RECORD OF DECISION

Arkla Terra Property Superfund Site
Thonotosassa, Hillsborough County, Florida

United States Environmental Protection Agency
Region 4
61 Forsyth Street
Atlanta, GA
August 2018

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ACRONYMS AND ABBREVIATIONS

1,1,1,2-TCA	1,1,1,2-tetrachloroethane
amsl	above mean sea level
ARAR	applicable or relevant and appropriate requirements
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
BLRA	Baseline Risk Assessment
CDI	chronic daily intake
Cells mgL	cells per milliliter
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIP	Community Involvement Plan
cis-1,2-DCE	cis-1,2-dichloroethene
Cl^-	chloride
COC	contaminants of concern
COPC	contaminants of potential concern
CSM	conceptual site model
Cvt	Concentration versus time
DCE	dichloroethene
DEM	Digital Elevation Model
DGW	downgradient ground water
DHC	Dehalococcoides
DO	dissolved oxygen
DOC	dissolved organic carbon
DPT	direct-push technology
DR	Deed Restriction
EC	Engineering Control
EE CA	Engineering Evaluation Cost Analysis
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERH	Electrical Resistance Heating
ERT	Environmental Response Team
ET-DSP™	Electro-Thermal Dynamic Stripping
EZVI	Emulsified Zero-Valent Iron

F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
Fe(II)	ferrous iron
FGS	Florida Geological Survey
FPDWS	Florida Primary Drinking Water Standard
FR	Federal Register
FS	Feasibility Study
ft day	feet per day
HCHD	Hillsborough County Health Department
HCPHU	Hillsborough County Public Health Unit
HHRA	Human Health Risk Assessment
HI	hazard index
HPT	Hydraulic Profiling Tool
HQ	Hazard Quotient
HRS	Hazard Ranking System
IC	Institutional Control
IRIS	Integrated Risk Information System
ISI	Integrated Site Investigation
K	hydraulic conductivity
kg L	Kilograms per liter
LOAEL	lowest observed adverse effect levels
LUC	Land Use Control
MCL	Maximum Contaminant Levels
MEE	methane, ethane, and ethane
mg L	milligrams per liter
MIP	Membrane Interface Probe
MNA	Monitored Natural Attenuation
MPE	multi-phase extraction
mV	millivolts
MW	monitoring well
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NOAEL	no observed adverse effect level

NO^{2-}	Nitrite
NO^{3-}	Nitrate
NTCRA	Non-Time Critical Removal Action
OGW	onsite ground water
O&M	operation and maintenance
ORP	oxidation-reduction potential
OSWER	Office of Solid Waste and Emergency Response
OTIE	Oneida Total Integrated Enterprises
PAH	polycyclic aromatic hydrocarbon
PCE	tetrachloroethene or perchloroethene
PIN	Parcel Identification Number
POE	Point of entry
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
RfDs	reference doses
RG	remedial goals
RI	Remedial Investigation
RI FS	Remedial Investigation Feasibility Study
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RSL	Regional Screening Levels
SARA	Superfund Amendments and Reauthorization Act of 1986
SDWA	Safe Drinking Water Act
SERAS	Scientific, Engineering, Response, and Analytical Services
SIS	Site Investigation Section
Site	Arkla Terra Property Site
SLERA	screening level ecological risk assessment
SO_4^{2-}	Sulfate
SODC	Southeast Oil and Development Corporation
SSI	Special Study Investigation
START	Superfund Technical Assessment and Response Team
SU	Standard Unit
SWFWMD	Southwest Florida Waste Management District
TCE	trichloroethene

TN&A	TN & Associates, Inc.
UCL	upper confidence limit
USGS	U.S. Geological Survey
UST	underground storage tank
VI	vapor intrusion
VISL	Vapor Intrusion Screening Level
VOC	volatile organic compound
WRS	WRS Infrastructure & Environment, Inc.
µg kg	micrograms per kilogram
µg L	micrograms per liter
µg m^3	micrograms per cubic meter

PART 1: DECLARATION

1.0 SITE NAME AND LOCATION

The Arkla Terra Property Superfund Site (hereinafter "the Site") is located in Thonotosassa, Florida (Hillsborough County). The National Superfund Database Identification Number is FLSN0406909. The Site is located 15 miles northeast of Tampa in Section 9, Township 28 South and Range 20 East. This Record of Decision (ROD) is for onsite ground water and soil gas and offsite ground water contamination, and includes the area within the fenced boundaries of the Site, and extends to approximately 0.75 mile in the south-southwest direction.

2.0 STATEMENT OF BASIS AND PURPOSE

This decision document presents the "selected remedy" for the Site (Figure 1 – Site Location). The selected remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 United States Code §9601 et. seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 Code of Federal Regulation (CFR) Part 300, as amended. The selected remedy for addressing onsite contaminated ground water is Onsite Ground water (OGW) Alternative 2 [Monitored Natural Attenuation (MNA) with Institutional Controls (IC)]; and for addressing offsite-contaminated ground water is Downgradient Ground water (DGW) Alternative 2 (Municipal Water Supply with MNA and IC). A detailed description of the selected remedy is presented in Section 19.0 (Selected Remedy) of this ROD.

This decision is based on the Administrative Record for the Site, which has been developed in accordance with Section 113 (k) of CERCLA, 42 United States Code §9613(k). This Administrative Record is available for review at the Thonotosassa Branch Library, Thonotosassa, Florida, and at the United States Environmental Protection Agency (EPA, Region 4) Records Center in Atlanta, Georgia. The Administrative Record Index (Appendix D) identifies each of the items comprising the Administrative Record upon which the selection of the Remedial Action is based. The State of Florida [Florida Department of Environmental Protection (FDEP)] has participated in the development of the ROD and its concurrence is anticipated.

3.0 ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect public health and the environment from actual or threatened releases of hazardous substances into the environment.

4.0 DESCRIPTION OF THE SELECTED REMEDY

The Site contamination was evaluated in two separate decision units: an onsite unit and an offsite unit, because of different levels of contaminants of concern (COC) concentrations and potential risks to receptors. Current onsite use is industrial commercial, while offsite use is predominantly residential. The selected remedy for onsite ground water contamination is OGW Alternative 2, and is estimated to cost $840,000. The selected remedy for offsite ground water contamination is DGW Alternative 2 and is estimated to cost $730,000. The Section 19.0 (Selected Remedy) of this ROD provides a detailed description of the components of these alternatives. The major components of these alternatives are:

Onsite (OGW Alternative 2):

a. MNA for ground water includes long-term monitoring of the ground water to ensure that constituents above cleanup levels are naturally attenuating; and implementation of land use controls [(LUCs), ICs including Deed Restrictions (DRs)] and government controls to limit exposure to onsite ground water, soil gas, and indoor air above unacceptable levels.

Offsite (DGW Alternative 2):

a. Provide new water connections to current properties within the offsite ground water remedial area that are not already connected to the municipal water supply system, andxtend water mains and service connections where needed;
b. MNA of offsite ground water includes long-term monitoring of the ground water to ensure that constituents above cleanup levels are naturally attenuating; and
c. Continuation of existing ICs to abate potential threats posed by offsite ground water including regulating installation of wells in the plume area.

5.0 STATUTORY DETERMINATIONS

The selected remedy achieves the mandates of CERCLA §121 and the regulatory requirements of the NCP. This remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and uses permanent solutions.

The selected remedy does not satisfy the statutory preference for treatment as a principal element of the remedy, because it does not involve treatment to reduce the toxicity, mobility, or volume of hazardous substances. However, it is important to note that the source removal action implemented in 2012 did satisfy the statutory preference for treatment as a principal element of the remedy.

Land use and ground water restrictions (e.g., ICs such as environmental covenants and governmental controls, zoning and permitting reviews) are necessary during the implementation of the selected remedy because hazardous substances are above levels that allow for unlimited use and unrestricted exposure. Additionally, the ground water contamination present onsite after the previous removal action may contribute to future soil gas vapor intrusion (VI) issues on the Site. The potential for VI exists if a building were to be constructed on the former ERH treatment area and occupied by commercial or industrial businesses. The VI pathway for onsite conditions is a Completed Pathway, but currently there are no unacceptable exposures associated with VI based on limited sampling results. Land use controls (LUC) for ground water and soil gas will be necessary to fully protect future occupants of the Site. A consultation with EPA will be required for any such proposed on-site construction to ensure the activities protect human health.

A statutory review will be conducted within five years after initiation of the remedial action, to ensure that the remedy continues to provide adequate protection of human health and the environment. This review will continue every five years or at a lesser frequency, so long as future uses remain restricted.

6.0 DATA CERTIFICATION CHECKLIST

The following information is included in The Declaration (Part 1) and the Decision Summary (Part 2) of this ROD, while additional information is included in the Administrative Record file for this Site:

a. COCs and their respective concentrations (see Section 14.1.1 – Identification of Chemicals of Concern);
b. Baseline risk represented by the COCs (see Section 14.1.4 – Risk Characterization);
c. Remediation goals (i.e., cleanup levels) established for the COCs and the basis for the goals (see Section 19.4.3 – Final Cleanup Levels);
d. How source materials constituting principal threats are addressed (see Sections 5.0 – Statutory Determinations and 18.0 – Principal Threat Wastes);

e. Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of ground water used in the Baseline Human Health Risk Assessment (HHRA) and this ROD (see Sections 13.1 – Current and Potential Future Land Uses; 13.2 – Current and Potential Future Ground water Uses; 19.4.1 – Available Land Uses; and 19.4.2 – Available Ground water Uses);
f. Potential land and ground water use that will be available at the Site as a result of the selected remedy (see Sections 13.1 – Current and Potential Future Land Uses; 13.2 – Current and Potential Future Ground water Uses; 19.4.1 – Available Land Uses; and 19.4.2 – Available Ground water Uses);
g. Estimated capital, lifetime operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected [see Section 16.2.2 – OGW Alternative 2 (MNA with ICs); Section 16.2.6 – DGW Alternative 2 (Municipal Water Supply with MNA and ICs); Section 19.3 – Cost Estimate for the Selected Remedy; and Appendix B – Cost Estimate Details for OGW Alternative 2 and DGW Alternative 2); and
h. Key factors that led to selection of the remedy (see Section 14.3 – Basis for Remedial Action).

7.0 AUTHORIZING SIGNATURE

This ROD documents the selected remedy for contaminated ground water and soil gas at the Arkla Terra Property Superfund Site. The EPA selected this remedy with the participation and anticipated concurrence of the DEP. The Director of the Superfund Division (EPA, Region 4) has been delegated the authority to approve and sign this ROD.

U.S. Environmental Protection Agency (Region 4)

By: ______________________ Date: 8/29/18

For Franklin E. Hill, Superfund Division Director

PART 2: THE DECISION SUMMARY

This Decision Summary provides a description of the Site-specific factors and analyses that led to the selection of the ground water remedies for the Site. It includes background information about the Site, the nature and extent of contamination found at the Site, the assessment of human health and environmental risks posed by the contaminants at the Site, and the identification and evaluation of remedial action alternatives for the Site.

The Site contamination was evaluated in two separate decision units—an onsite unit and an offsite unit—because of different receptors, different levels of COC concentrations, and potential risk to receptors. The onsite unit consists of the ground water and soil gas located within a fenced boundary that occupies the Arkla Terra Property. The offsite unit consists of the residential area downgradient the Arkla Terra Property. Remedial Investigations (RI) occurred simultaneously in the onsite decision unit and offsite decision unit, and separate remedies were selected for each decision unit.

These two decision units are discussed in detail in Section 11.0 – Scope and Role of Decision Units and Response Action.

8.0 SITE NAME, LOCATION, AND BRIEF DESCRIPTION

The Site is located at 11706 U.S. Highway 301 in Thonotosassa, Hillsborough County, Florida. The Site is located 16 miles northeast of Tampa in Section 9, Township 28 South and Range 20 East and covers an approximate area of 7.11 acres. Geographic coordinates for the Site are Latitude 28°03'28" North and Longitude 82°19'03" West (Figure 1). The properties surrounding the Site are a mixture of residential, commercial, and industrial properties. Immediately to the west of the property are commercial industrial businesses followed by residential areas. To the south of the Site is a mixture of residential and commercial industrial properties. Immediately north of the Site are residential properties followed by the Lower Hillsborough Wilderness Preserve. Adjacent land use to the east of the Site includes commercial business that refurbishes buses.

The Site boundaries are a combination of two parcels:

1. Parcel Identification Number (PIN) U-09-28-20-ZZZ-000002-00000.0, currently under the ownership of Betacom Inc. and

2. PIN U-09-28-20-ZZZ-000001-99970.0, currently under the ownership of Arkla Terra Inc. (Hillsborough County Property Appraiser 2017).

The property comprises separate subplots, which are occupied by MB Accountants, Hollywood Automotive, Jamson Environmental, Hardcore Concrete Cutting, Jimco Automotive, Neon 2 Go, Bob's Dust, and Thonotosassa Materials, Inc., a landscape business (EPA 2008). Thonotosassa Materials, Inc. and Hollywood Automotive subplots are surrounded by a fence and are considered as the source area for contamination. Of the 7.11 acres defining the Site area, the identified source area amounts to approximately 2,025 square feet (Figure 2).

The EPA is the lead agency for the Site removal and current remedial activities. The Potentially Responsible Parties (PRPs) identified for the Site did not participate in the Remedial Investigation Feasibility Study (RI FS) and are not participating in the remedial action described in this ROD.

9.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

This section of the ROD provides the history of the Site and a brief discussion of EPA's and the State's removal, remedial, and enforcement activities. The "Proposed Rule" proposing the Site to the National Priorities List (NPL) was published in the Federal Register (FR) on September 39, 2008. The "Final Rule" adding the Site to the NPL was published in the FR on May 11, 2009.

9.1 History of Site Activities

The Hillsborough County Health Department (HCHD) received a water quality complaint from the resident at 9741 East Fowler Avenue in January 1989. The owner complained that her water supply well emitted a strong gasoline odor. The HCHD sampled the resident's potable well and, in February 1989, advised the owner to discontinue consumption and use of water from the well because of the presence of petroleum hydrocarbons (FDEP 1995). The Site Investigation Section (SIS) of the FDEP conducted an investigation in late 1989 to determine the source of this contamination, which SIS called the East Fowler Site. During SIS's investigations, 18 monitoring wells were installed and sampled and 52 private supply wells were sampled. Upon analysis of the collected data, SIS concluded that the probable source of petroleum hydrocarbons and chlorinated solvents, such as perchloroethylene [(PCE); also known as tetrachloroethylene and trichloroethylene (TCE)], was the Entrepreneur property near the intersection of Highway 301 and East Fowler Avenue at 11511 East Fowler Avenue (current address is 11511 Thonotosassa Road). The Entrepreneur property was, and currently is, the location of a service gas station. Based on interviews conducted by SIS with the residents in the area, an underground storage tank

(UST) refurbishing operation had existed on the Entrepreneur property from the late 1970s until approximately 1983. It was discovered during SIS's investigation that Entrepreneur moved its UST refurbishing operations to a location approximately 0.5 mile east to what is now known as the Arkla Terra Property. The *Ground Water Investigation Report 91-07* documented SIS investigations and recommended the following actions in regard to the East Fowler Site:

- Remove the USTs that were abandoned in place and remove the surrounding contaminated soils
- Conduct a proper assessment and remediation of the contamination
- Investigate the current location of the UST refurbishing facility located approximately 0.5 mile east of the gas station (the Arkla Terra Property)

A supplemental environmental assessment was conducted at the East Fowler Site by the FDEP SIS in December 1994 as requested by FDEP's Office of General Counsel. The investigation was conducted to verify the source of chlorinated solvents and petroleum hydrocarbons detected in the private supply wells and the monitoring wells that were installed during the investigation documented in the 1991 report. Four monitoring wells were installed at the East Fowler Site in the surficial aquifer at a depth of 30 feet below ground surface (ft bgs). Soil gas and soil samples were collected as part of this investigation from a grid pattern laid out at the site. The findings concluded that both petroleum hydrocarbons and chlorinated solvents found in the surficial and Floridan aquifers at the East Fowler Avenue site was coming from the Entrepreneur property near the intersection of Highway 301 and East Fowler Avenue (FDEP 1995).

As noted in the 1991 FDEP report, Entrepreneur, previously owned by Southeast Oil and Development Corporation (SODC), had moved their UST refurbishing activities to a location east of 11511 Fowler Avenue property to 11706 US Highway 301, now known as the Arkla Terra Property Site.

Prior to 1980, the Arkla Terra Site was part of a large orchard. In 1980, the SODC purchased the property and developed it into a tank farm that stored and distributed petroleum hydrocarbon products and refurbished USTs. The entire property was cleared of the orchard farm by April 1984, during which time, 251 USTs were observed stored onsite. In 1987, activities expanded to include five permanent buildings and 573 USTs stored on the property. A review of aerial photographs indicated stained soil around many tanks and in several areas around the property. In 1993, Arkla Terra, Inc. purchased the business from a successor company of SODC, Nova Oil and Gas. Arkla Terra, Inc., then leased the property back to Nova Oil and Gas and later to its successor, Titan Tank, until 2006.

9.2 History of Federal and State Investigations and Removal/Remedial Actions

In early 1995, the FDEP SIS requested that the Hillsborough County Public Health Unit (HCPHU) collect and analyze water samples from potable supply wells near Rock Hill Road (near the intersection of US Highway 301 and Jackson Road). This request was made due to detected ground water contamination in three public supply wells at the Hilltop Mobile Home Park. The Hilltop Mobile Home Park is south of the SODC operation located at 11706 US Highway 301 (the current Arkla Terra Site). Four of the nine wells sampled by HCPHU exceeded Florida Primary Drinking Water Standard (FPDWS) for PCE (3 micrograms per liter [µg/L]). PCE as high as 180 µg/L was detected in the potable wells (FDEP 2000).

The contaminated area at this location identified by HCPHU was named as the Rock Hill Road Site. After extensive soil, soil gas, and ground water investigations near Rock Hill Road, the Arkla Terra Property was determined to be another source of contamination, and the soil and soil gas contamination was confined to the Arkla Terra Property.

The FDEP SIS concluded that the Floridan Aquifer has been impacted by the release of chlorinated solvents, primarily PCE. Based on the analytical results of ground water samples collected from monitoring wells and residential wells, the ground water contamination extended 7,500 feet southwest from near the corner of US Highway 301 and Jackson Road to the intersection of Tom Folsom and Joe Ebert roads.

In January 2005, the Superfund Technical Assessment and Response Team (START) contractor Weston Solutions, Inc. conducted a Hazard Ranking System (HRS) Special Study Investigation (SSI) for EPA at the Arkla Terra Site [TN & Associates, Inc. (TN&A) 2006]. The Site was proposed for inclusion on the NPL on September 3, 2008, and was listed on the NPL on May 11, 2009.

In 2008, EPA Region 4 initiated an RI/FS of the Site to address source contamination and ground water contamination. EPA considered the need for a non-time critical removal action (NTCRA) during the RI/FS activities. The NTCRA was considered due to the potential for the onsite PCE source to further contaminate the Floridan Aquifer. The Floridan Aquifer is a protected ground water resource (FDEP 2000).

In accordance with the NCP, a NTCRA requires a site-specific Engineering Evaluation/Cost Analysis (EE/CA) to assess human and environmental threats from the Site.

EPA Region 4 tasked EPA Environmental Response Team (ERT) to characterize ground water contamination at the Site and assist in preparation of the EE/CA Report. As part of the evaluation, *in situ* and *ex situ* source treatment technologies were evaluated to identify the most technologically viable and cost-effective alternatives (EPA ERT 2010).

The EE/CA Site characterization included:

a. Integrated Site Investigation (ISI) of soil, soil gas, and ground water (REAC, 2009a)
b. Hydraulic Profiling Tool (HPT) tests and grain size analysis (SERAS 2009b)
c. Vapor intrusion study to semi-quantify the potential risk of indoor air vapor intrusion on the site (SERAS 2009c)
d. Quarterly ground water sampling, which included sampling of monitoring wells on the Arkla Terra property and sampling of offsite residential wells

The EE/CA Site characterization activities and analyses of the data, as well as the risk assessment and evaluation of remedial alternatives resulted in the recommendation of in situ thermal treatment for the Site. The recommended in situ thermal technology included electrical resistance heating (ERH) and *in situ* conductive heating. These two technologies would offer the most effective remedy and provide protection of the public health and the environment. The in situ thermal treatment remedial system was a multi-phase extraction (MPE) system working in conjunction with the Electro-Thermal Dynamic Stripping (ET-DSP™) electrical resistivity heating technology (WRS 2013).

The construction of the thermal treatment system began in the summer of 2012 and treatment of the source area occurred between August 2012 and January 2013. At the completion of the NTCRA, the ET-DSP™ system removed 94 to 99 percent of the PCE mass in the treated source area.

Upon completion of the NTCRA in January 2013, EPA continued with the RI/FS activities for the Site, which included onsite soil and gas sampling, quarterly monitoring well and ground water sampling both onsite and offsite. The purpose of the RI/FS was to determine the nature and extent of remaining contamination, its risks, and to gather sufficient information about the Site to support an informed decision regarding the most appropriate post treatment action. The data from this RI/FS supports the selected remedy presented in this ROD.

EPA signed an Action Memorandum on June 3, 2011, to treat PCE- and TCE-contaminated soil and ground water by in situ thermal treatment. The source area footprint for treatment was approximately 100 feet by 110 feet by 55 feet deep.

10.0 COMMUNITY PARTICIPATION

EPA has been actively engaged in dialogue and collaboration with the affected community and has strived to advocate and strengthen early and meaningful community participation during EPA's remedial activities at the Site. These community participation activities during the remedy selection process meet the public participation requirements in CERCLA and the NCP.

10.1 Community Involvement Plan

The Community Involvement Plan (CIP) for the Site was revised in 2018. This CIP specifies the community involvement activities that EPA has undertaken, and will continue to undertake, during the remedial activities planned for the Site.

10.2 Community Meetings

The EPA and FDEP have conducted community meetings during the course of the RI FS for the Site and provided public notices of these meetings in order to encourage the community's participation.
A community meeting was held on February 10, 2010, at the Thonotosassa Public Library, located approximately 1.75 miles from the Site. The purpose of this meeting was to discuss EPA's planned activities during the RI FS for the Site. EPA also held an informational meeting in April 2011 for the community to explain the NTCRA. EPA met with the community on June 27, 2018, to discuss the details of the Proposed Plan and to address questions, concerns and receive comments and feedback on the Plan.

10.2.1 Community Meeting for the Proposed Plan

EPA held a community meeting on June 27, 2018, at the Seffner-Mango Branch Library in Seffner, Florida, to present the Proposed Plan for the Arkla Terra Site. At this meeting, representatives from EPA answered questions about EPA's preferred alternative for the Site. The preferred alternative presented at the meeting was OGW Alternative 2 for onsite ground water and DGW Alternative 2 for offsite ground water.

EPA accepted the community's oral and written comments during the Proposed Plan meeting. A court reporter transcribed the meeting, and this transcript is included in the Administrative Record file for the

Site. The Administrative Record is maintained at the Information Repository at the Thonotosassa Public Library in Thonotosassa, Florida, and at EPA's office in Atlanta, Georgia.

The RI/FS Report (OTIE 2018), the Baseline Human Health Risk Assessment and Screening-Level Ecological Risk Assessment Report (OTIE 2018), and the Proposed Plan (EPA 2018) were made available to the public on June 22, 2018. These documents are currently located in the Administrative Record file for the Site. The Site's public comment period was from June 22, 2018, to July 23, 2018. EPA's responses to the comments received during this period are included in the Responsiveness Summary (Part 3) of this ROD.

10.3 Fact Sheets

Several fact sheets have been prepared during the planning and implementation of the RI/FS. These fact sheets were included in the Site's repository and distributed to all community members on the Site's mailing list.

10.4 Local Site Repository

The purpose of the local Site Repository is to provide the public a location near their community to review and copy background and current information about the Site. The Site's repository is near the Site at:

Thonotosassa Public Library
10715 Main Street
Thonotosassa, FL
Telephone: (813) 273-3652

11.0 SCOPE AND ROLE OF DECISION UNITS AND RESPONSE ACTION

This section of the ROD describes the decision units (Figure 3) designated for the Site and the selected remedy for the response action. EPA has organized the Site into two decision units to address the distinct geographical portions and different exposure population effected by the Site. The "onsite" decision unit consists of the onsite ground water on the Arkla Terra Property. The "offsite" decision unit consists of the offsite residential area ground water. The onsite decision unit will address the contaminated ground water at the Site, within the boundaries of the Arkla Terra Property. The offsite decision unit will address contaminated ground water in the residential area south/southwest (downgradient) of the Arkla Terra Property. Although the Site contamination is evaluated under two decision units, both decision unit remedies would be implemented simultaneously and are included in this ROD. The selected remedy presented in this ROD for onsite and offsite will limit exposure to ground water and vapors that may be harmful to human health and the environment.

11.1 Onsite Decision Unit (Onsite Ground Water and Soil Gas)

The onsite decision unit consists of the contaminated onsite ground water and soil gas located within the fenced boundaries of the Site, currently used for commercial industrial purposes. The NTCRA remediated soil generally up to 50 ft bgs (except for two post treatment sample depths between 32 and 50 feet, that exceeded 100 micrograms per kilogram [µg kg] PCE criteria) and removed approximately 1,500 pounds of volatile organic compounds (VOCs) from the vapor-phase and ground water. The remaining onsite ground water contamination in the surficial and the Floridan aquifers will be addressed during the implementation of MNA.

The MNA is expected to reduce the organic contaminant to below the Maximum Contaminant Levels (MCLs) specified in the Safe Drinking Water Act (SDWA) and MCLs specified in the Florida Administrative Code (F.A.C.) Chapter 62-550.310(4). The Site's VI pathway is complete, but the sub-slab and indoor air samples from existing commercial buildings indicate no current unacceptable exposure risk to occupants. Because only a limited number of air samples were collected, additional data will be collected on a pre-set monitoring program, similar to the ground water monitoring program. Since there is no current unacceptable risk from soil gas, monitoring data will be collected in support of re-evaluation of this pathway during the 5-year review process. LUCs for ground water and soil gas media will be implemented for the Site. These LUCs will prevent current and future Site occupants from exposures to ground water and vapors that are above acceptable levels.

There are no PRPs currently participating in the remedial activities for the onsite decision unit.

11.2 Offsite Decision Unit (Offsite Residential Area Ground Water)

The offsite decision unit consists of the offsite residential areas downgradient of the Site where the ground water plume has migrated offsite. The offsite ground water contamination extends from the southwestern Arkla Terra Property boundary (US Highway 301) to approximately 4,700 feet south southwest of the Site (north of Summers Road) with an average width of 1,700 feet and is located in the Floridan aquifer, mainly in the intermediate depths of 56 to 100 ft bgs. The NTCRA helped to shrink the offsite plume as the source area contamination decreased in concentration. The data analyses from the RI FS indicates that the offsite plume has dissociated (broken off) from the onsite main source area plume and continues to decrease in concentration. Currently, there are approximately 10 residential private properties not connected to municipal water and drawing water from either the surficial or the Floridan aquifers within the footprint of the ground water plume.

The selected remedy for the offsite decision unit will limit the exposure to ground water contamination by connecting the remaining 10 residential private properties to municipal water. The remaining offsite ground water contamination in the Floridan aquifer will be addressed by the implementation of MNA, which is expected to reduce the organic contaminant levels to below the MCLs specified in the SDWA and MCLs specified in the F.A.C Chapter 62-550.310(4). ICs to prevent future installation of private wells, and continued use of any existing private wells within the plume boundary, will be implemented by Hillsborough County until the PCE and TCE contaminant levels are below the MCLs.

12.0 SITE CHARACTERISTICS

This section of the ROD provides a brief comprehensive overview of the Site's soils, geology, surface water hydrology, and hydrogeology; the sampling strategy chosen for the Site; the conceptual site model (CSM); and the nature and extent of contamination at the Site. The RI FS Report (OTIE 2018) has detailed information about the Site's characteristics.

12.1 Overview of the Site

The Site property is home to several businesses located on separate subplots. The land use at the Site is industrial and commercial. The surrounding land use is predominantly residential.

12.1.1 Site Soils

In the Site vicinity, the soils and vadose zone are unconsolidated sediments, characterized as rhythmically layered to massive, mottled red, light gray and purple clay to silt that range in thickness from 40 to 70 feet. The unconsolidated sediments were deposited from the Pliocene to Holocene during a series of marine high and low stands. The unconsolidated sediments unconformably overlie the upper Oligocene Arcadia Formation of the Hawthorn Group [Florida Geological Survey (FGS)] 1984, FGS 1988, FGS 1991, and EPA ERT 2010]. Boring logs from EE CA investigations confirm interbedded layers of silt, clay, and silty to clayey sands across the Site.

12.1.2 Site Geology and Hydrogeology

Site Geology

The unconsolidated sediments unconformably overlie the upper Oligocene Arcadia Formation of the Hawthorn Group. Tan, gray, or white carbonates interfingered with calcareous mud and siliciclastic sediments characterize the Arcadia Formation. The Arcadia carbonates and the local Tampa and Nocatee Members separate the Arcadia Formation into two carbonate formations. The Arcadia carbonates are composed primarily of dolomite, but limestone is relatively common. The Tampa Member is characterized as a tan to white wackestone, or calcareous mudstone, with varying percentages of fine to coarse-grained sand. The Nocatee Member is characterized as interceded quartz and phosphorite sand and calcareous mud (SERAS 2011).

The relation among Arcadian carbonates and the Tampa and Nocatee Members is complex, representing transitional changes in depositional environments along the margin of a carbonate shelf in response to sea level fluctuations. The Arcadian carbonates are characterized by fossiliferous limestone that is indicative of a reef building facies. The Tampa Member was deposited adjacent to the carbonate shelf in a low energy, lagoonal environment that grades laterally westward to the Nocatee Member. The Nocatee Member was deposited in a much higher energy beach environment. Arcadian carbonates are found conformably both above and below the Tampa Member. The Tampa Member conformably overlies the Nocatee Member, and the Nocatee Member grades laterally westward into the Arcadian carbonates. The relation among the units suggests the carbonate shelf was prograding westward during intermittent periods of marine high stands in the Late Oligocene (SERAS 2011).

Based on boring logs, the Floridan aquifer in the Site vicinity straddles a near-shore depositional environment that developed during the Late Oligocene when sea levels were fluctuating. The Arkla Terra property is located east of the lagoonal environment on the carbonate shelf of the Arcadia Formation; however, southwest of the Arkla Terra Property, calcareous muds and siliciclastic sediments characteristic of the Tampa Member become more common in the well logs for EPA-7I, D & F and EPA-9I, D & F. The well log for EPA-8I, D & F, located southwest of the Site, indicates very well sorted fine to medium sands, characteristic of the Nocatee Member (SERAS 2011).

Identification of the Nocatee Member in the southwest area of the Site (EPA-8I, D & F), suggests the stable Arcadia carbonate shelf is located to the east. The suspected margin of the carbonate shelf coincides with the current eastern extent of the existing PCE plume (OTIE 2018). The Arcadia carbonate shelf facies is hydraulically more prolific than either the Tampa or Nocatee Members, because exposure of the carbonate shelf promoted karsting and, consequently, well-developed conduit flow. A cross-section of the Site geology was created from the onsite source area to monitoring well EPA-8I, D & F (Figure 4, plan view) and is shown in Figure 5.

Site Hydrogeology

At the Site, the water table in the unconsolidated formations (Surficial Aquifer) is present at approximately 20 to 35 ft bgs, consistent with the investigations performed by FDEP (FDEP 2000). Underlying the overburden materials is the Arcadia Formation, a predominantly white, tan or yellowish-gray limestone with lesser amounts of dolomites and siliciclastic sediments. The Arcadia Formation is composed of Arcadian carbonates and the Tampa and Nocatee Members. It is within these carbonates (limestone) where the Floridan aquifer is developed. The Floridan aquifer is one of the most productive systems in the world and covers an area of approximately 100,000 square miles (U.S. Geological Survey [USGS] 2017). In Hillsborough County, karst features or sinkholes are prevalent due to the absence or thinning of the clay-rich Hawthorn Group. Karst features develop from the dissolution of carbonate rocks and commonly create aquifers that can store large supplies of water. At least five sinkholes are identified near the Site (Figure 6). This is evidence of carbonate rock dissolution at the Site that may be creating not-yet-identified voids within the underlying limestone. The Floridan Aquifer near the Site serves both municipal water and private domestic supplies.

As part of the ground water sampling activities, monitoring wells were gauged with a water level indicator to obtain static water levels. A schematic of the estimated ground water elevation contours from November 2016 for the Floridan aquifer (intermediate wells) is shown on Figure 6 (SERAS 2017). The ground water contours take into account the elevation of the limestone along with the locations of the sinkholes. The average ground water elevation fluctuated up to 17 feet annually from the rainy to dry seasons; however, the hydraulic gradient (i) appeared to be relatively consistent, ranging from 5.58E-04 to 7.56E-04 feet/feet from the wettest to driest times of the year. The hydraulic gradient increased slightly toward three major sinkholes downgradient of the Site (SERAS 2017).

Based on the analysis conducted by SERAS, the Site-specific hydraulic conductivity (K) values ranged from 8.7 feet per day (ft/day) in the surficial aquifer to 26 ft/day in the "deep" zone of the Floridan aquifer (SERAS 2017). The RI/FS report (OTIE 2018) details the Site-specific aquifer tests analysis.

12.1.3 Surface Water Hydrology

The Site is essentially flat across much of the surface and covered with gravel or asphalt pavement. Any surface water from precipitation infiltrates through the grass and gravel areas of the Site.

12.2 Sampling Strategy

The sampling strategy for the Site addressed the following key issues in order to determine the nature and extent of contamination at the Site (OTIE 2018):

a. Distribution of VOC concentrations in soils onsite (specifically PCE),
b. Distribution of VOC concentrations in soil gas onsite (specifically PCE),
c. Effectiveness of the NTCRA in the source area,
d. Nature and extent of contamination in ground water at the Site (both onsite and offsite),
e. Ground water flow regimes that control contaminant migration beneath the Site, and
f. Use of MNA as a remedy for the Site.

Prior to the NTCRA, the source area was defined onsite through membrane interface probe (MIP) sampling, soil sampling using direct push technology (DPT), and soil gas sampling. The source area footprint was estimated as 2,025 square feet and the treatment area was a 40-foot by 40-foot strip with an average depth of 55 ft bgs. During the characterization of the soils, monitoring wells were installed onsite in both the surficial and Floridan aquifers at various depths. Offsite residential wells were also sampled to determine the extent of offsite contaminants migration in the Floridan aquifer and to determine if any residents were being exposed to Site-related contaminants.

Onsite soil contamination was remediated during the NTCRA conducted from August 2012 to January 2013. The thermal treatment system removed 94 to 99 percent of the PCE mass in the treated source area. Some contamination remains in the surficial and Floridan aquifers after the ERH treatment of the source area. Quarterly and biannual ground water sampling was conducted onsite from after the NTCRA (January 2013) through May 2017 and evaluated in the RI FS.

The offsite vertical extent of ground water contamination in the Floridan aquifer was delineated with the information from the nested monitoring wells. Although residential wells were used to help determine the lateral extent of offsite contamination, the actual depths of the residential wells are not known. The offsite monitoring wells and residential wells were sampled at the same time as the onsite monitoring wells, and their results were evaluated in the RI FS. Soil and soil gas sampling were conducted in May 2017, after the completion of the NTCRA to evaluate soils and soil gas contamination at the Site. The HHRA was developed with the post-ERH data.

12.3 Conceptual Site Model

The CSM (Figure 7 – Conceptual Site Model) for the Site identifies the sources of contamination, release mechanisms, pathways for contaminant transport, the impacted media, and potential human receptors. This CSM is the basis for the remedial action presented in this ROD.

Subsurface investigations and oil, and ground water sampling conducted since 2008 have identified an onsite soil source area. PCE and TCE contamination have leached into the surficial and Floridan aquifers resulting in a ground water plume that has migrated offsite in a south southwesterly direction. The ground water in the Floridan aquifer at the Site flows from the northeast to the south southwest into offsite residential areas. Contamination has been identified in historical and RI samples in onsite soils and ground water and in offsite ground water. Limited contamination has been identified in onsite soil gas; however, this has not posed a current VI issue for the Site as discussed in Section 5.9 of the RI FS report (OTIE 2018). Future VI risk could arise from soil and ground water contaminants volatilizing into the soil vadose zone and accumulating inside current and future onsite buildings. These future risks from VI will have to be evaluated through a pre-planned monitoring program.

The CSM (Figure 7) indicates spills and past operations as the primary release mechanism for the contamination, leading to soil as the secondary source. The secondary release mechanism includes release into:

1. subsurface soils due to sorption and downward migration through the vadose zone;
2. soil gas from volatilized COCs in the subsurface;
3. ground water due to leaching of contaminants; and
4. diffusion within ground water in the Floridan aquifer.

Identified migration pathways for the Site include soil, soil gas, and ground water. Identified exposure routes include ingestion, inhalation, and dermal absorption.

Ground water at the Site was characterized and evaluated on the following four depths:

- The surficial ground water: unconsolidated soils consisting of clays and silts with locations of silty and clayey sands
- Intermediate ground water (I): upper limestone screened between 56 and 100 ft bgs
- Deep ground water (D): weathered and broken limestone between 76 and 130 ft bgs

- Very deep ground water (F): silty fine sand with fragments of broken limestone between 140 and 200 ft bgs

The water table within the surficial ground water lies at approximately 30 to 35 ft bgs, which is approximately 15 to 20 feet above mean sea level (amsl). The potentiometric surface of the limestone aquifer underlying the surficial aquifer is anywhere from 24 feet amsl near the Site to 18 feet amsl at the southern edge of the ground water plume. Hydrogeological investigations performed at the Site have shown that the ground water in the Floridan aquifer generally flows in the south southwest direction.

The COCs in ground water are mobile, moving from the Site into the offsite residential areas. However, the current concentrations of ground water contamination within the Site boundary and offsite are orders of magnitude in difference (May 2017 data). Onsite PCE concentrations ranged from non-detect up to 2,500 µg L of PCE (MW-1); offsite PCE concentrations ranged from non-detect up to 11 µg L of PCE (EPA-7I) in the offsite monitoring well and 13 µg L in residential well (ID 227).

This ROD addresses the onsite and offsite ground water as separate units. Human receptors to these COCs could be exposed primarily through ingestion of ground water, dermal contact, and inhalation of vapors released when showering. Direct exposure to contaminated ground water is a potential concern for properties using private water wells as potable water sources. Many, but not all, properties within the extent of the PCE ground water plume are using municipal water supply.

The NTCRA remediated a majority of VOCs in soil up to depths of 50 ft bgs. Residual VOC contamination is located at depths below the water table and is now considered ground water contamination rather than soil contamination. Current conditions indicate that the soils above the surficial water table is remediated and they are not contributing to the ground water VOC contamination.

Due to the high concentrations of VOCs in the onsite surficial aquifer, the contaminants have volatilized and the vapors are present in soil gas. The VI pathway is a complete pathway on the Site and the investigation results indicate that, within current onsite buildings, there are no unacceptable risks from indoor air concentrations. Because of limited sampling results, PCE and TCE will continue to be monitored in onsite soil gas and indoor air to ensure concentrations do not significantly increase and are protective of human health.

The Screening Level Ecological Risk Assessment (SLERA) concluded that chemicals detected in Site soil do not pose a threat to the plant community nor terrestrial invertebrates. Therefore, ecological receptors are not addressed as a part of the remedial action presented in this ROD (see Section 14.2 – Summary of Screening Level Ecological Risk Assessment).

12.3.1 Nature and Extent of Surface Soil Contamination

The soil analytical results were evaluated based on their depths of occurrence and the depths were grouped into surface soil, near surface soil, and subsurface soil. Surface soil and near surface soil, datasets include samples collected from the 0 – 0.5 feet depth interval and 0 – 2 feet depth interval, respectively. Subsurface soil includes soil sampled beyond 2 ft bgs.

After the NTCRA, samples of the surface and near surface soils were collected in May 2017 and evaluated for the direct contact exposure pathway in the HHRA and the SLERA.

Screening of the soil data showed arsenic, chromium, iron, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, and dibenzo[a,h]anthracene needed to be further evaluated in the baseline risk assessment (BLRA) as contaminants of potential concern (COPCs). After further evaluation of the metals and polycyclic aromatic hydrocarbons (PAHs) in the BLRA, it was determined that these were not COCs for the Site, as they do not pose any unacceptable risks.

12.3.2 Nature and Extent of Subsurface Soil Contamination

Subsurface soil samples were collected before, during, and after the NTCRA, from 2 to 50 ft bgs, and analyzed for VOCs. Subsurface soils were remediated up to 50 ft bgs. Soil samples collected below 35 ft of the ground surface are within the saturated zone (surficial aquifer), and therefore is considered part of the ground water contamination.

Subsurface soil results that exceeded the screening criteria for VOCs were PCE, bromodichloromethane, ethyl benzene, and xylenes. With the exception of xylenes, soil samples exceeding the screening criteria were collected beyond the depth at which humans may interact with soil (i.e., 0 – 12 ft bgs). In the BLRA, soil samples collected up to 12 ft bgs were evaluated. Therefore, PCE, bromodichloromethane, and ethyl benzene were not evaluated. Xylene in subsurface soils was not further evaluated in the BLRA due to the low frequency of detection. The subsurface soils did not pose any unacceptable health risks; therefore, there were no COCs to be addressed in the remedial action for subsurface soils.

12.3.3 Nature and Extent of Ground water Contamination

Because onsite land uses and offsite land uses are different, two decision units were evaluated to address onsite industrial commercial use and offsite residential use. Therefore, the extent of ground water contamination was evaluated based on either onsite or offsite contamination to reflect the exposure scenarios used in the BLRA.

Onsite Ground Water Contamination

PCE, TCE, 1,1,1,2-tetrachloroethane (1,1,1,2-TCA), and chloroform were the contaminants detected above their respective screening values in onsite ground water and were further evaluated in the BLRA. Distribution of the PCE and TCE in onsite ground water is presented on Figures 8 and 9, respectively. 1,1,1,2-tetrachloroethane and chloroform were only detected in monitoring well MW-1. Upon further evaluation of the four compounds in the BLRA, only PCE and TCE were retained as COCs. The onsite PCE and TCE plume extends from the source area near the former monitoring well EPA-1S and expands approximately 320 feet hydraulically downgradient (southwest) to monitoring well RHF-15 on the Site boundary. The width of the onsite plume is approximately 350 feet, extending from EPA-3I to EPA-5I.

Offsite Ground Water

PCE, TCE, chloroform, and cis 1,2-dichloroethene (cis 1,2-DCE) were the contaminants detected above their respective screening values in offsite ground water and were further evaluated in the BLRA.

Distribution of the PCE and TCE in offsite ground water is presented on Figures 8 and 9 respectively. Cis-1,2-DCE was detected only in the nested monitoring well set EPA-7. Upon further evaluation of the four compounds in the BLRA, PCE and TCE were the only two compounds retained as COCs.

Based on analytical results for offsite monitoring wells and residential wells, the PCE and TCE ground water plume reached approximately 4,700 feet hydraulically downgradient of the Site boundary, with an average width of 1,700 feet. Much of the contamination appeared in the intermediate depth monitoring wells.

12.3.4 Nature and Extent of Soil Gas Contamination

PCE and TCE concentrations were identified above the vapor intrusion screening level (VISL) criteria in onsite soil gas samples collected in 2017. Two soil gas samples (SG01 and SG02), indicated PCE concentrations at 690 and 23,000 micrograms per cubic meter (µg m3), which were above the VISL criteria of 140 µg m3. SG01 sample location was adjacent to monitoring well MW-1 and SG02 sample location was within the footprint of the former ERH treatment area (Figure 10). The soil gas sample SG02 also indicated a TCE concentration of 83 µg m3, which was above the VISL criteria of 7 µg m3. Upon further evaluation of the two compounds in the BLRA, PCE and TCE were retained as COCs in the future risk scenario.

Indoor air, sub-slab, and crawl space air samples were collected from businesses located in the southwestern corner of the Site in 2010 and 2017 to investigate the VI pathway. These businesses are located in the path of the ground water flow and downgradient of the source area. All results were below the VISL criteria for indoor air. The VI pathway was a complete pathway based on the evaluation of these data for the onsite building occupants, and no unacceptable risks were observed from these concentrations. However, PCE and TCE contaminants in soil gas are of concern and pose potential future risks, if new construction occurs on top of the former ERH treatment area.

12.4 Fate and Transport of COCs

The expected fate and transport of each COC in ground water, soil, and soil gas at the Site was evaluated with the analytical results of samples collected between January 2013 and May 2017, with the exception of PCE in ground water. PCE in ground water was evaluated with the data from March 2009 (pretreatment data) to June 2016 (post-treatment data) to show the change in concentration with time. COCs in ground water were evaluated separately for onsite and offsite areas because of the two different decision units established from applicable risk exposures. Plume figures and cross-sectional figures of the ground water plume for PCE are presented in Figures 12 through 15.

The concentrations of PCE and TCE in soil gas is related directly to onsite contamination within the surficial ground water. Therefore, as COCs in ground water continue to decrease with time, the soil gas COC concentrations are also expected to decrease.

12.4.1 Fate and Transport of PCE in Ground water

PCE is a colorless, nonflammable liquid that evaporates readily, dissolves only slightly in water, and has a sharp, sweet odor. It is a chlorinated solvent. PCE can be released to the environment in soil, water, and air [Agency for Toxic Substances and Disease Registry (ATSDR) 2014a]. Because PCE is a liquid that does not bind well to soil, PCE released to soil can move through the soil and enter ground water (EPA 1994). If released to soil, PCE volatilization will slowly occur, as will leaching into soil and ground water. PCE is persistent in the environment. Under anaerobic conditions in ground water, PCE undergoes reductive dehalogenation to TCE if the proper microbes and nutrients are present (ATSDR 2014a).

Ground water at the Site is under adequate anaerobic conditions for reductive dehalogenation. See Section 12.4.5 for a discussion on the biodegradation evaluation of the Site. However, the most significant natural attenuation mechanisms for PCE at the Site are advection, dispersion, and diffusion.

Fate and Transport in Onsite Ground Water

PCE was detected in all onsite monitoring wells in all sampling events with the exception of EPA-4I, EPA-6D, and EPA-3F. The highest concentration of PCE in ground water was from MW-1, which has not decreased in concentration over time but rather has been fluctuating between 2,000 µg/L and 3,600 µg/L since the shutdown of the ERH treatment system in 2013. All other wells have shown a decreasing trend in PCE concentration over the last four sampling events, with the exception of EPA-5I. The decrease in PCE concentrations with time indicates that contaminant mass in the source area is reduced and the plume is shrinking with time. The only exceptions to this are onsite-monitoring wells MW-1 and EPA-5I. The fluctuating concentrations in these wells could indicate that PCE may have back-diffused into the soft calcareous clay, which is a common phenomenon that occurs in saturated zones contaminated with chlorinated solvents (Parker, et al. 2008; Martin, et al. 2016). MW-1 well was installed prior to EPA's association with the Site. MW-1 well construction indicates a well casing down to a depth of approximately 49 ft bgs, followed by open-hole drilling through either soft calcareous mud or possibly limestone of the Hawthorn Formation to a depth of 61 feet below grade. This construction indicates that monitoring well MW-1 is partially screened in the surficial aquifer and partly into the top of the limestone aquifer; therefore, its sample concentrations cannot represent any single aquifer.

Figure 11 shows the extent of PCE contamination in ground water in the intermediate zone, and Figure 12 shows the associated cross-sectional plume from the April 2012 through December 2013 time. These figures represent the period of time right before and right after the ERH treatment. Figure 13 shows the post-ERH PCE ground water plume from June 2014 through June 2016 and the associated cross-sectional plume in Figure 14.

The PCE source mass was depleted after the ERH treatment, with PCE concentrations greater than 25 µg/L retreating back to the treated source area. The source-attached plume segment retreated hydraulically upgradient toward the treated source area (SERAS 2017). Figures 13 and 14 show the plume detachment as well as how the plume is shrinking with time.

The ground water PCE lateral plume maps (Figures 11 and 13) were modeled for a depth of approximately 75 ft bgs using Rockware software (SERAS 2017). The cross-sectional schematic figures

(Figures 12 and 14) show that the onsite ground water contamination is still high, however, the farthest downgradient onsite monitoring well (RHF-15) has been recording decreasing PCE concentrations. This decrease in concentration is most likely attributed to diffusion and dispersion of ground water, in addition to reducing contaminant mass in the source area through the ERH treatment system.

Fate and Transport in Offsite Ground Water

PCE was detected in offsite monitoring wells and residential wells. Prior to the NTCRA ERH treatment, the plume boundary reached as far south as Summers Road, approximately one-mile south of the Site. The width of the plume extended from just west of the EPA-9 nested well set to approximately 1,500 feet east at its largest area. After the ERH treatment of onsite soil, the highest concentration of PCE in offsite ground water was within EPA-7I and the deepest extent of contamination was observed in the deep (D) zone in EPA-7D. Offsite nested monitoring well EPA-7 is located approximately 700 feet downgradient from the Site. PCE was not detected in the D-zone in monitoring wells EPA-8 or EPA-9, which are further downgradient from monitoring well EPA-7 (Figures 12 and 14). The extent of PCE contamination in offsite ground water is shrinking after the ERH treatment, as shown in Figure 13. This figure also shows an elevated PCE concentration near residential wells 226 and 227 (near the southern portion of the offsite plume). This dissociated PCE plume from the main onsite plume could be attributed to known agriculture wells near residential wells 226 and 227. The decrease in PCE concentration with time is likely due to source treatment and diffusion, as shown by the decrease in concentrations from June 2015 to June 2016 (Figure 13). Additionally, the presence of TCE in the ground water indicates that biodegradation is also happening in offsite areas.

Fate and Transport of COCs in Site-wide Ground Water

Site-wide analyses of fate and transport of PCE in ground water was performed by an EPA ERT contractor. The analyses included an evaluation of the plume attenuation and concentration versus time (Cvt) plots. Analytical results for PCE in ground water from the source area (former EPA-1S well and extraction wells X01 through X08) and from the entire plume (entire well network) was used in deriving these plots. The concentrations used in the analyses include baseline, interim, and post-ERH results and displayed as Cvt plots on Figure 16, for the Source Area and the Floridan Aquifer, respectively (Newell, et al. 2002). The Cvt attenuation constant (k_{source}, k_{plume} or k_{point}) for each well is summarized in Table 1 (SERAS 2017).

The relation (Newell, et al., 2002) used the Cvt plots to determine the attenuation constant (k_{source}, k_{plume} or k_{point}):

$$SLOPE = k_{point}\ (k_{source} \text{ or } k_{plume})$$

The k_{point} (k_{source} or k_{plume}) constant was used to estimate the time to reach the ground water criteria (3 µg L) by flushing both dissolved and adsorbed phases of PCE from the source area and Floridan aquifer. The estimated time to reach the ground water criteria (3 µg L) in the source area was determined from baseline PCE concentrations collected from monitoring well EPA-1S (destroyed during the construction of the thermal treatment system) and extraction wells X01 through X08 (installed as part of the system). The geometric mean for extraction wells X01 through X08 were plotted as a single value for the source area. The source area analytical results are plotted on Figure 15 and summarized below:

- Prior to activation of the thermal treatment system, the ground water concentration in the source area averaged 32,000 µg L with an estimated time of 644 years to reach the Florida MCL (3 µg L) by natural attenuation (Table 1).
- Treatment of the source area by thermal treatment increased the k_{point} constant by two orders of magnitude, which decreased the estimated time to reach the ground water criteria (3 µg L) by natural attenuation to 8 years (Table 1).

The estimated time to reach the ground water criteria (3 µg L) in the Floridan aquifer was determined by using the geometric mean of 14 to 18 wells per event that had PCE concentrations 1 µg L to represent the PCE plume in the Floridan aquifer for that particular sampling event. The Floridan aquifer analytical results are plotted on Figure 16 and summarized as follows:

- Prior to activation of the thermal treatment system, the geometric mean of the PCE concentration in the Floridan aquifer was 24 µg L with an estimated time of 276 years to reach the ground water criteria (3 µg L) by natural attenuation (Table 1).
- Treatment of the source area by ERH had little effect on the mean ground water concentration (25 µg L); however, it increased the k_{point} constant in the Floridan aquifer by one order of magnitude, which decreased the estimated time for the "whole" plume to reach the ground water criteria (3 µg L) by natural attenuation to 13 years (Table 1).
- Treatment of the source area by ERH caused a decline in PCE concentrations in all wells installed in the Floridan aquifer, except for EPA-5I and MW-1 (Table 1). Possible reasons for this are:

- Activation of the thermal treatment system appears to have altered the hydraulic gradient by locally redirecting flow from the source area towards monitoring well EPA-5I. It is uncertain as to whether the alteration of the hydraulic gradient is transient or permanent and whether the PCE concentrations in EPA-5I will eventually follow a declining trend, similar to the other wells.
- PCE concentrations in well MW-1 have stabilized between 2,100 and 3,100 µg/L, suggesting either a separate PCE phase migration into the erosional surface of the Hawthorn Formation or PCE adsorption in to the calcareous muds of the Hawthorn Formation. Consequently, a finite amount of PCE mass is diffusing backwards into the surficial aquitard and moving in to the uppermost Floridan aquifer, which will eventually attenuate.
- Monitoring well MW-1 is located outside the source area delineated by the subsurface investigation and the consistent decline of PCE in the surficial aquitard as shown in Figure 16 indicates back diffusion is the most likely scenario for the elevated PCE concentrations in monitoring well MW-1 (Parker, et al., 2008; Heron, et al., 2016).

12.4.2 Fate and Transport of PCE in Soil Gas

PCE was detected in all three soil gas samples collected as part of the RI investigations in 2017 and ranged in concentration from 18 µg/m3 to 23,000 µg/m3, well above the VISL Target Soil Gas Criteria of 140 µg/m3. The highest soil gas concentration was found in sample SG02, located in the former footprint of the ERH treatment area (Figure 10). The soil gas samples were collected in onsite areas of known ground water contamination within the surficial ground water to assess the potential VI risks to onsite occupants. Currently, there are no buildings on top of or adjacent to the three soil gas sample locations installed in 2017. The current onsite buildings in the southwest corner of the Site have been assessed for VI through indoor air, sub-slab, and crawl space sampling in 2010 and 2017 (pre- and post-treatment periods), and their results indicate detections but below VISL values and within acceptable risks. The VI pathway for the Site is evaluated as a complete pathway to current and future occupants.

PCE is a liquid at room temperature, but easily transitions to a volatile vapor form. In soil and/or ground water, PCE can migrate via pore space in soil and reach overlying structures. These soil vapors can then potentially enter the structures through cracks and/or holes in the foundation slab due to the lower pressure in the building than the subsurface. Migration through the soil column can be mitigated by the fraction of organic carbon contained in the soil, but organic carbon will become saturated over time unless the source is removed. Migration is also influenced by the porosity of the soil column. High porosity soils at the Site would likely aid in the movement of PCE. Generally, soil gas will diffuse naturally due to soil concentration gradients and under the influence of air exchanges between the soil gas and the atmosphere that take place in the shallow vadose zones. Microbial degradation or chemical oxidation do not play a significant role in the ultimate fate of PCE in soil gas.

12.4.3 Fate and Transport TCE

TCE is a colorless, sweet odor liquid, with a sweet burning taste. It is nonflammable, evaporates quickly, and has a low solubility in water. TCE can be released to the environment in soil, water, and air. TCE may remain trapped in the pore spaces between soil particles where the capillary pressure is sufficient to keep it from moving.

If released to the soil, TCE is not expected to bind to soil particles, but will volatilize rapidly with some leaching. In the presence of appropriate microbial population and under anaerobic conditions, TCE undergoes reductive dechlorination and will break down into cis- and trans-1,2-dichloroethene, with cis-1,2-DCE being the predominant isomer.

In surface water, TCE undergoes volatilization rapidly and will break down into cis- and trans-1,2-dichloroethene. TCE may bind to particles in surface water and settle to bottom sediment (ATSDR 2014b). TCE has a low solubility in water and, under anaerobic conditions in ground water, TCE may degrade if proper microbes and nutrients are present (ATSDR 2014b). The ground water at the Site is under adequate anaerobic conditions for biodegradation to occur. See Section 12.4.5 for a discussion on the biodegradation evaluation of the Site. The most significant natural attenuation mechanisms for TCE are advection, diffusion, dilution, and biodegradation.

Onsite Ground Water

TCE detections in onsite monitoring wells are generally below EPA MCL of 5 µg/L, with most detections below the Florida MCL of 3 µg/L. The TCE concentrations in onsite wells have fluctuated over the last four sampling events; however, it is likely that TCE concentrations will continue to decrease due to natural diffusion processes and biodegradation processes. Evidence for biological degradation of TCE and PCE is presented in Section 12.4.5.

Offsite Ground Water

TCE was detected in offsite monitoring wells and residential wells. Only five wells exhibited TCE concentrations exceeding the Florida criteria of 3 µg/L. Based on the Florida criteria of 3 µg/L, the lateral extent of the offsite plume extends from EPA-7I south to approximately 108th Street, is approximately

3,000 feet in length, and is approximately 800 feet wide at its largest area. The highest concentration is within EPA-7I and the deepest extent of contamination was in the D-zone in EPA-7D. TCE was not detected in the I-zone or D-zone in EPA-8 or the D-zone or F-zone in EPA-9, downgradient of the Site. Over the last four quarters of sampling, TCE concentrations in EPA-7I and EPA-7D have fluctuated. Between the November 2016 and May 2017, sampling events TCE concentrations increased in both wells.

The increasing TCE concentrations, along with anaerobic conditions, are indicative of anaerobic biodegradation occurring as the PCE in ground water is broken down into TCE. Natural biological degradation in offsite wells is evident due to the increase in TCE concentrations in well EPA-7I and EPA-7D from the installation of the well in 2011 (pre-ERH). From March 2011 to July 2013, TCE concentrations increase in well EPA-7I from 4.8 µg L to 88 µg L and fluctuated in concentration from November 2013 to May 2017. During the same period (March 2011 to July 2013), concentrations of TCE had increased in well EPA-7D from 8.6 µg L to 32 µg L and continued to fluctuate until May 2017. PCE concentrations in well EPA-7I increased from 14 µg L in March 2011 to 92 µg L in October 2012, but continually decreased in concentration to 11 µg L in May 2017. PCE concentrations in well EPA-7D increased from 7.9 µg L in March 2011 to 24 µg L in October 2012 but since have continually decreased in concentration to 2.5 µg L in May 2017. This data shows that while PCE is decreasing in concentration, TCE concentration is increasing with a slight lag in time, which can indicate that biological degradation is occurring in offsite ground water. The decrease in TCE concentration with distance from the source is most likely due to a combination of diffusion and natural biological degradation (Section 12.4.5).

12.4.4 Fate and Transport of TCE in Soil Gas

TCE is a liquid at room temperature but easily transitions to a volatile vapor form. In soil and ground water, TCE can migrate via pore in soil and reach overlying structures. These soil vapors can then potentially enter structures through cracks and holes in the foundation slab due to the lower pressure in the building than the subsurface. Migration through the soil column can be mitigated by the fraction of organic carbon contained in the soil, but organic carbon will become saturated over time unless the source is removed. Migration is also influenced by the porosity of the soil column. High porosity soils at the Site would not likely restrict movement of TCE. Microbial degradation or chemical oxidation do not play a significant role in the ultimate fate of TCE in soil gas.

12.4.5 MNA and Biodegradation Evaluation

As defined by Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-17, MNA refers to the reliance on natural attenuation processes (within the context of a carefully controlled and monitored cleanup) to achieve site-specific remedial action objectives (RAOs) within a reasonable time frame compared to other methods (EPA 1999). As part of the NTCRA, ground water samples collected between 2005 and 2014 were analyzed for chemical and anaerobic biodegradation parameters (SERAS 2017). These results were then evaluated using the framework and scoring system proposed in OSWER Directive 9200.4-17 (EPA 1999).

The MNA parameters for the site ground water included: alkalinity, pH, dissolved organic carbon, chloride, dissolved oxygen, dissolved gases [methane, ethane, ethylene (MEE)], ferrous iron, nitrates, oxygen reduction potential (ORP), sulfate, temperature, and the presence of dehalococcoides (DHC), the microbe that degrades chlorinated VOCs. Analysis of PCE daughter compounds [namely TCE, dichloroethene (DCE), and vinyl chloride], was also performed.

Two hundred forty-five ground water samples were collected from 23 monitoring wells from 2005 to 2014 and analyzed for all MNA parameters. Details are available in the RI/FS Report (OTIE 2018). The results are summarized below:

- Alkalinity ranged from 21 to 180 milligrams per liter (mg/L), with a geometric mean of 93 mg/L.
- pH ranged from 3.99 to 6.87 standard units (SU)
- DO ranged from 0.93 to 97 mg/L, with a geometric mean of 1.4 mg/L.
- ORP ranged from -480 to 380 millivolts (mV).
- Chloride (Cl^-) ranged from 3.3 to 41 mg/L, with a geometric mean of 8.2 mg/L.
- Nitrate (NO^{3-}) is overwhelmingly more abundant than nitrite (NO^{2-}), with the total NO^{3-}-NO^{2-} concentration ranging from 2.3 to 15.6 mg/L. The highest NO^{3-} and NO^{2-} concentrations were identified in private wells and may be attributed to residential septic systems.
- Sulfate ($SO4^{2-}$) ranged from 16 to 93 mg/L, with a geometric mean of 1.8 mg/L.
- Dissolved organic carbon (DOC) ranged from 1 to 11 mg/L, with a geometric mean of 2.9 mg/L.
- Ferrous iron [Fe(II)] ranged from 0.02 to 0.36 mg/L.
- Methane, ethane and ethane were not detected in the ground water samples.

The EPA (1998) devised a screening method based on MNA parameters to assess a site for the likelihood that bioattenuation is a viable remedial alternative. The ranking was based on a 30-point scoring system

(EPA 1998). The ground water sampling events were analyzed from March 2011 to July 2014 and the points awarded for each MNA parameter are (SERAS 2017):

- Both TCE and cis-1,2-DCE occur as breakdown products of PCE for a score of **4**.
- Cl^- ranges from 3.5 to 41 mg L, averaging 9.5 mg L with localized zones twice the background concentration for a score of **2**.
- NO^{3-} ranges up to 15.6 mg L, averaging 1.7 mg L with localizes zones less than ( ) 1 mg L for a score of **2**.
- SO_{4-2} range up to 93 mg L, averaging 27 mg L with localizes zones 20 mg L for a score of **2**.
- DOC concentrations are 20 mg L for a score of **0**.
- Methane concentrations are 0.5 mg L for a score of **0**.
- pH 5 and 9 standard units (SU) for a score of **0**.
- DO ranges up to 97 mg L, averaging 3.0 mg L with localizes zones 0.5 mg L for a score of **2**.
- ORP ranges from -480 to 380 mV, averaging 50 mV but zones of -100 mV common for a score of **2**.
- Alkalinity ranges from 21 to 180 mg L, averaging 119 mg L or $1^{1}{}_{2}$ times background for a score of **1**.
- Fe (II) 1 mg L for a score of **0**.
- Temperature 20 °C for a score of **1**.

Based on EPA (1998) scoring system for using MNA as a potential remedy, the Site has a rank of 16, on a scale from 1 to 30, which indicates there is adequate evidence for anaerobic biodegradation of chlorinated VOCs at the Site (EPA 1998).

In February 2016, post-ERH treatment samples were collected for DHC and other microbe analyses from onsite monitoring wells MW-1 and EPA-3I. These samples results indicated 5.8E+00 cells per milliliter (cells mL) DHC in EPA-3I and 1.0E+00 cells mL DHC for MW-1. The other microbes were not detected in the samples. Lu, et al. (2006) proposed that a concentration of 1.0E+04 cells mL could be used as a screening criterion to identify sites where reductive dechlorination will yield a generally useful biodegradation rate. The results from these two onsite wells indicate that there not enough microbes in the ground water and therefore reductive dechlorination of PCE and TCE to ethane is unlikely to occur under the existing conditions. It is a possible that the microbes were affected from the ERH treatment when the soils were heated. However, TCE ground water concentrations in offsite well EPA-7I has increased from pre-ERH treatment to post-ERH treatment, which may be an indication of biodegradation occurring offsite.

The analytical macro BioChlor (EPA 2000 and 2002) was used to determine the 1st-order degradation constants for chlorinated solvents by matching baseline concentrations in the Floridan aquifer to the following breakdown chain:

PCE → TCE → cis-1,2-DCE → VC → ethene

A BioChlor simulation was performed using the following input values from the intermediate hydraulic zone (50 to 100 feet below grade) of the Floridan aquifer (SERAS 2017):

- PCE solubility of 150 mg L, with source area of 10 by 10 by 1 cubic feet
- hydraulic conductivity 0.018 centimeters second (50 ft day)
- hydraulic gradient of 0.0023 feet feet based on water levels using a Digital Elevation Model (DEM) for wellhead surface elevations
- porosity of 0.2 (Freeze and Cherry, 1979)
- dispersion of 120 feet (based on plume dimensions of 1,500 feet by 4,700 feet)
- bulk density of 1.7 kilograms per liter (kg L)
- fraction of organic carbon of 0.001 assuming DOC equilibrium (SERAS 2017).

The data was analyzed and the biotransformation constants were chosen to simulate a best match curve to known baseline concentrations along the plume axis by holding the source area, values for the bulk density and porosity, the median values for the hydraulic gradient and fraction of organic carbon, and the dispersion coefficient constant. Only the hydraulic conductivity (50 ft day) was adjusted within the range of hydraulic conductivities for the intermediate zone were used to match the best curve fit for the baseline PCE and breakdown concentrations (SERAS 2017).

The results indicate a 52 percent reduction in the chlorinated solvent mass due to biodegradation, as contaminated ground water exits the surficial aquitard into the onsite Floridan aquifer. The curve fit also suggests that the majority of the biodegradation occurs within the first 700 feet downgradient of the source (SERAS 2017). This is consistent with the data collected from EPA-7I well located approximately 700 feet from the Site boundary, where TCE was observed to have increased from pre-ERH to post-ERH times.

13.0 CURRENT AND POTENTIAL FUTURE LAND AND GROUND WATER USES

This section of the ROD discusses the current and reasonably anticipated future land uses and current and potential future ground water uses at the Site. This section also discusses the basis for future use assumptions.

13.1 Current and Potential Future Land Uses

The Arkla Terra Property within the fenced boundaries of the Site is currently in commercial industrial land use. The offsite area is of mixed commercial and residential land use, with predominant residential land use.

Structures currently on the Site include six commercial industrial buildings leased to various businesses by Arkla Terra Inc. in the southwestern corner of the property. The northern half of the property is paved and used as a large lot for storing trailers. The southeastern corner of the Site is mainly a gravel surface area with one mobile trailer. The EPA has determined that commercial industrial land use is the reasonably anticipated future land use on the Arkla Terra Property. Additionally, as part of the selected remedy for the onsite decision unit, the LUCs for the site will address ground water and soil gas media to protect future site occupants.

EPA has determined that residential use is the reasonably anticipated future land use in the offsite areas.

13.2 Current and Potential Future Ground Water Uses

There are no drinking water wells completed or in use by onsite businesses. The Site is located in unincorporated Thonotosassa, where there is no current ordinance restricting the use of private potable wells. Appropriate ICs will restrict the use of future onsite ground water for potable purposes until cleanup levels are met.

There are offsite portable drinking water wells that exist within the footprint of the ground water plume. The Site ground water is classified per the F.A.C. 62-520.410 – Classification of Ground Water, Usage, Reclassification as CLASS G-II, Potable Water Use for ground water in aquifers with total dissolved solids content of less than 10,000 mg l.

Although a majority of the private properties are connected to municipal water, approximately 10 properties within the footprint of the plume are not connected to municipal water and are assumed to have some type of potable well on the property. Under the selected remedy, these properties will be connected to municipal water to ensure that the residents are not exposed to contaminated ground water. For the future ground water use, ICs will be enforced by the Southwest Florida Water Management District (SWFWMD) through regulating water well installations within the footprint of the plume.

The EPA expects that MNA will reduce the concentrations of PCE and TCE below MCLs so that the ground water from the Floridan aquifer would be restored to beneficial use in the future.

14.0 SUMMARY OF SITE RISKS

This section of the ROD provides a summary human health and environmental risks of the Site. A BLRA to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to Site contaminants was completed, assuming no remedial action would be undertaken. The BLRA provides the basis for taking actions and identifies the contaminants and exposure pathways that must be addressed during development of remedial alternatives. An HHRA and an SLERA were conducted as part of the RI (OTIE 2018).

The HHRA estimates risks the site poses if no actions were taken. This HHRA was conducted in the following process:

a. Hazard identification (identification of COCs)
b. Exposure assessment,
c. Toxicity assessment, and
d. Risk characterization.

14.1 Identification of Contaminants of Concern

The COCs and exposure point concentrations (EPCs) identified in onsite offsite ground water and onsite soil gas are presented in Tables 2A, 2B, and 2C. For the exposure assessment, the EPC for each COC is combined with the exposure assumptions identified for each receptor and medium. Specifically, EPA used an EPC for each COC and the reasonable maximum exposure (RME) scenario to estimate risk. The EPC was the lesser of the maximum detected concentration and the 95 percent upper confidence limit (UCL) of the arithmetic mean concentration. A 95 percent UCL is a statistically-derived value based on sample data within an exposure area.

Based on the BLRA, no cancer risk drivers (COCs) were identified in onsite or offsite media. Cancer risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. These risks are probabilities that usually are expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that an individual experiencing the RME estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk," because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual's developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposures is 10^{-4} to 10^{-6}. Florida Statutes establish a maximum acceptable risk of 1×10^{-6}.

All cancer risks estimated for the onsite and offsite receptors were within EPA target risk range of 10^{-4} to 10^{-6}. Accordingly, only non-cancer risk driver COCs were identified in onsite and offsite media. The non-cancer risk values (exposure assessment, toxicity assessment, etc.) are presented below. Information about the cancer risk calculations and assessment can be found in the BLRA of the RI FS (OTIE 2018).

14.2 Exposure Assessment

A CSM to identify potential exposure pathways for the current and future onsite and offsite receptors is presented in Figure 7. All of the scenarios and pathways considered in the risk assessment are presented in the standard Table 1 from RAGS Part D presented in Appendix A. Exposures were quantified in accordance with EPA guidance using standard default exposure assumptions for the receptors (EPA 1989a; EPA 2001; EPA 2014). Current potential human receptors located onsite include the industrial worker and a Site visitor trespasser. Although a locked fence limits Site access, it is possible for a trespasser to enter the Site and be exposed to Site surface soil. Current and future onsite industrial workers could be exposed to soil while performing intrusive work activities.

Current onsite receptors do not use ground water for any purpose, and there is no complete pathway for direct exposure to this medium. Based on this information, risks associated with the onsite industrial worker exposure to contaminated ground water are only evaluated under the most conservative future scenario. Without onsite land use restrictions, the Site can be redeveloped for residential land use. Volatile contaminants present in soil or ground water may volatilize into the soil vadose zone and accumulate inside current and future onsite buildings. In addition, future construction workers may be exposed to vapors during excavation activities.

For offsite receptors, water supply wells are located in areas affected by the ground water contamination. In accordance with the EPA Ground Water EPC Guidance, residential well data are not included with monitoring well data for evaluating na RME condition. Therefore, the use of monitoring well data in developing the offsite ground water EPC is highly conservative, as it represents a hypothetical offsite current receptor in a worst-case exposure scenario. The offsite soil was not impacted by Site operations. Accordingly, offsite soil was not considered an exposure route to current or future offsite receptors. In addition, volatilization of contaminants from the offsite ground water in the bedrock aquifer to the vadose zone was deemed insignificant and was not evaluated for offsite receptors.

14.3 Toxicity Assessment

A summary of non-cancer toxicity values used in the risk assessment is provided in Table 3. Toxicity values (e.g., reference dose) for COCs were obtained from the Integrated Risk Information System (IRIS) of EPA. Soil gas risks were evaluated individually through the EPA VISL calculator. For non-cancer risk calculations, the chronic toxicity data available for both COCs for oral exposures have been used to develop oral reference doses (RfDs). The pertinent toxicity data indicate that TCE and PCE primarily affect the development immune system and neurological system, respectively. Dermal RfDs were extrapolated from the oral RfDs by applying an adjustment factor as appropriate. An oral-to-dermal factor of 1 was applied (no adjustment) for both COCs, resulting in the unadjusted oral RfDs being used as the dermal RfDs for these contaminants. As presented in Table 4, the COCs have toxicity data indicating their potential for adverse non-carcinogenic health effects in humans.

14.4 Risk Characterization

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with an RfD derived for a similar exposure period. An RfD represents an dose that an individual may be exposed to that is not expected to cause any deleterious effects. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ 1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all COCs that affect the same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI 1 indicates that toxic noncarcinogenic effects from all contaminants are unlikely based on the sum of all HQ's from different contaminants and exposure routes. An HI 1 indicates that site-related exposures may present a risk to human health.

The HQ is calculated as follows: Non-cancer HQ = CDI RfD

where:

CDI = Chronic daily intake

RfD = reference dose

CDI and RfD are expressed in the same units and represent the same exposure period (i.e., chronic, subchronic, or short-term).

A summary of the risk characterization is presented in Tables 4 and 5. The ground water non-cancer HQ of 17 estimated for the future onsite child resident and the ground water non-cancer HQ of 10 estimated for the adult resident exceeded the target value of one. For the onsite adult and child receptor, the target organ HI exceeded one for the neurological system. PCE in onsite ground water was identified as the risk driver contributing to the cumulative target organ HI.

Non-cancer HQs estimated for the future onsite industrial worker is two, which exceeded the target value of one (the target organ HI exceeded one for the neurological system). PCE in ground water was identified as the risk driver contributing to the cumulative target organ HI for the onsite industrial worker. For all other onsite non-resident receptors (trespasser visitor and construction worker), the cumulative cancer risk estimates were within the EPA target risk range (1E-06 to 1E-04) and cumulative non-cancer HQs were less than one.

Non-cancer risks for the offsite resident child and adult resident exposed to COCs in ground water results in a total HI of four and three, respectively. TCE was identified as the risk driver contributing to the cumulative target organ HI (development and immune system). Screening of the indoor air and sub slab gas data against concentrations protective of the VI pathway identified no potential threats to current receptors working in the two onsite buildings. By using the VISL calculator, PCE and TCE in soil gas were identified as potential threats to future residential receptors who may reside in buildings constructed onsite. The estimated cancer risk from all exposure pathways were less than or within the EPA target risk range of 10^{-6} to 10^{-4}.

14.5 Human Health Uncertainty Analysis

The risk assessment process requires a number of assumptions about exposure and toxicity that introduce uncertainty to the risk and hazard estimates. The potential impacts of assumptions and uncertainties must be considered when interpreting the results of the risk characterization. The potential uncertainties resulting from the sampling and chemical analysis, exposure assessment, and toxicity assessment are discussed below.

Sampling and Chemical Analysis

At any given site, it is possible that there are more chemicals present than investigated during sampling and analysis effort. In order to minimize this potential uncertainty, the samples were analyzed for all potential contaminants associated with historical operations. In addition, the sample locations for each medium were biased to those areas with the greatest potential for contamination as indicated by previous environmental investigations and the geological surveys. For these reasons, it is unlikely that significant chemical contamination was not identified during the sampling and analysis efforts. In addition, quality control strategies were executed during sampling, laboratory analysis, and data analysis (i.e., data validation) to reduce uncertainty of the results.

The number of samples collected from some medium (e.g. soil gas) are fewer than the number generally needed to calculate a 95 percent UCL of the mean concentration. For a VI analysis, an ideal representative sample pool would include sampling air from every building onsite over multiple rounds in order to account for temporal variability. For this BLRA, the maximum concentration was used to represent the EPC. Overall, the frequency of multi-media sampling events that have occurred onsite over multiple years reduces the uncertainty associated with sampling and chemical analysis.

Potential uncertainty is associated with the sensitivity of each analytical method. Specifically, the analytical method may not be sensitive enough to detect potential site contaminants at concentrations that pose a threat to human health. The reporting limits for some of the non-detected chemicals are higher than the June 2017 residential regional screening levels (RSLs). Because it is possible for the non-detected analytes to be present in site media at concentrations greater than the screening values, the elevated reporting limits may have caused the potential risks to be underestimated.

Exposure Assessment

A level of uncertainty can arise from the assumptions required to estimate chemical risk, such as ingestion rates, exposure frequencies, and the other variables that comprise the equations. This HHRA used standard default exposure values (e.g., exposure frequency, exposure duration, soil ingestion rates, and skin surface areas) developed by EPA that generally provide a conservative analysis of risk. The use of default exposure values will likely overestimate the potential risk for a given receptor.

In addition, exposure pathways that were not selected could introduce another source of uncertainty. These associated exposure routes are expected to be lower than the pathways included in the risk assessment. For the inhalation exposure route of volatiles in ground water, tap water use beyond showering bathing (e.g., toilet, clothes washer, sink) were not evaluated in this risk assessment, which could underestimate the potential risk. In addition, the VI pathway could be highly variable, in which volatile chemicals are present in one building but not in others. To account for this variability, building within the core of the plume were targeted.

Toxicity Assessment

Toxicity values incorporated into this HHRA were derived from peer-reviewed sources in accordance with EPA guidance. The use of chronic toxicity values for resident child subchronic exposure is highly conservative and will likely overestimate risk. Some chemicals have limited toxicity information. For instance, numerical dermal exposure toxicity values have not been developed by EPA. In order to quantify the dermal exposure risk, a route-to-route extrapolation of the oral toxicity value to an absorbed dose dermal toxicity value was used. The patterns of distribution, metabolism, and excretion between oral and dermal routes of exposure may potentially be different, in which the use of oral toxicity values for dermal exposure may overestimate or underestimate risk. The use of screening values set at an excess cancer risk of 1.0×10^{-6} and a HQ of 0.1 minimizes this underestimation.

14.6 Summary of Screening Level Ecological Risk Assessment

This section summarizes the results of the SLERA for the Site. Although limited ecological habitat was identified, ecological receptors could be present at the Site and feed on plants or terrestrial invertebrates. Common terrestrial wildlife species (e.g., American robins, short-tailed shrews) are likely to be present.

There are no water bodies or streams on the Site. Ground water is present both onsite and offsite at an average depth of 35 ft bgs and is not hydraulically connected to any nearby surface water bodies. Based on this information, the transition zone community, in which ground water discharges to surface water bodies, is not identified as an ecological receptor and was not evaluated.

Below are the ecological receptors used to represent the assessment endpoints for the SLERA.

- Terrestrial plant community
- Terrestrial invertebrates
- Northern bobwhite: avian terrestrial herbivores

- American robin: avian terrestrial insectivores
- Red-tailed hawk: avian terrestrial carnivores
- Eastern cottontail: mammalian terrestrial herbivores
- Short-tailed shrew: mammalian terrestrial insectivores
- Red fox: mammalian terrestrial carnivores

A SLERA is conducted in a two-step process and provides a general measure of the potential ecological risk. The first step of the SLERA includes the comparison of the maximum detected soil concentrations (collected from 0 to 2 ft bgs) against benchmark values for each target community (i.e., terrestrial plants, terrestrial invertebrates, birds and mammals). For the initial food web model, the maximum detected soil concentrations were initially used to estimate the chemical consumption rates and compared against the no observed adverse effect levels (NOAEL) for wildlife receptors (e.g., mammalian herbivore).

The second step of the SLERA aims to provide a more realistic evaluation of potential risks. If the maximum concentration of a given chemical exceeded an ecological screening benchmark, a refined screening of analytical results was conducted by using the 95 percent UCL on the arithmetic mean concentration. For the refined food web model, the EPC for bio accumulative chemicals was also based on the 95 percent UCL on the arithmetic mean concentration. Chemical intakes were compared to lowest observed adverse effect levels (LOAELs) in addition to NOAELs selected from the literature. As presented in Appendix A of the RI FS (OTIE 2018), high molecular weight PAHs pose minimal threats to avian and mammalian insectivores. No other chemicals pose a threat to upper trophic receptors. Chemicals detected in Site soil do not pose a threat to the plant community nor terrestrial invertebrates.

14.6.1 Ecological Uncertainty Analysis

Similar to the HHRA, the ecological risk assessment requires a number of assumptions that may introduce uncertainty to the risk estimates. As discussed in the human health uncertainty analysis, more chemicals could be present at the Site than identified in the sampling and analysis effort. The analytical suites for this investigation were based on all potential contaminants associated with historical operations and previous investigations. In addition, sample locations were biased to those areas with the greatest potential for contamination as indicated in previous field investigations. Accordingly, the uncertainty associated with the analytical data suite used for this investigation is low.

For analytes that were not detected in Site soil, the sensitivity of the analytical methods may not be sufficient to detect potential contaminants at concentrations that could pose a threat to ecological receptors. This uncertainty is assessed by comparing reporting limits for non-detect analytes to ecological screening values. The reporting limits for some of the non-detected chemicals are higher than the ecological benchmarks. Because it is possible for the non-detected analytes to be present in site media at concentrations greater than the screening values, the elevated reporting limits may have caused the potential risks to be underestimated.

The ability to assess the risk to upper trophic ecological receptors through a food web model requires a number of assumptions about an animal's dietary habits and the associated concentrations of contaminants with these food items. This uncertainty is minimized by using ingestion rates, bioaccumulation factors, and NOAELs LOAELs available through EPA guidance documents and reliable sources in the literature. However, assumptions used in the food web could overestimate or underestimate potential risk to upper trophic levels.

14.7 Basis for Remedial Action

The response action selected in this ROD is necessary to protect public health and the environment from actual or threatened releases of pollutants or contaminants from this site, which may present an imminent and substantial endangerment to public health or welfare. The onsite response action is warranted because the non-cancer HQ of 17, estimated for the future onsite child resident exposure to ground water and the adult resident HQ of 10, exceeded the target value of one. Non-cancer HQs estimated for the future industrial worker (two) also exceeded the target value of one. PCE in ground water was identified as the risk driver contributing to the cumulative target organ HI for these receptors.

An offsite response action is warranted because the non-cancer risks for the offsite resident child and adult resident exposed to ground water result in a total HI of four and three, respectively. TCE was identified as the risk driver contributing to the cumulative target organ HI.

15.0 REMEDIAL ACTION OBJECTIVES

The RAOs for onsite and offsite ground water and onsite soil gas provide a general description of what the Superfund cleanup is designed to accomplish. These goals serve as the design basis for the selected remedy identified in this ROD.

15.1 Remedial Action Objective for the Site

The RAOs for the Site are (OTIE 2018):

a. Prevent human exposure to COCs in ground water through ingestion, dermal contact, and inhalation above levels that are protective of beneficial use (drinking water use);
b. Protect future commercial industrial occupants from adverse health effects that may result from exposure to PCE- and TCE-contaminated vapors within existing or new buildings or prevent unacceptable risks due to vapor intrusion into existing and new buildings (this RAO will address all future onsite occupants and current industrial commercial worker risks through implementation of LUCs); and
c. Restore ground water quality to meet Florida's MCLs based on the classification of the aquifer as a potential source of drinking water.

15.2 Basis for Rationale for Remedial Action Objectives

The basis for the ground water RAOs is to restore the Site ground water to drinking water levels, which is the current and reasonably anticipated future beneficial ground water use. The basis for the ground water RAOs is also to ensure that the current and future receptors are not exposed to contaminated ground water during the implementation of the remedy. EPA will generally initiate a response action if there is contamination above federal or state drinking water standards and if the contaminated aquifer is being used for drinking purposes. The cleanup goal for onsite and offsite ground water is set at 3 µg L PCE and 3 µg L TCE based on the State of Florida drinking water MCLs (Table 6). These goals are protective of human health based on drinking water standards.

The basis for the soil gas and indoor air RAO is to ensure that the Site industrial and commercial occupants are not exposed to PCE and TCE contaminated soil gas vapors above USEPA VISL. There are no current unacceptable soil gas vapor exposure or indoor air risks to onsite receptors. This RAO will ensure through LUCs that onsite occupants are not exposed to unacceptable VISL values.

15.3 Risks Addressed by the Remedial Action Objectives

The risks associated with PCE and TCE contaminated ground water at the Site will be addressed by MNA. When the remedy is completed, the ground water will be restored to its beneficial use and Site occupants are not exposed to concentrations of PCE and TCE in ground water above acceptable health-based levels.

All cancer risks estimated for the onsite residential receptors were within the EPA target risk range of 1.0×10^{-6} to 1.0×10^{-4}. The current/future onsite industrial worker HQ of two exceeded the HQ of one and will be addressed by ICs prohibiting the use of ground water at the Site. The onsite non-cancer HQ of 17 for future onsite child and adult resident HQ of 10 is greater than one and will be addressed by MNA.

The cumulative cancer risk associated with the hypothetical current and future offsite resident from ground water exposure to PCE and TCE is within the EPA target risk range of 1.0×10^{-4} to 1.0×10^{-6}. Non-cancer HI of four for the offsite adult and non-cancer HI of three for offsite child will be addressed by providing a municipal water supply and regulating the installation of water supply wells within the Site plume.

The EPA anticipates that the concentrations of PCE and TCE in ground water will naturally attenuate below the State MCL, thus reducing the non-cancer risk HQ/HI levels to below one.

While there are no identified unacceptable risks to current Site occupants from soil gas/vapor exposure or indoor air, LUCs and monitoring will ensure that the Site occupants are not exposed to PCE or TCE vapor concentrations above unacceptable health-based levels.

16.0 DESCRIPTION OF ALTERNATIVES

Seven alternatives were developed for the Site (OTIE 2018). Four of these alternatives were developed to address onsite ground water contamination and three of these alternatives were developed to address offsite ground water contamination. OGW Alternative 2 (MNA with ICs) and DGW Alternative 2 (Alternate Municipal Water Supply with MNA and ICs) describe the selected remedy presented in this ROD. These two were the preferred alternatives initially presented to the public in the Proposed Plan (EPA 2018). The following are the alternatives developed for the Site:

a. *OGW Alternative 1 – No Action*
b. *OGW Alternative 2 – MNA with ICs.* Onsite ground water contamination plume is addressed by MNA and ICs. ICs for OGW Alternative 2 include requirements for no intrusive activities in the former treatment footprint, regulating installation of water supply wells, and requirement for soil gas and VI assessment sampling and possible engineering controls to abate vapor mitigation threats.
c. *OGW Alternative 3 – Emulsified Zero Valent Iron (EZVI) Remediation Plus MNA with LUCs.* Targeted onsite ground water plume areas addressed by EZVI along with MNA and LUCs.

d. *OGW Alternative 4 – Pump and Treat with Ex Situ Air Stripping*. Ground water plume addressed by extracting ground water through pumps and treatment using air stripping technology and LUCs.
e. *DGW Alternative 1 – No Action*
f. *DGW Alternative 2 – Alternate Water Supply (Municipal Water) Plus MNA with ICs*. Offsite ground water risks abated by use of municipal water and ICs, while the plume is addressed by MNA.
g. *DGW Alternative 3 – Point of Entry (POE) Treatment Plus MNA with ICs*. Treatment of offsite ground water at each POE to the residence using small carbon treatment units and ICs.

16.1 Common Elements of Each Remedial Alternative

MNA and LUCs are common elements of each remedial alternative presented in the Proposed Plan (EPA 2018), except the no-action alternatives and the pump-and-treat alternative. Treatment of ground water is specific to OGW Alternative 4 – Pump and Treat and for DGW Alternative 3 – POE Treatment.

Monitored Natural Attenuation

The current ground water contamination in onsite and offsite areas will be remediated with MNA. A monitoring program will be developed during the remedial action for the Site, which will dictate the frequency of sampling, wells to be sampled, and evaluation of ground water with respect to natural attenuation of the contaminants. The monitoring program will also include installation of permanent sub-slab subsurface vapor ports and sampling for soil gas, subs lab and indoor air to evaluate contaminant concentrations with respect to protection of onsite occupants. EPA Region 4 will perform the selected MNA remedy sampling until the contaminants of concern achieve their cleanup standards applicable or relevant and appropriate requirements (ARARs). As identified in the *Guidance for Evaluating Completion of Ground Water Restoration Remedial Actions*, OSWER 9355.0-129, this will complete the remediation monitoring phase. Ground water monitoring would continue after the remediation monitoring phase is completed to verify that cleanup levels for each COC continue to remain at or below the cleanup level (i.e., the attainment monitoring phase). Once the attainment monitoring is complete, the monitoring wells will be abandoned and the site will be closed out and deleted. Five Year Reviews will continue until that time. MNA remedy will be considered as completed when the concentration of PCE and TCE in the ground water is at or below the State MCL of 3 µg L in eight consecutive sampling events.

Land Use Controls

ICs, such as an environmental covenant (EC) and governmental controls (zoning and permit reviews) will be implemented to protect the integrity of the ground water remedy and to prevent unacceptable exposure to contaminated ground water and VOC vapors from soil gas as part of the selected remedy. Construction of a building or other structure over contaminated areas with VOC soil gas may require mitigation systems or construction techniques to prevent VOC vapors entering the structure. Consultation with EPA will be required for any such proposed on-site construction to ensure it remains protective of human health.

The ICs implemented at this Site will include, but are not limited to, the following:

- *EC* – In conjunction with the implementation of the remedy, the landowner will draft (with EPA assistance) and record an EC in the Hillsborough County of Register of Deeds that includes the following use restrictions and or information:
  - Prohibits residential use of the property.
  - Prohibits installation of any ground water wells and prohibits consumptive uses of ground water on the Site property.
  - Prohibits any disturbance of remedy components on the Site property such as monitoring wells.
  - Includes Site map that delineates contaminated areas with potential for vapor intrusion and prohibits construction of structures unless consultation with EPA in order to determine if vapor mitigation is required.
- *SWFWMD Zone Restriction on the Construction of Wells*—The SWFWMD has a Memorandum of Understanding with EPA that governs the installation of any new residential or industrial wells on Arkla Terra Property Site and in the offsite plume area. SWFWMD has been provided maps of the ground water plumes that will be used in the review of any permit requests for installation of ground water wells.

16.2 Distinguishing Features of Each Remedial Alternative

Remedy components for each ground water alternative (except Alternative 1) include MNA, operations and maintenance, and LUCs.

16.2.1 OGW Alternative 1 – No Action

Estimated Time for Design Construction:	*Not applicable*
Estimated Time to Reach Remediation Goals:	*Not applicable*
Estimated Capital Costs:	*Not applicable*
Estimated Lifetime O&M Costs:	*$0*
Estimated Total Present-Worth Costs:	*$0*
Discount Rate:	*Not applicable*
Number of Years Costs Are Projected:	*Not applicable*

Alternative 1 (No Action) is required by the NCP (§300.430(e)(6)) and forms the baseline alternative against which the effectiveness of all other remedial alternatives is evaluated. Under this alternative, no monitoring or control of contaminated ground water migration from the Site will take place. The magnitude of risks is likely to remain the same since contaminated soils and ground water will remain on the Site that pose a risk to human health. There is no treatment, containment, MNA, or LUC component for this alternative. Because contaminated soil and ground water will remain at the Site, a review of the effectiveness and protectiveness of this alternative will be conducted every five years. This alternative will not comply with the ARARs for the Site.

16.2.2 OGW Alternative 2 – MNA with ICs

Estimated Time for Design Construction:	*4 weeks*
Estimated Time to Reach Remediation Goals:	*15 years*
Estimated Capital Costs:	*$122,000*
Estimated Lifetime O&M Costs:	*$640,000*
Estimated Total Present-Worth Costs:	*$660,000*
Discount Rate:	*7%*
Number of Years Costs Are Projected:	*15 years*

Under this alternative, onsite ground water will undergo MNA. Following are a list and descriptions of the remedy components for OGW Alternative 2.

Ground Water Contamination

a. *Treatment Component* – There is no treatment component to this alternative. Onsite ground water will undergo natural attenuation until the concentrations of PCE and TCE in ground water are equal to or lower than 5 µg/L. The effectiveness of MNA will be monitored through a ground water sampling and soil gas sampling protocol, until cleanup levels are achieved. Because contaminated ground water will remain at the Site, a review of the effectiveness and protectiveness of OGW Alternative 2 will be performed every five years as required by SARA.

b. *O&M Component* – All monitoring wells require periodic evaluation of their integrity, functionality, as well as maintenance, if any, of well casings, locks, etc.
c. *LUC Component* – ICs, such as deed restrictions and legal controls, will be implemented to protect the integrity of the remedy and protect the human population.

16.2.3 OGW Alternative 3 – EZVI Remediation Plus MNA with ICs

Estimated Time for Design Construction:	*6 months*
Estimated Time to Reach Remediation Goals:	*13 years*
Estimated Capital Costs:	*$546,000*
Estimated Lifetime O&M Costs:	*$590,000*
Estimated Total Present-Worth Costs:	*$1,090,000*
Discount Rate:	*7%*
Number of Years Costs Are Projected:	*13 years*

Under this alternative, ground water will be treated with micro- or nano-scale iron particles suspended in a water-in-oil emulsion (vegetable oil emulsion). In addition to iron particles, ground water will be amended with new microorganisms to assist with biodegradation. New wells will be installed for adding iron particles and microorganisms. Because of underlying Karst geology and potentially unknown sinkholes, EZVI may require additional time than estimated for alternate completion and achievement of remedial goals (RGs). This alternative will require periodic injections of EZVI and microorganisms and evaluation of its performance.

a. *Treatment Component* – Onsite ground water will be treated with EZVI and supplemented with microbes for the water to undergo natural attenuation until the concentrations of PCE and TCE in ground water is equal to or lower than 3 μg L. The effectiveness of EZVI and MNA will be monitored through ground water and soil gas sampling, until cleanup levels are achieved. Because contaminated ground water will remain at the Site, a review of the effectiveness and protectiveness of OGW Alternative 3 will be performed every 5 years as required by SARA.
b. *O&M Component* – The injection wells and monitoring wells require periodic maintenance and reintroduction of EZVI and microbes based on the results of the monitoring program.

c. *LUC Component* – ICs, such as deed restrictions and zoning, will be implemented to protect the integrity of the remedy and protect the human population.

16.2.4 OGW Alternative 4 – Pump and Treat with Ex Situ Air Stripping

Estimated Time for Design Construction:	*9 months*
Estimated Time to Reach Remediation Goals:	*10 years*
Estimated Capital Costs:	*$1,139,000*
Estimated Lifetime O&M Costs:	*$760,000*
Estimated Total Present-Worth Costs:	*$1,960,000*
Discount Rate:	*7%*
Number of Years Costs Are Projected:	*10 years*

Under this alternative, the contaminated ground water plume is addressed through extraction and then treated by Air Stripping technology to remove VOCs. Air stripping technology is typically used for VOC removals, but due to Site's Karst geology and potential for back-diffusion at the Site, other alternatives were also evaluated to treat ground water contamination.

a. *Treatment Component* – Contaminated ground water will be extracted through pumps and will be treated using air stripping technology. New extraction wells will be installed based on design requirements and extracted water will be treated by air stripping technology until the concentrations of PCE and TCE in ground water equal to or lower than 3 μg/L. Treated water will be discharged following all local requirements.
b. *O&M Component* – Pumps and treatment systems will be operated on a continuous basis and will require routine maintenance of equipment as long as the remedy is in-place. Dedicated crew or dedicated automated equipment with periodic checks will be required under this Alternative.
c. *LUC Component* – ICs, such as deed restrictions and zoning will be implemented to protect the integrity of the remedy and protect the human population.

16.2.5 DGW Alternative 1 – No Action

Estimated Time for Design Construction:	*Not applicable*
Estimated Time to Reach Remediation Goals:	*Not applicable*
Estimated Capital Costs:	*Not applicable*
Estimated Lifetime O&M Costs:	*$0*
Estimated Total Present-Worth Costs:	*$0*

Discount Rate: *Not applicable*

Number of Years Costs Are Projected: *Not applicable*

DGW Alternative 1 (No Action) is required by the NCP (§300.430(e)(6)) and forms the baseline alternative against which the effectiveness of all other remedial alternatives is evaluated. Under this alternative, no monitoring or control of contaminated offsite ground water will take place. The magnitude of risks is likely to remain the same since contaminated ground water will remain offsite and pose a risk to human health. There is no treatment, containment, MNA, or LUC component for this alternative. Because contaminated ground water will remain offsite, a review of the effectiveness and protectiveness of this alternative will be conducted every fuve years. This alternative will not comply with the ARARs for the Site.

16.2.6 DGW Alternative 2 – Alternate Water Supply (Municipal Water) Plus MNA with ICs

Estimated Time for Design Construction	*6 months*
Estimated Time to Reach Remediation Goals:	*15 years (ground water)*
Estimated Capital Costs:	*$133,000*
Estimated Lifetime O&M Costs:	*$530,000*
Estimated Total Present-Worth Costs:	*$580,000*
Discount Rate:	*7%*
Number of Years Costs Are Projected:	*15 years*

Under this alternative, residents will be hooked up to municipal water supply system while the offsite ground water will undergo MNA. Following is a listing and descriptions of the remedy components for DGW Alternative 2.

a. *Treatment Component* – There is no treatment component under this alternative. Offsite ground water will undergo natural attenuation until the concentrations of PCE and TCE in ground water equal to or lower than 3 µg/L. The effectiveness of MNA will be monitored through sampling until cleanup levels are achieved. Because contaminated ground water will remain offsite, a review of the effectiveness and protectiveness of DGW Alternative 2 will be performed every five years as required by SARA.
b. *O&M Component* – Under this alternative, there is no operations and maintenance component.
c. *LUC Component* – ICs, such as water well installation restrictions, will continue to be implemented to protect the integrity of the remedy and protect the human population.

16.2.7 DGW Alternative 3 - Point of Entry (POE) Treatment plus MNA with ICs

Estimated Time for Design Construction:	*3 months*
Estimated Time to Reach Remediation Goals:	*15 years*
Estimated Capital Costs:	*$42,000*
Estimated Lifetime O&M Costs:	*$790,000*
Estimated Total Present-Worth Costs:	*$695,000*
Discount Rate:	*7%*
Number of Years Costs Are Projected:	*15 years*

Under this alternative, ground water will be treated using carbon filters and ICs will be enforced.

a. *Treatment Component* – Offsite ground water will be treated with a small carbon filter installed in the pipeline before it enters each residence. This alternative will require periodic change of in-line filters by the resident. Offsite ground water will undergo natural attenuation until the concentrations of PCE and TCE in ground water equal to or lower than 3 µg/L.
b. *O&M Component* – The effectiveness of the carbon filter in reducing PCE and TCE concentration is dependent upon timely replacement of the carbon filters. The EPA will maintain filters for O&M of DGW Alternative 3 for 10 years, after which they will be maintained by FDEP until remedy goals are achieved. This alternative will also include MNA and the ground water will be monitored until cleanup levels are achieved. During the remedy, a review of the effectiveness and protectiveness of DGW Alternative 3 will be performed every five years as required by SARA.
c. *LUC Component* – ICs, such as water well installation restrictions, will continue to be implemented to protect the integrity of the remedy and protect the human population.

16.3 Other Common Elements and Distinguishing Features of Each Alternative

Common elements and distinguishing features unique to each alternative include key ARARs, long-term reliability of the remedy, and use of presumptive remedies.

Chemical-specific ARARs (Table 7) and action-specific ARARS (Table 8) present the ARARs pertaining to the main elements of each of the remedial alternatives. Several of the remedial alternatives have elements in common, including and monitoring requirements.

16.3.1 Key Applicable or Relevant and Appropriate Requirements

OGW Alternative 1 and DGW Alternative 1 would not comply with the ARARs for the Site. The OGW Alternative 2 MNA, OGW Alternative 3 – EZVI, DGW Alternative 2 Alternate Water Supply and MNA, and DGW Alternative 3 – POE Treatment and MNA will all comply with all federal and state ARARs related to MNA monitoring and State MCLs. OGW Alternative Pump and Treat with Air Stripping technology complies with all federal and state ARARs related to National Pollutant Discharge Elimination System (NPDES), MCLs, and air emissions.

16.3.2 Long-Term Reliability of the Remedy

The magnitude of risks at the Site for No Action Alternatives (OGW Alternative 1 and DGW Alternative 1) will likely remain the same, since contaminated ground water will continue to pose a risk to human health because no LUCs will be in place. All other alternatives will effectively treat ground water contamination. Ground water monitoring through a pre-designed monitor plan will assess the long-term effectiveness of all alternatives except OGW and DGW Alternative 1. The mobility of the contaminants will not be addressed by any of the alternatives, but LUCs set in place will reduce risks associated with exposure to contaminated ground water.

16.3.3 Quantities of Untreated Wastes

Because of Karst geology and existing sinkholes, the quantity of untreated waste is unknown at the Site.

16.3.4 Site Preparation Activities Common/Specific to Each Alternative

Site preparation activities common to alternatives OGW 2, OGW 3, and OGW 4 are:

a. Abandonment of extraction wells and MW-1 monitoring well, and installation of replacement well for MW1

The following Site preparation activities are specific to alternative OGW 4 – Pump and Treat with Air Stripping:

a. Treatment system building, office trailer, electrical service, installation of extraction wells, construction of treated water discharge system, and security measures will be implemented

16.4 Expected Outcomes of Each Alternative

The implementation and completion of the remedy for ground water under OGW Alternatives 2, 3, and 4, and under DGW Alternatives 2 and 3 will allow the Site to be developed to its current use, which is both residential and commercial use. The design and construction of OGW Alternatives 2 and 3 is estimated to take two months, while the estimated time for OGW 4 is estimated to take five to six months. The design and construction of offsite ground water alternatives OGW Alternatives 2 and 3 are estimated to take four months. The site and offsite residential areas can reuse ground water when the cleanup levels specified in this ROD are achieved.

17.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The remedial alternatives for the Site were evaluated using the nine NCP criteria. These nine criteria are categorized into three groups: threshold, balancing, and modifying. The threshold criteria must be met in order for an alternative to be eligible for selection. The threshold criteria are overall protection of human health and the environment and compliance with ARARs. The balancing criteria are used to weigh major tradeoffs among alternatives. The five balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost. The modifying criteria are state acceptance and community acceptance. Table 9 (Evaluation Criteria for Superfund Remedial Alternatives) briefly describes the evaluation criteria.

Three onsite ground water remedial alternatives and two offsite ground water alternatives were evaluated in the FS for the Site (OTIE 2018). Table 10 (Comparison of Remedial Alternatives – Onsite Ground water) and Table 11 (Comparison of Remedial Alternatives – Offsite Ground water) summarizes how these alternatives comply with the nine evaluation criteria specified in the NCP §300.430(f)(5)(i). Following is a comparative analysis of the remedial alternatives.

17.1 Overall Protection of Human Health and the Environment

Each alternative was evaluated in terms of: (a) its overall protection of human health and the environment, and (b) how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment and ICs.

OGW Alternative 1 and DGW Alternative 1 (No Action) are not protective of human health or the environment since no treatment component or LUCs are part of these alternatives. All other onsite and offsite ground water alternatives (OGW Alternatives 2, 3, and 4, and DGW Alternatives 2 and 3) are all protective of human health and the environment by eliminating, reducing, or controlling risks posed by the Site through MNA or treatment of ground water contaminants, and ICs.

OGW Alternatives 2 and 3 and DGW Alternatives 2 and 3 will provide both short- and long-term protection of future users of the Site and nearby residents by natural attenuation coupled with LUCs. OGW Alternative 4 provides both short- and long-term protection through active treatment but the amount of back-diffusion of contaminants and presence of sink-holes will be the determining factors in this evaluation. OGW Alternative 2 for onsite ground water contamination and DGW 2 Alternative for offsite ground water contamination would provide the greatest protection since the treatment through natural attenuation occurs in-situ and no wastes would be generated.

OGW Alternatives 2 and 3 and DGW Alternatives 2 and 3 are all protective of human health and the environment by eliminating, reducing, or controlling risks posed by the Site through MNA and LUCs for the ground water.

17.2 Compliance with ARARs

Section 121(d) of CERCLA, as amended, specifies, in part, that remedial actions for cleanup of hazardous substances must comply with requirements and standards under federal or more stringent state environmental laws and regulations that are ARARs to the hazardous substances or particular circumstances at a site or obtain a waiver. [See also 40 C.F.R. § 300.430(f)(1)(ii)(B) and 430(f)(5)(ii)(B) and (C)]. ARARs include only federal and state environmental or facility siting laws regulations and do not include occupational safety or worker protection requirements. Compliance with OSHA standards is required by 40 C.F.R. § 300.150; therefore, the CERCLA requirement for compliance with or wavier of ARARs does not apply to OSHA standards.

"Applicable requirements," as defined in 40 C.F.R. § 300.5, are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site. Only those state standards that are identified by the state in a timely manner and that are more stringent than federal requirements may be applicable.

"Relevant and appropriate requirements," as defined in 40 C.F.R. § 300.5, means those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well-suited to the particular site. Only those state standards that are identified by the state in a timely manner and that are more stringent than federal requirements may be relevant and appropriate.

ARARs Categories

For purposes of ease of identification, EPA has created three categories of ARARs: chemical-, location-, and action-specific.

Action-specific ARARs are usually technology-based or activity-based requirements or limitations that control actions taken at hazardous waste sites. Action-specific requirements often include performance, design and controls, or restrictions on particular kinds of activities related to management of hazardous substances. Action-specific ARARs are triggered by the types of remedial activities and types of wastes that are generated, stored, treated, disposed, emitted, discharged, or otherwise managed.

Chemical-specific ARARs are usually health or risk based numerical values limiting the amount or concentration of a chemical that may be found in, or discharged to, the environment. The SDWA MCLs at 40 C.F.R. Part 141 and the state or federal ambient water quality criteria established under Section 303 or 304 of the Clean Water Act are examples of chemical-specific ARARs that are used to establish remediation levels for restoration of ground water and surface water that are current or potential sources of drinking water. [See 40 C.F.R. §§ 300.430(e)(2)(i)(B), (C), & (E).]

In accordance with 40 C.F.R. § 300.400(g), EPA and FDEP have identified the potential ARARs and TBCs for the evaluated alternatives in the 2018 Remedial Investigation Feasibility Study Report, Tables 9-1 and 9-2. The tables list the chemical- and action-specific ARARs TBCs for remedial actions in the evaluated alternatives, respectively.

The No Action Alternatives (OGW Alternative 1 and DGW Alternative 1) do not comply with ARARs. All remaining onsite ground water and offsite ground water alternatives will comply with all ARARs. Under OGW Alternative 4, the PCE and TCE contaminated ground water would be extracted and treated to achieve the MCL value of 3 µg L for both the contaminants and the treated water will be discharged to the storm water system through a permitted process. OGW Alternatives 2 and 3 and DGW Alternatives 2 and 3 would comply with all ARARs once the cleanup level of 3 µg L in the ground water is achieved.

17.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain on-site following remediation and the adequacy and reliability of controls.

No Action Alternatives OGW 1 and DGW 1 do not provide long-term effectiveness and permanence. All other alternatives provide long-term effectiveness and permanence through natural attenuation process or treatment process.

The selected remedy described in this ROD (MNA) for both onsite and offsite ground water contamination is used in OGW Alternative 2 and DGW Alternative 2, which will provide long-term permanence by natural attenuation process of PCE and TCE contaminated ground water. These alternatives provide the greatest degree of long-term effectiveness and permanence compared to the other alternatives. ICs regulating the installation of new wells and providing hookups to municipal water will protect human health. A ground water monitoring plan involving sampling for site contaminants, its daughter compounds, and MNA parameters under OGW Alternative 2 and DGW Alternative 2 will assess the long-term effectiveness of the selected remedy. LUCs will provide long-term protection of future Site users and nearby residents until natural attenuation restores the aquifer to MCL levels.

For OGW Alternative 4 (Pump and Treatment), the long-term effectiveness and permanence is provided through active treatment process, which will restore the ground water to MCL levels. The ability of OGW Alternative 4 remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met is dependent upon the back-diffusion of contaminants into ground water due to adsorption and desorption processes.

17.4 Reduction in Toxicity, Mobility, and Volume

MNA remedy is not considered as a treatment alternative. Previously accomplished NTCRA involving ERH treatment did reduce the toxicity and volume contamination in soils. The selected MNA remedy will reduce the toxicity of COCs through the natural attenuation process without active treatment. MNA does not reduce the mobility of volume of contamination. The anticipated performance of the remedy with respect to reduction of toxicity, mobility, or volume through treatment is evaluated for those alternatives that involve treatment. The OGW Alternative 4 will result in the reduction of toxicity, mobility, and volume of the contamination through active treatment process.

17.5 Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community, and the environment during construction and operation of the remedy until cleanup levels are achieved.

OGW Alternative 1 and DGW Alternative 1 does not provide short-term effectiveness and all risks to onsite workers and nearby residents associated with contaminated ground water will remain. OGW Alternative 2 and 3 and DGW Alternative 2 (MNA with ICs) pose minimal short-term risks, as these alternatives do not involve construction activities except for installation of monitoring wells and abandonment of old wells. LUCs under these alternatives provide short-term effectiveness until the cleanup levels are achieved. OGW Alternative 4 will involve construction of a pump-and-treat system and may pose minimal level of adverse impacts to the construction workers. However, this technology is widely used in the industry and the workers doing construction follow all applicable safety precautions to avoid any adverse impacts during construction or implementation of the remedy.

The time to implement and complete the remedial action for OGW Alternatives 2 is estimated at 15 years. The time to implement and complete OGW Alternative 3 is estimated at 13 years and at 10 years for OGW Alternative 4. The time to implement DGW Alternative 2 and 3 is estimated at 15 years. OGW Alternative 4 involves potential short-term risks from handling contaminated ground water during construction activities.

The short-term risks include dermal contact with contaminated ground water, inhalation of vapors and dust, and dangers associated with operating material-handling and processing equipment and loading activities.

These onsite risks will be mitigated by implementing a project-specific Health and Safety Plan to minimize exposure as well as by performing remedial tasks following best management practices. Nearby residents also might be at risk due to inhalation of fugitive emissions during the implementation of the selected remedy. These risks can be mitigated through air monitoring and dust suppression techniques, which will be established during the remedial design for the selected remedy.

17.6 Implementability

The technical and administrative feasibility of a remedy from design through construction and operation is addressed by the implementability of the remedy. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered under implementability of a remedy.

OGW Alternative 1 and DGW Alternative 1 are easily implemented, and do not require any actions other than statutory five-year reviews. The remedial actions for onsite OGW Alternatives 2 and 3 can be easily implemented as they involved installation of new monitoring wells and abandonment of some existing monitoring wells. Installation and abandonment of wells is a routine task that has been successfully implemented at many Superfund sites. Introduction of zero-valent iron and microbial organisms is also a routine task successfully implemented at many superfund sites.

OGW Alternative 4 (Pump and Treat) technology has been successfully implemented at other Superfund sites to treat similar ground water VOC contaminants. Implementation requires relatively simple process equipment that is easy to construct and operate. Operation of the earth-moving equipment will require engineering measures to control air emissions, fugitive dust, runoff, erosion, and sedimentation.

DGW Alternative 2, which involves hooking up residents to municipal water and MNA of ground water is easily implementable and does not involve any handling of contaminated ground water, as the water line installation will be above the contaminated aquifer.

17.7 Cost

Estimated costs associated with each of the remedial alternatives are summarized in Table 12 (Remedial Alternatives Cost Summary). The estimated costs associated with the selected remedy OGW Alternative 2 and DGW Alternative 2 are detailed in Appendix B (Cost Estimate Details for Selected Remedy). OGW Alternative 4 is the most expensive remedy, estimated at $2,100,000. OGW Alternative 3 is estimated at $1,250,000. DGW Alternative 3 is estimated at $910,000.

OGW Alternative 2 and DGW Alternative 2, the selected remedy described in this ROD, are the least expensive and are estimated at $840,000 and $730,000, respectively.

OGW Alternative 1 and DGW Alternative 1 have very minimal costs in that no remedial actions will be performed. The cost for OGW Alternative 4 is high because it involves active extraction and treatment of ground water for several years, as well as discharge of the treated water. Costs for OGW Alternatives 2 and 3 differ because of the addition of nutrients and biological organisms under OGW Alternative 3.

Costs for DGW Alternatives 2 and 3 differ because DGW Alternative 2 involves permanent hookup to municipal water versus DGW Alternative 3, which involves replacement of carbon water fillers on a routine basis (O&M Cost).

OGW Alternative 2 and DGW Alternative 2 costs are the lowest of the full-scale remedial actions because contaminated ground water undergoes natural attenuation and does not involve any active treatment components and costs.

17.8 State Acceptance

The State of Florida, represented by the FDEP, agrees with EPA's decision to implement onsite ground water alternative OGW Alternative 2 (MNA with ICs) and downgradient ground water alternative DGW Alternative 2 (Alternate Municipal Water Supply with MNAs and ICs). The FDEP has participated in the development of this ROD and their concurrence is anticipated. The FDEP provided technical support to EPA during the implementation of the RI FS, Proposed Plan (EPA 2018), and this ROD.

17.9 Community Acceptance

EPA conducted a public meeting on June 27, 2018, to present the Proposed Plan (EPA 2018) to the public. EPA presented OGW Alternative 2 (MNA with ICs) for the onsite ground water and DGW Alternative 2 (Alternate Municipal Water Supply with MNAs and ICs) for the downgradient offsite ground water as the preferred alternatives for the Site. Based on comments received during the public meeting and those received during the 30-day public comment period, the community accepted OGW Alternative 2 and DGW Alternative 2.

17.10 Summary of Comparative Analysis of Alternatives

Four onsite and three offsite ground water remedial alternatives were fully evaluated during the FS for the Site. The No Action alternatives, OGW Alternative 1 and DGW Alternative 1, were evaluated as required by the NCP, but were eliminated from further consideration as a viable remedial alternative. OGW Alternatives 2, 3, and 4 and DGW Alternatives 2 and 3 all meet the RAOs identified for the Site and comply with all ARARs.

The OGW Alternative 2 and DGW Alternative 2, the selected remedies presented in this ROD, meet all of the statutory criteria for a remedial action and is the remedy preferred by the public. The OGW Alternative 2 and 3 and DGW Alternative 2 are the most protective, because after the completion of the remedy, the Site can be immediately developed for beneficial use. All alternatives result in the reduction of toxicity and volume due to natural attenuation or active treatment process. OGW Alternatives 1, 2, and 3 and DGW Alternatives 1, 2, and 3 do not reduce the mobility of the contaminants. OGW Alternative 4 will reduce the mobility and volume of the contamination through active treatment process.

18.0 PRINCIPAL THREAT WASTES

Those source materials considered to be highly toxic or highly mobile, which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur, are considered as principal threat wastes. The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable [NCP §300.430(a)(1)(iii)(A)]. Identifying principal threat wastes combines concepts of both hazard and risk. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied.

Non-principal threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure.

The principal threat waste was addressed by the NTCRA, which removed approximately 1,500 pounds of VOCs in soil and ground water up to depths of 50 ft bgs. Residual VOC contamination is located at depths below the water table and is now considered ground water contamination rather than soil contamination. Contaminated ground water generally is not considered a source material. The NCP establishes a different expectation for remediating contaminated ground water; that is, to return usable ground water to their beneficial uses in a time frame that is reasonable given the particular circumstances of the site.

19.0 SELECTED REMEDY

The EPA's selected remedy for this Site's ground water is OGW Alternative 2 (MNA with ICs) for onsite areas and DGW Alternative 2 (Alternate Municipal Water Supply with MNA with ICs) for downgradient offsite areas. Under these alternatives, the ground water will undergo natural attenuation process, while the threat from exposure to residents will be addressed through supply of water by municipal system and LUCs.

19.1 Summary of the Rationale for the Selected Remedy

Both onsite OGW Alternative 2 and offsite DGW Alternative 2 are protective of human health and the environment, meet all federal and state ARARs, and meet all of the RAOs through attainment of cleanup levels. These alternatives were selected over the other alternatives because they are easily implemented, expected to achieve substantial and long-term permanence and risk reduction through treatment, and are expected to allow the property to be used for the reasonably anticipated future land use. Remedial design will set quarterly, bi-annual, or annual ground water. The VI monitoring program is required for the selected remedy since contaminants above health-based levels will remain at the Site until the RAOs are achieved.

The selected remedial alternatives (OGW Alternative 2 and DGW Alternative 2) provide the best tradeoffs between alternatives with respect to the balancing and modifying criteria. Based on public comments received during the public meeting held by EPA to present the Proposed Plan (EPA 2018) and comments received during the public comment period, the public prefers OGW Alternative 2 and DGW Alternative 2.

19.2 Description of the Selected Remedy

The selected remedy is described below. Any changes to the remedy described in this ROD would be documented using a technical memorandum in the Administrative Record, an Explanation of Significant Differences, or a ROD Amendment, as appropriate and consistent with the applicable regulations.

19.2.1 OGW Alternative 2 – MNA with ICs (Onsite Groundwater)

MNA will be implemented onsite (OTIE 2018) along with LUCs to protect onsite receptors until the contaminant concentrations in ground water are reduced to acceptable levels. Under this alternative, a ground water and soil gas, sub-slab, and indoor air sampling and monitoring program will be developed and implemented. MNA activities will be discontinued when PCE and TCE concentration in onsite ground water attain the cleanup levels identified in Table 6 in accordance with the *Guidance for Evaluating Completion of Ground Water Restoration Remedial Actions*, OSWER 9355.0-129. Section 12.4.5 presents the various evidence supporting the use of MNA as remedy and identifies the way that the Site complies with these criteria.

The State of Florida considers the ground water in the Site area as a ground water resource. However, with the continuation of ICs, EPA does not expect that the onsite area will be used as a potable source of water in the near future. Some of the residents living downgradient of the Site use ground water as potable water, which is addressed in the offsite selected remedy described in the next subsection.

Based on the most recent ground water data, the contaminated ground water plume has split into onsite and offsite plumes. The onsite plume is localized and extends over a relatively small area outside the Site boundary. The contaminated ground water will not exert a long-term detrimental impact on available water supplies or other environmental resources. The EPA believes that MNA and ICs can be effectively implemented at the Site.

Monitoring Program

A ground water, soil gas, sub slab, and indoor air monitoring program will be developed for the Site. The program will specify the location, frequency, and type of samples and measurements necessary to evaluate whether the remedy is performing as expected and is capable of attaining RAOs. Some of the key elements of the monitoring program include:

- Gather ground water information to demonstrate that natural attenuation is occurring as expected;
- Identify and monitor daughter products of PCE and TCE to evaluate MNA;
- Verify that the onsite plume is not expanding beyond the Site boundary;
- Demonstrate that the LUCs are effective in protecting onsite receptors; and
- Determine the achievement of MCLs.

The key element of soil gas, sub slab, and indoor air monitoring will include installation of three or more permanent sub-slab vapor ports in and surrounding the former ERH treatment area and collection of 24-hour sub-slab air samples to verify that the soil gas vapors are reducing and are protective of human health. The soil gas monitoring would also include collection of sub slab and indoor air samples from one or more onsite business to ensure that business occupants are not being exposed to soil gas vapors due to possible structural changes in the building, natural aging of structures, or from any intrusive activities conducted on their property. The purpose of this monitoring will be to ensure that the remedy is, or will continue to be, protective of human health and the environment

19.2.2 DGW Alternative 2 – Alternate Water Supply (Municipal Water) Plus MNA and ICs (Downgradient Area)

EPA will coordinate with the local water utility agency to supply residents with access to the municipal water supply system. The ground water IC that governs the installation of water wells will continue to be implemented to minimize exposure to contaminated ground water. MNA will be implemented in the offsite plume and will be monitored through a ground water monitoring program. MNA monitoring of offsite ground water will be discontinued when the PCE and TCE concentration in offsite ground water monitoring wells attain the cleanup levels, identified in Table 6 in accordance with the *Guidance for Evaluating Completion of Ground Water Restoration Remedial Actions*, OSWER 9355.0.

Monitoring Program

A ground water monitoring program will be developed that will specify the location, frequency, and type of samples and measurements necessary to evaluate whether the remedy is performing as expected and is capable of attaining RAOs. Some of the key elements of the monitoring program include:

- Gather information to demonstrate that natural attenuation is occurring as expected;
- Identify and monitor daughter products of PCE and TCE to evaluate MNA;
- Verify that the onsite plume is not expanding beyond the Site boundary;
- Demonstrate that the LUCs are effective in protecting onsite receptors; and
- Determine the achievement of cleanup levels as provided Table 6.

19.2.3 Selected Remedy O&M

The selected remedy for ground water will involve installation of up to five monitoring wells and maintenance of the wells during the implementation of the remedy.

19.2.4 Land Use Controls

ICs, such as an EC and governmental controls (zoning and permit reviews), will be implemented to protect the integrity of the ground water remedy and to prevent unacceptable exposure to contaminated ground water and VOC vapors from soil gas as part of the selected remedy. Construction of a building or other structure over contaminated areas with VOC soil gas may require mitigation systems or construction techniques to prevent VOC vapors entering the structure. Consultation with EPA will be required for any such proposed on-site construction to ensure it remains protective of human health.

The ICs implemented at this Site will include, but are not limited to, the following:

- *EC* – In conjunction with the implementation of the remedy, the landowner will draft (with EPA assistance) and record an EC in the Hillsborough County of Register of Deeds that includes the following use restrictions and or information:
  - Prohibits residential use of the property.
  - Prohibits installation of any ground water wells and prohibits consumptive uses of ground water on the Site property.
  - Prohibits any disturbance of remedy components on the Site property such as monitoring wells.
  - Includes Site map that delineates contaminated areas with potential for vapor intrusion and prohibits construction of structures unless consultation with EPA in order to determine if vapor mitigation is required.
- *SWFWMD Zone Restriction on the Construction of Wells* – The SWFWMD has a Memorandum of Understanding with EPA that governs the installation of any new residential or industrial wells on Arkla Terra Property Site and in the offsite plume area. The SWFWMD has been provided maps of the ground water plumes that will be used in the review of any permit requests for installation of ground water wells.

19.3 Cost Estimate for the Selected Remedy

Appendix B (Cost Estimate Details for OGW Alternative 2 and DGW Alternative 2) provides estimated costs to implement the selected remedy. The estimated total cost to construct and implement the selected remedy presented in this ROD is $840,000 for onsite OGW Alternative 2 and $730,000 for offsite DGW Alternative 2. The information in this cost estimate for the selected remedy is based on the best available information regarding the anticipated scope of the remedial alternative.

Changes in the cost elements are likely to occur as a result of new information and data collected during implementation of the selected remedy. Major changes may be documented in the form of a technical memorandum in the Administrative Record file, an Explanation of Significant Differences, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within 50 to 30 percent of the actual project cost.

19.4 Expected Outcomes of the Selected Remedy

Expected outcomes are presented in terms of resulting land and ground water uses, the cleanup levels and the risk reduction achieved because of the response action, and anticipated community impacts. The expected outcomes of the selected remedy are presented below.

19.4.1 Available Land Uses

It is anticipated that the Arkla Terra Property area, where previous thermal treatment occurred, will be suitable for unrestricted use within 15 years of the initiation of the RA. An expected outcome of the selected remedy is that the Site ground water and downgradient ground water will not present unacceptable human health risks because the PCE- and TCE-contaminated ground water will be remediated.

19.4.2 Available Ground water Uses

The remedy will also be protective of ground water because MNA will reduce PCE and TCE concentrations in the ground water to at or below the State MCL value of 3 µg/L. It is anticipated that the onsite ground water and offsite ground water will be suitable as potable water within 15 years of the initiation of the remedial action. However, since the residents will be hooked up to municipal water supply system during the remedial action, ground water use for potable purposes after the remedy is unlikely.

19.4.3 Final Cleanup Levels

The final cleanup levels for PCE of 3 µg/L and for TCE of 3 µg/L identified in Table 6 are based upon the FDEP Primary Drinking Water Standards MCLs at F.A.C. Chapter 62-550.310(4) that are identified as "relevant and appropriate" chemical-specific requirements (see Table 7) .

Once the ground water concentrations meet cleanup levels, soil gas, sub slab, and indoor air assessment should not be necessary, as the source of the soil gas contamination will have been addressed.

19.4.4 Anticipated Community Impacts

The selected remedy will provide community revitalization impacts because it will allow the Site to be returned to beneficial use within 15 years of the start of the remedial action. Additionally, the selected remedy was accepted by the public.

20.0 STATUTORY DETERMINATIONS

Under CERCLA §121 and the NCP §300.430(t)(S)(ii), EPA must select remedies that are protective of human health and the environment, comply with ARARs (unless a statutory waiver is justified), are cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The following sections discuss how the selected remedy meets these statutory requirements.

20.1 Protection of Human Health and the Environment

The selected remedy for the ground water (onsite and offsite) at this Site will be protective of human health and the environment. The selected remedy will prevent the exposure of PCE and TCE through LUCs (onsite) and connection of private properties to municipal water along with ICs (offsite). The reduction of the PCE and TCE concentrations in onsite and offsite ground water through MNA will reduce the non-cancer HQ of 17 (onsite, future child resident) and five (offsite, hypothetical child resident) to below the acceptable risk level of one. In addition, MNA will return the ground water to beneficial use status as the PCE and TCE concentrations fall below the State drinking water MCL of 3 µg L.

LUCs for the onsite remedy will also prevent the possible onsite exposure to soil gas indoor air to future occupants. Currently, the VI exposure pathway is complete, but no VI unacceptable threats were identified in the existing buildings. However, if buildings are constructed onsite outside of the ERH treatment footprint, they need to be sampled and monitored for indoor air and sub-slab air contaminants and may require the installation of a sub-slab depressurization system.

There are no short-term threats associated with the selected remedy that cannot be controlled. In addition, no adverse cross-media impacts are expected from the selected remedy.

20.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA, as amended, specifies, in part, that remedial actions for cleanup of hazardous substances must comply with requirements and standards under federal or more stringent state environmental laws and regulations that are ARARs to the hazardous substances or particular circumstances at a site or obtain a waiver. [See also 40 C.F.R. § 300.430(f)(1)(ii)(B) and 430(f)(5)(ii)(B) and (C).] ARARs include only federal and state environmental or facility siting laws regulations and do not include occupational safety or worker protection requirements. Compliance with OSHA standards is required by 40 C.F.R. § 300.150; therefore, the CERCLA requirement for compliance with or wavier of ARARs does not apply to OSHA standards.

"Applicable requirements," as defined in 40 C.F.R. § 300.5, mean those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site. Only those state standards that are identified by the state in a timely manner and that are more stringent than federal requirements may be applicable.

"Relevant and appropriate requirements," as defined in 40 C.F.R. § 300.5, mean those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, or contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the particular site. Only those state standards that are identified by the state in a timely manner and that are more stringent than federal requirements may be relevant and appropriate.

The selected remedy will comply with all federal and more stringent state ARARs that are presented in Tables 7 and 8.

20.3 Cost-Effectiveness

The selected remedy is cost-effective because the costs are proportional to its overall effectiveness [see 40 CFR §300.430(f)(1)(ii)(D)]. This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all federal and any more stringent State ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). The overall effectiveness of each alternative was then compared to each alternatives' costs to determine cost-effectiveness. The relationship of the overall effectiveness of these remedial alternatives were determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

Onsite Ground Water:

The estimated total and present worth cost of the selected remedy (OGW Alternative 2) is the lowest cost compared to all of the other alternatives evaluated in the FS. The selected remedy does not offer active treatment of the ground water contaminants. The source area was successfully treated by ERH. Contaminated ground water remains on site, and through natural processes, will attenuate to MCLs. EZVI is most effective when administered to a source or high concentrated area and pump-and-treat technology may act more as a source migration control than as a thorough and effective treatment technology at the Site. Considering the costs and effectiveness of these alternatives, and the data showing that PCE concentrations drop off just outside of the Site boundary (not migrating offsite at high concentrations encountered in onsite wells), the selected onsite remedy, MNA with ICs, is the most cost-effective remedy.

***Offsite Ground Water*:**

The estimated total and present worth cost of the selected remedy (DGW Alternative 2) is the lowest costs compared to all of the other alternatives evaluated in the FS. The offsite ground water alternatives primarily mitigate ingestion threats posed by PCE and TCE. However, all three alternatives do not reduce overall contamination and thus require natural attenuation as a part of the remedy. The selected remedy, which offers connecting residents to Municipal Water source, offers a high degree of protectiveness and overall effectiveness than the Point of Entry filter alternative because it eliminates the need of human interactions in keeping the treatment filter working in good condition. When compared to all the offsite ground water alternatives, the selected remedy, Alternative Water Supply (Municipal Water) Plus MNA and ICs (DGW Alternative 2), provides the highest degree of protectiveness to offsite residents.

20.4 Utilization of Permanent Solutions to the Maximum Extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner at the Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element, bias against off-site treatment and disposal, and considering State and community acceptance.

Onsite Ground Water:

The selected remedy (OGW Alternative 2) does not actively treat the ground water plume; however, it satisfies the criteria for long-term effectiveness by removing exposure to ground water through LUCs and reducing the COCs ground water concentrations through natural attenuation. Ground water data and modeling has shown the onsite plume is shrinking through natural attenuation and would provide the long-term effectiveness and permanence. The other alternatives, EZVI and pump-and-treat would reduce site contaminants in the source area however, would also rely on natural attenuation to meet remedial action levels. The selected remedy presents the least short-term risks from the other treatment alternatives and would pose no risks to workers and the public. The other alternatives would pose medium risks to workers and the public due to invasive construction work within the plume area. The selected remedy is proven, easy to implement, and has been used successfully for other environmental cleanup projects. The other alternatives are implementable but would require commercial contractors and coordination with state and local parties during design and construction activities with the most challenging aspect of determining ideal locations for installation of the treatment wells due to the Karst geology and high ground water flow rates.

Offsite Ground Water:
The selected remedy (DGW Alternative 2) does not actively treat the ground water plume; however, the remedy satisfies the criteria for long-term effectiveness by removing exposure to ground water through connection of private properties to municipal water. The selected remedy is more effective and permanent because it does not require a filter replacement. The reduction of Site contaminants would be through natural attenuation rather than through treatment. The selected remedy would not present short-term risks to workers or the public during connection of private properties to municipal water. There are no special implementability issues that sets the selected remedy apart from any of the other alternatives evaluated.

20.5 Preference for Treatment as a Principal Element

The onsite and offsite remedies selected for the Site does not use treatment as a principal element but achieves reduction of Site contaminants through natural attenuation. However, treatment was employed via the thermal treatment employed as a non-time critical removal action. The Site is located in an area of known and unknown Karst formations (e.g., sinkholes), which makes active treatment of the ground water challenging. Many of the active treatments for ground water (pump-and-treat, EZVI, chemical oxidation, etc.) are effective at treating a source area, but loses effectiveness when treating a larger, relatively low concentration plume to low cleanup levels. The plume at the Site would require several treatment locations and would still need to rely on natural attenuation to reach the cleanup levels. Additionally, the data presented in the RI FS has shown reduction of the COCs in the ground water with plume shrinking and retreating.

20.6 Five-Year Review Requirements

Section 121(c) of CERCLA and the NCP §300.430(f)(5)(iii)(C) provide the statutory and legal bases for conducting five-year reviews. Because this remedy will result in hazardous substances remaining onsite and offsite in the ground water and soil gas onsite, a statutory review will be conducted within five years after initiation of the remedial action to ensure that the remedy is, or will continue to be, protective of human health and the environment. This review will continue every five years or at a lesser frequency, so long as future uses remain restricted.

21.0 DOCUMENTATION OF SIGNIFICANT CHANGES FROM PREFERRED ALTERNATIVE OF PROPOSED PLAN

The EPA has determined that significant changes to the remedy, as originally identified in the Proposed Plan (EPA 2018), were not necessary.

The Proposed Plan for the Site was released for public comment on June 22, 2018. The Proposed Plan identified OGW Alternative 2 and DGW Alternative 2 for onsite and offsite, respectively, as EPA's preferred alternative. The onsite OGW Alternative 2 consists of:

a. Implementation of MNA for the ground water, and
b. Implementation of LUCs for both the ground water and soil gas.

The offsite DGW Alternative 2 consists of:

a. Connection of private properties to the municipal water supply
b. Implementation of MNA for the ground water, and
c. Implementation of ICs for ground water.

The public comment period for the Proposed Plan was held from June 22, 2018, to July 23, 2018. A public meeting was held by EPA on June 27, 2018, to present the preferred alternative in the Proposed Plan. The EPA reviewed and responded to written and verbal comments submitted during the public comment period in the Responsiveness Summary (Part 3 of this ROD).

Based on the comments received during the public meeting and the public comment period, EPA preferred remedy remains unchanged.

22.0 STATE ROLE

The Florida Department of Environmental Protection, on behalf of the State of Florida, has reviewed the various alternatives and has indicated its support for the selected remedy. The State has also reviewed the RI FS (OTIE 2018) and BLRA (OTIE 2018) to determine if the selected remedy is in compliance with applicable or relevant and appropriate State environmental and facility siting laws and regulations. The State of Florida has participated in the development of the ROD and concurrence is anticipated.

PART 3: RESPONSIVENESS SUMMARY

23.0 RESPONSIVENESS SUMMARY

The Responsiveness Summary (Appendix C) provides information about the public opinion and the support agency regarding the remedial alternatives and general concerns about the Site submitted during the public comment period. This summary also documents, on the record, how public comments were integrated into the decision-making process.

The Administrative Record file for the Site is located at the local Thonotosassa Branch Library and EPA's Region 4 office and includes all of the information and documents supporting this ROD. This Administrative Record file includes a transcript of the public meeting held by EPA on June 27, 2018, to describe the preferred alternative.

The majority of the comments received during the public meeting and public comment period were supportive of EPA's preferred alternatives (OGW Alternative 2 and DGW Alternative 2) presented in the Proposed Plan. The concerns of the community have been considered in the selection of OGW Alternative 2 and DGW Alternative 2 as the selected remedy for the Site.

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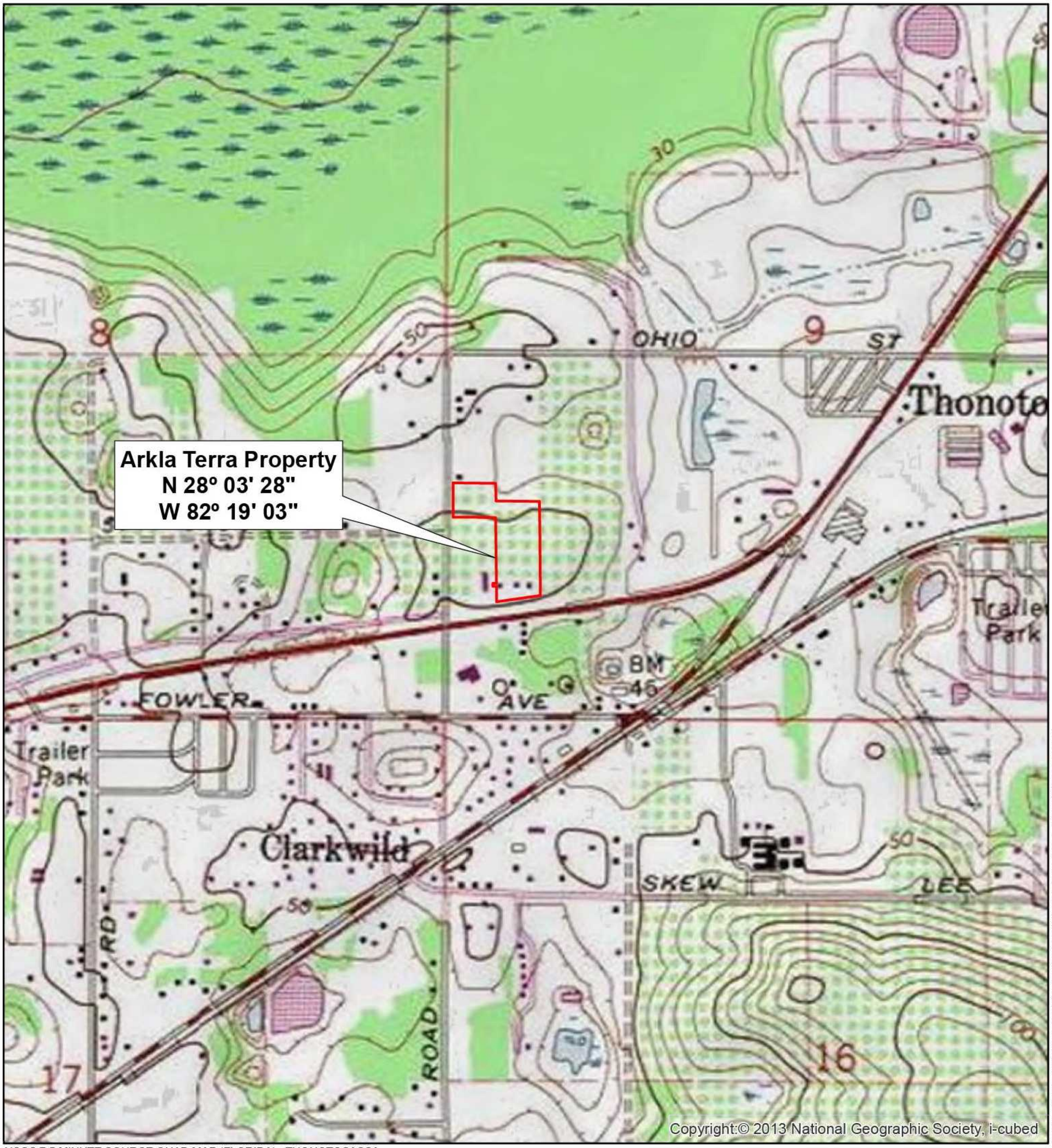
FIGURES



G:\GIS_Workspace\Arkla Terra\Data July 2017\RI-FS\Section 1\Figure 1-1 - Site Location Map.mxd

USGS 7.5 MINUTE SOURCE QUAD MAP (FLORIDA): THONOTOSASSA

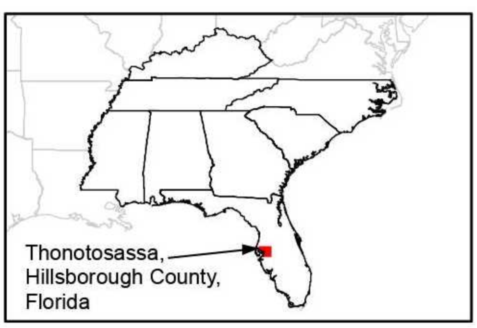
Disclaimer: This map is intended for visual orientation use only.
In no way is this map to be used for precise locational use.

Legend

Arkla Terra Property

N

0 1,000 2,000
Feet



United States Environmental Protection Agency

ARKLA TERRA SITE
THONOTOSASSA, FLORIDA

FIGURE 1
SITE LOCATION MAP

AERIAL: BING MAPS

Disclaimer: This map is intended for visual orientation use only. In no way is this map to be used for precise locational use.

Legend

Arkla Terra Property Parcel

Source Area

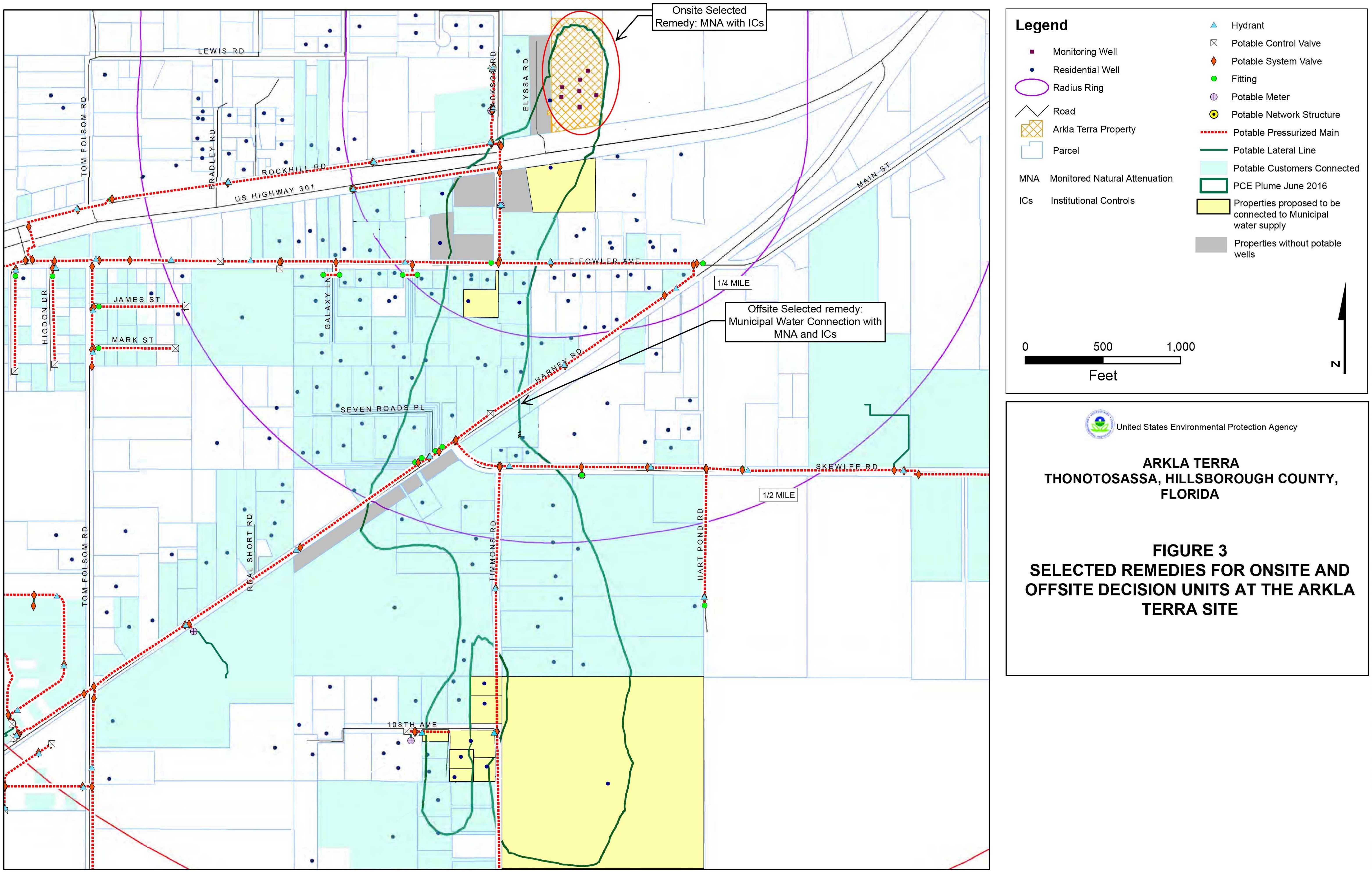
N

0 150 300 Feet

United States Environmental Protection Agency

ARKLA TERRA SITE
THONOTOSASSA, FLORIDA

FIGURE 2
SITE BOUNDARY WITH SOURCE AREA



United States Environmental Protection Agency

ARKLA TERRA
THONOTOSASSA, HILLSBOROUGH COUNTY, FLORIDA

FIGURE 3
SELECTED REMEDIES FOR ONSITE AND OFFSITE DECISION UNITS AT THE ARKLA TERRA SITE

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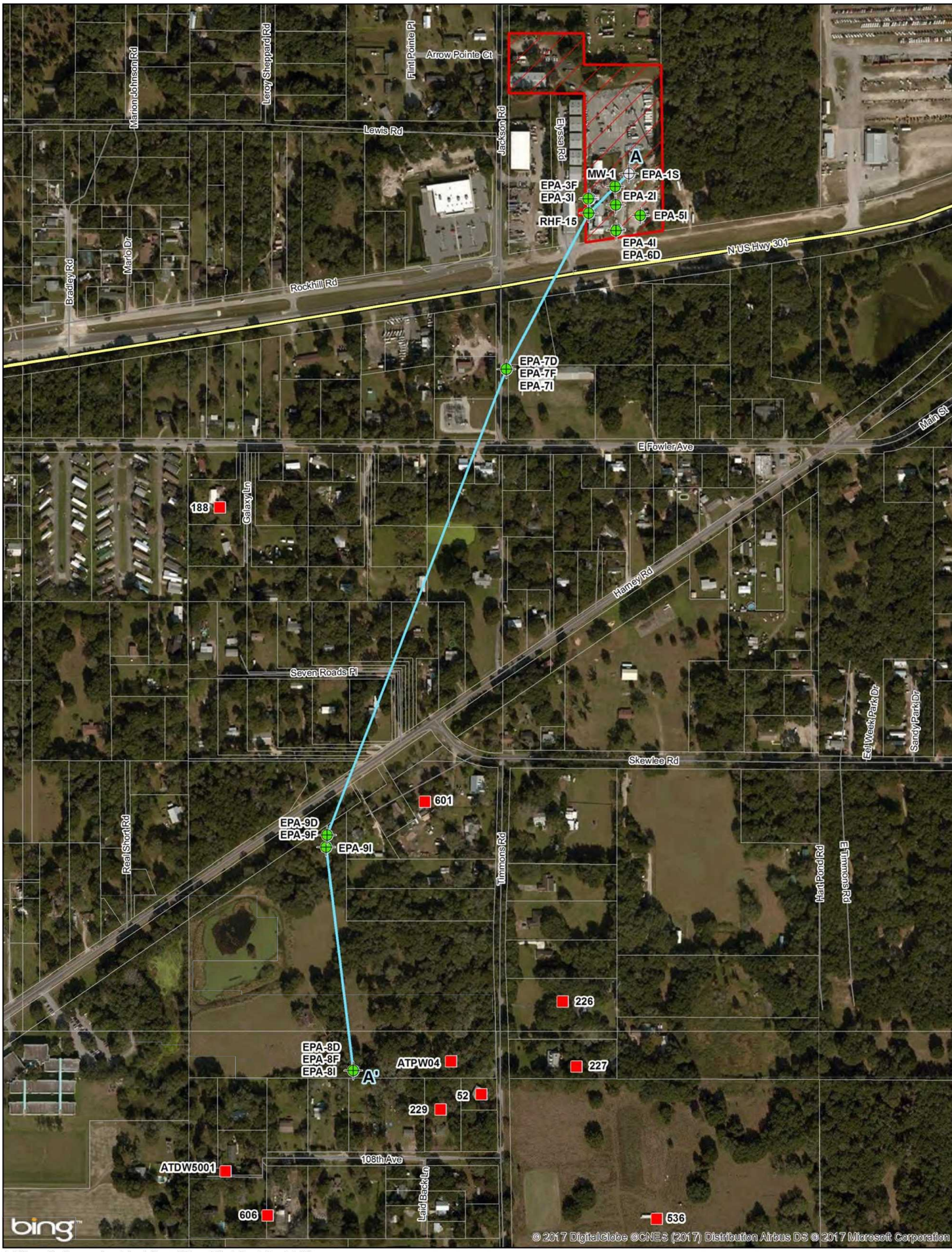
Basemap Source: Hillsborough County Property Appraiser's Office



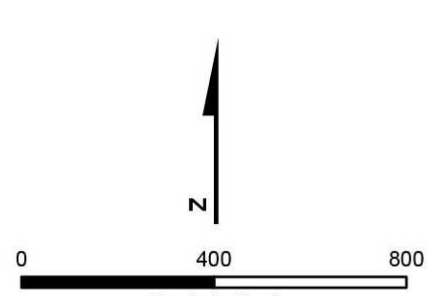
G:\GIS_Workspace\Arkla Terra\Data July 2017\RI-FS\Section 4\Figure 4-1 - Plan View of Cross Section Location.mxd

Aerial Source: Bing Maps   Property Parcels Source: Hillsborough County Property Appraiser's Office

Legend

- Monitoring Well Location
- Residential Well Location
- Geologic Cross Section A-A'
- Arkla Terra Property
- Parcel Boundary

Note:
EPA-1S was abandoned during the system installation in 2012.

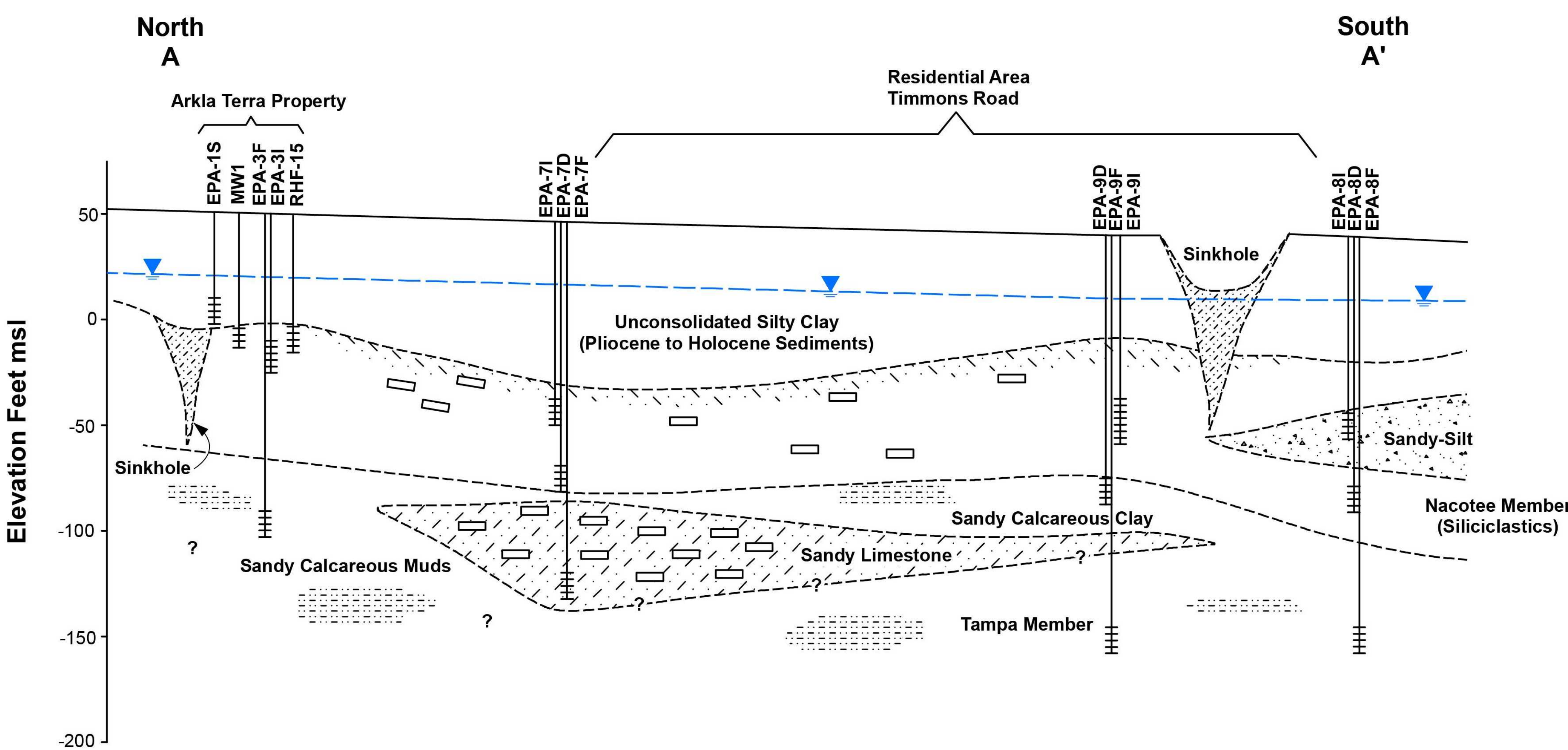


United States Environmental Protection Agency

ARKLA TERRA SITE
THONOTOSASSA, FLORIDA

FIGURE 4
PLAN VIEW OF
CROSS SECTION LOCATION

Cross-Sectional View Looking East



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Water Table

? Inferred Lithology

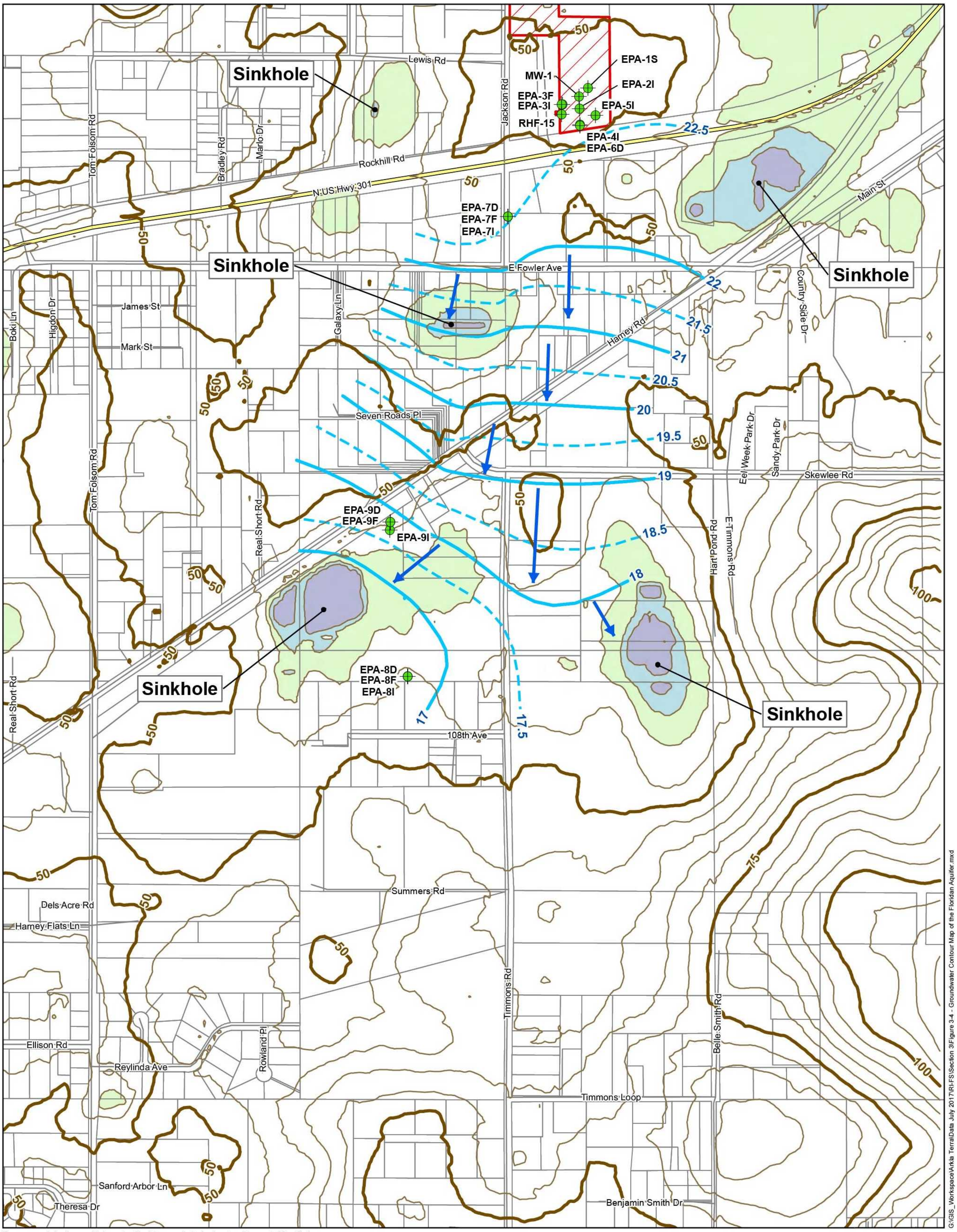
Note:
Vertical scale is elevation in feet relative to mean sea level (msl). The vertical exaggeration is 16.

United States Environmental Protection Agency

ARKLA TERRA SITE
THONOTOSASSA, FLORIDA

FIGURE 5
GEOLOGIC CROSS SECTION A-A'

G:\GIS_Workspace\Arkla Terra\Data July 2017\RI-FS\Section 4\Figure 4-2 - Geologic Cross Section A-A.mxd



Legend

- Monitoring Well Location
- Elevation Contour (Contour Interval = 25 feet)
- Elevation Contour (Contour Interval = 25 feet)
- Groundwater Elevation (ft.asl) (Contour Interval = 1 feet)
- Groundwater Elevation (ft.asl) (Contour Interval = 0.5 feet)
- Groundwater Flow Direction
- Arkla Terra Property
- Parcel Boundary

Depression Area

- <30 Feet
- 30-35 Feet
- 35-40 Feet

Notes:
1. The groundwater contours were created by SERAS using November 2016 groundwater elevations.
2. This figure was created by ERT's SERAS contractor Lockheed Martin.
3. ft. asl = feet above sea level

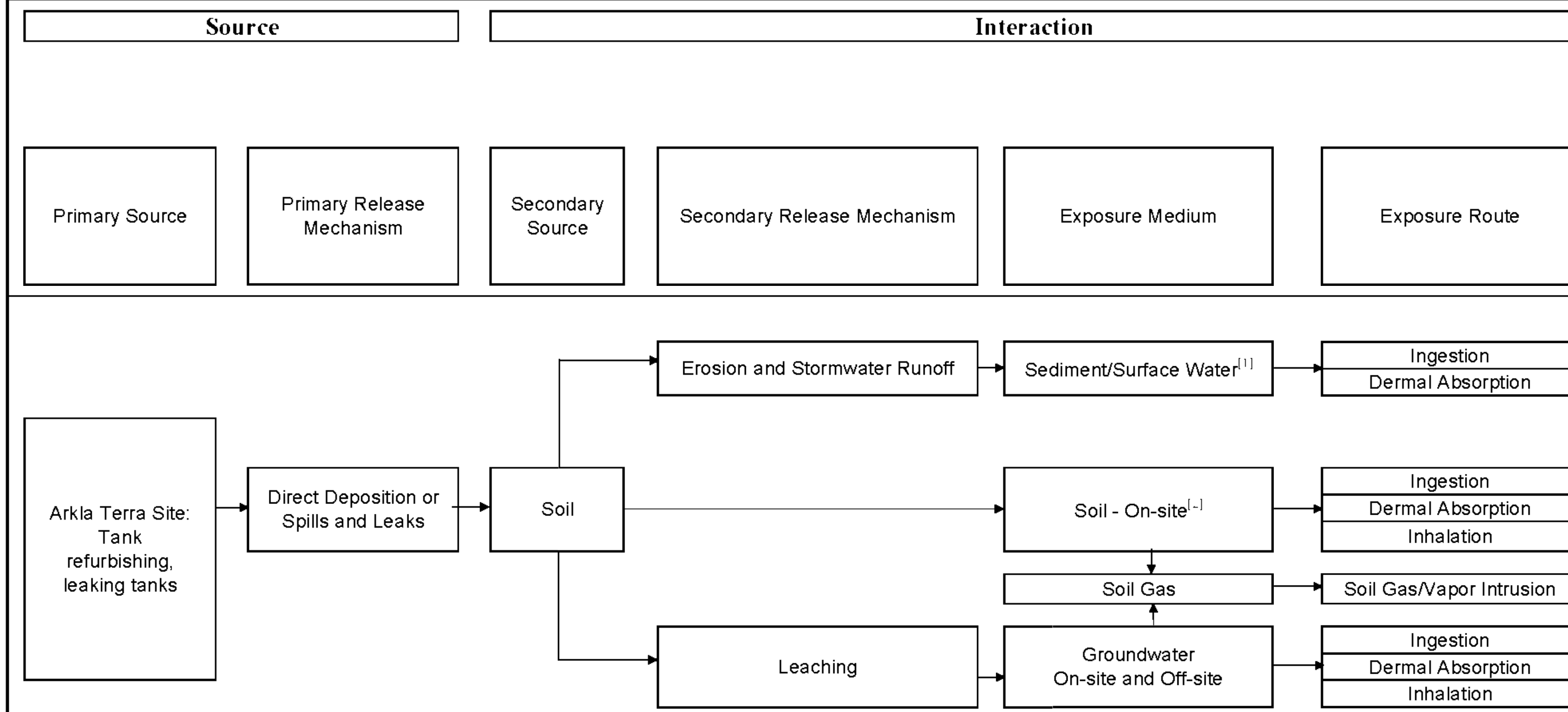
N

0 600 1,200
Scale in Feet

United States Environmental Protection Agency

ARKLA TERRA SITE
THONOTOSASSA, FLORIDA

FIGURE 6
GROUNDWATER CONTOUR MAP OF THE FLORIDAN AQUIFER



Exposure Medium	Exposure Route	Current Receptors: Industrial Worker On-site	Industrial Worker Off-site	Site Visitor / Trespasser On-site	Resident Off-site	Aquatic Biota	Terrestrial Biota	Future Receptors: Industrial Worker On-site	Industrial Worker Off-site	Site Visitor / Trespasser On-site	Construction Worker On-site	Resident On-site	Resident Off-site
Sediment/Surface Water[1]	Ingestion	--	--	--	--	--	--	--	--	--	--	--	--
	Dermal Absorption	--	--	--	--	--	--	--	--	--	--	--	--
Soil - On-site[2]	Ingestion	•	--	•	--	--	•	•	--	•	•	•	--
	Dermal Absorption	•	--	•	--	--	•	•	--	•	•	•	--
	Inhalation	•	--	•	--	--	•	•	--	•	•	•	--
Soil Gas	Soil Gas/Vapor Intrusion	•	x	--	x	--	--	•	x	--	x	•	x
Groundwater On-site and Off-site	Ingestion	•	•	--	•	--	--	•	•	--	x	•	•
	Dermal Absorption	•	•	--	•	--	--	•	•	--	x	•	•
	Inhalation	•	•	--	•	--	--	•	•	--	x	•	•

• Potentially Complete Exposure Route

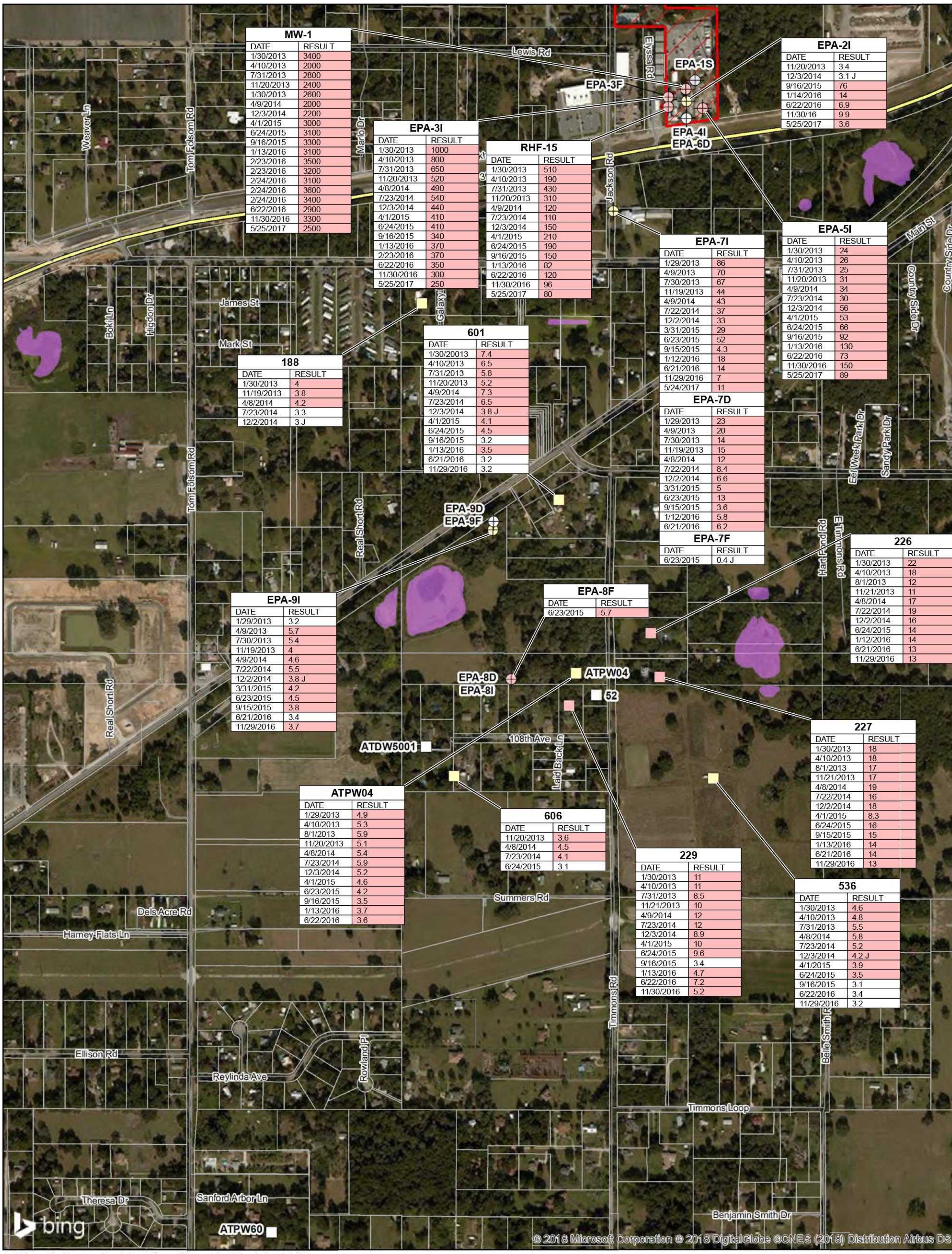
-- Incomplete Exposure Route

x Potentially complete but is not considered significant.

[1] = No surface water bodies exist on-site. A wetland was identified approximately 0.33 miles north of the Site boundary. Site groundwater is not expected to discharge into this wetland as the groundwater flow is moving South/Southwest of the Site.

[2] = Previous investigations documented no off-site soil contaminants. Accordingly. off-site soil has been identified as an incomplete exposure route.

Figure 7
Conceptual Site Model
Arkla Terra Site
Thonotosassa, Hillsborough County, Florida



MW-1

DATE	RESULT
1/30/2013	3400
4/10/2013	2000
7/31/2013	2800
11/20/2013	2400
1/30/2013	2600
4/9/2014	2000
12/3/2014	2200
4/1/2015	3000
6/24/2015	3100
9/16/2015	3300
1/13/2016	3100
2/23/2016	3500
2/23/2016	3200
2/24/2016	3100
2/24/2016	3600
2/24/2016	3400
6/22/2016	2900
11/30/2016	3300
5/25/2017	2500

EPA-3I

DATE	RESULT
1/30/2013	1000
4/10/2013	800
7/31/2013	650
11/20/2013	520
4/8/2014	490
7/23/2014	540
12/3/2014	440
4/1/2015	410
6/24/2015	410
9/16/2015	340
1/13/2016	370
2/23/2016	370
6/22/2016	350
11/30/2016	300
5/25/2017	250

RHF-15

DATE	RESULT
1/30/2013	510
4/10/2013	190
7/31/2013	430
11/20/2013	310
4/9/2014	120
7/23/2014	110
12/3/2014	150
4/1/2015	210
6/24/2015	190
9/16/2015	150
1/13/2016	82
6/22/2016	120
11/30/2016	96
5/25/2017	80

EPA-2I

DATE	RESULT
11/20/2013	3.4
12/3/2014	3.1 J
9/16/2015	76
1/14/2016	14
6/22/2016	6.9
11/30/16	9.9
5/25/2017	3.6

EPA-5I

DATE	RESULT
1/30/2013	24
4/10/2013	26
7/31/2013	25
11/20/2013	31
4/9/2014	34
7/23/2014	30
12/3/2014	56
4/1/2015	53
6/24/2015	66
9/16/2015	92
1/13/2016	130
6/22/2016	73
11/30/2016	150
5/25/2017	89

EPA-7I

DATE	RESULT
1/29/2013	86
4/9/2013	70
7/30/2013	67
11/19/2013	44
4/9/2014	43
7/22/2014	37
12/2/2014	33
3/31/2015	29
6/23/2015	52
9/15/2015	4.3
1/12/2016	18
6/21/2016	14
11/29/2016	7
5/24/2017	11

EPA-7D

DATE	RESULT
1/29/2013	23
4/9/2013	20
7/30/2013	14
11/19/2013	15
4/8/2014	12
7/22/2014	8.4
12/2/2014	6.6
3/31/2015	5
6/23/2015	13
9/15/2015	3.6
1/12/2016	5.8
6/21/2016	6.2

EPA-7F

DATE	RESULT
6/23/2015	0.4 J

188

DATE	RESULT
1/30/2013	4
11/19/2013	3.8
4/8/2014	4.2
7/23/2014	3.3
12/2/2014	3 J

601

DATE	RESULT
1/30/20013	7.4
4/10/2013	6.5
7/31/2013	5.8
11/20/2013	5.2
4/9/2014	7.3
7/23/2014	6.5
12/3/2014	3.8 J
4/1/2015	4.1
6/24/2015	4.5
9/16/2015	3.2
1/13/2016	3.5
6/21/2016	3.2
11/29/2016	3.2

226

DATE	RESULT
1/30/2013	22
4/10/2013	18
8/1/2013	12
11/21/2013	11
4/8/2014	17
7/22/2014	19
12/2/2014	16
6/24/2015	14
1/12/2016	14
6/21/2016	13
11/29/2016	13

EPA-8F

DATE	RESULT
6/23/2015	5.7

EPA-9I

DATE	RESULT
1/29/2013	3.2
4/9/2013	5.7
7/30/2013	5.4
11/19/2013	4
4/9/2014	4.6
7/22/2014	5.5
12/2/2014	3.8 J
3/31/2015	4.2
6/23/2015	4.5
9/15/2015	3.8
6/21/2016	3.4
11/29/2016	3.7

227

DATE	RESULT
1/30/2013	18
4/10/2013	18
8/1/2013	17
11/21/2013	17
4/8/2014	19
7/22/2014	16
12/2/2014	18
4/1/2015	8.3
6/24/2015	16
9/15/2015	15
1/13/2016	14
6/21/2016	14
11/29/2016	13

ATPW04

DATE	RESULT
1/29/2013	4.9
4/10/2013	5.3
8/1/2013	5.9
11/20/2013	5.1
4/8/2014	5.4
7/23/2014	5.9
12/3/2014	5.2
4/1/2015	4.6
6/23/2015	4.2
9/16/2015	3.5
1/13/2016	3.7
6/22/2016	3.6

606

DATE	RESULT
11/20/2013	3.6
4/8/2014	4.5
7/23/2014	4.1
6/24/2015	3.1

229

DATE	RESULT
1/30/2013	11
4/10/2013	11
7/31/2013	8.5
11/21/2013	10
4/9/2014	12
7/23/2014	12
12/3/2014	8.9
4/1/2015	10
6/24/2015	9.6
9/16/2015	3.4
1/13/2016	4.7
6/22/2016	7.2
11/30/2016	5.2

536

DATE	RESULT
1/30/2013	4.6
4/10/2013	4.8
7/31/2013	5.5
4/8/2014	5.8
7/23/2014	5.2
12/3/2014	4.2 J
4/1/2015	3.9
6/24/2015	3.5
9/16/2015	3.1
6/22/2016	3.4
11/29/2016	3.2

G:\GIS_Workspace\Arkla Terra\Data July 2017\RI-FS\Section 5\Figure 8.mxd

Aerial Source: Bing Maps   Property Parcels Source: Hillsborough County Property Appraiser's Office

Legend

- Monitoring Well Location
- Residential Well Location
- Arkla Terra Property
- Parcel Boundary
- Sinkhole

Notes:
1. All sample results presented are in micrograms per liter (µg/L).
2. EPA-1S was abandoned during the system installation in 2012.
3. Results highlighted in pink exceeds the Florida MCL (3 µg/L).
4. Because of rounding of the result, values above 3.4 are considered as exceedances of the contaminant.

N

0 600 1,200

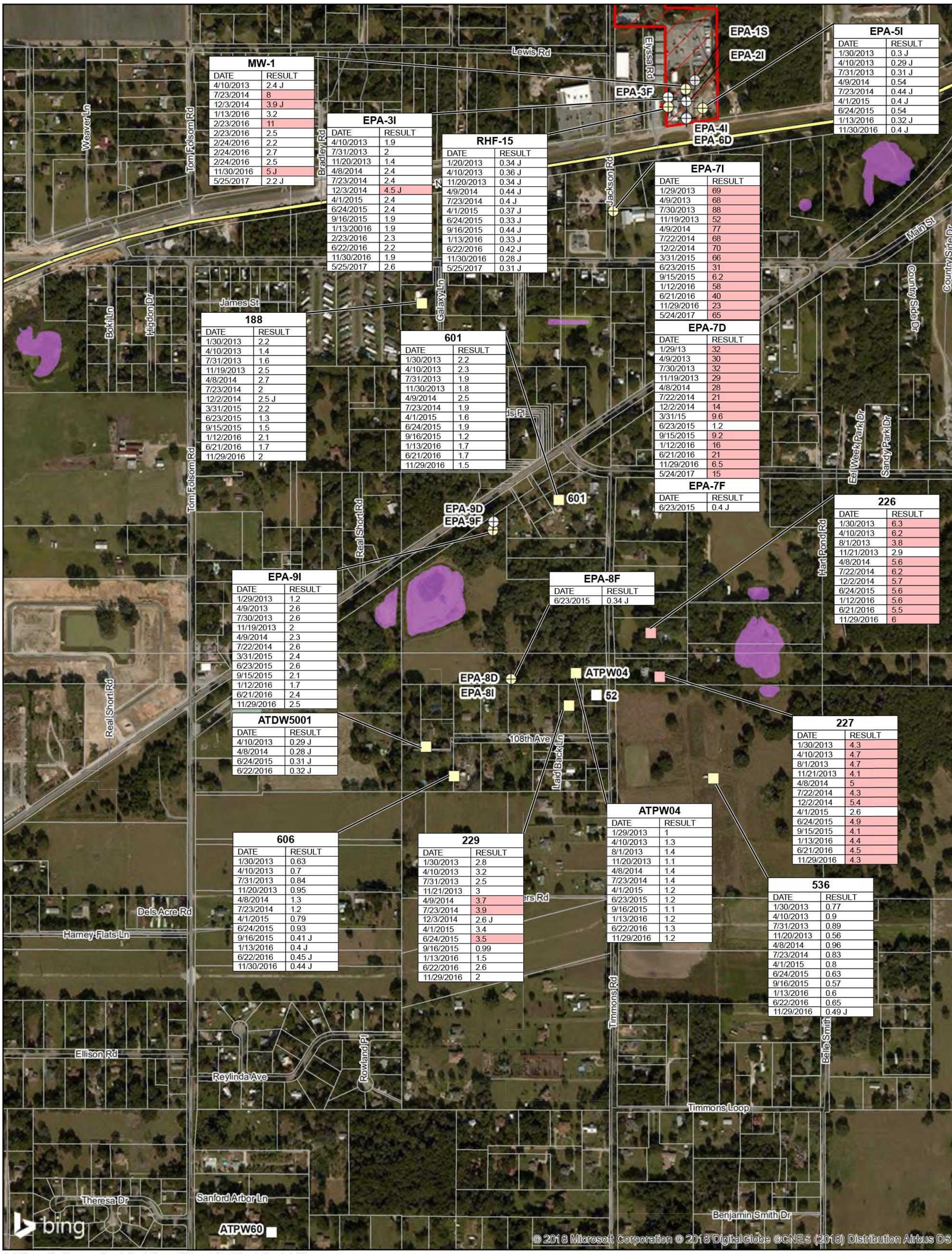
Scale in Feet

United States Environmental Protection Agency

ARKLA TERRA SITE
THONOTOSASSA, FLORIDA

FIGURE 8
CONTAMINANT OF CONCERN EXCEEDANCE PCE IN GROUNDWATER FROM MONITORING WELLS AND RESIDENTIAL WELLS

OTIE
An Oneida Nation Company



MW-1

DATE	RESULT
4/10/2013	2.4 J
7/23/2014	8
12/3/2014	3.9 J
1/13/2016	3.2
2/23/2016	11
2/23/2016	2.5
2/24/2016	2.2
2/24/2016	2.7
2/24/2016	2.5
11/30/2016	5 J
5/25/2017	2.2 J

EPA-3I

DATE	RESULT
4/10/2013	1.9
7/31/2013	2
11/20/2013	1.4
4/8/2014	2.4
7/23/2014	2.4
12/3/2014	4.5 J
4/1/2015	2.4
6/24/2015	2.4
9/16/2015	1.9
1/13/20016	1.9
2/23/2016	2.3
6/22/2016	2.2
11/30/2016	1.9
5/25/2017	2.6

RHF-15

DATE	RESULT
1/20/2013	0.34 J
4/10/2013	0.36 J
11/20/2013	0.34 J
4/9/2014	0.44 J
7/23/2014	0.4 J
4/1/2015	0.37 J
6/24/2015	0.33 J
9/16/2015	0.44 J
1/13/2016	0.33 J
6/22/2016	0.42 J
11/30/2016	0.28 J
5/25/2017	0.31 J

EPA-5I

DATE	RESULT
1/30/2013	0.3 J
4/10/2013	0.29 J
7/31/2013	0.31 J
4/9/2014	0.54
7/23/2014	0.44 J
4/1/2015	0.4 J
6/24/2015	0.54
1/13/2016	0.32 J
11/30/2016	0.4 J

EPA-7I

DATE	RESULT
1/29/2013	69
4/9/2013	68
7/30/2013	88
11/19/2013	52
4/9/2014	77
7/22/2014	68
12/2/2014	70
3/31/2015	66
6/23/2015	31
9/15/2015	6.2
1/12/2016	58
6/21/2016	40
11/29/2016	23
5/24/2017	65

EPA-7D

DATE	RESULT
1/29/13	32
4/9/2013	30
7/30/2013	32
11/19/2013	29
4/8/2014	28
7/22/2014	21
12/2/2014	14
3/31/15	9.6
6/23/2015	1.2
9/15/2015	9.2
1/12/2016	16
6/21/2016	21
11/29/2016	6.5
5/24/2017	15

EPA-7F

DATE	RESULT
6/23/2015	0.4 J

188

DATE	RESULT
1/30/2013	2.2
4/10/2013	1.4
7/31/2013	1.6
11/19/2013	2.5
4/8/2014	2.7
7/23/2014	2
12/2/2014	2.5 J
3/31/2015	2.2
6/23/2015	1.3
9/15/2015	1.5
1/12/2016	2.1
6/21/2016	1.7
11/29/2016	2

601

DATE	RESULT
1/30/2013	2.2
4/10/2013	2.3
7/31/2013	1.9
11/30/2013	1.8
4/9/2014	2.5
7/23/2014	1.9
4/1/2015	1.6
6/24/2015	1.9
9/16/2015	1.2
1/13/2016	1.7
6/21/2016	1.7
11/29/2016	1.5

226

DATE	RESULT
1/30/2013	6.3
4/10/2013	6.2
8/1/2013	3.8
11/21/2013	2.9
4/8/2014	5.6
7/22/2014	6.2
12/2/2014	5.7
6/24/2015	5.6
1/12/2016	5.6
6/21/2016	5.5
11/29/2016	6

EPA-9I

DATE	RESULT
1/29/2013	1.2
4/9/2013	2.6
7/30/2013	2.6
11/19/2013	2
4/9/2014	2.3
7/22/2014	2.6
3/31/2015	2.4
6/23/2015	2.6
9/15/2015	2.1
1/12/2016	1.7
6/21/2016	2.4
11/29/2016	2.5

EPA-8F

DATE	RESULT
6/23/2015	0.34 J

ATDW5001

DATE	RESULT
4/10/2013	0.29 J
4/8/2014	0.28 J
6/24/2015	0.31 J
6/22/2016	0.32 J

227

DATE	RESULT
1/30/2013	4.3
4/10/2013	4.7
8/1/2013	4.7
11/21/2013	4.1
4/8/2014	5
7/22/2014	4.3
12/2/2014	5.4
4/1/2015	2.6
6/24/2015	4.9
9/15/2015	4.1
1/13/2016	4.4
6/21/2016	4.5
11/29/2016	4.3

ATPW04

DATE	RESULT
1/29/2013	1
4/10/2013	1.3
8/1/2013	1.4
11/20/2013	1.1
4/8/2014	1.4
7/23/2014	1.4
4/1/2015	1.2
6/23/2015	1.2
9/16/2015	1.1
1/13/2016	1.2
6/22/2016	1.3
11/29/2016	1.2

606

DATE	RESULT
1/30/2013	0.63
4/10/2013	0.7
7/31/2013	0.84
11/20/2013	0.95
4/8/2014	1.3
7/23/2014	1.2
4/1/2015	0.79
6/24/2015	0.93
9/16/2015	0.41 J
1/13/2016	0.4 J
6/22/2016	0.45 J
11/30/2016	0.44 J

229

DATE	RESULT
1/30/2013	2.8
4/10/2013	3.2
7/31/2013	2.5
11/21/2013	3
4/9/2014	3.7
7/23/2014	3.9
12/3/2014	2.6 J
4/1/2015	3.4
6/24/2015	3.5
9/16/2015	0.99
1/13/2016	1.5
6/22/2016	2.6
11/29/2016	2

536

DATE	RESULT
1/30/2013	0.77
4/10/2013	0.9
7/31/2013	0.89
11/20/2013	0.56
4/8/2014	0.96
7/23/2014	0.83
4/1/2015	0.8
6/24/2015	0.63
9/16/2015	0.57
1/13/2016	0.6
6/22/2016	0.65
11/29/2016	0.49 J

Aerial Source: Bing Maps Property Parcels Source: Hillsborough County Property Appraiser's Office

Legend

- Monitoring Well Location
- Residential Well Location
- Arkla Terra Property
- Parcel Boundary
- Sinkhole

Notes:
1. All sample results presented are in micrograms per liter (µg/L).
2. EPA-1S was abandoned during the system installation in 2012.
3. Results highlighted in pink exceeds the Florida MCL (3 µg/L).
4. Because of rounding of the result, values above 3.4 are considered as exceedances of the contaminant.

N

0 600 1,200

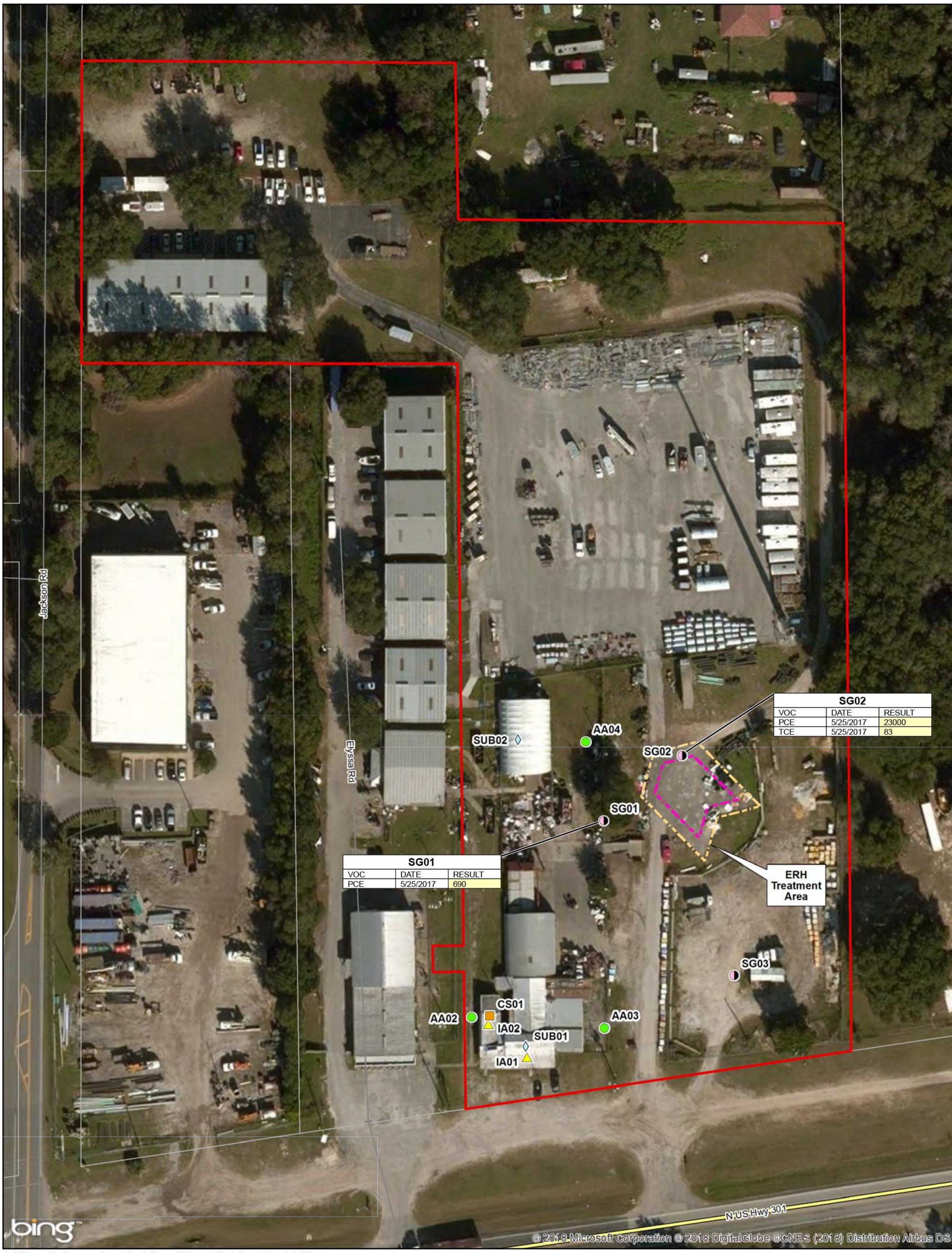
Scale in Feet

United States Environmental Protection Agency

ARKLA TERRA SITE
THONOTOSASSA, FLORIDA

FIGURE 9
CONTAMINANT OF CONCERN EXCEEDANCE
TCE IN GROUNDWATER FROM MONITORING WELLS AND RESIDENTIAL WELLS

OTIE
An Oneida Nation Company



Aerial Source: Bing Maps Property Parcels Source: Hillsborough County Property Appraiser's Office

G:\GIS_Workspace\Arkla Terra\Data July 2017\RI-FS\Section 5\Figure 5-10 - PCE and TCE Exceedances in Soil Gas.mxd

Legend

- Ambient Air Sample Location
- Crawl Space Sample Location
- Indoor Air Sample Location
- Soil Gas Sample Location
- Sub-slab Sample Location
- Outer Vapor Cap
- Inner Vapor Cap
- Arkla Terra Property
- Parcel Boundary

Notes:
1. All sample results presented are in micrograms per cubic meter (µg/m3).
2. Results highlighted in yellow exceeded the EPA VISL Target Soil Gas Criteria.
3. Soil gas EPA VISL criteria are as follows:
PCE - 140 µg/m3
TCE - 7 µg/m3

N

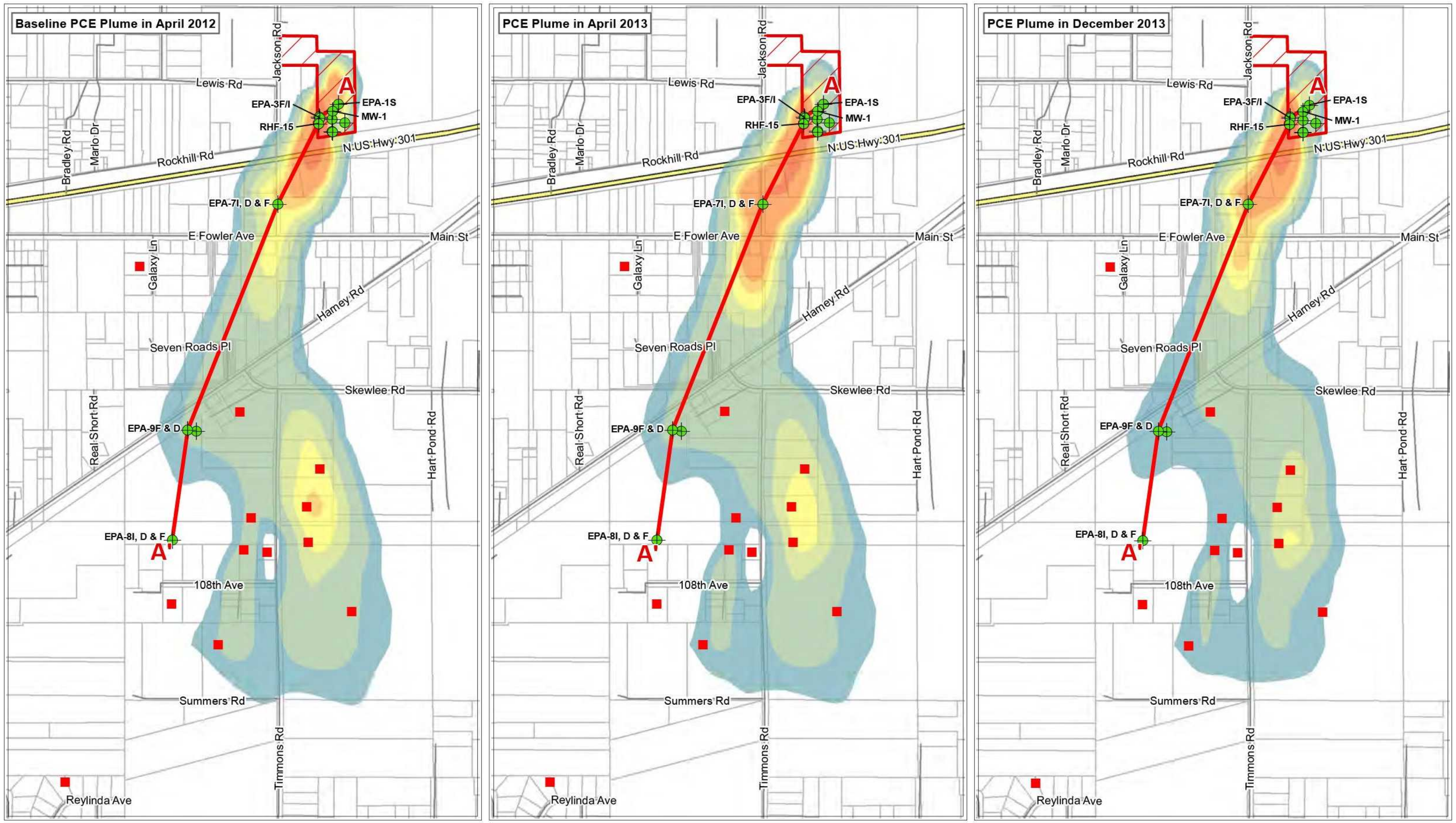
0 80 160

Scale in Feet

United States Environmental Protection Agency

ARKLA TERRA SITE THONOTOSASSA, FLORIDA

FIGURE 10 CONTAMINANTS OF CONCERN EXCEEDANCES PCE AND TCE IN SOIL GAS



Legend

- Monitor Well Location
- Residential Well Location
- Schematic Profile
- Arkla Terra Property
- Parcel Boundary

PCE Plume (µg/L)

<3, 3-5, 5-10, 10-15, 15-20, 20-25, 25-50, 50-100, >100

Note:
This figure was produced by SERAS and originally presented in the report, "Performance Assessment of the Non-Time Critical Removal Action at the Arkla Terra Site, Thonotosassa, Florida."

N

0 1,000 2,000

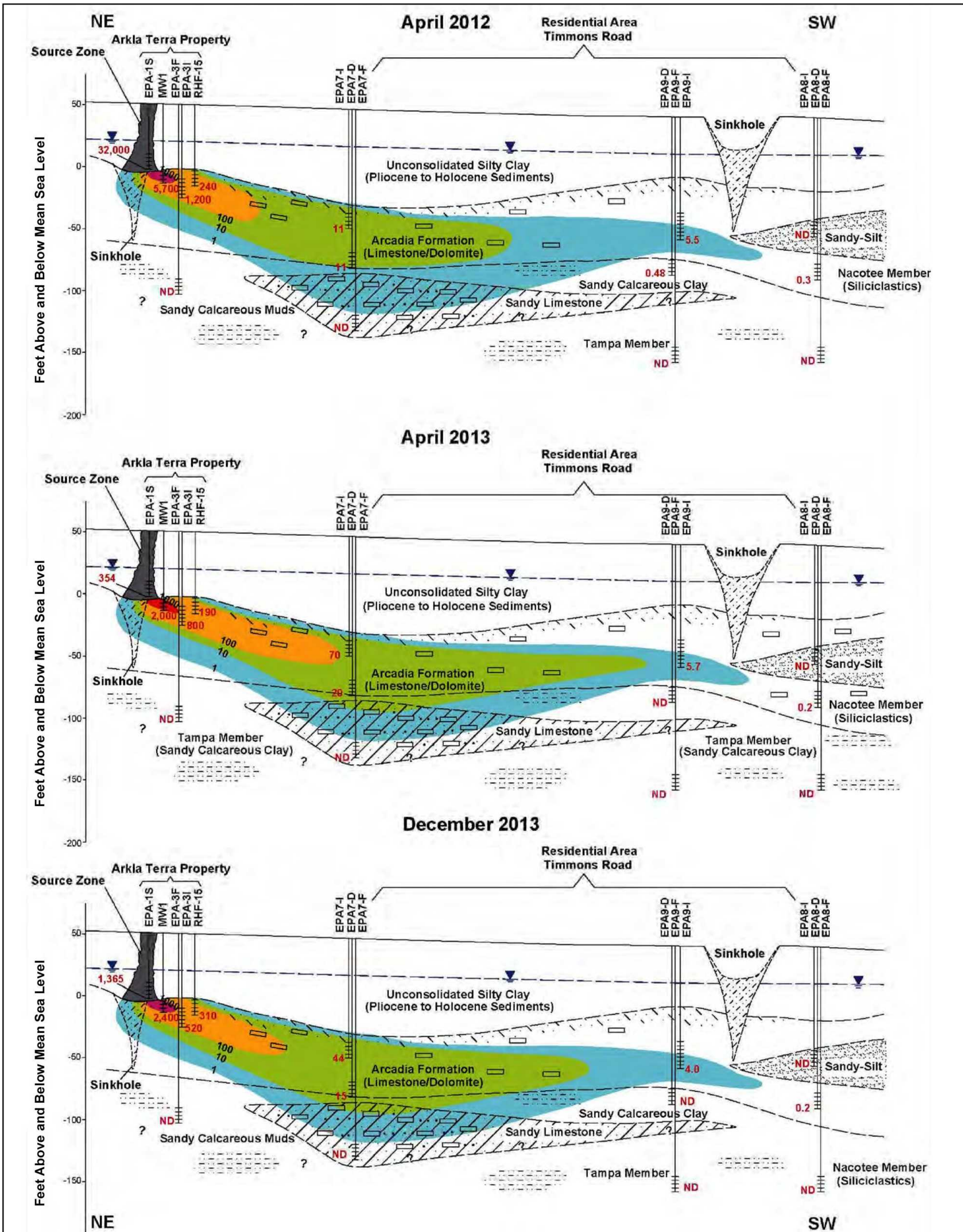
Scale in Feet

United States Environmental Protection Agency

ARKLA TERRA SITE THONOTOSASSA, FLORIDA

FIGURE 11
PCE PLUME IN APRIL 2012, APRIL 2013 AND DECEMBER 2013

G:\GIS_Workspace\Arkla Terra\Data July 2017\RI-FS\Section 6\Figure 6-3 - PCE Plume.mxd



G:\GIS_Workspace\Arkla Terra\Data July 2017\RI-FS\Section 6\Figure 6-4 - Schematic Profile April 2012_April 2013_December 2013.mxd

Legend

Plume Extent PCE Conncentration Contours (1, 10, 100, & 1000 µg/L)

Water Table

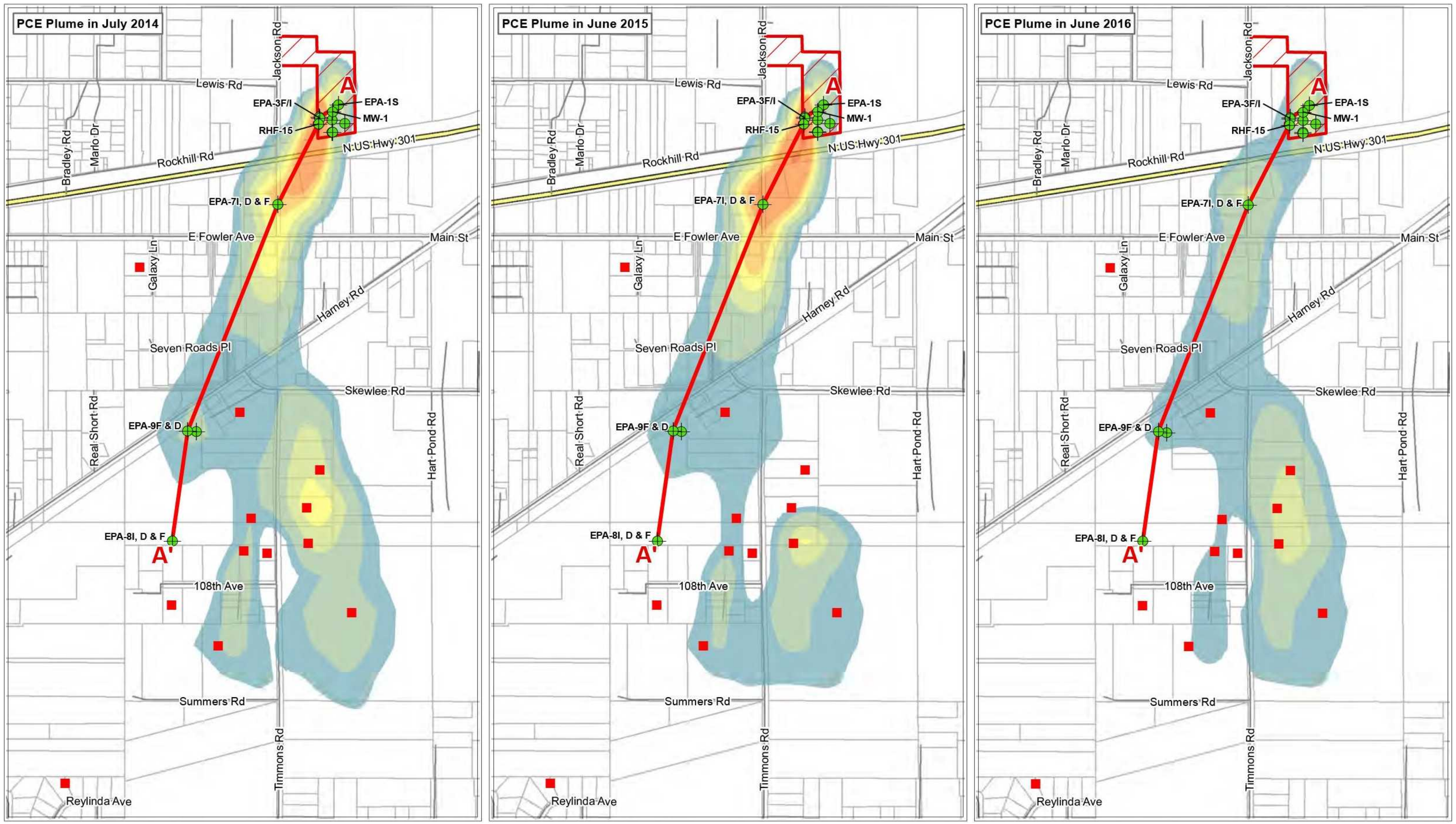
Note:
This figure was produced by SERAS and originally presented in the report, "Performance Assessment of the Non-Time Critical Removal Action at the Arkla Terra Site, Thonotosassa, Florida."

0 600 1,200
Scale in Feet

United States Environmental Protection Agency

ARKLA TERRA SITE
THONOTOSASSA, FLORIDA

FIGURE 12
SCHEMATIC PROFILE
APRIL 2012, APRIL 2013, DECEMBER 2013



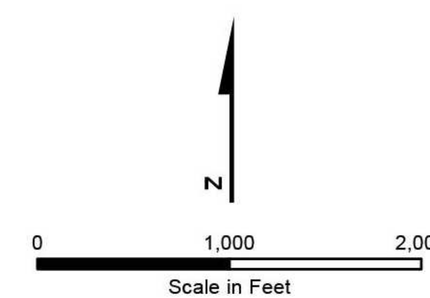
Legend

- Monitor Well Location
- Residential Well Location
- Schematic Profile
- Arkla Terra Property
- Parcel Boundary

PCE Plume (µg/L)

<3, 3-5, 5-10, 10-15, 15-20, 20-25, 25-50, 50-100

Note:
This figure was produced by SERAS and originally presented in the report, "Performance Assessment of the Non-Time Critical Removal Action at the Arkla Terra Site, Thonotosassa, Florida."

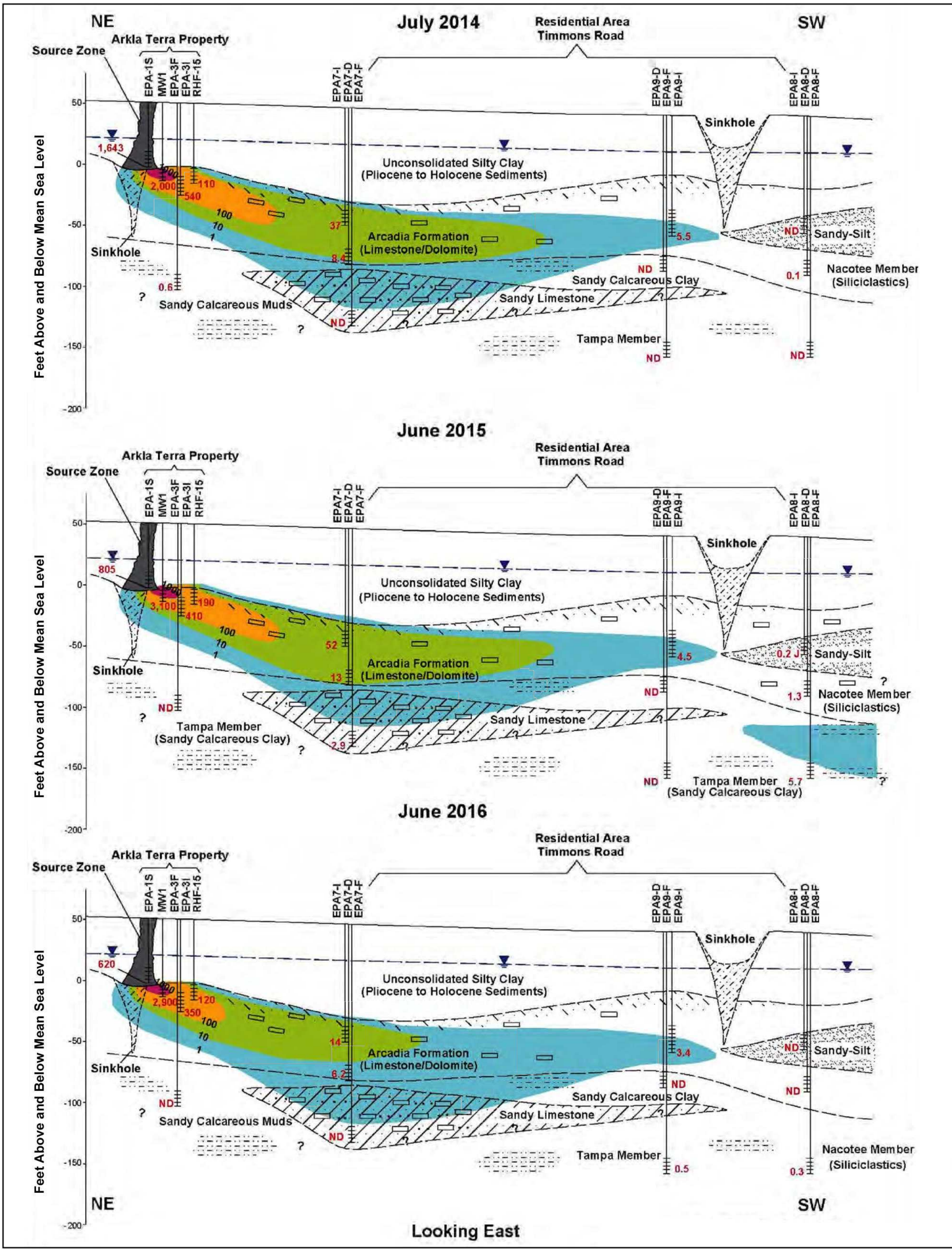


United States Environmental Protection Agency

ARKLA TERRA SITE
THONOTOSASSA, FLORIDA

FIGURE 13
PCE PLUME IN JULY 2014, JUNE 2015 AND JUNE 2016

G:\GIS_Workspace\Arkla Terra\Data July 2017\RI-FS\Section 6\Figure 6-5 - PCE Plume July 2014_June 2015_June 2016.mxd



G:\GIS_Workspace\Arkla Terra\Data July 2017\RI-FS\Section 6\Figure 6-6 - Schematic Profile July 2014_June 2015_June 2016.mxd

Legend

Plume Extent PCE Conncentration Contours (1, 10, 100, & 1000 µg/L)

Water Table

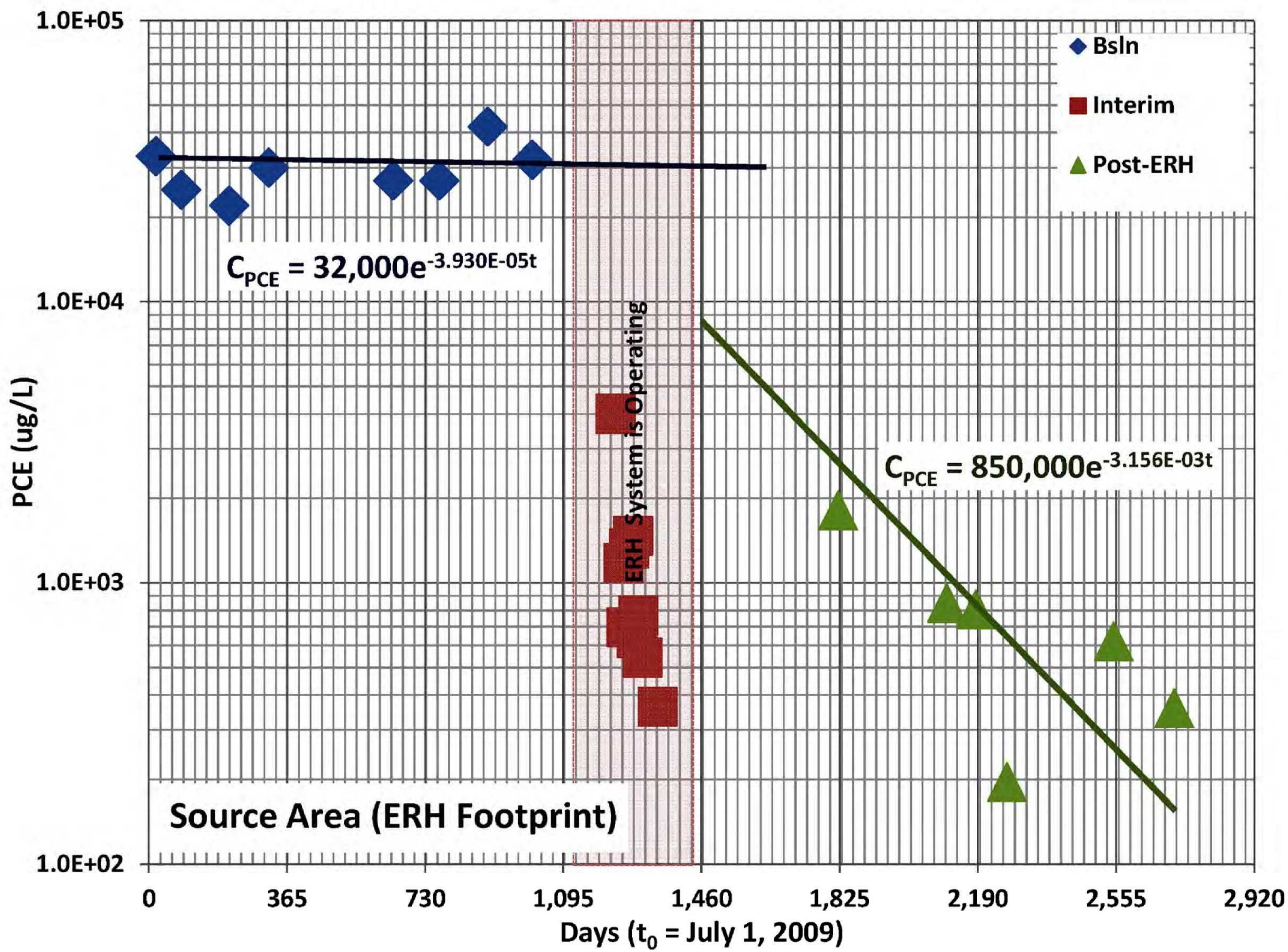
Note:
This figure was produced by SERAS and originally presented in the report, "Performance Assessment of the Non-Time Critical Removal Action at the Arkla Terra Site, Thonotosassa, Florida."

0 600 1,200
Scale in Feet

United States Environmental Protection Agency

ARKLA TERRA SITE
THONOTOSASSA, FLORIDA

FIGURE 14
SCHEMATIC PROFILE
JULY 2014, JUNE 2015, JUNE 2016



Legend

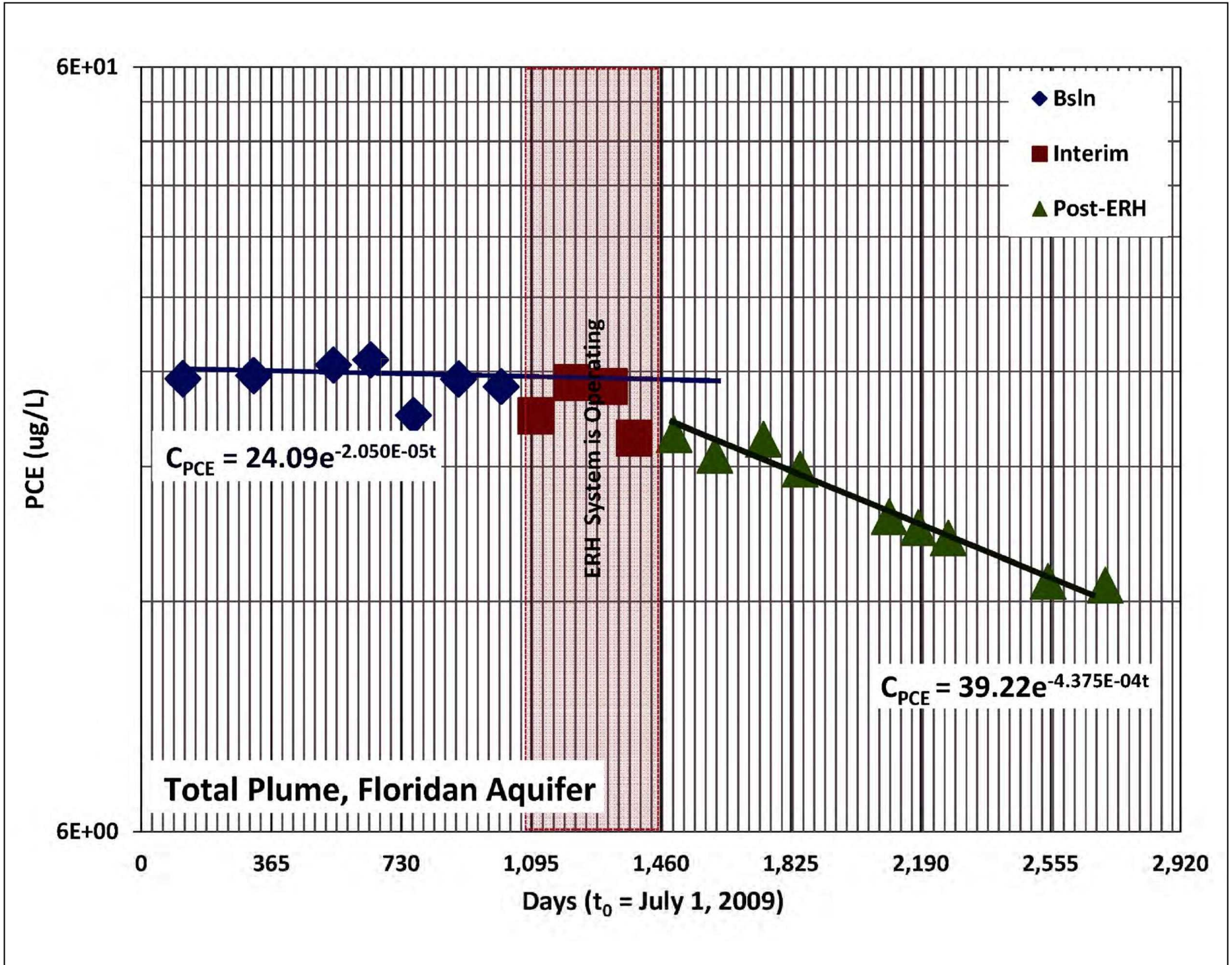
Bsln	Baseline Sampling (Pre-ERH)
C_{PCE}	Concentration of PCE
ERH	Electrical Resistance Heating
Interim	Sampling during ERH operation
Post-ERH	Sampling after ERH shutdown
t_0	Time at "0"
t	Time
ug/L	Micrograms per Liter
(green line)	Logarithmic trend line for Post-ERH samples
(dark line)	Logarithmic trend line for Baseline Samples

Note:
Source area PCE concentrations for the Bsln are from EPA-1S. Source area PCE concentrations for the Interim and Post-ERH are calculated as a single concentration by taking the geometric mean of samples collected from extractions wells X01 through X08. (EPA-1S was excluded because it was destroyed during system installation.)

United States Environmental Protection Agency

ARKLA TERRA SITE
THONOTOSASSA, FLORIDA

FIGURE 15
CONCENTRATION VS TIME PLOT FOR PCE - SOURCE AREA



Legend

Bsln	Baseline Sampling (Pre-ERH)
C_{PCE}	Concentration of PCE
ERH	Electrical Resistance Heating
Interim	Sampling during ERH operation
Post-ERH	Sampling after ERH shutdown
t_0	Time at "0"
t	Time
ug/L	Micrograms per Liter
(green line)	Logarithmic trend line for Post-ERH samples
(dark line)	Logarithmic trend line for Baseline Samples

Note:
Total Plume PCE concentrations are calculated as a single concentration per sample event. The PCE concentration was cacluated by taking the geometric mean of monitoring and residential wells which exhibited greater than 1 ug/L of PCE. The following monitoring wells were used in the geometric mean: EPA-2I, EPA-3I, EPA-5I, RHF-15, EPA-7I, EPA-7D, EPA-8D. The following residential wells were used in the geometric mean: 52, 188, 226, 227, 229, 536, 601, 606, ATPW0.

United States Environmental Protection Agency

ARKLA TERRA SITE
THONOTOSASSA, FLORIDA

FIGURE 16
CONCENTRATION VS TIME PLOT FOR PCE
WHOLE PLUME, FLORIDAN AQUIFER

G:\GIS_Workspace\Arkla Terra\Data July 2017\RI-FS\Section 6\Figure 6-8 - CvT plot for PCE – Whole Plume Floridan Aquifer.mxd

TABLES

TABLE 1
SUMMARY OF CONCENTRATION VS. TIME CONSTANT
ARKLA TERRA SITE

Well ID	North (feet)	East (feet)	Distance (feet)	PCE BSLN (µg/L)	Wells/ Samples	Attenuation Line Fit	PCE at t_0[1] (µg/L)	k_{point} [t^{-1}]	PCE at t_{ERH}[2] (µg/L)	t_{FC}[3] from t_{ERH} [years]	Remarks
GROUNDWATER at the SOURCE[4]			**Source Area**	**32,000**	**1 to 9**	**$32{,}000e^{-3.930E\text{-}05t}$**	**32,000**	**-3.930E-05**	**30,526**	**643**	**Source from EPA-1S BSLN**
GROUNDWATER at the SOURCE[4]			**Source Area**	**29,750**	**1 to 9**	**$850{,}000e^{-3.156E\text{-}03t}$**	**850,000**	**-3.156E-03**	**36,206**	**8**	**Source (July 2012 to November 2016) Surficial Aquifer (X01 thru X08)**
TOTAL PLUME ^{BSLN}			**4,600**	**24.1**	**27 to 51**	**$24.09e^{-2.050E\text{-}05t}$**	**24.1**	**-2.050E-05**	**24**	**276**	**Total Plume BSLN**
TOTAL PLUME[5]			**4,600**	**23.4**	**27 to 51**	**$39.22e^{-4.375E\text{-}04t}$**	**39.2**	**-4.375E-04**	**25**	**13**	**Total Plume (July 2012 to November 2016)**
MW-1	1,353,691.8	553,711.5	79	3,325	22	$5{,}700e^{-3.548E\text{-}04t}$	5,700	-3.548E-04	3,997	56	Floridan Aquifer source; 4" diameter well
EPA-2I	1,353,615.4	553,715.1	141	7.2	22	$20.0e^{-6.579E\text{-}04t}$	20.0	-6.579E-04	10	5	Cross-gradient well
EPA-5I	1,353,571.5	553,817.6	181	31.3	22	---	---	---	---	---	Cross-gradient well (concentrations are increasing)
EPA-3I	1,353,643.0	553,604.9	193	792	22	$2{,}000e^{-7.411E\text{-}04t}$	2,000	-7.411E-04	953	21	
RHF-15	1,353,580.8	553,601.5	235	242	22	$890e^{-7.998E\text{-}04t}$	890.0	-7.998E-04	400	17	4" diameter well
EPA-7I	1,352,928.7	553,257.6	964	40.5	17	$475e^{-1.433E\text{-}03t}$	475.0	-1.433E-03	113	7	
EPA-7D	1,352,928.4	553,257.3	964	12.2	17	$90.0e^{-1.183E\text{-}03t}$	90.0	-1.183E-03	28	5	
188	1,352,350.9	552,059.8	2,206	3.2	19	$15.1e^{-9.074E\text{-}04t}$	15.1	-9.074E-04	6	2	
601	1,351,119.8	552,917.8	2,760	8.2	16	$19.4e^{-7.081E\text{-}04t}$	19.4	-7.081E-04	10	4	plume is transient (shrinking)
EPA-9I	1,350,930.0	552,504.1	3,087	5.1	17	$10e^{-4.162E\text{-}04t}$	10.0	-4.162E-04	7	5	plume is transient; 6" diameter well
226	1,350,285.7	553,492.9	3,471	21.3	18	$45.0e^{-7.391E\text{-}04t}$	45.0	-6.320E-04	24	9	plume is transient (shrinking)
227	1,350,012.9	553,550.3	3,739	34.1	18	$25.6e^{-2.710E\text{-}04t}$	25.6	-2.710E-04	20	19	plume is transient (shrinking)
ATPW04	1,350,034.2	553,026.2	3,785	6.8	17	$13.5e^{-5.449E\text{-}04t}$	13.5	-5.449E-04	8	5	plume is transient (shrinking)

TABLE 1 (CONTINUED)
SUMMARY OF CONCENTRATION VS. TIME CONSTANT
ARKLA TERRA SITE

Well ID	North (feet)	East (feet)	Distance (feet)	PCE BSLN (µg/L)	Wells/ Samples	Attenuation Line Fit	PCE at t_0[1] (µg/L)	k_{point} $[t^{-1}]$	PCE at t_{ERH}[2] (µg/L)	t_{FC}[3] from t_{ERH} [years]	Remarks
229	1,349,832.6	552,982.1	3,991	13.1	19	$25.6e^{-5.532E-04t}$	25.6	-5.532E-04	15	8	plume is transient (shrinking)
536	1,349,376.1	553,886.3	4,371	9.9	16	$8.84e^{-3.983E-04t}$	8.8	-3.983E-04	6	5	plume is transient (shrinking)
606	1,349,389.8	552,260.7	4,609	19.5	15	$18.4e^{-9.602E-04t}$	18.4	-9.602E-04	7	2	plume is transient (shrinking)
Geometric Mean =				**27.6**				**-4.682E-04**	**32.3**	**8**	

1. Estimated PCE concentration at C(y)-intercept or time zero (t_0), where t_0 is defined as July 1, 2009.
2. Calculated PCE concentration at time (t) = 1,000 days determines the PCE concentration immediately before the remedy (t_{ERH}) was implemented.
3. Time (years) to reach the Florida MCL criteria (tFC) of < 3 µg/L PCE.
4. Plume source applies to the "surficial groundwater"
5. Total plume applies to the Floridan Aquifer.

BSLN = baseline covers groundwater sampling events from 2006 to 2012, µg/L = milligrams per liter

TABLE 2A

SUMMARY OF CHEMICALS OF CONCERN AND MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION FOR ONSITE GROUNDWATER

ARKLA TERRA SITE

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Onsite Groundwater

Exposure Point	Chemical	Concentration Detected		Units	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum Detection	Maximum Detection					
Onsite Groundwater (dermal, ingestion, inhalation)	Tetrachloroethylene	0.16	3300	µg L	24 28	1190	µg L	95% UCL

Key
µg L: microgram liter
95% UCL: 95% Upper Confidence Limit of the Arithmetic Mean (Gamma Adjusted KM-UCL, gamma distribution).

Explanation of Table 2A
This table presents the chemical of concern (COC) and exposure point concentration (EPC) for the COC detected in the ground water (i.e., the concentration that will be used to estimate the exposure and risk from the COC in the ground water). This table includes the range of concentrations detected for the COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the Site), the EPC, and how the EPC was derived. This table indicates that the tetrachloroethylene was detected in 24 of 28 of the water samples analyzed. The 95% UCL on the arithmetic mean was used as the EPC.

TABLE 2B

SUMMARY OF CHEMICALS OF CONCERN AND MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION FOR OFFSITE GROUNDWATER

ARKLA TERRA SITE

Scenario Timeframe: Current/Future

Medium: Groundwater

Exposure Medium: Offsite Groundwater

Exposure Point	Chemical	Concentration Detected		Units	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statistcal Measure
		Minimum Detection	Maximum Detection					
Offsite Groundwater (dermal, ingestion, inhalation)	Trichloroethylene	0.34	58	µg/L	9/12	30.17	µg/L	95% UCL

Key

µg/L: microgram/liter

95% UCL: 95% Upper Confidence Limit of the Arithmetic Mean (95% KM Bootstrap t UCL, gamma distribution).

Explanation of Table 2b

This table presents the chemical of concern (COC) and exposure point concentration (EPC) for the COC detected in the ground water (i.e., the concentration that will be used to estimate the exposure and risk from the COC in the ground water). This table includes the range of concentrations detected for the COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the Site), the EPC, and how the EPC was derived. This table indicates that the trichloroethylene was detected in 9 of 12 of the water samples analyzed. The 95% UCL on the arithmetic mean was used as the EPC.

TABLE 2C
SUMMARY OF CHEMICALS OF CONCERN AND MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION FOR ONSITE SOIL GAS
ARKLA TERRA SITE

Scenario Timeframe: Future
Medium: Site Soil
Exposure Medium: Air (Vapor Intrusion)

Exposure Point	Chemical	Concentration Detected		Units	Detection Frequency	Exposure Point Concentration	Exposure Point Concentration Units	Statisteal Measure
		Minimum Detection	Maximum Detection					
Onsite Soil Gas (inhalation)	Tetrachloroethylene	3	23000	µg/m^3	3/3	23000	µg/m^3	MAX
Onsite Soil Gas (inhalation)	Trichloroethylene	83	83	µg/m^3	1/3	83	µg/m^3	MAX

Key
µg/m^3: microgram cubic meters
MAX: Maximum Concentration (The 95% UCL was not calculated since the data set was small (n 3)).

Explanation of Table 2C
This table presents the chemical of concerns (COCs) and exposure point concentration (EPC) for the COCs detected in the soil gas (i.e., the concentration that will be used to estimate the exposure and risk from the COC in soil gas). This table includes the range of concentrations detected for the COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the Site), the EPC, and how the EPC was derived. This table indicates that trichloroethylene was detected in 1 of the soil gas samples analyzed, and tetrachloroethylene was detected in 3 of the 3 soil gas samples analyzed. The maximum detection was used as the EPC for each COC.

TABLE 3
NON-CANCER TOXICITY DATA SUMMARY
ARKLA TERRA SITE

Pathway: Ingestion, Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor	Adjusted Dermal RfD	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (MM/DD/YY)
Trichloroethylene	Chronic	5.0E-04	mg/kg-day	1.0E+00	5.0E-04	mg/kg-day	development and immune system	10	IRIS	04/17/18
Tetrachloroethylene	Chronic	6.0E-03	mg/kg-day	1.0E+00	6.0E-03	mg/kg-day	Neurological	1000	IRIS	04/17/18

Pathway: Inhalation

Chemical of Concern	Chronic/ Subchronic	RfC Value	RfC Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (MM/DD/YY)
Trichloroethylene	Chronic	2.0E-03	mg/m^3	development and immune system	10	IRIS	04/17/18
Tetrachloroethylene	Chronic	4.0E-02	mg/m^3	Neurological	1000	IRIS	04/17/18

Key
mg/kg-day: Milligrams per kilogram per day
mg/m^3: Milligrams per cubic meter
IRIS = Integrated Risk Information System, U.S. EPA

Explanation of Table 3
This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in ground water. The COCs have toxicity data indicating their potential for adverse non-carcinogenic health effects in humans. The chronic toxicity data available for both COCs for oral exposures, have been used to develop oral reference doses (RfDs). The oral RfDs for TCE and PCE are 5.0E-4 mg/kg day and 6.0E-3 mg/kg day, respectively (Source: IRIS, USEPA). The available toxicity data indicate that both TCE and PCE primarily affect the development/immune system and neurological system, respectively. Dermal RfDs were extrapolated from the oral RfDs by applying an adjustment factor as appropriate. An oral to dermal adjustment factor of 1 was applied by both COCs to derive the adjusted dermal RfD. Therefore, the oral RfDs discussed were used as the dermal RfDs for these contaminants. The inhalation reference concentrations for TCE and PCE is 2E-3 mg/m^3 and 4E-02 mg/m^3, respectively (Source: IRIS, USEPA).

TABLE 4
RISK CHARACTERIZATION SUMMARY - NONCARCINOGENS ONSITE
ARKLA TERRA SITE

Scenario Timeframe: Future
Receptor Population: Onsite Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Onsite Groundwater	Groundwater	Tap Showering	Tetrachloroethylene	Neurological	10	2	5	17
Groundwater Total								17
							Total Neurological HI	17

Scenario Timeframe: Future
Receptor Population: Onsite Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Onsite Groundwater	Groundwater	Tap Showering	Tetrachloroethylene	Neurological	6	1	3	10
Groundwater Total								10
							Total Neurological HI	10

Scenario Timeframe: Future
Receptor Population: Onsite Industrial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Onsite Groundwater	Groundwater	Tap	Tetrachloroethylene	Neurological	2	—	0.4	2
Groundwater Total								2
							Total Neurological HI	2

Key:
— not evaluated

Explanation of Table 4
This table provides hazard quotients (HQs) for the groundwater route of exposure and the hazard index (HI, sum of hazard quotients). A HI greater than 1 indicates the potential for adverse noncancer effects. The estimated HIs of 16, 10, and 2 for onsite receptors indicate that the potential for adverse noncancer effects could occur from exposure to contaminated groundwater. PCE affects the neurological system.

TABLE 5
RISK CHARACTERIZATION SUMMARY - NONCARCINOGENS OFFSITE
ARKLA TERRA SITE

Scenario Timeframe: Future
Receptor Population: Offsite Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Offsite Groundwater	Groundwater	Tap Showering	Trichloroethylene	development and immune system	3	1	0.4	4
Groundwater Total								4
							Total Neurological HI	4

Scenario Timeframe: Future
Receptor Population: Offsite Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Offsite Groundwater	Groundwater	Tap Showering	Tetrachloroethylene	development and immune system	2	1	0.2	3
Groundwater Total								3
							Total Neurological HI	3

Explanation of Table 5
This table provides hazard quotients (HQs) for the groundwater route of exposure and the hazard index (HI, sum of hazard quotients). A HI greater than 1 indicates the potential for adverse noncancer effects. The estimated HIs of 4 and 3 for offsite receptors indicate that the potential for adverse noncancer effects could occur from exposure to contaminated groundwater. TCE affects the development and immune system.

TABLE 6 CLEANUP LEVELS FOR CHEMICALS OF CONCERN ARKLA TERRA SITE				
Media: Groundwater **Site Area**: Onsite and Offsite **Available Use**: Future Residential **Controls to Ensure Restricted Use**: Institutional Controls for Groundwater				
COC	**Media**	**Cleanup Level**	**Basis for Cleanup Level**	**Cleanup Level Reference[1]**
PCE	Groundwater	3 µg L	ARAR	State MCL
TCE		3 µg L	ARAR	State MCL

Notes:

COC	Chemical of Concern
PCE	Tetrachloroethylene or Perchloroethylene
TCE	Trichloroethylene
µg L	Micrograms per Liter
ARAR	Applicable or Relavent and Approriate Requirements
MCL	Maximum Contaminant Level

1 State MCL: Florida Administrative Code. Chapter 62-550 Drinking Water Standards, Monitoring, and Reporting. Table 4 Maximum Contaminant Levels for Volatile Organic Contaminants. Accessed: May 2017.

Table 7. Chemical-Specific ARARs and TBCs for Arkla Terra Site RI/FS

Chemical-Specific ARARs/TBCs			
Action/Media	**Requirement**	**Prerequisite**	**Citation**
Classification of ground water	All ground water of the state is classified according to the designated uses and includes the following: Class G-II – Potable water use, ground water in single source aquifers which has total dissolved solids content of less than 10,000 mg/l, unless otherwise classified by the Florida Environmental Regulation Commission.	Groundwater within the state of Florida – **applicable**	F.A.C. 62-520.410 Classification of Groundwater
Restoration of ground water as a potential drinking water source	All ground water (except for Class G-IV) shall meet the minimum criteria for ground water specified in F.A.C. 62-520.400(1)(a)-(f).	Ground water within the state of Florida with designated beneficial use(s) of Class G-I or Class G-II – **relevant and appropriate**	F.A.C. 62-520.400 Minimum Criteria for Ground Water
	Class I and Class II ground water shall meet the primary drinking water standards listed in FAC 62-550.310 for public water systems, except as otherwise specified.		F.A.C. 62-520.420(1) Standards for Class - I and Class – II Ground Water
	Shall not exceed the maximum contaminant level (MCL) listed in Table 4 VOLATILE ORGANIC CONTAMINANTS. (These standards may also apply as ground water quality standards as referenced in Chapter 62-520, F.A.C.)	Supply of water to public water system, as defined in F.A.C. 62-550.200 (17) – **relevant and appropriate**	F.A.C. 62-550.310(4) Primary Drinking Water Standards
Restoration of groundwater as a potential drinking water source	Specifies Groundwater Cleanup Target Levels (CTLs) for site rehabilitation. FAC 62-777.170 Table I lists the default Groundwater Criteria. • Tetrachloroethene (PCE) – 3 ug/L [Primary Standard] • Trichloroethene (TCE) – 3 ug/L [Primary Standard] • Cis-1,2-dichloroethene (DCE) – 70 ug/L [Primary Standard] • Trans- 1,2-DCE – 100 ug/L [Primary Standard] • Vinyl chloride – 1 ug/L [Primary Standard]	Rehabilitation (i.e., remediation) of site contaminated groundwater – **relevant and appropriate**	F.A.C. 62-780.150(5) F.A.C. 62-777.170(1)(a)

Table 7. Chemical-Specific ARARs and TBCs for Arkla Terra Site RI/FS

Chemical-Specific ARARs/TBCs			
Action/Media	**Requirement**	**Prerequisite**	**Citation**
	Requires that a lifetime excess cancer risk level of 1.0E-6 and a hazard index of 1 or less shall be used in establishing alternative contaminant cleanup target levels for groundwater or soil.	Establishment of Alternative cleanup target levels (CTLs) for contaminants of concern at the Site – **relevant and appropriate**	F.A.C. 62-780.650(1)(d)

ARAR = applicable *or* relevant and appropriate requirement
CFR = Code of Federal Regulations
CTL = cleanup target level
F.A.C. = Florida Administrative Code, Chapters as specified
F.S. = Florida Statutes
TBC = To Be Considered guidance

Table 8 - Action-specific ARARs and TBCs for the Arkla Terra Site ROD

Action-Specific ARARs/TBCs			
Action	**Requirement**	**Prerequisite**	**Citation**
Monitoring Wells – Installation, Operation, and Abandonment			
Groundwater Monitoring Well Installation	Before construction of new ground water monitoring wells, a soil boring shall be made at each new monitoring well location to properly determine monitoring well specifications such as well depth, screen interval, screen slot, and filter pack.	Installation of groundwater monitoring well to detect migration of contaminants – **relevant and appropriate**	F.A.C. 62-532.600(6)(g)
	Provides detailed guidance to assist in monitoring well design and material specifications for construction of groundwater monitoring well.	Installation of groundwater monitoring well to detect migration of contaminants – **To Be Considered**	FDEP, Monitoring Well Design and Construction Guidance Manual (2008)
Construction and repair of groundwater well	Well casing. Well liner shall be in accordance with the substantive requirements specified in F.A.C. 62-532.500(1)(a) through(i) as appropriate	Installation of water well as defined in F.A.C. 62-532.200 – **relevant and appropriate**.	F.A.C. 62-532.500(1)
	Wells shall be constructed to meet the following criteria specified in F.A.C. 62-532.500(2)(a), (b), and (d)		F.A.C. 62-532.500(2)
Plugging and Abandonment of Groundwater Monitoring Wells and Water Wells	All abandoned wells shall be plugged by filling them from bottom to top with neat cement grout or bentonite and capped with a minimum of one foot of neat cement grout. An alternate method providing equivalent protection shall be approved by the Department and EPA.	Abandonment of a water well as defined in F.A.C. 62-532.200 – **relevant and appropriate**	F.A.C. 62-532.500(5)
Groundwater Monitoring for Monitored Natural Attenuation (MNA) remedy	A minimum of two monitoring wells is required[i]: • At least one well shall be located at the downgradient edge of the plume; and • At least one well shall be located in the area(s) of highest groundwater contamination or directly adjacent to it if the area of highest groundwater contamination is inaccessible (for example, under a structure).	Groundwater monitoring as part of the remedy relying on natural attenuation – **relevant and appropriate**	F.A.C. 62-780.690(8)(a) Natural Attenuation with Monitoring

Table 8 - Action-specific ARARs and TBCs for the Arkla Terra Site ROD

Action-Specific ARARs/TBCs			
Action	**Requirement**	**Prerequisite**	**Citation**
	The designated monitoring wells shall be sampled for analyses of applicable contaminants no more frequent than quarterly.[1]	Groundwater monitoring as part of the remedy relying on natural attenuation – **relevant and appropriate**	F.A.C. 62-780.690(8)(b)
	Water-level measurements in all designated wells and piezometers shall be made within 24 hours of initiating each sampling event.[1]	Groundwater monitoring as part of the remedy relying on natural attenuation – **relevant and appropriate**	F.A.C. 62-780.690(8)(c)
Waste Characterization – Primary Waste (e.g., excavated soils from well cuttings, purge water) and Secondary Wastes (e.g., contaminated equipment or treatment residuals)			
Characterization of ***solid waste*** (all primary and secondary wastes)	Must determine if solid waste is a hazardous waste using the following method: • Should first determine if waste is excluded from regulation under 40 CFR 261.4; and • Must then determine if waste is listed as a hazardous waste under subpart D 40 CFR Part 261.	Generation of solid waste as defined in 40 CFR 261.2 – **applicable**	40 CFR 262.11(a) and (b) F.A.C. 62-730.160
	Must determine whether the waste is (characteristic waste) identified in subpart C of 40 CFR part 261by either: (1) Testing the waste according to the methods set forth in subpart C of 40 CFR part 261, or according to an equivalent method approved by the Administrator under 40 CFR 260.21; or (2) Applying knowledge of the hazard characteristic of the waste in light of the materials or the processes used.	Generation of solid waste which is not excluded under 40 CFR 261.4(a) – **applicable**	40 CFR 262.11(c) F.A.C. 62-730.160
	Must refer to Parts 261, 262, 264, 265, 266, 268, and 273 of Chapter 40 for possible exclusions or restrictions pertaining to management of the specific waste.	Generation of solid waste which is determined to be hazardous waste – **applicable**	40 CFR 262.11(d) F.A.C. 62-730.160

Table 8 - Action-specific ARARs and TBCs for the Arkla Terra Site ROD

Action-Specific ARARs/TBCs			
Action	**Requirement**	**Prerequisite**	**Citation**
Characterization of ***hazardous waste*** (all primary and secondary wastes)	Must obtain a detailed chemical and physical analysis on a representative sample of the waste(s), which at a minimum contains all the information that must be known to treat, store, or dispose of the waste in accordance with pertinent sections of 40 CFR 264 and 268.	Generation of RCRA hazardous waste for storage, treatment or disposal – **applicable**	40 CFR 264.13(a)(1) F.A.C. 62-730.180(1)
Determinations for management of hazardous waste	Must determine each EPA Hazardous Waste Number (waste code) applicable to the waste in order to determine the applicable treatment standards under 40 CFR 268 et seq. Note: This determination may be made concurrently with the hazardous waste determination required in Sec. 262.11 of this chapter.	Generation of hazardous waste for storage, treatment or disposal – **applicable**	40 CFR 268.9(a) F.A.C. 62-730.183
	Must determine the underlying hazardous constituents [as defined in 40 CFR 268.2(i)] in the characteristic waste.	Generation of RCRA characteristic hazardous waste (and is not D001 non –wastewaters treated by CMBST, RORGS, or POLYM of Section 268.42 Table 1) for storage, treatment or disposal – **applicable**	40 CFR 268.9(a) F.A.C. 62-730.183
Determinations for management of hazardous waste	Must determine if the hazardous waste meets the treatment standards in 40 CFR 268.40, 268.45, or 268.49 by testing in accordance with prescribed methods or use of generator knowledge of waste. Note: This determination can be made concurrently with the hazardous waste determination required in 40 CFR 262.11.	Generation of hazardous waste for storage, treatment or disposal – **applicable**	40 CFR 268.7(a) F.A.C. 62-730.183
	Must comply with the special requirements of 40 CFR 268.9 in addition to any applicable requirements in CFR 268.7.	Generation of waste or soil that displays a hazardous characteristic of ignitability, corrosivity, reactivity, or toxicity for storage, treatment or disposal – **applicable**	40 CFR 268.7(a) F.A.C. 62-730.183
Waste Storage – Primary Waste (e.g., excavated soil from well cuttings and purge water) and Secondary Wastes (e.g., contaminated equipment or treatment residuals)			

Table 8 - Action-specific ARARs and TBCs for the Arkla Terra Site ROD

Action-Specific ARARs/TBCs			
Action	**Requirement**	**Prerequisite**	**Citation**
Temporary on–site storage of hazardous waste in containers	A generator may accumulate hazardous waste at the facility provided that: • waste is placed in containers that comply with 40 CFR 265.171 –173; and • the date upon which accumulation begins is clearly marked and visible for inspection on each container; • container is marked with the words "hazardous waste"; <u>or</u>	Accumulation of RCRA hazardous waste on site as defined in 40 CFR 260.10 – **applicable**	40 CFR 262.34(a); 40 CFR 262.34(a)(1)(i); 40 CFR 262.34(a)(2) and (3) F.A.C. 62-730.160
	Container may be marked with other words that identify the contents.	Accumulation of 55 gal. or less of RCRA hazardous waste or one quart of acutely hazardous waste listed in 261.33(e) at or near any point of generation – **applicable**	40 CFR 262.34(c)(1) F.A.C. 62-730.160
Use and management of hazardous waste in containers	If container is not in good condition (e.g. severe rusting, structural defects) or if it begins to leak, must transfer waste from this container to a container that is in good condition.	Storage of RCRA hazardous waste in containers **– applicable**	40 CFR 265.171 F.A.C. 62-730.180(2)
	Must use container made or lined with materials compatible with waste to be stored so that the ability of the container to contain is not impaired.		40 CFR 265.172 F.A.C. 62-730.180(2)
	Containers must be closed during storage, except when necessary to add/remove waste. Container must not opened, handled and stored in a manner that may rupture the container or cause it to leak.		40 CFR 265.173(a) and (b) F.A.C. 62-730.180(2)
Storage of hazardous waste in container area	Area must have a containment system designed and operated in accordance with 40 CFR 264.175(b)	Storage of RCRA hazardous waste in containers with free liquids – **applicable**	40 CFR 264.175(a) F.A.C. 62-730.180(1)

Table 8 - Action-specific ARARs and TBCs for the Arkla Terra Site ROD

Action-Specific ARARs/TBCs			
Action	**Requirement**	**Prerequisite**	**Citation**
	Area must be sloped or otherwise designed and operated to drain liquid resulting from precipitation, <u>or</u> Containers must be elevated or otherwise protected from contact with accumulated liquid.	Storage of RCRA–hazardous waste in containers that do not contain free liquids (other than F020, F021, F022, F023, F026 and F027) – **applicable**	40 CFR 264.175(c)(1) and (2) F.A.C. 62-730.180(1)
Waste Treatment and Disposal – Primary Waste (e.g., excavated soil from well cuttings, purge water) and Secondary Wastes (e.g., contaminated equipment or treatment residuals)			
Disposal of RCRA hazardous waste in a land-based unit	May be land disposed if it meets the requirements in the table "Treatment Standards for Hazardous Waste" at 40 CFR 268.40 before land disposal.	Land disposal, as defined in 40 CFR 268.2, of restricted RCRA waste – **applicable**	40 CFR 268.40(a) F.A.C. 62-730.183
	All underlying hazardous constituents [as defined in 40 CFR 268.2(i)] must meet the UTS, found in 40 CFR 268.48 Table UTS prior to land disposal	Land disposal of restricted RCRA characteristic wastes (D001 –D043) that are not managed in a wastewater treatment system that is regulated under the CWA, that is CWA equivalent, or that is injected into a Class I nonhazardous injection well – **applicable**	40 CFR 268.40(e) F.A.C. 62-730.183
Disposal of RCRA *hazardous waste soil* in a land–based unit	Must be treated according to the alternative treatment standards of 40 CFR 268.49(c) <u>or</u> according to the UTSs specified in 40 CFR 268.48 applicable to the listed and/or characteristic waste contaminating the soil prior to land disposal	Land disposal, as defined in 40 CFR 268.2, of restricted hazardous soils – **applicable**	40 CFR 268.49(b) F.A.C. 62-730.183
Disposal of RCRA characteristic wastewaters in a POTW	Are not prohibited, if the wastes are treated for purposes of the pre-treatment requirements of section 307 of the CWA unless the wastes are subject to a specified method of treatment other than DEACT in 40 CFR §268.40, or are D003 reactive cyanide.	Land disposal of hazardous wastewaters that are hazardous only because they exhibit a hazardous characteristic and are not otherwise prohibited under 40 CFR Part 268 – **applicable**	40 CFR § 268.1(c)(4)(ii) F.A.C. 62-730.183

Table 8 - Action-specific ARARs and TBCs for the Arkla Terra Site ROD

Action-Specific ARARs/TBCs			
Action	**Requirement**	**Prerequisite**	**Citation**
Storage and processing of non-hazardous waste	No person shall store, process, or dispose of solid waste except as authorized at a permitted solid waste management facility or a facility exempt from permitting under this chapter. No person shall store, process, or dispose of solid waste in a manner or location that causes air quality standards to be violated or water quality standards or criteria of receiving waters to be violated.	Management and storage of solid waste – **applicable**	F.A.C. 62 701.300(1)(a) and (b)
Waste Transportation – Primary and Secondary Wastes			
Transportation of *hazardous materials*	Shall be subject to and must comply with all applicable provisions of the HMTA and HMR at 49 CFR 171–180 related to marking, labeling, placarding, packaging, emergency response, etc.	Any person who, under contract with a department or agency of the federal government, transports "in commerce," or causes to be transported or shipped, a hazardous material – **applicable**	49 CFR 171.1(c)
Transportation of hazardous waste *off–site*	Must comply with the generator standards of Part 262 including 40 CFR 262.20–23 for manifesting, Sect. 262.30 for packaging, Sect. 262.31 for labeling, Sect. 262.32 for marking, Sect. 262.33 for placarding,	Preparation and initiation of shipment of hazardous waste off–site –**applicable**	40 CFR 262.10(h); F.A.C. 62-730.160
Transportation of samples (i.e. contaminated soils and wastewaters)	Are not subject to any requirements of 40 CFR Parts 261 through 268 or 270 when: • the sample is being transported to a laboratory for the purpose of testing; or • the sample is being transported back to the sample collector after testing • the sample is being stored by sample collector before transport to a lab for testing	Samples of solid waste or a sample of water, soil for purpose of conducting testing to determine its characteristics or composition – applicable	40 CFR 261.4(d)(1)(i)–(iii) F.A.C. 62-730.030
	In order to qualify for the exemption in 40 CFR 261.4 (d)(1)(i) and (ii), a sample collector shipping samples to a		40 CFR 261.4(d)(2) 40 CFR 261.4(d)(2) (ii)(A) and

Table 8 - Action-specific ARARs and TBCs for the Arkla Terra Site ROD

Action-Specific ARARs/TBCs			
Action	**Requirement**	**Prerequisite**	**Citation**
	laboratory must: • Comply with U.S. DOT, U.S. Postal Service, or any other applicable shipping requirements. • Assure that the information provided in (1) thru (5) of this section accompanies the sample. • Package the sample so that it does not leak, spill, or vaporize from its packaging.		(B) F.A.C. 62-730.030

ARAR = applicable *or* relevant and appropriate requirement
CFR = Code of Federal Regulations
CWA = Clean Water Act
F.A.C. = Florida Administrative Code, Chapters as specified
F.S. = Florida Statutes
HAP =hazardous air pollutant
HMTA = Hazardous Materials Transportation Act
HMR = Hazardous Materials Regulations
RCRA = Resource Conservation and Recovery Act
TBC = To Be Considered guidance
TCLP = toxicity characteristic leaching procedure
UHCs = underlying hazardous constituents
USDW = Underground Sources of Drinking Water
UTS = Universal Treatment Standards
VOC = volatile organic compound

[i] The designated number of wells, sampling time frames/frequency, and specific parameters for analyses will be provided in a Monitoring Plan that is included in a CERCLA post-ROD document prepared as part of the Remedial Design or Remedial Action which is approved by the EPA and the FDEP.

TABLE 9
EVALUATION CRITERIA FOR SUPERFUND REMEDIAL ALTERNATIVES
ARKLA TERRA SITE

Threshold Criteria	***Overall Protection of Human Health and the Environment:*** This criterion addresses whether an alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and or institutional controls.
	Compliance with Applicable or Relevant and Appropriate Requirements (ARARs): This criterion addresses whether a remedy will meet Federal and state environmental statutes, regulations, and other promulgated requirements that pertain to the site, or whether a waiver is justified.
Balancing Criteria	***Long-Term Effectiveness and Permanence***: This criteria refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met.
	Reduction of Toxicity, Mobility, or Volume Through Treatment: This criterion evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
	Short-Term Effectiveness: This criterion addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction and operation of the remedy until cleanup levels are achieved.
	Implementability: This criterion addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental agencies are also considered.
	Cost: This criterion includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to - 30 percent.
Modifying Criteria	***State/Support Agency Acceptance:*** This criterion considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI FS and Proposed Plan.
	Community Acceptance: This criterion considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

TABLE 10
COMPARATIVE ANALYSIS OF ALTERNATIVES– ONSITE GROUNDWATER
ARKLA TERRA SITE

Evaluation Criteria	**Alternative OGW-1:** No Action	**Alternative OGW-2:** Monitored Natural Attenuation with ICs	**Alternative OGW-3:** Emulsified Zero-Valent Iron (EZVI) and MNA	**Alternative OGW-4:** Pump and Treat with *Ex situ* Air Stripping
Threshold Criteria				
Overall Protection of Human Health and the Environment	Not protective	OGW 2 alternative provides both short-term and long-term protection by reducing the toxicity of the contaminants through treatment and reducing potential risks from contaminated vapor inhalation exposure. ICs associated with this alternative provide protection against ingestion and inhalation exposure threats. Implementation of the monitoring program will track the progress of the remedy and evaluate the long-term effectiveness of the remedy	Overall protection of human health and the environment is achieved by Alternative OGW 3. This alternative reduces the toxicity of the contaminants through treatment and minimizes potential risks from contaminated vapor inhalation exposure. ICs associated with this alternative provide protection against ingestion and inhalation exposure threats. Implementation of the monitoring program will track the progress of the remedy and evaluate the long-term effectiveness of the remedy	Alternative OGW 3 achieves Overall protection of human health and the environment. This alternative provides overall protection through active treatment and minimizes potential risks from contaminated vapor inhalation exposure. ICs associated with this alternative provide protection against ingestion and inhalation exposure threats.
Compliance with ARARs	Does not meet	This alternative would comply with all ARARs identified for the Arkla Terra Site	This alternative would comply with all ARARs identified for the Arkla Terra Site	This alternative would comply with all ARARs identified for the Arkla Terra Site

TABLE 10 (CONTINUED)
COMPARATIVE ANALYSIS OF ALTERNATIVES– ONSITE GROUNDWATER
ARKLA TERRA SITE

Evaluation Criteria	**Alternative OGW-1:** No Action	**Alternative OGW-2:** Monitored Natural Attenuation with ICs	**Alternative OGW-3:** Emulsified Zero-Valent Iron (EZVI) and MNA	**Alternative OGW-4:** Pump and Treat with *Ex situ* Air Stripping
Primary Balancing Criteria				
Long-Term Effectiveness and Permanence	Residual risk remains	After the completion of the remedy period, this alternative will provide long-term effectiveness and permanence of the solution as the Site groundwater contamination will be remediated to levels below the RAO levels and natural attenuation of the contaminated groundwater will continue to occur even after the RAOs are achieved	Long-term effectiveness and permanence of the remedy is achieved through this remedy as the contaminated groundwater will be remediated to levels below the RAO levels and natural attenuation of the groundwater contamination will continue to occur even after the RAOs are achieved	This remedy achieves long-term effectiveness and permanence of the remedy to most part. After peak removal of contaminants, back diffusion in to groundwater due to adsorption and desorption would be detrimental factor of this remedy
Reduction of Toxicity, Mobility, or Volume through Treatment	None	This alterative will reduce the toxicity and volume through treatment but will not be able to stop the mobility of the contaminants	This alterative will reduce the toxicity and volume through treatment but will not be able to stop the mobility of the contaminants	This alterative will reduce the toxicity, mobility, and volume through treatment.
Short-Term Effectiveness	No impacts	This alternative has minimal disturbances during installation of monitoring wells and abandonment of monitoring wells and poses minimal short-term risks to the Site workers. Dermal contact and ingestion risks will be mitigated through implementation of a site-specific HASP	This alternative has minimal disturbances during installation of monitoring wells and abandonment of monitoring wells. Periodic injection of EZVI and microbes poses minimal short-term risks to the Site workers. These risks, which include dermal contact and ingestion, will be mitigated through implementation of a site-specific HASP	The pump and treatment alternative involves moderate level of intrusive construction using moderate level equipment, and earth disturbing activities. During remedy construction period, short-term exposure to workers from contaminated water and soil as well as from inhalation is possible. Nearby human population may also be exposed to construction related dust. These risks, which include dermal contact and ingestion risks, will be mitigated through implementation of a site-specific

TABLE 10 (CONTINUED)
COMPARATIVE ANALYSIS OF ALTERNATIVES– ONSITE GROUNDWATER
ARKLA TERRA SITE

Evaluation Criteria	**Alternative OGW-1:** No Action	**Alternative OGW-2:** Monitored Natural Attenuation with ICs	**Alternative OGW-3:** Emulsified Zero-Valent Iron (EZVI) and MNA	**Alternative OGW-4:** Pump and Treat with *Ex situ* Air Stripping
				HASP, air monitoring, and engineering controls.
Implementability	High	This alternative is easy to implement and involves simple drilling machinery that is widely used in the industry. ICs are also easy to implement and commonly used on superfund sites	This alternative is easy to implement and involves simple drilling machinery that is widely used in the industry. ICs are also easy to implement and commonly used on superfund sites	This alternative has moderate level of difficulty to implement and involves drilling machinery for extraction wells and digging equipment for laying out pipes, etc. Pumping and air stripping equipment is routinely used in the industry and workers with expertise are readily available. ICs are also easy to implement and commonly used on superfund sites

Notes:
ARAR Applicable or Relevant and Appropriate Requirement
EZVI Emulsified Zero Valent Iron
HASP Health and Safety Plan
ICs Institutional Controls
MNA Monitored natural attenuation
RAOs Remedial Action Objectives

TABLE 11
COMPARATIVE ANALYSIS OF ALTERNATIVES– OFFSITE GROUNDWATER
ARKLA TERRA SITE

Evaluation Criteria	**Alternative DGW-1:** No Action	**Alternative DGW-2:** Municipal Water Supply and MNA with ICs	**Alternative DGW-3:** Point-of-Entry Treatment and MNA with ICs
Threshold Criteria			
Overall Protection of Human Health and the Environment	Not protective	DGW 2 alternative provides overall protection of human health and the environment by providing clean alternate water supply (Municipal Water). Natural attenuation will reduce the toxicity of the contaminants through treatment. ICs associated with this alternative provide protection against ingestion and inhalation exposure threats to non-potable users. During offsite monitoring well installations, measures will be required to protect site workers from exposure to contaminated groundwater. Implementation of the monitoring program will track the progress of the remedy and evaluate the long-term effectiveness of the remedy	This alternative will provide overall protection of human health and the environment provided the user replaces the point of entry carbon filters in a timely manner. When used properly, the carbon filtered water will reduce or eliminate inhalation and ingestion exposure to the consumer.
Compliance with ARARs	Does not meet	This alternative would comply with all ARARs identified for the Arkla Terra Site	This alternative would comply with all ARARs identified for the Arkla Terra Site
Primary Balancing Criteria			
Long-Term Effectiveness and Permanence	Residual risk remains	After the completion of the remedy period, this alternative will provide long-term effectiveness and permanence of the solution as the offsite groundwater contamination will be remediated to levels below the RAO levels and natural attenuation of the contaminated groundwater will continue to occur even after the RAOs are achieved	After the completion of the remedy period, this alternative will provide long-term effectiveness and permanence of the solution as the offsite groundwater contamination will be remediated to levels below the RAO levels and natural attenuation of the contaminated groundwater will continue to occur even after the RAOs are achieved
Reduction of Toxicity, Mobility, or Volume through Treatment	None	This alterative will reduce the toxicity and volume through treatment but will not be able to stop the mobility of the contaminants	This alterative will reduce the toxicity and volume through treatment but will not be able to stop the mobility of the contaminants

TABLE 11 (CONTINUED)
COMPARATIVE ANALYSIS OF ALTERNATIVES– OFFSITE GROUNDWATER
ARKLA TERRA SITE

Evaluation Criteria	**Alternative DGW-1:** No Action	**Alternative DGW-2:** Municipal Water Supply and MNA with ICs	**Alternative DGW-3:** Point-of-Entry Treatment and MNA with ICs
Short-Term Effectiveness	No impacts	This alternative has minimal disturbances during installation of monitoring wells and poses minimal short-term risks to the Site workers. Dermal contact and ingestion risks will be mitigated through implementation of a site-specific HASP	This alternative has minimal disturbances during installation of POE filters and installation of monitoring wells for MNA and poses minimal short-term risks to the Site workers. Dermal contact and ingestion risks will be mitigated through implementation of a site-specific HASP
Implementability	High	This alternative is easy to implement and involves simple drilling machinery that is widely used in the industry. ICs are also easy to implement and commonly used on superfund sites	This alternative is easy to implement and involves installing filters at each residence. Drilling machinery for monitoring well installation is widely used in the industry. ICs are also easy to implement and commonly used on superfund sites

Notes:

ARAR Applicable or Relevant and Appropriate Requirement
HASP Health and Safety Plan
ICs Institutional Controls
MNA Monitored natural attenuation
POE Point of Entry
RAOs Remedial Action Objectives

TABLE 12
REMEDIAL ALTERNATIVES COST SUMMARY
ARKLA TERRA SITE

Alternative	Capital Cost[1]	O&M Cost[2]	Net Present Worth Cost[3]	Total Cost
Onsite Groundwater Alternatives				
OGW-1: No Action	$0	$0	$0	$0
OGW-2: Monitored Natural Attenuation with ICs	$198,000	$640,000	$660,000	$840,000
OGW-3: Emulsified Zero-Valent Iron (EZVI) and MNA	$660,000	$590,00	$1,090,000	$1,250,000
OGW-4: Pump and Treat with *Ex situ* Air Stripping	$1,329,000	$870,000	$1,960,000	$2,100,000
Offsite Groundwater Alternatives				
DGW-1: No Action	$0	$0	$0	$0
DGW-2: Municipal Water Supply and MNA with ICs	$199,000	$530,000	$580,000	$730,000
DGW-3: Point-of-Entry Treatment and MNA with ICs	$125,000	$790,000	$695,000	$910,000

Notes:
All costs are rounded to two the nearest thousands of dollars.

1 Capital costs include site preparation, mobilization/demobilization, installation, abandonment of wells, construction of treatment system (OGW #4) and connection of municipal water system (DGW #2)
2 O&M costs include groundwater monitoring for MNA and five-year reviews, Pump and Treat operations and monitoring, and replacement filters
3 Net Present Worth costs are reported as net present worth estimate based on a 7% discount rate for 15 years.

APPENDICES

A HHRA Table 1 Selection of Exposure Pathways

B Cost Estimate Details for Selected Remedy

C Responsiveness Summary Administrative

D Record Index

Appendix A: HHRA Table 1 Selection of Exposure Pathways

Table 1

SELECTION OF EXPOSURE PATHWAYS

Arkla Terra Property Site, Florida

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/ Future	Groundwater	Groundwater	Potable Water Supply Well Installed in Floridan Aquifer	Resident	Child	Dermal Absorption	on-site and off-site	Quantitative	Potential risk posed to receptors who use contaminated water as a potable water supply. In the absence of land use controls, the Site may be re-developed for residential use. Accordingly, potential risk posed to future receptors who may use groundwater as a potable water supply.
						Ingestion	on-site and off-site	Quantitative	
					Adult	Dermal Absorption	on-site and off-site	Quantitative	
						Ingestion	on-site and off-site	Quantitative	
					Age-Adjusted	Dermal Absorption	on-site and off-site	Quantitative	
						Ingestion	on-site and off-site	Quantitative	
				Industrial Worker	Adult	Dermal Absorption	on-site	Quantitative	In the absence of land use controls, potential risk posed to the on-site future industrial worker who may use groundwater as a potable water supply.
						Ingestion	on-site	Quantitative	
				Other Receptors	All	Dermal Absorption	on-site and off-site	None	Other receptors (trespasser/site visitor and construction worker) exposure to groundwater under future site conditions is expected to be negligible.
						Ingestion	on-site and off-site	None	
		Air	Volatile Emissions While Showering	Resident	Adult	Inhalation	on-site and off-site	Quantitative	Potential risk posed to offsite (current and future) and on-site (future only) receptors who uses contaminated water as a potable water supply.
					Child				
				Industrial Worker	Adult	Inhalation	on-site	None	Industrial worker is not expected to shower during work hours onsite.
				Other Receptors	Adult	Inhalation	on-site and off-site	None	Other receptors (trespasser/site visitor and construction worker) exposure to groundwater under future site conditions is expected to be negligible.
			Indoor Air	Resident	Child	Inhalation	on-site and off-site	Quantitative	In the absence of land use controls, residents could be exposed to volatile compounds that accumulate in future residences.
					Adult	Inhalation	on-site and off-site	Quantitative	
					Age-Adjusted	Inhalation	on-site and off-site	Quantitative	
				Commercial/Industrial Worker	Adult	Inhalation	on-site and off-site	Quantitative	Commercial/Industrial workers could be exposed to volatile compounds that accumulate in buildings.
				Other receptors	Adult and Adolescent	Inhalation	on-site and off-site	None	Other receptors are unlikely to spend a significant length of time in a future building on-site.
Current/ Future	Soil	Site Soil	Site Surface Soil and Fugitive Dust/ Volatile Emissions From Surface Soil.	Resident (Future Only)	Adult	Dermal Absorption	On-site	Quantitative	In the absence of land use controls, residents could be in contact with surface soil.
						Ingestion	On-site		
						Inhalation	On-site		
					Child	Dermal Absorption	On-site	Quantitative	
						Ingestion	On-site		
						Inhalation	On-site		
					Age-Adjusted	Dermal Absorption	On-site	Quantitative	
						Ingestion	On-site		
						Inhalation	On-site		
				Trespasser/Visitor	Adolescent	Dermal Absorption	On-site	Quantitative	Trespassers/visitors could contact surface soil.
						Ingestion			
						Inhalation			
				Industrial/Commercial Worker	Adult	Dermal Absorption	On-site	Quantitative	Industrial workers may be exposed to surface soil, fugitive dust and volatile emissions.
						Ingestion	On-site	Quantitative	
						Inhalation	On-site	Quantitative	
			Surface Soil and Subsurface soil	Construction Worker (Future Only)	Adult	Dermal Absorption	On-site	Quantitative	Construction workers could contact surface and subsurface soil during excavating operations.
						Ingestion	On-site	Quantitative	
						Inhalation	On-site	Quantitative	
		Air	Indoor Air	Resident (Future Only)	Child	Inhalation	On-site	Quantitative	In the absence of land use controls, residents could be exposed to volatile compounds that accumulate in future residences.
					Adult	Inhalation	On-site	Quantitative	
					Age-Adjusted	Inhalation	On-site	Quantitative	
				Commercial/Industrial Worker	Adult	Inhalation	On-site	Quantitative	Commercial/Industrial workers could be exposed to volatile compounds that accumulate in buildings.
				Other receptors	Adult and Adolescent	Inhalation	On-site	Quantitative	Other receptors are unlikely to spend a significant length of time in a future building on-site.

Appendix B: Cost Estimate Details for Selected Remedy

TABLE B1
COST ESTIMATE
ONSITE GROUNDWATER ALTERNATIVES
ALTERNATIVE OGW-2: MONITORED NATURAL ATTENUATION AND INSTITUTIONAL CONTROLS
Arkla Terra Site
Thonotosassa, Florida

ITEM DESCRIPTION	QTY	UNIT	UNIT PRICE	COST	SUBTOTAL
CAPITAL COST					
DIRECT COST -					
Contractor (Planning/Preparation)	100	hour	$100	$10,000	
Well installation (2", 55-65 feet, PVC)	2	each	$3,000	$6,000	
Well Abandonment	9	each	$2,500	$23,000	
Field oversight					
Car/Gas	1	wk	500	500	
Per diem (hotel/food)	5	day	168	1680	
Field Team (Oversight)	40	hour	80	8000	
Institutional Controls (access/deed resitrictions)	1	LS	$1,000	$1,000	
Engineering Controls (fence, signage, land maintenance)	1	LS	$7,000	$7,000	
TOTAL DIRECT COST					**$50,180**
INDIRECT COST -					
Project (EPA) oversight	100	Hours	$90	$9,000	
EPA project trips - 15 (3-day trip)	360	Hours	$90	$32,400	
Per diem	45	Each	$168	$7,560	
SUBTOTAL					$48,960
DESIGN (5%)					2000
BONDS (2%)					1000
PERMITTING (1%)					
TOTAL INDIRECT COST					**$51,960**
SUBTOTAL CAPITAL COST					**$102,000**
CONTINGENCY (20%)					20000
				TOTAL CAPITAL COST	**$122,000**
O&M COST					
O&M-Monitored Natural Attenuation Recurring cost Info					
Car/Gas	1	wk	500	500	
Per diem (hotel/food)	6	day	168	1008	
Field Team Labor	60	hour	100	6000	
TOTAL				**7500**	
Equipment	1	Set	2100	2100	
Analytical (9 VOC, natural attenuation, and field tests)	1	Set	1500	1500	
Groundwater Monitoring Report	16	hour	100	1600	
O&M-Monitored Natural Attenuation (Years 1-5)					
Labor	20	quarterly	$7,500	$150,000	
Equipment/Materials	20	quarterly	$2,100	$42,000	
Analytical	20	quarterly	$1,500	$30,000	
Groundwater Monitoring Report	20	quarterly	$1,600	$32,000	
Institutional Control Maintenance	5	annual	$1,000	$5,000	
Activated Carbon Drum Replacement (every 3 years)	1	each	$600	$600	
				SUBTOTAL	$260,000
O&M -Monitored Natural Attenuation (Years 6-10)					
Labor	10	semiannual	$7,500	$75,000	
Equipment/Materials	10	semiannual	$2,100	$21,000	
Analytical	10	semiannual	$1,500	$15,000	
Groundwater Monitoring Report	10	semiannual	$1,600	$16,000	
Institutional Control Maintenance	5	annual	$1,000	$5,000	
Activated Carbon Drum Replacement (every 3 years)	2	each	$600	$1,200	
				SUBTOTAL	$130,000
O&M-Monitored Natural Attenuation (Years 11-15)					
Labor	5	annual	$7,500	$37,500	
Equipment/Materials	5	annual	$2,100	$10,500	
Analytical	5	annual	$1,500	$7,500	
Groundwater Monitoring Report	5	annual	$1,600	$8,000	
Institutional Control Maintenance	5	annual	$1,000	$5,000	
Activated Carbon Drum Replacement (every 3 years)	2	each	$600	$1,200	
				SUBTOTAL	$70,000
Five-year Reviews	3	each	$24,000	$72,000	$72,000
				SUBTOTAL O&M COST	$530,000
				CONTINGENCY (20%)	$110,000
				TOTAL O&M COST	**$640,000**
Total Capital and O & M					$760,000

PROJECT MANAGEMENT (10%)	**$76,000**
OGW-2 ALTERNATIVE TOTAL	**$840,000**
OGW-2 ALTERNATIVE PRESENT WORTH	**$660,000**

Notes:

1. MW-1 well be abandoned and replaced with two new 2-inch, PVC nested wells in overburdent (40-50 feet bgs) and floridan acquifer (60-70 feet bgs)
2. Abandon all 8 extraction wells
3. 800 ft of 6 feet chain link fencing ($17/ft) for north and south property boundaries and four superfund signs. Site maintenance for initial gravel road, grubbing and clearing
4. Oversight perdiem for monitoring well and fence installation activities is assumed for a 2 person, 5 day event.Assumed 10 hrs/day/person work day
5. Each on-site Monitored Natural Attenuation sampling will take 2 people, 3 days, 10 hour/day
6. Institutional Control maintenance includes repairs of fence, monioring wells, roads, etc.
7. Sample analytical cost is based on current commerical laboratory cost
8. Activated carbon drum is for treating purge water and assumes replacement of carbon every 3 years.
9. Monitored Natural Attenuation monitoring is assumed to last 15 years
10. Three five-year reviews are assumed
11. EPA oversight at 16 hours/month for 15 years (180 months)
12. Present Worth is based on 7% rate over a 15 year period

TABLE B2
COST ESTIMATE
OFFSITE GROUNDWATER ALTERNATIVES
ALTERNATIVE DGW-2: MUNICIPAL WATER SUPPLY PLUS MONITORED NATURAL ATTENUATION WITH INSTITUTIONAL CONTROLS
Arkla Terra Site
Thonotosassa, Florida

ITEM DESCRIPTION	QTY	UNIT	UNIT PRICE	COST	SUBTOTAL
CAPITAL COST					
DIRECT COST -					
Municipal Connection by the City	15	LS	$3,600	$50,000	
Contractor Coordination	480	hours	$100	$50,000	
EPA Field Labor	40	Hours	$90	$4,000	
EPA Per diem (hotel/food)	10	day	$168	$2,000	
Car/gas	2	week	$450	$1,000	
TOTAL DIRECT COST					**107,000**
INDIRECT COST -					
Project (EPA) oversight (4 hrs/house)	60	Each	$90	$5,400	
SUBTOTAL INDIRECT COST					5,400
PERMITTING (1%)					1,000
TOTAL INDIRECT COST					6,400
SUBTOTAL CAPITAL COST					113,000
CONTINGENCY (20%)					20,000
				TOTAL CAPITAL COST	**133,000**
O&M- Unit cost Info					
Car/Gas	2	wk	$500	$1,000	
Per diem (hotel/food)	6	day	$168	$1,008	
Field Team (2 personnel, 3 10-hr days)	60	hour	$100	$6,000	
Total VOCs +NA parameters (water)	1	event	$3,300	$3,300	
Equipment/Maerial per event	1	Each	$2,200	$2,200	
Groundwater Monitoring Report	16	hour	$100	$1,600	
O&M-Monitored Natural Attenuation (1-2 years)					
Labor	8	quarterly	$7,500	$60,000	
Equipment/Materials	8	quarterly	$2,200	$17,600	
Analytical	8	quarterly	$3,300	$26,400	
Groundwater Monitoring Report	8	quarterly	$1,600	$12,800	
Institutional Control Maintenance	2	annual	$1,000	$2,000	
Activated Carbon Drum Replacement (every 3 years)	0	each	$600	$0	
				SUBTOTAL	$120,000
O&M-Monitored Natural Attenuation (3-5 years)					
Labor	6	semiannual	$7,500	$45,000	
Equipment/Materials	6	semiannual	$2,200	$13,200	
Analytical	6	semiannual	$3,300	$19,800	
Groundwater Monitoring Report	6	semiannual	$1,600	$9,600	
Institutional Control Maintenance	3	annual	$1,000	$3,000	
Activated Carbon Drum Replacement (every 3 years)	1	each	$600	$600	
				SUBTOTAL	$91,000
O&M- Monitored Natural Attenuation (6-15 years)					
Labor	10	annual	$7,500	$75,000	
Equipment/Materials	10	annual	$2,200	$22,000	
Analytical	10	annual	$3,300	$33,000	
Groundwater Monitoring Report	10	annual	$1,600	$16,000	
Institutional Control Maintenance	10	annual	$1,000	$10,000	
Activated Carbon Drum Replacement (every 3 years)	4	each	$600	$2,400	
				SUBTOTAL	$160,000
Five-year Reviews	3	each	$24,000	$72,000	$72,000
				SUBTOTAL O&M COST	$440,000
				CONTINGENCY (20%)	$88,000
				TOTAL O&M COST	**$530,000**
Total Capital and O & M					$660,000
				PROJECT MANAGEMENT (10%)	$66,000
DGW-2 ALTERNATIVE TOTAL					$730,000
DGW-2 ALTERNATIVE PRESENT WORTH					**$580,000**

Notes:
1. Current total of houses needing connection is just over 15. We assumed 60 hours for new municipal connections
2. Municipal connection fees source is "Hllsborough County - Apply to Convert My Well to County Water".
3. Well plugging and additional plumbing is an engineers estimate
4. Natural attenuation sampling is based on 20 samples per trip, including QA/QC samples.
5. Each on-site Monitored Natural Attenuation sampling will take 2 people, 3 days, 10 hour/day
6. Sampling occurs quarterly in years 1 & 2, then bi annually in years 3, 4, & 5, and annually in years 6 through 15
7. Sample analytical cost is based on current commerical laboratory cost
8. Activated carbon drum is for treating purge water and assumes replacement of carbon every 3 years.
9. Monitored Natural Attenuation monitoring is assumed to last 15 years
10. Three five-year reviews are assumed
11. Present Worth is based on 7% rate over a 15 year period

Appendix C: Responsiveness Summary

APPENDIX C: RESPONSIVENESS SUMMARY

Table of Contents

Responsiveness Summary

1.0 INTRODUCTION

This responsiveness summary provides a summary of the significant comments and criticisms submitted by the public on the U.S. Environmental Protection Agency's (EPA's) June 2018 Proposed Plan for the Arkla Terra Property Superfund Site, and the EPA's responses to those comments and concerns. A responsiveness summary is required by the National Oil and Hazardous Substances Pollution Contingency Plan at 40 C.F.R. § 300.430(f)(3)(F). All comments summarized in this document have been considered in the EPA's final decision in the selection of a remedy to address the contamination at the Site.

2.0 SUMMARY OF COMMUNITY RELATIONS ACTIVITES

The June 2018 Proposed Plan, which identified the EPA's preferred remedy and the basis for that preference, including supporting analyses and information, was made available to the public in the administrative record file at the EPA Region 4 Records Center in its' Atlanta office, the Seffner-Mango Library, and an EPA Region 4 webpage.

The notice of availability of the above-referenced documents and the announcements of a public meeting date were distributed to approximately 250 addresses, including local residents living near the site and local government, on Monday, June 18, 2018. A public notice announcing the opportunity for public comment and the public meeting date/location ran in the Tampa Bay Times on Friday, June 23, 2018. A public comment period was open from June 22, 2018 to July 23, 2018. The EPA's response to the comments received during this period is included in the Responsiveness Summary, which is part of this Record of Decision.

On June 27, 2018, the EPA conducted a public meeting in the evening at the Seffner-Mango Library to inform local officials and interested citizens about the Superfund process, to review current and planned remedial activities at the Site, to discuss the Proposed Plan, and to listen to and respond to questions and comments from the area residents and interested parties. According to the sign-in-sheets, a total of 25 people were in attendance at the public meeting, 13 of which were residents.

3.0 OVERVIEW

The EPA's selected remedy for onsite contaminated groundwater includes Monitored Natural Attenuation (MNA) and Land Use Controls. The EPA's selected remedy for offsite contaminated groundwater is alternate (municipal) water supply with MNA and Institutional Controls. Performance monitoring will be required to determine the remedy's effectiveness in meeting pre-set remedial goals. Because this alternative will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a CERCLA statutory review will be conducted every five years after the completion of the remediation to ensure that the remedy is, or will be, protective of human health and the environment.

4.0 SUMMARY OF COMMENTS AND RESPONSES

Three emails were received during the comment period from June 22, 2018 to July 23, 2018. Copies of the emailed comments are provided in Appendix D.1. A summary of the comments contained in the letters and the EPA response to those comments are presented below.

A copy of the transcript from the public meeting is provided as an attachment to this Record of Decision as Appendix D.2 and is available in the Administrative Record, which is available at the following information repositories:

Thonotosassa Branch Library
10715 Main Street
Thonotosassa, FL 33592
(813) 273-3652

USEPA Region 4 Records Center 61 Forsyth Street
Atlanta, GA 30303
(404) 562-8561

Electronic documents are posted at the EPA Superfund webpage:
https://www.epa.gov/superfund/arkla-terra

During the public comment period from June 22, 2018 to July 23, 2018, EPA received one email from the resident community. A summary of the comments during the public meeting and the comment received during the public comment period; and EPA's response to these comments are below.

Comment:

- How much time has elapsed since the discovery until our proposed plan right now?

EPA Response:

- *State started investigations in 1990s.*

Comment:

- Are these chemicals odorless, tasteless, and invisible in the water so you can't see anything floating in the water, can't smell or taste anything?
- Is there a smell or taste to these chemicals above the MCL level?

EPA Response:

- *At maximum contaminant levels (MCLs) PCE and TCE are odorless and tasteless.*
- *Florida State: At certain high levels, one would smell it. Smell is real pungent, sweet smell, like one experiences at a dry cleaner.*

Comment:

- How many residents need hook up in the target area? And, if so, is that going to be enough to satisfy? Are you going to be under budget or over budget?
- Within the next 20 to 30 years, then, this diagram will be a lot different?

EPA Response:

- *Back in the early 2000s, about 120 residents in the community were hooked up. Some people chose not to be hooked up at that time. Properties numbering less than 20 are eligible for hookups. Of these 20 properties, some of them are vacant lots. Some of the properties were not interested in a hookup when they were asked back in 2000, and they still may not be interested in hookup.*
- *EPA believes that in the next three years the off-site plume south of Highway 301 may be below MCLs. It is anticipated that the on-site plume will be below MCLs in the next 13-year time frame.*

Comment:

- Is the plume traveling south from the Arkla Terra property and how EPA knows that the concentrations are not increasing?

EPA Response:

- *EPA has been collecting groundwater samples for the past 10 years. TCE was detected in offsite monitoring wells and residential wells. Only five wells exhibited TCE concentrations exceeding the Florida criteria of 3 µg/L. Prior to thermal treatment, the lateral extent of the offsite plume extended from EPA-7I south to approximately 108th Street, approximately 3,000 feet in length, and was approximately 800 feet wide at its largest area. After the thermal treatment of onsite soil, the plume has decreased in size to approximately 700 feet in length and is continuing to shrink.*

APPENDIX C.1 – COMMENT LETTERS DURING PUBLIC COMMENT PERIOD

Comment:

- A resident expressed concern about how water lines were previously installed in their community. According to the resident, the installation was disruptive and damaged personal property.

EPA Response:

- *If new water lines are required, EPA will ensure that they are done properly following local and state regulations.*

Comment:

- A resident expressed concern about the safety of their drinking water.

EPA Response:

- *If the resident is within the footprint of the plume and is using a potable well, they will be offered a hookup under the Selected Remedy. Additional information has been provided to the Thonotosassa community regarding drinking water from household wells.*

APPENDIX C.2 – PUBLIC MEETING TRANSCRIPT JUNE 27, 2018

In The Matter Of:

Proposed Plan Public Meeting
For The Arkla Terra Property Sity

June 27, 2018

Michael Musetta & Associates, Inc.
One Tampa City Center, Suite 3400
201 North Franklin Street
Tampa, Florida 33602
Phone: (813) 221-3171; Fax: (813) 225-1714

Original File 062718 EPA meeting.txt
Min-U-Script® with Word Index

PROPOSED PLAN PUBLIC MEETING FOR
THE ARKLA TERRA PROPERTY SITE

DATE: June 27, 2018

TIME: 6:04 p.m. to 6:49 p.m.

PLACE: 410 North Kingsway Road
Seffner, Florida

Pages 1 to 33

APPEARANCES:

BETH WALDEN
EPA Remedial Project Manager
61 Forsyth Street, SW
Atlanta, Georgia 30303
(404) 562-8814

ANGELA MILLER
EPA Community Involvement Coordinator
61 Forsyth Street, SW
Atlanta, Georgia 30303
(404) 562-8561

MS. WALDEN: We'll go ahead and get started. So my name is Beth Walden. I'm out of the Atlanta office for the Environmental Protection Agency. This is Angela Miller; she is also out of the Atlanta office for EPA.

I'm going to let Angela open the meeting up. We don't think this will take any more than 10 minutes. We could make it two hours, but we figured you guys came tonight because you really have specific questions that you want answered, so we want to get to those as quickly as we can. So we'll give you the broad brush of where we are, where we've been, and where we're going.

Okay. Angela?

MS. MILLER: All right. First of all, thank you so much for coming out here. We really appreciate it. We're excited. This might be the most we've had at one of our meetings. It might be the cookies, I don't know, dark chocolate, the table. I don't know, but thank you so much for coming.

Just a quick agenda. Again, thank you for coming out. We have several different agencies represented here tonight. And I thought I had it in my hand. Here we go. We have, of course, EPA; Florida Department of Health. We have Hillsborough County Environmental Protection Commission, and -- oh, my glasses. I turned 49, and I can't see anymore all of a sudden.

MS. WALDEN: She won't wear a chain.

MS. MILLER: I'm not wearing a chain, and I'm not getting those either.

Let's see. Southwest Florida Water Management District. Did I get that right, Dave? Where is Dave? See, I can't see far away with them on. But, anyway, so we've got several different agencies here tonight, so if EPA can't answer your question, we've got other people that can help you when we get through with the presentation.

Of course, tonight, the purpose of the meeting is there's contamination, and we have a plan. There's a little bit left, and we want to take care of it. So we'll go through that tonight, we'll go through those details.

And because this is a preferred plan that EPA is proposing to the community, we have a comment period. So our comment period started Friday, June the 22nd, and it goes through July the 23rd. There's several different ways that you can comment. You can e-mail Beth. If you didn't get one of these, there's a whole section that talks about it called "public comments."

So you can send your comments to Beth saying, Oh, I love the plan, or Oh, I hate the plan. Whatever your comment is, you can e-mail them to Beth. If you're still snail mail, which my parents are, then you can write them down, and you can mail them to Beth. The address is also in there. They just have to be postmarked by July the 23rd, because that's the last day.

Tonight, I have a court reporter that is transcribing the entire meeting. So if you have a question or a comment tonight, that's going in the record as well.

Once the comment period is over, we -- Beth compiles them all, and she replies to the questions, and that document is the responsiveness summary, and it is attached to the final decision. That is record of the decision, we call it ROD. So the government would just fold up and die if we did not have acronyms. So that is the ROD, the final decision, the responsiveness summary goes in to that.

And so we're going to have a presentation, five, ten minutes, and then we're going to open it up to you guys. And I know that there's some people that want us to look up your address to see if we've sampled or when we sampled or whatever. We'll be happy to do that, too.

So we want to go through the presentation. We don't want to go too fast, because we want you to understand what we're doing. So if you have a question, please feel free to raise your hand, but so you can help me and help my court reporter from going into distress, if you would stand up -- you don't have to stand up. Not everybody's like me. You don't have to stand up, but say -- at least speak your name, and spell it if it's not Smith. Okay? So -- and then we'll have the Q and A. Again, with the Q and A, if you would stand up and state your name and spell any unusual spelling. Okay?

So here is the map that we will be referring to a lot tonight. You can see this little green dotted line. That is our plume. At the very top that has the lattice-looking thing, that's our site. So what we are talking about tonight is monitoring natural attenuation. Government calls it MNA. So we're going to be talking about MNA on the site, and we're also going to be talking about hooking up the people -- offering hookups, because we offered a while back, and some people denied it. But -- so we're going to offer hookups to the people inside the plume that are yellowed out. If you see a yellow, we're going to offer hookups. So that's what we're going to talk about tonight. That's it, in a nutshell.

Okay. So we have a plan, but we also are the government, and we don't have a responsible party, so this is funded by the government. So, by law, we have to follow a process. So I really want to explain -- summarize our process that we have to follow.

So we start out with site discovery. That's self-explanatory. The site is discovered, and then EPA does a site evaluation, and whether the site scores or not, it can be placed on the National Priorities List. That is a list of all the hazardous waste sites in the country, and this site was listed -- I cannot even remember -- 2000 --

MS. WALDEN: '9, I think.

MS. MILLER: Something like that. 2000 --

MS. WALDEN: Maybe '6. I don't remember.

MS. MILLER: Early 2000s, it was placed on the National Priorities List. That gives EPA the authority to actually do work at the site, you know, to spend Superfund money, things like that.

Our first thing is a remedial investigation, and we've already done -- the library is closing. It's not evacuating or anything. If you hear something else -- I have a pump, it beeps sometimes. Just ignore it. I'll be okay.

But the remedial investigation, we know that there's contamination out there, we just have to know how much is out there. Okay. So we do a remedial investigation. We follow that up with a feasibility study. That gives us different alternatives to say this is how you can correct the problem. And then we come to the proposed plan, and that's where we are today. That's where we are on this site. We are at the proposed plan stage.

Beth looked at all of her alternatives in the feasibility study, and the plan that she's going to present today, we feel like that is the best plan that's going to get this stuff, you know, is going to take care of it.

Remedy selection, see that ROD, record of decision and responsiveness summary. After the comment period, we have a ROD that will be signed by our division director, and it becomes the decision of the site.

And then after the remedy selection, we have remedial design. That's when we put it all together, a plan, on how we're going to do this, and it will have all the details. And usually the remedial design, remedial action will come back out, and we'll either do a meeting like this or we'll have an availability session where you can come in and ask us questions. But the remedial design are the details of our remedial action.

Then we'll go through the remedial action, and then there's an operation and maintenance period of the site. And then luckily, down the road, there is a potential to delete the site. Even when a site is deleted, unless the levels are consistent to whatever -- each site is different. We won't conduct a review of the site every five years. Most of the time we still continue to review it every five years. We come out, and we make sure that the remedy that was selected that we implemented is still effective and protective to the community, and then we can delete the site.

So you can see the process, but this is what we have to follow. As much as we would like to just implement that plan, that's the hardest part is you have to wait. But this is the process that we call it -- we call it the Superfund snake.

MS. SMITH: Are we holding questions until the end?

MS. MILLER: If you want to -- I mean, if you want.

MS. SMITH: How much time has elapsed since the discovery until our proposed plan right now?

MS. WALDEN: Let's see. We started -- EPA -- the state started investigating it in the '90s. I'll tell you what --

MS. SMITH: You'll cover it?

MS. WALDEN: I think we're going to cover it, and if I don't, why don't you remind me.

MS. MILLER: If you need us to clarify something, though, please raise your hand. Don't hesitate to raise your hand and ask us questions to clarify.

Do you have a question? Are you okay back there? Okay. I read faces, so if I see your face, I'm going to ask you -- I'm going to point you out.

Okay. I'll go ahead and turn it over to Beth.

MS. WALDEN: Okay. So is everybody familiar where the -- with where the Arkla Terra property was? Is? The Red Barn right there on Highway 301.

MS. MILLER: And the Dollar General. Somebody told me a Dollar General tonight.

MS. WALDEN: There's a landscaping business now that's right here, right?

Okay. So, basically, they became aware of the site after the state had been investigating another site down the road, and what they realized was, wow, we've got another problem out here, and they did a hookup with Hillsborough County in the early 2000s. And it took a while to figure out where the other source was coming from.

So the EPA got involved in the mid '90s and when EPA got the site from the state, the state had already collected well over 1200 samples. I mean, they had done a lot of work trying to figure out where this thing was coming from.

So, basically, what we have found out since EPA's been involved in it, the reason why we couldn't find the source of it was the source of it didn't even begin until probably about 10 to 15 feet below the subsurface -- below the surface, I mean. And what we discovered was they must have had some type of vault or somewhere where they were storing the solvent. And that sol- -- whether they were cleaning things in that vault or whether they were storing it there, I can't tell you.

But what I can tell you was it was pretty darn hard to find, and, basically, this red -- what we call a DNAPL, it's a very dense nonaqueous phase liquid. It's basically a pure product, the pure solvent. So what happens is it bleeds into -- and found its way into what we call an archaic sinkhole. I know you guys are familiar with these, but, again, the sinkhole was about at 50 feet deep, and it just migrated its way in there and has gotten into the Floridan aquifer, which is your drinking water aquifer for most folks. Most of y'all don't install your drinking water wells in the overburden, because it just doesn't yield enough water.

So it took us a couple years to figure out where that source was. We never hit really high concentrations of the solvent in all the groundwater work we did, but we knew we had about a mile plume. And so we were pretty sure that there was a DNAPL involved.

So we used this technology called in situ thermal treatment. You'll hear it called ERH, ICH, but we're just going to call it thermal treatment.

And we had goals when we started this source removal in 2012. We wanted to get the soils down below a hundred. We wanted to make sure that we could restore the overall aquifer to acceptable drinking water levels of 3, and if we could hit that on site, great, but realistically, we thought if you can hit at least 300 before it leaves the site, we're pretty sure that over time that that can naturally attenuate.

So we operated the system for about six months, and this is the footprint of where the system was that we installed, and I'm going to show you some pictures of why you would never know this was a Superfund site. It looks just like a normal, typical commercial landscaping yard, right? Well, the source was right here. So you would -- right? You would never know from aboveground.

So this is the actual system installed where you put down -- these pipes down, you conduct electricity, you heat up the soils, and what groundwater is there, you drive that contamination out into a vapor or in --

even to a water phase. And then you collect all that, and you basically remove that contamination on carbon filters, and then you ship the carbon filters out.

So we actually removed about 1500 pounds of that solvent. We achieved about a 99 percent mass reduction of that source. Very aggressive, very successful. We were very happy with the results.

So, meanwhile, even though we felt really good about taking care of that source, every quarter for many, many years since EPA had the project from the state, we began quarterly sampling. And some of you guys have been participants in that quarterly sampling. And just in the last year, we've gone to once every -- or I'm sorry -- twice a year. We'll talk about that later.

But since we started doing the RIFS, we've collected about 435 soil samples, we've collected over 3100 groundwater samples, and about 121 air samples. So a lot's been going on. Even though it's been a while, we felt like we had such good results with that source reduction and the plume was shrinking, we've just been watching it to make sure that we could pick a remedy that we wouldn't have to revisit, you know, in four or five years, et cetera.

So this is what -- the next slide I'm going to show you is what -- the cartoon version of what the plume looks like now. This is where all that DNAPL was that we drove out through the vapor in the groundwater. And then we have got -- oh. We've got some residual.

MR. SYKES: Your pointer on your computer screen is not showing up on the --

MS. WALDEN: Man, I'm working that mouse hard over here.

MS. MILLER: Remember how large that red pile was? This is it after that ERH, the thermal.

MS. WALDEN: And so you can see the red that's in the top of the limestone. Is that right, John? Dave? Limestone?

MR. SYKES: It's the clay formation above the limestone.

MS. WALDEN: So, you know, look, we couldn't drive it out of the top of that interface, so we do have residual.

So, you know, if you're looking down from an airplane, this is what the plume would look like over the neighborhood. This is where we started around 2012. This is where we were in 2016. If we were to do another map of this, that plume might even be broken up, but certainly less than what the 2016 is showing.

So, again, that upper aquifer, that overburden over that clay Hawthorn Formation, we're about 99 percent successful. We also were able to drive the mass out in the Floridan, your drinking water aquifer, by about 54 percent. And we know it's still shrinking because each time we go out and we do our sampling, we are getting, over time, a decrease in the concentrations.

So, basically, we take all that information and we feed a model, and it is modeling, but we're estimating that in that overburden, we may be able to get to below MCLs in about six years. And then from the site to off site, we feel like we're going to get to MCLs in about 13 years.

Now, if you're off site, we may even get there in the next two to three years, but EPA's looking at the entire plume where we have, still, more contamination on site, and we -- we're projecting that for, you know, the whole plume. So two years off site, about 13 years on site in the Floridan.

So what we're here tonight to talk about was, well, what are you guys going to do now? And so we want to make sure that you guys are still protected from drinking contaminated groundwater. We want to make sure that if someone were to go out there and put a building where we have that residual contamination, that they would do sampling to ensure that they don't have any volatiles that are coming up through the building. And then lastly, the goal really is to restore the whole aquifer to MCLs.

So y'all heard the term "feasibility study." So we look at different things we can do to continue treating the aquifer. I call it magic juju. Is there anything we can throw into that aquifer to get it to clean up faster? The monitored natural attenuation is, basically, over time, that plume will basically dilute. And there are some mechanisms, biologically, that will also help break it down, but it's mainly through dilution.

And then we also looked at, Okay. Can we extract it? And we did -- we divided it up two ways. We looked at it on site, and we looked at it off site. And in the end, we believe that the monitored natural attenuation put engineering controls -- meaning, if we need a fence, if we need to have signage, do we need to put some deed restrictions on that Arkla Terra property? No one's residential property. Okay? I'll cover that in just a minute.

And so we look at the cost, and so when you combine the monitored natural attenuation with hooking people up off site, we're looking at about a million and a half dollars.

I mentioned for the off-site residents, we work with the Southwest Florida Water Management District who has the responsibility for permitting wells in the Southwest Florida district.

And we have given them the plume information, and so if someone were to come and try to install a well and it's within that groundwater plume, they decide whether that person is going to be permitted to put a well. That's not going to be EPA's decision. That's going to be -- we call them SWFWMD. That's going to be their decision.

So, again, just a reminder of the properties that are definitely eligible in yellow, there may be some folks in the room that are aware of maybe they've had some historical contamination, maybe they're close to where the plume is and would like us to consider hooking them up, and we're going to be taking your names for that information.

So how quickly is this going to happen? I don't have a good feel for when we're going to get the money to do the hookups. We basically are an NPL site that has chosen a remedy, and now headquarters -- EPA headquarters decides when this site gets money versus all the other sites in the country. I think we might be in a fortunate situation. We're going to be talking with Hillsborough County to see if there's anything we can do to expedite getting those hookups done.

So before I turn it over to Q and A, I just want to let you guys know where you can find the information. You don't have to carry the books out. You don't have to carry all the paper out. You can either go to the library, they have, I think, a disk of all the information. We also have a website where you can get any of this information from our website, and that is on that -- I do want you to leave with a one-pager, at least, because that has the website where you can look at all the documents.

MS. MILLER: And all of these are on there.

MS. WALDEN: Yeah. So what I wanted to share with you was we have all the work that we've done in our six inches of material. We have the 25-page version of it, and then we have the two-page version of it, but it's the same information. It's just how deep of a dive do you want to go into getting the information.

MS. MILLER: This is what I understand, so that's why I created this one.

MS. WALDEN: And then if you have a private well, I just want you to take this home as well. I have learned over my many years of doing this, when you own a private well, nobody is looking out for you. It is the homeowner's responsibility to make sure that their drinking water is safe. You know, in this situation because it's on the NPL site or maybe it can be on the state Superfund site, we will monitor certain wells, but we don't monitor all the wells. So I just want you guys to understand that, because there's been heartbreaking stories over the years with folks not understanding and thinking someone else is taking care of them.

We have a couple fact sheets on trichloroethylene, tetrachloroethylene. We're really fortunate tonight. We do have some human health risk assessors in the room, Kevin Koporec, right? He's with EPA. I know some of you guys have questions about, okay, so I'm not above the MCL. Is my water safe to drink? And Kevin is a great resource for that. He can come up and talk about it for a minute or two, if you want, after we get to Q and A.

What else did I want to say? Does anybody else from the state or the county have anything they want to add to this before we get to Q and A?

MS. LIEHR: So the Department of Health is here as well. If you have any health concerns, questions, feel free to ask us. We have some information here about the contaminants of concern, TCE and PCE. We even have our county health department joining us. So feel free to ask us any questions if you have to -- or want to, not have to.

MS. WALDEN: Did you have a survey?

MS. LIEHR: So we gave away a survey to a couple of people. It's very broad and very -- it's a four-question survey. Do not worry about the name and address below, but this survey will help us and the EPA to identify or to evaluate if you receive the information and the information you got. And if there are any health concerns, you can put them on and we can pursue them later on that. I hope you want to fill it out. It's really simple. It shouldn't take longer than two minutes. It definitely will help us now and for the future as well.

MS. WALDEN: And so for those of you who don't necessarily, you know, want to stand up and speak in front of others, we have a couple of other ways for you to let us know. We have -- where's that --

MS. MILLER: Oh, the follow-up sheet?

MS. WALDEN: Yeah. We have a follow-up sheet. If you don't -- again, if you don't want to stand up and ask a question, we have a follow-up sheet. If you don't know whether your well has been sampled or not, we want you to let us know on that sheet if you want it sampled. If you want it sampled, I have to have one of these, it's an access authorization. Okay? And that -- so that's all I've got. Do you have anything else before we open it up?

MS. MILLER: And if you're in a hurry, you're hungry, and want to get home, you can take one of my cards and you can call me or e-mail me, and I will be glad to help you out there.

MS. LIEHR: That's not an excuse; we have snacks here.

MS. MILLER: That's true.

This -- we're going to put this up on the website, too. So if there's not enough copies or if you'd like to save some trees and just read on the computer, you can. But here's a few more left up here.

MS. WALDEN: All right. Angela, you want to -- anybody want to start us off? Or, Kevin, you want to give a blanket statement about MCLs and the --

MR. KOPOREC: Yeah, I can do that. You mentioned the MCLs --

MS. MILLER: And your name.

MR. KOPOREC: My name is Kevin Koporec, EPA human health risk assessor. Beth mentioned drinking water standards called maximum contaminant limit. We refer to them as MCLs, you know, another acronym. But, basically, EPA will -- the drinking water program for

EPA sets drinking water standards for all the chemicals that we determine could be a problem from a health risk standard point. And both of the compounds that are of concern here are tetrachlorethylene and trichloroethylene have drinking water standards. And the EPA has set those standards based on looking at health risk, looking at feasibility of cleaning up the contamination once it's there -- once it's in the drinking water supply and looking at the cost and all that and balancing out all of that and coming to this MCL for these two chemicals.

The MCL the EPA has set is five micrograms per liter or parts per billion for both of these chemicals. The state of Florida has the prerogative of going lower than the federal EPA, and they have for both of these chemicals. They have the state MCL at three micrograms per liter for both of these chemicals. And those numbers represent a health risk that's very, very low, basically, but both of them are considered to be probable human carcinogens, but at these levels, these low part per billion levels, that will not add any cancer risk to the risk that we all already have of getting cancer. I mean, the state health people can talk more to this -- better to this than I can, but we all have a risk of getting cancer just by living in our society. You know, for men it's like one in two, for women it's like one in three. And this -- and these levels of these chemicals are adding, like, minuscule amounts, like one in -- one in a million or one in a hundred thousand. So it's very low compared to the risk that we all already have.

And that's why the EPA and the state decided that it's okay for us to have these levels in our water and still be an acceptable health risk.

So anyway -- yeah, so if you're below these MCLs, then you're at a very low risk level, and we wouldn't consider that to be a problem from a health risk standpoint. If you're above the level, then it may or may not be a problem, and depending on if you think you have a real health concern, then you can, of course, talk to your doctor or talk to the health department at the county or state level or whatever needs to happen to make you feel better about your situation.

But that's kind of where we're at with the MCLs and the health risk level. And it's good that we have, at least at this site, we have chemicals that we have good, strong -- scientifically strong health risk-based levels. So that's good. Some of our sites we have kind of odd chemicals or pesticides that we don't know very much about from a health standpoint or whatever, and some of the -- some of them are like that. But this site, at least we do have a good handle on the health risk for our contaminants of concern, is what we call them. So that gives you a little bit of information.

MS. MILLER: State your name.

MS. SMITH: Melody. She got me, initially.

Are these chemicals odorless, tasteless, invisible in the water so you can't see anything floating in the water, can't smell or taste anything?

MS. WALDEN: I'm pretty sure, yes.

MR. KOPOREC: I don't know what the odor threshold is or the taste threshold, but MCL level, we're definitely at an odorless, tasteless level.

MS. SMITH: But above it, is there a smell or a taste to it?

MR. KOPOREC: Well, I'm not sure what the level would have to get to. We could look that up in, you know, scientific documents or whatever.

MS. LIEHR: At certain high levels, you would smell it. So it has like --

MR. MCCRANIE: If you've ever been to a dry cleaner, the real pungent, sweet smell, that smell you've smelled before in your lifetime, it's very similar to that. So if you're not getting that smell, then chances are you're not going to smell it.

MR. KOPOREC: The compound perchloroethylene is still used as dry cleaning solvent. So, yeah, that's a good way to look at it.

MS. WALDEN: Good question.

Yes, sir?

MR. ADKINS: Deon Adkins.

You mentioned that you guys have been meaning to have -- in the event that you have to hook up water -- public water to the people who are going to be involved -- and you guys determined the amount of residents that's in the target area, how many? And, if so, is that going to be enough to satisfy? Are you going to be under budget or over budget?

MS. WALDEN: Yeah. So I don't know if I did a good job of explaining this, but back in the early 2000s, about 120 folks in the community were hooked up. Some people chose not to be hooked up, and if you look at the properties in yellow and gray, those are the properties we've identified, and it's less than 20. And I'm not sure if we'll do the gray properties or not, because they're empty lots. There's not even a building on them.

And some of the yellow properties I know weren't interested in a hookup when they were asked back in 2000, and they still may not be.

MR. KOPOREC: So the ones in gray don't have any water supply at all right now. They're not hooked up to -- they're not hooked up to public water, and they don't have a private well.

MS. WALDEN: Yellow or gray are not hooked up. You can see the water lines are in blue, so we know we've got the mainlines. Okay. The yellow ones are ones that we consider in the plume and would be eligible for a hookup in the federal program.

Does that answer your question?

MR. ADKINS: Pretty much so. I'm just wondering is that amount going to cover if -- I mean, from what he's saying, that's pretty much self-contained and it's not spreading --

MS. WALDEN: Correct.

MR. ADKINS: -- to this point.

MS. WALDEN: Yes. And, you know, we're very confident that it won't, because when you take care of the source, you no longer have anything feeding that plume. And so what we've actually seen in this picture here is you can see the red and the orange area up near the source is no longer here in 2016.

And, in fact, we had some more recent drawings, I just didn't have time to prepare them, but the plume now we actually have broken up into two or three, and the light blue is less than three parts per billion. The green is just around the state and federal MCL, and you can see the highest yellow is 15 to 20 in 2016. And, in fact, I just looked at the data, we don't have any of the residential -- the red dot -- the red square's above 13.

So it just keeps shrinking, and that's good news because what this means is it's not done shrinking.

MR. ADKINS: Within the next 20 to 30 years, then, this diagram will be a lot different?

MS. WALDEN: We think in the next three years the off-site plume, meaning south of Highway 301, we think we may be getting pretty close to MCLs.

Now, on site, we think that's more in the 13-year time frame.

MR. ADKINS: Within 20 years?

MS. WALDEN: Yes.

MR. ADKINS: Thank you.

MS. WALDEN: You're welcome.

MS. MILLER: She'll continue to monitor that. That's the MNA, monitor.

MS. WALDEN: Yes. We will continue monitoring until the aquifer is restored to MCL.

MR. KOPOREC: So that says a lot for the treatment that was already done, obviously. A lot of sites get to these things and they haven't had any treatment done yet. So that's really a good news story for this site.

MS. MILLER: There was another question over here somewhere, I thought.

MS. WALDEN: Well, while you guys are thinking, we will be sticking around. So feel free to come up and talk to us after the meetings. Materials. Anything else? I don't want to shut down too quickly.

Yes.

MS. SMITH: That light yellow plume that's between 301 and Harney, that middle one, what's the number on that light yellow plume?

MS. WALDEN: You mean the EPA 7 I, D, and F?

MS. SMITH: I can't see it.

MR. KOPOREC: This one up here?

MS. SMITH: What's the number?

MS. MILLER: Ten to 15.

MS. SMITH: So that plume is over --

MS. WALDEN: That was two years ago, and I don't think we have anything in that well cluster because that -- I didn't want to inundate you guys with the two-hour details. We actually installed three wells at that location at three different depths, and I don't think we have anything in either of those wells that's above 20. I think that's right.

MR. KOPOREC: And you've got data from 2017; is that what you're --

MS. WALDEN: Yes. Our last round will be back out in August.

MS. SMITH: Is that yellow -- is that middle yellow, is that traveling south, is that why it's --

MS. WALDEN: I -- you know, it will have minimal movement because, again, it's -- you're dealing with, like -- groundwater flow is to the south, and it's probably not ever going to get any higher.

MS. SMITH: So that's not moving? That's not moving?

MS. WALDEN: No. In fact, it's shrinking the other way. It's shrinking back toward the site.

MR. KOPOREC: The compounds are breaking down, right?

MS. WALDEN: Yeah. And we think -- this is a tidbit. I mean, I can just go on and on. I know you want to leave. But there used to be -- or there's still irrigation wells down on the big property, and we think the -- on that big piece of property, they were growing peanuts or strawberries. So that's why the plume took the shape it did, from those pumping wells.

MS. MILLER: But that's a good -- I mean, you can see that's a significant difference. That's good.

Yes.

MS. ALDERMAN: Linda Alderman. My property -- there's a strange line that runs right next to my property up there. If you'll see where it says Harney Road, on the right hand side, is that some sort of -- going up through that crazy line, it just cuts into my property.

MS. MILLER: Right next to the word Harney.

MS. ALDERMAN: Is that just a drawing mistake, or is that -- because that is right into my property. I'm like, why is there a line there on my property?

MR. NAGAM: That's two parcels.

MR. KOPOREC: Okay. Yeah, there's not any color there. The color area --

MS. ALDERMAN: I can see it overlapping into my property, and I'm like --

MR. KOPOREC: That's a good question.

MS. MILLER: Somebody got excited.

MS. ALDERMAN: I'm like, bring that back a little bit.

MS. WALDEN: Are there any of those maps up there?

MS. MILLER: Of that map? Uh-uh. (Indicates negatively).

MS. ALDERMAN: We have one.

MS. MILLER: We can post these on the --

MS. WALDEN: Yeah. That map --
MR. KOPOREC: Can it be available on the web site?
MS. MILLER: It can be.
MS. WALDEN: If you go on the website, this 25-pager actually has the figures of interest.
MR. KOPOREC: So you can get that on the website right know, right?
MS. WALDEN: Yes. This is on the website right now. Okay?
MS. MILLER: And then when we get new maps, we'll post it on the website as well.
MS. WALDEN: And that map's in there, too.
MS. ALDERMAN: Okay.
MS. MILLER: And any time -- keep my card up on your refrigerator so you're always thinking about me. If you ever have any questions or you're wondering or whatever, just pick up the phone and call me. It doesn't matter. I answer any time. You may hear my kids screaming in the back, but I answer.
MS. WALDEN: Oh, we have some -- how many of these do you have?
MS. MILLER: I told him to bring a couple. I promise you want my version. You want my two pages.
MS. WALDEN: I say you want this. We have two, so whoever -- first come, first serve on those.

MS. MILLER: You already gave it to somebody?

MS. WALDEN: Okay. Any more questions?

MS. MILLER: And, again, it's on the website, so don't feel like you're --

MS. WALDEN: Well, we'll let you guys go. Like I said, we're happy to hang out and answer any questions that you may have. Thank y'all for coming.

MS. MILLER: Thank you so much for coming. We appreciate you. You might not want to leave right now. You might want to grab some cookies.

(Meeting concluded at 6:49 p.m.)

REPORTER'S CERTIFICATE

STATE OF FLORIDA

COUNTY OF HILLSBOROUGH

I, Alexandria Wallace, Registered Professional Reporter, certify that I was authorized to and did stenographically report the foregoing proceedings and that the transcript is a true and complete record of my stenographic notes.

I further certify that I am not a relative, employee, attorney, or counsel of any of the parties, nor am I a relative or employee of any of the parties' attorney or counsel connected with the action, nor am I financially interested in the action.

Dated this 10th day of July, 2018.

____
Alexandria Wallace, RPR

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Q

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Appendix D: Administrative Record Index

[Draft]

Administrative Record Index
for the
ARKLA TERRA PROPERTY NPL Site

FLSFN0406909

2.0 REMOVAL RESPONSE

2. 8 Removal Response Reports

1. "Performance Assessment of the Non-Time Critical Removal Action at the Arkla Terra Site, Thonotosassa, Florida," SERAS. (February 08, 2017)

2. 9 Action Memoranda

1. Action Memorandum from Beth Walden, USEPA to Franklin Hill, USEPA. Subject: Request for a Ceiling Increase and Exemption from the 12-month Statutory Limit at the Arkla Terra Property. (July 10, 2012) [Note: Due to the Confidential nature, Attachment 3 - Enforcement Addendum has been withheld. Withheld material is available, for Judicial review only, from EPA Region 4, Atlanta, Georgia].

3.0 REMEDIAL INVESTIGATION (RI)

3. 8 Interim Deliverables

1. "Remedial Implementation Plan, ET-DSP In-situ Thermal Remediation, Arkla Terra Superfund Site, Thonotosassa, Hillsborough County, Florida," McMillan-McGee Corp. (March 09, 2012)
2. "Limited-Scope Remedial Action Plan, Arkla Terra Property, Thonotosassa, Hillsborough County, Florida," WRS. (April 24, 2012)
3. "Limited-Scope Remedial Action Plan Implementation Report, Arkla Terra Property, Thonotosassa, Hillsborough County, Florida," WRS. (May 03, 2013)

3.10 Remedial Investigation (RI) Reports

1. "Remedial Investigation Feasibility Study Report, Arkla Terra Property, Thonotosassa, Hillsborough County, Florida," OTIE. (May 18, 2018)

4.0 FEASIBILITY STUDY (FS)

4.10 Proposed Plans for Selected Remedial Action

1. "Proposed Plan, Arkla Terra Property Superfund Site, Thonotosassa, Hillsborough County, Florida," USEPA. (June 2018)

9.0 STATE COORDINATION

9. 1 Correspondence

1. Memorandum of Agreement between the U.S. Environmental Protection Agency, Region 4, Superfund Division and the Southwest Florida Water Management District. (September 11, 2008)
2. Letter from Beth Walden, USEPA to David Arnold, Southwest Florida Water Management District. Subject: Request to add Arkla Terra to the 2008 Memorandum of Agreement. (November 30, 2015)

[Draft]

Administrative Record Index
for the
ARKLA TERRA PROPERTY NPL Site

13.0 COMMUNITY RELATIONS

13. 9 Fact Sheets

1. "Proposed Plan Fact Sheet, Arkla Terra Property Superfund Site, Thonotosassa, Hillsborough County, Florida," USEPA. (June 2018)