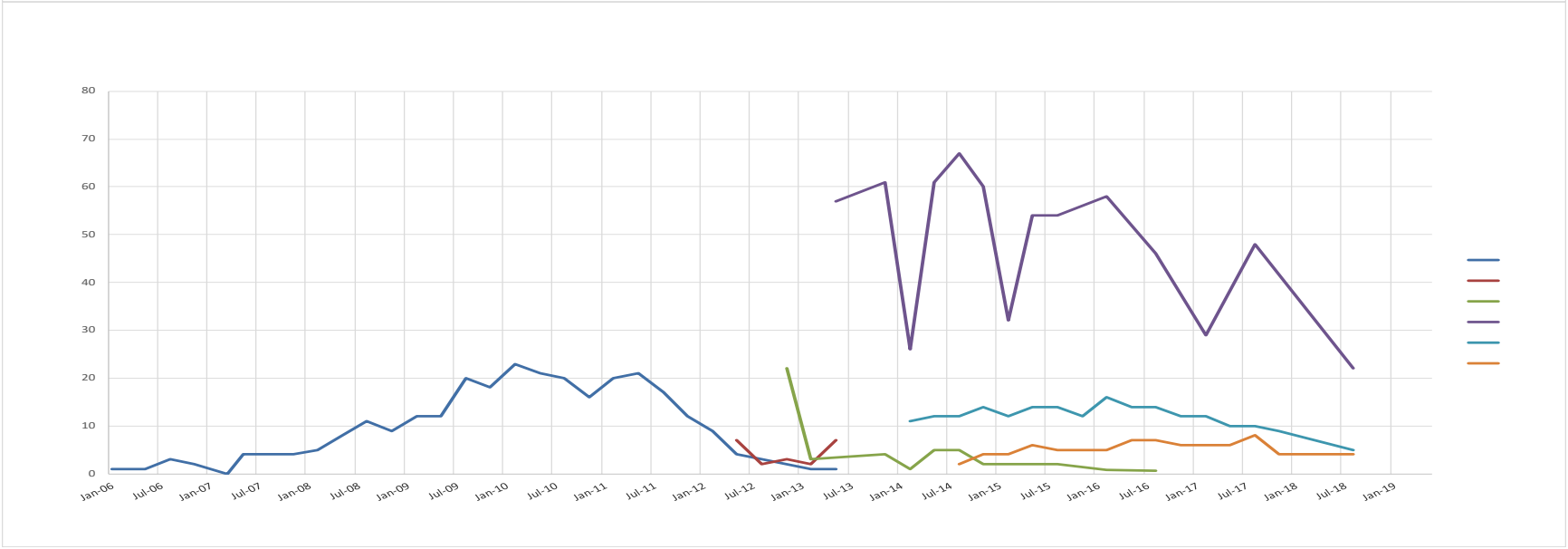
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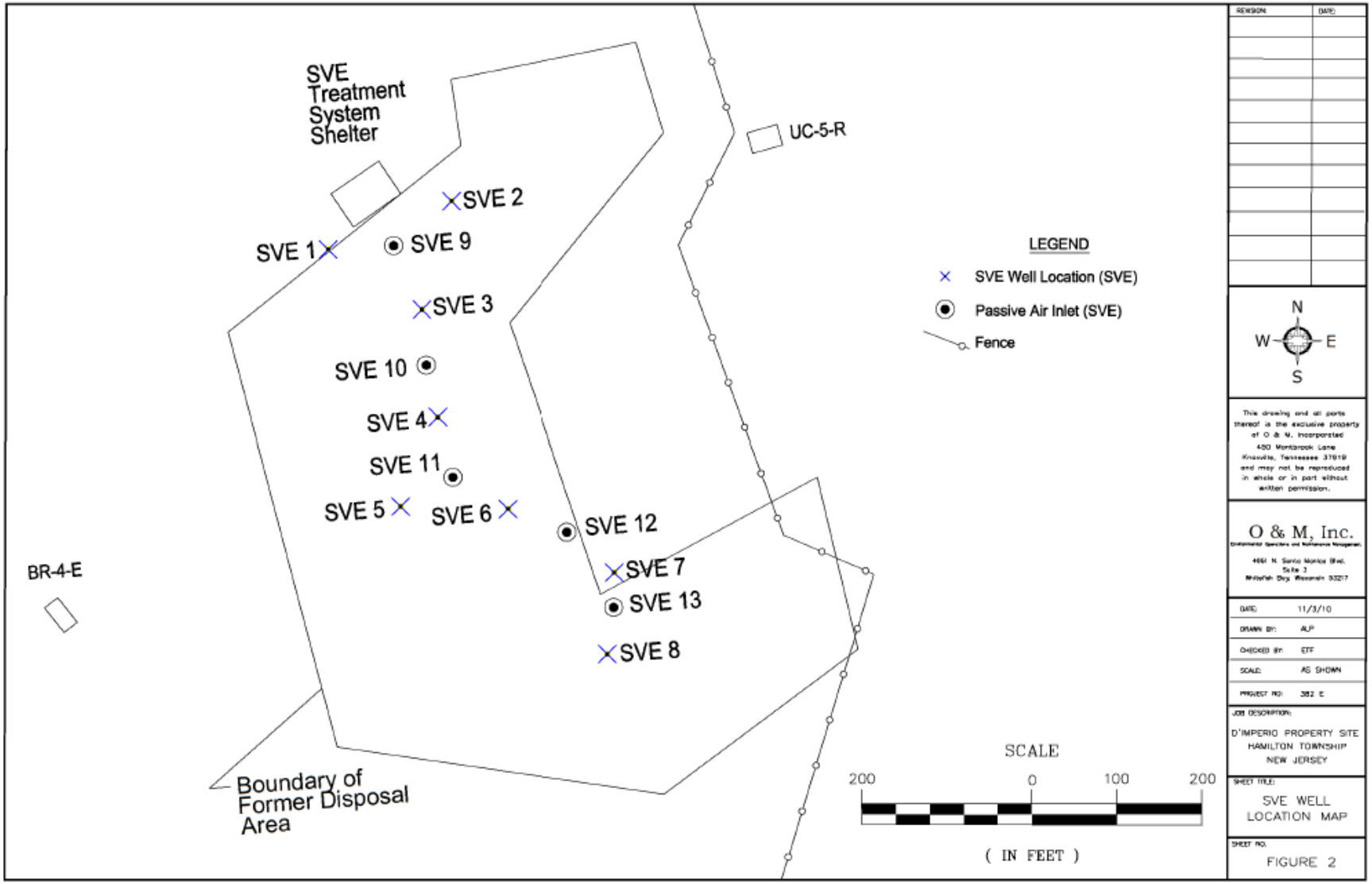
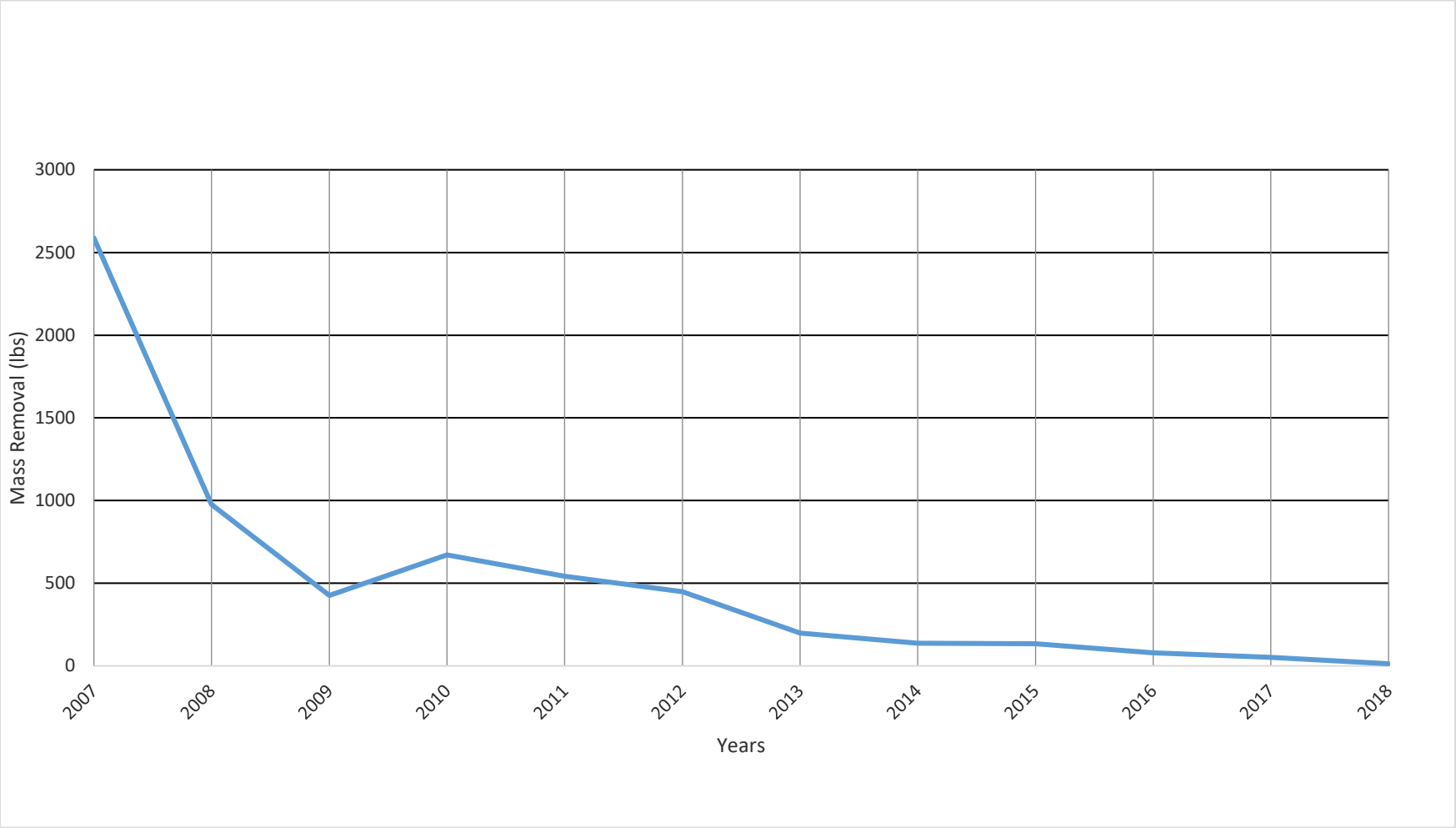
Jan-12
Jul-12
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18
Jul-18
Jan-19

Figure 8 – SVE Well Location




3000
2500
2000
1500
1000
500
0
Mass Removal (lbs)
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Years