

**Pinellas Environmental Restoration Project**

**Interim Remedial Action  
for Source Removal at the  
Northeast 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            | <i>cis</i> -1,2-dichloroethene                 |
| CTL             | cleanup target level                           |
| DOE             | U.S. Department of Energy                      |
| F.A.C.          | <i>Florida Administrative Code</i>             |
| 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 <sup>3</sup> | cubic yard                                     |

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## Executive Summary

The objective of this interim remedial action was to remove the source of contamination at the Northeast Site at the Young - Rainey Science, Technology, and Research Center 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 and analyzed 754 soil samples from 85 soil borings during four phases of soil sampling in 2007 and 2008. The following contaminants were detected at elevated concentrations in the soil samples: trichloroethene, *cis*-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 Northeast Site.

A total of 243 large-diameter (66 inches) auger borings and 337 small-diameter (16 inches) auger borings were installed in a 0.13-acre area in the southern half of the Northeast Site. A total in-place volume of 8,387 cubic yards (yd<sup>3</sup>) of soil was excavated during the project. This volume was composed of 4,667 yd<sup>3</sup> of clean overburden soil and 3,720 yd<sup>3</sup> of contaminated or “source” soil. The total cost of the project was \$2,918,721. The LDA project at the Northeast Site was conducted under the same contract as a subsequent, nearly identical LDA project at the nearby 4.5 Acre 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 Northeast Site on the Young - Rainey Science, Technology, and Research (STAR) Center located in Largo, Florida. An Interim Remedial Action Plan (DOE 2008a) was submitted to the Florida Department of Environmental Protection (FDEP) on August 6, 2008, and was approved by FDEP on August 22, 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). The LDA project at the Northeast Site was conducted under the same contract as a subsequent, nearly identical LDA project at the nearby 4.5 Acre Site.

### 1.1 Objective and Scope

The objective of this action was to remove the source of contamination at the Northeast 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 2008b).

DOE's ultimate goal at the Northeast 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 \$1,625,103, and soil disposal cost \$123,570 (all soil was disposed of as nonhazardous material). The total subcontracted cost of the LDA project was \$2,918,721. In addition to this amount, DOE spent \$22,810 in analytical costs for perimeter air monitoring during the project.

### **1.3 Project Timeline**

Mobilization to the site by WRS and BBES began on November 17, 2008. Site preparation, including 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, was completed by January 12, 2009. Large-diameter augering began on January 14, 2009, and was completed on March 17, 2009. Augering of the small-diameter borings began on March 31, 2009, and was completed on May 22, 2009. Demobilization and site restoration activities were completed by June 26, 2009.

### **1.4 Roles and Responsibilities**

WRS was subcontracted to Stoller for the Northeast 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 property currently known as the STAR Center and also the adjacent, privately owned 4.5 Acre Site. The Northeast Site is located at the northeast corner of the STAR Center (Figure 1). The Northeast Site is one of three active Solid Waste Management Units at the STAR Center and is governed by a Resource Conservation and Recovery Act (RCRA) Hazardous and Solid Waste Amendments (HSWA) permit.

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. During the period of DOE ownership, the property was used for disposal of drums of waste resins and solvents. As a result of this practice, the surficial aquifer was impacted by volatile organic compounds (VOCs). Although the Pinellas County government owns the STAR Center, LM is responsible for environmental restoration activities at the site.

Disposal of drums at the site was verified in a 1995 action that removed 241 drums or drum pieces from the subsurface. The drums contained solvent, resin, solidified resin, soil, scrap components and parts, and unidentified viscous liquids. Most drums containing liquid were located in the southern area of the site. Details of the excavation, removal, disposal, and restoration procedures are documented in the *Northeast Site Interim Measures Quarterly Progress Report* (DOE 1996). A groundwater pumping remedial action was conducted at the site from 1992 to 2004.

Investigations that determined the nature and extent of NAPLs at the Northeast Site were conducted in 1999, 2000, and 2003. A combination of the thermal treatment technologies electrical resistive heating and steam injection were used to remove approximately 20,000 pounds of contaminants from the subsurface at two areas of the site from 2002 to 2006 (DOE 2003; DOE 2007).

Subsequent groundwater monitoring indicated elevated contaminant concentrations in a small area in the southern portion of the site. Soil characterization conducted in 2007 and 2008 identified elevated contaminant concentrations remaining in soil, as described in more detail in Section 2.3. A feasibility study (DOE 2008b) 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 30 feet (ft) thick at the Northeast 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.

One man-made pond, the East Pond, was constructed on the Northeast Site to collect storm water runoff from parking lots and buildings. The East Pond is hydraulically connected to the shallow portion of the surficial aquifer. Typically, the shallow surficial aquifer recharges the East Pond, but occasionally, during periods of high rainfall, the East Pond recharges the shallow surficial aquifer.

The surficial aquifer at the STAR Center, including the Northeast Site, acts as a two-layer hydraulic system due mainly to horizontal-to-vertical anisotropy. In the shallow surficial aquifer, groundwater flow is generally toward the east with an occasional southeastward component. 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 Northeast 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

As mentioned in Section 2.1, NAPL characterization activities were conducted in 1999–2003, and thermal NAPL remediation was conducted in 2002–2006. Following completion of thermal NAPL remediation at NAPL Area B in the southern portion of the Northeast Site in the fall of 2006, nine monitoring wells were installed to monitor the remaining low levels of dissolved-phase contamination. Elevated contaminant concentrations were detected in groundwater samples from three of these monitoring wells during their first sampling event in March 2007 and in subsequent sampling events. Trichloroethene (TCE) was detected up to 23,000 micrograms per liter ( $\mu\text{g/L}$ ), *cis*-1,2-dichloroethene (cDCE) up to 16,000  $\mu\text{g/L}$ , and toluene up to 22,000  $\mu\text{g/L}$ . These maximum TCE and toluene concentrations exceed 1 percent of the compound's aqueous solubility, so these concentrations were indicative of contaminant source remaining in the subsurface.

To determine the extent of the remaining source area in the southern portion of the Northeast Site, DOE conducted four phases of soil sampling from August 2007 through June 2008, during which 754 soil samples were collected from 85 soil borings and analyzed for VOCs. The results of this investigation are described in detail in the *Northeast Site Source Characterization Data Report* (DOE 2008d). Analytical results from the soil samples demonstrated that TCE, cDCE, 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 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 to the north around monitoring wells PIN15–0587 and –0589 (the North Source Area) and one to the south around monitoring well PIN15–0586 (the South Source Area). Figure 2 shows the location of the source areas on the Northeast Site. Thiessen polygons were applied to divide the source areas into cells that surround each soil boring. Source area interval and depth to Hawthorn for each excavation cell is listed in Table 2. In general, the highest contaminant concentrations were found within the lower 5 ft of the surficial sediments, although elevated concentrations were also found at shallow depths within the surficial sediments and a few feet into the Hawthorn as well. The surface area of the source areas was 5,621 square ft, or 0.13 acre.

## 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). The HSWA permit governs how environmental restoration activities at the Northeast Site are implemented under RCRA; the permit was modified in 2007 to incorporate Global RBCA regulations.

Analytical results from the 2007–2008 soil characterization events 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 groundwater treatment system for 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. Northeast Site remediation 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. However, some of the small-diameter borings were cased (14-inch auger inside a 16-inch casing), as explained in detail in Section 4. 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 8,387 yd<sup>3</sup> (in-place volume) of soil were excavated during the project at the Northeast Site. This volume consisted of 4,667 yd<sup>3</sup> of clean soil (overburden) and 3,720 yd<sup>3</sup> of contaminated or “source” soil. The clean soil was left on site in a stockpile.

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 2009a) 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 2009b).

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 Plate 1. 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 243 large-diameter borings and 337 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 Plate 1.

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 Northeast Site, including monitoring wells, groundwater extraction wells, and thermal NAPL remediation components. Augering out monitoring wells and groundwater extraction wells did not interfere with augering operations. The electrodes remaining from thermal NAPL

remediation (stainless steel, 10-ft long by 8-inches in diameter, double stacked in boreholes) did cause a few problems during augering operations, but mostly these problems were minor.

### **3.2 Site Layout**

The site layout is shown on Plate 2. Northeast Site ingress/egress occurred using both the southeast and northwest gates. However, only truck material deliveries and disposal trucks were allowed through the southeast entrance. The northwest entrance was limited to employees, normal deliveries, and visitors.

A decontamination area was established close to the southeast entrance of the Northeast 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 systems.

As required by the Pinellas County Building and Development Department, WRS submitted an engineered site plan. The site plan included a single-wide office trailer and a crew trailer located along the west boundary of the site; a water treatment system that included two 21,000-gallon steel frac tanks, sand filters, and an air stripper located along the west boundary of the site; the flowable fill batch plant, consisting of a silo, hopper, conveyor, and scale located at the southeast corner of the site; and soil stockpile pads located on the northern portion of the 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<sup>3</sup> (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 gravel 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 [ $\mu\text{g}/\text{kg}$ ]) are less than 20 times the leachate TCLP criteria ( $\mu\text{g}/\text{L}$ ). It was assumed that this soil could be disposed of at a Subtitle D landfill.
- Hazardous <UTS. Total contaminant concentrations in soil ( $\mu\text{g}/\text{kg}$ ) are greater than 20 times the leachate TCLP criteria ( $\mu\text{g}/\text{L}$ ), 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 ( $\mu\text{g}/\text{kg}$ ) are greater than 20 times the leachate TCLP criteria ( $\mu\text{g}/\text{L}$ ), 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  $\text{yd}^3$  batches. Once approximately 500  $\text{yd}^3$  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<sup>3</sup> 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 January 15, 2009, through March 17, 2009, a total of 119 air samples were collected over 31 days at the perimeter of the Northeast Site. No site-related VOCs vapors were detected in any of the perimeter air samples.

### **3.6.2 Safety Incidents**

Three significant safety incidents occurred during the project, one of which resulted in a worker injury. The first incident occurred when a worker used an unapproved procedure to attach a strap

to a front end loader as the workers were removing wet plastic sheeting covering the soil stockpile one morning. The worker suffered two broken fingers and received several stitches. The tarp removal procedure was reviewed and detail was added to ensure that the correct strap attachment procedure was used in future work.

The second incident occurred while vibrating the large-diameter casing out of a completed boring. The hydraulic jaws on the vibratory hammer that were holding the casing opened inadvertently just as the casing was clearing the ground surface. The casing dropped about 1 ft back into the hole but was held by the safety cable attached to the casing and the hammer. Subsequently, the hammer was reattached to the casing, and the casing was moved to the next borehole without incident. Review of the incident indicated that operator error was the likely cause of the dropped casing. The hammer clamp control switch had three positions: open, off, and closed. Reportedly the operator intended to move the switch from the closed to the off position and instead moved the switch to the open position, resulting in the dropped casing.

The third incident occurred during disassembly of the concrete batch plant during demobilization activities. Workers were using steel rings located on the top of the silo to lift it off the mounting bolts before lowering it onto a trailer. As the lift was initiated, one of the steel rings broke, and a second ring partially broke. Tension was released from the sling, and the silo remained upright in place and was re-secured to the mounting bolts as the incident was being investigated. Discussions with the silo manufacturer determined that the steel rings atop the silo were not intended to be used as lift points (although the subcontractor had used the rings as lift points on several prior projects without incident). Subsequently, the silo was lowered and secured using the manufacturer's recommended procedure.

### **3.7 Polishing With Enhanced Bioremediation**

As mentioned in the *Interim Remedial Action Plan for Source Removal at the Northeast Site* (DOE 2008a), 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

The most significant problem encountered with this work involved installation of the small-diameter borings between the large-diameter borings. An intriguing aspect of the project from the start was the apparent lack of groundwater saturation of augered soil. Specifically, groundwater saturation was observed in approximately the upper 10 ft of soil within most casings but the soil below that depth down to the Hawthorn clay generally appeared to be damp but unsaturated. This phenomenon was observed in most, but not all, large-diameter borings. Water levels in monitoring wells located within the excavation areas and in adjacent areas had never previously suggested anything (e.g., perched saturated zone) other than complete saturation of the surficial sediments below the water table, and water levels measured in all accessible monitoring wells in March 2009, during the project, showed typical water levels and flow patterns.

The problem potentially associated with this phenomenon became apparent when the subcontractor began installing the small borings. As mentioned previously, the purpose of these small borings was to remove as much of the soil remaining between the large borings as possible, so the plan was to auger between the large borings without a casing and allow the surrounding soil to collapse into the boring. However, when the subcontractor installed the first small boring, they found a soil slurry instead of competent soil saturated with groundwater (or even damp but unsaturated soil). Augering into this slurry resulted in no soil being removed because the slurry flowed off the auger. Several additional small borings were installed with the same result. This was perplexing, given the apparent lack of saturation of the large-diameter borings.

The subcontractor typically does not install small-diameter borings between the large-diameter borings, having done so only once previously at a site where they were augering into the unsaturated zone, and no problems were encountered at that site. Therefore, they had not previously encountered this issue. Their typical procedure for removing the most soil from between the large-diameter borings is to overlap the large borings, but that produces additional uncontaminated material that must be disposed of along with the excavated soil. During the initial DOE design process, prior to selecting the subcontractor, DOE understood that it can also be problematic to drive a casing simultaneously into both sandy soil and cured fill, so this approach was not considered as an option.

Subsequently, the subcontractor decided to try casing the small borings. A 16-inch casing was driven, and a 14-inch auger was used to remove soil. Surprisingly, after the 16-inch casing was driven, most of the soil within the casing was found to be unsaturated. Based on these observations, it was determined that the compression and vibration from the casing-driving process had forced groundwater out of the area into which the casing was being driven and into the surrounding soil. Apparently, driving the large casing caused an oversaturation of the soil outside of the boring and created the slurry observed in the uncased small borings. In addition, when the small-diameter casings were driven, apparently enough adjacent space existed that the groundwater was forced out of these borings as well.

The cure time for the flowable fill also appeared to play a role in the occurrence of a soil slurry in the uncased small-diameter borings. After a few weeks of driving casing for the small-diameter borings, WRS decided to try a few uncased small borings and found that the soil no longer occurred as a slurry and was coherent enough to allow augering without a casing. In addition, once WRS 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.

The need to case the small-diameter borings was a significant issue, because it would have greatly increased the amount of time required to complete the project, and in fact added several weeks to the schedule until the problem was solved. The extended schedule would also have significantly increased cost.

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 miscommunication between the subcontractor and their surveyor led to the initial site auger layout being off by about 50 ft. Stoller observed that the initial layout appeared to be shifted relative to monitoring well locations, and subsequent comparison to a site map showing the excavation cells and monitoring wells confirmed the problem. The subcontractor corrected their auger layout and the surveyor used the corrected coordinates to relocate the initial auger layout.

Other minor problems were encountered during the project. DOE fielded some complaints from tenants in adjacent buildings about excessive vibration as the casings were being driven. This was discussed with WRS, and the vibratory hammer setting was modified slightly to produce less vibration. This appeared to satisfy the tenant's concerns while still allowing efficient casing installation. Tenants in the adjacent buildings also complained about dust from the batch plant settling onto their cars. This was solved by additional dust control measures.

## **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.

- Each of the three safety incidents could have been prevented by adherence to equipment manufacturer's recommended operation procedures and through proper field change control.
- Field change of the initial batch plant layout orientation and elevation may have been a contributing factor to the cement silo incident. This change may not have been necessary with better communication among subcontractors.
- Site auger layouts need to be confirmed by multiple parties and methods.
- 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.

## 5.0 References

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DOE (U.S. Department of Energy), 2009b. *Data Report for Overburden Soil at the Northeast Site and 4.5 Acre Site*, LMS/PIN/N01395, prepared for the U.S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, July.

*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.

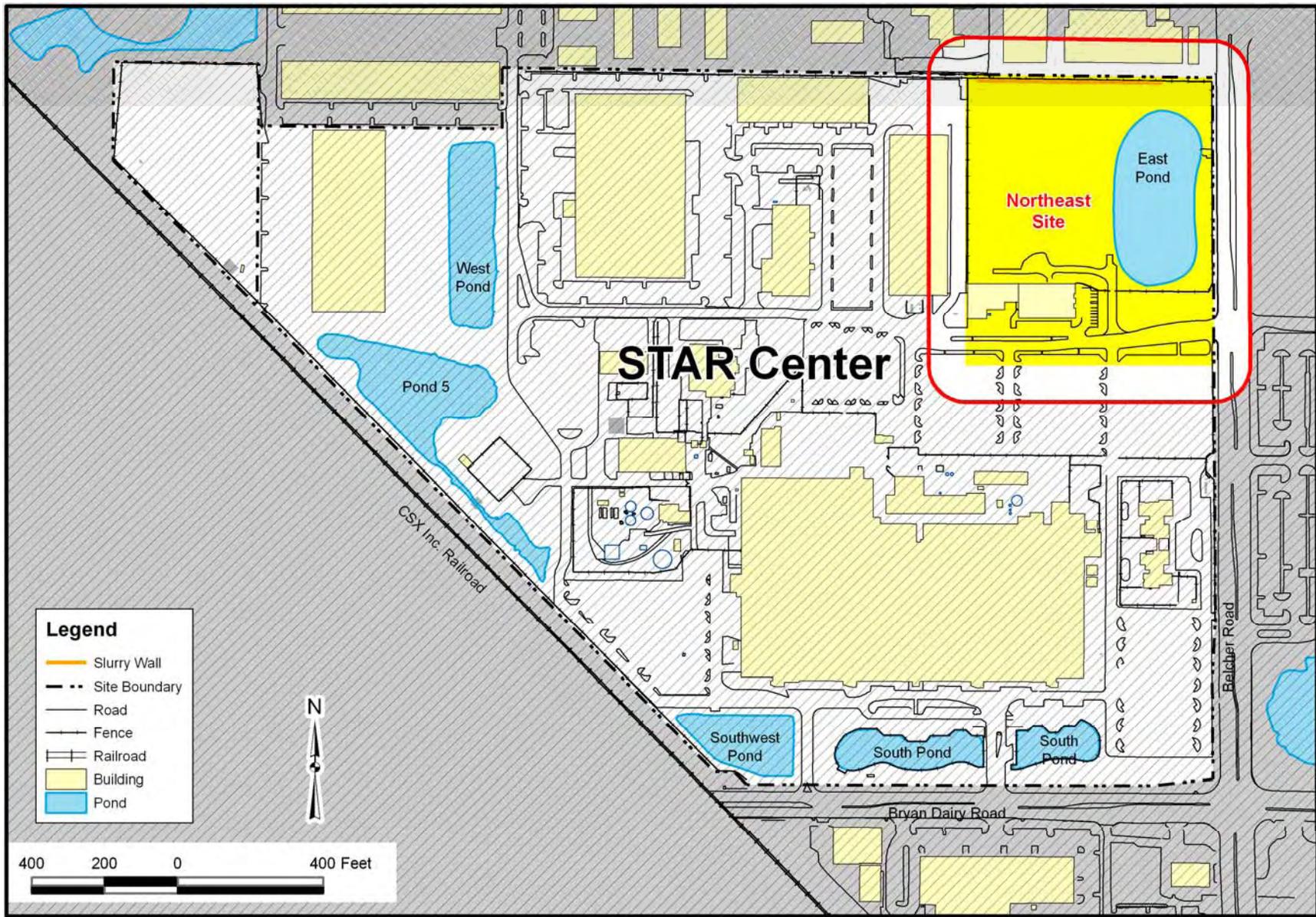


Figure 1. Location of the Northeast Site at the STAR Center

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Figure 2. Location of Source Areas at the Northeast Site

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Figure 3. Photo of LDA Activities at the Northeast Site

Table 1. Actual Costs for Northeast Site LDA Project

| Item   | Cost               |
|--|--------------------|
| Mobilization/Demobilization                        | \$484,400          |
| Construction Facilities/Temporary Controls         | \$306,850          |
| Auger Removal of Material                          | \$1,625,103        |
| On-Site Handling/Management of Clean Material      | \$20,348           |
| Handling and Disposal of Nonhazardous Material     | \$123,570          |
| Handling and Disposal of Hazardous <UTS Material   | \$0                |
| Handling and Disposal of Hazardous >UTS Material   | \$0                |
| Construct, Maintain, and Dispose of Stockpile Pads | \$173,500          |
| Groundwater Runoff Controls                        | \$131,200          |
| Construct, Maintain, and Dispose of Decon Facility | \$27,300           |
| Standby Time—Auger Rig/Field Crew                  | \$26,450           |
| <b>Total Cost:</b>                                 | <b>\$2,918,721</b> |

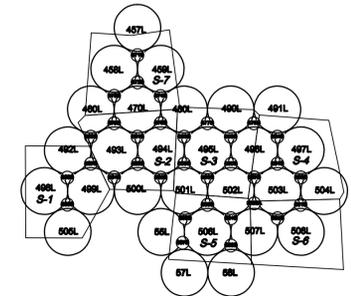
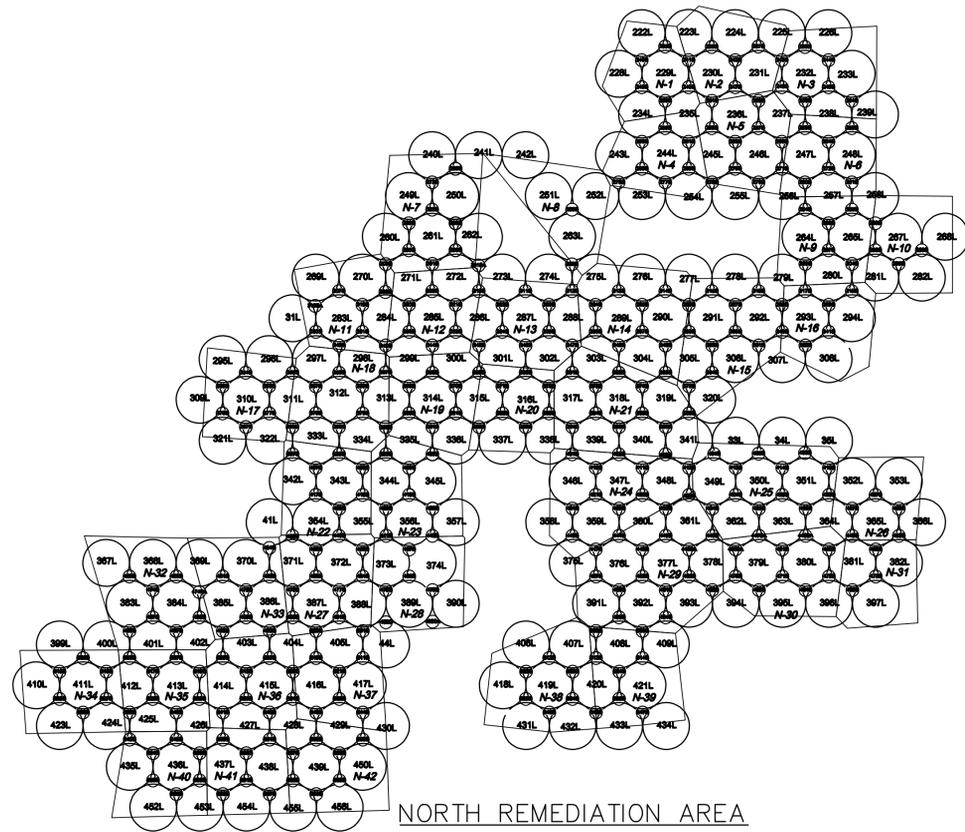
Table 2. Source Area Intervals and Depth to Hawthorn.  
The excavation cells are shown on Plate 1.

| Excavation Cell Number | Source Interval Top (ft bls) | Source Interval Bottom (ft bls) | Depth to Hawthorn (ft bls) |
|------------------------|------------------------------|---------------------------------|----------------------------|
| N-1                    | 29                           | 37                              | 29                         |
| N-2                    | 24                           | 33                              | 28                         |
| N-3                    | 27                           | 39                              | 32                         |
| N-4                    | 24                           | 35                              | 29                         |
| N-5                    | 24                           | 35                              | 29                         |
| N-6                    | 24                           | 40                              | 30.5                       |
| N-7                    | 9                            | 25                              | 30.5                       |
| N-8                    | 26                           | 34                              | 30                         |
| N-9                    | 25                           | 40                              | 31                         |
| N-10                   | 27                           | 38                              | 31                         |
| N-11                   | 17                           | 35                              | 30                         |
| N-12                   | 15                           | 34                              | 30                         |
| N-13                   | 21                           | 35                              | 31                         |
| N-14                   | 19                           | 32                              | 28                         |
| N-15                   | 26                           | 35                              | 31                         |
| N-16                   | 24                           | 40                              | 32                         |
| N-17                   | 10                           | 40                              | 31                         |
| N-18                   | 8                            | 32                              | 30                         |
| N-19                   | 12                           | 30                              | 29                         |
| N-20                   | 15                           | 40                              | 33                         |
| N-21                   | 19                           | 31                              | 30                         |
| N-22                   | 14                           | 40                              | 32                         |
| N-23                   | 8                            | 35                              | 30                         |
| N-24                   | 18                           | 33                              | 32                         |
| N-25                   | 20                           | 34                              | 31.5                       |
| N-26                   | 15                           | 39                              | 30.5                       |
| N-27                   | 19                           | 37                              | 32                         |

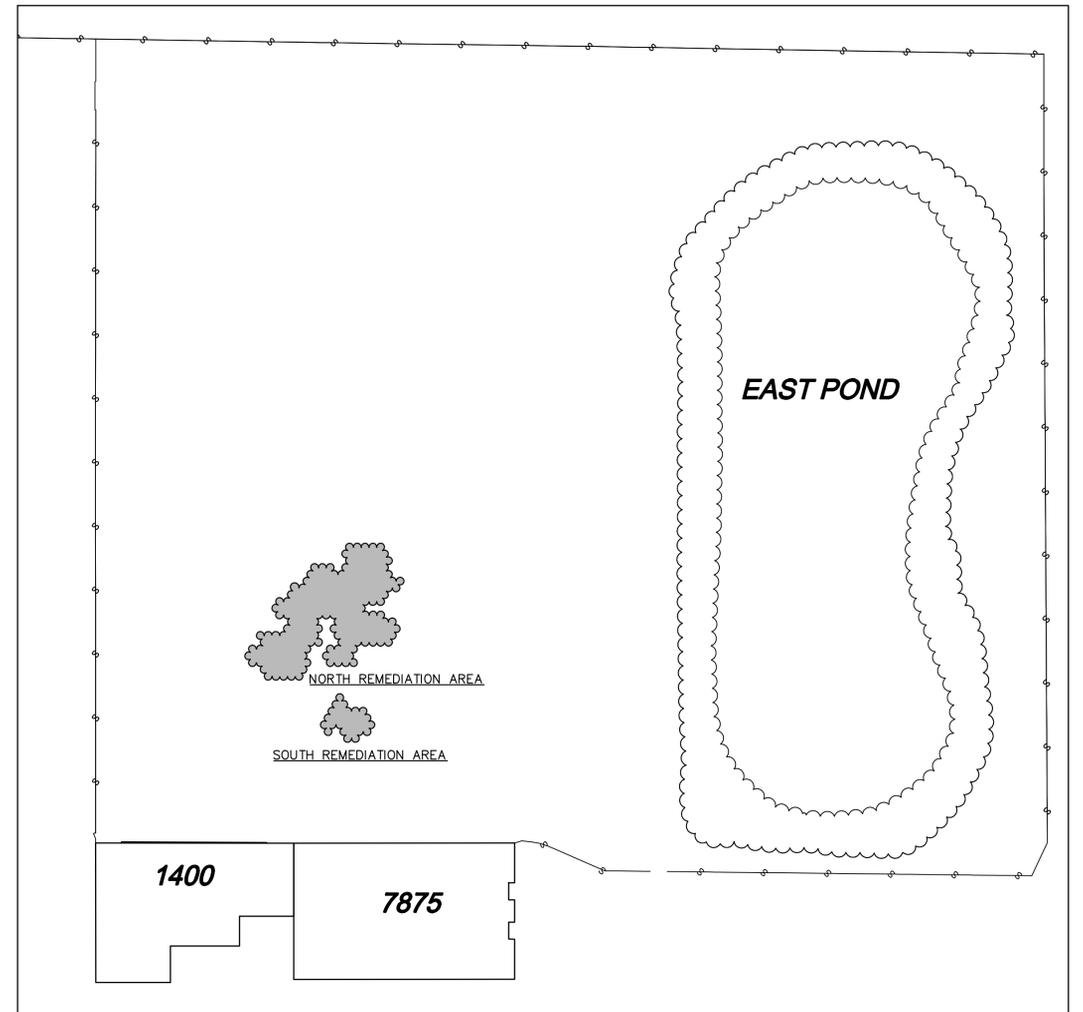
Table 2 (continued). Source Area Intervals and Depth to Hawthorn. The excavation cells are shown on Plate 1.

| Excavation Cell Number | Source Interval Top (ft bls) | Source Interval Bottom (ft bls) | Depth to Hawthorn (ft bls) |
|------------------------|------------------------------|---------------------------------|----------------------------|
| N-28                   | 15                           | 40                              | 30.5                       |
| N-29                   | 25                           | 33                              | 30.5                       |
| N-30                   | 13                           | 35                              | 30.5                       |
| N-31                   | 27                           | 35                              | 29.5                       |
| N-32                   | 20                           | 39                              | 31                         |
| N-33                   | 24                           | 40                              | 34                         |
| N-34                   | 20                           | 35                              | 31                         |
| N-35                   | 20                           | 39                              | 30                         |
| N-36                   | 15                           | 40                              | 32                         |
| N-37                   | 23                           | 36                              | 32                         |
| N-38                   | 25                           | 37                              | 33                         |
| N-39                   | 32                           | 39                              | 32                         |
| N-40                   | 25                           | 35                              | 33                         |
| N-41                   | 20                           | 40                              | 33.5                       |
| N-42                   | 0                            | 39                              | 32.5                       |
| S-1                    | 29                           | 40                              | 30                         |
| S-2                    | 20                           | 40                              | 30.5                       |
| S-3                    | 16                           | 40                              | 28.5                       |
| S-4                    | 24                           | 36                              | 28                         |
| S-5                    | 29                           | 40                              | 32                         |
| S-6                    | 32                           | 40                              | 32                         |
| S-7                    | 25                           | 39                              | 33                         |

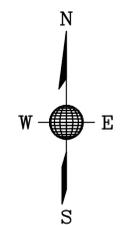
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PLAN  
SCALE: 1"=10'



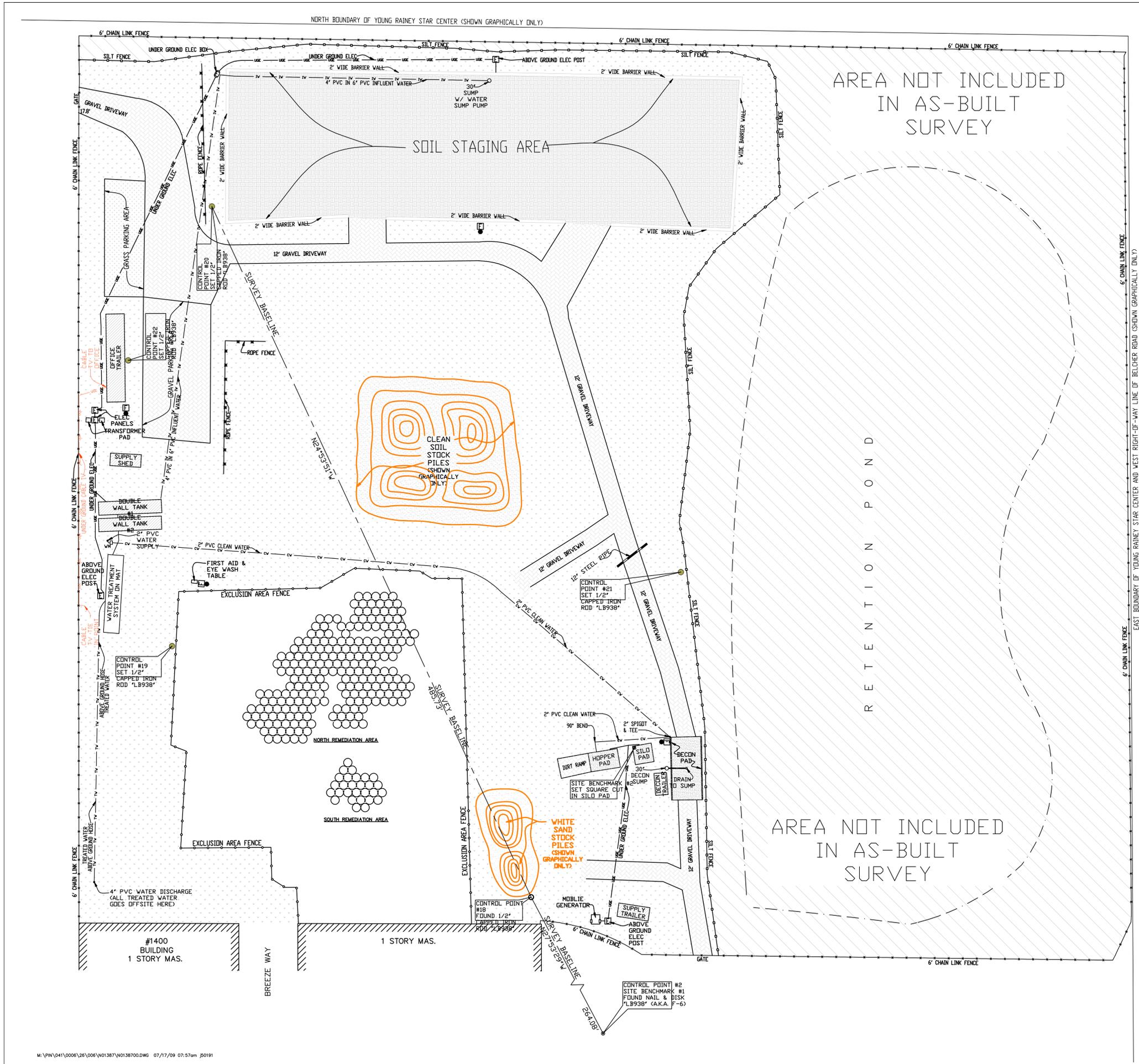
NORTHEAST SITE  
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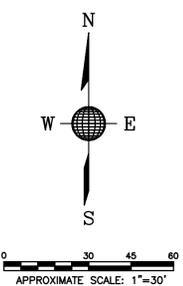
434L Auger Boring ID  
N-39 Excavation Cell ID

PLATE 1

| REVISION NO.  | DATE | DESCRIPTION  | DRAWN BY          | CHECKED BY                         | PROJECT A/E | APPROVAL            |
|---|------|--|-------------------|------------------------------------|-------------|---------------------|
| U.S. DEPARTMENT OF ENERGY<br>GRAND JUNCTION, COLORADO             |      | Work Performed by<br>S.M. Stoller Corporation<br>Under DOE Contract<br>No. DE-AC01-07LM00060 |                   |                                    |             |                     |
| PROJECT LOCATION<br>Young-Rainey<br>STAR Center<br>LARGO, FLORIDA |      | APPROVALS  |                   | NORTHEAST SITE<br>LDA FINAL REPORT |             |                     |
|   |      | ENGINEER   | J. WHITNEY        | DATE                               | 7/09/09     |                     |
|   |      | PROJECT ENGINEER   | M. MADRIL         | DATE                               | 7/09/09     |                     |
|   |      | APPROVED BY  | M. MADRIL         | DATE                               | 7/09/09     |                     |
|   |      | PROJECT MANAGER  | J. DANIEL         | DATE                               | 7/09/09     |                     |
|   |      | DOE CONTRACT NUMBER  | (SEE RECORD)      |                                    | PROJECT NO. | PIN-041-0006-26-006 |
|   |      | DRAWING NO.  | N01386-R00-C01-D+ |                                    | SHT.        | 1 OF 1              |



WEST BOUNDARY OF SECTION 13, TOWNSHIP 30 SOUTH, RANGE 15 EAST  
 WEST BOUNDARY OF SECTION 18, TOWNSHIP 30 SOUTH, RANGE 15 EAST



| LEGEND OF SYMBOLS AND ABBREVIATIONS               |  |
|---|--|
| AKA = ALSO KNOWN AS                               |  |
| DECON = DECONTAMINATION                           |  |
| ELEC = ELECTRICAL                                 |  |
| HWM = HARRY W. MARLOW, INC.                       |  |
| LB938 = LICENSED BUSINESS (HARRY W. MARLOW, INC.) |  |
| PVC = POLYVINYL CHLORIDE                          |  |
| SBM = SITE BENCHMARK                              |  |
| TV = TELEVISION                                   |  |
| — = DRAINAGE PIPE                                 | □ = GRASS PARKING AREA                   |
| CV = CLEAN WATER PIPE                             | □ = UNDISTURBED / GRASS                  |
| TW = TREATED WATER HOSE                           | □ = SOIL STAGING AREA                    |
| IW = INFLUENT WATER PIPE                          | □ = CONCRETE SLAB                        |
| — = UNDER GROUND CABLE                            | □ = CLEAN SAND                           |
| — = UNDER GROUND ELECTRICAL                       | □ = CLEAN SOIL                           |
| — = CHAIN LINK FENCE                              | □ = GRAVEL / DIRT DRIVEWAY               |
| — = EXCLUSION AREA FENCE                          | □ = ENCLOSURE                            |
| — = SILT FENCE                                    | □ = AREA NOT INCLUDED IN AS-BUILT SURVEY |
| — = ROPE FENCE                                    |  |
| — = ELECTRICAL POST / PANEL                       |  |
| — = UNDER GROUND ELECTRICAL BOX                   |  |
| — = FIRE EXTINGUISHER AND POST                    |  |
| — = LARGE BORING SET BY WRS COMPASS               |  |
| — = LARGE BORING SET BY HWM                       |  |
| — = FOUND NAIL & DISK                             |  |
| — = FOUND IRON ROD                                |  |
| — = SET IRON ROD                                  |  |
| — = SET SQUARE CUT                                |  |
| — = WATER METER                                   |  |

**PLATE 2**

| REVISION NO.  | DATE | DESCRIPTION | DRAWN BY  | CHECKED BY | PROJECT A/E  | APPROVAL |
|---|------|-------------|---|------------|--|----------|
| <p>U.S. DEPARTMENT OF ENERGY<br/>           GRAND JUNCTION, COLORADO</p> <p>Work Performed by<br/> <b>S.M. Stoller Corporation</b><br/>           Under DOE Contract<br/>           No. DE-AC01-07LM00060</p> |      |             |   |            |  |          |
| <p>PROJECT LOCATION<br/> <b>Young-Rainey Star Center<br/>           LARGO, FLORIDA</b></p>  |      |             | <p>APPROVALS</p> <p>ENGINEER: J. WHITNEY<br/>           PROJECT ENGINEER: M. MADRIL</p> |            | <p>NORTHEAST SITE<br/>           LDA FINAL REPORT<br/> <b>CONTAMINATED SOILS REMOVAL<br/>           AND DISPOSAL<br/>           AUGER LAYOUT</b></p> |          |
| <p>APPROVED BY:<br/>           J. DANIEL<br/>           PROJECT MANAGER</p>   |      |             | <p>DATE: 9/29/97</p>  |            | <p>PROJECT NO.: PIN-041-0006-26-006<br/>           DRAWING NO.: N01387-R00-C01-D+</p>  |          |
| <p>REFERENCE</p>  |      |             | <p>DOE CONCURRENCE<br/>           (SEE RECORD)</p>                                      |            | <p>SHT. 1 OF 1</p>   |          |