LMS/PIN/N01359

Pinellas Environmental Restoration Project

Interim Remedial Action for Source Removal at the 4.5 Acre Site

Final Report

September 2009

U.S. DEPARTMENT OF ENERGY | Legacy Management

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Abbreviations

BBES	Big Bend Environmental Services
bls	below land surface
cDCE	*cis*-1,2-dichloroethene
CTL	cleanup target level
DOE	U.S. Department of Energy
F.A.C.	*Florida Administrative Code*
FDEP	Florida Department of Environmental Protection
ft	feet
GPS	Global Positioning System
HASP	Health and Safety Plan
HSWA	Hazardous and Solid Waste Amendments
LDA	large-diameter auger
LM	(DOE) Office of Legacy Management
NAPL	nonaqueous-phase liquid
PID	photoionization detector
psi	pounds per square inch
RBCA	Risk-Based Corrective Action
RCRA	Resource Conservation and Recovery Act
STAR	Science, Technology, and Research
Stoller	S.M. Stoller Corporation
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
UHC	underlying hazardous constituents
UTS	Universal Treatment Standards
VOCs	volatile organic compounds
WRS	WRScompass
yd^3	cubic yard

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Executive Summary

The objective of this interim remedial action was to remove the source of contamination at the 4.5 Acre Site using the large-diameter auger (LDA) method of soil excavation followed by off-site disposal of the contaminated soil. The project was conducted from November 2008 through June 2009 for the U.S. Department of Energy (DOE) by the team of WRScompass and Big Bend Environmental Services, who were under contract to the S.M. Stoller Corporation, the Legacy Management Support contractor.

DOE collected 1,172 soil samples from 138 soil borings installed at two areas of the 4.5 Acre Site from June to September 2007 to characterize the source areas. The following contaminants were detected at elevated concentrations in the soil samples: trichloroethene, *cis*-1,2-dichloroethene, *trans*-1,2-dichloroethene, and toluene. Soil concentrations indicative of contaminant source were determined by comparison to Florida Department of Environmental Protection Cleanup Target Levels, and source areas were delineated. A feasibility study selected large-diameter augering as the best method to remove the source of contamination in soil at the 4.5 Acre Site.

A total of 221 large-diameter (66 inches) auger borings and 326 small-diameter (16 inches) auger borings were installed at the 4.5 Acre Site. A total in-place volume of 7,035 cubic yards (yd^3) of soil was excavated during the project. This volume was composed of 4,522 yd^3 of clean overburden soil and 2,513 yd^3 of contaminated or “source” soil. The total cost of the project was $2,875,000. The LDA project at the 4.5 Acre Site was conducted under the same contract as a similar LDA project at the nearby Northeast Site.

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1.0 Introduction

This document serves as the final report for the Interim Remedial Action conducted from November 2008 through June 2009, in which the large-diameter auger (LDA) method was used to excavate soil that was a source of contamination at the 4.5 Acre Site located in Largo, Florida. An Interim Remedial Action Plan (DOE 2008b) was submitted to the Florida Department of Environmental Protection (FDEP) on July 23, 2008, and was approved by FDEP on August 19, 2008. The remediation was completed for the U.S. Department of Energy (DOE) Office of Legacy Management (LM) by the team of WRScompass (WRS) and Big Bend Environmental Services (BBES), who were under contract to the Legacy Management Support contractor, S.M. Stoller Corporation (Stoller).

1.1 Objective and Scope

The objective of this action was to remove the source of contamination at the 4.5 Acre Site using LDA followed by off-site disposal of the contaminated soil. DOE chose this source removal method during a feasibility study conducted in 2008 (DOE 2008a).

DOE's ultimate goal at the 4.5 Acre Site is to close the site under the FDEP's Global Risk-Based Corrective Action (RBCA) rules (Chapter 62-780 *Florida Administrative Code* [F.A.C.]). These rules require removal of potential free product (nonaqueous-phase liquids [NAPLs]) from the site and also require an evaluation of soils as a source of groundwater contamination during the selection of the appropriate risk-management option for site closure. For the purposes of this Interim Remedial Action, contaminant source is defined as contaminant concentrations in soil that result in unacceptable contaminant concentrations in groundwater (i.e., groundwater concentrations exceeding poor water quality cleanup target levels [CTLs] as determined under the RBCA rules). This definition of contaminant source includes both NAPLs and contaminants sorbed to the soil matrix.

This soil excavation source removal action affected only the source of contamination; it did not treat the dissolved-phase contaminant plumes located hydraulically downgradient from the source areas. However, DOE plans to add amendments to enhance anaerobic contaminant biodegradation adjacent to the source areas in early 2010, as discussed in Section 3.7. This should treat any residual amounts of contaminants in soils outside the excavation areas and decrease dissolved-phase contaminant concentrations for a short distance downgradient from the source areas. This biological polishing should shorten the life of the plumes and accelerate site closure.

1.2 Project Cost

Detailed costs are listed in Table 1. The augering task cost $1,939,650, and soil disposal cost $192,413 (all soil was disposed of as nonhazardous material). The total subcontracted cost of the LDA project was $2,875,000. In addition to this amount, DOE spent $22,810 in analytical costs for perimeter air monitoring during the project.

1.3 Project Timeline

The LDA project at the 4.5 Acre Site was conducted under the same contract as a similar LDA project at the nearby Northeast Site. Some site preparation activities were conducted concurrently at both sites starting with mobilization to the site by WRS and BBES on November 17, 2008, and other site preparation activities were conducted following relocation from the Northeast Site to the 4.5 Acre Site starting on March 16, 2009. Site preparation included installation of soil stockpile pads and decontamination areas, establishment of storm water controls, assembly of the flowable fill batch plant, surveying of the auger layout, and mobilization of cranes, auger rigs, dump trucks and other machinery. Large-diameter augering began on March 31, 2009, and was completed on May 16, 2009. Augering of the small-diameter borings began on May 19, 2009, and was completed on May 27, 2009. Demobilization and site restoration activities were completed by June 26, 2009.

1.4 Roles and Responsibilities

WRS was subcontracted to Stoller for the 4.5 Acre Site LDA project. WRS teamed with subcontractor BBES. BBES provided the LDA equipment and operators, and WRS provided project management, soil management and disposal activities, and documentation. Responsibilities, authorities, and actions of the participants in the project were described in the *Management Plan for the Source Remediation Project at the Northeast Site and 4.5 Acre Site* (DOE 2008c).

1.5 Project Documents

The documents prepared by WRS for this project are listed below.

- Auger Layout
- Site Layout
- Environmental Compliance/Waste Management Plan
- Storm Water Pollution Prevention Plan
- Health and Safety Plan
- Sampling and Analysis Plan
- Stockpile Management Plan

2.0 Background

This section presents relevant site background information.

2.1 Site Description and History

The former DOE Pinellas Plant facility consisted of the 4.5 Acre Site and the property currently known as the Young-Rainey STAR Center, located in Largo, Florida. The 4.5 Acre Site is located to the west of the STAR Center (Figure 1). The Pinellas Plant was constructed in the

mid-1950s as part of a nationwide nuclear weapons research, development, and production complex. Production of weapons-related components at this facility ceased in September 1994. DOE owned the 4.5 Acre Site from 1957 to 1972, at which time it was sold to a private landowner. During the period of DOE ownership, the property was used for disposal of drums of waste resins and solvents.

Groundwater remediation activities conducted at the site since December 1988 include groundwater pumping, dual phase extraction, and biosparging. Subsequent monitoring showed persistently elevated contaminant concentrations potentially indicative of continuing source of contamination, so DOE conducted the source characterization activities summarized in the *4.5 Acre Site Source Characterization Data Report* (DOE 2007a). A feasibility study (DOE 2008a) determined that LDA was the best option to remove the contaminant source in soil. Stoller issued a Request for Proposal for LDA excavation, and the WRS/BBES team was selected to conduct the remediation.

2.2 Hydrology

The uppermost deposits are known as the surficial sediments and consist of silty to shelly sands that are about 28 feet (ft) thick at the 4.5 Acre Site. Depth to water ranges from about 1 to 5 ft below land surface (bls), depending on the season. No municipal water supplies are obtained from the surficial aquifer due to the poor yield and poor quality of the groundwater. Underlying the surficial sediments is the Hawthorn Group (Hawthorn). The Hawthorn is a 70-ft-thick clay aquitard that separates the surficial aquifer from the underlying upper Floridan aquifer.

The surficial aquifer at the 4.5 Acre Site acts as a two-layer hydraulic system due mainly to horizontal-to-vertical anisotropy. In shallow surficial aquifer, groundwater flow is generally toward the northwest with a potential minor southeastward component at the southern tip of the site. The hydraulic gradient in the shallow surficial aquifer was about 0.003 ft/ft in March 2009, and groundwater is estimated to move about 4−5 ft/year. Similar flow patterns and velocity were observed in the deep surficial aquifer.

Geochemical conditions at the 4.5 Acre Site generally are moderately reducing, as evidenced by the low values of dissolved oxygen and negative values of oxidation-reduction potential. Dissolved oxygen concentrations generally are less than 1 milligram per liter, and oxidation-reduction potential values average approximately –100 millivolts, indicating iron-reducing conditions. These conditions are generally conducive to biological reductive dechlorination of the chlorinated ethene contaminants. In fact, biodegradation products (such as vinyl chloride and ethene) are detected in groundwater samples at the site, indicating that contaminant biodegradation is occurring naturally.

2.3 Source Area Determination

To investigate the potential for contaminant source remaining in the subsurface at the 4.5 Acre Site, DOE collected 1,172 soil samples from 138 soil borings installed at two areas of the site from June to September 2007. The surface area covered by the soil borings was approximately 0.3 acre (Figure 2). The choice of characterization technique and sampling methodology is described in detail in the *4.5 Acre Site Source Characterization Work Plan* (DOE 2007b), and the results of the source characterization are described in detail in the *4.5 Acre Site Source*

Characterization Data Report (DOE 2007a). Analytical results from the soil samples demonstrated that trichloroethene, *cis*-1,2-dichloroethene, *trans*-1,2-dichloroethene, and toluene were found in multiple locations at elevated concentrations

To determine which concentrations represented a potential source of contamination, the data were compared to the default soil CTL (Table 1) based on leachability to poor quality groundwater as listed in Table II in Chapter 62-777 F.A.C. CTLs were chosen because they represent the lowest soil concentration at which a contaminant could be considered to be a source of contamination (i.e., have a negative impact to groundwater). Two distinct contaminant source areas were apparent, one in the east central part of the site and one near the southwest border of the site (Plates 1 and 2). Source area interval and depth to Hawthorn for each excavation cell are listed in Table 2.

2.4 Regulatory Requirements and Permits

This section summarizes the regulatory requirements that were relevant to this project. A more detailed description of the regulatory requirements is found in the *Pinellas Environmental Restoration Project Environmental Compliance Plan Young - Rainey STAR Center* (DOE 2004).

Analytical results from the 2007 soil characterization indicated that some portion of the contaminated soil contained total concentrations greater than 20 times the leachate Toxicity Characteristic Leaching Procedure (TCLP) criteria, and that RCRA requirements could potentially apply to the transportation and disposal of the soil. As a result of consultation with FDEP and verification that the Interim Remedial Action Plan would act as the permit, a RCRA permit was not required, and management and storage requirements under RBCA applied.

Wastewater from the excavation activities at the Northeast Site was discharged to the on-site Industrial Wastewater Neutralization Facility, which discharges to the municipal water treatment system under a discharge permit issued to the STAR Center. Stoller was responsible for monitoring the waste streams going to the Industrial Wastewater Neutralization Facility on a monthly basis to ensure that permit limits were not exceeded as a result of treatment activities.

Discussions with the state regulators determined that air permits were not required for this activity because the actions met the generic unit exemption under 62-210.300 F.A.C. The State confirmed that no ambient air monitoring was required for this project, although ambient air monitoring was conducted, as described in Section 3.6. The state regulators also suggested that best management practices be used to minimize fugitive dust emissions.

Storm water was managed according to the applicable state and local requirements. The 4.5 Acre Site excavation resulted in a disturbance of between 1 and 5 acres of land and was considered a Phase I small construction area and, therefore required a Generic Storm Water Permit Notice of Intent. The permit was issued under the provisions of Section 403.0885, Florida Statutes, and Rule 62-621.300(4), F.A.C., pursuant to FDEP's federally approved National Pollutant Discharge Elimination System storm water regulatory program. An FDEP Generic Permit for Storm Water Discharge from Large and Small Construction Activities was maintained, and a Storm Water Pollution Prevention Plan was developed and implemented.

3.0 LDA Approach

The LDA method involved first driving a 35-ft-long, 66-inch inside diameter steel casing into the ground using a vibratory hammer attached to a crane, then using a 60-inch-diameter auger to excavate the soil from inside the casing (Figure 3). The casing prevents the collapse of the surrounding soils into the boring and prevents groundwater from flowing into the boring. Most auger borings extended into the Hawthorn, but the steel casing was not driven more than a few feet into the Hawthorn because the Hawthorn did not collapse into the uncased boring, and little or no groundwater entered the boring from the Hawthorn. Use of the vibratory hammer as the driving unit allowed the energy to be varied as different types of soil units were encountered. This maximized the rate at which the casing was advanced and minimized the amount of energy transmitted through the formation into nearby structures.

In addition to the large-diameter borings, small-diameter borings (16-inch auger) were installed in the spaces between the large borings to remove as much soil as possible. These small borings were uncased to allow as much soil as possible to collapse into the boring and be removed. Each boring had a unique alpha-numeric designation and boring installation was tracked using an Access database.

Most auger borings had clean soil overlying the contaminated soil, as defined during the characterization events described in Section 2.3. The clean soil was augered out to the pre-determined depth and stockpiled on the ground outside the exclusion zone. The depth of excavation within the casing was measured using a weighted tape measure. When the contaminated soil depth was reached, that soil was augered out and transported to the appropriate contaminated-soil stockpile. As the auger was removed from the casing, the rig swung to the side to a position above the bed of a small dump truck, and the auger was backspun to place the soil into the dump truck (Figure 3). Once filled, the dump truck left the exclusion zone and then dumped its load of soil into the appropriate stockpile. To prevent cross-contamination of materials from excavation cell to excavation cell, the auger flights were dry-decontaminated to remove solid debris.

Once the excavation within each casing was completed, the cased hole was backfilled with a low-strength concrete, also known as flowable fill. The flowable fill strength was in the range of 100 pounds per square inch (psi) to 175 psi. The fill was produced on site in a batch plant in order to deliver a consistent flowable fill mix in a timely manner. The low-strength fill was used because it is excavatable for potential future building at the site. The fill must be placed into the casing in a minimum amount of time so the fill does not set up before the casing was pulled. The vibratory hammer was used to extract the casing when approximately half of the fill was in place, then the remainder of the boring was filled.

A total of 7,035 yd^3 (in-place volume) of soil were excavated during the project at the 4.5 Acre Site. This volume consisted of 4,522 yd^3 of clean soil (overburden) and 2,513 yd^3 of contaminated or “source” soil. The clean soil was graded across the site during demobilization activities.

DOE sampled the clean soil according to the FDEP-approved *Sampling and Analysis Plan for Overburden Soil at the Northeast Site and 4.5 Acre Site* (DOE 2009c) to ensure that the soil was

clean. The results are reported in the *Data Report for Overburden Soil at the Northeast Site and 4.5 Acre Site* (DOE 2009a).

The LDA work was completed in the following general sequence:

1. Mobilization
2. Establish access controls
3. Establish staging area
4. Install erosion control features
5. Construct stockpile pads
6. Construct decontamination facility
7. Install air stripper for water treatment
8. Prepare flowable fill batch plant
9. Auger soils
10. Backfill augered holes
11. Stockpile soils
12. Sample stockpiles
13. Lab analysis
14. Transportation and disposal of soils
15. Completion of soils removal
16. Removal and disposal of support facilities (stockpile pads, decontamination pad, staging area, erosion controls)
17. Removal of flowable fill batch plan
18. Demobilization
19. Site Restoration

3.1 Auger Layout

The as-built auger layout is shown on Plates 1 and 2. The large circles represent the locations of 66-inch-diameter auger borings, and the small circles represent the locations of 16-inch-diameter auger borings. A total of 221 large-diameter borings and 326 small-diameter borings were installed. All the large-diameter borings were completed first, and subsequently all the small-diameter borings were completed.

As described in Section 2.3, the source areas were divided into excavation cells based on characterization data. The excavation cell layout was provided to WRS, and WRS designed the auger layout. Source area interval and depth to Hawthorn for each excavation cell is listed in Table 2, and the excavation cells are shown on Plates 1 and 2.

The borings were located by surveying some of the first locations using a licensed land surveyor and comparing this information to that from a hand-held Global Positioning System (GPS)

device. The GPS device was able to match the surveyed locations within 4–6 inches, so it was determined that subsequent borings would be located using only the GPS device. Staking the boring locations would have been problematic, because the movement of large machinery across the site likely would have destroyed or moved the stakes.

A considerable amount of historical remediation infrastructure exists in the subsurface at the 4.5 Acre Site, including monitoring wells, groundwater extraction wells, and horizontal biosparging wells. Augering out these wells did not interfere with augering operations.

3.2 Site Layout

The site layout is shown on Plate 3. A decontamination area was established close to the entrance of the 4.5 Acre Site. Decontamination pads were constructed of a minimum 3,000-psi strength concrete reinforced with fiber and welded wire mesh. The pad was 20 ft by 40 ft and 6 inches thick with curbs along each length. The pad was sloped to a central catch basin that contained a submersible pump. The pump's discharge hose was routed through a conduit and discharged into a 200-gallon tank. A decontamination trailer equipped with lockers and showers was stationed next to the decontamination pad. Accumulated water was processed through the on-site water treatment system.

As required by the Pinellas County Building and Development Department, WRS submitted an engineered site plan. The site plan included a water treatment system located near the southern boundary of the site and soil stockpile pads located on the northern portion and western portions of the site. The flowable fill batch plant, consisting of a silo, hopper, and conveyor, was located at the Northeast Site.

The source remediation areas were considered to be exclusion zones. Only certified, trained personnel were allowed entry into these areas. The exclusion zones were demarcated with orange safety fence and posted signs. The decontamination area served as the contaminant reduction zone from the exclusion zone. This zone/area was equipped with health and safety features such as hand and eye wash stations, air horns, sign-in sheets, boot brushes, and fire extinguishers.

3.3 Stockpile Pad Construction

WRS determined that the optimum stockpile size for managing excavated soils (both hazardous and nonhazardous) was 500 yd^3 (10-ft high, 70-ft diameter). This volume was developed by considering the sampling frequency criteria required by the disposal facilities, the daily soil production rates, the resulting source material stockpile location, the earliest sample collection date for each stockpile, and the resulting load-out date for each source stockpile.

The overall stockpile pad footprint was 350 ft by 100 ft. The pad was constructed such that the finished surface tilted to create a positive slope to the northwest corner of the pad footprint where the sump was located. An electric sump pump was placed in the sump to collect accumulated rainwater and any groundwater that drained from the stockpiles. This pump transferred any water to the frac tank for treatment using the air-stripper treatment system.

Pad construction began with placement and compaction of a 6-inch base. Next, a 2-ft by 2-ft anchor trench was cut with an excavator along the outside of the stockpile pad footprint. Concrete bin blocks (6 ft long, 2 ft wide, and 3 ft tall) were installed on the subgrade around the

perimeter of the pad footprint to serve as a berm. A soil berm was also placed to separate the nonhazardous soil stockpile area from the hazardous soil stockpile area. An opening was left in the bin block wall so that the stockpiles could be accessed to add the soil. A reinforced polypropylene geomembrane, fabricated in pre-sized panels, was placed over the compacted subgrade and bin blocks, and the seams were welded. Then the geomembrane was placed in the anchor trench and backfilled with trench spoils. Finally, 6 inches of imported sand was placed over the geomembrane, prior to introduction of any stockpile material. During operations, the stockpiles were left uncovered during the work day but were covered with sheets of polyethylene material during rainstorms and every night to prevent rainwater infiltration.

3.4 Soil Management and Disposal

Prior to the start of excavation, each excavation cell was assigned a potential waste disposal designation based on the prior soil characterization data.

- Nonhazardous. Total contaminant concentrations in soil (in micrograms per kilogram [μg/kg]) are less than 20 times the leachate TCLP criteria (μg/L). It was assumed that this soil could be disposed of at a Subtitle D landfill.
- Hazardous <UTS. Total contaminant concentrations in soil (μg/kg) are greater than 20 times the leachate TCLP criteria (μg/L), but soil underlying hazardous constituents (UHC) concentrations are less than the Land Disposal Restriction Universal Treatment Standards (UTS) for soil (40 CFR 268.49); the UHC concentrations for soil are 10 times the UTS. It was assumed that this soil could be disposed of directly (without treatment) at a Subtitle C landfill.
- Hazardous >UTS. Total contaminant concentrations in soil (μg/kg) are greater than 20 times the leachate TCLP criteria (μg/L), and soil UHC concentrations are greater than the UTS. It was assumed that this soil required treatment to below UTS concentrations before it could be disposed of at a Subtitle C landfill.

The excavated soils were segregated and stockpiled according to these designations. However, once in the stockpile, the soils were sampled and analyzed according to the stockpile sampling plan, and the actual soil disposal was based on the analytical results. The stockpiled soil was handled in 500 yd^3 batches. Once approximately 500 yd^3 of soil had accumulated in a stockpile, the pile was sampled for waste characterization by using a backhoe to dig into the pile and collect a composite sample that consisted of five individual soil samples distributed evenly across the interior of the stockpile. The results of TCLP analysis showed that no contaminant concentrations exceeded the TCLP limits, so all excavated source area soils were disposed of as nonhazardous. The soil was hauled by truck from the site to the Omni Waste Landfill in Holopaw, Florida.

3.5 Water Management

During excavation activities, potentially contaminated water could be produced by drainage from stockpiled contaminated soil and by storm water that came in contact with stockpiled contaminated soil. Therefore, the stockpile pads were constructed so that any water would drain to a sump that would pump the water to a frac tank, and the water subsequently would be treated on site using an air stripper. As discussed in Section 2.4, this treated water would be discharged

to the STAR Center's wastewater facility once analytical results demonstrated that it met all of the STAR Center's wastewater discharge requirements.

However, no water was treated during the excavation project. Soil excavated by the LDA was damp but appeared to be unsaturated with groundwater, even though the majority of the excavated soil was located below the water table. As described in more detail in Section 4.1, this lack of saturation was probably due to the vibration and compression associated with driving the casing, which forced groundwater from the area below the casing as it was being driven. This lack of groundwater saturation resulted in no groundwater draining from the stockpiled soil. Some rain fell on the covered stockpiles during the project, and this water accumulated in the frac tank. An analysis of this water demonstrated that it met the STAR Center's wastewater discharge requirements without treatment, so this water was simply discharged directly to the STAR Center's wastewater facility.

3.6 Health and Safety

WRS developed a Health and Safety Plan (HASP) for the excavation project by incorporating relevant requirements from Stoller's Legacy Management Support *Health and Safety Manual* (LMS/POL/S05421) and addressing specific aspects of the excavation that were not covered in the *Health and Safety Manual*. The project was intentionally scheduled for the dry season to avoid both the wet working conditions of the wet season (June−September) and the potential safety issues associated with thunderstorms and hurricanes.

A hazard assessment identified the following project-associated hazards:

- Chemical
- Noise
- Fire/explosion
- Heat stress
- Underground utilities
- Heavy equipment
- Same level falls (trips, slips, falls)
- Different level falls
- Trenching/shoring
- Overhead hazards
- Electrical hazards
- Unstable/uneven terrain (soil piles)
- Confined-space entry (frac tanks)
- Rigging and lifting

A dedicated Health and Safety officer was present at least 40 hours per week throughout the construction and excavation phases, and safety meetings were conducted daily. These meetings discussed pertinent safety topics or reviewed potential hazards for the current day's work. A Job

Safety Analysis was executed for any hazards not specifically addressed in the WRS HASP. Personnel were required to acknowledge through signature that they had read and reviewed the WRS HASP. In addition, all workers were certified as trained in Occupational Safety and Health Administration Hazardous Waste Operations and Emergency Response prior to the start of work.

3.6.1 Vapor Monitoring

WRS established work process controls to minimize the potential for worker exposure to VOC vapors. The initial control was to begin auger work in locations where soil concentrations were lowest so the auger process could be refined before moving to areas of higher soil contamination. All pieces of heavy equipment near the auger were equipped with air conditioners that were set in recirculation mode to keep vapors out of the equipment cab during operations. Finally, the auger process only removed about 1 yd^3 of contaminated soil from the ground during each lift. Each of these controls was put into place in an effort to minimize the need for workers to wear respiratory protection during augering activities.

Based on the soil contaminants of concern, a sampling strategy was prepared to ensure that worker exposure to VOCs was maintained at levels below occupational exposure limits. The primary method to control worker exposure was to use a photoionization detector (PID) to conduct real-time monitoring at locations where worker exposures would be possible. In addition to the real-time PID air monitoring, WRS collected charcoal tube air samples to establish exposure assessment information during periods when worker exposure to VOCs was expected. Stoller also collected charcoal tube air samples at the site perimeter during LDA activity. All charcoal tube air samples were analyzed by DataChem (ALS) Laboratory in Cincinnati, Ohio. DataChem is accredited by the American Industrial Hygiene Association for the analysis of VOCs.

Real-time air monitoring was performed during augering in locations and at depths where VOC-contaminated soil was known to be present. A RAE Systems MultiRAE PID equipped with an 11.7 electron volt lamp was used to monitor at the top of the casing as VOC soil was being removed to ensure that respiratory protection was not required. Real-time monitoring at the top of the casing did indicate the presence of VOCs, but the concentrations dropped off almost immediately as the PID was moved away from the top of the casing. PID monitoring never detected VOCs present at levels above 5 parts per million as an instantaneous reading at any of the heavy equipment positioned around the casing during soil removal.

Because businesses were located adjacent to the soil excavation area, perimeter air sampling was conducted at the perimeter of each site during augering activities. Initial air sampling was conducted to establish baseline levels of VOCs at the site boundary during initial soil excavation, and also during excavation of areas identified as containing the highest concentrations of VOCs in soil. Efforts were made to collect two samples downwind and one sample upwind from the augering operation. During the period of March 31, 2009, through May 13, 2009, a total of 48 air samples were collected at the perimeter of the 4.5 Acre Site. No site-related VOCs vapors were detected in any of the perimeter air samples.

3.7 Polishing With Enhanced Bioremediation

As mentioned in the *Interim Remedial Action Plan for Source Removal at the 4.5 Acre Site* (DOE 2008b), DOE plans to implement enhanced bioremediation as a polishing step around the excavation areas now that the excavation work has been completed. This work is scheduled for January 2010. A work plan will be written and submitted to FDEP.

3.8 Recycling

WRS recycled the following materials during demobilization. These totals are for both the Northeast Site and 4.5 Acre Site LDA projects.

- 20 pounds of plastic bottles and aluminum cans.
- 139 concrete bin blocks provided to Trademark Metals Recycling LLC of Tampa for reuse. They will be using the blocks as barricades for their operations at the Port of Tampa.
- 4,080 pounds of scrap metal provided to Trademark Metals as part of demolition activities at the 4.5 Acre Site.
- 168.2 tons of concrete sent to Angelo's Aggregate Materials LLC of Largo for recycling. Concrete was generated during demolition of the site decon pads.

4.0 Problems Encountered and Lessons Learned

This section describes the problems encountered during the project and presents lessons learned.

4.1 Problems Encountered During LDA Activities

As described in detail in the *Interim Remedial Action for Source Removal at the Northeast Site Final Report* (DOE 2009b), driving the large casing caused an oversaturation of the soil outside of the boring and created a soil slurry in the uncased small borings. Once the subcontractor observed the original slurry problem at the Northeast Site, they began adding a liquid calcium hardener to the flowable fill that was used at the adjacent 4.5 Acre Site to accelerate the curing of the fill. WRS found that the fill cured much quicker at the 4.5 Acre Site and that, once all the large-diameter borings were completed, they were able to proceed with the uncased small-diameter borings and no slurry was observed.

Another phenomenon observed during small-diameter augering was that a considerable amount of fill was encountered in these borings and that the amount of fill encountered appeared to increase with depth. This indicated that, once the fill was placed into the large borings, and the casing was pulled, the fill flowed out into the surrounding soil to some degree before it cured, most likely as a result of the pressure exerted by the overlying uncured fill. Therefore, it appears likely that any soil remaining within the augered areas is encapsulated within the fill, at least at depth.

A problem encountered only at the 4.5 Acre Site was the presence of dense, hard limestone in the subsurface at some locations. The LDA could not penetrate this rock layer, resulting in

termination of a few borings above the target depth. This limestone layer was not observed during the soil characterization events.

4.2 Observations and Lessons Learned

Observations and lessons learned include the following.

- Overall, communications among the numerous organizations on site were very good.
- The subcontractor reported that the preconstruction conference was very positive and helpful.
- Waste tracking, sampling, characterization, shipment, disposal, and the associated tracking database maintained by the subcontractor worked extremely well.
- If small diameter borings are to be installed between the large diameter borings in saturated sandy soil, it is best to add agent to accelerate the cure time of the fill.
- It may not be necessary to install small diameter borings between the large diameter borings because the flowable fill may encapsulate the remaining soil, particularly below about 10−15 ft bls.
- Stormwater management during periods of heavy rain could have been better.

Additional observations and lessons learned associated with the LDA project at the Northeast Site are described in the *Interim Remedial Action for Source Removal at the Northeast Site Final Report* (DOE 2009b).

5.0 References

DOE (U.S. Department of Energy), 2004. *Pinellas Environmental Restoration Project Environmental Compliance Plan Young - Rainey STAR Center*, DOE−LM/GJ648−2004, prepared for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, April.

DOE (U.S. Department of Energy), 2007a. *4.5 Acre Site Source Characterization Data Report*, DOE−LM/1549−2007, prepared for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, December.

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DOE (U.S. Department of Energy), 2009b. *Interim Remedial Action for Source Removal at the Northeast Site Final Report*. September.

DOE (U.S. Department of Energy), 2009c. *Sampling and Analysis Plan for Overburden Soil at the Northeast Site and 4.5 Acre Site*, LMS/PIN/N01353, prepared for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, April.

Health and Safety Manual, LMS/POL/S04321, continually updated, prepared by S.M. Stoller Corporation for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado.

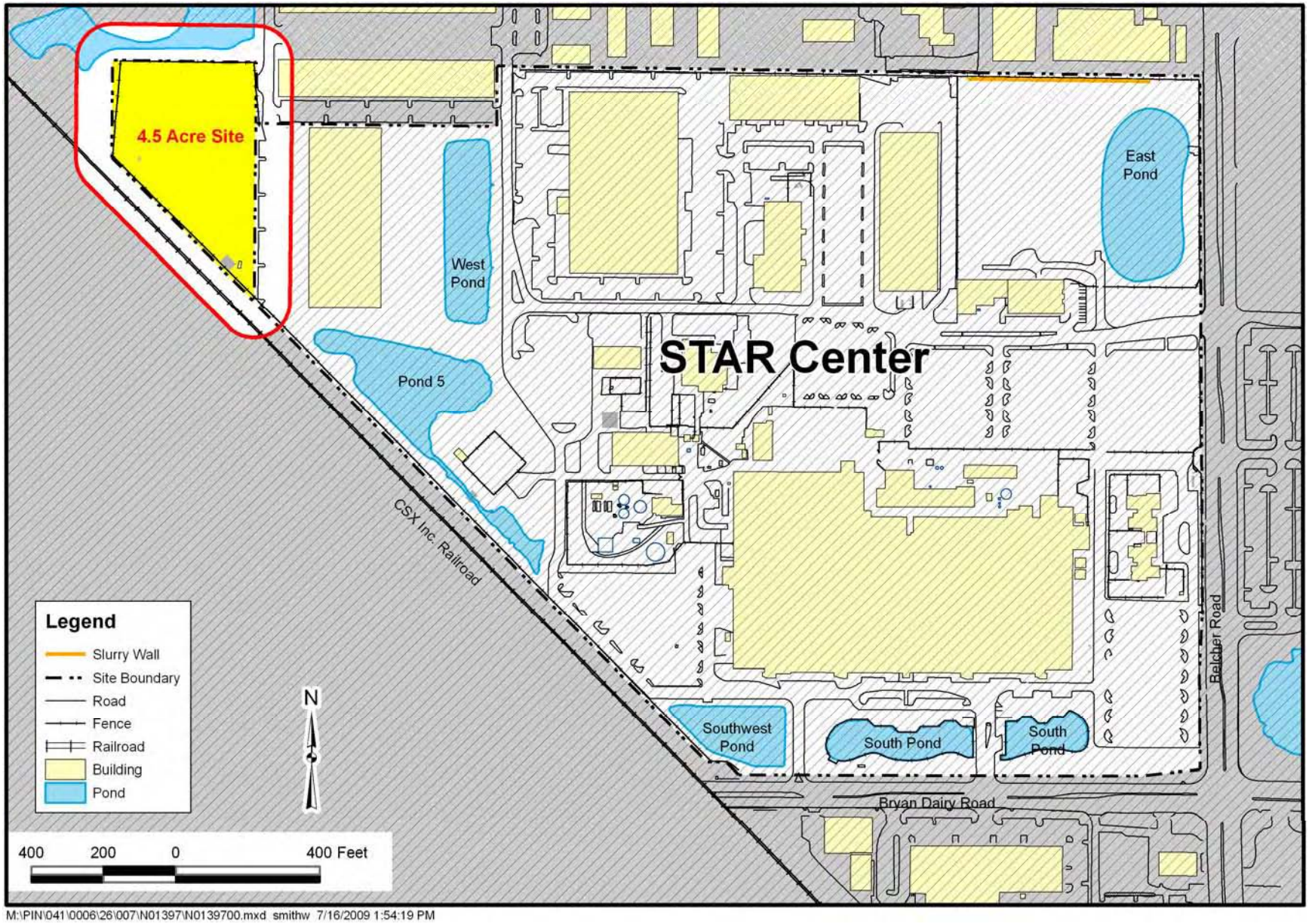

Figure 1. Location of the 4.5 Acre Site at the STAR Center

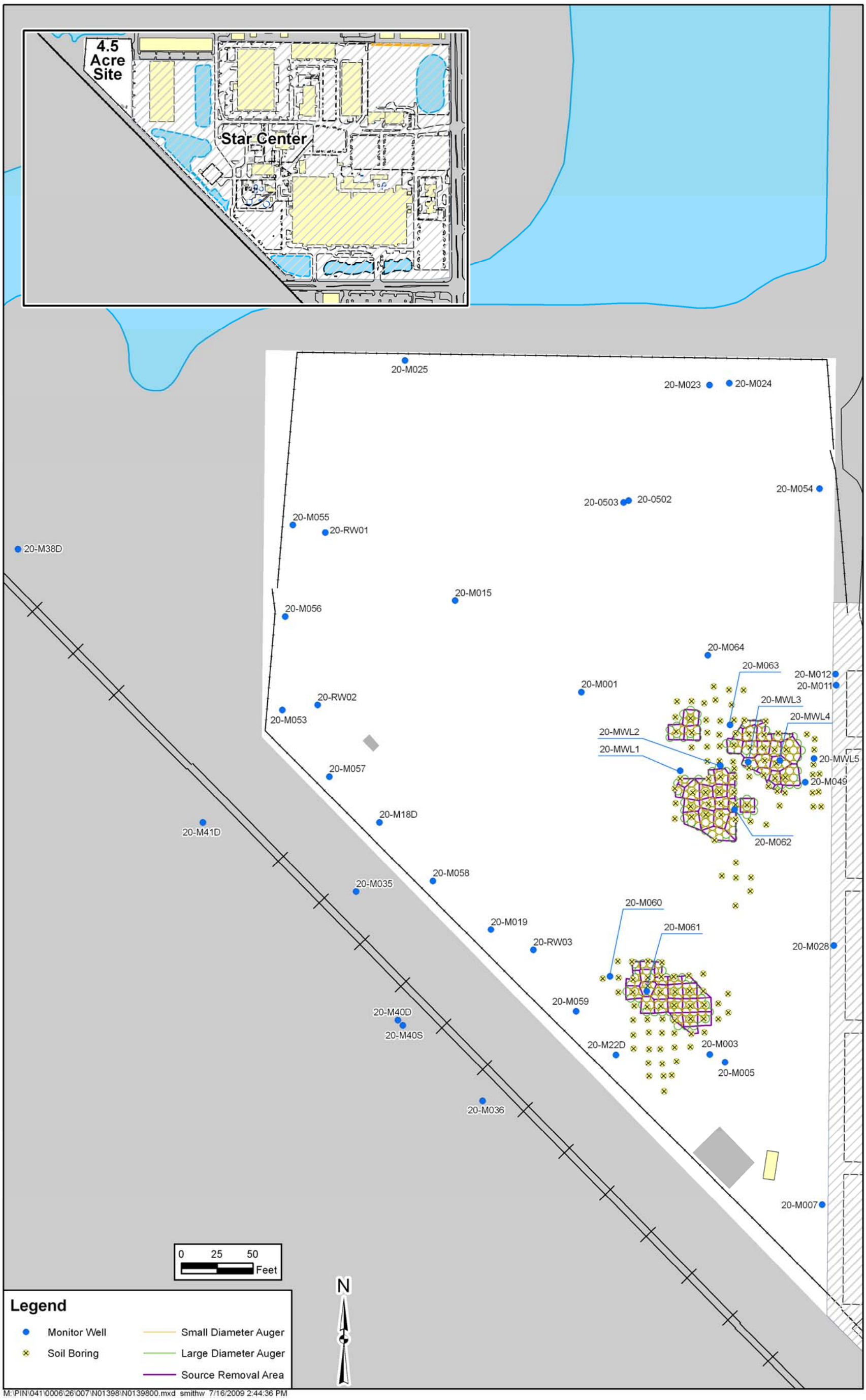

Figure 2. Location of Source Areas at the 4.5 Acre Site

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Figure 3. Photo of LDA Activities

Table 1. Actual Costs for 4.5 Acre Site LDA Project

Item	Cost
Construction Facilities/Temporary Controls	$389,900
Auger Removal of Material	$1,939,650
On Site Handling/Management of Clean Material	$21,043
Handling and Disposal of Nonhazardous Material	$192,413
Construct, Maintain, and Dispose of Stockpile Pads	$173,500
Groundwater Runoff Controls	$131,200
Construct, Maintain, and Dispose of Decon Facility	$27,300
Total Cost:	**$2,875,006**

Table 2. Source Area Intervals and Depth to Hawthorn.
The excavation cells are shown on Plates 1 and 2.

East Area				Southwest Area			
Grid Label	**Depth to Top of Source Area (ft bls)**	**Depth to Bottom of Source Area (ft bls)**	**Depth to Hawthorn (ft bls)**	**Grid Label**	**Depth to Top of Source Area (ft bls)**	**Depth to Bottom of Source Area (ft bls)**	**Depth to Hawthorn (ft bls)**
E-01	25	30	27.5	SW-01	22	30	27.0
E-02	17	25	24.8	SW-02	22	30	27.0
E-03	20	27	27.5	SW-03	22	30	27.0
E-04	21	31	26.6	SW-04	22	30	27.0
E-05	21	31	26.6	SW-05	22	30	27.0
E-06	21	31	26.6	SW-06	12	31	27.0
E-07	24	48	27.0	SW-07	12	29	29.0
E-08	24	39	29.0	SW-08	22	40	28.2
E-09	0	10	28.5	SW-09	26	35	26.5
E-10	24	48	28.0	SW-10	24	33	28.0
E-11	24	48	27.8	SW-11	12	31	26.3
E-12	24	39	29.0	SW-12	12	29	29.0
E-13	24	32	28.7	SW-13	22	40	28.2
E-14	25	41	28.6	SW-14	22	40	28.0
E-15	25	41	28.6	SW-15	24	35	26.6
E-16	19	45	27.3	SW-16	21	30	27.5
E-17	25	41	28.0	SW-17	12	36	25.0
E-18	28	39	28.0	SW-18	8	45	27.7
E-19	30	45	27.7	SW-19	29	40	28.0
E-20	28	39	28.0	SW-20	12	36	28.0
E-21	28	39	28.0	SW-21	28	40	28.5
E-22	23	32	27.5	SW-22	30	37	28.2
E-23	23	33	28.0	SW-23	28	40	28.5
E-24	24	33	28.4				
E-25	24	33	28.4				
E-26	23	32	27.5				
E-27	23	32	27.5				
E-28	24	32	27.3				

Table 2 (continued). Source Area Intervals and Depth to Hawthorn.
The excavation cells are shown on Plate 1.

East Area				
Grid Label	**Depth to Top of Source Area (ft bls)**	**Depth to Bottom of Source Area (ft bls)**	**Depth to Hawthorn (ft bls)**	
E-29	25	33	28.8	
E-30	25	33	28.8	
E-31	23	32	28.8	
E-32	23	37	28.0	
E-33	23	49	28.0	
E-34	23	40	28.0	
E-35	0	13	28.2	
E-36	24	35	30.0	
E-37	25	37	30.0	
E-38	23	40	27.5	
E-39	23	40	27.5	
E-40	23	40	29.0	

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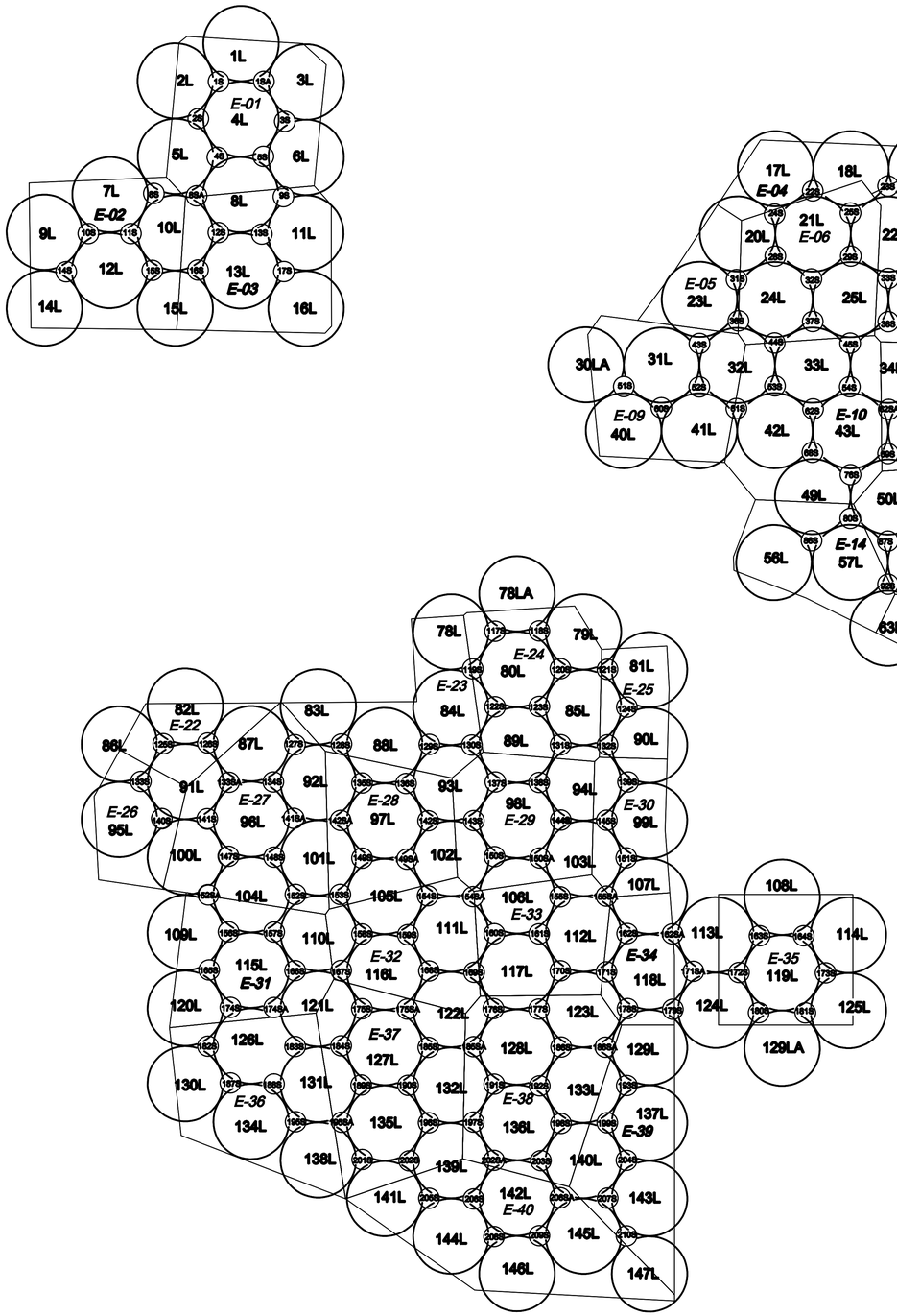
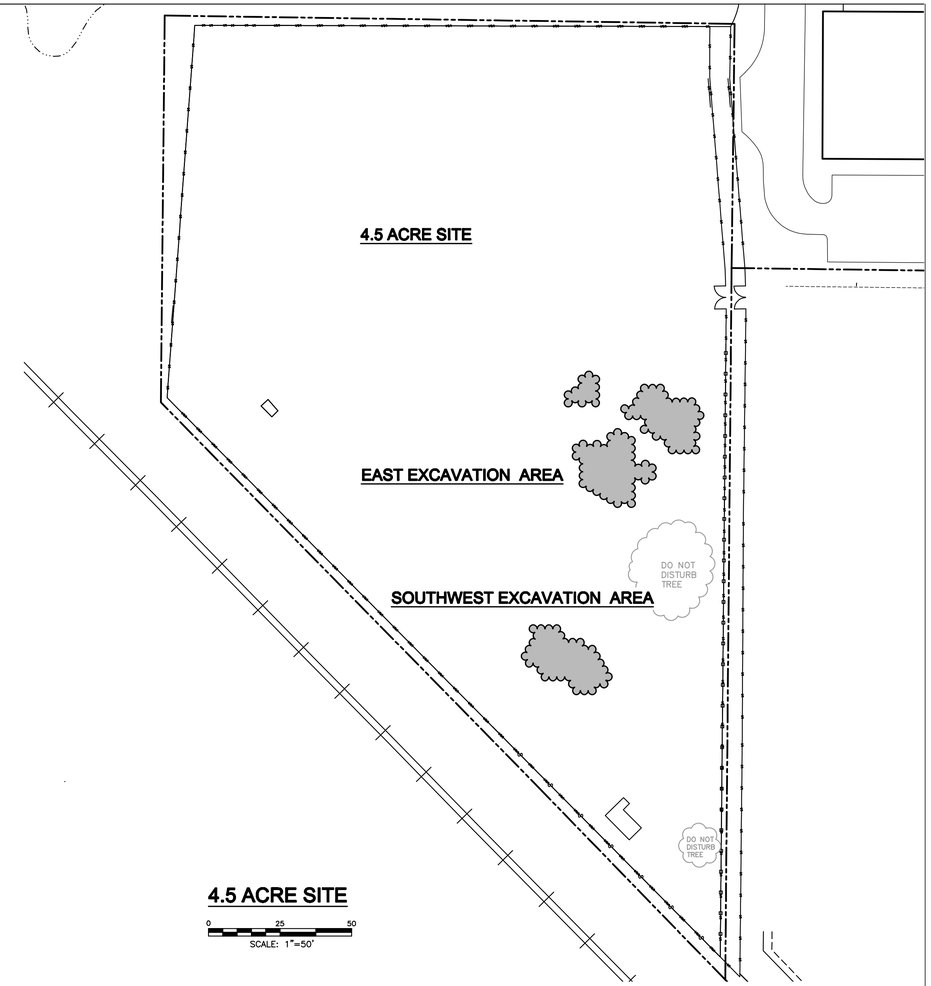


EAST EXCAVATION AREA

0 5 10
SCALE: 1"=5'



4.5 ACRE SITE

0 25 50
SCALE: 1"=50'

LEGEND

- **E-35** Excavation Cell ID
- **119L** Auger Boring ID
- Excavated Area

N
W E
S

PLATE 1

REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT A/E	APPROVAL

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO

Work Performed by
S.M. Stoller Corporation
Under DOE Contract
No. DE-AC01-07LM00060

PROJECT LOCATION
Young-Rainey
STAR Center
LARGO, FLORIDA

REFERENCE

APPROVALS		
DRAWN BY:	J. WHITNEY	7/09/09
ENGINEER:	M. MADRIL	7/09/09
PROJECT ENGINEER:	M. MADRIL	7/09/09
APPROVED BY:	J. DANIEL	7/09/09
PROJECT MANAGER:	J. DANIEL	7/09/09
DOE CONCURRENCE:	(SEE RECORD)	

4.5 ACRE SITE
LDA FINAL REPORT

4.5 ACRE SITE
EAST EXCAVATION AREA
AUGER LAYOUT

PROJECT NO. PIN-041-0006-26-007
DRAWING NO. N01399-R00-C01-D+
SHT. 1 OF 2

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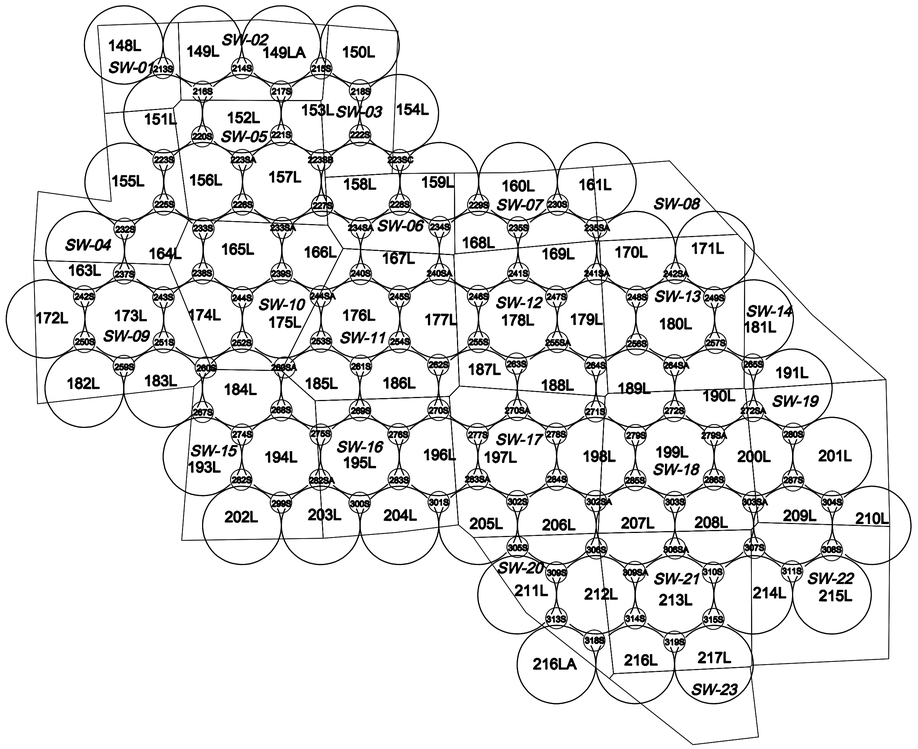
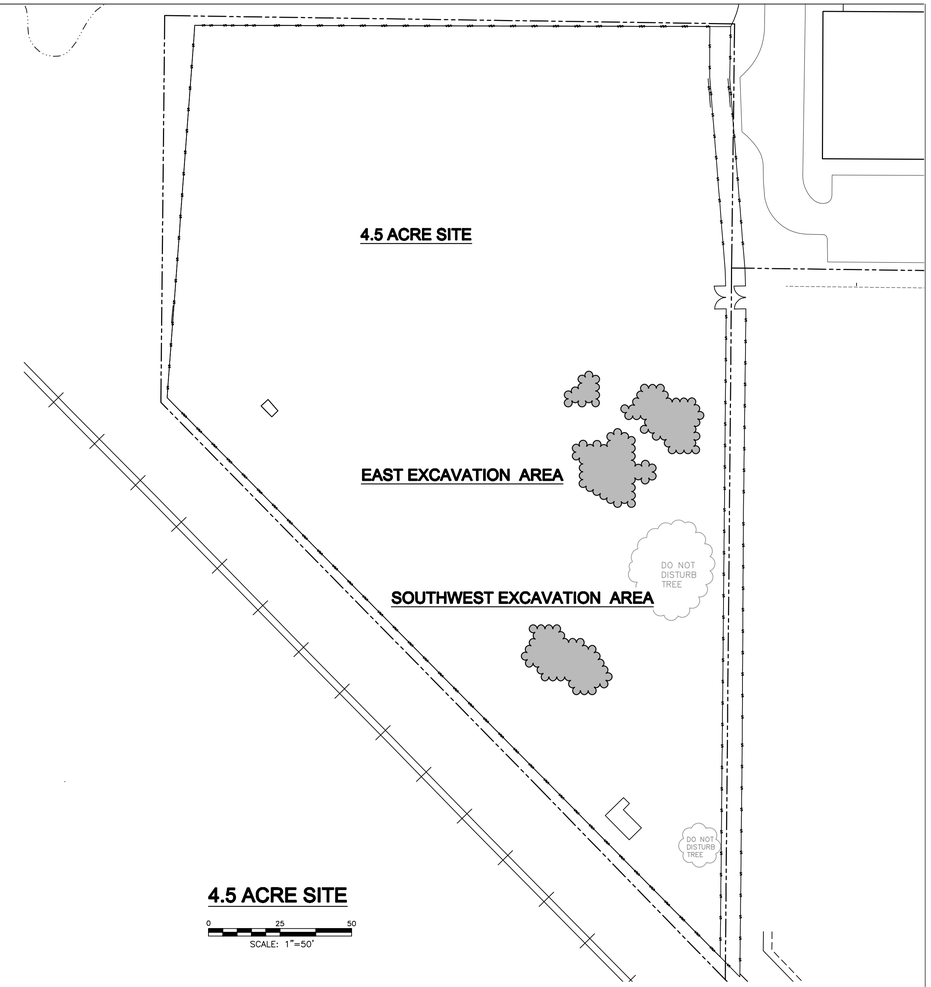


SOUTHWEST EXCAVATION AREA

0 5 10
SCALE: 1"=5'



4.5 ACRE SITE

0 25 50
SCALE: 1"=50'

LEGEND

E-35	Excavation Cell ID
119L	Auger Boring ID
	Excavated Area

N
W E
S

PLATE 2

REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT A/E	APPROVAL

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO

Work Performed by
S.M. Stoller Corporation
Under DOE Contract
No. DE-AC01-07LM00060

PROJECT LOCATION
Young-Rainey
STAR Center
LARGO, FLORIDA

REFERENCE

APPROVALS		DATE
DRAWN BY:	J. WHITNEY	7/09/09
ENGINEER	M. MADRIL	7/09/09
PROJECT ENGINEER	M. MADRIL	7/09/09
APPROVED BY:	J. DANIEL	7/09/09
PROJECT MANAGER	J. DANIEL	7/09/09
DOE CONCURRENCE	(SEE RECORD)	

4.5 ACRE SITE
LDA FINAL REPORT

4.5 ACRE SITE
SOUTHWEST EXCAVATION AREA
AUGER LAYOUT

PROJECT NO. PIN-041-0006-26-007
DRAWING NO. N01399-R00-C01-D+
SHT. 2 OF 2

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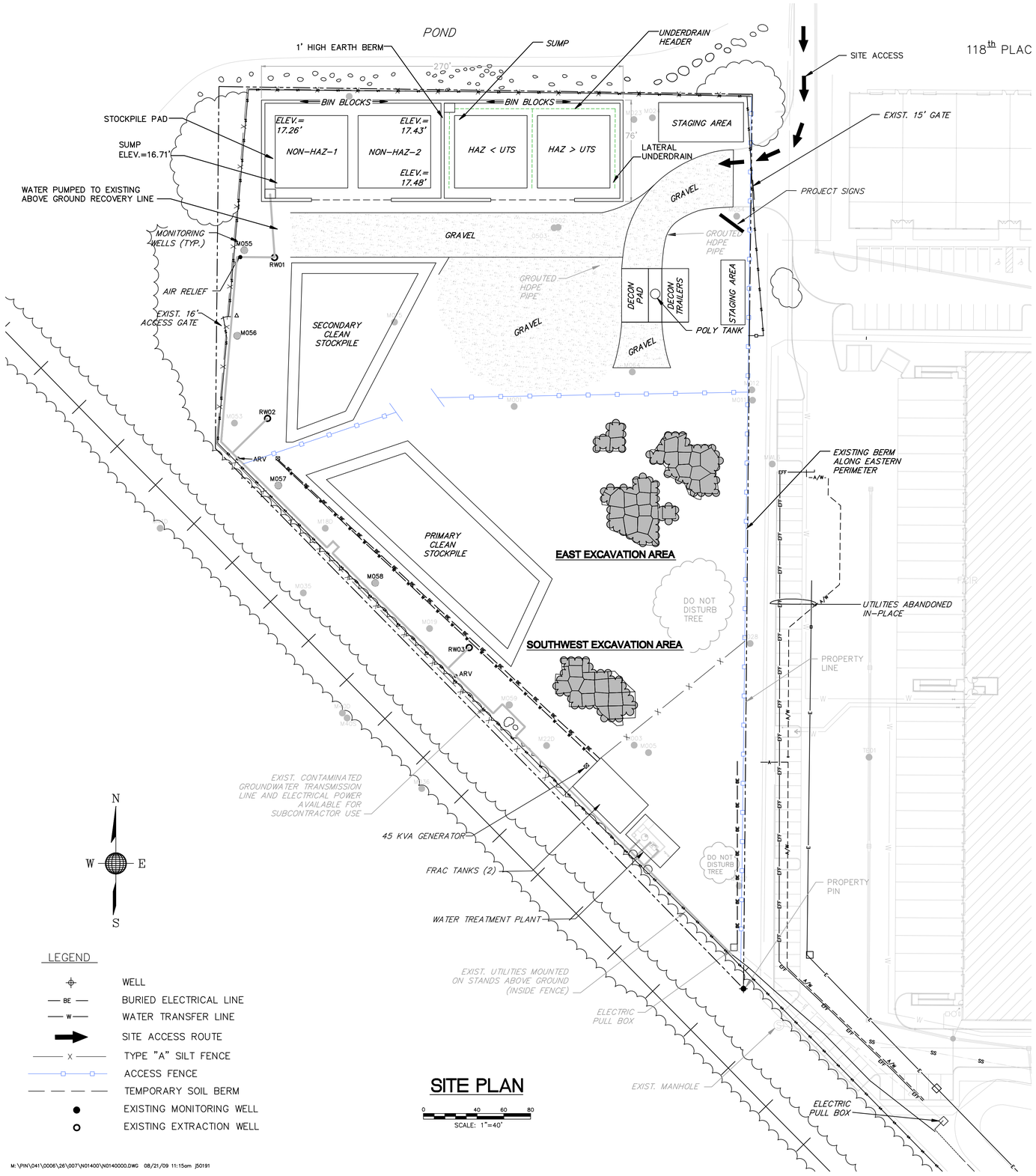

SITE PLAN

0 40 60 80

SCALE: 1"=40'

LEGEND

- WELL
- BE — BURIED ELECTRICAL LINE
- W — WATER TRANSFER LINE
- SITE ACCESS ROUTE
- X — TYPE "A" SILT FENCE
- ACCESS FENCE
- TEMPORARY SOIL BERM
- EXISTING MONITORING WELL
- EXISTING EXTRACTION WELL

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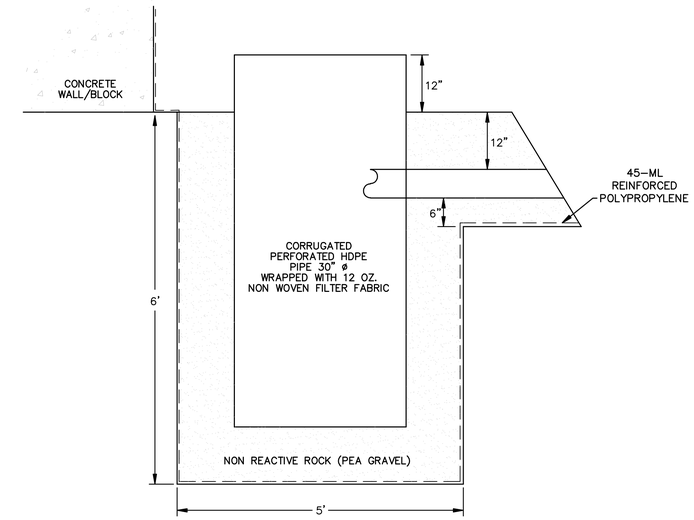

SUMP SECTION

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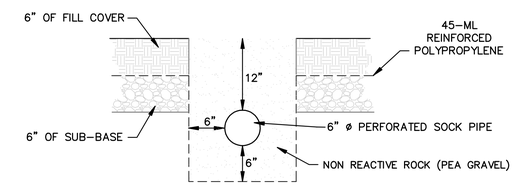
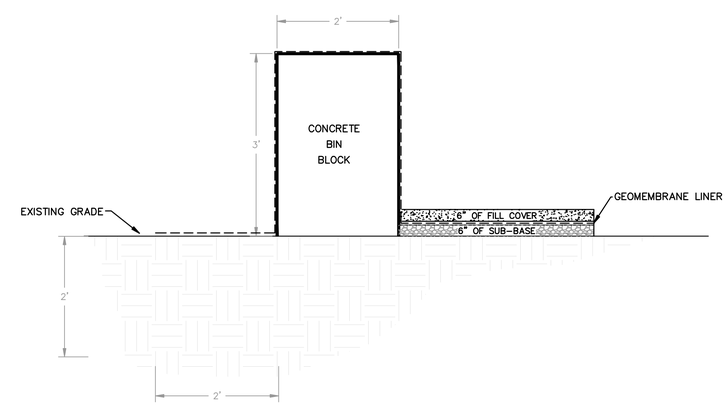


UNDER DRAIN PIPE SECTION (TYP)

NOT TO SCALE



STOCKPILE PAD SECTION

NOT TO SCALE

PLATE 3

REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT A/E	APPROVAL

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION, COLORADO

Work Performed by:
S.M. Stoller Corporation
Under DOE Contract
No. DE-AC01-07LM00060

PROJECT LOCATION: Young-Rainey STAR Center, LARGO, FLORIDA

REFERENCE

APPROVALS		DATE
DRAWN BY:	J. WHITNEY	7/09/09
ENGINEER:	M. MADRIL	7/09/09
PROJECT ENGINEER:	M. MADRIL	7/09/09
APPROVED BY:	J. DANIEL	7/09/09
PROJECT MANAGER:	J. DANIEL	7/09/09
DOE CONCURRENCE:	(SEE RECORD)	

4.5 ACRE SITE
LDA FINAL REPORT

4.5 ACRE SITE
LDA SITE LAYOUT

PROJECT NO. PIN-041-0006-26-007
DRAWING NO. N01400-R00-C01-D+
SHT. 1 OF 1