Pre-Design Investigation Work Plan: Design Track 2

Cabot/Koppers Superfund Site
Operable Units Two, Three, and Five (Koppers)
Gainesville, Florida
EPA ID: FLD980709356

Version 2
August 25, 2015

Prepared on behalf of Beazer East, Inc.

TETRA TECH

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APPROVAL

Date: 8/25/2015

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CERTIFICATION

This report has been reviewed and approved by the undersigned Florida-licensed Registered Professional Engineer. Tetra Tech prepared this report in a manner that is consistent with sound engineering practices. Except as otherwise noted, all work for this report was completed by me or by engineering staff working under my direct supervision. Furthermore, I have expertise in the discipline used in the production of this document.

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REVISION HISTORY

Version	Date	Description
1	May 13, 2015	Initial Release
2	August 25, 2015	Updated in response to comments from EPA and others

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ACRONYMS

CCA	chromated copper arsenate
COC	chain of custody
CQA	construction quality assurance
CSM	conceptual site model
DNAPL	dense non-aqueous phase liquid
EPA	United States Environmental Protection Agency
ISGS	in-situ geochemical stabilization
MSY	materials storage yard
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PEC	probable effects concentration
PID	photoionization detector
RA	remedial action
RD	remedial design
RDWP	*Remedial Design Work Plan* (Tetra Tech, Version 2, December 9, 2013)
ROD	Record of Decision
SCR	Seaboard Coast Line Railroad
SVOC	semivolatile organic compound
UFA	Upper Floridan Aquifer
VOC	volatile organic compound

1 INTRODUCTION

On behalf of Beazer East, Inc. (Beazer), Tetra Tech, Inc. (Tetra Tech) has prepared this Pre-Design Investigation Work Plan for activities at the Cabot/Koppers Superfund Site (Site) in Gainesville, Alachua County, Florida. The Site includes areas that have been environmentally impacted by activities at the former Koppers wood-treatment facility and at the former Cabot Carbon pine-tar products facility (**Figure 1**).

The Site includes five Operable Units (OUs) for Remedial Design (RD) and Remedial Action (RA):

OU1: The former Cabot Carbon facility and sediment impacts in Hogtown and Springstead Creeks attributable to the Cabot Carbon facility (Beazer has no responsibilities for OU1)

OU2: Soil and the surficial (shallow) aquifer at the former Koppers facility

OU3: The Hawthorn Group which lies below the surficial aquifer

OU4: The Upper Floridan Aquifer (UFA) which lies below the Hawthorn Group

OU5: Soils and sediments outside of the former Koppers facility property

This Work Plan pertains to OU2, OU3, and OU5.

A Consent Decree between Beazer and the United States government was entered final in the United States District Court for the Northern District of Florida on July 9, 2013. The Consent Decree requires Beazer to conduct RD and RA activities for OU2, OU3, OU4, and OU5. Beazer’s responsibilities are limited to impacts attributable to the operations at the former Koppers facility. Another party, Cabot Corporation, is responsible for activities related to OU1 and impacts attributable to the former Cabot Carbon facility.

This Work Plan is a submittal to the United States Environmental Protection Agency (EPA) per the requirements of the Consent Decree. This document is specific to the Beazer RD/RA Program for the Site.

This Work Plan describes field and laboratory activities needed to develop the RD for the following three components of the selected RA program for the Site:

- A subsurface cutoff wall,
- Stormwater controls, and
- Sediment removal downstream from the former Koppers facility.

These three components comprise Design Track 2 as defined by the *Remedial Design Work Plan* (RDWP; Tetra Tech, Version 2, December 9, 2013). Per Section 2.3.2.1 of the RDWP, this Work Plan describes the following activities to be performed at the Site:

- Soil borings along the cutoff wall alignment to assess subsurface conditions, to recover soil samples for laboratory testing, and to define wall depth.

- Laboratory testing to document the baseline hydraulic conductivity of soil deposits along the cutoff wall alignment.
- Laboratory testing to measure the hydraulic conductivity of various soil-bentonite and cement-bentonite mixtures for design of a cutoff wall.
- Laboratory testing to evaluate the compatibility between various bentonite products and various water sources that may be used to prepare soil-bentonite and cement-bentonite mixtures.
- Shallow soil borings and hydraulic conductivity tests to support design of a stormwater management system.
- Sampling and testing of sediment downstream of the Koppers facility to determine if the sediments are impacted at levels greater than cleanup goals.
- Sampling and testing of soil stockpiles at the former materials storage yard (MSY) owned by the City of Gainesville to determine the suitability of the soils for use as final cover material at the Site.

1.1 Site and Property Description

This section defines and describes the Superfund "Site" as well as the Beazer "Property" that is the part of the Site that formerly contained the Koppers wood-treatment facility.

The Site means the Cabot/Koppers Superfund Site and includes the former Koppers wood-treatment facility and the former Cabot Carbon pine-tar products facility in Gainesville, Florida. The Site includes areas where environmental impacts attributed to these former operations has come to be found, with the exception of the Northeast Lagoon, which is generally located at the intersection of N. Main Street and NE 28th Place. These two former facilities were located on the north side of Florida Route 120, also known as NW 23rd Avenue, in Gainesville, Florida (**Figure 1**). A Seaboard Coast Line Railroad (SCR) line ran in a north-south corridor located between the two facilities, with the Koppers facility on the west side of the rail line and the Cabot Carbon facility on the east side. SCR became part of what is now CSX Transportation.

Under the Consent Decree, Beazer has RD and RA responsibilities for the former Koppers facility and impacts related to the Koppers facility. The Koppers facility was operated on an 86-acre parcel (Property) located at 200 NW 23rd Avenue and bearing Alachua County parcel tax identifier 08250-000-000. The Property is zoned for general industrial use. Beazer currently owns the Property. The Property is approximately rectangular, covering a north-south distance of 3,100 feet and an average east-west distance of 1,200 feet. The Property is no longer used for industrial activity.

A paved main driveway runs from the Property entrance at NW 23rd Avenue north to approximately the center of the Property. There are other unpaved mulch-covered roadways used to access different parts of the Property. Much of the Property is nearly flat and covered with grass.

The Property is bounded by a variety of land uses. The southern property boundary is Florida Route 120, also known as NW 23rd Avenue; a 66-foot wide right-of-way for this road is held by the Florida Department of Transportation. Several commercial businesses, a few apartments, and the Genesis Preparatory School (a public charter school for kindergarten through third grade) are located on the south side of NW 23rd Avenue across from the Property.

Residential parcels of the Stephen Foster neighborhood are located immediately west and north of the Property.

Also north of the Property, east of the residences, is the MSY parcel that has been used by the City of Gainesville Department of Public Works.

The 120-foot wide rail corridor east of the Property, owned by CSX, is no longer used as a main rail line but there are still tracks on a raised ballast north of NW 23rd Avenue. Beyond the railroad corridor are parcels that once contained the Cabot Carbon facility and properties north of that facility. The former Cabot Carbon property has been redeveloped and now contains commercial businesses. North of the former Cabot Carbon property and adjacent to the railroad corridor there are other commercial and light industrial properties as well as parcels containing woodlands and wetlands.

1.2 Site History

The wood-treating facility that formerly existed on the Property (the Koppers facility) began operations in 1916 and ceased wood treating operations in 2009. Beazer is the current owner of the Property.

Over the years, wood-treatment preservatives used at the Koppers facility included creosote, pentachlorophenol, and chromated copper arsenate (CCA). Creosote is a dense (i.e. heavier than water) non-aqueous-phase liquid (DNAPL) derived from coal tar that is comprised mainly of polycyclic aromatic hydrocarbons (PAHs) with other semivolatile organic compounds (SVOCs) and volatile organic compounds (VOCs). Pentachlorophenol is an anthropogenic organic pesticide which, in commercial form, often contained impurities including polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (collectively referred to as "dioxin"). As its name implies, CCA contains chromium, copper, and arsenic compounds. Historical wood-treatment practices led to releases of wood preservatives at the Property. Primary release areas included the former Process (pressure-treatment) Area, the former Drip Track area where wood was allowed to dry immediately after treatment, and two former process-water lagoons called the South Lagoon and North Lagoon. The two lagoons have been backfilled.

The initial Record of Decision (ROD) was issued by EPA on September 27, 1990. At the Koppers portion of the Site, data from studies conducted after issuance of the 1990 ROD revealed Site conditions that were not contemplated by the 1990 ROD. Various environmental investigation and interim measures were completed through 2011. EPA issued a final Feasibility Study report in May 2010 and an Amended ROD in 2011.

1.3 Conceptual Site Model

The 2010 Feasibility Study provides a detailed description of Site conditions and an understanding of how Site-related constituents move in the environment and could possibly reach potential environmental receptors. The summary of this information and understanding is called the conceptual Site model (CSM). The CSM provides a concise summary of all pertinent Site knowledge such that key features and their interrelationships can be understood succinctly and in context.

Figure 2 is a conceptual block diagram that summarizes some important aspects of the CSM, especially as related to subsurface environmental impacts and migration. Key aspects of the CSM relevant to Design Track 2 are presented below. Further details and references can be found in the 2010 Feasibility Study.

1.3.1 Geology

The main geologic units at the Site, from top-to-bottom, are:

- Sandy surficial marine-terrace deposits
- Clayey Hawthorn Group deposits
- Ocala Limestone
- Dolomitized limestone of the Avon Park Formation

The uppermost geologic unit is a 20- to 30-foot thick unit of Plio-Pleistocene marine terrace deposits consisting primarily of fine- to medium-grained sand with trace amounts of silt and clay.

These surficial marine terrace deposits are underlain by the Miocene age Hawthorn Group deposits, which are approximately 115 to 125 feet thick. The Hawthorn Group is comprised of interbedded and intermixed clay, silty-clayey sand, sandy clay, and occasional carbonate beds.

Three predominant clay units separated by two clayey-sand units have been identified in the Hawthorn Group deposits at the Site. The upper portion of the Hawthorn Group deposits consists of a green-gray clay unit that is undulating and dips generally toward the northeast. This upper clay unit ranges from 0.5 to 7 feet in thickness. Below this clay is a clayey-sand deposit (34 to 42 feet thick), which is underlain by a second clay unit (2 to 15 feet thick). Below this middle clay unit is another clayey-sand deposit (10 to 35 feet thick), which is underlain by a lower clay unit (20 to 38 feet thick). This lower clay unit consists of two to three discernible clay sub-layers (each 1 to 9 feet thick) separated by thin seams of clayey sand and sandy clay.

Below the Hawthorn Group are Eocene age dolomitized limestone formations (Ocala Limestone and Avon Park Formation) that are approximately 470 feet in total thickness.

1.3.2 Hydrogeology

The three principal hydrostratigraphic units at the Site coincide with the major geologic units. As shown in **Figure 2**, the main hydrogeologic units are:

- Surficial Aquifer
- Hawthorn Group
- UFA

The UFA is used regionally for water supply, including at the Murphree Wellfield which is located approximately 2 miles northeast of the Site and supplies drinking water for Gainesville and other parts of Alachua County. The Hawthorn Group is an effective low-permeability confining unit for the UFA with yields that are generally too low (less than 1 gallon per minute [gpm]) to be viable for water supply. The Surficial Aquifer is generally not used for water supply due to: (1) low yield (less than 4 gpm); (2) better water source options in the Floridan Aquifer; and (3) potential water quality impacts from anthropogenic activities (e.g. sewers, underground storage tanks, dry-cleaning operations, agricultural land uses and industrial land uses).

The primary transmissive zones at the Site are the Surficial Aquifer, the Upper Transmissive Unit of the UFA, and the Lower Transmissive Unit of the UFA. In these units, the principle direction of groundwater flow is horizontal to the north-northeast. At the Murphree Wellfield production of groundwater comes primarily (approximately 85%) from Lower Transmissive Unit of the UFA. The water table is in the Surficial Aquifer and varies spatially and temporally from approximately 5 to 15 feet below ground surface on Site.

In contrast, the three Hawthorn Group clay units depicted in **Figure 2** as dark brown regions have very low capacities to transmit water. Strong evidence for the limited capacities of these Hawthorn Group clay units to transmit water is provided by differences in piezometric head above and below each clay unit. For each unit, the downward head loss across the layer approaches or exceeds the thicknesses of the layer (i.e. a hydraulic gradient of 1 or greater). For the lower clay unit, there is a head drop of approximately 90 feet across the 30-foot thick, hard plastic, lower clay unit. This Hawthorn Group lower clay unit is a very effective upper confining unit for the UFA.

The Upper Hawthorn, Lower Hawthorn, and semi-confining zones of the UFA have moderate permeability with intermediate capacities to transmit water.

1.3.3 Source Areas and DNAPL Presence

The origin of Site-related impacts is linked to facility operations and historical waste management methods. Releases occurred when wood-treatment chemicals dripped onto the soil or were deposited in unlined lagoons. Site investigations have identified four primary constituent source areas related to former Koppers-facility operations and facilities. These are labeled [a] through [d] in **Figure 2**, and are mapped in **Figure 3**. The four primary source areas are:

- Former Process Area
- Former South Lagoon
- Former North Lagoon
- Former Drip Track

The four primary source areas cover a total of approximately 5.4 acres. DNAPL exists in the Surficial Aquifer and Upper Hawthorn in each of these source areas, with some impacts extending into the Lower Hawthorn. Much of the DNAPL is present in residual, immobile form. There is no evidence of DNAPL presence in the UFA.

1.3.4 Groundwater Concentrations

Figure 3 shows Beazer monitoring well locations where the concentration of at least one constituent exceeds the groundwater cleanup goal. The predominant PAH compound detected in groundwater is naphthalene, a relatively mobile PAH that degrades relatively easily in the environment under aerobic conditions. Concentrations of other constituents (e.g., pentachlorophenol, arsenic, benzene, carbazole, dibenzofuran) also exceed cleanup goals in select wells.

1.3.5 Migration and Exposure Pathways

1.3.5.1 DNAPL Migration and Dissolution

Creosote DNAPL is a viscous mixture of hundreds of chemical compounds, mainly PAHs, with a density that is slightly greater than water. Driving forces affecting DNAPL movement include hydraulic gradients and gravity. At the Site both of these forces act in a downward direction. When the wastewater lagoons were closed over 30 years ago, the driving forces for downward DNAPL migration were substantially decreased. The Hawthorn Group clay units can act as capillary barriers at the Site, preventing entry to small pores unless large static-pool heights develop.

With time, DNAPL is depleted by drainage and/or dissolution. As this occurs the fraction of pore space containing DNAPL decreases. Ultimately, DNAPL in continuous pore-space bodies of DNAPL (pools) will become discontinuous blobs and ganglia that are no longer mobile as a separate liquid phase.

Formation of dissolved constituent plumes comes about through dissolution of DNAPL. With this dissolution, DNAPL is depleted. The rate at which DNAPL is depleted is dependent on how the DNAPL is distributed within pore spaces. In general, rates of natural DNAPL depletion will be greatest when DNAPL is sparsely distributed in small fingers.

Due to the residual saturation, relatively high concentrations of dissolved-phase constituents of creosote (e.g. PAHs) may persist in soil and in groundwater even though the DNAPL is no longer present in a mobile form. In addition, because of the low solubility and slow dissolution rates of some creosote DNAPL constituents, the residual saturation may persist for an extended length of time, even after DNAPL migration has ceased.

1.3.5.2 Groundwater Migration

Once dissolved into groundwater, constituents are affected by the processes of advection, dispersion, sorption, and matrix diffusion. Organic constituents are also affected by natural biodegradation. Arsenic may chemically precipitate from solution under certain geochemical conditions. The term “natural attenuation” includes all of these chemical migration and fate processes that result in decreasing concentrations of constituents. Thus, the processes of biodegradation, dispersion, sorption, and matrix diffusion all result in natural attenuation of constituents.

1.3.5.3 Stormwater Runoff

Stormwater runoff at the Property flows generally to the north-northeast. Much of the runoff evaporates or infiltrates to groundwater at stormwater impoundments on the Property. The intermittent stormwater ditch that bisects the Property carries runoff from NW 23rd Avenue and adjacent streets south of the Property, and it is the receiving ditch for any water that may overtop the on-Property stormwater impoundment berms.

The stormwater drainage ditch flows northward from the Property, along the eastern boundary of the City MSY parcel, and into to Springstead Creek. Springstead Creek flows westward to Hogtown Creek.

1.3.5.4 Potentially Complete Exposure Pathways

Based on Remedial Investigations, exposure to Site constituents may be possible via contact with the following media, where these media are impacted:

- Surface soil (including dust)
- Subsurface soil (on Property)
- Sediment
- Surface water
- Groundwater, specifically:
  - Surficial Aquifer groundwater
  - Upper Hawthorn groundwater
  - Lower Hawthorn groundwater
  - UFA groundwater

1.4 Overview of Design Track 2 Remediation Components

Per the RDWP, Design Track 2 includes the subsurface cutoff wall, stormwater controls, and off-Property sediment-removal components of the remedy. Other on-Property components are being or will be implemented as part of Design Tracks 3, 4, and 5 to complement the components of Design Track 2 and meet all RA objectives for the Site. **Figure 4**[1] presents a preliminary map of the on-Property remedy components and **Figure 5** depicts a conceptual cross section of these components.

Since completion of the RDWP, removal of soil stockpiles and impacted surface soil at the City MSY parcel has been added as an additional remedial component for Design Track 2. This component will be completed in a manner consistent with the November 2014 Settlement Agreement between Beazer and the City of Gainesville.

1.4.1 Cutoff Wall

A continuous, vertical, subsurface hydraulic barrier wall (e.g. soil-bentonite cutoff wall) will be constructed to provide containment of groundwater impacts. The cutoff wall will extend from the ground surface to the middle clay layer of the Hawthorn Group, which occurs approximately 65 feet below ground surface. The cutoff wall will completely encircle the four principal DNAPL source areas at the Property and adjacent areas with the highest groundwater concentrations, creating a groundwater containment zone. After completion of the source treatment actions, a low-permeability cover/cap will be installed to minimize rainfall infiltration and recharge into the groundwater containment zone.

Until the final cover/cap is constructed, the existing system of groundwater collection drains will be operated to keep the water table below the top of the cutoff wall. Design Tracks 3 and 4 will address the source-treatment components and design of the cover/cap is part of Design Track 5. The low-permeability middle clay layer of the Hawthorn Group will serve as the bottom of the groundwater containment zone.

[1] The planned location of the cutoff wall (and boundary of the consolidation area) has been adjusted. See **Figure 6** for the updated planned alignment.

1.4.2 Stormwater Management System

Stormwater management actions at the Property will include: (a) grading and contouring the Property to direct water toward designed collection areas, (b) construction of one or more stormwater detention/retention basins, and (c) replacement or improvement of the existing main drainage ditch that flows through the Property with a new conveyance such as a ditch or underground pipe (culvert).

1.4.3 Off-Property Sediment Removal

Sediment removal may be needed to meet cleanup goals in the ditch that runs along the eastern edge of the City MSY parcel from the Property to Springstead Creek.

For total PAHs, the removal-action cleanup goal is the ecological probable-effects concentration (PEC) of 22.8 mg/kg (see Section 11.2.3.2 of the Amended ROD). Monitored natural recovery may be employed after reaching that level. Per the Consent Decree, Beazer is responsible for addressing impacts that are “attributable to and downstream of the former Koppers Facility.” Removed sediment may be placed in the soil consolidation area.

1.4.4 MSY Soil Removal

Per the November 2014 Settlement Agreement, soil stockpiles currently at the City MSY parcel will be moved to the Beazer Property. Similarly, surface soil (uppermost 1 foot around or under the stockpiles) with concentrations greater than cleanup goals will be moved to the Property.

2 INVESTIGATION TASKS

2.1 Cutoff-Wall Borings

A subsurface cutoff wall will be designed to preclude horizontal groundwater and DNAPL movement from principal source areas of the Property to areas of little or no impact. The planned cutoff wall (**Figure 6**) has a length of approximately 5,000 feet and a depth of approximately 70 feet, for a vertical wall area of approximately 350,000 square feet. The containment area enclosed by the cutoff wall will occupy approximately 35 acres. The existing land surface elevation along the planned cutoff-wall route varies from approximately 184 feet[2] near the southern boundary of the Property to approximately 178 feet northeast of the former Drip Track.

Based on past experience with cutoff walls in Florida, it is expected that a soil-bentonite cutoff wall will provide a cost-effective design solution. However, a cement-bentonite mixture will also be evaluated in case a cement-bentonite cutoff wall is later found to be a more cost-effective solution during design of the cutoff wall.

Based on the geological condition documented from previous studies, the generalized subsurface stratigraphy at the Site consists of the following hydrostratigraphic layers, from top to bottom, above the limestone formations:

- Surficial aquifer
- Hawthorn upper clay layer
- Upper Hawthorn
- Hawthorn middle clay layer
- Lower Hawthorn
- Hawthorn lower clay layer

The subsurface cutoff wall will be keyed a minimum of three feet into the Hawthorn middle clay layer. Based on existing borehole logs in the vicinity of the planned wall alignment, the elevation of the top of the Hawthorn middle clay layer varies from approximately 115 feet along the east side to approximately 125 feet along the west side, at typical depths of approximately 60 to 70 feet below existing grade.

2.1.1 Sampling Locations

Subsurface exploration to support design and construction of a soil-bentonite cutoff wall is typically accomplished by drilling of soil borings at a typical horizontal spacing of 200 feet and to a depth of 5 feet into the stratum where the cutoff wall will be keyed or terminated. The objectives of the soil borings are to document the subsurface conditions along the cutoff wall alignment, to verify the competency of the soil stratum for key-in of the cutoff wall, and to allow recovery of soil samples for laboratory soil testing and soil-bentonite mix design study (described in Section 2.3). Because subsurface explorations have been previously performed at the Property, the existing subsurface soil data will be utilized, where appropriate, to reduce the level of field exploration effort.

[2] All elevations in this report are relative to the North American Vertical Datum of 1988 (NAVD88).

Along the eastern section of the cutoff wall alignment, the depth to the Hawthorn middle clay layer has been well established from previous core borings. The core logs and photographs of the core samples indicate the presence of clayey soils in the Hawthorn middle clay layer. However, the index and engineering properties of the soil deposits were not documented. To supplement the previous eastern Property boundary core borings, Standard Penetration Test (SPT) soil borings will be drilled at an 800-foot spacing 5 feet into the Hawthorn middle clay layer, corresponding to a depth of approximately 70 feet below existing grade, to confirm the previous core borings and to obtain SPT soil samples for laboratory testing. In addition, borings will be drilled at a spacing of approximately 400 feet to collect undisturbed Shelby tube samples (two undisturbed samples from each boring location) from the Hawthorn middle clay layer for index, strength, and hydraulic conductivity testing.

Along the remaining wall sections, SPT soil borings will be drilled at a spacing of approximately 200 feet as shown in **Figure 6**, terminating 5 feet into the Hawthorn middle clay layer, corresponding to a depth of approximately 70 feet below the existing grade. In addition, borings will be drilled at a spacing of approximately 400 feet to collect undisturbed Shelby tube samples (two undisturbed samples from each boring) of the Hawthorn middle clay for index, strength, and hydraulic conductivity testing. The soil borings for Shelby-tube sampling will be installed adjacent to the SPT soil boring locations, and the undisturbed samples will be recovered at depths based on results of the adjacent SPT soil borings.

In summary, 20 SPT soil borings and 13 Shelby-tube borings are planned along the approximately 5,000 lineal feet of cutoff wall alignment. Considering that each boring will be drilled to an average depth of approximately 70 feet below existing grade, there will be 1,400 lineal feet of SPT soil borings and 910 lineal feet of borings for Shelby-tube sampling. With the recovery of two undisturbed samples from the Hawthorn middle clay layer from each of the Shelby-tube borings, there will be a total of 26 undisturbed clay samples. The SPT soil boring and Shelby-tube boring locations are shown in **Figure 6**.

2.1.2 Personnel

The field exploration program will be performed by a licensed driller. A field engineer or geologist will also be on site to direct the drilling and sampling operations. All field personnel will have received HAZWOPER training, will have received equipment training appropriate to job function, and will follow a Health and Safety Plan specific to the Site and to the activities being performed.

2.1.3 Equipment

The soil borings will be advanced using a truck-mounted CME-45 or CME-55 drill rig outfitted for mud rotary drilling and SPT split-spoon sampling. The undisturbed clay samples will be collected using a Shelby tube, a fixed-piston sampling device, or a GUS undisturbed sampler.

2.1.4 Procedures

2.1.4.1 Standard Penetration Test and Split-Spoon Soil Sampling

The Standard Penetration Test (SPT) is a widely accepted method for *in situ* testing of subsurface soils (ASTM D1586). A 2-foot long, 2-inch outside diameter, split-barrel sampler attached to the end of a string of drilling rods is driven 18 inches into the ground by successive blows of a 140-pound hammer freely dropping 30 inches. The number of blows needed for each 6 inches of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch increments of penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual examination and classification of the retained soil sample. The N-value has been empirically correlated to various soil properties allowing conservative estimates of soil behaviors under load.

The SPT tests are usually performed at 5-foot vertical intervals. However, more frequent or continuous testing can be performed where a more accurate definition of soil layers is desired. For this project, the SPTs and associated split-spoon soil sampling will be performed continuously from land surface to a depth of 10 feet, and at 5-foot vertical intervals thereafter to a depth of 50 feet. Below 50 feet, the sampling will be performed continuously until 5 feet into the Hawthorn middle clay layer, corresponding to an estimated depth of 70 feet below existing grade.

The SPT test holes will be advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is a bentonite drilling mud, will be used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, NX-size flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or to prevent the loss of circulating fluid. After completion of a test boring, the borehole will be backfilled with a cement grout. Representative split-spoon samples are shipped in air-tight sampling jars for further potential laboratory evaluation and testing (see Section 2.3).

The field engineer or geologist will log the borehole and will evaluate the presence of DNAPL in soil cores using visual observation, a photoionization detector (PID), and plastic sheeting pressed to the soil core. A numerical DNAPL-impact rating will be applied using the established Site procedures (Tetra Tech 2013), as follows:

1. Low PID readings, no visual DNAPL staining;
2. Elevated PID readings, no visual DNAPL staining;
3. Elevated PID readings, limited residual DNAPL staining;
4. Elevated PID readings, heavy residual DNAPL staining, minimal or no staining on plastic; or
5. Elevated PID readings, free-phase DNAPL in core, possible free-product droplets on plastic.

2.1.4.2 Undisturbed Sampling of the Hawthorn Middle Clay

Undisturbed sampling implies the recovery of soil samples in a state as close to their natural condition as possible. Complete preservation of *in situ* conditions cannot be realized; however, with careful handling and proper sampling techniques, disturbance during sampling can be minimized. Examination and testing of undisturbed samples gives a more accurate estimate of *in situ* soil behavior than is possible with disturbed samples.

The undisturbed samples will be obtained using fixed-piston sampling device. Mud-rotary drilling will be used to advance the borehole to the top of the Hawthorn middle clay layer as determined from adjacent split-spoon samples. The fixed-piston sampler is a 2.875-inch inside diameter Shelby tube with a piston inside it. While the sampler is lowered into the borehole, the piston is located at the lower end of the sampling tube. When lowered into place, the piston is then at the bottom of the borehole and on top of the soil to be sampled. The piston is then held stationary while the tube is smoothly pushed past the piston 24 inches into the soil. The sample is sheared from the parent soil by rotating the sampling device. After the sampler is brought out of the hole, the ends of the tube are sealed and the sample is shipped to the soil testing laboratory (see Section 2.3).

At each location, a sample will be collected from the upper 2 feet of the Hawthorn middle clay and a second sample will be collected from 3-5 feet beneath the top of the Hawthorn middle clay. The borehole will then be backfilled with a cement grout.

2.1.4.3 Management of Investigation-Derived Waste

All investigation-derived waste (IDW) from the drilling operation will be managed and disposed of in accordance with applicable regulations. The IDW will include a mixture of soil cuttings, drilling fluid, and disposable personal protective equipment (PPE). Materials will be placed in approved 55-gallon drums and temporarily stored within the hazardous materials storage area at the Property. From there, the drums will be picked up for off-Site hazardous waste disposal. It is anticipated that approximately 1.5 drums of IDW per borehole will be generated, for a total of approximately 50 drums.

2.1.5 Outputs

Split-spoon soil samples and undisturbed samples of the Hawthorn middle clay will be generated for use in laboratory testing and mix design as described in Section 2.3. The subsurface soil profiles along the cutoff wall alignment will be documented in field boring logs consistent with logs that have been created for recent Site investigations. These field boring logs will be considered draft. Final soil boring logs will be prepared after completion of laboratory testing (Section 2.3.1) of selected representative soil samples.

2.1.6 Schedule

Performance of the 1,400 lineal feet of SPT soil borings at 20 locations and 910 lineal feet of borings at 13 locations for recovery of 26 undisturbed samples will require approximately 6 to 8 weeks, assuming one drill rig working 5 days per week and including some allowances for decontamination and inclement weather conditions when drilling cannot be performed.

2.2 Contingent Borings to Define Outer Limits of Source Areas

The planned cutoff wall alignment is approximately 50 feet from the outer limits of three DNAPL source areas (i.e. former North Lagoon, former Process Area, and former South Lagoon) as defined by past investigation activities. In the event that a soil boring along the planned cutoff wall alignment encounters significantly impacted soils, the borehole will be terminated near the top of the Hawthorn middle clay layer to avoid drilling through the middle clay. In this case, one or more replacement borings may be drilled to establish an alternate wall alignment outside the edge of significant impacts. Significantly impacted soils will include soils with a DNAPL rating of 4 or 5, as determined by the field engineer or geologist using the DNAPL rating scale and methods that have been used in recent characterization work (Tetra Tech 2013; see section 2.1.4.1).

The contingent soil borings will also be drilled to an estimated depth of 70 feet below existing grade, with SPT, split-spoon sampling, and undisturbed soil sampling to replace information that would have been obtained from the soil borings along the original cutoff wall alignment. Drilling and sampling procedures will be the same as for the original borings (Section 2.1). The locations of the contingent soil borings, if needed, will be determined based on the results from the original cutoff wall borings and other relevant information including prior investigative borings in the area.

The time required to complete this task will depend on the number of contingent borings that may be needed to establish the alternate wall alignment. Soil logs from the original and contingent borings will be developed and the definition of the DNAPL source area(s) will be adjusted as warranted. The information from the soil borings will be used in source-area definition and visualization for the design of the source-area components of the RA.

2.3 Geotechnical Laboratory Testing for Cutoff Wall Design

2.3.1 Index and Engineering Properties Testing for Soil Samples

Soil samples recovered from the drilling will be tested for index and engineering properties to characterize the subsurface materials. All soil samples will be visually classified in the laboratory using the procedures outlined in ASTM D2487. Furthermore, index and classification tests will be performed on representative SPT soil samples selected by the design engineer for the cutoff wall. These tests will include moisture content determinations (ASTM D2216), fines content determinations (ASTM D1140), sieve analyses (ASTM D421 and D422), Atterberg limits determinations (ASTM D4318), and organic content determinations (ASTM D2974). The index and classification tests will be used to characterize the materials encountered in the soil borings and to aid in establishing a subsurface soil profile to support design and construction of a cutoff wall.

In addition to the index and classification tests, hydraulic conductivity tests (ASTM D5084) and unconsolidated-undrained triaxial tests (ASTM D2850) will be performed on representative undisturbed Shelby tube soil samples selected by the design engineer for the cutoff wall to determine the permeability and strength characteristics of the clayey soils of the Hawthorn middle clay layer, which the soil-bentonite cutoff wall will be keyed into. Performance of 13 hydraulic conductivity and 4 unconsolidated-undrained triaxial shear strength tests is planned.

2.3.2 Cutoff Wall Mix Testing

Laboratory hydraulic conductivity testing (ASTM D5084) will be conducted on various soil-bentonite design mixes using a composite soil sample that is representative of the subsurface soil layers that will be encountered during excavation of the cutoff wall. The composite sample will be comprised of split-spoon soil samples mixed in a proportion based on the relative occurrences of the different soil layers encountered in the soil borings, to represent the soil composition from trench excavation. Moisture content and grain-size distribution will be measured for the composite soil sample to document that the composite soil sample is representative of the soil strata that will be encountered in the cutoff-wall construction.

At a minimum, soil-bentonite mixtures will be prepared using two different bentonite products, three different bentonite contents, and two different water sources. Laboratory hydraulic conductivity testing (ASTM D5084) will also be performed on a cement-bentonite mix, in case a cement-bentonite cutoff wall is later found to be more cost-effective during design of the cutoff wall.

The bentonite products will be selected from available commercial sources and will have demonstrated prior use in soil-bentonite or cement-bentonite cutoff wall construction. The laboratory testing for the soil-bentonite mixes will begin with a bentonite content of 5 percent by dry weight. If the test results are promising (i.e. the hydraulic conductivity of the soil-bentonite mix is likely to be on the order of 10^{-7} cm/s or less), additional testing will be performed using bentonite contents of 3 and 4 percent. If the test results are negative or marginal, additional tests will be performed using bentonite contents greater than 5 percent.

Water used in the preparation of soil-bentonite and cement-bentonite mixtures will be from: (1) untreated surficial-aquifer groundwater from the influent to the on-Site groundwater pretreatment facility, and (2) treated drinking water from the Gainesville municipal water system, obtained at the Property. Depending on the initial test results, additional water sources such as pretreatment facility effluent water and untreated UFA groundwater may be evaluated and tested to achieve a cost-effective mix design.

As a preliminary indication on the compatibility between the selected water sources and the different bentonite products prior to performance of laboratory hydraulic conductivity testing, swell index tests (ASTM D5890) will be performed to evaluate whether the selected water sources will inhibit the swelling potential of the different bentonite products.

After preparing test mixtures using the composite soil sample, the selected bentonite products, and the selected water sources for initial hydration and mixing, Site (impacted) groundwater will be used as the permeant for laboratory hydraulic conductivity testing. A minimum of two pore volumes of permeant will be allowed to pass through each promising test specimen. The groundwater samples to be used for hydraulic conductivity testing will be obtained from one or more of the existing monitoring wells selected by the design engineer for the cutoff wall based on a review of historical water quality data. Testing will also be performed with a permeant that includes the sodium permanganate-based in-situ geochemical stabilization (ISGS) reagent that is being used for source-area treatment; this will ensure that the reagent does not have an adverse effect on cutoff-wall performance.

If deemed necessary by the design engineer, the water samples from different sources will be tested for multivalent cations such as Ca^{2+} that are known to have adverse effects on bentonite.

As part of the laboratory soil-bentonite mix study, the density of the soil-bentonite mixture, the density and Marsh funnel viscosity of the bentonite slurry, and the pH of the mixing water will be documented. Specifications for these properties will be outlined in the design along with requirements for construction quality assurance (CQA). Filtrate loss will also be measured as part of the design effort to make sure that the bentonite is of good quality.

The density of *in situ* soils along the wall alignment will be compared to the density of soil-bentonite mixes to estimate the volume of any excess excavated material that will have to be dealt with as part of the cutoff wall construction.

2.3.3 Outputs

Laboratory reports will be generated to document the results of all testing of soil samples and design mixes. The key results from the laboratory tests will include:

- ASTM classifications for the various soil types encountered along the cutoff wall route.
- Hydraulic-conductivity and strength of the Hawthorn middle clay layer, with confirmation of the depth of this layer.
- Hydraulic conductivity of various soil-bentonite and cement-bentonite mixes that may be considered during design.

Laboratory test results for split-spoon and Shelby-tube soil samples will be incorporated into the final soil boring logs along the cutoff wall alignment.

The laboratory reports and boring logs will provide a design basis for the cutoff wall and will be included in the Preliminary Design document for Design Track 2.

2.3.4 Schedule

Based on the number of tests currently expected for this project, laboratory testing of the recovered soil samples and various soil-bentonite mixtures will require 12 to 16 weeks after completion of the field exploration program.

2.4 Stormwater Design Borings and Testing

A new stormwater management system will be designed for the Property as part of Design Track 2. The key components of the redesigned system will be:

- A replacement ditch or culvert(s) to convey stormwater from NW 23rd Avenue northward to the ditch that runs along the eastern edge of the MSY, and
- One or more stormwater management basins to handle runoff generated on the Property, with swales and culverts as needed to convey runoff to the basin(s), and with discharge from the basin(s) to the MSY ditch.

The locations and dimensions of stormwater management facilities will be determined during design. The stormwater management design will take into account the expected soil covers and slopes that will not be finalized until completion of Design Track 5.

In order to complete design for this system it is important to understand the following:

- The soil profile beneath planned stormwater conveyances and stormwater basins;
- The horizontal and vertical hydraulic conductivity of soils beneath planned dry stormwater basins (if designed) to assess the ability of Site soils to allow stormwater infiltration;
- The water table elevation under normal and seasonal high conditions to assess whether unlined ponds and ditches (if designed) will be wet or dry and to what extent unsaturated soils may be present beneath unlined ponds and ditches;
- The competency of shallow site soils for support of a large stormwater culvert (if designed); and
- The concentrations of Site constituents in unsaturated-zone soils and in groundwater beneath planned stormwater facilities.

Existing information is available from previous soil borings, soil sampling, and groundwater monitoring to address many of these items, and some of the information derived from the testing described in Sections 2.1 through 2.4 will also be helpful, particularly soil profiles and SPTs for the upper portion of the borings along the western side of the planned cutoff wall alignment. The additional testing planned for pre-design investigation includes:

- SPT tests and soil profiles of the upper 15 feet of soil at two locations north of the planned cutoff wall alignment to confirm the competency of subsurface soil; and
- Undisturbed soil sampling and hydraulic conductivity testing at four locations near the western and northern boundaries of the Property which are the most likely locations for stormwater management basins.

2.4.1 Locations

Figure 6 shows the planned locations of the two shallow SPT borings and the four locations for soil hydraulic conductivity sampling. The SPT locations are chosen in areas where a replacement culvert may be routed that will not have nearby SPT data from the planned work described in Section 2.1. The soil sampling for hydraulic conductivity is in the western and northern portions of the Property where stormwater management basins are likely to be located in the final stormwater design.

2.4.2 Equipment and Procedures

SPT soil borings will be advanced with continuous split-spoon sampling to a depth of 15 feet below ground surface using the procedure of ASTM D1586 as described in Section 2.1.5.1. These borings will be drilled using the same equipment used for the cutoff wall borings.

At the four locations for shallow hydraulic conductivity testing, the seasonal high water table elevation is approximately 2 to 6 feet below land surface based on a review of the Site topographic survey and water table maps from 2007 through 2014. At each location, a test pit will be excavated using a small excavator to a depth of approximately 5 feet deep or to the water table (whichever is shallower). A Shelby tube or a drive sleeve will then be pushed downward from the pit bottom and horizontally from the pit sidewall to collect undisturbed samples for hydraulic conductivity testing. If the sandy soil cannot be retained inside the samplers, then disturbed samples will be collected and remolded samples that best duplicate field condition will be used for hydraulic conductivity testing.

Split-spoon samples from the SPT borings will be transferred to the laboratory and representative samples selected by the design team may be analyzed for index and classification properties as described in Section 2.3.1. Such laboratory testing will be performed to the extent needed to finalize the soil boring logs.

Test-pit soil samples will be analyzed for hydraulic conductivity following the procedure of ASTM D5084.

2.4.3 Outputs

The results of this task will include:

- Boring logs with SPT (blow-count) results for the two 15-foot deep SPT borings;
- Soil descriptions for the test pits; and
- Horizontal and vertical hydraulic conductivity results for the soil above the water table at the four test pits.

2.4.4 Schedule

The field samples will be collected in the week after collection of samples for the cutoff wall (Sections 2.1 and 2.2). The soil boring logs and laboratory results will be completed approximately 2 weeks after sample collection.

2.5 Off-Property Sediment and Soil Sampling and Analysis

Sediment and soil samples will be collected from the City MSY to:

- Determine the extent of remediation for the ditch that runs along the east edge of the MSY from the Beazer outfall to Springstead Creek (the Outfall Ditch); and
- Determine whether the soil in the three stockpiles of the MSY may be suitable for final cover at the Beazer Property.

2.5.1 Locations

Figure 7 shows the location of sediment and soil samples at the City MSY. Structured composite sampling will be used to cost-effectively meet the pre-design investigation objectives. Grab samples from locations used to form composite samples will also be collected for possible use on an as-needed basis. The sampling locations will be marked in the field.

2.5.1.1 Stockpile Soil Samples

The three soil piles at the MSY are shown in **Figure 7**. These piles are generally composed of spoil soils of various consistency from miscellaneous City projects such as road construction and were stored for possible reuse on other projects. Pile 1 and Pile 2 were active in recent years. Pile 3 is an older, highly vegetated soil pile that is also called the Attenuation Berm and has been used for sound attenuation and visual obstruction. Based on past surface-soil sampling results, it is expected that portions of Pile 3 may not be suitable for use as final cover due to relatively high constituent concentrations. Pile 1 and Pile 2 are expected to have relatively low concentrations and are more likely to be suitable for use as final cover.

A five-point composite sample will be collected to represent Pile 1 and a separate five-point composite sample will be collected to represent Pile 2. The subsample locations for each pile are labeled A through E in **Figure 7**. Grab samples at these point locations will also be retained for possible follow-up analysis at the laboratory. Sampling depth will be between 1 and 6 feet.

Pile 3 is divided into five sections for purposes of pre-design sampling. Each section will be characterized by a three-point composite sample. The component subsamples (labeled A, B, and C) for each pile section are shown in **Figure 7**. Grab samples at the point locations will also be retained for possible follow-on analysis at the laboratory. Sampling depth will be between 1 and 6 feet.

Table 1 lists the stockpile samples to be collected and the order of collection.

2.5.1.2 Outfall Ditch Sediment Samples

The stormwater ditch that runs through the Beazer Property has an outfall near the northeast corner of the Property. From there, collected stormwater is directed through underground pipes (culverts) beneath a concrete pad (approximately 110 feet by 110 feet) upon which stands a communication tower operated by Gainesville Regional Utilities (**Figure 7**). The stormwater exits the culverts at a headwall on the MSY property approximately 140 feet north of the Beazer Property. From there, stormwater flows northward in the Outfall Ditch approximately 740 feet to Springstead Creek, with an approximately 20-foot section flowing through a culvert.

Grab samples will be collected along the Outfall Ditch for analysis of SVOCs and comparison to sediment cleanup goals. Arsenic and dioxin concentrations will also be determined. As shown in **Figure 7** and listed in **Table 2**, samples will be taken at four locations along the ditch at the ditch central low point (thalweg), beginning approximately 10 feet north of the headwall. At each location, samples will be collected from each of two depth intervals: 0-6 inches and 6-24 inches. Where there is an exposed concrete ditch bottom, the samples will be taken adjacent to (either east or west of) the concrete strip on the side that appears to be more toward the center of the ditch flow (field determination).

2.5.2 Sampling Equipment

Each stockpile soil subsample and 6-24-inch sediment sample will be collected with a hand auger or similar device. Each 0-6-inch sediment sample will be collected with a trowel. Each composite sample will be generated using a bucket (or large bowl) with a mixing spoon (or trowel). All sampling and compositing equipment will be decontaminated prior to use and new, clean chemical-resistant gloves will be worn by the sampling personnel for each sample collection and for each preparation of a composite sample.

Sample containers, preservatives, shipping coolers, and chain-of-custody (COC) forms will be obtained from the analytical laboratory prior to the sampling event. Ice, decontamination supplies, sample-location stakes, and other standard sampling equipment will be obtained by the sampling crew. A measuring tape will be used to measure distance from the headwall to sampling locations at the Outfall Ditch.

2.5.3 Procedures

Except as specified herein, stockpile soil samples will be collected in general accordance with procedures defined by the *Off-Site Soil Sampling Plan* (AMEC 2008) and *Quality Assurance Project Plan: Off-Site Investigation* (Environmental Standards 2008). Likewise, except as defined herein, sediment samples will be collected in general accordance with procedures defined by the *Revised Supplemental Sampling Plan* (AMEC 2006) for on-Property sediment sampling. Where not specified otherwise by this work plan or the plans referenced in this paragraph, the standard operating procedures (SOPs) of the EPA Region 4 and the SOPs of FDEP will apply, in that order of precedence.

2.5.3.1 Stockpile Soil Sampling

Stockpile soil samples will be collected for analysis of the parameters identified in **Table 3**. At each subsample location, surface vegetation will be removed and a hand auger will be advanced to a depth of 1 foot, and this material will be set aside. Then the auger will be advanced to approximately 3 feet and collected soil will be gently placed in a clean sample bucket for mixing. Laboratory-provided, hermetically-sealed, VOC sample vials (for EPA SW-846 Method 5035) will be used to collect soil for VOC analysis from a freshly exposed soil surface approximately 2 to 3 feet below the pile surface. Hand augering will then continue to a depth of 6 feet or the practical limit of augering, whichever comes first; this soil will also be added to the sample bucket. The soil volume collected for the sample will be at least twice the volume needed for all analyses identified in **Table 3** (excepting the VOC analysis). The soil in the sample bucket will be thoroughly mixed and sample containers will be filled to generate a depth-composited grab sample at the subsample location. The remaining soil will be temporarily stored in a cool place outside direct sunlight.

After collection of grab samples at each subsample location, a composite sample will be formed in a separate bucket by adding an equal volume of soil from each component subsample bucket. The composite-sample bucket will then be thoroughly mixed and the sample containers filled.

Excess soil will be placed in the auger borehole it came from. Excess composited soil will be placed in one or more of the component boreholes of the subsamples.

Sampling will proceed in the order defined in **Table 1**, generally starting farthest from the Beazer Property and proceeding toward the Beazer Property. A set of field duplicate samples will be collected at Pile 3-4 by repeating the grab and composite sampling procedure at locations within 5 feet of the original sampling locations. Prior to collecting the samples at Pile 3-4, an equipment blank (rinse water) sample will be collected from decontaminated sampling equipment.

All soil samples (composite and grab) will be packed on ice (immediately upon filling of containers) and shipped to the analytical laboratories under standard COC procedures. The COCs will indicate that the composite samples and blank samples are to be analyzed and the grab samples are to be held at the laboratory for possible later analysis. For VOCs in soil there will be no field composite sample; the COC will indicate that the central (grab) sample at each stockpile is to be analyzed and the remaining grab samples are to be extracted and held for possible later analysis.

2.5.3.2 Outfall Ditch Sediment Sampling

Sediment sampling for SVOCs, arsenic, and dioxin (**Table 4**) will be conducted in a similar fashion using a trowel for the 0-6-inch sample and a hand auger for the 6-24-inch sample at each sample location shown in **Figure 7**. Sampling will proceed in the order defined in **Table 2** and will occur after stockpile soil sampling.

An equipment blank sample and a set of field duplicate samples will be collected after completion of the original samples. Field duplicate samples will be collected from the 0-6 inch depth interval at the sampling point nearest the Beazer property.

All sediment samples will be packed on ice and shipped to the analytical laboratory under standard COC procedures.

2.5.3.3 Laboratory Analysis

Table 3 and **Table 4** identify the test methods that will be used to measure concentrations in the soil, sediment, and water (blank) samples.

Upon receipt of laboratory data for stockpile composite soil samples and central-point VOC samples, the design team will determine if analysis of held grab samples is warranted to determine whether certain pile sections are suitable for final cover.

Full (Level 4) laboratory reports will be generated. Data review will be conducted to the extent necessary to validate the quality of data (relative to Site Data Quality Objectives) that will be relied upon for design.

The design team will summarize the laboratory results in tables of measured concentrations.

2.5.4 Outputs

This task will generate the following outputs:

- Field sampling logs;
- Level 4 laboratory data reports;
- Validation reports, as warranted; and
- Summary tables of measured concentrations.

2.5.5 Schedule

Sample collection will take 3 to 5 days which will likely occur immediately before, during, or immediately after the field activities described in Sections 2.1, 2.2, and 2.4. Initial laboratory analysis will be completed within 3 weeks of sample collection. One or two additional 4-week periods may be needed for ordering and analysis of held samples. Generation of final Level 4 laboratory reports, data validation, and tabular summaries will take approximately 4 additional weeks.

3 REFERENCES

AMEC, 2006. *Revised Supplemental Sampling Plan – Additional Data for Risk Assessment*, September 25. (Updated target sensitivity tables for the Quality Assurance Project Plan submitted November 21, 2006).

AMEC, 2008. *Off-Site Soil Sampling Plan.* October 2.

Environmental Standards, 2008. *Quality Assurance Project Plan: Off-Site Investigation.* December 11.

Tetra Tech, 2013. *Former Process Area In-Situ Geochemical Stabilization Remediation Demonstration Project: Phase I Characterization*. Version 1. December 9.

Table 1. MSY Stockpile Soil Sample Identification

Order	Sample ID	Pile (and Segment)	Location	Note	Lab Hold* or Analyze - VOC	Lab Hold* or Analyze - Other	Associated Samples
1	SOPILE1C	Pile 1	C	Depth Composite 1-6 ft**	Hold	Hold	
2	SOPILE1B	Pile 1	B	Depth Composite 1-6 ft**	Hold	Hold	
3	SOPILE1A	Pile 1	A	Depth Composite 1-6 ft**	Analyze	Hold	
4	SOPILE1E	Pile 1	E	Depth Composite 1-6 ft**	Hold	Hold	
5	SOPILE1D	Pile 1	D	Depth Composite 1-6 ft**	Hold	Hold	
6	SOPILE1	Pile 1		Composite of SOPILE1C, SOPILE1B, SOPILE1A, SOPILE1E, and SOPILE1D	NA	Analyze	
7	SOPILE2B	Pile 2	B	Depth Composite 1-6 ft**	Hold	Hold	
8	SOPILE2E	Pile 2	E	Depth Composite 1-6 ft**	Hold	Hold	
9	SOPILE2A	Pile 2	A	Depth Composite 1-6 ft**	Analyze	Hold	
10	SOPILE2C	Pile 2	C	Depth Composite 1-6 ft**	Hold	Hold	
11	SOPILE2D	Pile 2	D	Depth Composite 1-6 ft**	Hold	Hold	
12	SOPILE2	Pile 2		Composite of SOPILE2B, SOPILE2E, SOPILE2A, SOPILE2C, and SOPILE2D	NA	Analyze	
13	SOPILE3-5A	Pile3-5	A	Depth Composite 1-6 ft**	Hold	Hold	
14	SOPILE3-5B	Pile3-5	B	Depth Composite 1-6 ft**	Analyze	Hold	
15		*Pile3-5*	*B*	*Aliquot of SOPILE3-5B for Matrix Spike*	*Hold*	*Hold*	*SOPILE3-5B*
16		*Pile3-5*	*B*	*Aliquot of SOPILE3-5B for Matrix Spike Duplicate*	*Hold*	*Hold*	*SOPILE3-5B*
17	SOPILE3-5C	Pile3-5	C	Depth Composite 1-6 ft**	Hold	Hold	
18	SOPILE3-5	Pile3-5		Composite of SOPILE3-5A, SOPILE3-5B, and SOPILE3-5C	NA	Analyze	
19	SOPILE3-1A	Pile3-1	A	Depth Composite 1-6 ft**	Hold	Hold	
20	SOPILE3-1B	Pile3-1	B	Depth Composite 1-6 ft**	Analyze	Hold	
21	SOPILE3-1C	Pile3-1	C	Depth Composite 1-6 ft**	Hold	Hold	
22	SOPILE3-1	Pile3-1		Composite of SOPILE3-1A, SOPILE3-1B, and SOPILE3-1C	NA	Analyze	
23	SOPILE3-2A	Pile3-2	A	Depth Composite 1-6 ft**	Hold	Hold	
24	SOPILE3-2B	Pile3-2	B	Depth Composite 1-6 ft**	Analyze	Hold	
25	SOPILE3-2C	Pile3-2	C	Depth Composite 1-6 ft**	Hold	Hold	
26	SOPILE3-2	Pile3-2		Composite of SOPILE3-2A, SOPILE3-2B, and SOPILE3-2C	NA	Analyze	
27	SOPILE3-3A	Pile 3-3	A	Depth Composite 1-6 ft**	Hold	Hold	
28	SOPILE3-3B	Pile 3-3	B	Depth Composite 1-6 ft**	Analyze	Hold	
29	SOPILE3-3C	Pile 3-3	C	Depth Composite 1-6 ft**	Hold	Hold	
30	SOPILE3-3	Pile 3-3		Composite of SOPILE3-3A, SOPILE3-3B, and SOPILE3-3C	NA	Analyze	
31	*EBSOPILE*			*Equipment Blank Water Sample*	*Hold*	*Hold*	*All Stockpile Samples*
32	SOPILE3-4A	Pile 3-4	A	Depth Composite 1-6 ft**	Hold	Hold	
33	*SOPILEFD1*	*Pile 3-4*	*A*	*Depth Composite 1-6 ft***	*Hold*	*Hold*	*SOPILE3-4A*
34	SOPILE3-4B	Pile 3-4	B	Depth Composite 1-6 ft**	Analyze	Hold	
35	*SOPILEFD2*	*Pile 3-4*	*B*	*Depth Composite 1-6 ft***	*Analyze*	*Hold*	*SOPILE3-4B*
36	SOPILE3-4C	Pile 3-4	C	Depth Composite 1-6 ft**	Hold	Hold	
37	*SOPILEFD3*	*Pile 3-4*	*C*	*Depth Composite 1-6 ft***	*Hold*	*Hold*	*SOPILE3-4C*
38	SOPILE3-4	Pile 3-4		Composite of SOPILE3-4A, SOPILE3-4B, and SOPILE3-4C	NA	Analyze	
39	*SOPILEFD4*	*Pile 3-4*		*Composite of SOPILEFD1, SOPILEFD2, and SOPILEFD3*	*NA*	*Analyze*	*SOPILE3-4*

Notes

Composite Pile or Section Sample

Quality Assurance Sample

* Extract and hold if needed for analytical procedure

** VOC sample is at discrete point 2-3 ft bgs

Table 2. Outfall Ditch Sediment Sample Identification

Order	Sample ID	Distance North of Headwall (ft)	Note	Lab Hold or Analyze	Associated Samples
1	SDMSY720A	720	Grab Sample 0-6 in	Analyze	
2	SDMSY720B	720	Grab Sample 6-24 in	Analyze	
3	SDMSY480A	480	Grab Sample 0-6 in	Analyze	
4	SDMSY480B	480	Grab Sample 6-24 in	Analyze	
5			*Aliquot of SDMSY480B for Matrix Spike*	*Analyze*	*SDMSY480*
6			*Aliquot of SDMSY480B for Matrix Spike Duplicate*	*Analyze*	*SDMSY480*
7	SDMSY240A	240	Grab Sample 0-6 in	Analyze	
8	SDMSY240B	240	Grab Sample 6-24 in	Analyze	
9	*EBSDMSY*		*Equipment Blank Water Sample*	*Analyze*	*All Sediment Samples*
10	SDMSY010A	10	Grab Sample 0-6 in	Analyze	
11	*SDMSYFD1*	*10*	*Grab Sample 0-6 in*	*Analyze*	*SDMSY010A*
12	SDMSY010B	10	Grab Sample 6-24 in	Analyze	

Notes

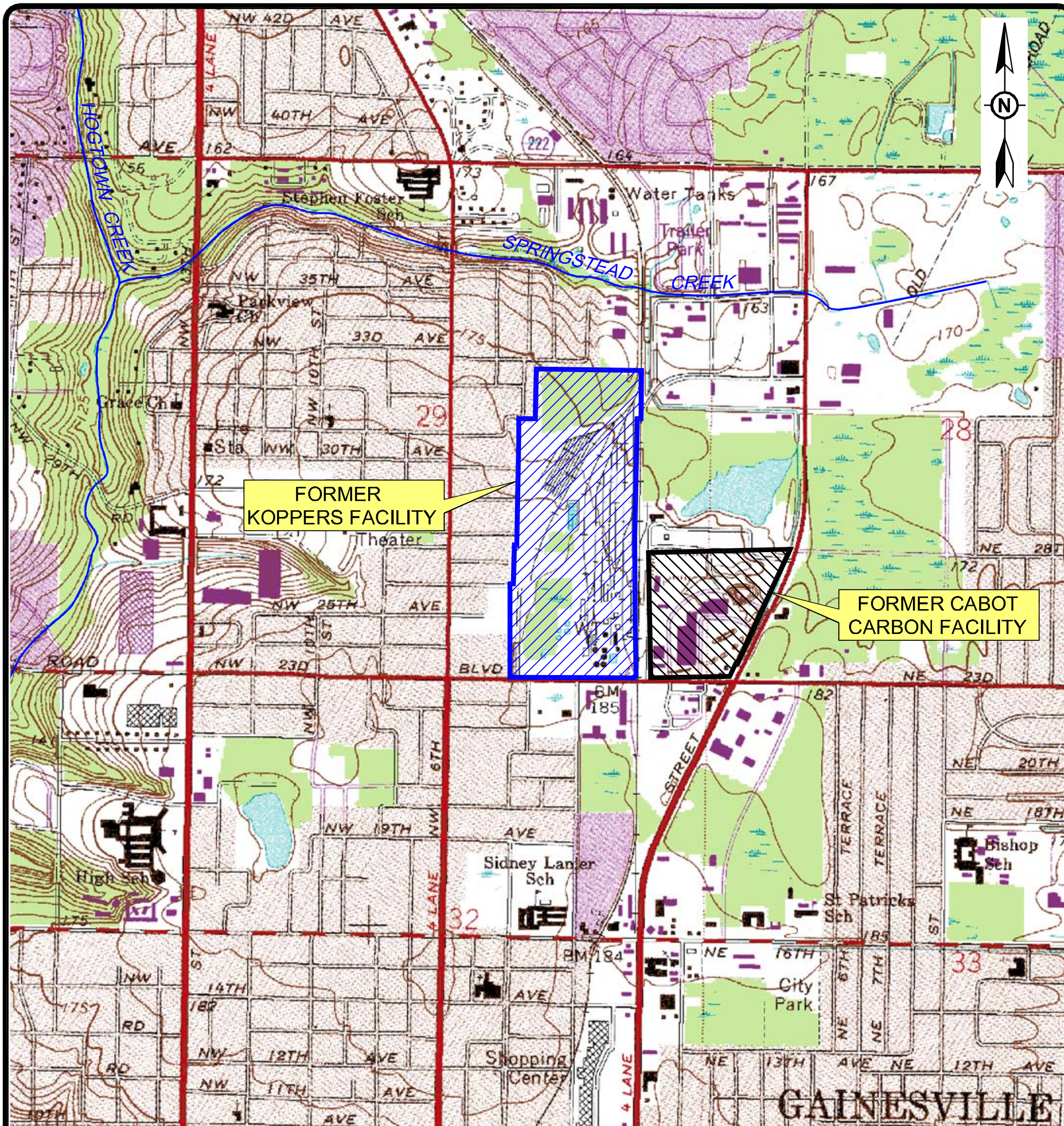
Quality Assurance Sample

Table 3. Laboratory Analyses for Stockpile Soil Samples

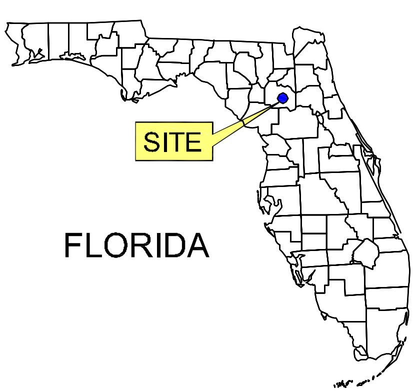
Matrix	Analytes	Preparation Method	Analysis Method
Soil	Metals (EPA Region 4 Target Analytes)	SW-846 3050B	SW-846 6020
	Mercury	SW-846 7471A	SW-846 7471A
	VOCs (EPA Region 4 Target Analytes)	SW-846 5035	SW-846 8260B
	SVOCs (EPA Region 4 Target Analytes)	SW-846 3541	SW-846 8270C SIM
	Pesticides (EPA Region 4 Target Analytes)	SW-846 3541	SW-846 8081A
	Herbicides (EPA Region 4 Target Analytes)	SW-846 8151A	SW-846 8151A
	PCBs (EPA Region 4 Target Analytes)	SW-846 3541	SW-846 8082
	PCDD/PCDFs (all TEQ component congeners+Totals)	EPA 1613B	EPA 1613B
	Sulfide	SW-846 9030B	SW-846 9034
	Cyanide	SW-846 9012B	SW-846 9012B
	pH	None	SW-846 9045D
	Organic Carbon	None	Walkley Black
Water (Equip. Blanks)	Metals (EPA Region 4 Target Analytes)	SW-846 3050B	SW-846 6020
	Mercury	SW-846 7470A	SW-846 7470A
	VOCs (EPA Region 4 Target Analytes)	None	SW-846 8260B
	SVOCs (EPA Region 4 Target Analytes)	SW-846 3510C	SW-846 8270C SIM
	Pesticides (EPA Region 4 Target Analytes)	SW-846 3510C	SW-846 8081A
	Herbicides (EPA Region 4 Target Analytes)	SW-846 8151A	SW-846 8151A
	PCBs (EPA Region 4 Target Analytes)	SW-846 3510C	SW-846 8082
	PCDD/PCDFs (all TEQ component congeners+Totals)	EPA 1613B	EPA 1613B
	Sulfide	SW-846 9030B	SW-846 9034
	Cyanide	SW-846 9012B	SW-846 9012B
Water (Trip Blanks)	VOCs (EPA Region 4 Target Analytes)	None	SW-846 8260B

Table 4. Laboratory Analyses for Outfall Ditch Sediment Samples

Matrix	Analytes	Preparation Method	Analysis Method
Sediment	Pentachlorophenol + PAHs (Site-specific List)	SW-846 3541	SW-846 8270C SIM
	Arsenic	SW-846 3050B	SW-846 6020
	PCDD/PCDFs (all TEQ component congeners+Totals)	EPA 1613B	EPA 1613B
Water (Equip. Blanks)	Pentachlorophenol + PAHs (Site-specific List)	SW-846 3510C	SW-846 8270C SIM
	Arsenic	SW-846 3050B	SW-846 6020
	PCDD/PCDFs (all TEQ component congeners+Totals)	EPA 1613B	EPA 1613B



SOURCE: U.S.G.S. QUADRANGLE GAINESVILLE EAST, FLA 1966 (PHOTOREVISED 1988)



LEGEND

FORMER KOPPERS FACILITY

FORMER CABOT CARBON FACILITY

NOTE:
FEATURES SHOWN AT FORMER KOPPERS FACILITY DO NOT REFLECT CURRENT CONDITIONS.

0 1500 3000
SCALE IN FEET

TITLE:
SITE LOCATION

LOCATION:
Cabot Carbon/Koppers Superfund Site
Gainesville, Florida

TETRA TECH

APPROVED	GC	FIGURE
DRAFTED	CP	1
PROJECT#	117-2201283	
DATE	9-3-13	

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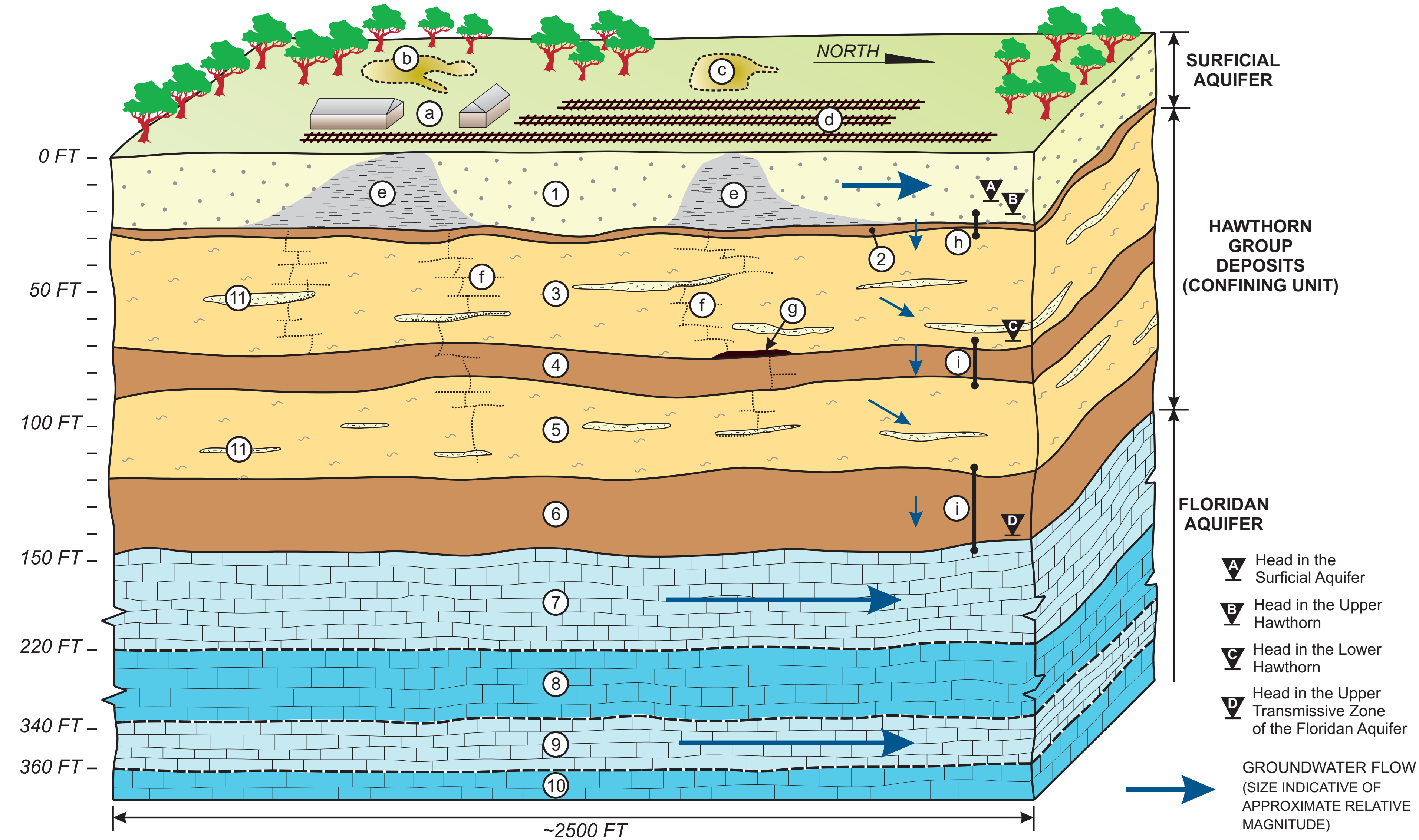

1) Surficial Aquifer
2) Hawthorn Group - Upper Clay
3) Hawthorn Group - Upper Hawthorn
4) Hawthorn Group - Middle Clay
5) Hawthorn Group - Lower Hawthorn
6) Hawthorn Group - Lower Clay
7) Floridan Aquifer - Upper Transmissive Zone
8) Floridan Aquifer - Semi-Confining Zone
9) Floridan Aquifer - Lower Transmissive Zone
10) Floridan Aquifer - Semi-Confining Zone
11) Discontinuous Sandy Interbeds

a) Former Process Area
b) Former South Lagoon
c) Former North Lagoon
d) Former Drip Track
e) Soils with Residual DNAPL
f) Sparse Seams of Residual DNAPL
g) Sparse Seams of Locally Continuous DNAPL
h) Moderate Vertical Hydraulic Gradient (~1 ft/ft)
i) Large Vertcial Hydraulic Gradient (~3 ft/ft)

Note:
There are uncertainties associated with the conceptual understanding presented in this figure.

NOT TO SCALE

TITLE:

CONCEPTUAL SITE MODEL

LOCATION: **Cabot Carbo/Koppers Superfund Site Gainesville, Florida**

TETRA TECH

APPROVED	GC	FIGURE
DRAFTED	CP	2
PROJECT#	2201315	
DATE	9-3-13	

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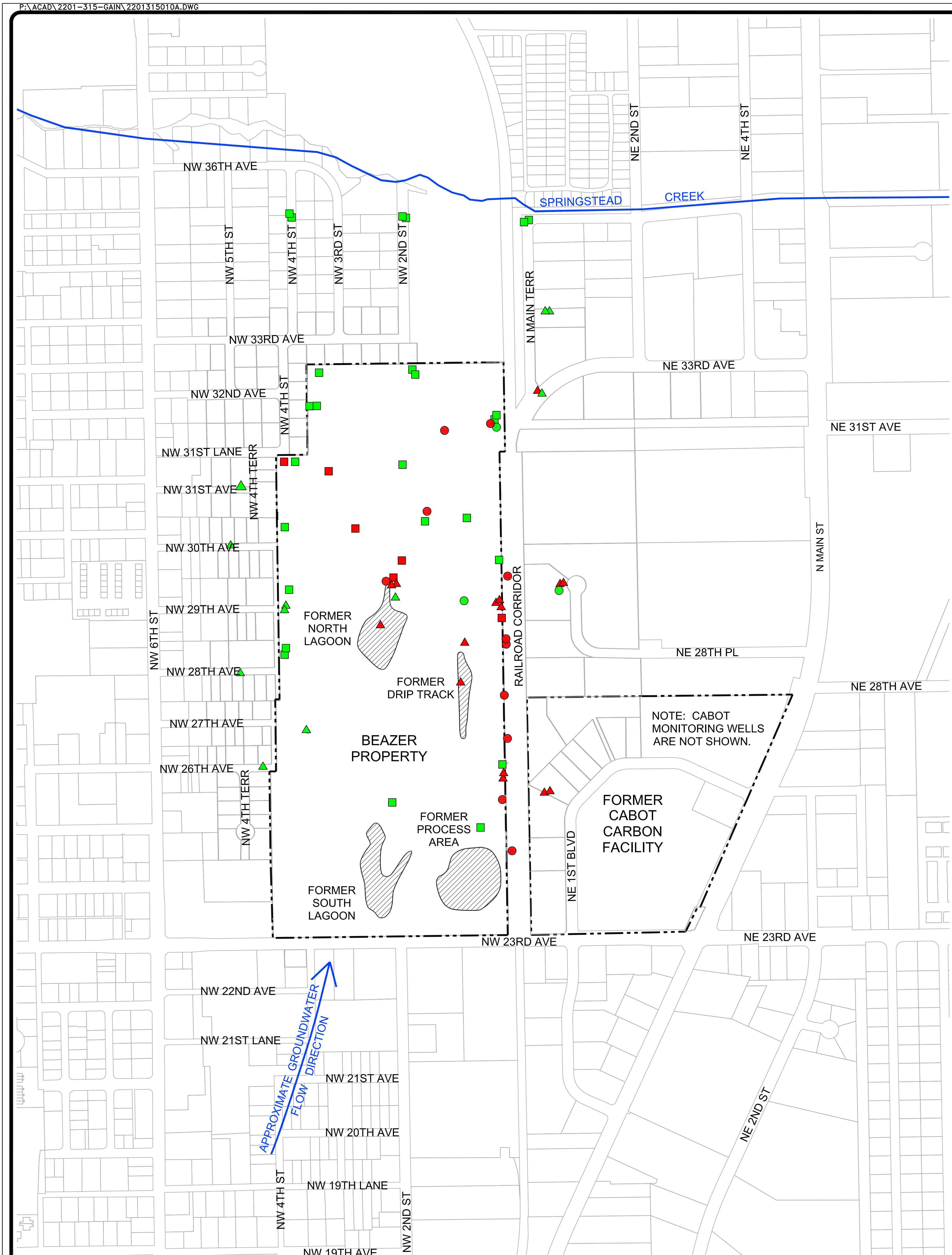

LEGEND

SURFICIAL AQUIFER MONITORING WELL
- MEETS CLEANUP GOALS
- DOES NOT MEET CLEANUP GOALS

HAWTHORN GROUP MONITORING WELL
- MEETS CLEANUP GOALS
- DOES NOT MEET CLEANUP GOALS

FLORIDAN AQUIFER MONITORING WELL
- MEETS CLEANUP GOALS
- DOES NOT MEET CLEANUP GOALS

PRINCIPAL DNAPL SOURCE AREAS (FORMER KOPPERS FACILITY)

N

0 500 1000
SCALE IN FEET

TITLE:	**PRINCIPAL SOURCE AREAS AND CONCENTRATIONS RELATIVE TO GROUNDWATER CLEANUP GOALS**
LOCATION:	**Cabot Carbon/Koppers Superfund Site Gainesville, Florida**

TETRA TECH

APPROVED	GC	FIGURE
DRAFTED	CP	3
PROJECT#	117-2201315	
DATE	9-3-13	

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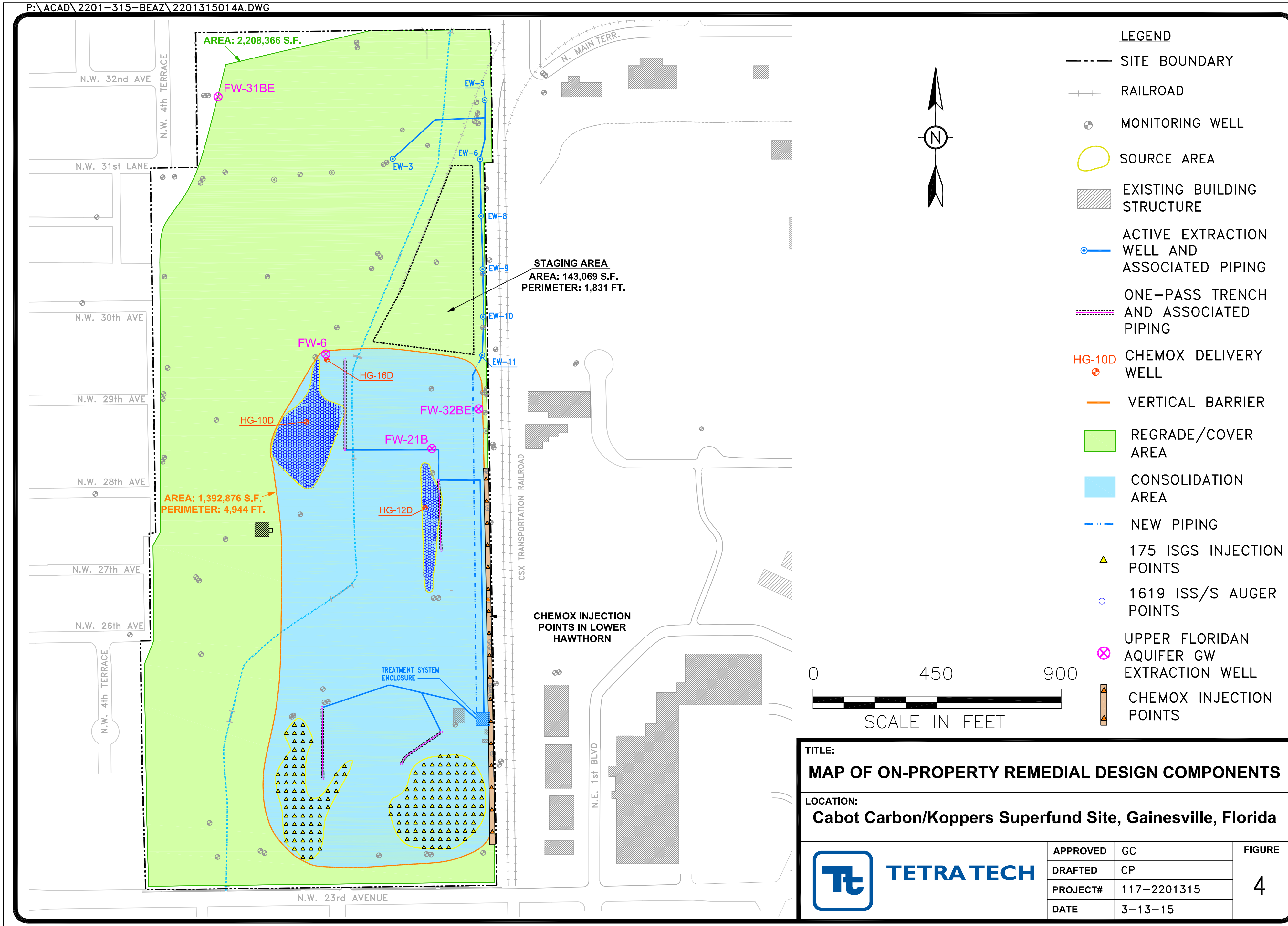


TITLE:

MAP OF ON-PROPERTY REMEDIAL DESIGN COMPONENTS

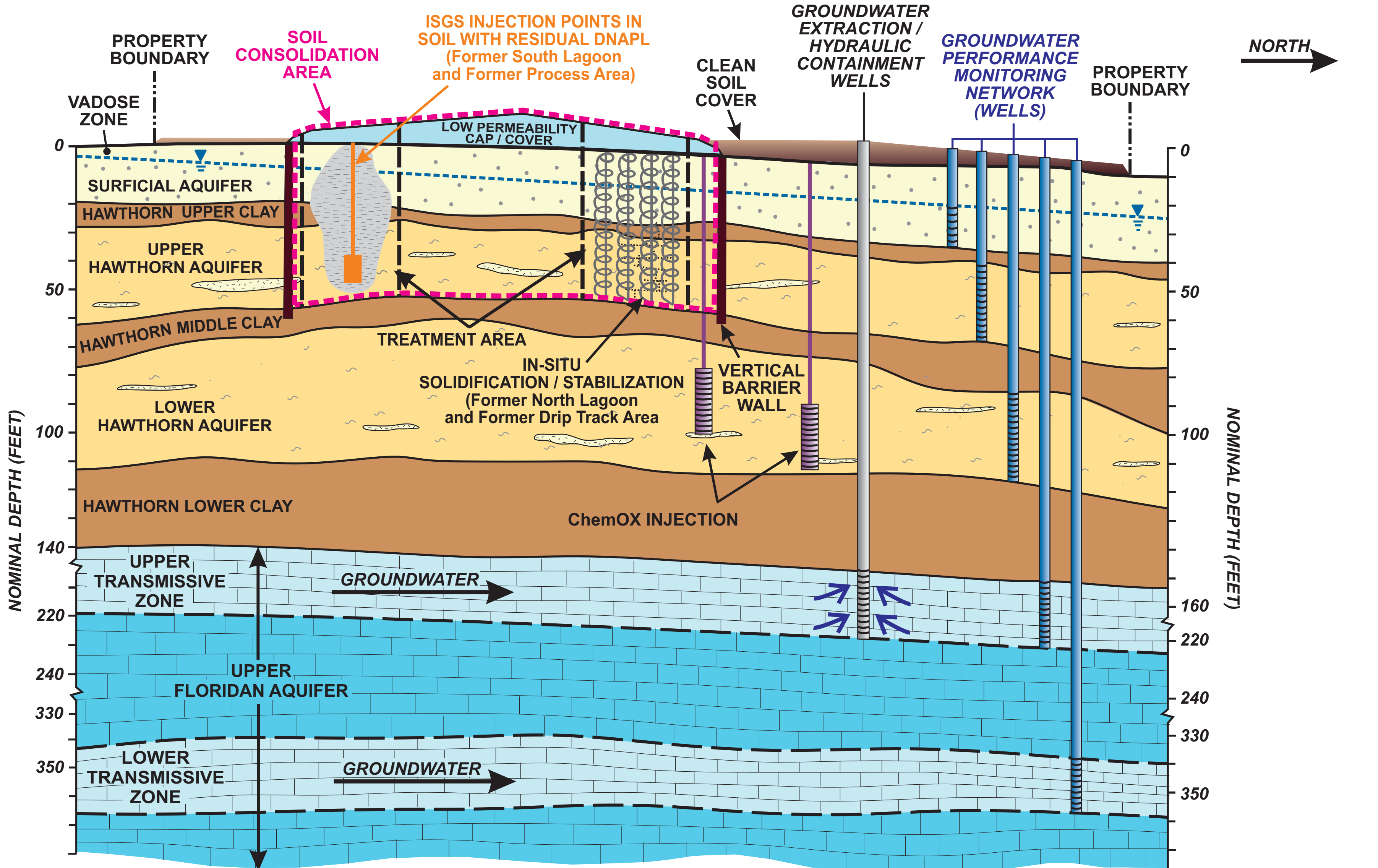
LOCATION:

Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

TETRA TECH

APPROVED	GC	FIGURE
DRAFTED	CP	4
PROJECT#	117-2201315	
DATE	3-13-15	

2201315002A.CDR



NOT TO SCALE

TITLE: **CONCEPTUAL CROSS SECTION OF ON-PROPERTY REMEDIAL DESIGN COMPONENTS**

LOCATION: **Cabot Carbon/Koppers Superfund Site Gainesville, Florida**

TETRA TECH

APPROVED	GC
DRAFTED	CP
PROJECT#	2201315
DATE	3-13-15

FIGURE 5

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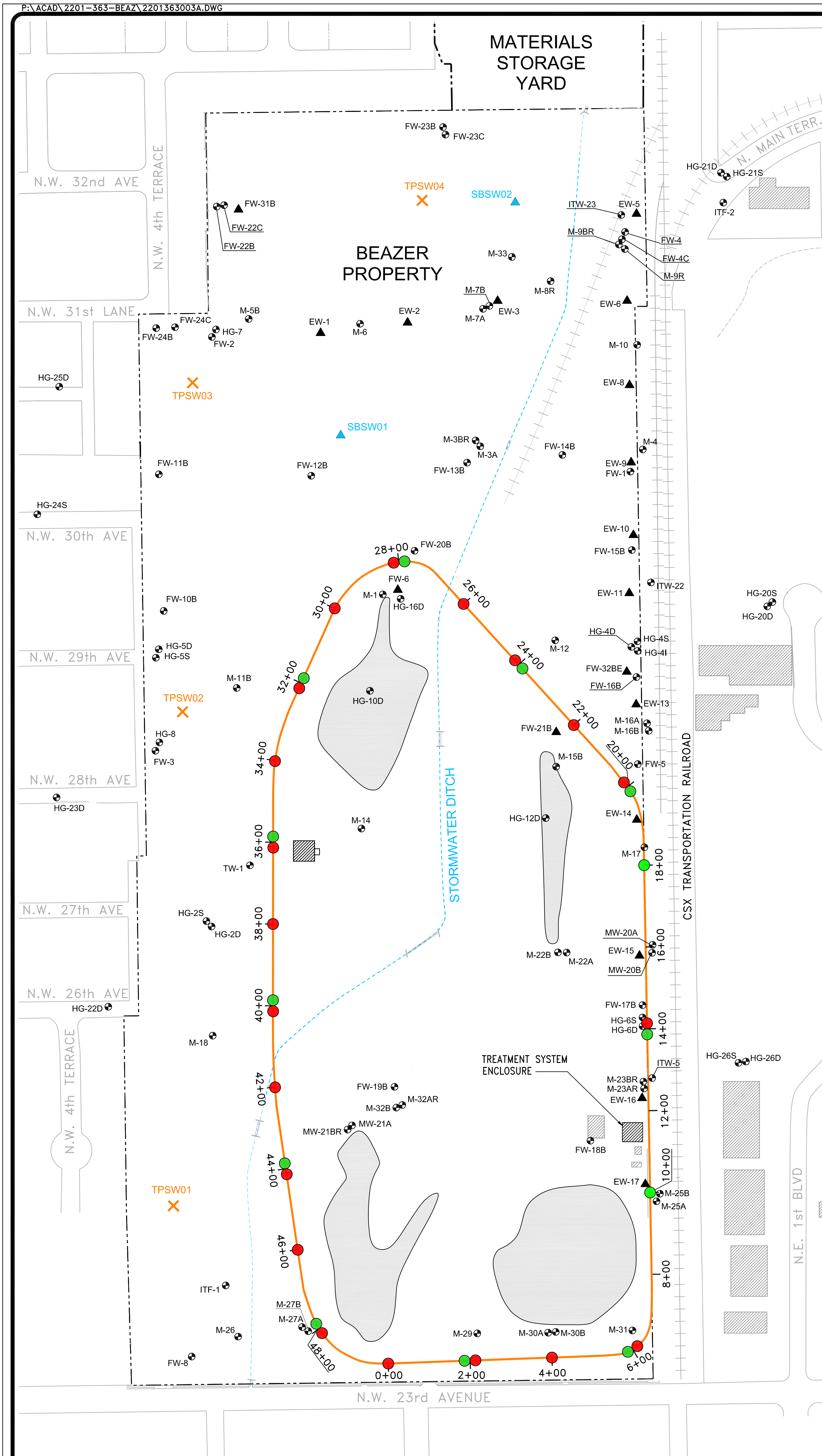

SAMPLE LOCATIONS		
STATION	NORTHING	EASTING
0+00	251739.01	2658615.40
2+00	251746.37	2658815.26
4+00	251753.73	2659015.13
6+00	251773.77	2659212.22
10+00	252157.10	2659254.81
14+00	252557.03	2659247.46
18+00	252956.96	2659240.11
20+00	253147.88	2659198.59
22+00	253299.21	2659068.36
24+00	253447.19	2658933.82
26+00	253595.18	2658799.28
28+00	253698.46	2658643.38
30+00	253584.43	2658484.65
32+00	253401.88	2658402.94
34+00	253213.51	2658339.29
36+00	253013.12	2658334.17
38+00	252813.12	2658334.00
40+00	252613.12	2658333.84
42+00	252413.95	2658339.06
44+00	252214.94	2658365.08
46+00	252017.08	2658394.28
48+00	251824.75	2658446.24
SBSW01	254007.22	2658499.43
SBSW02	254576.51	2658925.46
TPSW01	252124.78	2658090.73
TPSW02	253331.78	2658113.17
TPSW03	254135.91	2658137.72
TPSW04	254581.51	2658698.11

HORIZONTAL DATUM IS NAD 83 STATE PLANE COORDINATE SYSTEM, FLORIDA NORTH ZONE, U.S. SURVEY FEET.

LEGEND

- PLANNED DEEP (70') SPT BORING LOCATION
- PLANNED SHELBY TUBE SAMPLING OF HAWTHORN MIDDLE CLAY
- PLANNED SHALLOW (15') SPT BORING LOCATION
- PLANNED TEST PIT FOR HORIZONTAL AND VERTICAL SHELBY TUBE SAMPLING
- EXISTING MONITORING WELL
- EXISTING EXTRACTION WELL
- PROPERTY BOUNDARY
- SOURCE AREA
- CUTOFF WALL ROUTE
- EXISTING BUILDING STRUCTURE

TITLE: **GEOTECHNICAL SAMPLING LOCATIONS**

LOCATION: **Gainesville, Florida**
Cabot Carbon/Koppers Superfund Site

TETRA TECH

APPROVED	GC	FIGURE
DRAFTED	CP	6
PROJECT#	117-2201355	
DATE	8-17-15	

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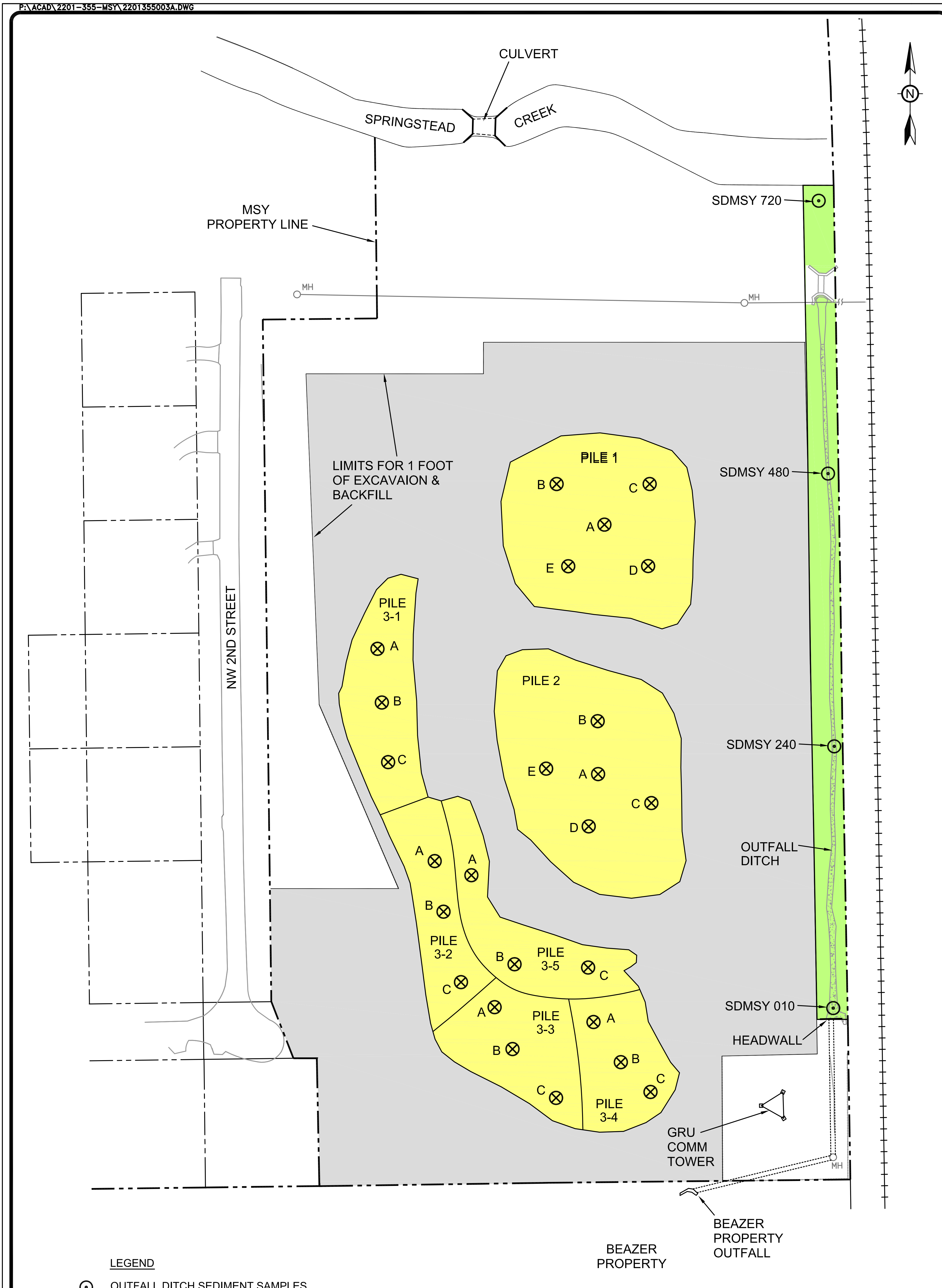

LEGEND

- OUTFALL DITCH SEDIMENT SAMPLES
- STOCKPILE SAMPLES
- STOCKPILES
- SURFACE SOIL REMOVAL AREA
- OUTFALL DITCH
- CULVERT
- MH MANHOLE

0 80 160
SCALE IN FEET

TITLE:	MSY SEDIMENT & SOIL SAMPLING			
LOCATION:	Gainesville, Florida Cabot Carbon/Koppers Superfund Site			
TETRA TECH	APPROVED	GC	FIGURE	
	DRAFTED	CP		7
	PROJECT#	117-2201355		
	DATE	5-11-15		