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THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 701

Memphis Depot
Dunn Field
Engineering Evaluation/ Cost Analysis
Former Pistol Range, Site 60

July 2002
Rev. 1

CH2MHILL

U.S. Army Engineering and Support Center, Huntsville

U.S. Army Engineering and Support Center, Huntsville
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Engineering Evaluation/Cost Analysis
for
Site 60, Former Pistol Range
Dunn Field of the Memphis Depot
Memphis, Tennessee

Prepared by CH2M HILL

July 2002

David D. Nelson, P.G. 7/19/02
CH2M HILL Project Manager Date

Stephen D. Offner, P.G. 7/19/02
CH2M HILL Program Manager Date

Contents

Tables

Figures

Appendices

Acronyms and Abbreviations

ARAR	applicable or relevant and appropriate requirement
BRAC	Base Realignment and Closure
BCT	BRAC Cleanup Team
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CL	clay
CWM	Chemical Warfare Materiel
CY	cubic yards
DDD	Dichlorodiphenyldichloroethane
DDE	1,1,1-Dichloro-2,2-bis(4-chlorophenyl)ethylene
DDT	Dichlorodiphenyltrichloroethane
DLA	Defense Logistics Agency
DoD	U.S. Department of Defense
EE/CA	Engineering Evaluation/Cost Assessment
EPA	U.S. Environmental Protection Agency
FFA	Federal Facilities Agreement
FS	Feasibility Study
ft	feet
HHRA	Human Health Risk Assessment
LDR	land disposal restriction
MCL	maximum contaminant level
MI	Main Installation
µg/L	micrograms per liter
µg/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
ML	silt
MLGW	Memphis Gas Light and Water
msl	mean sea level
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
POTW	publicly owned treatment works
ppm	parts per million
RA	remedial action
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
TCL/TAL	Target compound list/target analyte list
TCLP	Toxicity characteristic leaching procedure
TDEC	Tennessee Department of Environment and Conservation

TAB

Executive Summary

Executive Summary

This Engineering Evaluation/Cost Analysis (EE/CA) evaluates the recommended removal action for removing lead contaminated surface soil from the Site 60 – former Pistol Range in the Northeast Open Area on Dunn Field of the former Defense Distribution Depot Memphis, Tennessee (now known as the Memphis Depot or Depot). This action will make the Northeast Open Area available for unrestricted future land use. Further, this action will allow the area to be granted to the City of Memphis for their use and development, possibly as a park or some type of recreation facility. The Northeast Open Area consists of primarily 20 acres of undeveloped land with the former Pistol Range in the center of the area.

Lead contamination in surface soil is the greatest potential concern to human health and the environment at Site 60. The maximum recorded lead concentration in surface soil at the Northeast Open Area is 2,100 mg/kg, with an estimated arithmetic mean of 196 mg/kg. The maximum concentration was detected in sample Location 6085D from Site 60. All concentrations for Site 60 and the entire Northeast Open Area except the maximum are below a residential exposure-based screening level of 400 mg/kg and an industrial worker exposure-based target concentration of 1,536 mg/kg (CH2M HILL, June 2002). The lead is possibly associated with spent bullets in the firing range, as the elevated concentrations were limited to this area. The maximum observed lead levels at the site are expected to pose health hazards for any of the receptors mentioned because both screening levels have been exceeded.

Limited biased uncertainty for lead at the bullet stop area may exist due to the limited sampling of this area and random distribution of source, lead bullets. The single sample from this area may underestimate the importance of this area's contribution to lead exposure at this site.

Other contaminants were detected in soil samples, however, based on an evaluation completed in the Risk Assessment for the Northeast Open Area in the Dunn Field Remedial Investigation (CH2M HILL, June 2002), none were found to be at levels above risk-based concentrations.

On the basis of the screening evaluation, and consideration of future land use and accessibility, the following actions were deemed appropriate by the BCT:

- Removal of surface soil within the perimeter of Site 60.
- Demolition of the former pistol stand and associated building at Site 85.

Based on previous surface soil removal actions completed for Parcels 35 and 28 on the Main Installation (MI) of the Memphis Depot, as well as Building 949 on the MI, as stated in the September 2001 MI Record of Decision (ROD), the recommended removal action for Site 60 is excavation and offsite disposal. After reviewing these previous removal actions, this method was selected by the BCT as the most cost efficient and expeditious.

Prior to selection of excavation and offsite disposal as the method for removal at Site 60, it was evaluated in terms of effectiveness, implementability, and cost, and the following removal goals and objectives:

- Reduce the potential risk to long-term site users to a level deemed acceptable to the US Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation (TDEC);
- Be technically appropriate and feasible to accomplish using commonly accepted construction practices;
- Minimize, to the extent possible, the volumes of materials that must be removed and landfilled offsite;
- Have a reasonable and acceptable cost;
- Be implemented in an expedited manner; and
- Involve minimal post-removal operational, maintenance, or monitoring requirements.

The evaluation results revealed that the excavation and removal method was capable of meeting and exceeding these goals and objectives. The method has been used successfully during several previous surface soil removal actions with similar chemicals of concern at the Memphis Depot. An estimated 890 cubic yards or 1290 tons of surface soil would be excavated, transported and disposed offsite at an approved, permitted landfill as part of the non-time critical removal action at Site 60. The order of magnitude cost estimate for this removal action is $300,000.

TAB

Section 1

1.0 Site Characterization

1.1 Description and Background

1.1.1 Site Location

The Memphis Depot (formerly known as Defense Distribution Depot Memphis, Tennessee and referred to in this document as the Depot), is located in Memphis, Tennessee (Figure 1-1), consists of approximately 642 acres and includes the Main Installation (MI), which includes open storage areas, warehouses, military family housing, and outdoor recreational areas, and Dunn Field, which includes former mineral storage and waste disposal areas. The major features of the Depot are shown in Figure 1-2. The Depot lies approximately 5 miles east of the Mississippi River and just northeast of the Interstate 240–Interstate 55 junction in the south-central portion of Memphis, approximately 4 miles southeast of the central business district and one mile northwest of Memphis International Airport (Figure 1-1). Airways Boulevard borders the MI portion of the Depot on the east and provides primary access to the MI. Dunn Avenue, Ball Road, and Perry Road serve as the northern, southern, and western boundaries of the MI, respectively.

Dunn Field, comprising 64 acres of primarily undeveloped land, is immediately adjacent, across Dunn Avenue, to the north-northwest portion of the MI. Dunn Field is bounded by the Illinois Central Gulf Railroad and Person Avenue to the north, Hays Road to the east, and Dunn Avenue to the south. Dunn Field is partially bounded to the west by: (1) Kyle Street; (2) Memphis Light Gas and Water (MLGW) powerline corridor (which bisects Dunn Field); (3) undeveloped property; and (4) a commercial trucking facility (Figure 1-2).

1.1.2 Type of Facility and Operational Status

Much of the information contained within this section has been excerpted from Section 1 of the Dunn Field RI Report (CH2M HILL, July 2002). The reader is referred to that report for additional discussion on the history of the Memphis Depot. The Depot originated as a military facility in the early 1940s. Its initial mission and function was to provide stock control, materiel storage, and maintenance services for the U.S. Army (Memphis Depot Caretaker, 1998).

On October 14, 1992, the Depot was placed on the National Priorities List (NPL) by the U.S. Environmental Protection Agency (EPA), bringing the facility within the Superfund program. As a result of its status as an NPL site, the Depot entered into a Federal Facilities Agreement (FFA) on March 6, 1995. The signatories to that agreement, the Defense Logistics Agency (DLA), EPA, and the Tennessee Department of Environment and Conservation (TDEC), agreed that investigating and remediating all applicable sites at the Depot would proceed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Dunn Field was given the designation of Operable Unit (OU) 1 while the MI was split into OUs 2, 3, and 4.

In July 1995, the Depot was placed on the list of Department of Defense (DoD) facilities to be closed under the Base Realignment and Closure (BRAC) Act, indicating that the facility was to

be closed and converted to potentially different ownership and uses. The BRAC Cleanup Team (BCT) was developed to implement BRAC requirements, which include identifying methods for expeditious property transfer and reuse. The BCT is composed of representatives of DLA, EPA, and TDEC. Therefore, in addition to meeting CERCLA requirements, environmental restoration at the facility must also comply with specific requirements for property transfer in accordance with Public Law 501-510 under Title XXIX, enacted in 1990.

Dunn Field was divided into three separate areas within the Remedial Investigation (RI) to assist the investigation of previous activities (CH2M HILL, July 2002). These areas are known as the Northeast Open Area, Disposal Area, and Stockpile Area (Figure 1-3). This document is concerned with the Northeast Open Area only.

The Northeast Open Area (approximately 20 acres) consists of a grassy area with a number of interspersed mature trees in the northeast quadrant of Dunn Field. Further information on aspects of the Northeast Open Area can be found in the Dunn Field RI Report. Importantly, the Northeast Open Area contains Site 60 - Pistol Range Impact Area and Bullet Stop and the adjacent Site 85 - Pistol Range Building and Temporary Pesticide Storage Building. These sites are located in the northeastern quadrant of the Northeast Open Area (Figure 1-3).

Site 60 is located approximately 400 feet south of the north fence surrounding Dunn Field and 90 feet west of Building 1184. The boundary of the site has been estimated using historical aerial photography, which also indicate that the site was constructed between 1953 and 1958. Records from the former Memphis Depot identify Site 60 as a former pistol range used for marksmanship training. No additional information is available about previous uses of this area. There is no documented evidence that this site was ever used for the storage or disposal of hazardous or toxic materials. The time period that Site 60 was used for target practice is unknown, but the Installation Assessment report (USATHMA, 1982) states that the "area was abandoned in the late 1970s and the building [1184] is currently being used for pesticide storage."

From historical documents, Site 85 appears to be the building located at the former pistol range. Site 85 is the Pistol Range Building (Building 1184) that served as an office and control point for Site 60 and is located immediately adjacent to the pistol stand and Site 60 area (see Figure 1-4). Reportedly during activities at Dunn Field, this building also served as a location for temporary storage of pesticide containers. No additional information is available about previous uses of this area. Building 1184 is no longer used for temporary storage of pesticides. Photographs (April 2002) of Site 60 are included in Appendix A.

1.1.3 Structures and Topography

The Northeast Open Area consists of the mowed and wooded area in the northeast section of Dunn Field. The topography is generally level over the entire area, exhibiting maximum and minimum surface relief features in the form of manmade berms and drainage ditches, respectively. Ground elevation ranges from approximately 310 feet msl measured at the southern boundary of the Northeast Open Area to 275 feet msl in a drainage area adjacent to the northern boundary.

The dominant manmade features within the Northeast Open Area are the former firing range (Sites 60 and 85) and two concrete drainage ditches. The firing range is in the center of the area,

approximately 400 feet south of the northern boundary of Dunn Field. The two concrete ditches originate at the eastern boundary at points approximately 350 feet and 900 feet south of the northeast corner; proceed individually in a generally northwest direction; join about 175 feet from the north fence line to form a single drainageway; and terminate into an open ditch outside the northern boundary and just south of Person Avenue. An underground conveyance system for the groundwater extraction system operating on the western perimeter of Dunn Field, including the meter and by-pass station, is located along the north boundary of the Northeast Open Area.

1.1.4 Geology and Soil Information

1.1.4.1 Geology at Dunn Field

A thorough discussion of the regional and local geologic characteristics of the Memphis and Memphis Depot areas can be found in Section 2 of the Dunn Field RI report (CH2M HILL, July 2002). There are four primary geologic and stratigraphic units underlying Dunn Field, however, only the upper few feet of the uppermost unit, loess deposits, are important to this EE/CA document and the activities performed as result of the approval of this document. A brief review of the geologic characteristics of the loess is presented in the following paragraph. For more information on the loess and underlying units, the reader is referred to Section 2 of the Dunn Field RI report (CH2MHILL, July 2002).

The uppermost geologic unit at or near ground surface at Dunn Field is loess deposits, consisting of brown to reddish brown low-plasticity clayey silt (ML) or low-plasticity silty clay (CL). Portions of the loess may also be described as fine sandy clayey silt. Based on data from the RI monitoring well installation effort, the loess is continuous throughout the entire Memphis Depot area. The loess deposits range from 10 feet thick in the southwestern portion of Dunn Field to 36 feet thick at the western boundary of Dunn Field and are on average about 20 to 30 feet thick.

1.1.4.2 Regional Hydrogeology

Information describing the groundwater conditions and resources of Shelby County was obtained from Section 2 of the Dunn Field RI report (CH2MHILL, July 2002).

The Memphis area is located within a region that includes several aquifers of local and regional importance. An alluvial aquifer is located throughout Memphis, however the distribution is limited to the channels of primary streams; therefore, it does not occur at Dunn Field. Other aquifers are present beneath Dunn Field albeit at depths where they will not be significant to the action described in this EE/CA. The reader is referred to Section 2 of the Dunn Field RI report (CH2M HILL, July 2002) for a more a thorough discussion of the regional and local hydrogeology in the Memphis area.

1.1.5 Sensitive Ecosystems

Dunn Field is essentially a maintained industrial site located within a highly developed (mixed residential, commercial, and industrial land uses) portion of the Memphis area. As such, the facility offers little or no natural habitat to support wildlife. Industrial land uses are expected to continue into the future.

Sections 2 and 9 of the Dunn Field RI report (CH2M HILL, July 2002) found that there are no natural terrestrial ecological or aquatic habitats within the Dunn Field boundary. The entire facility has been either historically or recently disturbed, and the existing landscape features consist primarily of mowed grass with some patches of trees and/or shrubs. Surface drainage of Dunn Field occurs by overland flow via swales, ditches, concrete-lined channels, and a storm drainage system. The open grassed areas, which cover at least 75 percent of the facility, are frequently mowed for landscaping and access purposes. A small overgrown area including young trees, shrubs, and vines occurs at Site 60.

1.2 Source, Nature, and Extent of Contamination

1.2.1 Sources of Contaminants

The primary source of contamination in Site 60 and the adjacent Site 85 is the former use of the area as a pistol range and temporary pesticide storage area.

- Site 60 was used as a former pistol range used for markmanship training. Potential contaminants include metals or pesticide residues that may have been tracked into the area.

- Site 85 consists of the Pistol Range Building (Building 1184), where the only potential contaminants include metals and pesticides.

1.2.2 Nature of Contaminants

During the 1999 Dunn Field RI sampling program, sampling was conducted to characterize the past operations or disposal activities at each site. Specific sampling objectives at Site 60 were:

- Evaluate the extent of pesticides and metals in surface soil.

- Determine if bullets or bullet fragments are present in the surface soil that may present an exposure risk.

At Site 60 and the adjacent Site 85, 6 surface soil samples were collected and analyzed for pesticides, PCBs and metals in 1999. Soil from the pistol range was sieved onsite during the sampling event, verifying the presence of lead bullets and casings. Table 1-1 presents a summary of sampling locations and results of analytes detected.

1.2.3 Extent and Magnitude of Contaminants

1.2.3.1 Metals in Soil

Of the 6 surface soil samples analyzed for lead, 5 samples contained lead concentrations that exceeded the background value of 30 milligrams per kilogram (mg/kg). The lead concentrations ranged from 39.2 mg/kg to 2,100 mg/kg, with the maximum value recorded in samples from the former Pistol Range. Figure 1-5 shows the locations of the samples that were collected and the concentrations detected above background.

Other metals detected in soil samples from the Pistol Range include beryllium, cadmium, chromium, copper, and zinc:

Beryllium - this metal was detected in 1 of 6 samples. One result (at sample Location 6085B) with a concentration of 1.2 mg/kg slightly exceeded the background of 1.1 mg/kg.

Cadmium - this metal (background level of 1 mg/kg) was detected in 1 of 6 samples (6085D), and exceeded background with concentrations of 4.8 mg/kg.

Chromium - total chromium was detected 1 of 16 surface soil samples, but only exceeded the background value of 24.8 mg/kg with a concentration of 25 mg/kg. The chromium concentrations ranged from 9 mg/kg to 239 mg/kg.

Copper - Copper in the surface soils was detected 2 of 6 samples, and exceeded the background value of 34 mg/kg in these samples. The copper concentrations ranged from 43.9J mg/kg to 115J mg/kg.

Zinc - Zinc in the surface soils was detected in 2 of 6 samples, and exceeded the background value of 126 mg/kg in these samples with concentrations of 884 mg/kg and 1,780 mg/kg.

1.2.3.2 Pesticides/PCBs in Soil

A total of 5 pesticides were detected in 6 surface soil samples from Sites 60 and 85: DDT, DDD, dieldrin, and endrin. Figure 8-5 in Section 8 of the Dunn Field RI report (CH2MHILL, July 2002) presents the locations within the Northeast Open Area where samples were collected for pesticides analysis, and highlights the pesticides with concentrations above background or with any detectable concentration if no background concentration is available.

The pesticides detected at concentrations above background are discussed below.

Dieldrin. This common pesticide was detected in 4 of 6 samples, and exceeded the background value of 0.086 mg/kg at all locations. The range of concentrations above background was from 0.101 mg/kg to 4.75 mg/kg.

DDD. This pesticide was detected in 2 of 6 samples, and exceeded the background value of 0.0067 mg/kg at these locations. The range of concentrations above background was from 0.007J mg/kg to 0.0543J mg/kg.

DDT. This pesticide was detected in 1 of 6 samples, and exceeded the background value of 0.074 mg/kg at this location with a value of 0.0819J mg/kg.

The Dunn Field RI report stated that dieldrin, DDD, and DDT were detected across the Northeast Open Area, but are not associated with discrete releases from source areas within the Northeast Open Area. In the past, these pesticides were sprayed routinely on grassy areas and around buildings, and a wide range of variability was observed (CH2M HILL, 1999, Main Installation RI Report). The Dunn Field RI report also stated that the high dieldrin concentration near the Former Pistol Range (6085D) may result from increased application in this area because of frequent activity and is not indicative of releases specifically from pesticide handling at Site 85.

PCBs (Aroclor 1260) were detected in 3 of 6 samples analyzed; however, all results were reported as estimated with a "J" qualifier, and none were reported above the background value of 0.11 mg/kg.

1.2.3.3 Groundwater

Analytical data for chemical constituents found in soils at Site 60 was collected during the RI field effort. The contaminants, specifically beryllium and lead, present at Sites 60 and 85 have

been detected in groundwater samples collected immediately downgradient of this area. Lead does not have an EPA maximum contaminant level (MCL); however, it does have an action limit of 15 micrograms per liter (ug/L) at the tap. This value is exceeded at MW-09 with a value of 24.7 ug/L.

There are no known uses of groundwater from the fluvial aquifer and remediation of groundwater will not be considered in this EE/CA. Evaluation of the risks from groundwater at the Depot and the need for remedial actions, however, are included in the Dunn Field RI report (CH2M HILL, July 2002). Groundwater flows predominantly to the west across Dunn Field.

1.2.4 Receptors Potentially Effected by the Site

Dunn Field has been primarily inactive since the closure of the Depot. There are no potentially exposed populations under current conditions specific to this site.

Under assumed immediate future use conditions, maintenance workers for Dunn Field involved in weed control and other maintenance-related activities could be present for limited periods of time. Although this is a potentially complete exposure scenario, the maintenance worker scenario was not quantified within Site 60. A maintenance worker exposure scenario was quantified for the Northeast Open Area as a conservative representative of the potential risks from Site 60 within the risk assessment presented in Section 9 of the Dunn Field RI report (CH2M HILL, July 2002).

The risk assessment also reviewed other potential receptors although potentially exposed populations within future land use scenarios are unknown at this time. On the basis of *The Memphis Depot Redevelopment Plan* (The Pathfinders *et al.*, 1997), Site 60 may be used in the future as unrestricted, public open space, possibly as a recreational area open to the public. Under such a scenario, offsite residents could visit the site. In addition, since the site provides an attractive area for future unrestricted development, as part of the future unrestricted land use scenario, a residential land use scenario was included. The residential land use scenario evaluated represents the worst-case exposure scenario during the site risk management. Site 60 was evaluated for a future industrial worker exposure as well. The exposure assumptions for the future industrial worker are default values, which assume 8 hours per day spent in the contaminated area for 25 years for 250 days per year. As stated above, the future land use identified for this area in the redevelopment plan is as an open public space, indicating unrestricted public access to the site.

Lead contamination in surface soil is the greatest potential concern to human health and the environment at Site 60. The maximum recorded lead concentration in surface soil at the Northeast Open Area is 2,100 mg/kg, with an estimated arithmetic mean of 196 mg/kg. The maximum concentration was detected in sample Location 6085D from Site 60. All lead concentrations for Site 60 and the entire Northeast Open Area, except the maximum, are below a residential exposure-based screening level of 400 mg/kg and an industrial worker exposure-based target concentration of 1,536 mg/kg (CH2M HILL, July 2002). The lead is possibly associated with spent bullets in the firing range, as the elevated concentrations were limited to this area. The maximum observed lead levels at the site are expected to pose health hazards for any of the receptors mentioned because both screening levels have been exceeded.

Limited biased uncertainty for lead at the backstop area may exist due to the limited sampling of this area and random distribution of source, lead bullets. The single sample from this area

may underestimate the importance of this area's contribution to lead exposure at this site. Due to the randomly occurring nature of lead (in the form of bullets) at the backstop, increased sampling may not necessarily improve the true characterization of lead distribution at this site due to the form it is in.

1.2.5 Applicable or Relevant or Appropriate Requirements

The following list of applicable or relevant or appropriate requirements (ARARs) was developed based on the scope of work to be performed during the removal action:

- The excavation and disposal of soil that contains RCRA-restricted waste may trigger the RCRA land disposal restrictions (LDRs). In general, RCRA's LDRs were established for waste streams that differ significantly from Superfund wastes. Because the LDRs are not based on treating wastes that contain soil and debris, a treatability variance may be appropriate. Under a treatability variance, alternative treatment levels based on data from actual treatment of soil, or best management practices (BMPs) for debris, become the "treatment standard" that must be met. To determine if the soils are to be disposed of in a hazardous or solid waste landfill, a toxicity characteristic leaching procedure (TCLP) test is conducted on representative soil samples to determine if a waste is characterized as hazardous per Title 40 of the *Code of Federal Regulations* Part 261 Subpart C (40 CFR 261C). The excavation and off-site disposal of soil and debris that contain a RCRA hazardous waste must comply with transporter regulations under 40 CFR 263C). A transporter under Subtitle C is defined as any person engaged in off-site transportation of hazardous waste within the United States. Such transportation requires a manifest under 40 CFR 262.

- Applicable Occupational Safety and Health Administration (OSHA) health and safety regulations will be followed during removal actions. Workers performing the activities will be properly trained and under appropriate medical supervision. Appropriate personal protective equipment (PPE) will be used and appropriate safe work practices will be followed. This includes OSHA 29 CFR 1926.62, which also addresses when employees must follow mandatory hand-washing procedures and when full-body showers are required, and when employers must make available medical exams for workers as well as testing for blood lead levels. There are provisions for removing workers with high blood lead levels from jobs involving lead exposure.

- Lead contaminated materials, if any will be managed in accordance with appropriate OSHA, EPA, State of Tennessee and Memphis and Shelby County Health Department/Pollution Control Division requirements.

- Lead contaminated soils will be removed as necessary to achieve cleanup standards described in Section 1.4 below.

- Emissions to air during excavation and/or on-site treatment may require compliance with the substantive requirements of Tennessee Rule 1200-3-1, which includes requirements for the control of fugitive dust emissions, among others.

1.3 Removal Action Potential

1.3.1 Previous Removal Actions

Previous removal actions at Dunn Field have included removals outside of the Site 60 area. These activities were conducted as non-time critical removal actions under CERCLA. An EE/CA was performed by Parsons Engineering Science, Inc. in June 1999 to: (1) assess whether CWM contamination was migrating from the CWM disposal pits at Dunn Field; (2) analyze risk management alternatives; and (3) recommend feasible CWM remedial alternatives for contaminants found to be present. The recommended alternative for the three identified areas of concern at Dunn Field was Alternative 4, excavation and removal of CWM. UXB International, under contract with USAESC, Huntsville, conducted the remove action from mid-2000 to mid-2001 at Sites 1, 24-A, and 24-B.

Other surface soil removal actions have occurred at the MI, including removals at Parcels 35 and 28 (in 2000), Building 949 (in 2001), the former cafeteria area (in 1998), and the housing area (in 1998). The Building 949 removal action on the MI involved removal of lead contaminated soil down to one foot, similar to the activity for Site 60. In each case, excavation and removal of the contaminated material was the remedial method. This method was preferred over others because of the low amount of material to be removed and remediated. Other methods were found to be too costly because of equipment and time requirements. Cleanup limits for these projects were based on risk-based criteria.

1.3.2 Treatability of Compounds

The preferred method of disposal of non-hazardous contaminated soil and debris from projects at the Memphis Depot has been at a RCRA Subtitle D industrial waste landfill. Landfills, located relatively close to the Depot, are permitted to accept contaminated soil and debris that are not found to be hazardous when tested by the toxicity characteristics leaching procedure (TCLP). Use of the landfill provides significant (order of magnitude) savings on transportation and disposal costs and facilitates a more timely completion of the remedies.

On- and offsite treatment options to landfilling may be potentially viable from a technical perspective, but the relatively small volume of soil and low-cost landfill available for removal projects at the Depot suggest that treatment options would not be a cost-effective solution. As a result, no treatment options were considered.

Based on analytical results for lead in soil samples collected at Site 60 during the Dunn Field RI, there is potential that volumes of materials could be found to have characteristics of hazardous waste as defined by 40 CFR Subpart C. These materials would be properly containerized, manifested, and shipped to a licensed hazardous waste landfill for disposal.

Removal actions may generate contaminated wastewater that must be appropriately treated. The local sewer authority has accepted contaminated water from past projects, provided that this water has been tested and found to be nonhazardous.

Should the water be found to be hazardous, there are two possible alternatives that could be considered:

- Shipment to a RCRA treatment facility licensed to treat and dispose of water exhibiting hazardous waste characteristics;
- Pretreatment (carbon adsorption, etc.) so that it can meet the disposal requirements of the local sewer authority.

Selection of the appropriate alternative will depend on economics and acceptability of pretreatment by regulatory agencies and the local sewage authority.

1.3.3 Equipment and Utilities at the Site

Dunn Field has no utilities underground or at the surface other than those used for a groundwater extraction system along the western perimeter and a fire-hydrant system. This system has access to the public water system only; there are no other underground utilities (i.e., sewer, electricity, gas, etc.) available. In addition, there are no covered or uncovered storage spaces available for equipment and materials. Work areas are within a fenced area; however, there are no security guards or other personnel to monitor equipment and materials.

1.4 Risk-Based Cleanup Requirements

Areas requiring shallow soil removal within Site 60 were selected on the basis of risk-based screening criteria, future use, and potential access to areas of contamination. This section describes risk-based industrial and residential screening criteria, delineation of potential remediation areas represented by each, and the use of these delineation's along with other factors to select areas requiring surface soil remediation.

1.4.1 Industrial and Residential Screening Criteria

Industrial and residential screening criteria were developed in the risk assessment for Dunn Field (Dunn Field RI, CH2M HILL, July 2002) for selected constituents. The Dunn Field screening value for lead is 400 mg/kg. The soil target concentration protective of an adult worker (industrial site exposure) of 1,536 mg/kg was calculated. Evaluation of proposed soil removal quantities assuming residential land use were based on a criterion of 400 mg/kg.

1.4.2 Soil Samples Exceeding Industrial and Residential Screening Criteria

As shown in Table 1-1, the maximum recorded lead concentration in surface soil at Site 60 (and the Northeast Open Area) is 2,100 mg/kg, with an estimated arithmetic mean of 382 mg/kg. All concentrations except the maximum are below the residential screening level of 400 mg/kg and an industrial worker exposure-based target concentration of 1,536 mg/kg. The lead is possibly associated with spent bullets in the firing range, as the elevated concentrations were limited to this area. However, the maximum observed lead levels at the site are expected to pose health hazards for any of the receptors mentioned because both screening levels have been exceeded.

1.4.3 Proposed Removal Action Limits for Shallow Soil Excavations

Contaminants in shallow surface soil within the perimeter of Site 60 are consistent with the activities that occurred within the area, and removal of the surface soil has been deemed appropriate by the BCT. Because the area within the perimeter of Site and the entire Northeast Open Area has a proposed future use as a recreational area, and the general public will have

access to the area, it is proposed that lead contaminated surface soil exceeding the residential screening criteria of 400 mg/kg be removed within the limits of the Site 60. Figure 1-6 shows the estimated horizontal limits of excavation. The site has been divided in to 6 areas (Areas A through G).

On the basis of an excavation depth of zero to one foot below ground surface and the estimated horizontal limits of the excavation, the volume of soil that would be removed to achieve the residential screening criteria is estimated to be 890 cubic yards (The depth of soil to be removed from Area C [bullet stop] in Figure 1-6 is actually zero to 2 feet bgs). It should be noted, however, that the horizontal limits of excavation described in this section are primarily for initial design and cost estimating purposes. The actual extent of surface soil excavation will be determined by confirmatory sampling.

1.4.4 Removal Action Limits for Other Work

Although shallow soil excavation is a primary component of the removal action, there are other components that also must be considered. These include:

- Demolition of Building 1184, including the pistol stand, and concrete slabs that are in the footprint of the excavation; and
- Excavation of soil greater than the estimated limits based on confirmation sampling.

Once an excavation has been completed, the floor and walls of the excavation will be sampled for confirmatory purposes to ensure that no additional contaminated material above 400 mg/kg is present. If the samples show that additional material must be excavated, the sampling will be repeated as necessary to confirm excavation limits.

TAB

Section 2

2.0 Identification of Removal Action Objectives

2.1 Removal Action Goals and Objectives

The goal of the removal action is to provide technically sound, cost-effective, and timely measures that will result in an acceptable risk to human health from contaminants (lead) located in the surface soil at Site 60. Specific objectives of the removal action include the following:

- Reduce the potential to long-term site users to a level deemed acceptable to EPA and TDEC;
- Be technically appropriate and feasible to accomplish using commonly accepted construction practices;
- Minimize, to the extent possible, the volumes of materials that must be removed and disposed offsite;
- Have a reasonable and acceptable cost;
- Be implemented in an expedited manner; and
- Involve minimal post-removal operational, maintenance, or monitoring requirements.

2.2 Statutory Limits on Removal Actions

Non-time critical removal actions funded by EPA have a $2 million and a 12-month statutory limit pursuant to Section 104(c)(1) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). Because removal actions at the Memphis Depot are not being funded by EPA, these statutory limits do not apply.

2.3 Determination of Removal Scope

Removal actions are defined by EPA 540-R-93-057, *Guidance on Non-Time-Critical Removal Actions Under CERCLA* (EPA, August 1993), as: "The cleanup or removal of hazardous substances from the environment, such actions as may necessarily be taken in the event of the threat or release of hazardous substances into the environment, such actions as may be necessary to monitor, assess, and evaluate the release or threat of release of hazardous substances, the disposal of removed materials, or the taking of other actions as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare, or to the environment, which may otherwise result from a release or threat of release."

2.4 Determination of Removal Schedule

Although the 12-month statutory limit on EPA-lead removal actions does not apply, Site 60 and Dunn Field are sites slated for turnover as part of the BRAC process. Therefore, it is assumed that the work will be completed within 6 months after approval of selected removal action.

2.5 Planned Removal Actions

Planned removal actions should be capable of being developed and implemented using current removal action contracting mechanisms at the Memphis Depot. During previous surface soil removal actions at Dunn Field and the Memphis Depot, the use of existing service contracts, equipment, procedures, and subcontract/vendor arrangements has provided expeditious and cost-effective work.

All removal actions must conform with appropriate federal, state, local, and facility environmental protection, health and safety, and security requirements. It should be assumed that these requirements would be met using measures similar to those used for previous surface soil removal actions at the Depot.

TAB

Section 3

3.0 Identification and Analysis of Removal Action Alternatives

3.1 Removal Action Alternative

To expedite this removal action, the BCT determined that the process of a full analysis of available alternatives for Site 60 was not necessary. Instead, this removal action would be based upon previous, similar EE/CA and feasibility study activities at the Memphis Depot, especially those conducted for Parcels 35 and 28 and the soils on the Main Installation (e.g., Building 949) in Functional Unit (FU) 4. The documentation and activities for those two removals were used as the basis for selection of the remedial alternative at Site 60. Sections 3, 4, and 5 of the final EE/CA document for the Old Paint Shop and Maintenance Area, Parcels 35 and 28 (CH2M HILL, August 1999) identify, analyze, and compare the alternatives. The method recommended as the primary remedial alternative included excavation and removal of surface soil contamination in excess of risk-based industrial and residential screening criteria. The excavation and removal method was selected because: (1) this alternative would effectively meet risk-based cleanup criteria and decrease residual effects; (2) the alternative is technically appropriate and feasible; and (3) costs were acceptable. The MI Soils Feasibility Study (FS) (CH2M HILL, July 2000) also identified several remedial alternatives for removal of lead contaminated surface soil at various locations (e.g., Building 949) on the MI. Section 4 of the FS identified excavation, transportation, and off-site disposal as being protective of human health and the environment via contaminant reduction to industrial worker exposure levels acceptable to appropriate land use. The alternative was also found to be permanent, timely in implementation, and cost-effective. Further, the MI Record of Decision (ROD) (CH2M HILL, September 2001) provided that, for Building 949, excavation and removal is the preferred alternative for remediation due to its expediency, permanence, and moderate cost. The reader is referred to these documents for specific information related to the alternative evaluation and selection process.

As identified by the BCT, the one objective that is to be accomplished by this non-time critical removal is that Site 60 should, after the removal is completed, be available for unrestricted use. Based on these requirements, the parameters of previous removal actions, and successful implementation of those previous removal actions, excavation, transportation, and offsite disposal of all contaminated surface soil and debris at Site 60 (including the removal of Building 1184 [Site 85]) was selected by the BCT as the most effective and efficient method.

3.1.1 Description of the Alternative

Specific elements of this removal action alternative include:

- Clearing and grubbing of the bushes and trees that have grown in and around Site 60. Removal of roots from former tree locations and removal of potentially contaminated soil from the root balls.

- Removal of up to 12-inches of soil for all areas (except Area C in Figure 1-6) of contaminated surface soil within the perimeter of Site 60 where previous sampling suggests the presence of surface soil contamination in excess of residential screening criteria, and the presence of spent bullet and casings have been found.
- Removal of up to 24 inches of surface soil from Area C within the perimeter of Site 60, as shown in Figure 1-6, as this area served as the bullet stop while the site was used as a pistol range.
- Removal of Building 1184 (Site 85), as well as all other metal emplacements including the pistol stand and target racks.
- Confirmatory sampling from all excavations to ensure that: (1) no additional contaminated soil above residential screening criteria (lead at 400 mg/kg) is present; and (2) spent bullets are not present.
- Replacement of excavated areas (primarily Areas A and B) with clean (laboratory tested), imported backfill soil.
- Engineering controls to minimize fugitive dust and stormwater releases as well as all water related to decontamination procedures.

3.2 Evaluation Criteria

Evaluation criteria for evaluating alternatives conform to criteria for removal actions under CERCLA. They include effectiveness, implementability, and cost. Each is described below along with a description of how the selected alternative shall satisfy each criterion.

3.2.1 Effectiveness

The effectiveness criterion addresses the expected results of the removal alternatives. It includes two major subcategories: protectiveness and ability to achieve the removal objectives. Protectiveness includes protection of public health and community, workers during implementation, the environment, and compliance with ARARs. Achievement of removal action objectives includes meet or exceeding level of treatment, no residual effects, and maintains control over a long period.

Implementation of this alternative will be fully protective in Site 60 for unrestricted use by eliminating risk of exposure to areas of surface soil with lead exceeding levels acceptable under a residential land use scenario. This alternative will remain effective after completion because contaminated soil will have been removed. Removal is reliable and permanent. No monitoring or management beyond the implementation period will be required.

This alternative provides no reduction in toxicity, mobility, or volume of the contaminated soil through treatment. Disposal in an offsite landfill reduces the mobility of contaminants by physical containment.

Site engineering controls will be required to minimize fugitive dust and stormwater releases during periods of soil disturbance such as excavation and hauling. Site workers might be required to wear dermal and respiratory protective equipment to minimize the likelihood of

exposure during intrusive activities in the lead-contaminated areas of Site 60. Medical blood-lead monitoring of site workers may be required.

3.2.2 Implementability

The implementability criterion encompasses the technical and administrative feasibility of the removal action. It includes three subcategories: technical feasibility, availability of resources, and administrative feasibility. The definition of technical feasibility includes construction and operational considerations, demonstrated performance, adaptability and implementation within the allotted time. Availability of resources refers to availability of personnel, equipment, services, laboratory testing, disposal capacity, treatment, and post-removal site control. Administrative activities include ability to obtain permits, potential impacts, institutional controls, and exemptions from statutory limits.

This alternative is easily implemented and monitored and involves common practices similar to those used at other removal action sites conducted at the Memphis Depot. No special techniques, materials, equipment, or skills are required. The project will be capable of meeting cleanup objectives in a reasonable time.

Abundant and existing resources exist for using the excavation and removal method. Existing contractors and laboratories have needed expertise. Established and CERCLA/RCRA approved disposal facilities have capacity for accepting waste and debris. Native offsite soil is available locally for backfill. Offsite transportation may require special controls on trucking operations. The removal action could be enhanced by enlarging the excavated area if more contamination were discovered. All access to the site can be controlled within the existing perimeter.

Administrative needs will also be satisfied by the excavation and removal method. The project will be completed within existing government property. The project can be completed without offsite impacts, except traffic. Institutional controls are possible but not required.

3.2.3 Cost

The cost criterion typically encompasses the life-cycle costs of a project, including the projected implementation costs and the long-term operational and maintenance costs of the remedial action. Because the excavation and removal method has no long-term operational and maintenance requirements, only implementation costs are used for the comparison of alternatives.

Implementation costs include three subcategories of cost: capital costs, post-remediation site control costs, and present-worth costs. Of these, only capital costs, including direct capital costs and indirect costs, are applicable because contamination will be removed and no post-removal operational or maintenance activities will be required. Present-worth costs do not apply because the project can be accomplished within a single year and there are no long-term costs thereafter.

Direct capital costs include actual costs of the removal action, such as:

- Construction costs;
- Equipment and material costs;
- Buildings and service costs;

- Transport and disposal costs;
- Analytical costs; and
- Contingency allowances.

Other commonly encountered direct costs, such as land and site acquisition costs, relocation expenses, and treatability costs are not applicable to this project.

Indirect capital costs typically include non-construction costs of the removal action, such as:

- Engineering, design, and project management expenses;
- Legal fees and license or permit fees; and
- Startup and shutdown costs for processes and equipment.

Of these, only project management expenses appear to be applicable to removal activities in Site 60. Engineering and design are based on previous removal activities at the MI, especially for Building 949, which was completed in 2001 and was based on information presented in the MI ROD. Although the intent of applicable regulatory and permit requirements will be included in the removal actions, the work is within a CERCLA site and no special licenses or permits will be necessary to conduct the work.

Appendix B presents the costs for this remedial method, including direct costs, indirect costs, and total cost. These costs are order-of-magnitude capital costs. Order-of-magnitude estimates are made without detailed engineering data and included estimates of major cost components and quantities, typical costs for similar work, cost curves, and scale-up or scale-down factors or ratios. It is normally expected that estimates of this type would be accurate to within plus 50 percent to minus 30 percent.

The final costs of this project will depend on actual labor and material costs, competitive market conditions, final project costs, implementation schedule, and other variable factors. As a result, the final project costs will vary from the estimates presented herein. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding. The following assumptions were used in this estimate:

The scope of work for this removal action is as described herein.

- The following contingencies were included to account for unknown variables:
  - Construction contingency at 15 percent
- Direct cost data are based on unit costs provided in the estimate for the work conducted at Building 949 on the MI, and current vendor quotes.
- Indirect costs for Project Management are based on 10% of the construction costs.
- The work area is within a secured government site and is of sufficient size and configuration to support all work. No additional site security, land acquisition, or relocation costs will be incurred.

- Slightly over half of the waste materials will be considered hazardous (Areas A, B and C on Figure 1-6) for cost estimating purposes.
- Up to approximately 890 cubic yards (1,290 tons) of contaminated soil will require removal and disposal. This includes removal of contaminated surface soil from all areas depicted in Figure 1-6. All areas in Figure 1-6, except for Area C, will be excavated to 1-foot bgs. Area C will be excavated to 2-feet bgs because this area was the bullet stop and there is a higher potential of bullets being penetrating deeper than 1-foot. Assumed hazardous and non-hazardous soil will be segregated and stockpiled onsite pending sampling and disposal characterization analysis. The square footage calculations for Areas A through G of Site 60 are included in Appendix B. Much of the cost estimate is based on these square footage calculations.
- Trees, bushes, and other above ground vegetation will be mulched and stockpiled onsite pending sampling and analysis, and have been assumed to be non-hazardous.
- Root materials will be separated from other vegetation and stockpiled pending sampling and analysis due to the potential lead uptake. This material has been assumed to be non-hazardous.
- Up to 753 tons of RCRA hazardous waste (D008) may be present and will require transportation and disposal at a RCRA subtitle C hazardous waste landfill.
- Non-hazardous materials (537 tons of soil and 80 cubic yards of vegetation debris) will be transported to a RCRA Subtitle D landfill.
- Concrete, where present, will be sampled but for cost purposes has been considered non-hazardous and will be stockpiled with the excavated non-hazardous soil.
- Wastewater will be collected, containerized, sampled, and disposed of at the local publicly owned treatment works (POTW) in a manner similar to that which was done during previous removals at Memphis Depot.
- Scrap metal, sheeting, concrete, and equipment parts will be decontaminated. All metal pieces will be transported to a local scrap metal yard for disposal as recyclable metal. Metals to be removed to a recycling facility will not require prior sampling.
- Protective measures will include dust suppression during excavation and load-out operations, and continuous dust monitoring during soil handling activities.
- Sampling and analysis requirements during construction activities will include the following general criteria:
  - Confirmation samples will be collected from each excavation according to the sampling frequency and sample grids to be developed within the Site 60 RA Workplan by the remedial action contractor. The cost tables presented in Appendix B have assumed approximately 50 confirmation samples will be collected based on an approximate 25' x 25' sampling grid within the excavations. All confirmation samples will be analyzed for total lead content on a 3-day turnaround time basis. In addition, confirmation soil samples will be hand screened (or sieved) in the field for the presence of spent bullets.

  - Approximately 6 disposal characterization samples (TCLP) will be required to confirm disposal of the various waste streams.
  - All samples will require Level 3 analysis quality control (QC) criteria, which includes a data package documenting the QC and data quality evaluation process used to validate the accuracy of the analytical data. QC samples include additional field and laboratory samples used to verify the accuracy of analytical results and the potential effects of laboratory and field procedures and reagents on the analytical results. All laboratory data will be provided in hardcopy and electronic data deliverable formats.

- Site restoration will include the following:
  - Granular soil backfilling of Areas A and B.
  - Grading existing soil for all other disturbed areas.
  - Hydroseeding of all disturbed areas.
- All granular imported soil backfill material will be sampled and subjected to a Level 3 full-scan analysis, including volatiles, semi-volatiles, pesticides, PCBs, TAL metals) at a rate of one sample for every 500 cubic yards to confirm that the material is free of contaminants prior to placement.

TAB

Section 4

4.0 References

CH2M HILL, August 1999. *Final Engineering Evaluation/Cost Analysis (EE/CA) Old Paint Shop and Maintenance Area Parcels 35 and 28.* Former Defense Distribution Depot Memphis, Tennessee. US Army Corps of Engineers, Huntsville.

CH2M HILL, January 2001. *Main Installation Remedial Investigation Report.* Defense Distribution Center (Memphis). Memphis, Tennessee. US Army Corps of Engineers, Huntsville.

CH2M HILL, July 2000. *Main Installation Soils Feasibility Study.* Defense Distribution Center (Memphis). Memphis, Tennessee. US Army Corps of Engineers, Huntsville.

CH2M HILL, September 2001. *Main Installation Record of Decision.* Defense Distribution Center (Memphis). Memphis, Tennessee. US Army Corps of Engineers, Huntsville.

CH2M HILL, July 2002. *Rev. 2 Dunn Field Remedial Investigation Report.* Defense Distribution Center (Memphis). Memphis, Tennessee. US Army Corps of Engineers, Huntsville.

Parsons Engineering Science, Inc., June 1999. *Engineering Evaluation/Cost Analysis for the Removal of Chemical Warfare Materiel Former Defense Distribution Depot Memphis, Tennessee.* Prepared for US Army Corps of Engineers, Huntsville.

The Pathfinders, Woolpert ETI Toles and Associates, Trust Marketing Verner, Liipfert, Bernhard, McPherson and Hand. May 1997. *Memphis Depot Redevelopment Plan.*

TAB

Tables

TABLES

TABLE 1-1
Summary of Surface Soil Analytical Results
Rev 0 EE/CA Dunn Field - Site 60

Station ID :		SS6085A	SS6085B	SS6085C	SS6085D	SS6085E	SS6085F	
Sample ID :		DJA185	DJA186	DJA187	DJA188	DJA189	DJA190	DJA288FD
Date Collected :		04/01/1999	04/01/1999	04/01/1999	04/01/1999	04/01/1999	04/01/1999	
Sample Type :		N	N	N	N	N	N	Duplicate
Matrix :		SS	SS	SS	SS	SS	SS	SS
Depth :		0-1	0-1	0-1	0-1	0-1	0-1	0-1
Parameter	**Units**							
Metals								
ALUMINUM	mg/Kg	7040 =	8960 =	9370 =	8690 =	6550 =	8410 =	6780 =
ARSENIC	mg/Kg	9 3 =	4 =	10 =	14 =	9 7 =	11 3 =	9 7 =
BERYLLIUM	mg/Kg	0 49 J	1 2 =	0 62 J	0 56 J	0 44 J	0 56 J	0 48 J
CADMIUM	mg/Kg	0 87 U	0 75 U	0 81 U	4 8 =	0 87 U	0 91 U	0 85 U
CHROMIUM, TOTAL	mg/Kg	12 2 =	8 7 =	25 =	23 7 =	9 7 =	12 1 =	9 4 =
COPPER	mg/Kg	16 7 J	9 1 J	43 9 J	115 J	13 2 J	15 J	12 9 J
LEAD	mg/Kg	44 2 =	21 6 =	45 7 =	2100 =	39 2 =	40 4 =	39 3 =
MERCURY	mg/Kg	0 06 U	0 05 U	0 06 U	0 27 =	0 06 U	0 05 U	0 06 U
NICKEL	mg/Kg	14 =	2 6 U	17 5 =	19 4 =	13 2 =	15 5 =	11 9 =
SELENIUM	mg/Kg	0 56 UJ	0 48 UJ	0 52 UJ	0 6 J	0 56 UJ	0 59 UJ	0 55 UJ
SILVER	mg/Kg	0 92 J	0 58 J	1 2 J	1 2 J	0 82 J	0 59 U	0 55 U
ZINC	mg/Kg	67 3 J	884 J	105 J	1780 J	60 3 J	66 2 J	57 9 J
Organochlorine Pesticides & PCBs								
ALPHA-CHLORDANE	mg/Kg	0 0282 U	0 12 U	0 0025 J	0 149 U	0 028 U	0 0029 U	0 0027 U
DDD (1,1-bis(CHLOROPHENYL)-2,2-DICHLOROETHANE)	mg/Kg	0 0282 U	0 007 J	0 0543 J	0 149 U	0 028 U	0 0011 J	0 00095 J
DDE (1,1-bis(CHLOROPHENYL)-2,2-DICHLOROETHENE)	mg/Kg	0 0045 J	0 0178 J	0 122 =	0 0747 J	0 009 J	0 0128 =	0 0108 =
DDT (1,1-bis(CHLOROPHENYL)-2,2,2-TRICHLOROETHANE)	mg/Kg	0 0072 J	0 0364 J	0 074 J	0 0819 J	0 014 J	0 022 J	0 0159 J
DIELDRIN	mg/Kg	0 0729 =	0 607 =	0 101 =	4 75 =	0 552 =	0 0259 J	0 0272 J
ENDRIN	mg/Kg	0 0282 U	0 0055 J	0 026 U	0 149 U	0 028 U	0 0029 U	0 0027 U
GAMMA-CHLORDANE	mg/Kg	0 0282 U	0 0012 J	0 026 U	0 149 U	0 028 U	0 0029 U	0 0027 U
PCB-1260 (AROCHLOR 1260)	mg/Kg	0 0051 J	0 0133 J	0 0138 J	0 0149 UJ	0 014 UJ	0 0147 UJ	0 0137 UJ

Note Only the compounds detected are summarized in this table
SS surface soil
N normal sample
mg/Kg milligrams per kilograms

= detected concentration
J estimated concentration
U not detected

TAB

Figures

FIGURES

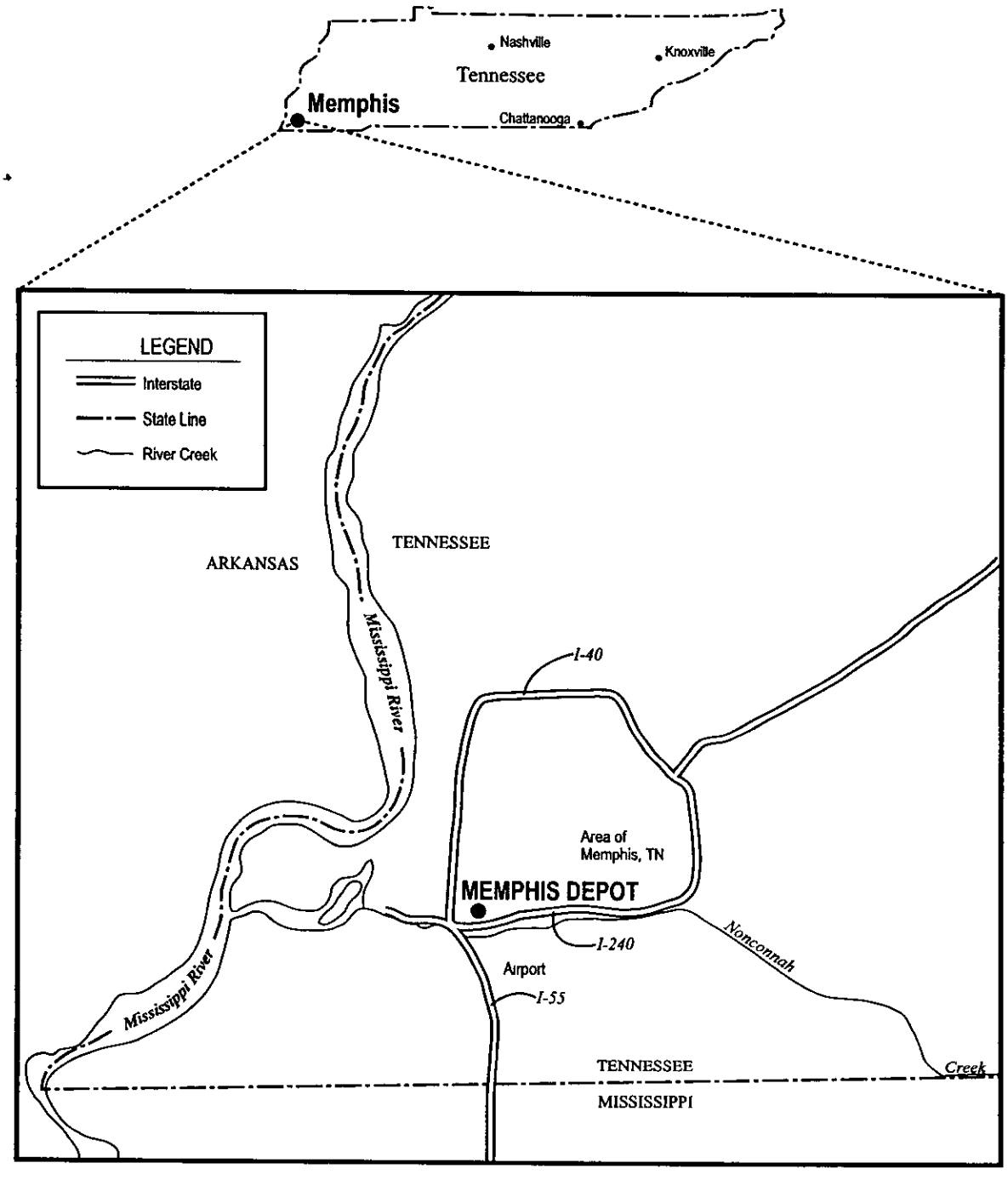


FIGURE 1-1
MEMPHIS DEPOT LOCATION IN THE MEMPHIS METROPOLITAN AREA
REV 0 DUNN FIELD - SITE 60 EE/CA

E062002027ATL \ Dunn128 FH8

CH2MHILL

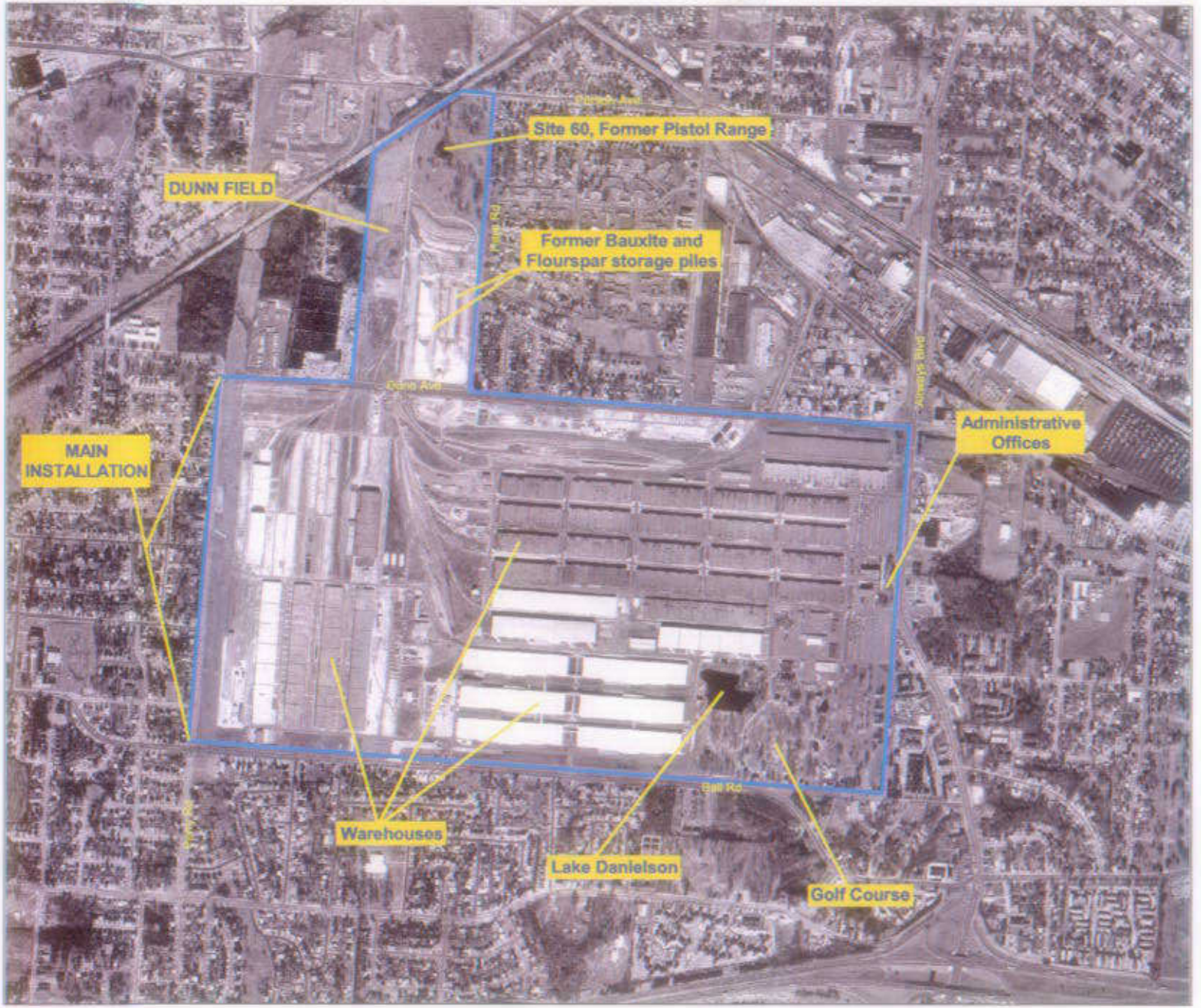


Figure 1-2
MAJOR FEATURES OF THE DEPOT
Aerial Photo Date: 1997
Rev. 0 Dunn Field - Site 60 EE/CA

701 36

CH2MHILL

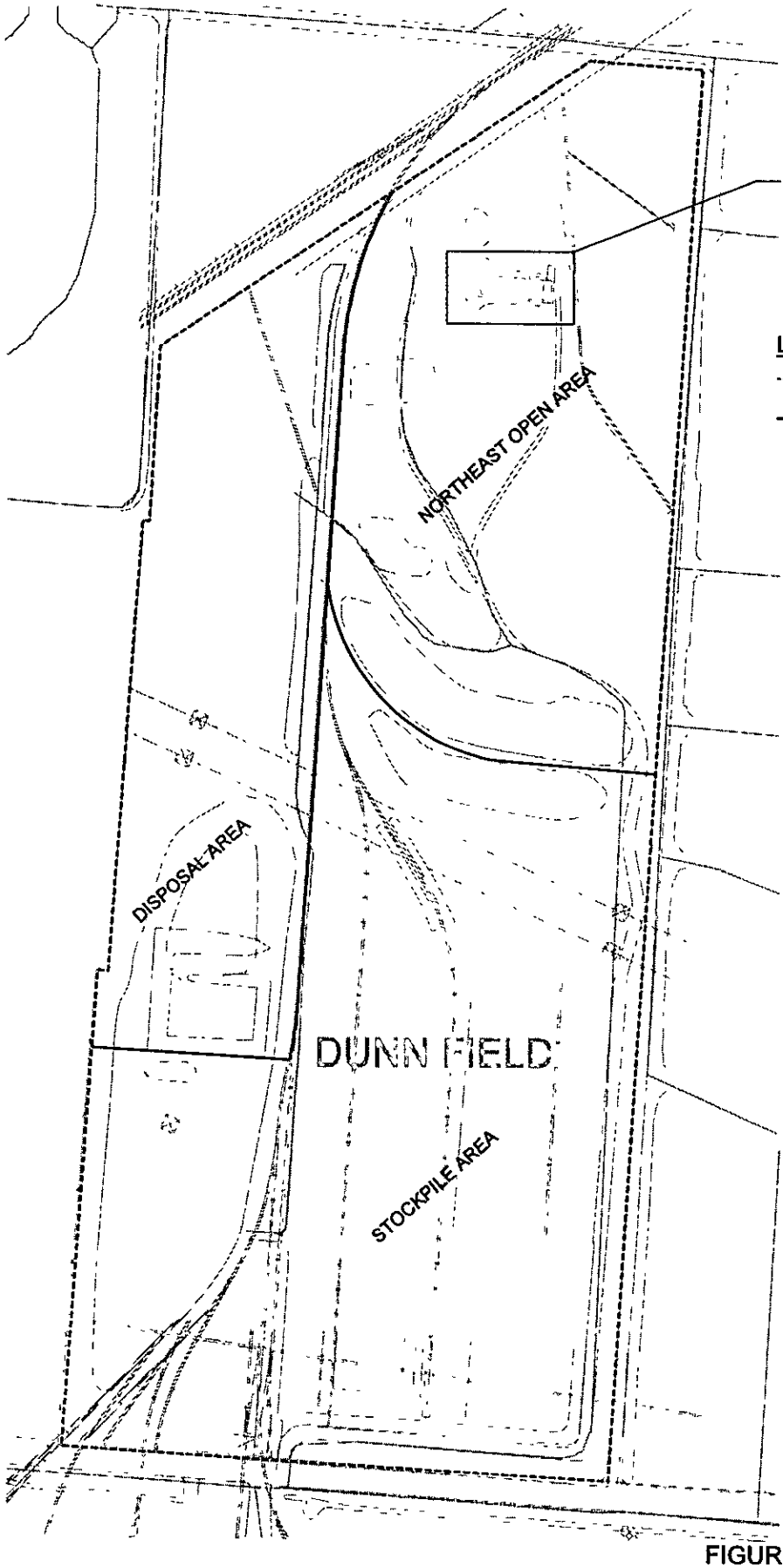


FIGURE 1-3
Area Designations at Dunn Field
Rev. 0 Dunn Field - Site 60 EE/CA

ATL/CAD1/PROJECTS/1160492 EE/CA

CH2MHILL

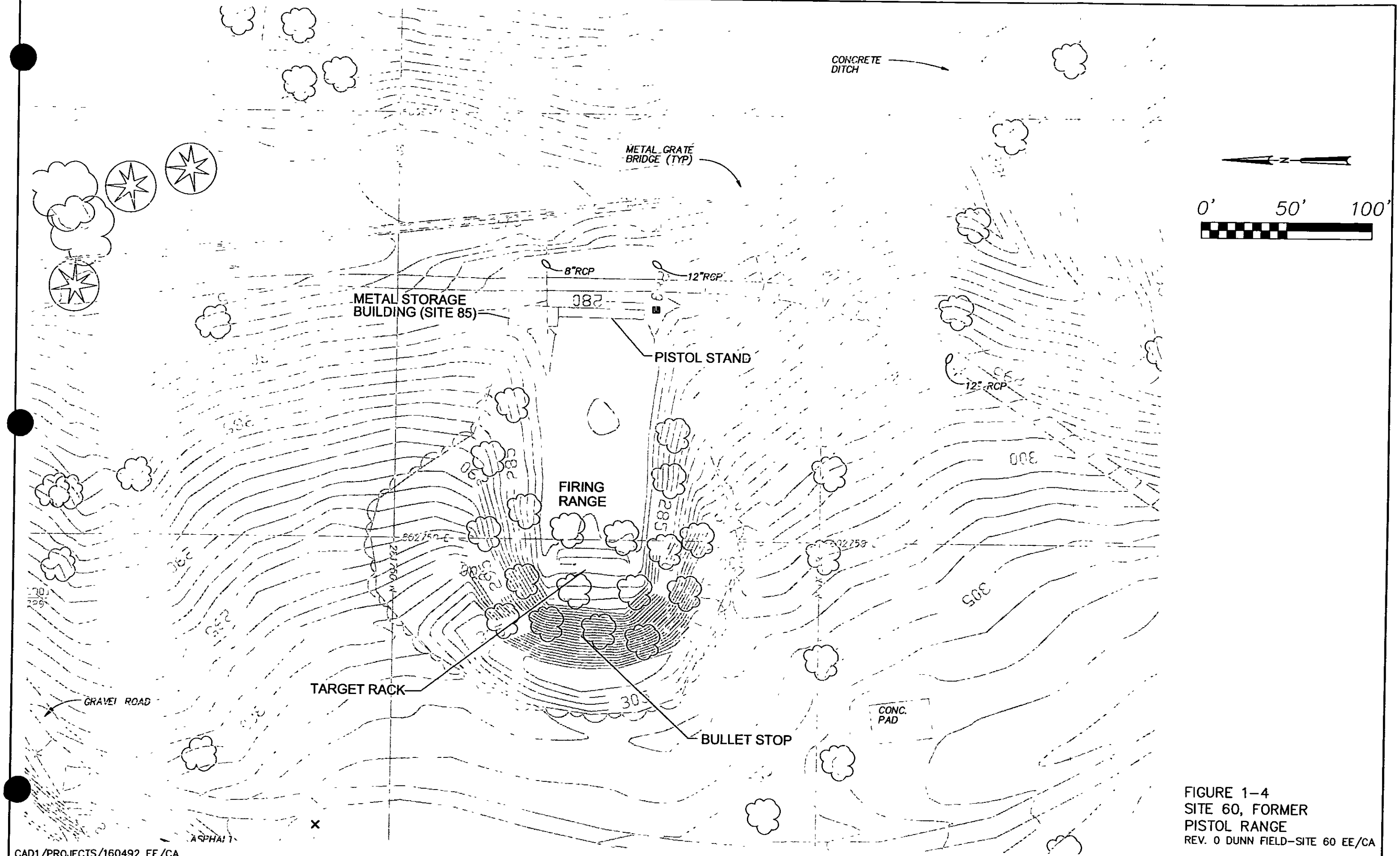


FIGURE 1–4
SITE 60, FORMER
PISTOL RANGE
REV. 0 DUNN FIELD–SITE 60 EE/CA

CAD1/PROJECTS/160492 EE/CA

CH2MHILL

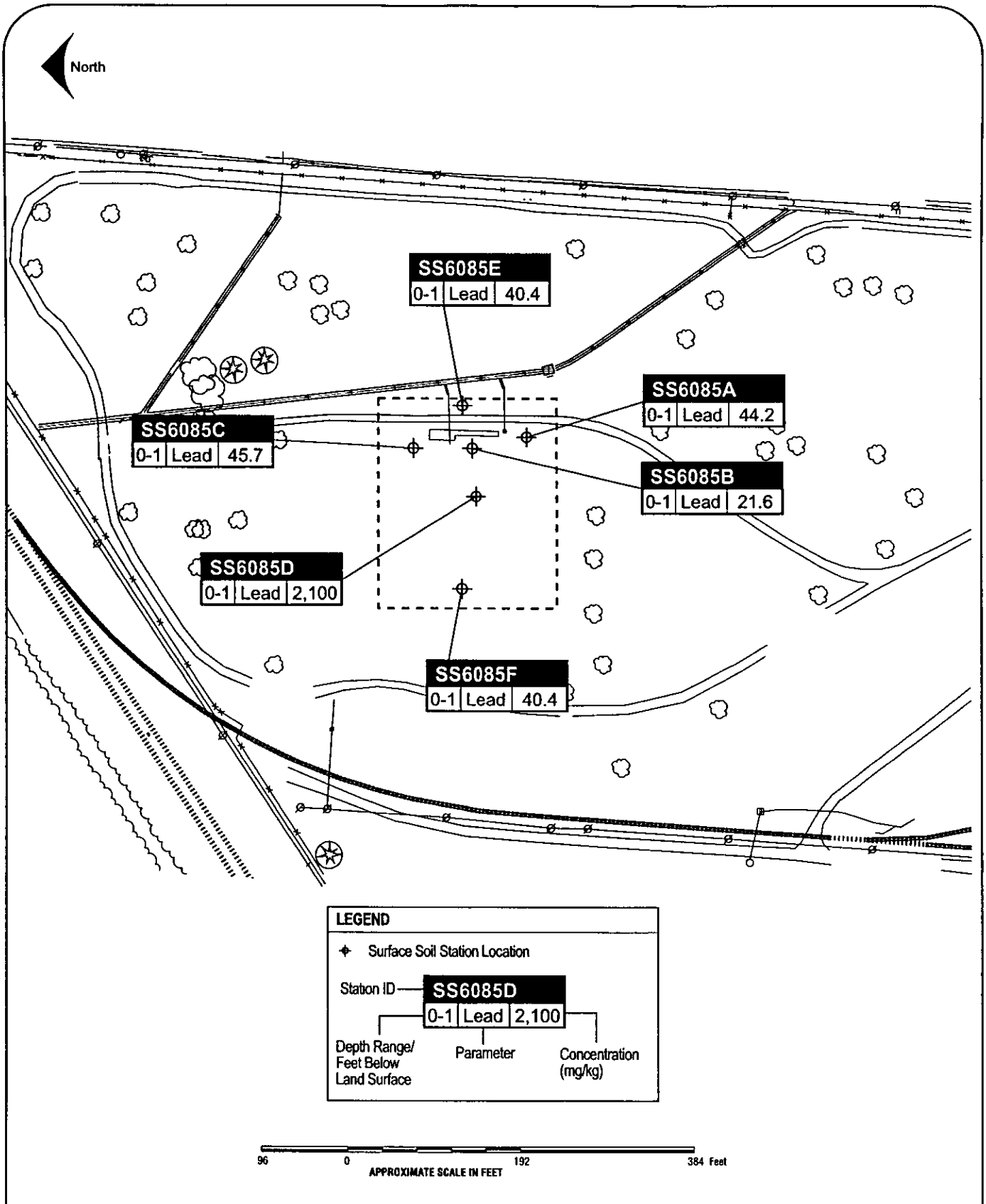
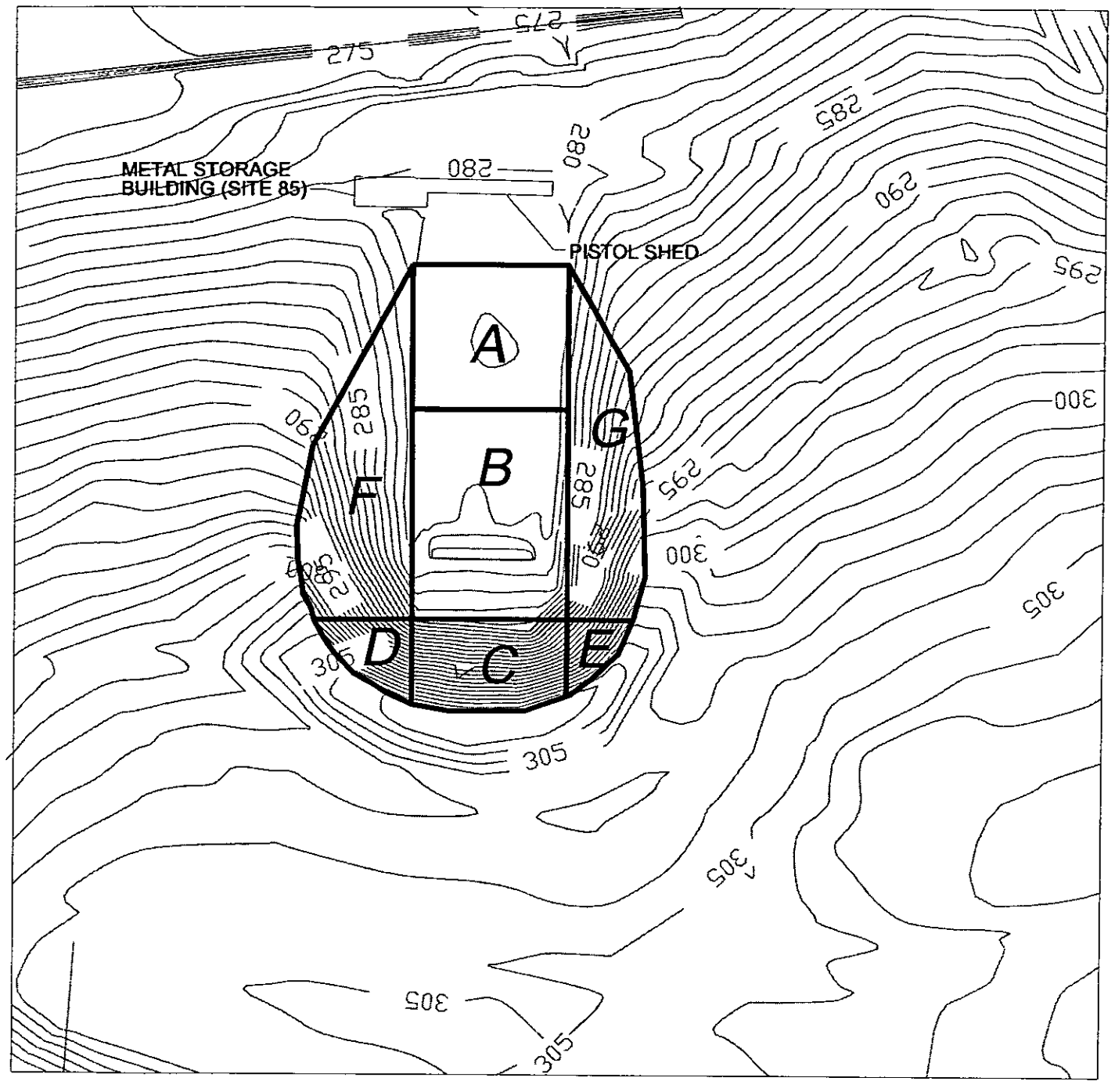


FIGURE 1-5
LEAD IN SURFACE SOIL
REV 1 DUNN FIELD - SITE 60 EE/CA

E062002027ATL \ Dunn142 FH8

CH2MHILL



N

0′ 50′ 100′

LEGEND

AREA A = 3563.7 SF
AREA B = 5298.6 SF
AREA C = 2576 1 SF
AREA D = 1000.0 SF
AREA E = 620 5 SF
AREA F = 4646 1 SF
AREA G = 3708.4 SF

FIGURE 1–6
EXCAVATION AREA
REV 1. DUNN FIELD–SITE 60 EE/CA

CAD1/PROJECTS/160492 EE/CA

CH2MHILL

TAB

Appendix A

APPENDIX A

Photographs of Site 60, Former Pistol Range (April 2002)

Memphis Depot, Dunn Field – Site 60 EE/CA

View: West
Date: 19-Apr-2002
Comment: Former pistol range, including overgrown bullet stop and building

View: East
Date: 19-Apr-2002
Comment: View of the west side of the former pistol range bullet stop

Memphis Depot, Dunn Field – Site 60 EE/CA

View: North
Date: 19-Apr-2002
Comment: Pistol stand and associated building

View: East
Date: 19-Apr-2002
Comment: View of the pistol stand from the target rack

Memphis Depot, Dunn Field – Site 60 EE/CA

View: West
Date: 19-Apr-2002
Comment: View of the overgrown bullet stop through the target rack

View: West
Date: 19-Apr-2002
Comment: View through the pistol stand

Memphis Depot, Dunn Field - Site 60 EE/CA

View: South
Date: 19-Apr-2002
Comment: View of the north side of the building (Site 85)

View: Northwest
Date: 19-Apr-2002
Comment: View of the inside of the building (Site 85)

TAB

Appendix B

APPENDIX B

Order of Magnitude Cost Summary & Surface Area Calculations

APPENDIX B

Surface Soil Remedial Action: Excavation and Off-Site Disposal

Order of Magnitude Cost Estimate

Rev. 1 Dunn Field - Site 60 EE/CA

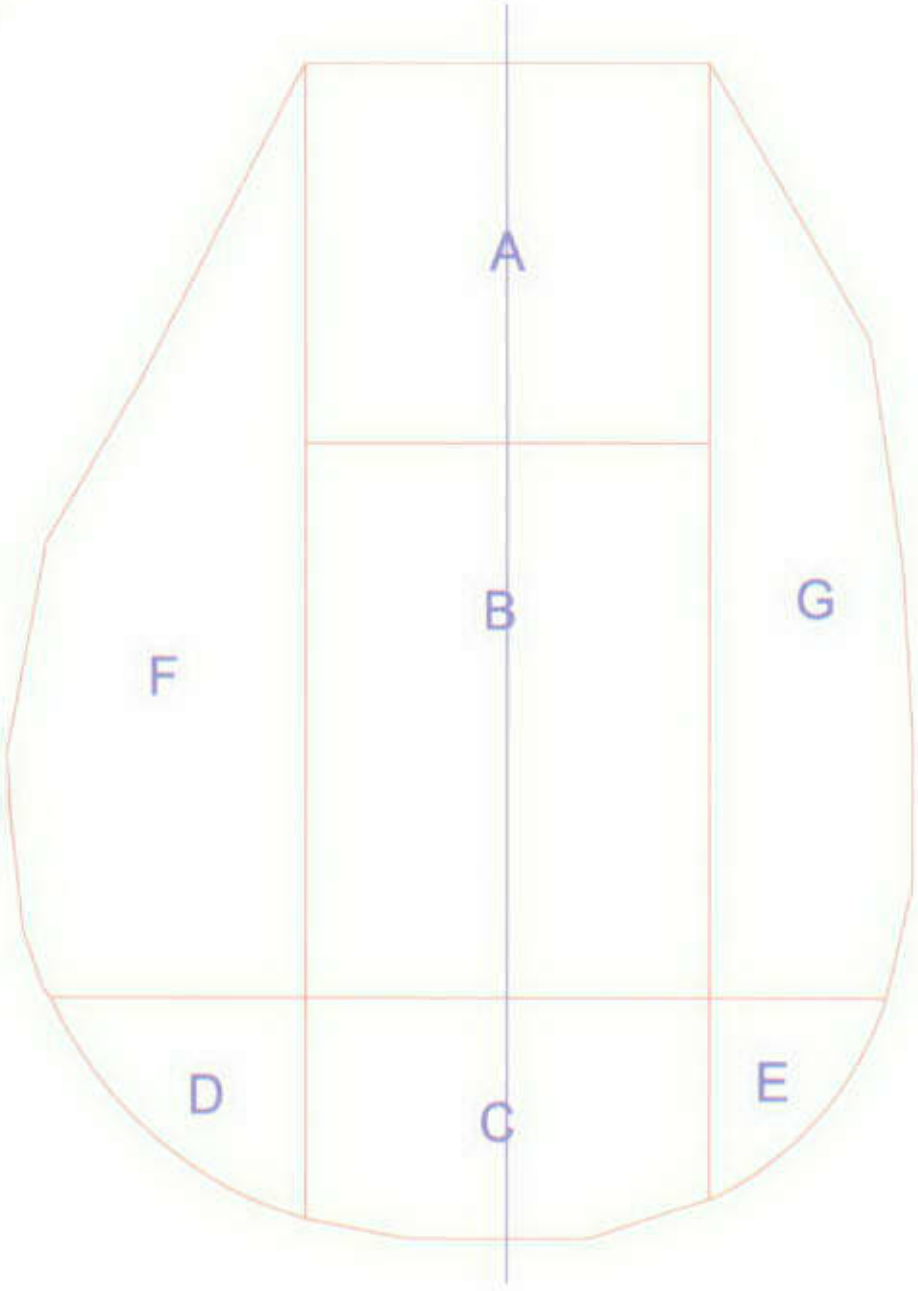
Item	Activity/Component	Quantity	Unit	Unit Cost	Capital Costs[a,b]	Cost Basis
Plans for Implementation	Remedial Action Work Plan	96	hr	$85	$8,200	Order of magnitude level of effort estimate, CH2M HILL
Site Preparation	Mobilization	1	Lumpsum	$4,500	$4,500	
	Prepare staging areas	1	Lumpsum	$2,500	$2,500	Order of magnitude cost estimate from CH2M HILL Constructors, Inc
	Site Setup	1	Lumpsum	$1,500	$1,500	
	Site Clearing & Grubbing	1	Lumpsum	$5,000	$5,000	
	Silt fence	1,000	L.F	$1	$1,100	Local Memphis, TN vendor
	Hay bales	350	each	$4	$1,278	Local Memphis, TN vendor
Excavation Activities	Excavation, stage and load	1,290	ton	$40	$51,600	Based on the excavation of Areas A through G Order of magnitude cost estimate from CH2M HILL Constructors, Inc Includes labor, equipment, health & safety monitoring
Transportation & Disposal	Disposal Characterization Sample Analyses	6	each	$955	$5,730	Kemron Laboratory , based on 14-day TAT
	Non-hazardous Soil - Stockpiled	537	ton	$28	$15,036	Areas D, E, F & G. Costs from Waste Management, Tunica, MS
	Non-hazardous Vegetation Debris	80	CY	$14	$1,120	Waste Management, Tunica, MS
	Hazardous Soil - Stockpiled (D008)	753	ton	$157	$118,445	Areas A, B & C Costs from Waste Management, Emelle, AL
	Vac-Truck for Non-Hazardous Wastewater	125	hr	$6	$750	Memphis Waste, Memphis, TN
Confirmation Sampling - Lead	Labor	40	hr	$75	$3,000	Order of magnitude level of effort estimate, CH2M HILL
	Laboratory Analysis - Lead	50	each	$65	$3,250	Kemron Laboratory, based on 25'x25' sampling grid and 3-day TAT
	Rental Equipment	1	event	$500	$500	Estimation of Misc costs
	Supplies	1	event	$500	$500	Estimation of Misc costs
Restore Site	Backfill, placed and compacted	330	CY	$25	$8,085	CCI, Pensacola Naval Air Station, 2002
	Clean Backfill Lab Analysis - TAL/TCL	1	each	$770	$770	Kemron Laboratory , based on 7-day TAT
	Vegetative Cover - Hydroseed	1	0 5 Acre	$2,700	$2,700	Michael L Hatcher & Associates Landscaping, Memphis, TN
Demobilization	Decontamination & Site Tear-down	1	Lumpsum	$1,500	$1,500	
	Demobilization	1	Lumpsum	$2,500	$2,500	Order of magnitude cost estimate from CH2M HILL Constructors, Inc
Annual O&M Costs: None						
Construction Subtotal:					$239,563	
Project Management (10%)					$23,956	
Contingency (15%)					$35,934	
Total Costs					**$299,454**	

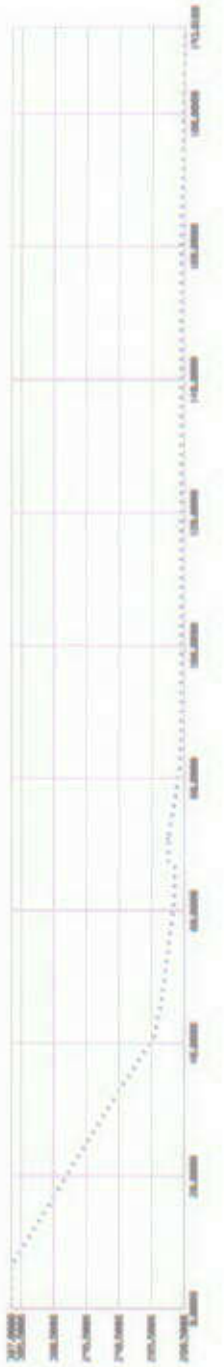
NOTE: Costs presented in this estimate are not complete project costs and are only used to help choose a remediation alternative

[a] An order of magnitude cost estimate is made without detailed engineering data The estimate is typically accurate within plus 50 to minus 30 percent.

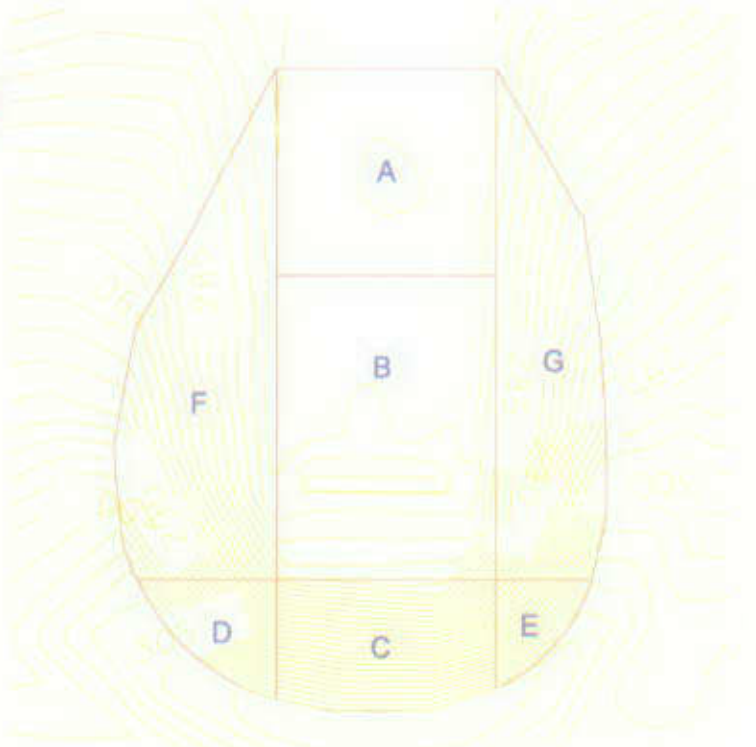
[b] Costs do not include planning and engineering fees

CY = cubic yard
hr = hour
sf = square feet
L F = linear foot

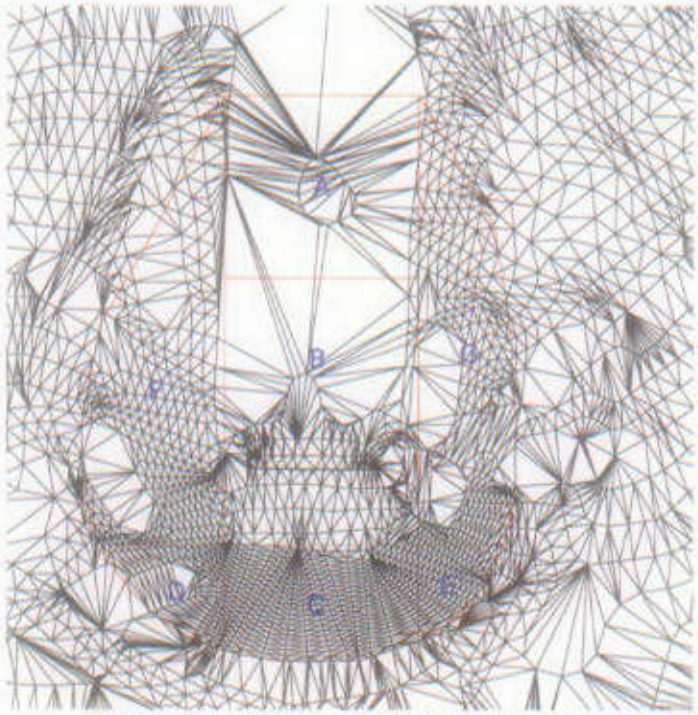




Profile of surface along the blue line ..



Site Topography w/sub-areas delineated



Triangulated Surface made from the contours only

Results below, as calculated by Geopak Slope Area Utility per sub-boundary against the tin surface. Values are in Square Yards and Square Feet

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE