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FINAL DESIGN OSDF SUPPORT PLANS - ON-SITE DISPOSAL FACILITY, REVISION G, OCTOBER - ALSO CONTAINS LARGE DRAWINGS - (ACTUAL SUBJECT OF LETTER IS TRANSMITTAL OF FINAL DESIGNS OF THE ON-SITE DISPOSAL FACILITY AND LEACHATE CONVEYANCE SYSTEM)

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REPORT

FINAL DESIGN
OSDF SUPPORT PLANS
ON-SITE DISPOSAL FACILITY

REVISION G
OCTOBER 1996

FOR INFORMATION ONLY

United States Department of Energy
Fernald Environmental Management Project
Fernald, Ohio

prepared by

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SUPPORT PLANS

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PERMITTING PLAN AND SUBSTANTIVE REQUIREMENTS FOR THE ON-SITE DISPOSAL FACILITY

October 1996
Revision G

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

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ACRONYMS

ACOE	Army Corps of Engineers
ARAR	applicable or relevant and appropriate requirements
AWWT	Advanced Waste Water Treatment
CAMU	corrective action management unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
LDR	land disposal restriction
MTR	minimum technology requirement
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NWP	nationwide permit
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSDF	on-site disposal facility
PTI	permit to install
RCRA	Resource Conservation and Recovery Act
ROD	record of decision
TSD	treatment, storage, and disposal

1.0 INTRODUCTION

The Operable Unit 2, Operable Unit 3, and Operable Unit 5 Records of Decision (RODs) established on-site disposal as the selected remedy and established the applicable or relevant and appropriate requirements (ARARs) for the remediation. This Permitting Plan takes into account all waste that will be disposed in the on-site disposal facility (OSDF) from Operable Units 2, 3, and 5. ARARs for these three operable units are consistent with each other; the only variations are based on different waste types that will be generated during remediation. The remedial actions performed at the Fernald Environmental Management Project (FEMP) are regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended. Section 121(e)(1) of CERCLA states that no Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on site, where such remedial action is selected and carried out in compliance with Section 121. While an on-site action is exempted from complying with the administrative requirements associated with a permit (e.g., administrative reviews, reporting and recordkeeping requirements, etc.), it is not exempt from complying with the substantive requirements that would have been imposed by each permit.

To determine if a permit is required for a remedial action, an evaluation must be made as to whether the action is "conducted entirely on site," as stated in Section 121(e)(1) of CERCLA. Discussions with United States Environmental Protection Agency (EPA) and Ohio Environmental Protection Agency (OEPA) have established a consensual strategy for permitting activities at the FEMP. This strategy determined that air releases, fill/dredging of wetlands, and construction and operation of the OSDF would be considered "on-site activities" and not subject to the administrative requirements of a permit. It was further decided that waste water and storm water discharges to the Great Miami River and Paddys Run would be considered "off-site" activities subject to both the administrative and substantive requirements of the National Pollutant Discharge Elimination System (NPDES) Permit.

Paragraph XIII.B of the Amended Consent Agreement requires that the following information be compiled for the remedial action:

- identification of each permit that would have been required in the absence of the CERCLA 121(e) permitting exemption;

- identification of the standards, requirements, criteria, or limitations that would have had to have been met to obtain the permits; and

- explanation of how the remedial action will meet the substantive requirements, criteria, or limitations identified above.

Paragraph XI.A of the Amended Consent Agreement also requires that a "plan for satisfaction of permitting requirements" be prepared.

This Permitting Plan will provide the information required by the Amended Consent Agreement in accordance with the decisions made with EPA and OEPA. This document will identify the administrative and substantive requirements for the NPDES Permit and the substantive requirements for all of the operable units' on-site disposal needs for the following permits:

- Wetlands Nationwide Permit
- Ohio Solid Waste Permit to Install (PTI)
- Resource Conservation and Recovery Act (RCRA) Permit

Additionally, this Permitting Plan will discuss how the requirements relate to the OSDF, present the plan for compliance with the requirements, and discuss additional ARARs that are not related to the issuance of a specific permit. Appendix A and Appendix B present a detailed listing of the substantive requirements and ARARs, respectively. These tables will be used throughout the remedial design as a checklist to ensure that the requirements are being met. As the project continues through the design process and additional documentation is completed, the details regarding specific implementation of the substantive requirements will be revised or updated, as needed. When the design is completed, the tables will be finalized to clearly show how the substantive requirements and ARARs are met.

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2.0 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

2.1 PERMIT INFORMATION

Section 402 of the Clean Water Act establishes the NPDES program. This program is implemented by 40 Code of Federal Regulations (CFR) Part 122 and regulates the discharge of waste water to waters of the United States through the issuance of an NPDES permit which specifies discharge limitations necessary to comply with applicable technology-based effluent standards and/or water quality-based standards. This permit will also include monitoring requirements and additional conditions regulating the discharge. Discharges of storm water from specific types of activities (e.g., RCRA Subtitle C and D landfills; construction activities including clearing, grading, and excavation activities) have also been included under the NPDES permit program. Authority for administering the NPDES permit program has been delegated to the State of Ohio.

2.2 APPLICABILITY TO THE OSDF

During the active life of the OSDF (i.e., construction, waste placement, and closure activities), construction water, impacted storm water, and leachate will be generated. After placement of a stable vegetative layer on the top of the cap system and closure of the OSDF, only leachate will continue to be generated.

All leachate will be collected in a leachate collection system and transmitted to the Advanced Waste Water Treatment (AWWT) facility for treatment. Storm water from the active portions of the OSDF (those areas where waste placement is occurring) will also be collected and transmitted to the AWWT. Following treatment, the leachate and contaminated storm water will be discharged to the Great Miami River via a permitted outfall. Uncontaminated construction water (i.e., perched water encountered during excavation and storm water contacting uncontaminated disturbed areas) generated during the construction of the liner system and the cover system (but prior to the placement of the vegetative layer) will be conveyed to a permitted storm water outfall at Paddys Run. Appropriate erosion control measures will be designed and installed to mitigate sediment loading to Paddys Run.

2.3 PERMIT REQUIREMENTS

The FEMP currently has a NPDES permit for storm water and waste water discharges to Paddys Run and the Great Miami River (OEPA Permit Number 1IO00004*ED). The permit contains effluent limitations and monitoring requirements for six separate outfalls from the FEMP to receiving waters.

The FEMP NPDES Permit contains conditions which require OEPA notification of any significant change in the character of the discharge, or of any facility expansion or process modifications resulting in new, different, or increased levels of pollutants. This notification may trigger NPDES Permit modifications.

The storm water discharges from the OSDF are considered to be already covered under NPDES Permit 1IO00004*ED through the implementation of the permit-required Site Storm Water Pollution Prevention Plan. However, the leachate from the OSDF will constitute a new and different source of waste water and, as such, will require OEPA notification.

3.0 WETLANDS

3.1 PERMIT INFORMATION

Pursuant to Section 404 of the Clean Water Act, any activity that results in the discharge of dredged or fill material into wetlands or waters of the United States requires permit authority from the United States Army Corps of Engineers (ACOE). The ACOE authorizes dredging and filling activities in wetlands and waters of the United States through the issuance of three types of permits: Nationwide permits (NWPs), regional general permits, and individual permits. NWPs are promulgated in Appendix A to 33 CFR Part 330 and are "designed to regulate with little, if any, delay or paperwork certain activities having minimal impacts." [33 CFR §330.1(b)] The ACOE has established NWPs and conditions for 40 distinct activities associated with dredging and filling wetlands and waters of the United States. An activity is authorized under a NWP only if the activity meets all the conditions established for that particular NWP. Activities that do not qualify for a NWP may seek a regional general permit or an individual permit from the ACOE.

In addition to Section 404 permitting requirements, activities resulting in the discharge of dredged or fill material to wetlands or waters of the United States are also required to obtain authorization under a Section 401 State Water Quality Certification. In Ohio, the Section 401 certification process is administered by the OEPA pursuant to Chapter 3745-32 of the Ohio Administrative Code (OAC).

3.2 APPLICABILITY TO THE OSDF

Construction of the OSDF will dredge and/or fill less than one acre of wetlands. This activity will be regulated under Section 404 of the Clean Water Act and, because the activity will be conducted entirely on site, must meet the substantive requirements of the ACOE's permit program. Based upon review of the NWPs promulgated by the ACOE in Appendix A to 33 CFR Part 330, United States Department of Energy (DOE) has determined that the impact from construction of the OSDF is authorized under NWP 26, Headwaters and Isolated Waters Discharge. NWP 26 is applicable because the wetland area that will be impacted by the OSDF drains to Paddys Run (via the Storm Sewer Outfall Ditch), within the headwater area of the stream. Under this NWP, discharges of dredged or fill material into headwaters and isolated waters are allowed if the following conditions are met:

- The discharge does not cause the loss of more than 10 acres of waters of the United States;

- The permittee notifies the district engineer if the discharge would cause the loss of waters of the United States greater than one acre. For discharges in wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands; and

- The discharge, including all attendant features, both temporary and permanent, is part of a single and complete project. [Section (B)(26) of Appendix A to 33 CFR Part 330]

In addition to the specific requirements of a particular NWP, the activity must also comply with a series of general NWP conditions, including erosion and siltation controls, protection of endangered species, and notification requirements [Section (C) of Appendix A to 33 CFR Part 330]. The general conditions also require that, if applicable, an individual state water quality certification must be obtained or waived. The Director of the OEPA granted State Water Quality Certification on January 17, 1992 for a series of NWPs, including NWP 26, in a letter to the Chief of the ACOE. In this letter, OEPA specified additional general and specific requirements that must be met in order for an activity to be authorized under a NWP.

The substantive requirements specified in Appendix A to 33 CFR Part 330 will be demonstrated in the following documents:

- Operable Unit 2 Feasibility Study Report; and
- Sitewide Excavation Plan.
- Map of FEMP Jurisdictional Wetlands and Waters of the United States

The substantive requirements associated with NWP 26 are presented Table A-1 of Appendix A. As the project continues through the design process and additional documentation is completed, Table A-1 will be revised or updated, as needed.

3.3 WETLAND MITIGATION

Wetland impacts associated with the construction of the OSDF were considered during the remedial investigation/feasibility study (RI/FS) process and have been avoided/minimized to the maximum extent practicable. The unavoidable impact that will result from the construction of the OSDF will be conducted in accordance with the substantive requirements of NWP 26 and its corresponding Section 401 State Water Quality Certification. To ensure a consistent approach to mitigation, wetland impacts

will be mitigated on a site-wide basis. The wetland mitigation strategy will be addressed by the Site-Wide Excavation Plan which will be submitted to EPA and OEPA in March 1997.

3.4 ADDITIONAL ARARs

The Operable Unit 2, Operable Unit 3, and Operable Unit 5 RODs identify additional location-specific ARARs related to the protection of wetland and floodplain areas during the construction and operation of the OSDF. These include National Environmental Policy Act (NEPA) and DOE requirements to avoid, to the extent practicable, adverse impacts to wetland and floodplain areas and Ohio requirements associated with the placement of solid waste in or near wetlands or floodplains. Table B-1 of Appendix B lists these ARARs from the RODs. As the project continues through the design process and additional documentation is completed, Table B-1 will be revised or updated, as needed.

4.0 RESOURCE CONSERVATION AND RECOVERY ACT

4.1 PERMIT INFORMATION

Subtitle C of RCRA requires all facilities that treat, store, or dispose of hazardous waste (TSD facilities) to have a permit. The permit consists of two parts (Part A and Part B) and must be obtained before construction of a TSD facility begins. Part A includes basic information about the facility, such as name, location, and type of activities performed. Part B requires detailed information about the facility, such as types of waste to be handled, groundwater monitoring plans, and design of the facility. These permit requirements are established in 40 CFR Part 270 and reflect the requirements of 40 CFR Part 264. The State of Ohio has been authorized by the EPA to administer the RCRA program. The general RCRA permit requirements are equivalent to the Federal requirements and have been promulgated in OAC 3745-50.

4.2 APPLICABILITY TO THE OSDF

Because the OSDF will contain hazardous waste, design and construction of the OSDF must comply with the substantive requirements of the RCRA permit. The FEMP submitted a RCRA Part B Permit Application (this includes the information required under the RCRA Part A Permit) to OEPA in October 1991 in accordance with the Consent Decree with OEPA and its stipulated amendment. Therefore, the design and construction of the OSDF must address the substantive requirements that were not included in the site RCRA permit application, namely the requirements for landfills [40 CFR §270.21 or OAC 3745-50-44(C)(7)]. Compliance with the RCRA substantive requirements will be demonstrated in the following documents:

- Operable Unit 5 Feasibility Study Report:
- Operable Unit 5 Record of Decision;
- OSDF Design Review Package;
- OSDF Remedial Action Work Plan and Support Documents; and
- Integrated Environmental Monitoring Plan.

Some of these documents have been approved and finalized; others are being prepared for future submittals to the regulatory agencies. The substantive requirements for the OSDF associated with the RCRA permit are presented in Table A-2 of Appendix A. As the project continues through the design process and additional documentation is completed, Table A-2 will be revised or updated, as needed.

The OSDF at the FEMP is designated as a Corrective Action Management Unit (CAMU) in the approved Operable Unit 3 and Operable Unit 5 RODs. The CAMU designation may be considered as a substantive permitting requirement because this designation information is typically included in a RCRA permit. Designation information would include a description of compliance with the seven CAMU criteria, alternate standards for the land disposal restrictions (LDRs), and minimum technology requirements (MTRs).

The LDRs for Operable Units 3 and 5 will not be invoked with consolidation of remediation waste into the OSDF. The MTRs for a CAMU are also not invoked, although the design standards of the OSDF exceed the MTRs. The CAMU is designated in the Operable Unit 3 and Operable Unit 5 RODs based on site-specific risk-based concentration standards. These standards were used to establish 1) final remediation levels in soil and water, and 2) waste acceptance criteria of the OSDF for consolidation of those remediation wastes which are to be managed on-property. These site-specific remedial action objectives and cleanup levels are defined for the selected remedy in Section 9.2 of the Operable Unit 5 ROD.

4.3 ADDITIONAL ARARs

The Operable Unit 3 and Operable Unit 5 RODs identify additional ARARs associated with hazardous waste disposal in the OSDF. These include design requirements, protection of groundwater, and landfill closure standards. Table B-2 of Appendix B presents these ARARs from the RODs. As the design of the OSDF proceeds and additional documentation is completed, Table B-2 will be revised or updated, as needed.

5.0 OHIO SOLID WASTE DISPOSAL REGULATIONS

5.1 PERMIT INFORMATION

Under the Ohio Solid Waste Disposal Regulations, a PTI is required before constructing a new solid waste disposal facility (OAC 3745-27-06). The PTI application must provide all information specified in OAC 3745-27-06, including detailed information on the following topics:

- conditions surrounding the proposed location (e.g., topography, wetlands, floodplains, water supply wells, buildings, etc.);
- the proposed configuration of the solid waste landfill;
- geology and hydrogeology of the site;
- construction and operational plans;
- design of the solid waste landfill; and
- monitoring plans for surface water, groundwater, and leachate.

If the facility will impact wetlands, additional information on mitigation and restoration must be provided.

5.2 APPLICABILITY TO THE OSDF

Because the OSDF will contain solid waste, an Ohio PTI would have been required. However, because the OSDF will be located entirely on site, the design and construction must only comply with the substantive requirements of the permit, not the administrative requirements. The substantive requirements specified in OAC 3745-27-06 will be demonstrated in the following documents:

- Operable Unit 2 Feasibility Study Report;
- Operable Unit 3 Remedial Investigation/Feasibility Study Report;
- Operable Unit 5 Feasibility Study Report;
- Operable Unit 2 Record of Decision;
- Operable Unit 3 Record of Decision;
- Operable Unit 5 Record of Decision;
- FEMP Sitewide CERCLA Quality Assurance Project Plan;
- Project Specific Plan for Phase I and II of Operable Unit 2 Predesign Field Investigation;
- Predesign Investigation and Site Selection Report for the On-Site Disposal Facility;
- OSDF Design Review Package;
- Leachate/Liner Compatibility Study Final Report;
- OSDF Remedial Action Work Plan and Support Plans;
- Design of Haul Road and Rerouted North Entrance Road;
- Integrated Environmental Monitoring Plan; and
- Soil Remediation Project Area 1, Phase I Remedial Action Work Plan.

Some of these documents have been approved and finalized; others are being prepared for future submittals to the regulatory agencies. The substantive requirements associated with the Ohio Solid Waste PTI are presented in Table A-3 of Appendix A. As the project continues through the design process and additional documentation is completed, Table A-3 will be revised or updated, as needed.

5.3 ADDITIONAL ARARs

The Operable Unit 2, Operable Unit 3, and Operable Unit 5 RODs identify additional ARARs associated with solid waste disposal in the OSDF. These include siting criteria and design requirements. Table B-3 of Appendix B lists these ARARs from the RODs. As the design of the OSDF proceeds and additional documentation is completed, Table B-3 will be revised or updated, as needed.

A CERCLA waiver from an Ohio solid waste disposal facility siting criteria was granted in the Operable Unit 2, Operable Unit 3, and Operable Unit 5 RODs. This waiver allows construction of the OSDF over a high-yield, sole-source aquifer although it is prohibited in the Ohio Solid Waste Disposal Regulations [OAC 3745-27-07(H)(2)(c) and (H)(2)(d)]. This waiver is based on the condition that the OSDF be located in the area of the FEMP which exhibits the best hydrogeologic conditions to ensure protection of human health and the environment.

APPENDIX A

SUBSTANTIVE REQUIREMENTS

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ACRONYMS

ACOE	Army Corps of Engineers
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DCP	Design Criteria Package
FEMP	Fernald Environmental Management Project
FS	Feasibility Study
NESHAP	National Emission Standards for Hazardous Air Pollutants
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSDF	on-site disposal facility
PCB	polychlorinated biphenyl
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
USCS	Unified Soil Classification System

TABLE A-1
WETLANDS SUBSTANTIVE REQUIREMENTS

Citation	Requirement	Remarks	Cross-Reference
	General Conditions for a Nationwide Permit		
33 CFR §330.4 (c)(1) OAC 3745-32	State 401 water quality certification pursuant to section 401 of the Clean Water Act, or waiver thereof, is required prior to the issuance or reissuance of individual or nationwide permits authorizing activities which may result in a discharge into waters of the United States.	This requirement will be addressed in the Sitewide Excavation Plan.	Letter from T. Schneider (OEPA) to the Chief of Engineers (ACOE) "401 Certification - Grant," January 17, 1992.
Appendix A to 33 CFR Part 330, Section C	Factors that the District Engineer will consider when determining the acceptability of appropriate and practicable mitigation include, but are not limited to: • To be practicable the mitigation must be available and capable of being done considering costs, existing technology, and logistics in light of overall project purposes; • To the extent appropriate, permittees should consider mitigation banking and other forms of mitigation including contributions to wetland trust funds, which contribute to the restoration, creation, replacement, enhancement, or preservation of wetlands. • Furthermore, examples of mitigation that may be appropriate and practicable include but are not limited to: reducing the size of the project; establishing buffer zones to protect aquatic resource values; and replacing the loss of aquatic resource values by creating, restoring, and enhancing similar functions and values. In addition, mitigation must address impacts and cannot be used to offset the acreage of wetland losses that would occur in order to meet the acreage limits of some of the nationwide permits.	These requirements will be addressed in the Sitewide Excavation Plan.	

TABLE A-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
	Specific Conditions for Nationwide Permit Number 26		
Appendix A to 33 CFR Part 330, Section B(26)	Discharges of dredged or fill material into headwaters and isolated waters [are approved] provided:		
	• the discharge does not cause the loss of more than 10 acres of waters of the United States. • the permittee notifies the district engineer if the discharge would cause the loss of waters of the United States greater than one acre. • for discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands.	These requirements will be addressed in the Sitewide Excavation Plan.	1993 Jurisdictional Wetlands & Waters of the U.S. (FEMP Map)
	• the discharge, including all attendant features, both temporary and permanent, is part of a single and complete project.	This requirement will be addressed in the Sitewide Excavation Plan.	
	Section 404 Only Conditions		
Appendix A to 33 CFR Part 330, Section C	In addition to the General Conditions, the following conditions apply only to activities that involve the discharge of dredged or fill material and must be followed in order for authorization by the nationwide permits to be valid:		
	• No discharge of dredged or fill material may consist of unsuitable material (e.g., trash, debris, car bodies, etc.) And material discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).	This requirement will be addressed in the Sitewide Excavation Plan.	
	• Discharges of dredged or fill material into waters of the United States must be minimized or avoided to the maximum extent practicable at the project site, unless the DE has approved a compensation mitigation plan for the specific regulated activity.	This requirement will be addressed in the Sitewide Excavation Plan.	Appendix H of Operable Unit 2 FS.

TABLE A-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
Appendix A to 33 CFR Part 330, Section C (continued)	• To the maximum extent practicable, discharges must not permanently restrict or impede the passage of normal or expected high flows or cause the relocation of the water (unless the primary purpose of the fill is to impound waters).	This requirement will be addressed in the Sitewide Excavation Plan.	

TABLE A-2
RCRA SUBSTANTIVE REQUIREMENTS

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-50-44 (B)	The following additional information regarding protection of groundwater is required from owners or operators of hazardous waste facilities containing a regulated unit except as provided in paragraph (B) of rule 3745-54-90 of the Administrative Code:		
	• Identification of the uppermost aquifer and aquifers hydraulically interconnected beneath the facility property, including ground water flow direction and rate, and the basis for such identification (i.e., the information obtained from hydrogeologic investigations of the facility area).		Section A.2.2 of Appendix A of Operable Unit 5 FS
	• On the topographic map required under paragraph (A)(19) of this rule, a delineation of the waste management area, the property boundary, the proposed point of compliance as defined under rule 3745-54-95 of the Administrative Code, the proposed location of ground water monitoring wells as required under rule 3745-54-97 of the Administrative Code and, to the extent possible, the information required in paragraph (B)(2) of this rule. • Detailed plans and an engineering report describing the proposed ground water monitoring program to be implemented to meet the requirements of rule 3745-54-97 of the Administrative Code. • If the presence of hazardous constituents has not been detected in the ground water at the time of permit application, the owner or operator must submit sufficient information, supporting data, and analyses to establish a detection monitoring program which meets the requirements of rule 3745-54-98 of the Administrative Code. This submission must address the following items as specified under rule 3745-54-98 of the Administrative Code. - A proposed list of indicator parameters, waste constituents, or reaction products that can provide a reliable indication of the presence of hazardous constituents in the ground water;		OSDF Groundwater Monitoring Plan and Appendix B of Integrated Environmental Monitoring Plan

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TABLE A-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-50-44 (B) (continued)	- A proposed ground water monitoring system; - Background values for each proposed monitoring parameter or constituent, or procedures to calculate such values; and - A description of proposed sampling, analysis and statistical comparison procedures to be utilized in evaluating ground water monitoring data.		
OAC 3745-50-44 (C)(7)	Except as otherwise provided in rule 3745-57-02 of the Administrative Code, owners and operators of facilities that dispose of hazardous waste in landfills must provide the following additional information:		
	• A list of the hazardous wastes placed or to be placed in each landfill or landfill cell;		Section 9.2 of Operable Unit 5 ROD
	• Detailed plans and an engineering report describing how the landfill is or will be designed, constructed, operated, and maintained to comply with the requirements of rule 3745-57-03 of the Administrative Code. This submission must address the following items as specified in rule 3745-57-03 of the Administrative Code:		
	- The liner system and leachate collection and removal system (except for an existing portion of a landfill).		**Liner system** - Section 2.4 of OSDF DCP, Drawings G-22 and G-25 of OSDF Design **Leachate system** - Section 2.5 of OSDF DCP, Drawings M-2, M-4 through M-6, M-9, S-1, S-3, E-4, and E-7 of OSDF Design

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TABLE A-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-50-44 (C)(7) (continued)	- Control of run-on; - Control of run-off; - Management of collection and holding facilities associated with run-on and run-off control systems; and		Sections 2.8.3 and 2.8.4 of OSDF DCP, Section 02270 of OSDF Specification Package, and Drawings G-30 through G-32 of OSDF Design
	- Control of wind dispersal of particulate matter, where applicable.		Section 2.11.1 of OSDF DCP and Section 13040 of OSDF Specification Package
	• When required, detailed plans and an engineering report describing and explaining the design of a double liner system between the liners and a leachate collection and removal system above the liners;		Sections 2.4 and 2.5 of OSDF DCP and Drawings G-22 and G-24 of OSDF Design
	• A description of how each landfill, including the liner and cover systems, will be inspected in order to meet the requirements of paragraphs (A) and (B) of rule 3745-57-05 of the Administrative Code. This information should be included in the inspection plan submitted under paragraph (A)(5) of this rule;		Sections 6.0 through 10.0 of OSDF Construction Quality Assurance Plan and Sections 3.0 and 4.0 of OSDF Systems Plan

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TABLE A-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-50-44 (C)(7) (continued)	• Detailed plans and an engineering report describing the final cover which will be applied to each landfill or landfill cell at closure in accordance with paragraph (A) of rule 3745-57-10 of the Administrative Code, and a description of how each landfill will be maintained and monitored after closure in accordance with paragraph (B) of rule 3745-57-10 of the Administrative Code. This information should be included in the closure and post-closure plans submitted under paragraph (A)(13) of this rule.		Section 2.6 of OSDF DCP, Drawings G-11 and G-26 through G-29 of OSDF Design, Section 4.0 of OSDF Systems Plan, Sections 5.0 through 10.0 of OSDF Post-Closure Care and Inspection Plan, OSDF Groundwater Monitoring Plan, and Appendix B of Integrated Environmental Monitoring Plan
OAC 3745-66-18 (A)&(C)	The owner of a hazardous waste disposal unit shall have a written post-closure plan, which shall identify the activities that will be carried on after closure of each unit and the frequency of those activities, and include at least:		
	• A description of the planned monitoring activities and frequencies at which they will be performed;		Sections 5.0, 7.0, and 8.0 of OSDF Post-Closure Care and Inspection Plan
	• A description of the planned maintenance activities and frequencies at which they will be performed to ensure the integrity of the cap and final cover or other containment systems and to ensure the function of the monitoring equipment; and		Section 9.0 of OSDF Post-Closure Care and Inspection Plan
	• The name, address, and telephone number of the person or office to contact about the hazardous waste disposal unit or facility during the post-closure period.		Section 4.2 of OSDF Post-Closure Care and Inspection Plan

TABLE A-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-66-16	The owner shall submit - to the local zoning authority with jurisdiction over local land use, and to the Director - a survey plat, prepared and certified by a professional land surveyor, indicating the location and dimensions of landfill cells or other hazardous waste disposal units with respect to permanently surveyed benchmarks. The plat must contain a note, prominently displayed, which states the owner's obligation to restrict disturbance of the hazardous waste disposal unit in accordance with OAC 3745-66-17(C).		Section 4.5 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-66-18 (D)	The owner may amend the post-closure plan any time during the active life of the facility or during the post-closure period.		Section 12.0 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-66-18 (G)	The post-closure plan and length of the post-closure care period may be modified any time prior to the end of the post-closure care period. A modification of the post-closure plan may include, where appropriate, the temporary suspension rather than permanent deletion of one or more post-closure care requirements. At the end of the specified period of suspension, the Director would then determine whether the requirements should be permanently discontinued or reinstated to prevent threats to human health and the environment.		Section 12.0 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-66-19(A)	The owner shall submit - to the local zoning authority, or the authority with jurisdiction over local land use, and to the Director - a record of the type, location, and quantity of hazardous wastes disposed of within each cell or disposal unit of the facility.		Section 4.5 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-66-19(B)	The owner shall record, in accordance with state law, a notation on the deed of the facility property, or on some other instrument which is normally examined during title search, that will notify in perpetuity the potential purchasers of the property that: • The land has been used to manage hazardous wastes;		Section 4.5 of OSDF Post-Closure Care and Inspection Plan

TABLE A-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-66-19(B) (continued)	• Its use is restricted under the Ohio Administrative Code closure and post-closure rules; and • The survey plat and record of the type, location, and quantity of hazardous wastes disposed of within each cell or hazardous waste unit of the facility as required by OAC 3745-66-16 and 3745-66-19(A) have been filed with the local zoning authority or the authority with jurisdiction over local land use and with the Director.		
OAC 3745-66-19(C)	If the owner or any subsequent owner of the land upon which a hazardous waste disposal unit was located wishes to remove hazardous wastes and hazardous waste residues in satisfaction of the criteria in OAC 3745-66-17(C), the owner may request that the Director approve either: • The removal of the notation on the deed to the facility property or other instrument normally examined during title search; or • The addition of a notation to the deed or instrument indicating the removal of the hazardous waste.		Section 4.5 of OSDF Post-Closure Care and Inspection Plan

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TABLE A-3
OHIO SOLID WASTE PERMIT TO INSTALL SUBSTANTIVE REQUIREMENTS

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(2)	Plan drawings shall show the following items located within the facility boundary or within 1,000 feet of the limits of solid waste placement or as otherwise specified in this paragraph. A scale of one inch equals no greater than 200 feet shall be used.		
	• the property lines of all land owned or leased for the sanitary landfill facility as determined by a property survey conducted by a professional skilled in the appropriate discipline		Drawing X-4 of OSDF Design
	• the limits of solid waste placement		Drawing X-4 of OSDF Design
	• all public roads, railroads, and occupied structures		Drawing X-6 of OSDF Design
	• existing topography showing vegetation, streams, lakes, springs, and other surface waters, with a contour interval no greater than five feet		Section 1.5 of Operable Unit 2 FS
	• the north arrow		Drawing X-6 of OSDF Design
	• the location of all benchmarks		Drawing X-4 of OSDF Design
	• wetlands located within the limits of waste placement and within 200 feet of the limits of waste placement		See Table B-1 within Appendix B of this plan
	• the unit(s) of the sanitary landfill facility		Drawings G-2 and G-5 of OSDF Design
	• all existing land uses, zoning classifications, property owners, political subdivisions, and communities		Section 1.0 of Operable Unit 5 ROD and Drawing X-6 of OSDF Design

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(2) (continued)	• all man-made potential explosive gas migration pathways, including underground utilities (sewers, water lines, electric cables), field tiles, french drains, pipelines, and all other potential sources of explosive gas, including oil wells and other landfills		Drawing X-6 of OSDF Design
	• the limits of a regulatory floodplain		Drawing X-6 of OSDF Design
	• all public and private water supply wells within 2,000 feet of the limits of solid waste placement (use a scale insert if necessary) and the current status of each, including depth, use, and, where applicable, abandonment date, based on publicly available data		Drawing X-6 of OSDF Design
OAC 3745-27-06(B)(3)	Plan drawings shall show the following items located within the facility boundary or within 300 feet of the limits of solid waste placement. A scale of one inch equals no greater than 200 feet shall be used.		
	• the locations of all existing or proposed maintenance buildings, weighing facilities, storage buildings, other occupied structures, and salvaging areas		Drawing G-2 of OSDF Design
	• the location of existing or proposed utilities, including water, sewerage and sewage treatment, electricity, gas, and telephone or other means of communication; and any utility company easement bordering or within the proposed facility boundaries		Drawing X-6 of OSDF Design
	• the location of all fencing, gates, and natural or other screening on the site (may be shown on an aerial photograph)		Drawing X-3 and X-4 of OSDF Design

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(3) (continued)	• the location of all borings and hydrogeologic study test pits, and all proposed ground water monitoring wells		Section 2.0 of OSDF Predesign Investigation Report, Drawings X-7 and X-12 of OSDF Design, and Figure 4.2 of OSDF Groundwater Monitoring Plan
	• potentiometric maps of the uppermost aquifer and all significant zones of saturation above the uppermost aquifer (more than one map sheet may be used)		Drawings X-8 and X-9 of OSDF Design
	• the location of any ground water control structures	This requirement is not applicable to the design of the OSDF.	
	• the location of explosive gas probes and test stations, and proposed explosive gas control/extraction structures	This requirement is not applicable to the design of the OSDF.	
	• the general phasing diagram for the systematic construction and development of the unit(s) of the sanitary landfill facility (more than one plan sheet may be used)		Drawing G-2 of the OSDF Design
OAC 3745-27-06(B)(4)	Plan drawings for the entire sanitary landfill facility shall show the boundaries and elevations of the following items. The scale on these drawings shall be one inch equals no greater than 200 feet and contour intervals shall be no greater than 5 feet.		
	• the horizontal and vertical limits of excavation proposed in the permit to install application		Drawing G-5 of OSDF Design
	• the horizontal limits and top and bottom elevations of the recompacted soil liner proposed in the permit to install application		Drawings G-5 and G-6 of OSDF Design

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(4) (continued)	• the top elevation of the drainage layer, pipe inverts, and layout of the leachate management system(s) proposed in the permit to install application		Drawing G-8 of OSDF Design
	• the horizontal limits and top and bottom elevations of all emplaced waste and areas proposed for waste placement in the permit to install application		Drawings X-4 and G-15 through G-18 of OSDF Design
	• the horizontal limits and top and bottom elevations of the cap system and surface drainage structures proposed in the permit to install application		Drawings G-11, G-15, and G-18 of OSDF Design
OAC 3745-27-06(B)(5)	Cross sections shall show the following items and shall clearly show the horizontal and vertical scale used:		
	• the sanitary landfill facility showing, at and interval no greater than every 300 feet of length and width: - existing topography - the horizontal and vertical limits of excavation proposed in the permit to install application - the horizontal limits and top and bottom elevations of all emplaced waste and all areas of waste placement proposed in the permit to install application - the horizontal limits and top and bottom elevations of the cap system proposed in the permit to install application		Drawings G-1 and G-15 through G-18 of OSDF Design
	• the hydrogeology of the site intercepting the borings and showing the following:		
	- geologic stratigraphy and significant zones of saturation corresponding to site-boring information		Sections 2.3 through 2.6, 3.2, 4.2, and 4.3 of OSDF Predesign Investigation Report and Drawings X-13 through X-15 of OSDF Design

TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(5) (continued)	- the uppermost aquifer and all saturated strata above the uppermost aquifer		Section 1.5.2.3 of Operable Unit 2 FS and Drawings X-13 through X-15 of OSDF Design
	- all well logs of the borings intercepted by the cross section		Appendix F of OSDF Predesign Investigation Report
	- ground water flow patterns for the uppermost aquifer and all significant zones of saturation above the uppermost aquifer	This requirement will be addressed in the Addendum to the OSDF Predesign Investigation Report.	Section 3.0 of OSDF Predesign Investigation Report
	- limits of excavation		Drawings G-5 and G-15 through G-18 of OSDF Design
	- any permanent ground water control structures	This requirement is not applicable to the design of the OSDF.	
	• the perimeter of the property showing all man-made and natural potential explosive gas migration pathways	This requirement is not applicable to the design of the OSDF.	
OAC 3745-27-06(B)(6)	Detailed construction and operational plans outlining the systematic development of each phase of the unit(s) of the sanitary landfill facility shall show the following:		
	• phase preparation		Drawing G-2 of OSDF Design
	• location of any on-site borrow areas and storage areas for the recompacted soil liner material, recompacted soil barrier material for the cap system, and cover material		Drawings X-4, G-12, and G-19 of OSDF Design

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(6) (continued)	• direction of prevailing winds during each season		Drawing X-3 of OSDF Design
	• anticipated direction that the working face will proceed		Drawing G-2 of OSDF Design and Section 6.7 of OSDF Impacted Material Placement Plan
	• areas of operation during inclement weather		Section 6.6.2 of OSDF Impacted Material Placement Plan
	• traffic patterns		Drawing G-2 of OSDF Design
	• direction of flow and points of concentration of all surface waters on the site; measures to be utilized to control surface water run-on and run-off, sediment discharge, erosion, and ground water infiltration		Drawings X-4, G-2, G-30, and G-31 of OSDF Design
	• grades of the completed phase		Drawing G-11 of OSDF Design
OAC 3745-27-06(B)(7)	The following information shall be on detailed plan drawings:		
	• recompacted soil liner, flexible membrane liner, and geosynthetic clay liner (if applicable), including the interface between phases		Drawings G-22 and G-24 of OSDF Design
	• final cap system		Drawing G-26 of OSDF Design
	• key systems for the final cap system, leachate management system, and recompacted soil liner, flexible membrane liner, and geosynthetic clay liner (if applicable)		Drawings G-22, G-24, G-26, and M-2, M-4, M-5, and M-9 of OSDF Design
	• all leachate management system elements		Drawings M-2, M-4, M-5, and M-9 of OSDF Design

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(B)(7) (continued)	• permanent ground water control structures, if any	This requirement is not applicable to the design of the OSDF.	
	• ground water monitoring well construction		Section 5.2 of FEMP Sitewide CERCLA Quality Assurance Project Plan
	• explosive gas control and extraction system elements, if any • explosive gas monitoring probe construction	These requirements are not applicable to the design of the OSDF.	
	• earthen structures, if any		Drawings G-20, G-24, G-26, G-30, and G-31 of OSDF Design
	• on-site roads with vertical profiles of the roads showing maximum grades		Drawings G0005-G0009 of Haul Road Design and Drawings G0005-G0011 of Rerouted North Access Road Design
	• sedimentation pond and discharge structures and surface water run-on and runoff control structures with vertical profiles of the ditches showing minimum and maximum grades		Drawings G-30 and G-31 of OSDF Design
OAC 3745-27-06(C)(2)	A hydrogeologic site investigation report shall be presented, which shall at a minimum include:		
	• sufficient hydrogeologic information to allow the director to:		
	- determine the suitability of the site for solid waste disposal		Sections 4.2 and 4.3 of OSDF Predesign Investigation Report
	- identify and characterize the hydrogeology of the uppermost aquifer system and all geologic strata that exist above the uppermost aquifer system		Sections 2.0 and 3.0 of OSDF Predesign Investigation Report

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	- sufficiently characterize the site geology to allow for the evaluation of the proposed design of the sanitary landfill facility and to ensure that it will be in compliance with the requirements of this chapter		Sections 2.5, 3.2, and 4.2 of OSDF Predesign Investigation Report
	• a description, based on publicly available information of the regional hydrogeology of the proposed sanitary landfill facility. This shall include, but may not be limited to:		
	- the identification of the regional aquifer(s)		Section A.2.2 of Appendix A of Operable Unit 5 FS
	- the well logs of public and private water supply wells within one mile of the proposed sanitary landfill facility - the average yield of water supply wells within one mile of the sanitary landfill facility	These requirements are not applicable to the design of the OSDF.	
	- the direction of the groundwater flow in the regional aquifer - the identification of recharge and discharge areas of the regional aquifer(s)		Section A.2.2 of Appendix A of Operable Unit 5 FS
	- the identification of any public water supply wells within 10 miles of the sanitary landfill facility	This requirement is not applicable to the design of the OSDF.	
	- regional stratigraphy - the structural geology, including a description of local and regional structural features - a description of the regional geomorphology, including the location of surface water bodies, floodplains, etc. This description shall include an analysis of any topographic features that may influence the ground water flow system.		Section A.2.2 of Appendix A of Operable Unit 5 FS

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	• a detailed description of the hydrogeology under the proposed sanitary landfill facility. This description shall be based on data collected from boreholes, piezometers, and test pits. The description shall include but may not be limited to:		
	- a description of the consolidated and unconsolidated stratigraphic units from the ground surface down to the base of the uppermost aquifer system, including: • sedimentary composition, including, for unconsolidated formations, textural classification "Unified Soil Classification System" (USCS), Atterberg limits, grain size distribution, and hydraulic conductivity • thickness • lateral extent		Sections 2.2 through 2.4, 3.2, 4.2, and 4.3 of OSDF Predesign Investigation Report
	- a description of the geomorphology at the proposed sanitary landfill facility - a description of the structural geology under the proposed sanitary landfill facility		Section A.2.2 of Appendix A of Operable Unit 5 FS
	- a description of the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system. This description shall include the depth to, and lateral and vertical extent of, the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system. This description shall include but not be limited to:		Sections 2.3 through 2.6, 4.2, and Appendices B and C of OSDF Predesign Investigation Report
	• temporal fluctuations in ground water levels and the effects on ground water flow directions	This requirement will also be addressed in the Addendum to the OSDF Predesign Investigation Report.	Sections 2.6 and Appendices B and C of OSDF Predesign Investigation Report

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	• an interpretation of the ground water flow system, including rate of flow, direction of flow, vertical and lateral components of flow, and interconnections between and within the uppermost aquifer system and any significant zones of saturation above the uppermost aquifer system. This interpretation shall be described in both narrative and map form	This requirement will also be addressed in the Addendum to the OSDF Predesign Investigation Report.	Sections 2.0 and 3.0 of OSDF Predesign Investigation Report, Section A.2.2 of Appendix A of Operable Unit 5 FS, and Section 3.3 of OSDF Groundwater Monitoring Plan
	• identification and characterization of recharge and discharge areas within the boundaries of the proposed sanitary landfill facility. This shall include any relationships of ground water with seeps, springs, streams, and other surface water features	This requirement will also be addressed in the Addendum to the OSDF Predesign Investigation Report.	Sections 2.0 and 3.0 of OSDF Predesign Investigation Report and Section A.2.2 of Appendix A of Operable Unit 5 FS
	• a quantification of the vertical and horizontal hydraulic conductivity of the uppermost aquifer system and all strata within the zone of saturation above the uppermost aquifer system. This shall include at least three measurements of hydraulic conductivity per stratum measured	This requirement will also be addressed in the Addendum to the OSDF Predesign Investigation Report.	Section 3.0 of OSDF Predesign Investigation Report, Section A.2.2 of Appendix A of Operable Unit 5 FS, and Section 3.3 of OSDF Ground-water Monitoring Plan
	• a description and quantification of the ground water quality of the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system. The description and quantification of ground water quality shall describe and quantify the rate, extent, and concentration of any ground water contamination located under the site. This description shall include data gathered by sampling and analyzing the ground water from the uppermost aquifer system an all significant zones of saturation above the uppermost aquifer system. These samples shall, at a minimum, be analyzed for compounds 1 to 79 listed in Appendix I of rule 3745-27-10 of the Administrative Code and the following parameters:	This requirement will also be addressed in the Addendum to the OSDF Predesign Investigation Report.	Sections 2.3, 2.4, and 2.6 of OSDF Predesign Investigation Report and Section A.2.2 of Appendix A of Operable Unit 5 FS

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	- total organic carbon - turbidity - phosphorus - cyanide		
	• a detailed description of the drilling and soil sampling methods used in characterizing the soil and hydrogeologic properties of the proposed sanitary landfill facility • a detailed description of the analytical procedures and methodology used to characterize the soil and rock materials obtained from test pits and borings		Section 2.0 of OSDF Predesign Investigation Report and Sections 7.0 and 8.0 of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation
	• a detailed description of the methodology, equipment, and procedures used to define the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system including the well and piezometer construction specifications, and water level measurement procedures		Sections 2.3, 2.4, and 2.6 of OSDF Predesign Investigation Report and Sections 7.0 and 8.0 of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation
	• a detailed description of the methodology, equipment, and procedures used to determine the groundwater quality in the uppermost aquifer system and any significant zones of saturation above the uppermost aquifer system including:		
	- detection of immiscible layers	This requirement is not applicable to the design of the OSDF.	

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	- collection of groundwater samples, including well evacuation, sample withdrawal, sample containers and handling, and sample preservation		Sections 2.3, 2.4, and 2.6 of OSDF Predesign Investigation Report and Sections 7.0 and 8.0 of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation
	- performance of field analysis including procedures and forms for recording data and the exact location, time, and facility-specific considerations associated with the data acquisition, and calibration of field devices.		Sections 7.0 and 8.0 of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation
	- decontamination of equipment		Sections 7.0 and 8.44 of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation
	- analysis of ground water samples		Sections 2.3 and 2.4 of OSDF Predesign Investigation Report and Sections 7.0 and 8.0 of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation
	- chain of custody control including standardized field tracking reporting forms to record sample custody in the field prior to and during shipment, and preprepared sample labels containing all information necessary for effective sample tracking		Section 8.0 and Attachment IV of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(2) (continued)	- field and laboratory quality assurance and quality control including collection of replicate samples, submission of field-bias blanks, and potential interferences		Sections 6.0, 7.0, and 8.0 of Project Specific Plan for Phases I and II of Operable Unit 2 Predesign Field Investigation
	- all boring logs, test pit logs, ground water quality data, soil analytical data, and any other data generated while preparing this report		Appendices A through L of OSDF Predesign Investigation Report
OAC 3745-27-06(C)(3)	Detail the measures and operations to control and manage the following:		
	• leachate production and migration		Section 3.0 of OSDF Systems Plan
	• ground water infiltration	This requirement is not applicable to the design of the OSDF.	
	• explosive gas migration • fires, dust, scavenging, vectors, erosion, blowing litter, and birds	Except for erosion, these requirements are not applicable to the operation of the OSDF.	Sections 2.8.3 and 2.8.4 of OSDF DCP, Sections 12.0 and 13.0 of OSDF Calculation Package, and Section 5.0 of OSDF Surface Water Management and Erosion Control Plan
	• surface water run-on and runoff and sediment discharge		Sections 5.0 and 6.0 of Surface Water Management and Erosion Control Plan

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(4)	The following design calculations with reference to equations used, showing site specific input and assumptions:		
	• calculations showing volume of the sanitary landfill facility in cubic yards and anticipated life in years, and the volume in cubic yards and anticipated life in years of each unit of the sanitary landfill facility		Section 2.0 of OSDF Calculation Package
	• liner thickness calculations, from appendix I of rule 3745-27-08 of the Administrative Code, if any	This requirement is not applicable to the design of the OSDF.	
	• calculations for hydrostatic forces on the recompacted soil liner		Section 6.1 of OSDF Calculations Package
	• calculations for leachate generation before and after final closure		Section 7.1 of OSDF Calculations Package
	• leachate management system calculations		Sections 8.0, 9.0, and 10.0 of OSDF Calculations Package
	• pump size calculations		Section 10.0 of OSDF Calculations Package
	• pipe strength and pipe deflection calculations for the leachate management system		Section 8.0 of OSDF Calculations Package
	• calculations demonstrating that the landfill as designed will resist the earth movement in unstable areas		Section 4.0 of OSDF Calculations Package
	• calculations demonstrating that the landfill as designed will resist the maximum horizontal acceleration in lithified material at the site		Section 4.0 of OSDF Calculations Package
	• slope stability analysis		Section 3.0 of OSDF Calculations Package

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(4) (continued)	• calculations to determine the volume of soil necessary to construct and operate the sanitary landfill facility, and calculations to estimate the volume of soil available on site for each intended construction and operational use		Section 15.0 of OSDF Calculations Package
	• soil erosion calculations		Section 11.3 of OSDF Calculations Package
	• surface water control structure calculations		Sections 12.0 and 13.0 of OSDF Calculations Package
	• sedimentation basin calculations		Section 12.2 of OSDF Calculations Package
	• calculations for the explosive gas threshold limit for each station and/or probe	This requirement is not applicable to the design of the OSDF.	
	• other relevant calculations		Volumes 1 through 4 of OSDF Calculations Package
OAC 3745-27-06(C)(5)	Discussion of the following construction information as illustrated in the detail engineering plans:		
	• site preparation • sequence of construction activities		Section 2.6 of OSDF RAWP
	• installation of the items specified in rules 3745-27-08 and 3745-27-10 of the Administrative Code	See Table B-3 of Appendix B for each of these rules.	Division 2 of OSDF Specifications Package
	• seaming and bonding methods to be used for the geosynthetic materials		Section 02772 of OSDF Specification Package

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(5) (continued)	• chemical compatibility testing as required in paragraph (D) of rule 3745-27-08 of the Administrative Code and demonstration of physical and chemical resistance as required in paragraph (E) of rule 3745-27-08 of the Administrative Code		Leachate/Liner Compatibility Study Final Report
OAC 3745-27-06(C)(6)	Discussion of the following operational information:		
	• authorized maximum daily waste receipt as defined in paragraph (A) of rule 3745-27-01 of the Administrative Code requested for the sanitary landfill facility • sources of [daily] cover material; and from each source, anticipated material quantity, characteristics, and intended use	These requirements are not applicable to the design of the OSDF.	
	• methods to be used to handle solid waste, including methods to be used to handle bulky materials and dusty materials		Sections 6.0 through 8.0 of OSDF Impacted Material Placement Plan
	• whether acceptance of asbestos or asbestos containing waste that is subject to the provisions of NESHAP, 40 CFR Part 61, subpart M is anticipated and if permitted, a description of how these materials will be managed		Sections 4.3 and 8.6 of OSDF Impacted Material Placement Plan
	• equipment to be used to construct, operate, and maintain the sanitary landfill facility		OSDF Specification Package
	• schedule of leachate management system inspections		Sections 3.4 and 3.6 of OSDF Systems Plan
	• inclement weather operation procedures		Section 5.0 of OSDF Systems Plan and Section 6.6.2 of OSDF Impacted Materials Placement Plan
	• salvaging operation procedures, if any • use of those portions of the sanitary landfill facility where solid waste is not to be deposited during the operating life of the facility	These requirements are not applicable to the design of the OSDF.	

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(7)	The following plans:		
	• ground water detection monitoring plan as required in rule 3745-27-10 of the Administrative Code, and if applicable the ground water quality assessment plan and/or corrective measures plan required pursuant to rule 3745-27-10 of the Administrative Code		OSDF Groundwater Monitoring Plan and Appendix B of Integrated Environmental Monitoring Plan
	• surface water monitoring plan if required by the Director to ensure compliance with paragraph (J)(5) of rule 3745-27-19 of the Administrative Code	This plan is not applicable to the operation of the OSDF.	
	• leachate monitoring plan to ensure compliance with paragraph (M)(4) of rule 3745-27-19 of the Administrative Code		Section 3.0 of OSDF Systems Plan, Section 4.0 of OSDF Groundwater Monitoring Plan, and Appendix B of Integrated Environmental Monitoring Plan
	• leachate contingency plan as required in paragraph (K)(6) of rule 3745-27-19 of the Administrative Code		Section 6.0 of OSDF Post-Closure Care and Inspection Plan
	• explosive gas monitoring plan as required in rule 3745-27-12 of the Administrative Code	This plan is not applicable to the operation of the OSDF.	
	• the quality assurance/quality control plan specified in paragraph (F) of rule 3745-27-08 of the Administrative Code		OSDF Construction Quality Assurance Plan
	• the final closure/post-closure plan as detailed in paragraph (B) of rule 3745-27-11 of the Administrative Code		OSDF Post-Closure Care and Inspection Plan

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(7) (continued)	• the final closure and post-closure care financial assurance instruments required by rules 3745-27-15 and 3745-27-16 of the Administrative Code, respectively, and if applicable the corrective measures financial assurance instrument required by rule 3745-27-18 of the Administrative Code	This requirement is not applicable to the operation of the OSDF.	
	• the PCB and hazardous waste prevention and detection program required in paragraph (L) of rule 3745-27-19 of the Administrative Code	This requirement is not applicable to the operation of the OSDF.	
OAC 3745-27-06(C)(8)	Contingency plans detailing emergency equipment, procedures, notification, and remediation for the following:		
	• discovery of unauthorized liquid waste, and waste that is burning or at a temperature likely to cause fire	This requirement is not applicable to the operation of the OSDF.	
	• escape of asbestos, if any is accepted • fire, explosion, and spills • erosion, leachate outbreaks, and differential settling • equipment failure		Section 7.2 of OSDF RAWP and Sections 9.0, 10.0, and 11.0 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-27-06(C)(10)	Applications which propose to locate unit(s) of the sanitary landfill facility in wetlands, as defined in paragraph (B) of rule 3745-27-01 of the Administrative Code, shall include the following demonstrations:		
	• where applicable under section 404 of the Clean Water Act or applicable state wetlands laws, the presumption that practicable alternatives to the proposed unit(s) are available which do not involve wetlands is clearly rebutted		Appendix H of Operable Unit 2 FS
	• the construction and operation of the unit(s) of the sanitary landfill facility will not:		

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(10) (continued)	- cause or contribute to violations of any applicable state water quality standard - violate any applicable toxic effluent standard or prohibition under section 307 of the Clean Water Act	These requirements will be addressed in the Sitewide Excavation Plan.	
	- jeopardize the continued existence of endangered or threatened species or result in the destruction of a critical habitat, protected under the Endangered Species Act of 1973		Section 10.6 of Operable Unit 2 ROD, Section 9.6 of Operable Unit 3 ROD, Section 10.6 of Operable Unit 5 ROD, and Appendix D of Soil Remediation Project Area 1, Phase I Remedial Action Work Plan
	• the unit(s) of the sanitary landfill facility will not cause or contribute to significant degradation of wetlands. The owner or operator must demonstrate the integrity of the unit(s) of the sanitary landfill facility and their ability to protect ecological resources by addressing the following factors:		
	- erosion, stability, and migration potential of native wetland soils, muds, and deposits used to support the unit(s) of the sanitary landfill facility - erosion, stability, and migration potential of dredged and fill materials used to support the unit(s) of the sanitary landfill facility	These requirements will be addressed in the Sitewide Excavation Plan.	
	- the volume and chemical nature of the waste managed in the unit(s) of the sanitary landfill facility		The Operable Unit 2, 3, and 5 FS Reports, and Section 4.0 of OSDF Impacted Material Placement Plan

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TABLE A-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-06(C)(10) (continued)	- impacts on fish, wildlife, and other aquatic resources and their habitat from release of the solid waste - the potential effects of catastrophic release of waste to the wetland and the resulting impacts on the environment - any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
	• to the extent required under section 404 of the Clean Water Act or applicable state wetlands laws, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent practicable as required by paragraph (C)(10)(a) of this rule, then minimizing unavoidable impacts to the maximum extent practicable, and finally offsetting wetland impacts through all appropriate and practicable compensatory mitigation actions (e.g., restoration of existing degraded wetlands or creation of man-made wetlands)		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
	• sufficient information is available to make a reasonable determination with respect to these demonstrations	The above-referenced documents provide sufficient information to make a determination with respect to the required demonstrations.	
OAC 3745-27-11(H)(5)(a)	The owner shall file - with the board of health having jurisdiction, with the county recorder of the county in which the facility is located, and with the Director - a plat of the unit(s) of the sanitary landfill facility and information describing the acreage, exact location, depth, volume, and nature of the solid waste deposited in the unit(s) of the sanitary landfill facility.		Section 4.5 of OSDF Post-Closure Care and Inspection Plan

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APPENDIX B

ADDITIONAL ARARs

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ACRONYMS

ARAR	applicable or relevant and appropriate requirement
ASTM	American Society for Testing and Materials
CAMU	corrective action management unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm/s	centimeter per second
DCP	Design Criteria Package
DOE	United States Department of Energy
FEMP	Fernald Environmental Management Project
FHBM	Flood Hazard Boundary Map
FIRM	Flood Insurance Rate Map
FS	Feasibility Study
HDPE	high-density polyethylene
MCL	maximum contaminant level
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NWP	nationwide permit
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
ORC	Ohio Revised Code
OSDF	on-site disposal facility
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
μm	micrometer
U.S.C.	United States Code
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
yd^3	cubic yard

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TABLE B-1
WETLANDS/FLOODPLAINS ARARs

Citation	Requirement	Remarks	Cross-Reference
40 CFR §6.302(a) [Executive Order 11990]	Federal agencies conducting certain activities must avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands when a practicable alternative exists.	This requirement will be addressed in the Sitewide Excavation Plan.	Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
40 CFR §6.302(b) [Executive Order 11988]	Federal agencies must evaluate the potential effects of actions they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain.	This requirement is not applicable to the design of the OSDF.	
33 U.S.C. §1344 40 CFR §230.10	No discharge of dredged or fill material shall be permitted:		
	• if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as, the alternative does not have other significant adverse environmental consequences. • unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem.	These requirements will be addressed in the Sitewide Excavation Plan.	Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
	• causes or contributes, after consideration of disposal site dilution and dispersion, to violations of any applicable state water quality standard. • violates any applicable toxic effluent standard or prohibition under section 307 of the Clean Water Act.	These requirements will be addressed in the Sitewide Excavation Plan.	
	• jeopardizes the continued existence of species listed as endangered or threatened under the Endangered Species Act of 1973, as amended, or results in likelihood of the destruction or adverse modification or a habitat which is determined to be a critical habitat under the Endangered Species Act of 1973, as amended.	This requirement will be addressed in the Sitewide Excavation Plan.	Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS

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TABLE B-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
33 CFR §323.3	Permits will be required for the discharge of dredged or fill material into waters of the United States including wetlands. Certain discharges specified in 33 CFR Part 330 are permitted by that regulation (nationwide permits).	This requirement will be addressed in the Sitewide Excavation Plan.	
	If a discharge of dredged or fill material is not permitted by 33 CFR Part 330 (Nationwide Permits), an individual section 404 permit will be required for the discharge of dredged or fill material into waters of the United States.	This requirement is not applicable to the construction of the OSDF.	
	Discharges of dredged or fill material into waters of the United States done by or on behalf of any Federal agency, other than the Corps of Engineers, are subject to the authorization procedures of these regulations.	This requirement will be addressed in the Sitewide Excavation Plan.	
33 U.S.C. §1341(a)(1),(d) 33 CFR §330.1 (c)	An activity is authorized under an NWP only if that activity and the permittee satisfy all of the following NWPs terms and conditions. Potentially applicable NWPs include:		
	• Nationwide Permit #38 - Cleanup of Hazardous and Toxic Waste - This permit authorizes specific activities required to effect the containments, stabilization or removal of hazardous or toxic waste materials that are performed ordered, or sponsored by a government agency with established legal or regulatory authority provided the permittee notifies the district engineer. - For discharges in special aquatic sites, including wetlands, the notification must also include a delineation of affected special aquatic sites, including wetlands. - This nationwide permit does not authorize the establishment of new disposal sites or the expansion of existing sites used for the disposal of hazardous or toxic waste.	These requirements are not applicable to the design of the OSDF.	

TABLE B-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
10 CFR §1022.3(a), (b)(1), (2),(3),(5),(6),(c),(d),(e)	DOE shall exercise leadership and take action to: • avoid to the extent possible the long- and short-term adverse impacts associated with the destruction of wetlands and the occupancy and modification of floodplains and wetlands, and avoid direct and indirect support of floodplain and wetlands development wherever there is a practicable alternative. • incorporate floodplain management goals and wetlands protection considerations into its planning, regulatory, and decision-making processes and shall to the extent practicable: - reduce the hazard and risk of flood loss. - minimize the impact of floods on human safety, health, and welfare. - restore and preserve natural and beneficial values served by the floodplains. - minimize the destruction, loss, or degradation of wetlands. - preserve and enhance the natural and beneficial values of wetlands. • undertake a careful evaluation of the potential effects of any DOE action taken in a floodplain and any new construction undertaken by DOE in wetlands not located in a floodplain	These requirements will be addressed in the Sitewide Excavation Plan.	Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
	• identify, evaluate, and as appropriate, implement alternative actions which may avoid or mitigate adverse floodplain/wetlands impacts	This requirement will be addressed in the Sitewide Excavation Plan.	Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS

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TABLE B-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
10 CFR §1022.3(a), (b)(1), (2),(3),(5),(6),(c),(d),(e) (continued)	• provide opportunity for early public review of any plans or proposals for actions in floodplains and new construction in wetlands		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
10 CFR §1022.5(b),(h)	This part shall apply to all proposed floodplain/wetlands actions, including those sponsored jointly with other agencies, where practicable alternatives to the proposed actions are still available. The policies and procedures of this part which are applicable to floodplain actions shall apply to all proposed actions which occur in a wetlands located in a floodplain.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
10 CFR §1022.11(a),(b), (c)	Concurrent with its review of a proposed action to determine appropriate NEPA requirements, DOE shall determine applicability of the floodplain management and wetlands protection requirements of this part. In making a floodplain determination, DOE shall utilize the Flood Insurance Rate Maps (FIRMs) or the Flood Hazard Boundary Maps (FHBMs) prepared by the Federal Insurance Administration of the Department of Housing and Urban Development to determine if a proposed action is located in the base or critical action floodplain, as appropriate. For a proposed action in an area of predominantly Federal or State land holdings where FIRM or FHBM maps are not available, information shall be sought from the land administering agency (e.g., Bureau of Land Management, Soil Conservation Service, etc.) or from agencies with floodplain analysis expertise.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
10 CFR §1022.12(a)	If DOE determines, pursuant to 10 CFR §§ 1022.5 and 1022.11, that this part is applicable to the proposed action, DOE shall prepare a floodplain/wetlands assessment, according to the requirements in this section (10 CFR §1022.12).		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS

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TABLE B-1
(continued)

Citation	Requirement	Remarks	Cross-Reference
10 CFR §1022.15(a)	If DOE finds that no practicable alternative to locating in the floodplain/wetlands is available, consistent with the policy set forth in Executive Order 11988, DOE shall, prior to taking action, design, or modify its action in order to minimize potential harm to or within the floodplain/wetlands.	This requirement will be addressed in the Sitewide Excavation Plan.	Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
OAC 3745-27-20 (C)(2)	The limits of solid waste placement and the leachate management system cannot be located in a regulatory floodplain, unless deemed acceptable by the Director.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
OAC 3745-27-07 (G)(15)	A solid waste disposal facility may not be located in a floodway.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
OAC 3745-27-07 (H)(4)(d)	The limits of waste placement cannot be located within 200 feet of a stream, lake, or wetland, unless deemed acceptable by the Director.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
40 CFR §258.12	New municipal solid waste landfill units must not be located in wetlands unless Ohio approves otherwise.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS

TABLE B-2
RCRA ARARs

Citation	Requirement	Remarks	Cross-Reference
OAC 3745.05 (D)(6)(c) [ORC 3734.05 (D)(6)(c)]	A hazardous waste facility installation and operation permit shall not be approved unless it is proven that the facility represents the minimum adverse environmental impact, considering the state of available technology, the nature and economics of various alternatives and other pertinent considerations.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
OAC 3745.05 (D)(6)(d) [ORC 3734.05 (D)(6)(d)]	A hazardous waste facility installation and operation permit shall not be approved unless it is proven that the facility represents the minimum risk of all the following:		
	• contamination of groundwater and surface water; • fires or explosions from treatment, storage, or disposal methods; • accidents during transportation; • impact to public health and safety;		Operable Unit 2, Operable Unit 3, and Operable Unit 5 FS Reports and RODs
	• air pollution; and		OSDF Air Monitoring Plan
	• soil contamination.		Operable Unit 2, Operable Unit 3, and Operable Unit 5 FS Reports and RODs
ORC 3734.02(I)	No owner or operator of a hazardous waste facility, in the operation of the facility, shall cause, permit, or allow the emission therefrom of any particulate matter, dust, fumes, gas, mist, smoke, vapor, or odorous substance that, in the opinion of the Director, unreasonably interferes with the comfortable enjoyment of life or property by persons living or working in the vicinity of the facility, or that is injurious to public health.		Section 2.11.1 of OSDF DCP and Section 13040 of OSDF Specification Package

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TABLE B-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §264.552 Subpart S	Corrective action management unit or CAMU means an area within a facility that is designated by the Regional Administrator under part 264 Subpart S, for the purpose of implementing corrective action requirements under Section 264.101 and RCRA Section 3008(h). A CAMU shall only be used for the management of remediation wastes pursuant to implementing such corrective action requirements at the facility. For the purpose of implementing corrective action for solid waste management units, the Regional Administrator may designate an area at the facility as a corrective action management unit (CAMU). One or more CAMU's may be designated at a facility. • Placement of remediation wastes into or within a CAMU does not constitute land disposal of hazardous wastes. • Consolidation or placement of remediation wastes into or within a CAMU does not constitute creation of a unit subject to minimum technology requirements. • The CAMU shall facilitate the implementation of reliable, effective, protective, and cost-effective remedies. • Waste management activities associated with the CAMU shall not create unacceptable risks to humans or to the environment resulting from exposure to wastes. • The CAMU shall include uncontaminated areas of the facility only if including such areas for the purpose of managing remediation waste is more protective than management of such wastes at contaminated areas of the facility. • Areas within the CAMU, where wastes remain in place after closure of the CAMU, shall be managed and contained so as to minimize future releases, to the extent practicable. • The CAMU shall expedite the timing of remedial activity implementation, when appropriate and applicable.		Section 9.1.8 of Operable Unit 5 ROD

TABLE B-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §264.552 Subpart S (continued)	• The CAMU shall enable the use, when appropriate, of treatment technologies (including innovative technologies) to enhance the long-term effectiveness of remedial actions by reducing the toxicity, mobility, or volume of wastes that will remain in place after closure of the CAMU. • The CAMU shall, to the extent practicable, minimize the land area of the facility upon which wastes will remain in place after closure of the CAMU. The owner/operator shall provide sufficient information to enable the Regional Administrator to designate a CAMU in accordance with the criteria in Section 264.552.		
40 CFR §265.301(a) OAC 3745-68-011	Construction of a landfill must include 2 or more liners and a leachate collection and removal system above and between such liners.		Section 2.4.1 of OSDF DCP and Drawings G-22 and G-24 of OSDF Design
40 CFR §265.90 Subpart F OAC 3745-65-90	The owner or operator of a surface impoundment, landfill, or land treatment facility which is used to manage hazardous waste must implement a groundwater monitoring program capable of determining the facility's impact on the quality of groundwater in the uppermost aquifer underlying the facility.		OSDF Groundwater Monitoring Plan and Appendix B of Integrated Environmental Monitoring Plan
40 CFR §264.92-.100 Subpart F OAC 3745-54-92 to -100	The owner or operator must ensure that hazardous constituents detected in the groundwater from a regulated unit do not exceed the concentration limits for MCLs in the uppermost aquifer underlying the waste management are beyond the point of compliance during the compliance period.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
	The groundwater monitoring requirements include procedures for detection, compliance, and corrective action monitoring programs.		OSDF Groundwater Monitoring Plan and Appendix B of Integrated Environmental Monitoring Plan

TABLE B-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §265.111 Subpart G OAC 3745-66-11	The owner or operator must close a facility in a manner that: • Minimizes the need for further maintenance; • Controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere; and • Complies with these closure requirements.		Section 2.6 of OSDF DCP
40 CFR §265.310 Subpart N OAC 3745-68-10	At final closure of the landfill or upon closure of any cell, the owner or operator must cover the landfill or cell with a final cover designed and constructed to: • provide long-term minimization of migration of liquids through the closed landfill; • function with minimum maintenance; • promote drainage and minimize erosion or abrasion of the cover; • accommodate settling and subsidence so that the cover's integrity is maintained; and • have a permeability less than or equal to the permeability of any bottom liner system or natural subsoil present.		Section 2.6.1 of OSDF DCP and Drawing G-26 of OSDF Design
	After final closure, the owner or operator must comply with all postclosure requirements, including maintenance and monitoring throughout the postclosure care period. The owner or operator must:		
	• maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events;		Section 4.0 of OSDF Systems Plan and Section 9.0 of OSDF Post-Closure Care and Inspection Plan

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TABLE B-2
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §265.310 Subpart N OAC 3745-68-10 (continued)	• continue to operate the leachate collection and removal system until leachate is no longer detected; • maintain and monitor the leak detection system;		Section 6.0 of OSDF Post-Closure Care and Inspection Plan
	• maintain and monitor the groundwater monitoring system;		Section 5.3 of OSDF Post-Closure Care and Inspection Plan and Section 6.0 of OSDF Groundwater Monitoring Plan
	• prevent run-on and run-off from eroding or otherwise damaging the final cover;		Section 4.0 of OSDF Systems Plan and Section 9.3 of OSDF Post-Closure Care and Inspection Plan
	• protect and maintain surveyed benchmarks; and • restrict access to the landfill as appropriate for its post-closure use.		Sections 4.4, 7.0, and 9.3.2 of OSDF Post-Closure Care and Inspection Plan

TABLE B-3
SOLID WASTE ARARs

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-05 (A)	Solid waste shall be disposed of only by the following methods: • sanitary landfill • incineration • composting Methods not mentioned above and not prohibited by this chapter, OAC 3745-27, may be used provided that such methods are demonstrated to the satisfaction of the Director to be capable of disposing of solid waste without creating a nuisance or a health hazard, without causing water pollution, and without violating these regulations and any regulation adopted by the Director pursuant to Ohio Revised Code Chapter 3704 (Air Pollution Control).		Section 9.0 of Operable Unit 2 ROD, Section 8.0 of Operable Unit 3 ROD, and Section 9.0 of Operable Unit 5 ROD
OAC 3745-400-04(A)	Construction and demolition debris shall be disposed of by landfilling or by other methods demonstrated to the satisfaction of the licensing authority.		Section 8.0 of Operable Unit 3 ROD
40 CFR §257.3-7	The solid waste disposal facility or practice shall not engage in open burning of residential, commercial, institutional, or industrial solid waste. This requirement does not apply to land-clearing debris, diseased trees, debris from emergency clean-up operations, and ordnance.		Section 9.0 of Operable Unit 2 ROD, Section 8.0 of Operable Unit 3 ROD, and Section 9.0 of Operable Unit 5 ROD
ORC 3734.03	No person shall dispose of solid wastes by open burning or open dumping, except as authorized by the Director. No person shall dispose of treated or untreated infectious wastes by open burning or open dumping.		Section 9.0 of Operable Unit 2 ROD, Section 8.0 of Operable Unit 3 ROD, and Section 9.0 of Operable Unit 5 ROD

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §257.3-3	A solid waste disposal facility shall not cause a discharge of pollutants into waters of the United States that is in violation of the requirements of the NPDES under section 402 of the Clean Water Act, as amended. A solid waste disposal facility shall not cause a discharge of dredged material or fill material to waters of the United States that is in violation of the requirements under section 404 of the Clean Water Act, as amended. A solid waste disposal facility or practice shall not cause non-point source pollution of waters of the United States that violates applicable legal requirements implementing an area-wide or Statewide water quality management plan that has been approved by the Administrator under section 208 of the Clean Water Act, as amended.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, Appendix J of Operable Unit 5 FS, OSDF Surface Water Management and Erosion Control Plan, and the FEMP NPDES Permit
40 CFR §257.3-4	A solid waste disposal facility or practice shall not contaminate an underground drinking water source beyond the solid waste boundary.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
40 CFR §241.200	In consultation with the responsible agencies the owner/operator shall determine what wastes shall be accepted and shall identify any special handling required.		Sections 4.0 and 8.0 of OSDF Impacted Material Placement Plan
40 CFR §241.201	Using information supplied by the waste generator/owner, the responsible agency and the disposal site owner/operator shall jointly determine specific wastes to be excluded and shall identify them in the plans.		Section 4.4 of OSDF Impacted Material Placement Plan
40 CFR §241.202	Site selection and utilization shall be consistent with public health and welfare, and air and water quality standards and adaptable to appropriate land-use plan.		OSDF Predesign Investigation Report

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §241.203	Plans for the design, construction, and operation of new sites or modifications to existing sites shall be prepared or approved by a professional engineer.		OSDF Drawings
40 CFR §241.204	The location, design, construction, and operation of the land disposal site shall conform to the most stringent of applicable water quality standards established in accordance with or effective under the provisions of the Federal Water Pollution Control Act, as amended.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 FS, and Appendix J of Operable Unit 5 FS
40 CFR §241.205	The design, construction, and operation of the land disposal site shall conform to applicable ambient air quality standards and source control regulations established under the authority of the Clean Air Act, as amended, or State or local standards effective under that Act, if the latter are more stringent.		OSDF Air Monitoring Plan
40 CFR §241.206	Decomposition gases generated within the land disposal site shall be controlled on site, as necessary, to avoid posing a hazard to occupants of adjacent property.	This requirement is not applicable to the design of the OSDF.	
40 CFR §241.207	Conditions shall be maintained that are unfavorable for the harboring, feeding, and breeding of vectors.	This requirement is not applicable to the design of the OSDF.	
40 CFR §241.208	The land disposal site shall be designed and operated at all times in an aesthetically acceptable manner.		Section 2.2 of OSDF DCP
40 CFR §241.209	Cover material shall be applied as necessary to minimize fire hazards, infiltration of precipitation, odors, and blowing litter; control gas venting and vectors; discourage scavenging; and provide a pleasing appearance.	This requirement is not applicable to the design of the OSDF.	
40 CFR §241.210	In order to conserve land disposal site capacity, thereby preserving land resources, and to minimize moisture infiltration and settlement, municipal solid waste and cover material shall be compacted to the smallest practicable volume.		Sections 6.8, 7.0, and 8.0 of OSDF Impacted Material Placement Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §241.211	The land disposal site shall be designed, constructed, and operated in such a manner as to protect the health and safety of personnel associated with the operation.		FEMP Site Health and Safety Procedures and OSDF Project-Specific Health and Safety Requirements Matrix
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9)	The following layers must be installed in the construction of a sanitary landfill (from bottom to top):		
	Recompacted Soil Liner		Section 02225 of OSDF Specification Package
	The recompacted soil liner shall be:		
	• constructed using loose lifts 8 inches thick with a maximum permeability of 1 x 10^{-7} cm/s.		Sections 2.4.1 and 2.4.3 of OSDF DCP
	• constructed of a soil with a maximum clod size of 3 inches or half the lift thickness, whichever is less.		Section 2.4.3 of OSDF DCP
	• constructed of soil with:		
	- 100% of the particles having a maximum dimension not greater than 2 inches. - not more than 10% of the particles, by weight, having a dimension greater than 0.75 inches. - not less than 50% of the particles, by weight, passing through the 200-mesh sieve.		Section 02225 of OSDF Specification Package
	- not less than 25% of the particles, by weight, having a maximum dimension not greater than 0.002 millimeters.	An alternative to this requirement has been approved by OEPA in a letter from T. Schneider to J. Reising dated January 26, 1996, "Hamilton County Comments: Clay Liner Paper."	Section 2.4.3 of OSDF DCP

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	• compacted to at least 95% of the maximum "Standard Proctor Density" using ASTM D-698 or at least 90% of the maximum "Modified Proctor Density" using ASTM D-1557. • compacted at a moisture content at or wet of optimum.		Section 2.4.3 of OSDF DCP
	Alternatives for the above requirements may be used if it is demonstrated to the satisfaction of the Director that the materials and techniques will result in each lift having a maximum permeability of 1×10^{-7} cm/s.		Letter from T. Schneider to J. Reising dated January 26, 1996, "Hamilton County Comments: Clay Liner Paper"
	Additionally, the recompacted soil liner shall:		
	• not comprised of solid waste. • be constructed using the same number of passes and lift thickness, and the same or similar type and weight of compaction equipment established by testing (as defined in this table).	These requirements will be addressed in the OSDF Test Pad Program Final Report.	Section 2.4.3 of OSDF DCP
	• be placed on the bottom and exterior excavated sides of the landfill and have a minimum bottom slope of 2% and a maximum slope based on:		Section 2.4.3 of OSDF DCP and Drawing G-6 of OSDF Design
	- compaction equipment limitations;	This requirement will be addressed in the OSDF Test Pad Program Final Report.	
	- slope stability;		Section 3.1 of OSDF Calculation Package

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	- maximum friction angle between any soil-geosynthetic interface and between any geosynthetic-geosynthetic interface; and		Section 3.2 of OSDF Calculation Package and Section 5.0 of OSDF Soil-Geosynthetic Interface Direct Shear Testing Report
	- resistance of geosynthetics and geosynthetic seams to tensile forces.		Section 3.2 of OSDF Calculation Package
	• constructed on a prepared surface that shall:		
	- be free of debris, foreign material, and deleterious material;		Section 2.4.3 of OSDF DCP
	- be able to bear the weight of the landfill and its construction operations without causing or allowing a failure of the liner to occur through settling; and		Section 2.4.3 of OSDF DCP and Section 5.1 of OSDF Calculation Package
	- not have any abrupt changes in grade that may result in damage to geosynthetics.		Section 2.4.3 of OSDF DCP and Drawing G-5 of OSDF Design
	• be at least 5 feet thick, although the Director may approve an alternate thickness, to be no less than 3 feet, based upon the result of calculations or on a design that is no less protective of human health and the environment.	This requirement is not applicable to the design of the OSDF (see next requirement).	
	• be at least 3 feet thick with a geosynthetic clay liner that meets the specifications in paragraph (C)(3) of this rule although the Director may approve an alternate thickness to be no less than 1½ feet, based upon the results of calculations or on a design that is no less protective of human health and the environment.		Section 2.4.1 of OSDF DCP and Drawings G-22 through G-25 of OSDF Design

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	• have a factor of safety for hydrostatic uplift not less than 1.4.		Section 2.4.2 of OSDF DCP and Section 6.1 of OSDF Calculation Package
	• be adequately protected from damage due to desiccation, freeze/thaw cycles, wet/dry cycles, and the intrusion of objects during construction and operation.		Section 2.4.3 of OSDF DCP and Section 02240 of OSDF Specification Package
	Flexible Membrane Liner		Section 02770 of OSDF Specification Package
	The flexible membrane liner shall be:		
	• placed on the recompacted soil liner.		Section 2.4.5 of OSDF DCP and Drawings G-22 through G-25 of OSDF Design
	• sixty mil high density polyethylene (HDPE).		Section 2.4.5 of OSDF DCP
	• be protected from the drainage layer by a cushion layer, as required by the Director		Section 2.4.5 of OSDF DCP and Drawings G-22 through G-25 of OSDF Design
	Other materials or thicknesses may be used if, at a minimum, the flexible membrane liner meets all the following: • negligibly permeable to fluid migration. • physically and chemically resistant to chemical attack by the solid waste, leachate, or other materials which may come in contact with the flexible membrane liner.	DOE does not presently anticipate utilizing these alternative provisions.	

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	• seamed to allow no more than negligible amounts of leakage with seaming material that is physically and chemically resistant to chemical attack by the solid waste, leachate, or other materials which may come in contact with the seams. • have properties for its installation and use which are acceptable to the Director. • protected from the drainage layer by a cushion layer, as required by the Director. • have a minimum thickness of 40 mils.		
	Geosynthetic Clay Liner The geosynthetic clay liner used in lieu of part of the recompacted soil liner shall be:		Section 02772 of OSDF Specification Package
	• negligibly permeable to fluid migration. • be installed to allow no more than negligible amounts of leakage by a minimum overlap of 6 inches, or, for end of panel seams, a minimum over of 12 inches. Overlap shall be increased in accordance with manufacturers specifications or to account for shrinkage due to weather conditions. • have a bentonite mass per unit area of at least 1 pound per square foot. • be installed in accordance with the manufacturers specifications in regards to handling, overlap, and the use of granular or powdered bentonite to enhance bonding at the seams.		Section 2.4.4 of OSDF DCP
	• be constructed above the recompacted soil liner.		Section 2.4.4 of OSDF DCP and Drawings G-22 through G-25 of OSDF Design

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	Leachate Management System		
	The leachate management system shall:		
	• be designed to prevent clogging and crushing of the system and to limit the level of leachate in areas other than lift stations to a maximum of 1 foot.		Section 2.5.1 of OSDF DCP and Section 8.0 of OSDF Calculation Package
	• include a drainage layer placed on top of the flexible membrane liner composed of granular material that must:		Section 2.5.1 of OSDF DCP and Drawings G-22 through G-25 of OSDF Design
	- have a minimum permeability of 1 x 10^{-3} cm/s; - have a minimum thickness of 1 foot; - have a negligible amount of fines; and - not contain carbonate material.		Section 2.5.1 of OSDF DCP and Section 02710 of OSDF Specification Package
	An alternate material and/or thickness may be used if it is demonstrated to the satisfaction of the Director that the material meets the requirements.	DOE does not presently anticipate utilizing these alternative provisions.	
	• include leachate collection pipes to remove leachate from the bottom of the landfill. The pipes must:		
	- be imbedded in the drainage layer; - have a minimum slope of 0.5%; - have lengths and configuration which shall not exceed the capabilities of clean-out devices;		Section 2.5.1 of OSDF DCP and Drawing G-22 through G-25 of OSDF Design
	- be provided with access for clean-out devices which shall be protected from differential settling;		Section 2.5.1 of OSDF DCP

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	- have joints sealed to prevent separation; and		Section 2.5.1 of OSDF DCP and Section 02605 of OSDF Specification Package
	- be physically and chemically resistant to attack by the solid waste, leachate, or other materials that they may come in contact with. Sealing material and means of access for clean-out devices shall also be physically and chemically resistant to attack by the solid waste, leachate, or other materials that they may come in contact with.		Section 2.5.1 of OSDF DCP and Leachate/ Liner Compatibility Study Final Report
	An alternate means for leachate removal may be used if it is demonstrated to the satisfaction of the Director that the means for leachate removal meets the requirements.	DOE does not presently anticipate utilizing these alternative provisions.	
	• include a filter layer to prevent clogging of the leachate collection system.		Section 2.5.1 of OSDF DCP, Section 02712 of OSDF Specification Package, and Drawings G-22 through G-25 of OSDF Design
	• include a protective layer to protect the recompacted soil liner, flexible membrane liner, geosynthetic clay liner (if applicable), and leachate collection system from the intrusion of objects during construction and operation.		Section 2.5.1 of OSDF DCP, Section 02240 of OSDF Specification Package, and Drawings G-22 through G-25 of OSDF Design
	• include lift stations which are to be protected from adverse effects from leachate and differential settling. If manholes are used as lift stations, they must be equipped with automatic high level alarms located no greater than 6 feet above the invert of the leachate inlet pipe. Lift station pipes should be of adequate capacity and shall automatically commence pumping before the leachate elevation activates the high level alarm.		Section 2.5.3 of OSDF DCP, Sections 10.3 and 10.4 of OSDF Calculation Package, and Drawings M-2, M-4, M-5, and M-9 of OSDF Design

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	Leachate Collection and Storage		
	Any leachate conveyance and storage structures located outside the limits of solid waste placement shall be no less protective of the environment than the landfill facility, as determined by the Director, and:		
	• The structures must be monitored, as required by the Director.		Section 2.5.3 of OSDF DCP, Section 3.6 of the OSDF Systems Plan, Section 6.0 of OSDF Post-Closure Care and Inspection Plan, and Section 4.3.2 of OSDF Groundwater Monitoring Plan
	• Storage tanks must be provided with spill containment • Leachate lines must be double-cased		Section 2.5.3 of OSDF DCP
	• Storage structures must have a minimum of 1 week of storage capacity using design assumptions simulating final closure.		Section 2.5.3 of OSDF DCP and Section 7.2 of OSDF Calculation Package
	• If at any time leachate is evaluated to be hazardous in accordance with rule 3745-52-11 of the OAC, it shall be managed in accordance with Chapters 3745-50 to 3745-69 of the OAC, and the generator standards for storage shall apply in accordance with Chapter 3745-52 of the OAC.	This requirement is not applicable to the design of the OSDF.	
	Surface Water Control		
	• Any permanent or temporary surface water control structures shall be designed to accommodate, by non-mechanical means, the peak flow from the 25-year/24-hour storm event.		Section 2.8.3 of OSDF DCP and Sections 12.1 and 13.1 of OSDF Calculation Package

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1),(2),(3),(4),(5),(6),(7),(9) (continued)	• Surface water control structures shall be designed to minimize silting and scouring.		Section 2.8.3 of OSDF DCP
	• If sedimentation ponds are used, they shall be designed and constructed according to OAC 3745-27-08 (C)(6)(b).		Section 2.8.3 of OSDF DCP and Section 12.2 of OSDF Calculation Package
	Benchmarks		
	• At least 3 permanent third order benchmarks on separate sides of the landfill facility shall be within easy access to the limits of solid waste placement and shall be constructed in accordance with OAC 3745-27-08(C)(7)(a)-(c).		Drawing X-4 of OSDF Design
	Groundwater Control	DOE does not presently anticipate utilizing permanent groundwater control structures.	
	• Any permanent groundwater control structures shall adequately control groundwater infiltration through the use of non-mechanical means such as impermeable barriers or permeable drainage structures. • No permanent groundwater control structures may be used to dewater an aquifer system, except if the recharge and discharge zone of the aquifer system are located entirely within the boundary of the landfill facility.		
40 CFR §258.40	The liner and leachate system shall be designed and constructed to maintain less than a 30-cm depth of leachate over the liner.		Section 2.5.1 of OSDF DCP and Section 8.1 of OSDF Calculation Package
	The geomembrane must be at least 30-mil thick.		Section 2.4.5 of OSDF DCP and Section 02770 of OSDF Specification Package

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
40 CFR §258.26	The landfill shall have: • a run-on control system to prevent flow onto the active portion of the landfill during the peak discharge from a 25-year storm. • a run-off control system from the active portion of the landfill to collect and control at least the water volume resulting from a 24-hour, 25-year storm.		Section 2.8.3 of OSDF DCP and Sections 12.1 and 13.1 of OSDF Calculation Package
OAC 3745-27-08 (D) and (E)	Prior to being used in the construction of the recompacted soil liner and drainage layer of the sanitary landfill or the landfill cap, the following characteristics of the earthen materials must be determined to show that the material is suitable for use in construction of the landfill.		Test Pad Program and Geotechnical Sampling and Testing Work Plans
	Soil Material Specifications		
	The following tests shall be performed on representative samples at least once for every 1,500 yd^3 of soil except the recompacted permeability test, which shall be performed at least once for every 10,000 yd^3 of soil. • recompacted permeability at construction specifications; • moisture content and density using an approved ASTM method; • grain size distribution using ASTM D-422 for sieve and hydrometer methods; and • Atterberg limits using ASTM D-4318.		Section 2.4.3 of OSDF DCP and Section 6.0 of the OSDF Construction Quality Assurance Plan
	Granular Drainage Material Specifications		
	The following tests shall be performed at least once for every 3,000 yd^3 of material. • permeability; • grain size distribution using ASTM D-422 for the sieve method; and		Section 2.5.1 of OSDF DCP and Section 6.0 of the OSDF Construction Quality Assurance Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (D) and (E) (continued)	• chemical compatibility testing may be required by the Director.	This requirement is not applicable to the design of the OSDF.	
	Geosynthetic Material Specifications		
	Geosynthetics, other synthetic materials, and joint sealing compounds used in the construction of the flexible membrane liner, geosynthetic clay liner, and leachate management system for a sanitary landfill facility or a sanitary landfill cap system shall be shown to: • be physically and chemically resistant to attack by the solid waste, leachate, or other materials that they may come in contact with using USEPA Method 9090 or other documented data. • have properties acceptable for installation and use.		Leachate/Liner Compatibility Study Final Report, Section 2.4.9 of OSDF DCP, and Section 02772 of the OSDF Specification Package
OAC 3745-27-08 (C)(1)(m),(o) and (C)(2)(g)	The following activities must be performed to ensure that the components of the sanitary landfill facility meet the specifications of this rule.		
	Test Pads		
	The recompacted soil liner and the recompacted soil barrier layer in the cap system shall be modeled by the construction of test pads. The test pads shall:		
	• be designed such that the proposed tests are appropriate and their results are valid.		Section 2.7.1 of OSDF DCP and Sections 2.2 and 5.1 of OSDF Test Pad Work Plan
	• be constructed to establish the construction details which are necessary to obtain sufficient compaction to satisfy the permeability requirement. The construction details include: - lift thickness; - water content necessary to achieve the desired compaction; and		Section 2.7.1 of OSDF DCP and Section 2.2 of OSDF Test Pad Work Plan

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1)(m),(o) and (C)(2)(g) (continued)	- type, weight, and number of passes of construction equipment. • be constructed prior to the construction of the sanitary landfill component which the test pad will model.		
	• be constructed whenever there is a significant change in soil material properties.		Section 2.7.3 of OSDF DCP and Section 2.1 of OSDF Test Pad Work Plan
	• have a minimum width three times the width of the compaction equipment, and a minimum length two times the length of compaction equipment, including power equipment and any attachments.		Section 2.7.3 of OSDF DCP and Section 5.1 of OSDF Test Pad Work Plan
	• be comprised of at least four lifts.		Section 2.7.3 of OSDF DCP and Sections 2.3.4 and 5.1 of OSDF Test Pad Work Plan
	• be tested for field permeability, following the completion of test pad construction. For each lift a minimum of 3 tests for moisture content and density shall be performed.		Section 2.7.3 of OSDF DCP and Sections 2.3.5, 7.0, and 8.0 of OSDF Test Pad Work Plan
	• be reconstructed as many times as necessary to meet the permeability requirement. Any amended construction details shall be noted.		Section 2.7.3 of OSDF DCP
	An alternative to test pads may be used if it is demonstrated to the satisfaction of the Director that the alternative meets the requirements.	DOE does not currently anticipate utilizing this alternative provision.	

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(1)(m),(o) and (C)(2)(g) (continued)	Moisture Content and Density Testing		
	Moisture content and density testing of the recompacted soil liner and recompacted soil barrier in the cap system shall be performed at a frequency of no less than 5 tests per acre per lift. Any penetrations shall be repaired using methods acceptable to the Director.		Section 2.4.3 of OSDF DCP, Section 02225 of OSDF Specification Package, and Section 6.0 of OSDF Construction Quality Assurance Plan
	Flexible Membrane Liner Testing		
	• For the purpose of testing every seaming apparatus in use each day, peel and shear tests shall be performed on scrap pieces of flexible membrane liner at the beginning of the seaming period and every four hours thereafter. • Nondestructive testing shall be performed on 100% of the flexible membrane liner seams. • Destructive testing for peel and shear shall be performed at least once for every 500 feet of seam length. An alternate means may be used if it is demonstrated to the satisfaction of the Director that the alternate means meets the requirements.		Section 2.4.5 of OSDF DCP, Section 02770 of OSDF Specification Package, and Section 7.0 of OSDF Construction Quality Assurance Plan
OAC 3745-27-08 (G)	All tests failing to meet the specifications outlined above must be investigated and the areas reconstructed to meet specifications.		Sections 6.12, 7.9, 8.8, and 9.7 of OSDF Construction Quality Assurance Plan
OAC 3745-27-08 (F)	The following testing procedures shall be included in a Quality Assurance/Quality Control Plan: • sampling and testing procedures to be used in the field and in the laboratory; • testing frequency; • parameters and sample locations;		OSDF Construction Quality Assurance Plan

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (F) (continued)	• procedures to be followed if a test fails; • the management structure and the experience and training of the testing personnel; and • contingency plan for anticipated construction difficulties. The following components shall be included in a Quality Assurance/Quality Control Plan: • in-situ foundation preparation; • recompacted soil and/or geosynthetic clay liner system; • flexible membrane liner; • leachate management system; • cap system; • permanent ground water control structures; and • explosive gas control/extraction systems.		
OAC 3745-27-19 (E)(19)	To demonstrate that the solid wastes to be received at the landfill facility will not compromise the integrity of any material used to construct the landfill facility, the Director may require chemical compatibility testing to be performed.		Leachate/Liner Compatibility Study Final Report
OAC 3745-27-19 (E)(26)	The integrity of the engineered components of the landfill facility shall be maintained and any damage to, or failure or, the components shall be repaired.		OSDF Systems Plan and Sections 6.0 through 10.0 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-27-19 (E)(30)	The owner or operator shall not accept for disposal or dispose of: • whole scrap tires at a sanitary landfill facility • shredded whole scrap tires at a sanitary landfill facility.		Section 4.4 of OSDF Impacted Material Placement Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-19 (J)(1),(4)	Surface water shall be diverted from areas where solid waste is being, or has been, deposited. The facility shall be designed, constructed, maintained, and provided with surface water control structures, as necessary, to control run-on and run-off of surface water to ensure minimal infiltration of water through the cover material and cap system, and minimal erosion of the cover material and cap system. If ponding or erosion occurs on areas of the landfill facility where solid waste is being, or has been, deposited, action will be taken to correct the conditions causing the ponding or erosion.		Sections 2.8.3 and 2.8.4 of OSDF DCP, Sections 12.0 and 13.0 of OSDF Calculation Package, and Section 5.0 of OSDF Surface Water Management and Erosion Control Plan
OAC 3745-27-19 (K)(1)	If leachate is detected on the surface of the landfill facility, then the outbreak(s) shall be repaired and: • leachate shall be contained and properly managed at the sanitary landfill facility. • if necessary, leachate shall be collected and disposed in accordance with paragraph (K)(5) and (K)(6) of OAC 3745-27-19. • actions shall be taken to minimize, control, or eliminate the conditions which contribute to the production of leachate.		Section 3.0 of OSDF Systems Plan and Sections 6.0 and 10.0 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-27-19 (K)(2)	At least one lift station back-up pump shall be kept at the sanitary waste landfill facility at all times.		Section 2.5.3 of OSDF DCP
OAC 3745-27-19 (K)(3)	The collection pipe network of the leachate management system shall be inspected after placement of the initial lift of waste to ensure that crushing has not occurred and shall be inspected annually thereafter to ensure that clogging has not occurred.		Section 3.4 of OSDF Systems Plan and Section 6.0 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-27-19 (K)(4)	If authorized by the Director, leachate may be temporarily stored within the limits of solid waste placement until the leachate can be treated and disposed.		Section 2.5.3 of OSDF DCP

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-19 (K)(5)	The owner shall treat and dispose of collected leachate in accordance with the following: • Treat and dispose of collected leachate on site at the sanitary landfill facility; • Pre-treat collected leachate on site and dispose of collected leachate off site of the sanitary landfill facility; or • Treat and dispose of collected leachate off site of the sanitary landfill facility.		Section 9.1.5 of Operable Unit 5 ROD
OAC 3745-27-19 (K)(6)	The owner or operator shall prepare a contingency plan for the storage and disposal of leachate and place a copy in the operating record. The plan shall describe the immediate and long-term steps, including the setting aside of land for the construction and operation of an on-site treatment facility, to be taken for leachate management in the event that collected leachate cannot be managed in accordance with the management option selected in paragraph (K)(5) of this rule.		Section 6.0 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-27-19 (M)(4),(5)	The owner annually shall report: • A summary of the quantity of leachate collected for treatment and disposal on a monthly basis during the year; • Location of leachate treatment and/or disposal; • Verification that the leachate management system is operating in accordance with this rule; and • Results of analytical testing of an annual grab sample from the leachate management system.		Section 6.0 of OSDF Post-Closure Care and Inspection Plan and Section 8.3 of Integrated Environmental Monitoring Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-10	The groundwater monitoring system for detection monitoring, assessment monitoring, or corrective measures shall consist of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from both the uppermost aquifer system and any significant zones of saturation that exist above the uppermost aquifer system that: • represent the quality of the background groundwater that has not been affected by past or present operations; and • represent the quality of the groundwater passing directly downgradient of the limits of solid waste placement. The groundwater monitoring program shall include consistent sampling and analysis procedures and statistical methods that are protective of human health and the environment and that are designed to ensure monitoring results that provide an accurate presentation of groundwater quality at the background and downgradient well. If contamination from the landfill is discovered, corrective measures shall be taken.		OSDF Groundwater Monitoring Plan and Appendix B of Integrated Environmental Monitoring Plan
OAC 3745-27-11 (A), (B), (G)(1)-(3), (G)(7)	It is the responsibility of the permittee to complete final closure of the solid waste landfill facility in a manner that minimizes the need for further maintenance and minimizes postclosure formation and release of leachate and explosive gases to air, soil, groundwater, or surface water to the extent necessary to protect human health and the environment. The adequacy of closure methods must be approved by OEPA for cap design, soil barrier layer, granular drainage layer, and vegetative cover.		Section 2.6 of OSDF DCP
OAC 3745-27-11 (H)	At final closure of a landfill facility:		
	• all land surfaces shall be graded to prevent ponding of water where solid waste has been placed. Drainage facilities shall be provided to direct surface water from the landfill facility.		Drawings G-11, G-30, and G-31 of OSDF Design and Section 5.0 of OSDF Surface Water Management and Erosion Control Plan

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-11 (H) (continued)	• a groundwater monitoring system shall be designed and installed in accordance with OAC 3745-27-10, if a system is not already in place.		OSDF Groundwater Monitoring Plan
OAC 3745-27-11 (O)	Closure of the sanitary landfill facility must be completed in a manner that minimizes the need for further maintenance and minimizes post-closure formation and release of leachate and explosive gases to air, soil, groundwater, or surface water to the extent necessary to protect human health and the environment.		Section 2.6 of OSDF DCP
OAC 3745-27-08 (C)(15)	A composite cap system which shall minimize infiltration, must be constructed in all areas of solid waste placement:		
	• The cap system shall have a slope of between 5% and 25% or some greater slope based on stability analyses.		Section 2.6.9 of OSDF DCP and Drawing G-11 of OSDF Design
	• The cap system shall have a maximum projected erosion rate of 5 tons/acre/year.		Section 2.6.3 of OSDf DCP and Section 11.3 of OSDF Calculation Package
	• Any penetrations into the cap system shall be sealed so that the integrity of the soil barrier layer is maintained.		Section 2.6.9 of OSDF DCP and Section 02225 of OSDF Specification Package
	The cap system shall, at a minimum, consist of the following (from bottom to top):		
	Recompacted Soil Barrier Layer		
	The recompacted soil barrier layer of the cap shall be:		

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(15) (continued)	• a minimum of 18 inches thick and constructed in accordance with the specifications outlined above for construction of the recompacted soil liner for a landfill facility ((C)(1)(a) to (C)(1)(g) and (C)(1)(m) to (C)(1)(o) of OAC 3745-27-08) with the exception that the maximum permeability of the recompacted soil barrier shall be $1x10^{-6}$ cm/sec; OR		Section 2.6.9 of OSDF DCP, Drawings G-22 through G-25 of OSDF Design, and Section 02225 of OSDF Specification Package
	• a geosynthetic clay liner of equal or less permeability as the recompacted soil barrier layer, with an engineered subgrade constructed in accordance with the following requirements:		Section 2.6.9 of OSDF DCP and Section 02772 of OSDF Specification Package
	- The thickness of the subgrade shall be sufficient to achieve an evenly graded surface and shall be a minimum of 12 inches. - Be constructed of a soil with 100% of the particles have a maximum dimension not greater than 2 inches and with not more than 10% of the particles, by weight, having a dimension greater than 0.75 inches. - Be compacted to at least 95% of the maximum "Standard Proctor Density" using ASTM D-698 or at least 90% of the maximum "Modified Proctor Density" using ASTM D-1557. - After being smooth-rolled, the surface shall not have sharp edged or protruding particles.		Section 2.6.9 of OSDF DCP and Section 02200 of OSDF Specification Package
	- The particle size and proctor density required shall be verified by tests performed on representative samples based on the variability and homogeneity of the material, but no less than a minimum of once for every 5,000 cubic yards of material used in the engineered subgrade. - Field density testing shall be performed at a frequency not less than 5 tests per acre. Any penetrations in the subgrade as a result of the testing must be repaired using bentonite or a bentonite-soil mixture.		Section 2.6.9 of OSDF DCP and Section 6.0 of OSDF Construction Quality Assurance Plan

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(15) (continued)	Flexible Membrane Liner		
	The flexible membrane liner for the cap system shall be constructed on top of the soil barrier layer or geosynthetic clay liner in accordance with the specifications listed above for a flexible membrane liner for a landfill facility [OAC 3745-27-08 (C)(2)].		Section 2.6.9 of OSDF DCP, Section 02770 of OSDF Specification Package, and Drawings G-26 through G-29 of OSDF Design
	Drainage Layer		
	The drainage layer shall be:		
	• a minimum of 1 foot of granular material; OR		Section 2.6.7 of OSDF DCP and Drawings G-26 through G-29 of OSDF Design
	• a drainage net that has equivalent performance capabilities as the granular material.	DOE does not currently anticipate utilizing these alternative provisions.	
	• constructed on top of the flexible membrane liner in accordance with the specifications outlined above for the drainage layer included in the leachate management system of a sanitary landfill facility ((C)(4)(a) of 3745-27-08 of the OAC).		Section 2.6.7 of OSDF DCP and Drawings G-26 through G-29 of OSDF Design
	Frost Protection Layer		
	The frost protection layer shall be: • placed on top of the drainage layer. • a minimum of 30 inches thick. If the drainage layer is constructed with granular material instead of a drainage net, the drainage layer may be used as part of the frost protection layer.		Section 11.4 of OSDF Calculation Package

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-08 (C)(15) (continued)	Soil Vegetative Layer		
	The soil vegetative layer shall: • consist of soil and vegetation placed on top of the frost protection layer. • have soil of sufficient thickness and fertility to support its vegetation and to protect the recompacted soil barrier layer and flexible membrane liner from damage due to root penetration. • have healthy grasses or other vegetation that form a complete and dense vegetative cover. Soil from the frost protection layer may be used as a part of the vegetative layer.		Sections 2.6.3 and 2.6.4 of OSDF DCP, Drawings G-26 through G-29 of OSDF Design, and Sections 02250, 02920, and 02930 of OSDF Specification Package
	Comparable materials and/or thicknesses for the soil barrier layer, the granular drainage layer, and the soil vegetative layer may be used if approved by the Director.	DOE does not currently anticipate utilizing these alternative provisions.	
OAC 3745-20-06	Each owner or operator of an active asbestos waste disposal site shall cause or permit no visible emissions to the outside air; or shall comply with the following requirements. Rather than meet the no visible emissions requirement above, each owner or operator of an active asbestos waste disposal site shall comply with the following: • There shall be no visible emissions from asbestos-containing waste materials during the on-site transportation, transfer, deposition, or compacting operations. • Deposition and burial operations shall be conducted in a manner which prevents handling by equipment or persons that causes asbestos-containing waste materials to be broken-up or dispersed before the materials are buried.		Section 8.6 of OSDF Impacted Material Placement Plan and OSDF Air Monitoring Plan

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-20-06 (continued)	• As soon as practicable after deposition of the asbestos-containing waste materials but no later than at the end of each operating day, the asbestos-containing waste material deposited at the site during the operating day shall be buried with at least 12 inches of compacted nonasbestos-containing material. • During the unloading, deposition, burial, and initial compaction of asbestos-containing waste materials, the owner or operator of the active waste disposal site shall establish a restricted area adequate to deter the unauthorized entry of the general public and any unauthorized personnel from any location within 100 feet of operations.		
OAC 3745-20-07(A), (C)	Prohibits visible emissions from asbestos-containing materials from an inactive asbestos waste disposal site, and requires at least 6 inches of cover of compacted non-asbestos containing material over that asbestos-containing material and growth and maintenance of a cover of vegetation on an area adequate to prevent exposure of the asbestos-containing waste material, or at least 2 feet of cover of compacted non-asbestos containing material, and maintenance of that cover to prevent exposure to the asbestos-containing waste material.		Section 8.6 of OSDF Impacted Material Placement Plan and OSDF Air Monitoring Plan
OAC 3745-27-11 (H)(5)(b)	A notation must be recorded on the deed to the sanitary landfill facility property, or on some other instrument which is normally examined during title search, that will in perpetuity notify any potential purchaser of the property that the land has been used as a sanitary landfill facility. The notation shall include information describing acreage, exact location, depth, volume, and nature of the solid waste deposited in the sanitary landfill facility.		Section 4.5 of OSDF Post-Closure Care and Inspection Plan
OAC 3745-27-14 (A)(1),(2)	Following completion of final closure activities in accordance with rule 3745-27-11 of the OAC, post-closure care activities shall be conducted at the sanitary landfill facility for a minimum of 30 years.		Section 1.1 of OSDF Post-Closure Care and Inspection Plan
	Post-closure care activities for all sanitary landfill facilities shall include, but are not limited to:		

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-14 (A)(1),(2) (continued)	• continuing operation and maintenance of the leachate management system, the surface water management system, any explosive gas extraction and/or control system, any explosive gas monitoring system, and the groundwater monitoring system		Sections 5.0, 6.0, and 9.0 of OSDF Post-Closure Care and Inspection Plan
	• maintaining the integrity and effectiveness of the cap system, including making repairs to the cap system as necessary to correct the effects of settling, dead vegetation, subsidence, erosion, leachate outbreaks, or other events, and preventing run-on and run-off from eroding or otherwise damaging the cap system		Section 4.0 of OSDF Systems Plan and Section 9.3.2 of Post-Closure Care and Inspection Plan
40 CFR §258.61	The Director of Ohio EPA may allow the owner or operator to stop managing leachate if the owner or operator demonstrates that leachate no longer poses a threat to human health and the environment.		Section 6.0 of OSDF Post-Closure Care and Inspection Plan
40 CFR §257.3-2	Solid waste disposal facilities or practices shall not cause or contribute to the taking of any endangered or threatened species of plants, fish, or wildlife. Solid waste disposal facilities or practices shall not result in the destruction or adverse modification of the critical habitat of endangered or threatened species as identified in 50 CFR Part 17.		Appendix H of Operable Unit 2 FS, Appendix J of Operable Unit 3 RI/FS, and Appendix J of Operable Unit 5 FS
OAC 3745-27-20 (C)(2)	The limits of solid waste placement and the leachate management system cannot be located in a regulatory floodplain, unless deemed acceptable by the Director.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP
OAC 3745-27-07 (H)(4)(d)	The limits of waste placement cannot be located within 200 feet of a stream, lake, or wetland, unless deemed acceptable by the Director.	See Table B-1 of Appendix B of this plan.	Section 2.1.2 of OSDF DCP
OAC 3745-27-07 (H)(3)(a)	A sanitary landfill facility may not be located within the surface and subsurface areas surrounding a public water supply well through which contaminants may move toward and may reach the public water supply well within a period of 5 years.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OEPA GD202.105	The minimum distance to a public water supply will be considered by application of this criteria: • The five-year time of travel shall be calculated between the boundary of the solid waste landfill facility and the closest public water supply. A period of no less than five years will be required before groundwater flowing in a downgradient direction from the facility can intersect with a public water supply well screen. To be considered for an exemption from this rule, the following will need to be demonstrated: • that there is at least 50 feet of separation between the bottom of the solid waste landfill facility liner and the aquifer system in which the public water supply well is screened; • that any release of leachate will be detected before reaching the aquifer system in which the public water supply well is screened; and • that once leachate is released below the liner, the leachate will not reach the aquifer system in which the public water supply will is screened within a time span of 100 years plus the anticipated life of the solid waste landfill facility, which shall include the 30-year postclosure care period.	DOE does not currently anticipate utilizing this exemption.	
OAC 3745-27-07 (H)(2)(c)	A sanitary landfill facility cannot be located above an aquifer declared by the federal government under the Safe Drinking Water Act to be a sole source aquifer.	A waiver from this requirement has been granted by U.S. EPA.	Section 2.1.2 of OSDF DCP, Section 7.5.4 of Operable Unit 2 ROD, Sections 9.2.1 and 9.2.2 of Operable Unit 3 ROD, and Sections 10.2.1. and 10.2.2 of Operable Unit 5 ROD

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OEPA GD202.101	The Director may grant an exemption to the prohibition of siting a solid waste landfill facility over a sole-source aquifer under ORC 3743.02(G). In order to grant an exemption, the Director needs to determine that no adverse impact to human health or safety or the environment will occur due to granting the exemption. The decision to grant an exemption from this rule is made on a site-by-site basis. Among the items that should be considered when determining if a waiver will be granted are whether a significant thickness of low permeable material exists between the landfill facility liner and the sole-source aquifer and whether there is an interconnection between the sole-source aquifer and any significant saturated zones which exist above the sole-source aquifer.	DOE does not currently anticipate utilizing this exemption.	
OAC 3745-27-07 (H)(2)(d)	A sanitary landfill facility cannot be located above an unconsolidated aquifer capable of sustaining a yield of 100 gallons per minute for a 24-hour period to an existing or future water supply well located within 1,000 feet of the limits of solid waste placement, unless deemed acceptable by the Director.	A waiver from this requirement has been granted by U.S. EPA.	Section 2.1.2 of OSDF DCP and Section 7.5.4 of Operable Unit 2 ROD, Sections 9.2.1 and 9.2.2 of Operable Unit 3 ROD, and Sections 10.2.1. and 10.2.2 of Operable Unit 5 ROD
OEPA GD202.102	An exemption to the prohibition of siting a solid waste landfill facility over an unconsolidated aquifer capable of sustaining a yield of 100 gallons per minute for a 24-hour period may be obtained by demonstrating that the thickness and lack of permeability of the sediment that exists between the bottom of the proposed landfill facility liner and the top of the unconsolidated high-yield aquifer from the effects of a release of leachate from the solid waste landfill facility. The sediment should prevent leachate from migrating from the bottom of the facility liner to the high-yield aquifer in a time period equal to the active life of the facility, including the postclosure care period.	DOE does not currently anticipate utilizing this exemption.	

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-07 (H)(3)(c)	The limits of solid waste placement cannot be located within 1,000 feet of an existing water supply well or developed spring unless it is deemed acceptable by the Director or it is: • controlled by the applicant, is needed as a source of nonpotable water, no other reasonable alternate water source is available, and the well is constructed to prevent contamination of the groundwater, OR • located at least 500 feet hydrogeologically up-gradient from the limits of solid waste placement, OR • separated from the limits of solid waste placement by a hydrogeologic barrier, OR • constructed and used solely for monitoring groundwater quality	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP
OEPA GD202.103	This guidance clarifies when exceptions to the required 1000-foot isolation distance from water supply wells and developed springs apply and when a situation contrary to the rule can be deemed acceptable to the Director of OEPA.	DOE does not currently anticipate utilizing this exemption.	
OAC 3745-27-07 (H)(2)(e)	The isolation distance between the uppermost aquifer system and the bottom of the recompacted soil liner of a sanitary landfill system cannot be less than 15 feet of in situ or added geologic material deemed acceptable by the Director.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP, Section 4.2.1 of OSDF Predesign Investigation Report, and Drawings X-13 through X-15 of OSDF Design
OEPA GD202.104	For geologic material to be deemed acceptable to the Director as added fill under OAC Rule 3745-27-07 (B)(15), it must be able to meet the following criteria: • the geologic material must be impermeable enough so it will not store, transmit or yield a significant amount of water to a well or spring • the geologic material must be able to impede both physically and chemically, the flow of leachate constituents through it	DOE does not currently anticipate utilizing these alternative provisions.	

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
GD202.104 (continued)	In order to meet both criteria listed above, the added geologic material should: • be classified as CL, SC, GC, CL-ML, or CH under the Unified Soil Classification System (USCS) • be composed of particles of which at least 25% by dry weight will pass through a No. 200 (75 μm) sieve • be composed of no more than 25% by dry weight particles which will not pass through a No. 4 sieve • no particle should be greater than 8 inches in diameter • have a final permeability of no more than 1×10^{-8} cm/sec • be recompacted in a manner that when the landfill is constructed on it, no damage to the landfill liner will occur due to settling of the added material		
OAC 3745-27-07 (H)(1)	The limits of solid waste placement cannot be located in any of the following areas: • national park or recreation area; • candidate area for potential inclusion in the national park system; • state park or established state park purchase area; or • any property that lies within the boundaries of a national park or recreation area but that has not been acquired or in not administered by the secretary of the United States Department of the Interior.	The location of the OSDF fulfills these requirements.	Section 2.1.2 of OSDF DCP
OAC 3745-27-07 (H)(2)(a)	The solid waste disposal facility cannot be located in a sand or gravel pit where the sand or gravel deposit has not been completely removed.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP
OAC 3745-27-07 (H)(2)(b)	The solid waste disposal facility cannot be located in a limestone quarry or sandstone quarry, unless deemed acceptable by the Director.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP

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TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
OAC 3745-27-07 (H)(3)(b)	The solid waste landfill cannot be located within an area of potential subsidence due to an underground mine.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP
OAC 3745-27-07 (H)(4)(a)	The limits of solid waste placement cannot be located within 1,000 feet of the following: • areas designated by the Ohio Department of Natural Resources as either a state nature preserve, a state wildlife area, or a state scenic river; • areas designated, owned, and managed by the Ohio Historical Society as a nature preserve; • areas designated by the United States Department of the Interior as either a national wildlife refuge or a national scenic river; • areas designated by the United States Forest Service as either a special interest area or a research natural area in the Wayne National Forest; or • stream segments designated by Ohio EPA as either a state resource water, a coldwater habitat, or an exceptional warmwater habitat.	The location of the OSDF fulfills these requirements.	Section 2.1.2 of OSDF DCP
OAC 3745-27-07 (H)(4)(b)	The limits of waste placement cannot be located within 300 feet of the sanitary landfill facility's property line, unless deemed acceptable by the Director.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP and Drawing X-4 of OSDF Design
OAC 3745-27-07 (H)(4)(c)	The limits of solid waste placement cannot be located within 1,000 feet of an existing domicile whose owner has not consented in writing to the location of the sanitary landfill facility.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP
OAC 3745-27-20 (C)(3)	The limits of solid waste placement cannot be located within 200 feet of a fault that has had displacement in Holocene time unless the owner or operator can demonstrate that a distance less than 200 feet will prevent damage to the structural integrity of the solid waste landfill.	The location of the OSDF fulfills this requirement.	Section 2.1.2 of OSDF DCP

TABLE B-3
(continued)

Citation	Requirement	Remarks	Cross-Reference
ORC 3734.02(A)	The director of environmental protection shall adopt and may modify, suspend, or repeal rules for all solid waste facilities in order to ensure that the facilities will be located, maintained, and operated, and will undergo closure and post-closure care, in a sanitary manner so as not to create a nuisance, cause or contribute to water pollution, create a health hazard, or violate 40 CFR § 257.3-2 or 257.3-8.	The design of the OSDF fulfills this requirement.	
OAC 3745-27-19(N)	The permittee shall submit to the Director of the OEPA, upon every 10th anniversary of the effective date of a permit to install that approved the initial construction of the facility, an analysis demonstrating that the design, construction, and final closure plan of the solid waste landfill facility continue to constitute the best available technology. If the Director of the OEPA determines that the design is no longer consistent with best available technology as being applied to the solid waste landfill industry in the State of Ohio, the permittee may be required to submit a permit to install application for necessary modifications to the landfill facilities. If a permit to install is required, the Director of the OEPA shall not apply the siting criteria outlined in paragraph (H) of OAC 3745-27-07 when considering the permit to install application.	This requirement will be met through the CERCLA five-year review process.	Section 9.1 of Operable Unit 2 ROD, Section 9.0 of Operable Unit 3 ROD, and Section 10.0 of Operable Unit 5 ROD

BORROW AREA MANAGEMENT AND RESTORATION PLAN

ON-SITE DISPOSAL FACILITY

20100-PL-005
Revision G
October 1996

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

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Fernald Environmental Restoration Management Corporation
Subcontract 95PS005028

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APPENDIX A: GEOTECHNICAL DATA SUMMARY

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1.0 INTRODUCTION

1.1 Overview

This Borrow Area Management and Restoration (BAMR) Plan describes the management and restoration activities that will be undertaken for obtaining on-site borrow soils for construction, filling, and closure of the Fernald Environmental Management Project (FEMP) On-Site Disposal Facility (OSDF), Fernald, Ohio. These activities are conducted primarily at the East Field Borrow Area (borrow area) located south of the OSDF and east of the South Entrance Road. Borrow activities conducted within the footprint of the OSDF are also briefly described.

This plan addresses management and restoration activities at the borrow area throughout construction, impacted material placement, and closure of the OSDF, as prescribed in the *"Final Record of Decision for Remedial Actions at Operable Unit 2 (OU2 ROD)"* [DOE, 1995a]. The plan does not address maintenance activities beyond final restoration of the borrow area.

1.2 Project Description

The OSDF will be constructed to permanently contain impacted materials derived from remediation of the operable units at the FEMP. All material destined for OSDF disposal will be required to meet OSDF waste acceptance criteria (WAC). The estimated total volume of material destined for OSDF disposal is 2.5 million cubic yards (1.9 million cubic meters) bank/unbulked. Approximately 80 percent of this material is impacted soil, with the remainder consisting of building demolition rubble, fly ash, lime sludge, municipal solid waste, and small quantities of miscellaneous other materials.

The design approach for the OSDF is presented in the document, *"Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2"* [DOE, 1995b]. The design of the OSDF, as currently developed, is presented in the *"Final Design Package, On-Site Disposal Facility"* [GeoSyntec, 1996a]. The design of the OSDF includes a liner system, impacted material placement, final cover system, leachate management system, surface-water management system, and other ancillary features.

The construction, impacted material placement, and closure of the OSDF is currently scheduled to occur over a period of approximately 7 years, as described in the Accelerated Remediation Plan. However, due to the potential for variations in the pace of remedial action activities, the OSDF has been designed to be constructed, filled, and closed in phases.

1.3 Plan Scope

The scope of this BAMR Plan is to identify the development, management, and restoration activities that the Subcontractor shall follow to ensure proper development of the borrow area in accordance with the design. Activities to be undertaken by the contractor before, during, and after borrow excavation occurs are discussed in this plan.

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1.4 Plan Organization

The remainder of this BAMR Plan is organized as follows:

- the design requirements applicable to this work plan are presented in Section 2;
- a description of the borrow area is presented in Section 3.0;
- borrow area operations are described in Section 4.0;
- the borrow area sequence of development is contained in Section 5.0 and;
- borrow activities at the OSDF footprint are described in Section 6.0.

1.5 Related Plans

Several other implementation plans have been prepared for the OSDF that contain information relevant to this BAMR Plan. Other plans of direct relevance to this BAMR Plan are listed below along with a brief statement of the relationship of the work plan to this plan:

- *OSDF Surface-Water Management and Erosion Control (SWMEC) Plan [GeoSyntec, 1996b]:* provides details of temporary and permanent erosion and sediment controls and surface-water controls for the borrow area;
- *Final Design Package [GeoSyntec, 1996a]:* provides project drawings and specifications that shall be followed during construction and;
- *OSDF Construction Quality Assurance (CQA) Plan [GeoSyntec, 1996c]:* provides soil testing standards and frequencies that will be implemented to evaluate soils from the borrow area.

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2.0 APPLICABLE REQUIREMENTS

2.1 Overview

Regulatory and other requirements applicable to the BAMR Plan are contained in the Design Criteria Package (DCP) for the OSDF. The DCP is contained within the overall OSDF Design Package [GeoSyntec, 1996a]. These requirements take the form of applicable or relevant and appropriate requirements (ARARs) and to be considered criteria (TBCs) as determined in by the record of decision for each of the various FEMP operable units, functional requirements, and general design criteria. There are no ARARs, TBCs, or functional requirements for the development of the borrow area. The general design criteria applicable to the BAMR Plan were obtained from the DCP.

2.2 General Design Criteria

The DCP identifies a number of general design criteria for the OSDF. The general design criteria that the Subcontractor shall meet in developing the borrow area:

- The borrow area should be laid out in a manner that provides easy ingress and egress.
- The borrow area shall be developed in a manner that requires minimal additional earthwork after borrow activities are complete to achieve the required restoration grades.
- Restoration shall be performed progressively as work is completed in portions of the borrow area.
- Erosion and sediment controls shall be implemented in the borrow area during construction and restoration.
- The borrow area shall be developed in a manner that produces consistent materials for construction of the OSDF and effectively utilizes the existing topography to control stormwater runoff and runon.
- Processing of borrow area soils shall be in accordance with the applicable requirements of the project specifications. Such processing includes moisture conditioning and screening.
- Before the start of construction in the borrow area, the following activities shall be performed:
    - establishment of temporary surface water management and erosion and sediment controls for the borrow area, including sediment basins;
    - establishment of soil processing facilities (if any are needed).

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3.0 BORROW AREA DESCRIPTION

3.1 Existing Conditions

The borrow area is located in the southeast portion of the FEMP south of the OSDF. It is bounded to the north by the relocated North Entrance Road, to the west by the South Entrance Road, to the south by Willey Road, and to the east by an oil pipe line easement. The total plan area of the borrow area is approximately 50 acres (20 hectares).

The existing topography at the borrow area is relatively flat with surface elevations ranging from 606 ft. to 575 ft. Surface water flows generally from east to west along slopes ranging from approximately one to eight percent. Surface water runoff crosses the South Entrance Road via three reinforced concrete pipe culverts and discharges ultimately to Paddys Run.

Perched ground-water potentiometric surfaces in the borrow area range from approximately 5 ft. to 15 ft. (1.5 m to 4.6 m) below the existing ground surface. Perched ground water potentiometric levels may locally approach the ground surface after periods of heavy precipitation. Perched ground water is expected to be present in sand and gravel lenses below this potentiometric surface and to extend from these depths to below the proposed finished grades of the borrow area.

The existing vegetative cover at the borrow area consists of long grasses in good condition.

3.2 On-Site Borrow Material

3.2.1 Uses for Borrow Soils

Material excavated from the borrow area will be used to construct several components of the OSDF liner and final cover system as well as compacted fill used in construction of temporary and permanent roads and other site work applications. The components of the liner and final cover system to be constructed from borrow area materials are (from bottom to top):

- compacted clay liner;
- compacted clay cap; and
- vegetative support layer.

The topsoil layer will be stripped from the borrow area and used for topsoil for the OSDF final cover system.

If needed, material from the borrow area will also be used to construct compacted fill, seasonal cover, the non-granular protective layer in the lining system and the contouring layer above the impacted materials, should sufficient volume of suitable impacted materials not be available for the construction of these components.

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3.2.2 Description of Borrow Area Soils

The soil profile at the borrow area consists of a clay-loam topsoil layer overlying a 10- to 18-foot (3-m to 5.5-m) thick brown till layer, overlying a 10- to 20-ft. (3-6 m) thick gray till layer. Brown till will be used to construct the earthwork components of the OSDF discussed in the previous section. The brown till layer is a lean clay to sandy lean clay with the following properties and characteristics:

- plasticity index (PI): 8 to 30
- clay content: 12 to 48 percent
- moisture content (in-situ): 10 to 28 percent
- percent saturation: 86 to 100 percent
- dry unit weight (in-situ): 102 to 130 lbs/ft^3

The plasticity index, clay content, and moisture content of the brown till tend to decrease with depth. The percent saturation and dry unit weight of the brown till tend to increase with depth. Geotechnical data obtained from previous field investigations conducted at both the borrow area and the OSDF are summarized in Appendix A.

Additional information on the geotechnical characteristics of the brown fill from the borrow area can be found in Parsons [1996].

It is anticipated that not all of the borrow area soils will be suitable for construction of the clay liner and/or clay cap. These unsuitable materials shall be separated as described in a later section of this report and used in the construction of the other OSDF and cover system components or general site work construction previously described.

3.2.3 Borrow Soils

Prior to constructing any OSDF cells, brown till at the OSDF footprint shall be excavated to the required grade in accordance with Section 02200 of the technical Specifications. The depth of excavation to subgrade at the OSDF footprint ranges from zero to 15 ft. A small portion of this excavated material will be impacted material requiring disposal in the OSDF. The remaining portion of this material will be used for construction of the compacted clay liner, if suitable, or other applicable components of the OSDF. Although the OSDF footprint is not within the limits of the borrow area, the procedures for removing and handling the material is similar to those procedures for materials excavated from the borrow area. Borrow activities associated with the OSDF footprint are, therefore, discussed in this plan (Section 6).

This BAMR assumes that impacted soil is removed from within the OSDF footprint prior to the start of excavation by the Subcontractor. If it is decided that impacted material will be removed concurrently with cell construction, this BAMR Plan shall be amended to reflect changes or additional work necessitated by the current activities.

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4.0 BORROW AREA OPERATIONS

4.1 General

Borrow area operations include activities that occur prior to, during, and after excavation of the borrow materials. These activities are presented in detail in the following sections. At the time this BAMR Plan was prepared, no impacted areas have been identified in the borrow area; thus, impacted material removal is not discussed in this plan. Should impacted material be identified in the borrow area, this BAMR Plan will either be amended to reflect changes or additional work necessitated by the presence of the impacted material.

4.2 Erosion and Sediment Controls

Erosion and sediment controls that shall be implemented at the borrow area include silt fence, straw bale barriers, sediment basin, drainage channels, and vegetation. These controls shall be implemented as required by Section 6 of the Specifications and the *OSDF SWMEC Plan*. The erosion and sediment controls shall be implemented as required to effectively divert surface water runon from active borrow sites within the borrow area, minimize sedimentation and erosion within the active borrow site, and collect and contain construction water within the area of active borrow. Erosion and sediment controls shall be established in the vicinity of each borrow site prior to the commencement of any soil disturbance in the borrow area.

The OSDF Subcontractor shall maintain the erosion and sediment controls in accordance with the Specifications and the *OSDF SWMEC Plan*.

4.3 Borrow Area Haul Road

The layout for the haul roads within the borrow area shall be planned prior to commencement of borrow activities. The Subcontractor may establish haul road layouts within the borrow area limits suitable for planned excavation sequence and for transportation of materials to the OSDF. Temporary drainage structures such as culverts and or drainage channels shall be established as necessary so that surface water is not impounded in anyway by the haul road. Any temporary drainage structure utilized by the Subcontractor shall be in accordance with the Specifications and the *OSDF SWMEC Plan*.

The subcontractor shall maintain the haul roads within the borrow area and haul road to the OSDF cell construction. Once established, fugitive emissions control of the borrow area haul roads shall be watered regularly.

4.4 Clearing and Grubbing

Clearing and grubbing shall take place in areas that will be stripped for borrow activities. Clearing and grubbing shall be performed in accordance with Section 02110 of the technical Specifications. Disposal, stockpiling, or reuse of cleared and grubbed material shall also be in accordance with Section 02110.

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4.5 Topsoil Removal and Stockpiling

Topsoil shall be stripped from the borrow area from an area no larger than 10 acres (4 ha). The thickness of the topsoil for stockpiling will be established by the Construction Manager (CM). The stripped topsoil shall be stockpiled at the Subcontractor's work area at a location designated by the Construction Manager that is easily accessible by the Subcontractor for maintenance. Topsoil stockpiling and stripping shall be in accordance with Section 02110 of the technical Specifications. The stockpiled topsoil shall either be temporarily seeded in accordance with Section 02930 of the technical Specifications or covered with a tarp. If a tarp is used, it shall be sufficiently anchored with sandbags or tires to resist uplift.

4.6 Borrow Activities

Borrow activities shall begin in the vicinity of the sediment basin and proceed upgradient. Material shall be excavated from the borrow area and transported to either the point of construction or the Subcontractor's soil stockpile area. Suitability of borrow material for clay liner and clay cap will be established by the CM with the CQC Consultant performing conformance testing. It is the responsibility of the Subcontractor to establish the suitability of all other borrow material for the proposed end use. The CQC Consultant will monitor and test soil used in construction for conformance with the Specifications based on the end use selected by the Subcontractor. Monitoring and testing by the CQC Consultant will be in accordance with the *OSDF CQA Plan*. The Subcontractor shall manage borrow materials in two separate stockpiles: one stockpile containing borrow material suitable for use as clay liner and clay cap, and one stockpile containing all other borrow material.

4.7 Borrow Area Restoration

As borrow activities continue, progressive restoration of the borrow area shall be implemented. As any active portion of the borrow area reaches final grade, it shall be permanently revegetated in accordance with Section 02930 of the Specifications. The maximum area of bare soil that may be exposed at any one time in the borrow area is 10 acres (4 ha). Once all portions of the borrow area within the contributory drainage area of a sediment basin are restored (*i.e.*, have established permanent vegetation), the sediment basin shall be decommissioned by removing the riser structure and 36-inch diameter portion of the culvert. The remaining 48-inch diameter culvert will remain as a permanent drainage structure. Decommissioning of the sediment basin shall be in accordance with the *OSDF SWMEC Plan*. Progressive restoration of the borrow area is discussed further in Section 5.0. Refer to Figure 5-1 for the approximate limits of the borrow area stages.

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5.0 SEQUENCE OF DEVELOPMENT

5.1 General

The borrow area shall be developed in two major stages in a manner that effectively utilizes the existing topography to control stormwater runoff and runon (see Figure 5-1). The dividing line between the two stages is an existing swale that crosses the borrow area in the east west direction located in the northern half of the borrow area. The area north of the existing swale represents the early stage of the borrow area and the area south of the existing swale represents the late stage of the borrow area. The development of these two stages are discussed further below.

5.2 Early Stage Development

The plan area of the early stage is approximately 21 acres (8 ha). The existing swale to the south of the early stage will intercept runon before it enters the early stage area and direct it to the existing 30-inch (0.8-m) diameter culvert at the South Entrance Road. The sequence of development for the early stage of the borrow area shall be as presented below.

1. Erosion and sediment controls shall be implemented in the vicinity of sediment basin and to the west of the South Entrance Road where a drainage channel in the borrow area will be constructed.

2. Clearing, grubbing and topsoil stripping operations shall take place in the vicinity of the sediment basin. These materials shall be handled as described in Section 4.4 (clearing and grubbing), or Section 4.5 (topsoil), as appropriate.

3. Construction of sediment basin shall begin. Construction activities include: (i) excavating for the sediment basin and removing the excavated materials as described in Section 4; (ii) excavating the culvert trench beneath the South Entrance Road (iii) seeding the base and side slopes of the sediment basin.

4. Concurrently with the construction of the sediment basin, an area suitable for establishing a soil processing operation, if needed, shall be established as described in Section 4.7.

5. The layout of the borrow area haul roads shall be planned and erosion and sediment controls shall be implemented in the vicinity of the haul roads and location of the first borrow site [not to exceed 10 acres (4 ha)] within the early stage of the borrow area.

6. Clearing, grubbing, and topsoil stripping of the borrow site shall occur as described in Section 4.4 (clearing and grubbing), or Section 4.5 (topsoil), as appropriate.

7. Borrow operations shall begin. Excavated material shall be hauled and stockpiled as described in Section 4.6. Excavation grades shall be established such that positive drainage to the sediment basin is maintained.

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8. Throughout excavation operations, the Subcontractor shall maintain erosion and sediment controls.

9. As final grades are reached within the active borrow site, the finished areas shall be promptly revegetated. Topsoil need not be placed over finished grades in cut areas but the finished subgrade shall be prepared in accordance Section 02930 of the Specifications.

10. As final grades are approached throughout the first active borrow site, and vegetation has been established over much of the site, the next borrow site within the early stage shall be planned, and Step Nos. 7 through 11 above shall be implemented for each subsequent borrow site within the early stage of the borrow area.

5.3 Late Stage Development

The plan area of the late stage is approximately 29 acres (12 ha). The finished grades of the early stage developed previously will direct stormwater runoff from the early stage away from the later stage. The sequence of development for the late stage of the borrow area shall be as presented below.

1. The layout of the borrow area haul roads shall be planned and erosion and sediment controls shall be implemented in the vicinity of the haul road and location of the first borrow site [not to exceed 10 acres (4 ha)] within the late stage of the borrow area. The Subcontractor shall minimize erosion and/or sedimentation in the completed early stage of the borrow area.

2. Clearing, grubbing, and topsoil stripping of the borrow site shall occur as described in Section 4.4 (clearing and grubbing), or Section 4.5 (topsoil), as appropriate.

3. Borrow operations shall begin. Excavated material shall be hauled and stockpiled as described in Section 4.6. Excavation grades shall be established such that positive drainage to relevant erosion and sediment controls is maintained.

4. Throughout excavation operations, the Subcontractor shall maintain erosion and sediment controls.

5. As final grades are reached within the active borrow site, the finished areas shall be promptly revegetated. Topsoil need not be placed over finished grades in cut areas, but the finished subgrade shall be prepared in accordance with Section 02930 of the Specifications.

6. As final grades are approached throughout the first active borrow site, and vegetation has been established over much of the site, the next borrow site within the late stage shall be planned, and Step Nos. 2 through 10 above shall be implemented for each subsequent borrow site within the late stage of the borrow area.

7. Once final grades are obtained throughout the late stage of the borrow area, and vegetation has been established over the entire late stage. The sediment basin shall be decommissioned in accordance with Section 02270 of the Specifications.

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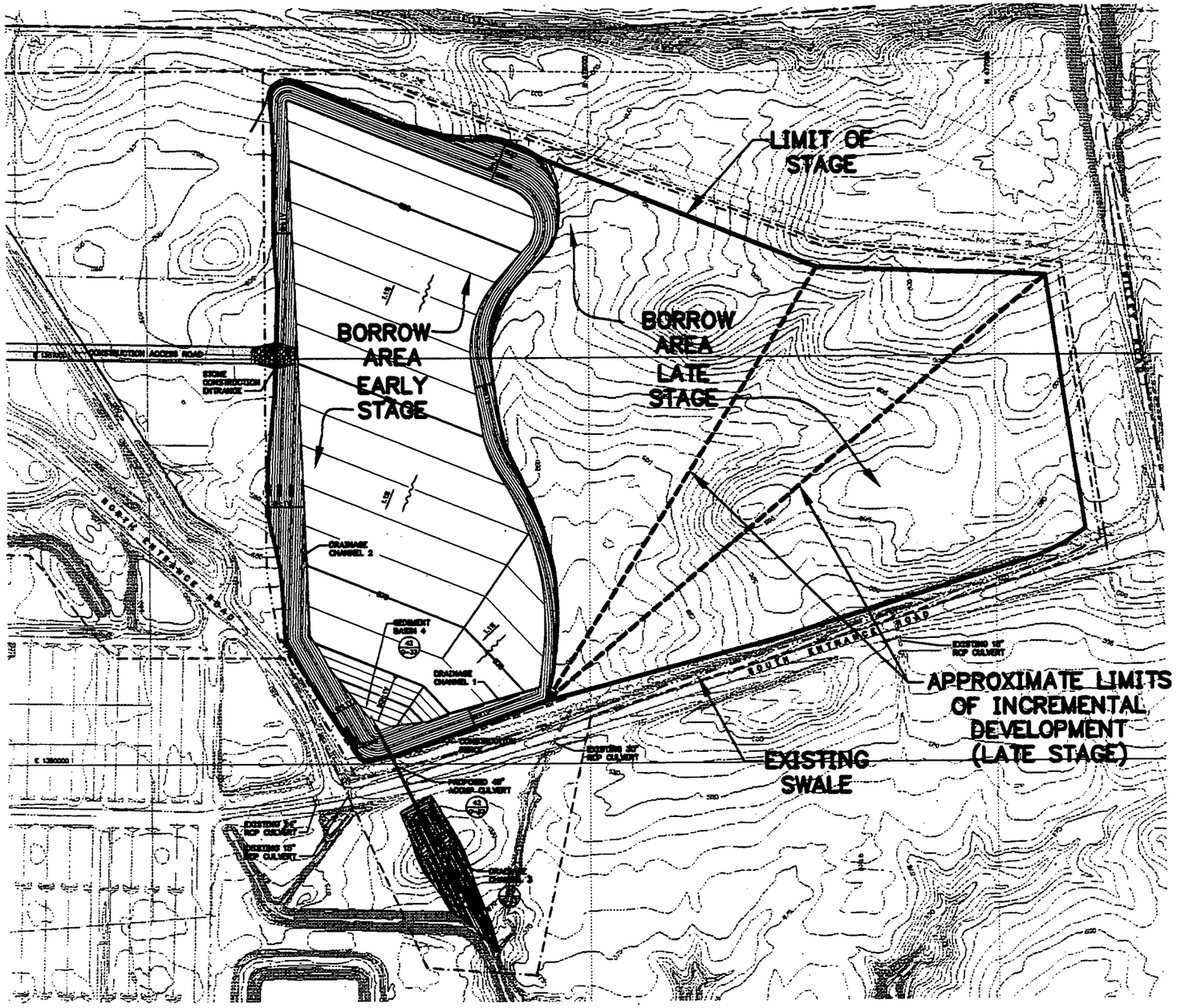

LEGEND

600	EXISTING GROUND ELEVATION (FEET)
570	FINISHED GRADE ELEVATION (FEET)
	BATTERY LIMIT
	FEMP PROPERTY LINE
	DRAINAGE FLOW DIRECTION
	DRAINAGE CHANNEL
	LIMIT OF BORROW AREA

0 300
SCALE IN FEET

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NOTES:

1. SEQUENCE OF CONSTRUCTION FOR BORROW AREA EARLY STAGE IS PRESENTED IN BORROW AREA MANAGEMENT AND RESTORATION (BAMR) PLAN.
2. DEVELOP BORROW AREA SO THAT, TO THE EXTENT POSSIBLE, RUNOFF FROM THE AREAS BEING DEVELOPED DRAINS TO SEDIMENT BASIN 4 AND RUNOFF FROM AREAS TO BE TO BE DEVELOPED IN THE FUTURE DRAINS TO THE EXISTING SWALE ON THE WEST SIDE OF THE SOUTH ENTRANCE ROAD.

GEOSYNTEC CONSULTANTS
ATLANTA, GA

PROJECT NO.	GE3900	FIGURE NO.	5-1
DOCUMENT NO.		FILE NO.	F96-G010

APPENDIX A

GEOTECHNICAL DATA

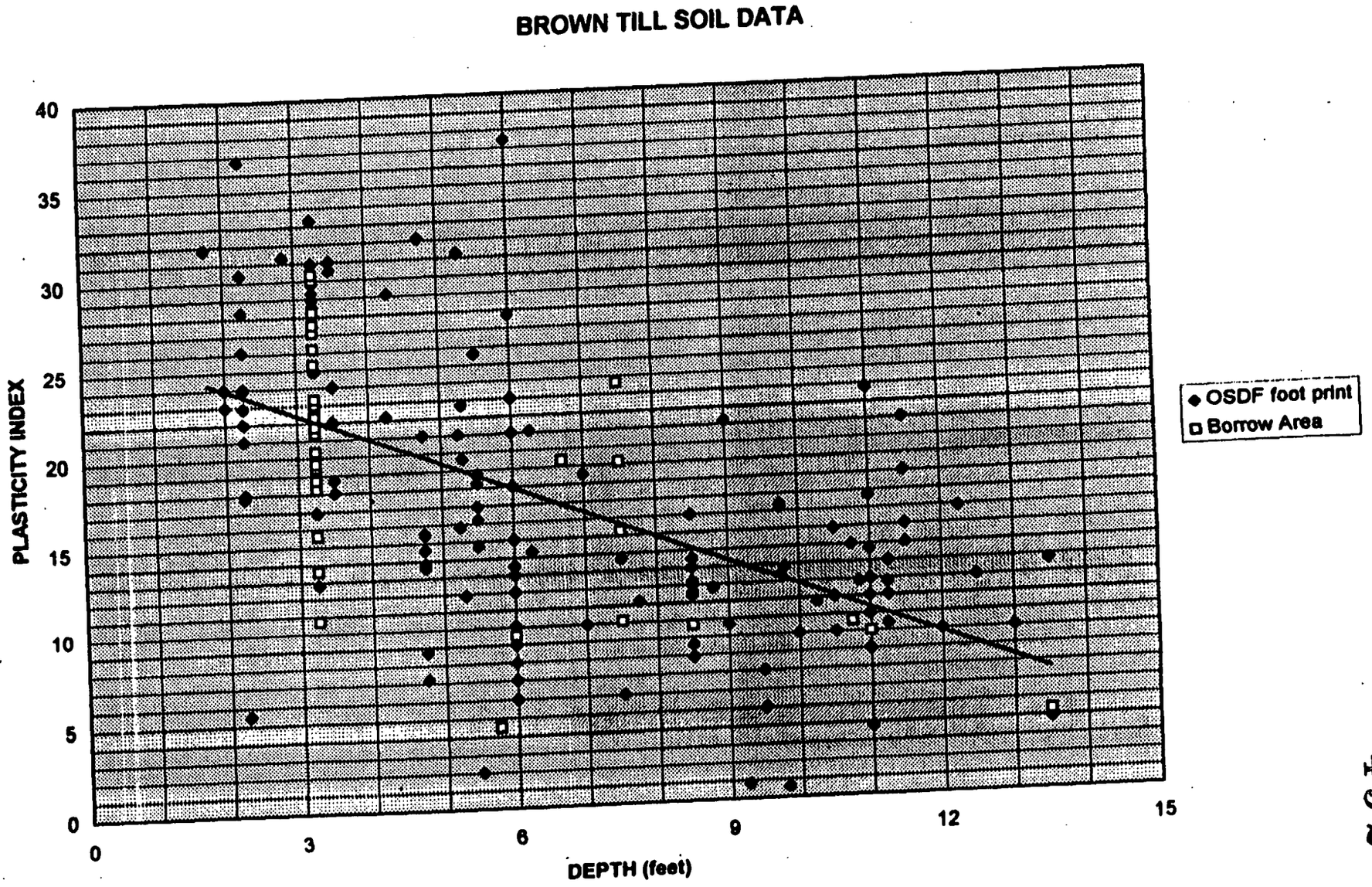


Figure 1. Brown Till Plasticity Index Data

[data obtained from Parsons, 1995 and 1996]

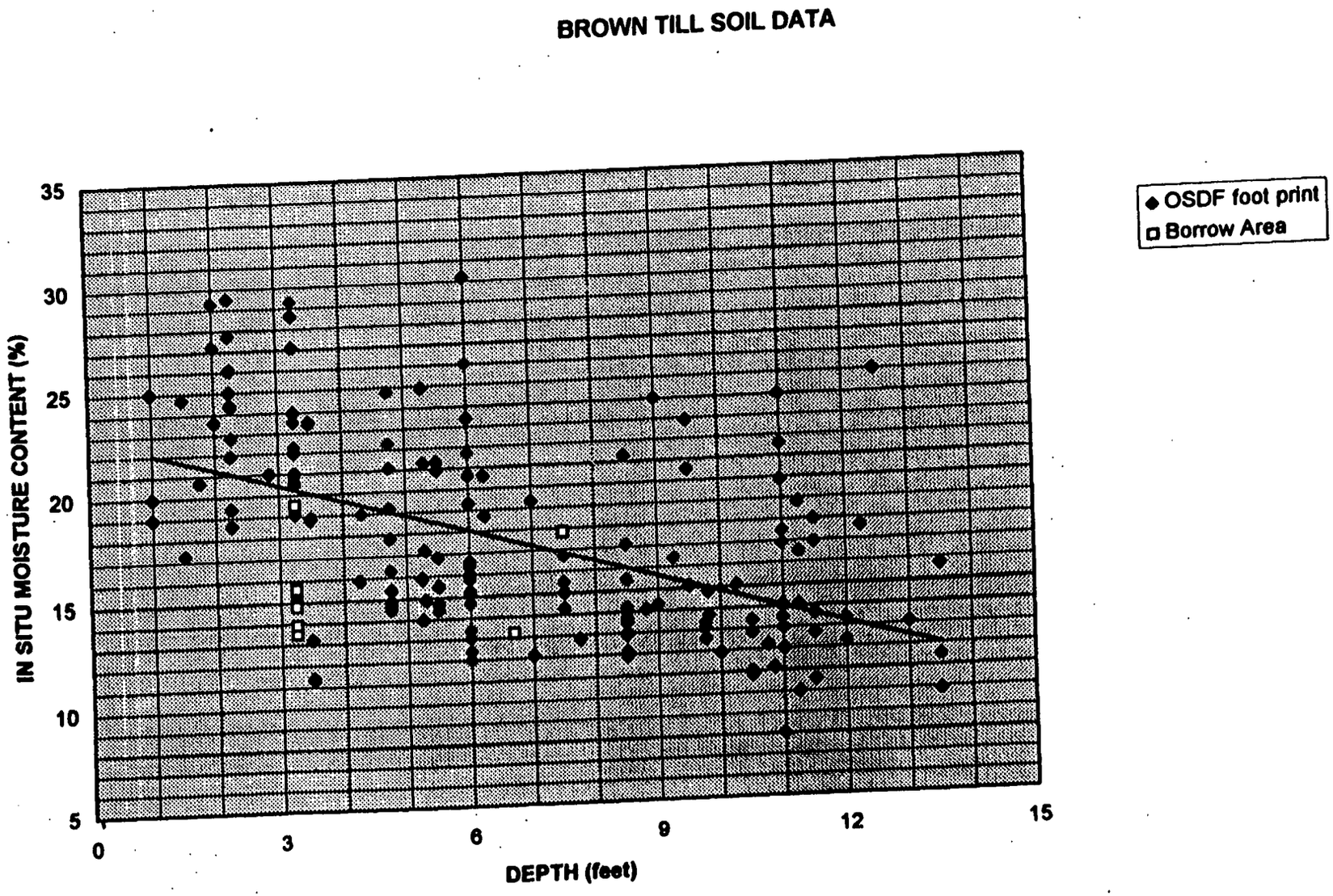
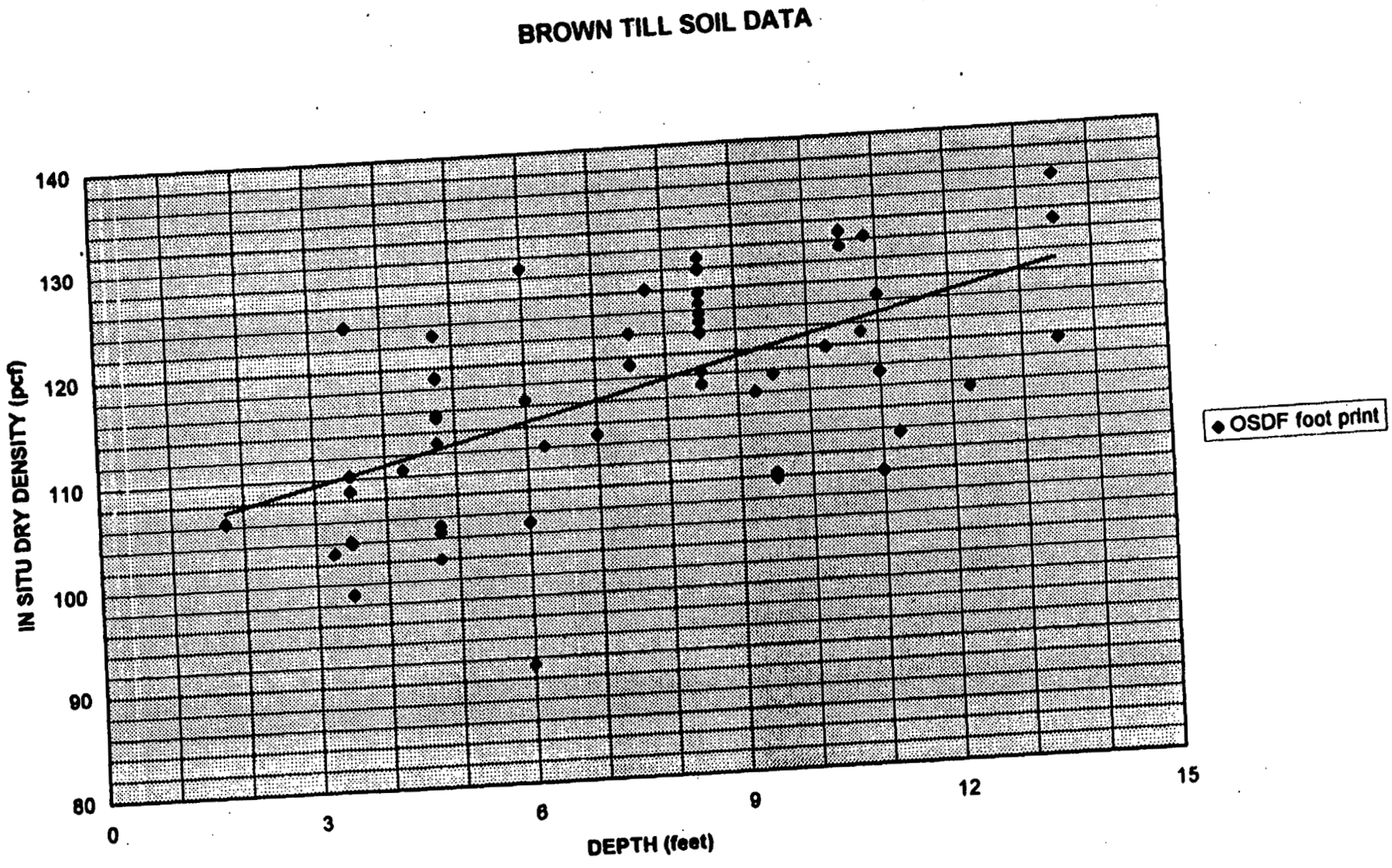


Figure 3. Brown Till In Situ Moisture Content Data

(data obtained from Parsons, 1995 and 1996)



[data obtained from Parsons, 1995]

Figure 5. Brown Till In Situ Dry Density Data

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6.0 BORROW ACTIVITIES AT THE OSDF FOOTPRINT

As discussed in Section 3.2.3, zero to 15 feet (0 to 4.6 m) of material will generally be removed from the OSDF foot print during excavation to OSDF cell subgrade elevation. The excavated material shall be used for construction of the compacted clay liner, if suitable, or other applicable components of the OSDF. The construction activities associated with this excavation are similar to those within the borrow area and are briefly described below.

Erosion and sediment controls, including sediment basins, shall be implemented in accordance with Section 02270 of the Specifications and the *OSDF SWMEC Plan*. Excavated materials shall be hauled to the point of construction or the soil stockpile area. Borrow activities shall be as described in Section 4.6 of this plan. It is anticipated that the Subcontractor will, to the extent possible, use excavated material from the OSDF footprint to construct compacted fill and compacted clay liner prior to obtaining material from the borrow area.

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7.0 REFERENCES

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Parsons, *"Geotechnical Investigation Report, On-Site Disposal Facility, Operable Unit 2, Project Order 140, Revision 0,"* prepared for FERMCO for the Fernald Environmental Management Project, Subcontract No. 2-21487, December, 1995.

Parsons, *"Preliminary Results of Borrow Area Sampling and Testing Program."*

U.S. Department of Energy (DOE), *"Final Record of Decision for Remedial Actions at Operable Unit 2,"* Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1995a.

U.S. Department of Energy (DOE), *"Final Remedial Design Work Plan for Remedial Actions at Unit 2"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1995b.

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SURFACE-WATER MANAGEMENT AND EROSION CONTROL PLAN

ON-SITE DISPOSAL FACILITY

20100-PL-004
Revision G
October 1996

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

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Atlanta, Georgia 30342

Under

Fernald Environmental Restoration Management Corporation
Subcontract 95PS005028

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ACRONYM LIST

ARAR	Applicable or Relevant and Appropriate Requirement
BSL	Biodenitrification Surge Lagoon
CFR	Code of Federal Regulations
CQA	Construction Quality Assurance
DCP	Design Criteria Package
DOE	United States Department of Energy
E&S	Erosion and Sediment
FEMP	Fernald Environmental Management Project
LCS	Leachate Collection System
LTS	Leachate Transmission System
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
ODNR	Ohio Department of Natural Resources
OSDF	On-Site Disposal Facility
OU2	Operable Unit 2
OU5	Operable Unit 5
ROD	Record of Decision
SWMEC	Surface Water Management and Erosion Control

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1.0 INTRODUCTION

1.1 Overview

This Surface-Water Management and Erosion Control (SWMEC) Plan describes the surface-water management and erosion control practices to be followed within the battery limit of the Fernald Environmental Management Project (FEMP) On-Site Disposal Facility (OSDF), Fernald, Ohio. The guidance provided in this document applies to the use of engineered features designed to manage surface water, minimize erosion, and control off-site sedimentation.

This plan addresses surface-water management and erosion control practices throughout the construction, impacted material placement, and closure of the OSDF. This plan does not address surface-water management and erosion control practices during or beyond the 30-year post-closure period prescribed in the *"Final Record of Decision for Remedial Actions at Operable Unit 2" (OU2 ROD)* [DOE, 1995a]. Those activities are addressed in the *OSDF Post-Closure Care and Inspection Plan.*

1.2 Project Description

The construction, impacted material placement, and closure of the OSDF is currently scheduled to occur over a period of approximately 7 years, as described in the Accelerated Remediation Plan. However, due to the potential for variations in the pace of remedial action activities, the OSDF has been designed to be constructed, impacted material placed, and closed in phases.

The design approach for the OSDF is presented in the document, *"Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2"* [DOE, 1995b]. The design of the OSDF as currently developed, is presented in the *"Final Design Package, On-Site Disposal Facility"* [GeoSyntec, 1996c]. The *"Final OSDF Design Criteria Package" (DCP)* for the OSDF, which is contained within the overall OSDF Design Package [GeoSyntec, 1996] component of the *Final Design Package* requires preparation of a SWMEC Plan to address the work scope identified in Section 1.3 of this plan. This SWMEC Plan also satisfies the applicable requirements identified in Section 2.0 of this plan.

1.3 Plan Scope

This SWMEC Plan establishes the surface-water management, erosion minimization, and sediment control practices that the Subcontractor shall follow to maintain the proper performance of the OSDF, and to minimize impacts to surrounding areas and stormwater conveyances from excessive sediment loading. The scope of this SWMEC Plan includes a description of the engineered features that will handle:

- Stormwater runon from outside the battery limit into the OSDF battery limit;
- Stormwater runoff from areas within the battery limit that will be discharged through the temporary and permanent drainage system of the OSDF; and
- Wastewater, which includes all waters that must be contained, collected, and ultimately discharged to the Biodenitrification Surge Lagoon (BSL).

Wastewater generated as a result of development of the OSDF area includes:

- Leachate from impacted material within each cell of the OSDF — leachate is defined to mean stormwater that percolates into the leachate collection system (LCS), and is discharged to the OSDF leachate transmission system (LTS); impacted material runoff retained within the OSDF cells may be pumped to the FEMP former production area storm drainage control system;

- Runoff from impacted-material staging areas within the OSDF battery limits; these wastewaters will be contained, collected, and discharged to the FEMP former production area storm drainage control system;

- Runoff from impacted-material haul roads within the OSDF battery limits; these wastewaters will be contained, collected, and discharged dependent on location of collection to the FEMP former production area storm drainage control system; and

- Perched ground water that seeps into excavations within the OSDF battery limits; these wastewaters will be contained, collected, and transferred to the FEMP former production area storm drainage control system.

The engineered features are described in Sections 4.0, 5.0 and 6.0 of this plan, in the Construction Drawings, and in the Project Specifications.

1.4 Plan Organization

The remainder of this SWMEC Plan is organized as follows.

- A description of the plans related to this SWMEC Plan is presented in the remainder of Section 1.0.

- The requirements from the OSDF DCP applicable to this SWMEC Plan are described in Section 2.0.

- General information regarding the development of the OSDF as it relates to this SWMEC Plan is presented in Section 3.0.

- Soil stabilization controls are described in Section 4.0.

- Runon/runoff controls are described in Section 5.0.

- Sediment controls are described in Section 6.0.

- References are presented in Section 7.0.

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1.5 Related Plans

Several other support plans have been prepared for the OSDF remedial action project and should be used in conjunction with this SWMEC Plan. The other plans containing information relevant to this SWMEC Plan are listed below with a brief statement of the relationship to this plan.

- *OSDF Impacted Materials Placement (IMP) Plan*. The *IMP Plan* contains the procedures that the Subcontractor shall use to place the impacted materials into the OSDF.

- *OSDF Borrow Area Management and Restoration (BAMR) Plan*. The *BAMR Plan* contains the procedures that the Subcontractor shall use to develop, manage, and restore the on-site borrow area.

- *OSDF Systems Plan*. The *Systems Plan* contains the procedures that the Subcontractor shall use to inspect and maintain the OSDF during construction, impacted material placement, and closure.

- *Final Design Package* [GeoSyntec, 1996]. This document provides project drawings and specifications that the Subcontractor shall follow during construction.

- *OSDF Construction Quality Assurance (CQA) Plan*. The *CQA Plan* contains procedures to evaluate soils compaction and other features of the OSDF liner and final cover system.

- *OSDF Post-Closure Care and Inspection (PCCI) Plan*. The *PCCI Plan* addresses inspection and maintenance of the surface-water management and erosion control features during the post-closure period.

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2.0 APPLICABLE REQUIREMENTS

2.1 Overview

Regulatory and other requirements applicable to this SWMEC Plan are contained in the *DCP* [GeoSyntec, 1996]. These requirements take the form of applicable or relevant and appropriate requirements (ARARs) and to be considered criteria (TBCs) as determined by the record of decision for each of the various FEMP operable units, functional requirements, and general design criteria. The following requirements applicable to the SWMEC Plan were obtained from the *DCP*.

2.2 Applicable or Relevant and Appropriate Requirements

ARARs that should be addressed by the Subcontractor are provided here.

No.	Title	Requirement
1.	Waste Storage Piles OAC 3745-56-51, 54 & 58, and 40 CFR §264.251 through .259	Collection and holding facilities associated with a runon and runoff control system must be inspected weekly and be emptied or otherwise managed expeditiously after storms to maintain design capacity of the system.
2.	Ohio Solid Waste Disposal Regulations OAC 3745-27-19(E)(26)	The integrity of the engineered components of the landfill facility shall be maintained and any damage to, or failure of, the components shall be repaired.
3.	Ohio Solid Waste Disposal Regulations OAC 3745-27-19(J)(1),(4)	Surface water shall be diverted from areas where solid waste is being, or has been, deposited. The facility shall be designed, constructed, maintained, and provided with surface water control structures, as necessary, to control runon and runoff of surface water to ensure minimal infiltration of water through the cover material and cap system, and minimal erosion of the cover material and cap system. If ponding or erosion occurs on areas of the landfill facility where solid waste is being, or has been, deposited, action will be taken to correct the conditions causing the ponding or erosion.
4.	Ohio Solid Waste Disposal Regulations OAC 3745-27-11(H)	At final closure of a landfill facility, all land surfaces shall be graded to prevent ponding of water where solid waste has been placed. Drainage facilities shall be provided to direct surface water from the landfill facility.
5.	Ohio Solid Waste Disposal Regulations OAC 3745-27-11(O)	Closure of the sanitary landfill facility must be completed in a manner that minimizes the need for further maintenance and minimizes post-closure formation and release of leachate and explosive gases to surface water to the extent necessary to protect human health and the environment.

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2.3 Functional Requirements

The *DCP* contains a variety of functional requirements that have been established for the OSDF. The functional requirements that the Subcontractor shall meet applicable to the SWMEC Plan are:

- route surface water to designated locations where it can be appropriately managed;
- protect the OSDF from damage caused by precipitation and stormwater runon and runoff; and
- discharge surface water to existing watercourses in accordance with applicable regulatory and DOE requirements.

The Subcontractor shall develop a surface water management system that performs in a manner that meets the project requirements for both temporary conditions (*i.e.*, during construction, impacted material placement, and closure of the OSDF) and long-term conditions (*i.e.*, after closure of the OSDF). The system shall prevent stormwater runon to the OSDF and uncontrolled stormwater and wastewater runoff from the OSDF. Features of the long-term surface-water management system shall be constructed to require minimal monitoring and maintenance. The system shall be integrated, to the extent possible, with existing topography, features, and facilities.

2.4 General Design Criteria

The *DCP* also identifies a number of general design criteria for the OSDF. The Subcontractor shall incorporate these criteria in its plan to manage stormwater and control erosion. The applicable general design criteria are:

- Temporary erosion and sediment (E&S) control features for the OSDF shall be designed for the 25-year, 24-hour storm event [ARARs: 40 CFR §258.26 and OAC 3745-27-08(C)(6)(a) and (b)];
- Temporary E & S control features shall be designed to minimize silting and scouring [ARAR: OAC 3745-27-08(C)(6)(c)];
- Temporary sediment ponds or basins, if used, shall be designed following the criteria of OEPA [ARAR: OAC 3745-27-08(C)(6)(d)];
- Long-term E&S control features for the OSDF shall be designed for the 2,000-year, 24-hour storm event (design criterion for assumption of a DOE Performance Category 2 facility); and
- Long-term runon/runoff control structures for the OSDF shall be designed to limit interruption and damage (*i.e.*, washout) of the OSDF in the 2,000-year, 24-hour storm event (design criterion for assumption of a DOE Performance

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Category 2 facility); runon should be controlled and diverted away from and around the OSDF using swales, channels, or diversion berms.

2.5 Other Requirements

In addition to the requirements contained in the DCP, the Subcontractor shall incorporate the following other requirements into the plan to manage stormwater and control erosion:

- Disturbed areas shall be stabilized (*i.e.*, vegetated) after the area has been constructed to final grade;
- General practices for construction, inspection, and maintenance of erosion and sediment control features shall be as recommended by the Ohio Department of Natural Resources (ODNR) Division of Soil and Water Conservation document entitled *"Rainwater and Land Development"* [ODNR, 1996]; and
- Temporary sediment basins shall be cleaned out to the design capacity when the sediment retained in the basin has reduced one-half of the basin's original storage depth [ODNR, 1996].

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3.0 OSDF DEVELOPMENT RELATED TO SURFACE-WATER MANAGEMENT AND EROSION CONTROL

3.1 Introduction

The OSDF is anticipated to be developed in stages (*e.g.*, early, middle, and final). In general, each stage consists of the construction of disposal cells, placement of impacted material in the disposal cells, closure of the disposal cells. For the purposes of managing surface water and controlling erosion, each development stage is sub-divided as follows:

- preconstruction period;
- cell construction period;
- impacted material placement period; and
- closure period.

In addition, surface-water management and erosion control is anticipated to be maintained throughout the OSDF post-closure period; however, as stated previously in Section 1.1 of this plan, post-closure activities are outside the scope of this plan and will be addressed in a separate forthcoming plan.

In the remainder of the section, a description of the surface-water management and erosion control features needed for each of the aforementioned development periods is presented. The construction, inspection, and maintenance activities for the surface-water management and erosion control features are presented in the remaining sections of this plan.

3.2 Preconstruction Period

The preconstruction period is defined as the period of time prior to all construction. During this period, disturbed areas shall be kept to a minimum. Erosion prevention and sediment control deemed necessary by the Subcontractor shall be provided prior to earth disturbance. The first line of defense in minimizing soil erosion and sedimentation is the establishment of soil stabilization features. The following soil stabilization features shall be implemented during the pre-construction period:

- In disturbed areas where additional grading or reworking is not scheduled for more than 45 days, temporary seeding and mulching will be applied to exposed soils within 7 days to stabilize soil and minimize erosion;

- Where additional grading or reworking is not scheduled for a year or more, disturbed areas will be permanently seeded and mulched as soon as possible to stabilize soil and reduce erosion; and

- Riprap will be applied within and along watercourses to prevent soil erosion under the design flow conditions.

Stormwater runon/runoff control measures shall be established to minimize erosion and off-site sedimentation. These features shall also be used to divert stormwater away from contaminated areas, thus

maintaining separation between clean and potentially contaminated water. Runon to areas under construction shall be prevented by constructing runon diversion dikes and channels to route water to a natural watercourse. The location of these features shall be selected by the Subcontractor based on the sequence of construction activities.

The following runon/runoff control features may be used during the pre-construction period:

- temporary sediment basins;
- temporary drainage channels;
- check dams;
- temporary diversions;
- silt fence; and
- culverts.

Runoff from undisturbed areas shall be diverted from running on to the disturbed areas using temporary drainage channels, culverts, and temporary diversions.

Runoff from disturbed areas shall be diverted to a temporary sediment basin using temporary drainage channels, culverts, and temporary diversions.

3.3 Cell Construction Period

The cell construction period will include the excavation and construction of the OSDF disposal cells. The soil stabilization, runon/runoff control, and off-site sedimentation features used during this period will be the same as those used for the pre-construction period. The location of these features shall be selected by the Subcontractor based on the sequence of construction activities.

Wastewater encountered during the cell construction period will be limited to perched ground water. Perched ground water that enters the OSDF excavation shall be collected in a toe drain, or other suitable sump, and pumped or otherwise transferred to the FEMP former production area storm drainage control system.

3.4 Impacted Material Placement Period

The impacted material placement period includes placing impacted material in the cells. Features to manage surface water and control erosion and offsite sedimentation will be the same as those features used during the construction of the OSDF. The locations of these features shall be selected by the Subcontractor based on the sequence of construction activities.

In addition to these features, the leachate management system will be employed to contain leachate and impacted material runoff within the cells of the OSDF. These wastewaters shall percolate into the LCS and shall be discharged to the LTS or pumped to the FEMP former production area storm drainage control system. Specifically, wastewaters that will be encountered in the cell filling period of the OSDF should be managed as follows.

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- *Leachate*. All precipitation or other water that falls into an active (*i.e.*, in the process of having impacted material placed in accordance with the *IMP Plan*) OSDF cell and percolates into the cell LCS will be considered leachate. Placement of impacted material in OSDF cells shall be performed such that runoff from active and open portions of a cell can be managed within the cell. Runoff from the impacted material retained within the OSDF cells may be pumped to the FEMP former production area storm drainage control system.

- *Impacted Runoff*. Runoff from impacted material staging areas and haul roads should drain to sumps or impacted runoff sediment control structures. Runoff from the staging area shall be discharged to the FEMP former production area storm drainage control system. Runoff from impacted material haul roads within the battery limit should be contained, and allowed to flow by gravity, to the FEMP former production area storm drainage control system.

3.5 Closure Period

The closure period includes construction of the OSDF final cover system and the long-term surface-water management system. Features of the final cover system that may discharge stormwater to the permanent drainage structures includes the drainage layer and final cover surface.

The permanent drainage channels, which are located at the perimeter of the OSDF, are shown on the Construction Drawings.

During construction of the final cover system, the surface-water management and erosion and sediment control measures used during the cell construction period will remain in place as much as feasible.

3.6 Post-Closure Period

As stated previously in Section 1.1, this plan does not address surface-water management and erosion control practices during or beyond the post-closure period as they are outside the scope of this plan; those activities are addressed in the *OSDF Post-Closure Care and Inspection Plan*.

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4.0 SOIL STABILIZATION

4.1 Introduction

A description of the construction, inspection, and maintenance of the soil stabilization features for both temporary and long-term conditions are presented in this section. These features include:

- temporary seeding and mulching;
- permanent seeding and mulching; and
- riprap.

The construction, inspection, and maintenance of these control features shall be based on standard engineering and soil conservation practices. The methods presented in this section are taken from the ODNR document entitled *"Rainwater and Land Development"* [ODNR, 1996]. The Subcontractor shall be prepared to implement other methods to control erosion of sediment at the site as deemed necessary by the Construction Manager.

4.2 Temporary Seeding and Mulching

4.2.1 Definition

Temporary seeding and mulching are common soil stabilization measures that serve to hold soil in place until permanent cover is provided at the time of final grading. Temporary seeding establishes a temporary vegetative cover on disturbed areas by seeding with the appropriate rapid growing plants and is essential to preserve the integrity of earthen structures used to control sediment, such as temporary diversion dikes and the banks and dams of sediment basins. Mulching involves the application of plant residues and other suitable materials to the soil surface and protects against rain, wind, and sun while seeds are germinating and helps to ensure a vegetative stand.

4.2.2 Purpose

The Subcontractor shall apply temporary seeding to:

- Reduce the erosion and sedimentation by stabilizing disturbed areas that will not be brought to final grade for a year or less;
- Reduce problems associated with mud or dust from bare soil surfaces during construction; and
- Reduce sediment runoff to downstream areas and improve the visual aspects of the construction area.

The Subcontractor shall apply mulch to:

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- Inhibit erosion by protecting the soil surface from raindrop impact and reducing the velocity of overland flow; and

- Foster the growth of vegetation by increasing available moisture and providing insulation against extreme heat and cold.

4.2.3 Application

The Subcontractor shall apply temporary seed and mulch to soil surfaces where additional grading or reworking is not scheduled for a period of 45 days to less than one year.

Temporary seeding and mulching shall be applied in accordance with Section 02930 of the Project Specifications.

4.2.4 Maintenance

Where seeding does not establish as expected, the Subcontractor shall reseed and mulch the area within 3 weeks. The cause of the failure should be ascertained and corrected by the Subcontractor before reseeding. Physical conditions such as soil conditions may be unfavorable, resulting in the failure, and may require an alternative approach and/or type of cover. Areas requiring reseeding shall be prepared in the same manner as the original installation. Once established, a regular maintenance program will be performed.

The Subcontractor shall inspect applied mulch periodically, particularly after rainstorms, to check for rill erosion. Where erosion is observed, the Subcontractor shall apply additional mulch. Nets used to anchor mulch shall also be inspected after rainstorms for dislocation or failure. If washouts or breakage occur, reinstall nets as necessary after repairing damage to the slope. Inspections should take place until grasses are firmly established.

Additional temporary seeding and mulching planning considerations and design criteria are provided in *"Rainwater and Land Development"* [ODNR, 1996].

4.3 Permanent Seeding and Mulching

4.3.1 Definition

Permanent seeding and mulching shall be applied to establish permanent vegetation when an area has been brought to final grade and will not be subjected to disturbance for a year or more.

4.3.2 Purpose

The Subcontractor shall apply seeding and mulching to:

- Reduce erosion and decrease sediment yield from overland flow;

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- Permanently stabilize disturbed areas in a manner that is economical, adaptable to site conditions, and allows selection of the most appropriate plant materials; and

- Stabilize drainage channels where concentrated flow occurs.

4.3.3 Application

The Subcontractor shall apply permanent seeding and mulching to:

- Disturbed areas where permanent, long-lived vegetative cover is needed to stabilize the soil; and

- Rough graded areas which will not be brought to final grade for a year or more.

Permanent seeding and mulching shall be applied in accordance with Section 02930 of the Project Specifications.

4.3.4 Maintenance

Maintenance for permanent seeding and mulching shall be performed in accordance with Section 4.2.4.

4.4 Riprap

4.4.1 Definition

Riprap is an erosion-resistant ground cover consisting of large, loose, angular stone installed wherever soil conditions, water turbulence and velocity, expected vegetative cover, etc., are such that soil may erode under design flow conditions.

4.4.2 Purpose

The Subcontractor shall place riprap to:

- Protect the soil surface from the erosive forces of concentrated runoff;

- Slow the velocity of concentrated runoff while enhancing the potential for infiltration; and

- Stabilize slopes with seepage problems and/or erosive soils.

The Subcontractor shall calculate the size and areal extent of the riprap based on surface-water calculations performed in accordance with Section 2.0 of the SWMEC Plan.

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4.4.3 Application

The Subcontractor shall place riprap at soil-water interfaces where the soil conditions, water turbulence and velocity and, expected vegetative cover are such that the soil may erode under the design peak flow conditions. Typical uses of riprap may be at storm drain outlets, on channel banks and/or bottoms, within drainage channels, or at the toe of slopes.

The Subcontractor shall place riprap in accordance with the following minimum guidelines:

- Riprap used at channel transitions shall extend upstream and downstream of the transition a distance of five times the downstream channel depth; the minimum extension should be 15 ft (4.5 m).
- Riprap used at culvert exits shall have a minimum width of 4 ft. wider than the pipe diameter and a minimum width based on calculated peak flow velocities using Figure 2-3 of ODNR [1996].
- Geotextiles shall be used to control piping and erosion beneath riprap in temporary facilities. Geotextiles shall meet the requirements of Section 02714 of the Project Specifications.

"Rainwater and Land Development" [ODNR, 1996] should be consulted for additional design criteria and planning considerations.

4.4.4 Maintenance

Once riprap has been installed it should require little maintenance though the Subcontractor shall periodically inspect riprapped areas to determine if high flows have caused scour beneath the riprap or dislodged any of the stone. If repairs are needed, the Subcontractor shall accomplish such repairs within the same work day.

4.5 Construction Entrance

4.5.1 Definition

A construction entrance is a stabilized pad of aggregate over a geotextile base and is used to reduce the amount of mud tracked off-site with construction traffic.

4.5.2 Purpose

The Subcontractor shall use a construction entrance:

- where construction vehicles leave active construction areas;
- at all points of egress to public roads; and

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- where frequent vehicle and equipment ingress/egress is expected.

4.5.3 Application

The Subcontractor shall build construction entrances in accordance with ODNR [1996, page 158].

4.5.4 Maintenance

The Subcontractor shall inspect the construction entrances on a weekly basis, and after rainstorms. The Subcontractor shall follow the maintenance guidelines provided in ODNR [1996, page 158].

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5.0 RUNON/RUNOFF CONTROLS

5.1 Introduction

A description of the construction, inspection, and maintenance of the runon/runoff control features for both temporary and long-term conditions are presented in this section. These features include:

- temporary diversions;
- temporary drainage channels;
- permanent drainage channels;
- check dams; and
- culverts.

The construction, inspection, and maintenance of these control features shall be based on standard engineering and soil conservation practices. The methods presented in this section are taken from the ODNR document entitled *"Rainwater and Land Development"* [ODNR, 1996]. The Subcontractor shall be prepared to implement other methods to control erosion of sediment at the site as deemed necessary by the Construction Manager.

5.2 Temporary Diversions

5.2.1 Definition

Temporary diversions consist of an earth channel constructed across the slope. Adjoining the channel and on the lower side of the slope, a berm is constructed from material taken from the channel to help divert and contain flow in the channel. A detail of a temporary diversion is illustrated in ODNR [1996, page 156].

5.2.2 Purpose

In general, temporary diversions are intended to prevent erosion. This is accomplished by diverting water (overland sheet flow) from areas where the water may cause erosion to areas where the water can be used or disposed safely.

The Subcontractor shall use temporary diversions to:

- Divert stormwater runon away from contaminated areas of the OSDF;
- Divert stormwater runoff away from unprotected slopes to a stabilized outlet;
- Divert sediment-laden runoff from a disturbed area to a temporary sediment basin; and
- Shorten the flow length within a long sloping drainage area.

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5.2.3 Application

The Subcontractor shall construct temporary diversions in areas where runoff from higher-lying areas have the potential to damage or is damaging: (i) lower-lying areas; (ii) cut or fill slopes or steeply sloping land; (iii) critical sediment source areas; and (iv) active gullies or other erodible areas.

Temporary diversions shall have stable outlets. The Subcontractor shall stabilize the diversions throughout its planned life. Guidelines for stability are provided in ODNR [1996, page 156]. Temporary check dams may be used in conjunction with other stabilizing methods. Diversions are not recommended below high sediment-producing areas unless land treatment practices or structural measures, designed to prevent damaging accumulations of sediment, are installed with or before the diversions. The Subcontractor shall locate the temporary diversions according to outlet condition, topography, land use, soil type, and length of slope. Temporary diversions must be located so that water will empty on established water disposal areas, a stable watercourse, waterway, or structure.

5.2.4 Maintenance

The Subcontractor shall regularly inspect and maintain temporary diversions as follows:

- Check for points of scour or bank failure, rubbish or channel obstruction, rodent holes, breaching or settling of the berm, excessive wear from pedestrian or construction traffic;
- Repair damage and remove deposits or sediment from the diversion; and
- Restabilize as needed.

If no sediment protection is provided, the Subcontractor shall periodically clean out accumulated sediment.

5.3 Temporary Drainage Channels

5.3.1 Definition

A temporary drainage channel is a natural or constructed channel or outlet shaped or graded to convey runon and runoff. The channel may have a protective lining of vegetation or erosion-resistant materials such as concrete, riprap, erosion mat, or grass.

All temporary drainage channels shall have stable outlets with adequate capacity for the designed peak flow. The outlet must discharge in such a manner as not to cause erosion. Outlets should be constructed and stabilized prior to the operation of the temporary drainage channels.

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5.3.2 Purpose

The Subcontractor shall construct temporary drainage channels to provide for the conveyance of excess surface water from diversions and other erosion and sediment control measures, or natural concentrations of flow without causing erosion or flooding.

5.3.3 Application

The Subcontractor shall construct temporary drainage channels as needed to manage runon and runoff and to control erosion resulting from concentrated runoff. Temporary drainage channels shall be designed based on surface water calculations performed in accordance with Section 2.0 of the SWMEC Plan. Whenever possible, temporary drainage channels shall be used in such a way that preserves the existing and permanent drainage systems. Temporary drainage channels shall generally be located in existing and permanent drainageways where water can drain in from all sides. In all situations, channels shall be located so that they do not make sharp, unnatural changes in direction of flow.

The proposed locations for temporary drainage channels shall be selected by the Subcontractor based on its sequence of construction activities. Supplemental measures, such as check dams may be used in conjunction with temporary drainage channels.

5.3.4 Maintenance

The Subcontractor shall inspect and maintain the temporary drainage channels in accordance with the following:

- Inspection shall be frequent and repairs shall be made promptly as needed.
- All temporary drainage channels shall be inspected immediately (*i.e.*, that work day, or the first work day) after each rainfall event and at least once each work day during prolonged rainfall. Necessary repairs to channels shall be made promptly.
- Temporary drainage channels shall be kept clear of debris at all times.
- The protective lining vegetation or erosion-resistant materials shall be maintained as built to prevent undermining, scour, or deterioration.

5.4 Permanent Drainage Channels

5.4.1 Definition

Permanent drainage channels consist of a series of channels designed for conveying runon and runoff away from the OSDF. Details of the permanent drainage channels are shown on the Construction Drawings. The Construction Drawings also show the proposed location of the permanent drainage channels for the OSDF.

5.4.2 Purpose

The permanent drainage channels shall be used to divert stormwater runon and runoff from damaging the OSDF final cover system.

5.4.3 Application

The Subcontractor shall construct the permanent drainage channels at the perimeter of the OSDF as shown on the Construction Drawings. The permanent drainage system shall divert runoff from abutting land north and east of the facility and rejoin the existing drainage channels north and south of the FEMP former production area. The permanent drainage system shall be installed in phases as the OSDF is constructed and closed.

5.4.4 Maintenance

The Subcontractor shall inspect and maintain permanent drainage channels in accordance with the following:

- Inspection shall occur periodically to ensure that the channels are free-flowing and not clogged with sediment or debris.
- Permanent drainage channels shall be kept clear of debris at all times.
- The protective lining of vegetation or erosion-resistant materials shall be maintained as built to prevent undermining, scour, or deterioration.

5.5 Check Dams

5.5.1 Definitions

Check dams consist of a section of rocks placed at the inlet, along the length or at the outlet of a drainage feature. A detail illustrating a constructed check dam is provided in ODNR [1996, page 133].

5.5.2 Purpose

Check dams may be installed in temporary diversions and temporary and permanent drainage channels to reduce erosion.

5.5.3 Application

The Subcontractor shall install check dam in accordance with ODNR [1996, page 133].

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5.5.4 Maintenance

The Subcontractor shall inspect and maintain check dams in accordance with the following:

- Inspection shall occur periodically to ensure that the structures have not been damaged by high energy flows. Repairs shall be made promptly, as needed.
- All check dams shall be inspected immediately (*i.e.*, that work day, or the first work day) after each rainfall event and at least once each work day during prolonged rainfall. Necessary repairs shall be made promptly.
- Check dams shall be maintained as built.

5.6 Culverts

5.6.1 Definition

Culverts are temporary or permanent structures used to convey stormwater beneath a road or other embankment.

5.6.2 Purpose

The Subcontractor shall install culverts to provide:

- Temporary means to convey stormwater under construction and operation-related roads; and
- Permanent means to convey stormwater under OSDF access roads.

5.6.3 Application

The Subcontractor shall install temporary culverts as needed to manage runon and runoff. The Subcontractor shall design temporary culverts based on surface water calculations performed in accordance with Section 2.0 of the SWMEC Plan. Temporary culverts shall also be designed to withstand construction traffic loading. The size and locations of permanent culverts are shown on the Construction Drawings.

5.6.4 Maintenance

The Subcontractor shall inspect and maintain the culverts as follows:

- Periodic inspection shall be performed to ensure that the culverts are clear and not damaged.

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- Maintenance shall be performed as needed in a timely manner to ensure that culverts are functioning as designed. This shall include removal and disposal of any trapped sediment or debris.

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6.0 SEDIMENT CONTROL

6.1 Introduction

A description of the construction, inspection, and maintenance of the sediment control features for both temporary and long-term conditions are presented in this section. These features are:

- silt fences; and
- temporary sediment basins.

The construction, inspection, and maintenance of these control features should be based on standard engineering and soil conservation practices. The methods presented in this section are taken from the ODNR document entitled *"Rainwater and Land Development"* [ODNR, 1996]. The Subcontractor shall be prepared to implement other methods to control erosion of sediment at the site as deemed necessary by the Construction Manager.

6.2 Silt Fences

6.2.1 Definition

A silt fence is a temporary sediment barrier constructed of posts and filter fabric. The filter fabric is stretched across and attached to the supporting posts and is entrenched. The silt fence is placed on the level contour of the land near the toe of a slope. It can also be placed in a minor drainage way to intercept and detain sediment and decrease flow velocities from drainage areas of limited size.

6.2.2 Purpose

The Subcontractor shall use silt fences to:

- Intercept and detain small amounts of sediment from disturbed areas during construction operations in order to prevent sediment from leaving the site; and
- Decrease the velocity of sheet flows and low-to-moderate level channel flows.

6.2.3 Application

The Subcontractor shall install silt fences on the downslope side of areas to be disturbed until permanent drainage and erosion control structures are established. The silt fence shall be placed on the level contour of the land near the toe of the slope. A silt fence should not be placed directly at the toe of the slope if it is at all possible to place it several (preferably at least five feet horizontal distance) away. Criteria for establishing silt fence locations is provided on ODNR [1996, page 119].

Under no circumstances shall the Subcontractor install silt fences in streams or in channels where flows are likely to exceed 1 cubic foot per second (cfs).

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6.2.4 Maintenance

The Subcontractor shall inspect and maintain all silt fences in accordance with the following.

- Daily inspection of the silt fence to identify areas that require repair or removal of accumulated sediment.

- Silt fences shall be inspected immediately (*i.e.*, that work day, or the first work day) after each rainfall and at least once each work day during prolonged rainfall. Any required repairs shall be made within the same work day.

- Accumulated silt and debris shall be removed from behind the face of the silt fence when the silt fence deposits reach approximately one-half the height of the fence.

- If runoff overtops the silt fence, flows under or around the ends, or in any other way becomes a concentrated flow, one of the following shall be performed as appropriate: (a) change the layout of the silt fence, (b) remove the accumulated sediment, or (c) install a different erosion and sediment control measure.

- Sediment deposits should be removed after each rainfall event (*i.e.*, that work day, or the first work day after the rainfall event).

- The expected usable life of a silt fence is 6 months. Should the fabric on a silt fence decompose or become ineffective prior to the end of the expected usable life and the fence is still necessary, the fabric shall be replaced promptly.

- Any sediment deposits remaining in place after the silt fence is no longer required shall be dressed to conform with the existing grade, prepared, and seeded.

6.3 Temporary Sediment Basins

6.3.1 Definition

A temporary sediment basin is a structure designed to catch and store sediment and other waterborne debris.

6.3.2 Purpose

Temporary sediment basins are constructed downgradient of construction activities. Sediment basins are not 100 percent effective in trapping sediment which flows into them. Therefore, they should be used in conjunction with erosion control measures such as temporary seeding, mulching, diversions, etc. to reduce the

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amount of sediment flowing into the basin. Temporary sediment basins shall receive only stormwater runoff, not wastewater.

6.3.3 Application

The Subcontractor shall construct temporary sediment basins in accordance with plans and specifications to be provided by the Construction Manager. Temporary sediment basins will be located to intercept the largest possible amount of runoff from the disturbed areas. Temporary sediment basins shall be removed within 36 months after its construction or after the exposed areas are adequately protected against erosion by vegetative or mechanical means as directed by the Construction Manager.

Removal of a temporary sediment basin shall consist of:

- draining the sediment basin of all water;
- removing the sediments from the basin;
- removing primary and emergency spillways and appurtenances
- grading the sediment basin to the lines and grades provided by the Construction Manager; and
- revegetating disturbed areas

6.3.4 Maintenance

The Subcontractor shall inspect and maintain the temporary sediment basins. Inspections shall be performed following rainstorms. Regular maintenance shall include repair of eroded areas, replacement of vegetation or riprap around the basins, repair of damaged or clogged spillways in the basins, and removal of sediment from the basins. Sediment shall be removed from the basins when the sediment has filled one-half the basin's original depth.

6.4 Final Cover System

6.4.1 Definition

The final cover system of the OSDF shall consist of a layered combination of natural material (soil/rock) and synthetic components. A detail of the final cover system is shown in the Construction Drawings. The surface of the compacted materials shall be shaped/prepared for placement of the capping system. This system will include a composite cap overlain by the following layers:

- drainage layer — placed above the composite cap to collect and convey water infiltrating the capping system with direct discharge to the permanent drainage system;

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- biointrusion layer — a biointursion barrier placed above the drainage layer to provide long-term protection from burrowing animals and vegetative root intrusion;

- granular filter layer — placed above the biointrusion layer to separate the vegetative zone from the biointrusion layer and prevent loss of the soil from the vegetative zone into the biointrusion layer;

- vegetative soil layer — consisting of a minimum of 6 in. of topsoil overlaying a minimum of 12 in. of soil suitable to support vegetative growth of sufficient thickness to maintain proper moisture control within the plant root zone; and

- topsoil — surface cover/vegetation to provide, to the extent feasible, protection against erosion.

6.4.2 Purpose

The final cover system has been designed to satisfy the following general conditions:

- isolate impacted material in the OSDF;
- protect the OSDF from inadvertent intrusion;
- promote vegetative growth;
- limit infiltration into the facility after closure; and
- minimize requirements for long-term inspection, maintenance, and repair.

6.4.3 Application

The final cover system shall be constructed when the waste in the OSDF has reached its design elevation. The exterior side slopes will be closed as soon as possible after the planned vertical extent of waste is achieved for each phase of placement activities.

In anticipation of a "seasonal" shutdown (*e.g.*, winter weather), the facility will be graded to promote proper drainage. Exposed surfaces will be covered with a layer of soil. An extended shutdown of the facility (greater than one year) may necessitate partial closures. In the event of an extended shutdown, a partial closure will be implemented, thus creating a cell within the overall OSDF. All slopes will be graded in compliance with applicable standards, then capped with the barrier layer, drainage layer, and vegetative zone.

6.4.4 Maintenance

The OSDF final cover system shall be maintained in accordance with the *OSDF Systems Plan*.

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7.0 REFERENCES

GeoSyntec Consultants (GeoSyntec), *"Final Design Package, On-Site Disposal Facility, Fernald Environmental Management Project"*, GeoSyntec Consultants, Atlanta, GA, 1996.

Ohio Department of Natural Resources (ODNR), *"Rainwater and Land Development: Ohio's Standards for Stormwater Management, Land Development and Urban Stream Protection, Second Edition"*, ODNR Division of Soil and Water Conservation, Columbus, Ohio, 1996 [FORMERLY U.S. Department of Agriculture-Soil Conservation Service (USDA-SCS), *"Water Management and Sediment Control in Urbanizing Areas"*, U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C., 1987].

U.S. Department of Energy (DOE), *"Final Record of Decision for Remedial Actions at Operable Unit 2"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1995a.

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CULTURAL RESOURCE UNEXPECTED DISCOVERY PLAN

ON-SITE DISPOSAL FACILITY

20100-PL-005
Revision G
October 1996

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

Fernald Environmental Management Corporation
Fernald, Ohio
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ACRONYM LIST

CFR	Code of Federal Regulations
DOE	Department of Energy
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
NAGPRA	Native American Graves Protection and Repatriation Act
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
OHPO	Ohio Historic Preservation Office
OSDF	On-Site Disposal Facility
SSOP	Site Standard Operating Procedure

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1.0 PURPOSE/SCOPE

The Department of Energy (DOE) recognizes its stewardship responsibilities for managing cultural resources at the Fernald Environmental Management Project (FEMP) site and on other lands that are impacted by the FEMP site. In recognizing that responsibility, DOE and its contractors are taking a proactive approach to acknowledge the cultural and scientific value of cultural resources at the FEMP site, and identifying, avoiding if possible, and mitigating when necessary, any cultural resources affected by actions at the FEMP site.

This plan provides a method to ensure compliance with the National Historic Preservation Act (NHPA), Native American Graves Protection and Repatriation Act (NAGPRA), and other applicable cultural resource regulations in the event Fernald Environmental Restoration Management Corporation (FERMCO) personnel, sub-contractor personnel and/or any other persons working or assisting with the conduct of a project (performing any ground disturbing activity) discover a cultural resource/historic property[1].

2.0 BACKGROUND

The FEMP site and surrounding area are located within a 4.8 kilometer- (3 mile-) wide subterranean valley formed as a result of Pleistocene glaciation. The remaining glacial outreach made the valley's soil rich for farming. The FEMP site and surrounding area are also located near the Great Miami River, which provided a source of water for early residents. Historically, these combined factors made the FEMP site and surrounding area desirable as a settlement place. As a result of this desirability, the area is rich with diverse cultural resources.

Cultural resource investigations (Phase I and II) were conducted in the area of the On-Site Disposal Facility (OSDF) and its support operations prior to any ground disturbing activities. During the Phase I investigations, twenty-three (23) archeological sites were identified. Nineteen of the sites (33Ha646 through 33Ha664) were located in Hamilton County; the remaining four sites (33Bu487 through 33Bu490) were located in Butler County. Three of the sites were designated as historic, and 20 were prehistoric. Two of the historic sites (33Ha654 and 33Bu487), and four of the prehistoric sites (33Ha646, 33Ha647, 33Ha650, and 33Ha662) were recommended as potentially eligible for inclusion in the National Register of Historic Places (NRHP). The other 17 were not recommended as eligible.

A Phase II investigation was conducted on the six sites that were recommended as potentially eligible for the NRHP. The investigation involved shovel testing and test unit excavations. A subsurface feature at each of the two sites (33Ha646 and 33Ha662) was sectioned and proved to be prehistoric hearths. Some additional historic features were also identified at sites 33Bu487 and 33Ha654.

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[1] cultural resource, or historic property means any prehistoric or historic district, site, building, or object included in, or eligible for inclusion in the National Register of Historic Places; term includes things such as artifacts, records, and human remains which are related to such district, site, building, structure, or object. Appropriate subcontractors will be trained to recognize if a cultural resource has been encountered during excavation activities (Section 5.0 of this plan).

Based on the findings of the Phase II investigation, it was determined that 33Bu487, 33Ha647, and 33Ha648 were not eligible for the NRHP. However, sites 33Ha646, 33Ha654 and 33Ha662 retain the integrity and possess the scientific value capable of yielding data important to either the prehistory or history of the region. These three sites were designated as sites requiring Phase III or data recovery to ensure the safe removal and/or recording of the cultural resources identified. The Phase III activities will be completed prior to any construction activities in the area of these sites designated as potentially eligible for the NRHP.

3.0 PROCEDURAL RESPONSIBILITIES

In the event that a remedial action affects an unidentified cultural resource, project staff will ensure safe handling of any cultural resource by isolating the affected area until an emergency on-call (within 4 hours) contractor can perform data recovery as necessary; a contract is in place for this potential event and has been utilized during installation of the public water supply. The DOE will consult with the appropriate parties (*e.g.*, Ohio Historic Preservation Office) pursuant to 36 Code of Federal Regulations (CFR) Part 800 to determine an appropriate course of action as necessary. DOE will avoid and minimize any adverse impacts to the extent practicable. The following discussion of is an overview of responsibilities if such an event occurs (refer to EP-0003, "Unexpected Discovery of Cultural Resources, Rev. 1").

3.1 Responsibilities

3.3.1 Responsible Field Representative

- Stops work upon discovery of a cultural resource (see Section 5.0)
- Notifies FERMCO Cultural Resource Coordinator upon discovery of a cultural resource
- Completes and signs Unexpected Cultural Resource Discovery Form (with assistance from the FERMCO Cultural Resource Coordinator)

3.1.2 FERMCO Cultural Resource Coordinator

- Notifies FERMCO Natural Resource Department Manager of unexpected cultural resource discovery
- Completes and signs Prehistoric/Historic Assessment Report
- Assists in completion and signs Unexpected Cultural Resource Discovery Form
- Coordinates mitigation

3.1.3 FERMCO Natural Resource Management Department Manager

- Notifies DOE-FEMP of unexpected cultural resource discovery
- Coordinates mitigation
- Completes documentation (Prehistoric/Historic Assessment Report)

3.1.4 DOE-Fernald Cultural Resource Point of Contact

- Notifies the Ohio Historic Preservation Office (OHPO) of unexpected cultural resource discovery

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- Negotiates mitigation
- Notifies FERMCO of authorization to proceed with work

3.2 NAGPRA

In the event that a human remain or associated funerary object, unassociated funerary object, sacred object, or object of cultural patrimony is discovered during ground disturbing activity (*e.g.*, excavation of a disposal cell), the appropriate Native American tribes would be consulted in order to expedite removal of the remains and/or objects. While this consultation would be taking place, the DOE must cease activity in the immediate area and make a reasonable effort to secure the remains and/or objects. Work stoppage in the immediate area could last up to 30 days.

4.0 APPLICABLE DOCUMENTS

4.1 Drivers

- National Historic Preservation Act (NHPA)
- Native American Graves and Repatriation Act (NAGPRA)
- Archeological Resources Protection Act of 1979
- American Indian Religious Freedom Act
- 36 CFR Part 800
- 43 CFR Part 10

4.2 References

- Unexpected Discovery of Cultural Resources, EP-0003, Rev. 1
- NAGPRA (25 U.S.C. Section 3000)

5.0 TRAINING

Subcontractors will be trained (*e.g.*, how to recognize a cultural resource), as needed, to this plan. Additionally, this plan will be included in any pertinent procurement packages in order for the subcontractor to accurately estimate potential down time.

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CONSTRUCTION QUALITY ASSURANCE PLAN

ON-SITE DISPOSAL FACILITY

October 1996
Revision G

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

GeoSyntec Consultants
1100 Lake Hearn Drive, NE, Suite 200
Atlanta, Georgia 30342

Under

Fernald Environmental Restoration Management Corporation
Subcontract 95PS005028

ACRONYM LIST

ALARA	As Low As Reasonably Achievable
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society of Testing and Materials
BAMR	Borrow Area Management and Restoration
CCM	Construction Manager
COE	Corps of Engineers
CQC	Construction Quality Assurance
CQC	Construction Quality Control
CS	Confirmatory Sampling
CSS	Construction Safety and Security
DCP	Design Criteria Package
DOE	United States Department of Energy
DOT	Department of Transportation
FEMP	Fernald Environmental Management Project
FTMS	Federal Testing Method Standards
HDPE	High Density Polyethylene
IMP	Impacted Materials Placement
NSF	National Sanitation Foundation
O&M	Operations and Maintenance
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSDF	On-Site Disposal Facility
OU1	Operable Unit 1
OU2	Operable Unit 2
OU3	Operable Unit 3
OU4	Operable Unit 4
OU5	Operable Unit 5
PE	Polyethylene
QA	Quality Assurance
QC	Quality Control

RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SWMEC	Surface Water Management and Erosion Control
TPP	Test Pad Program
USEPA	United States Environmental Protection Agency
WAC	Waste Acceptance Criteria

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1. INTRODUCTION

1.1 Overview

This Construction Quality Assurance (CQA) Plan describes the quality assurance and construction quality control (CQC) activities that will be undertaken during construction of the On-Site Disposal Facility (OSDF) at the Fernald Environmental Management Project (FEMP) near Fernald, Ohio. The purpose of this document is to define the scope, formal organization, and procedures necessary to achieve a high level of quality in the OSDF and assure that OSDF components are constructed in compliance with the approved Construction Drawings and Technical Specifications. This plan addresses the CQA and CQC activities to be performed during construction of the OSDF.

The OSDF CQA plan will address the following elements of the OSDF construction:

- general earthwork;
- liner system;
- final cover system;
- leachate collection, leak detection, and transmission systems;
- electrical and mechanical work; and
- other general site work.

The quality assurance and quality control monitoring and testing procedures, along with the required frequency of tests, are provided. Also detailed in this plan are the organization and minimum qualifications the CQC personnel and other key parties to

be involved in the construction of the OSDF as well as the minimum standards for construction testing and documentation to assure quality.

1.2 Project Description

The design approach for the OSDF is presented in the document, "*Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2*". The design of the OSDF, as currently developed, is presented in the "*Prefinal Design Package, On-Site Disposal Facility*". The OSDF Design Criteria Package (DCP) component of the Prefinal Design Package requires preparation of a CQA Plan to address, at a minimum, the following;

- construction of the double composite liner system;
- construction of the leachate management system;
- construction of the final cover system; and
- general site work including installation of various appurtenances such as general earthwork, mechanical and electrical systems, and concrete.

This CQA Plan presented in this document has been prepared to address these items and to satisfy the applicable requirements identified in Section 2 of this plan. The interface of the CQA Plan with other related plans is discussed in Section 1.6.

1.3 Major Components of the OSDF

The major components of the OSDF include the liner system, final cover system, leachate management system, surface-water management system, support elements, utilities, and temporary support facilities.

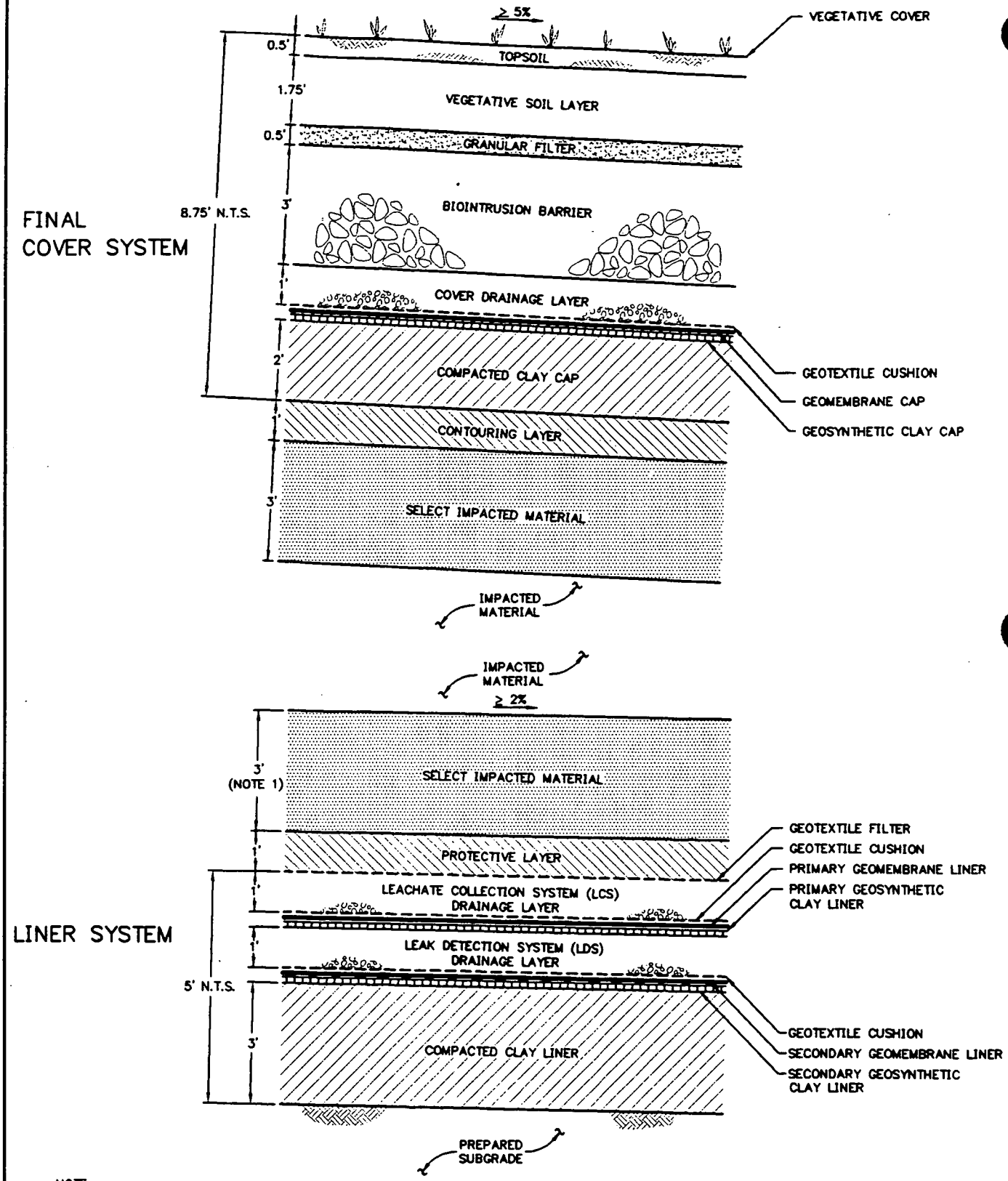
- *Liner and Final Cover Systems.* The liner and final cover systems will be constructed using both soil and geosynthetic components (refer to Figure 1-1). The liner system consists of a double-composite liner that will have a leachate collection system (LCS) above the primary liner and a leakage detection system (LDS) between the primary and secondary liners. The final cover system includes a composite cap overlain by the following layers: drainage layer; biointrusion barrier; granular filter layer; vegetative soil layer; and topsoil.

- *Leachate Management System.* The leachate management system collects leachate generated by the OSDF and conveys it to a treatment facility. Components of the leachate management system within the battery limit include: double-walled gravity drain pipes from each OSDF cell, detection and collection manholes, double-walled gravity transmission pipe, and permanent lift station.

- *Surface-Water Management System.* The surface-water management system manages surface water under both short-term (i.e., during construction and impacted material placement) and long-term (i.e., after OSDF closure) conditions. The design addresses stormwater runon and runoff, perched ground water, other construction waters, and wastewaters from various sources such as the equipment decontamination facility.

- *Support Elements and Utilities.* Both permanent and temporary support elements are included in the OSDF design. Permanent support elements include survey benchmarks, a perimeter access corridor, and a facility access road. Temporary support elements include construction security fencing, administrative support facilities, equipment decontamination facility, impacted material staging areas, temporary haul roads and construction materials stockpile areas. Utilities include electrical, water, telephone, and wastewater lines for the administrative support areas. The administrative support offices are also provided with parking, security fencing, and all-weather ingress and egress.

LINER AND COVER SYSTEM DESIGN
ON-SITE DISPOSAL FACILTY



NOTE:

1. SELECT IMPACTED MATERIAL THICKNESS ABOVE LINER SYSTEM MAY BE DECREASED TO 2 FEET IF THE FIRST LIFT OF MATERIAL TO BE PLACED OVER THE SELECT IMPACTED MATERIAL CONSISTS OF SOIL OR RELATIVELY SMALL SIZE DEBRIS THAT CAN BE PLACED IN CONTROLLED LIFTS.

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GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FIGURE NO.	1-1
PROJECT NO.	GE3900-16.4
DOCUMENT NO.	F9650002.CDG
FILE NO.	F95C001.DWG

1.4 CQA Plan Scope

The CQA Plan establishes the quality assurance and quality control procedures and monitoring requirements to be implemented during construction of the OSDF. The CQA Plan was developed to conform the Ohio Environmental Protection Agency (OEPA) requirements (ARAR: OAC 3745-27-08(F)) and relevant U.S. Environmental Protection Agency (USEPA) guidance. The scope of the CQA Plan includes:

- defining the responsibilities of parties involved with the construction of the OSDF;
- providing guidance in the proper construction of liner and cover system components;
- establishing testing protocols for the evaluation of lining and cover system components;
- establishing procedures for construction documentation; and
- providing the means for assuring that the facilities constructed conform to the Applicable or Relevant and Appropriate Requirements (ARARs), specifications, and construction drawings.

The CQA Plan is intended to give guidance to the CQC Consultant and the Subcontractor during the construction of the OSDF and to supplement the specifications of the OSDF Construction Subcontract. This plan is part of the construction subcontract. In the case of any conflicts between the CQA procedures described in this plan and the requirements of the project specifications, the specifications will govern.

It should be noted that the scope of this CQA Plan does not cover procedures for CQA/CQC for placement of impacted materials into the OSDF. CQA/CQC procedures

for placement of impacted materials into the OSDF are contained in the *Impacted Materials Placement Plan*.

1.5 CQA Plan Organization

The remainder of this CQA Plan is organized as follows:

- other OSDF plans related to this CQA Plan are summarized in the remainder of Section 1;
- the requirements from the OSDF DCP applicable to the CQA Plan are presented in Section 2;
- the definitions of key terms are presented in Section 3;
- the project organization and definitions, responsibilities, and qualifications of key parties involved with the construction of the OSDF are presented in Section 4;
- the requirements for CQC documentation are described in Section 5;
- the CQC activities for the soil components of the OSDF lining and final cover systems and general earthwork are presented in Section 6;
- the CQC activities for geomembranes, geosynthetic clay liner, and geotextiles are presented in Sections 7 through 9 respectively;
- the CQC activities for the installation of HDPE manholes, pipes, fittings, and valves are presented in Section 10;

- the CQC activities for appurtenant work items such as mechanical and electrical systems, and concrete appurtenances are described in Sections 11 and 12, respectively;

- the CQC activities for road construction are presented in Section 13; and

- the CQC activities for general site work are presented in Section 14.

1.6 Related Plans

Several other plans have been prepared for the OSDF and contain information relevant to the CQA Plan. These other plans are listed below along with a brief statement of the relationship of the plan to this CQA Plan.

- *OSDF Impacted Materials Placement (IMP) Plan*. The *IMP Plan* contains information regarding the placement, compaction, and testing of impacted materials within the OSDF.

- *OSDF Systems Plan*. The *Systems Plan* contains information regarding the OSDF and various support elements and utilities.

- *OSDF Surface-Water Management and Erosion Control (SWMEC) Plan*. The *SWMEC Plan* addresses stormwater runon and runoff and various aspects of erosion and sediment control.

- *OSDF Borrow Area Management and Restoration (BAMR) Plan*. The *BAMR Plan* addresses the development, operation, and subsequent restoration of the on-site borrow area.

- *OSDF Remedial Action Work Plan*. The plan identifies the implementation strategy and schedule for completion of construction of the OSDF.

2. APPLICABLE REQUIREMENTS

2.1 Overview

Regulatory and other requirements applicable to the CQA Plan are contained in the DCP. These requirements take the form of Applicable or Relevant and Appropriate Requirements (ARARs) for the various FEMP operable units, functional requirements, and general design considerations. The following requirements applicable to the CQA Plan were obtained from the DCP.

2.2 Applicable or Relevant and Appropriate Requirements

Various ARARs provide criteria for the selection and installation of materials to be used in the OSDF liner and final cover systems. Many of the CQA standards described herein were derived from the Ohio Administrative Code (OAC) 3745-27-08. Specific criteria for the OSDF are presented in the following sections.

2.2.1 Liner System

The function of the liner system is to isolate impacted material from the environment while containing and collecting leachate generated by the material. As shown on Figure 1-1, the liner system will contain two liners (i.e., primary and secondary liners), separated by a leak detection system, with the primary liner overlain by a leachate collection system (ARAR: 40 CFR § 265.301(a)). Both the primary and secondary liners will consist of a geomembrane overlying a geosynthetic clay liner; in addition, the components of the secondary liner will be underlain by a 3-ft (0.9-m) thick layer of compacted, low-permeability clay (i.e., a clay with a hydraulic conductivity not more than 1×10^{-7} cm/s (ARAR: OAC 3745-27-08(C)(1)(j)(ii)).

2.2.1.1 Compacted Clay Liner

The compacted clay liner shall satisfy the requirements of OAC 3745-27-08(C)(1). Specifically, the compacted clay liner shall be constructed:

- using loose lifts 8 in. thick, or less, to achieve uniform compaction; each lift shall have a maximum hydraulic conductivity of 1 x 10^{-7} cm/s (ARAR: OAC 3745-27-08(C)(1)(a));

- of a soil with a maximum clod size of 3 in., or half the compacted lift thickness, whichever is less (ARAR: OAC 3745-27-08(C)(1)(b)); and

- of a soil with:

  - 100 percent of the particles having a maximum dimension not greater than 2 in.;
  - not more than 10 percent of the particles, by weight, having a dimension greater than 0.75 in.;
  - not less than 50 percent of the particles, by weight, passing through the standard U.S. No. 200-mesh sieve; and
  - not less than 25 percent of the particles, by weight, having a maximum dimension not greater than 0.002 mm (ARAR: OAC 3745-27-08(C)(1)(c)).

As part of the OSDF design, a compacted clay liner test pad program (TPP) was conducted using soil obtained from the area of OSDF excavation. During the TPP, two test pads were constructed using equipment and techniques that are suitable for use in construction of the OSDF clay liner and cap. Laboratory and field permeability testing was performed during the TPP to define the compaction conditions that yield a soil liner or cap with a hydraulic conductivity of not greater than 1 x 10^{-7} cm/s. The TPP was organized to comply with the requirements set forth in OAC 3745-27-08(C)(1)(m).

The results of the TPP, including all laboratory and field hydraulic conductivity test results from the program, are presented in a report entitled *Test Pad Program Final Report*. This report specifies construction equipment types and construction procedures that result in a compacted clay liner satisfying the hydraulic conductivity performance criterion of OAC 3745-27-08(C)(1). The report is available for reference by the Subcontractor and should be consulted for the information contained therein.

During construction of the OSDF liner system, a detailed CQA program must be implemented in accordance with OAC 3745-27-08(F). The CQA activities will include moisture/density testing of soil liner materials at the frequency required by OAC 3745-27-08(C)(1)(o) (i.e., no less than five tests per acre per lift) to verify that the compaction conditions are consistent with those established during the TPP, and monitoring activities in accordance with 40 CFR § 264.303(C). In so doing, a high level of assurance will be provided that the hydraulic conductivity of the soil liner material is not greater than 1×10^{-7} cm/s.

In addition to the foregoing, the compacted clay liner shall:

- be compacted to at least 95 percent of the maximum standard Proctor dry density (ASTM D 698), or at least 90 percent of the maximum modified Proctor dry density (ASTM D 1557) (ARAR: OAC 3745-27-08(C)(1)(d));

- be compacted at a moisture content at or wet of optimum (ARAR: OAC 3745-27-08(C)(1)(e));

- not be comprised of solid waste (ARAR: OAC 3745-27-08(C)(1)(f));

- be constructed using the number of passes and lift thickness, and the same or similar type and weight of compaction equipment, used to obtain acceptable results during the soil liner test pad program (ARAR: OAC 3745-27-08(C)(1)(g));

- be placed on the bottom and excavated exterior slope of the OSDF and have a minimum bottom slope of 2 percent and a maximum slope based on: (i) compaction equipment limitations; (ii) slope stability; (iii) maximum shear strength between soil-geosynthetic and geosynthetic-geosynthetic interfaces; and (iv) resistance of geosynthetics and geosynthetic seams to tensile stresses (ARAR: OAC 3745-27-08(C)(1)(h));

- be constructed on a prepared surface that is: (i) free of debris, foreign material, and deleterious material; (ii) be able to bear the weight of the OSDF without causing or allowing a failure of the compacted clay liner to occur through settling; and (iii) without abrupt changes in grade that could cause damage to the geosynthetics (ARAR: OAC 3745-27-08(C)(1)(i)); and

- be adequately protected from damage due to desiccation, freeze/thaw cycles, wet/dry cycles, and the intrusion of objects during construction, filling, and closure (ARAR: OAC 3745-27-08(C)(1)(l)).

OAC 3745-27-08(D)(1) indicates that the following conformance tests shall be performed on representative samples of the clay to be used for liner construction at a frequency not less than one test per 1,500 yd^3 of soil, except for the hydraulic conductivity testing, which shall be performed at a frequency not less than one test per 10,000 yd^3:

- hydraulic conductivity on specimens compacted to achieve the conditions described in the construction specifications;

- moisture content and dry density using an approved ASTM method;

- grain size distribution using the test method ASTM D 422 for sieve and hydrometer analyses; and

- Atterberg limits using the test method ASTM D 4318.

2.2.1.2 Geosynthetic Clay Liner

The geosynthetic clay liner (GCL) shall satisfy the requirements of OAC 3745-27-08(C)(3). Specifically, the GCL shall:

- be negligibly permeable to fluid migration (interpreted herein to require that the GCL have a maximum a hydraulic conductivity of 5×10^{-9} cm/s);
- be installed having a minimum overlap of 6 in., or, for end of panel seams, a minimum overlap of 12 in. (overlap shall be increased in accordance with manufacturers specifications or to account for shrinkage due to weather conditions);
- have a bentonite mass per unit area of at least one pound per square foot;
- be installed in accordance with the manufacturer's specifications in regard to handling, overlap, and the use of granular or powdered bentonite to enhance bonding at the seams; and
- be constructed above the compacted clay liner.

2.2.1.3 Geomembrane Liner

The geomembrane component of the liner and final cover systems shall satisfy the requirements of OAC 2745-27-08(C)(2). Specifically the geomembrane shall:

- be placed on a GCL which has been previously placed over a compacted clay liner (ARAR: OAC 3745-27-08(C)(2));
- be manufactured of at least 60-mil thick high density polyethylene (ARAR: OAC 3745-27-08(C)(2));

- be protected from the drainage layer by a cushion layer (ARAR: OAC 3745-27-08(C)(2));

- be negligibly permeable to fluid migration (ARAR: OAC 3745-27-08(C)(2)(a));

- be physically and chemically resistant to attack by solid waste, leachate, or other materials which may come in contact with the geomembrane (ARAR: OAC 3745-27-08(C)(2)(b));

- be seamed to allow no more than negligible amounts of leakage; the seaming material shall be physically and chemically resistant to attack by solid waste, leachate, or other materials that may come in contact with the seams (ARAR: OAC 3745-27-08(C)(2)(c));

- have acceptable properties for installation and use (ARAR: OAC 3745-27-08(C)(2)(d)); and

- as necessary, be protected from the overlying leachate collection system by a cushion layer (ARAR: OAC 3745-27-08(C)(2)(e)).

Geomembrane seams shall be tested by the Installer in accordance with the following, unless the geomembrane manufacturer's specifications for testing are more stringent, in which case the manufacturer's specifications shall be used:

- for the purpose of testing every seaming apparatus in use each day, peel and shear tests shall be performed on scrap pieces of geomembrane at the beginning of the seaming period and every 4 hours thereafter (ARAR: OAC 3745-27-08(C)(2)(g)(i));

- nondestructive testing shall be performed on 100 percent of the geomembrane seams (ARAR: OAC 3745-27-08(C)(2)(g)(ii)); and

- destructive testing for peel and shear shall be performed at least once every 500 ft of seam length (ARAR: OAC 3745-27-08(C)(2)(g)(iii)).

2.2.2 Leachate Collection System

The functions of the leachate collection system (LCS) are to collect leachate, route it from the OSDF to the leachate transmission system, and limit the buildup of hydraulic head on the underlying primary composite liner (functional requirements). The LCS shall extend over all areas that will subsequently be used for impacted material disposal and function with minimal maintenance and monitoring.

In accordance with OAC 3745-27-08(D)(2) the following conformance tests shall be performed on representative samples of the granular drainage components of the LCS:

- permeability (ASTM D 2434);
- soil classification (ASTM D 2487);
- particle-size analysis (ASTM C 136); and
- calcium carbonate content (ASTM D 3042).

The conformance tests described above shall be performed at a frequency of not less than one test per 3,000 yd^3 with the exception of calcium carbonate testing which will be performed at a frequency of one test per 5,000 yd^3.

2.2.3 Leak Detection System

The function of the leak detection system (LDS) is to detect leakage through the overlying primary composite liner system. The LDS shall be designed to collect

leakage, should it occur, and route it from the OSDF to the leachate management system. The LDS shall extend over all areas that will subsequently be used for impacted material disposal and as with the LCS, function with minimal maintenance and monitoring.

In accordance with the ARAR OAC 3745-27-08-(D)(2), the following conformance tests shall be performed on representative samples of the granular drainage component of the LDS:

- permeability (ASTM D 2434);
- soil classification (ASTM D 2487);
- particle size analysis (ASTM C 136); and
- calcium carbonate content (ASTM D 3042).

The conformance tests described above shall be performed at a frequency of not less than one test per 3,000 yd^3 with the exception of calcium carbonate testing which will be performed at a frequency of one test per 5,000 yd^3.

2.2.4 Final Cover System

The final cover system must isolate impacted material in the OSDF, protect the OSDF from inadvertent intrusion, promote vegetative growth, and greatly limit infiltration into the facility after closure. The final cover system must also be designed to minimize requirements for long-term monitoring, maintenance, and repair. The components of the final cover system are shown in Figure 1-1 and include (in descending order), topsoil, vegetative soil layer, filter layer, biointrusion barrier, cover drainage layer, composite cap, and impacted-material contouring layer.

2.2.4.1 Topsoil

A vegetated topsoil layer will form the uppermost component of the OSDF final cover system. The topsoil layer shall have healthy grasses or other vegetation that form a complete and dense vegetative cover (ARAR: OAC 3745-27-08(C)(15)(e)). The topsoil shall satisfy the requirements of OAC 3745-27-08-(C)(15)(e).

2.2.4.2 Vegetative Soil Layer

A vegetative soil layer will underlie the topsoil component of the OSDF final cover system. The vegetative soil layer shall satisfy the requirements of OAC 3745-27-08-(C)(15)(e). The vegetative soil layer shall be a well-graded mixture of clayey, silty, and sandy material, at least 1.75 ft thick and have sufficient thickness to protect the geomembrane and compacted clay components of the geocomposite cap from damage due to root penetration (ARAR: OAC 3745-27-08(C)(15)(e)).

2.2.4.3 Granular Filter

A granular filter will underlie the vegetative soil layer component of the OSDF final cover system. The granular filter shall satisfy the requirements of the specifications and comply with the following design criteria:

- be at least 6 in. thick; and
- prevent migration of soil from the vegetative support soil layer through the filter to the biointrusion barrier layer.

2.2.4.4 Biointrusion Barrier

A biointrusion barrier layer shall underlie the granular filter component of the OSDF final cover system. The purpose of this layer is to prevent intrusion of plant roots and burrowing animals into the OSDF. The biointrusion barrier layer shall satisfy the requirements of the specifications and consist of durable cobbles (possibly with gravel and boulder size fractions) at least 3 ft thick and extend at least 40 ft laterally beyond the limit of impacted material disposed in the OSDF.

2.2.4.5 Cover Drainage Layer

A cover drainage layer shall underlie the biointrusion barrier component of the OSDF final cover system and overlie the geomembrane cap component of the OSDF final cover system (OAC 3745-27-08(C)(15)(a)). The cover drainage layer shall consist of a 12 in. thickness of granular drainage material, with the layer meeting the requirements of OAC 3745-27-08(C)(4)(a) (ARAR: OAC 3745-27-08(C)(16)(b)(i)).

2.2.4.6 Geotextile Cushion Layer

A geotextile cushion layer shall satisfy the requirements of the specifications. The geotextile shall be installed above the geomembrane cap component of the OSDF final cover system to protect the geomembrane from puncture by particles in the overlying granular filter layer and resist the effects of construction (i.e., termed construction survivability).

2.2.4.7 Composite Cap

The OSDF final cover system shall contain three low-permeability infiltration barrier layers designed to isolate impacted material from the surrounding environment

while minimizing liquid infiltration into the OSDF. These three layers are, from top to bottom (Figure 1-1):

- 60-mil thick geomembrane cap;
- geosynthetic clay cap; and
- 2-ft thick compacted clay cap.

Taken together, these three layers are called the "composite cap". Applicable criteria for the composite cap are as follows:

- The composite cap shall overlie all areas where impacted material has been placed (ARAR: OAC 3745-27-08(C)(15)).
- The composite cap shall have a permeability less than or equal to the permeability of the liner system (ARAR: 40 CFR §265.310).
- The compacted clay component of the composite cap shall satisfy the requirements of the specifications and have a minimum thickness of 24 in. and a maximum hydraulic conductivity of 1×10^{-7} cm/s (ARAR: OAC 3745-27-08(C)(15)(ii)). In addition, the compacted clay cap must satisfy the requirements of OAC 3745-27-08(C)(1)(a) to (C)(1)(g) and (C)(1)(m) to (C)(1)(o) (ARAR: OAC 3745-27-08(C)(16)(a)(ii)).
- The HDPE geomembrane component of the composite cap shall have a minimum thickness of 60 mils, be negligibly permeable to fluid migration, and satisfy the requirements of OAC 3745-27-08(C)(2) (ARAR: OAC 3745-27-08(C)(16)(a)(ii)).
- The composite cap shall be constructed at a slope between 5 and 25 percent (ARAR: OAC 3745-27-08(C)(15)(f)(ii)).

- Any penetrations through the composite cap system shall be sealed so that the integrity of the compacted clay component of the cap is maintained (ARAR: OAC 3745-27-08(C)(15)).

2.3 Other Considerations

This CQA Plan also reflects the guidance of the Hazardous and Solid Waste Amendments of 1984 to the Resource Conservation and Recovery Act (RCRA), as well as the following Technical Guidance Documents:

- "Construction Quality Assurance for Hazardous Waste Land Disposal Facilities", EPA/530-SW-86- 031, October 1986; and

- "Quality Assurance and Quality Control for Waste Containment Facilities", EPA/600/R-93/182, September 1993.

3. CQA PLAN DEFINITIONS

3.1 Construction Quality Assurance and Construction Quality Control

In the context of this document, construction quality assurance and construction quality control are defined as follows:

- *Construction Quality Assurance (CQA)* - The planned and systematic means and actions designed to assure adequate confidence that materials and/or services meet contractual and regulatory requirements, and will perform satisfactorily in service.

- *Construction Quality Control (CQC)* - Those actions which provide a means to measure and regulate the characteristics of an item or service in relation to contractual and regulatory requirements.

In the context of this document:

- CQA refers to means and actions employed by FERMCO to assure conformity of the lining and final cover system component production and installation with this CQA plan, the Construction Drawings and Technical Specifications.

- CQC refers to those actions taken by the CQC Consultant, Subcontractor, Manufacturers, or Installers to ensure that the materials and the workmanship meet the requirements of the Construction Drawings and Technical Specifications. In the case of the geosynthetic components of these systems, CQC is provided by the CQC Consultant and the Manufacturers, Fabricators, and Installers of the various geosynthetics.

3.2 Geosynthetics

Geosynthetics is the generic term for all synthetic materials used in geotechnical engineering applications; the term includes geotextiles, geogrids, geonets, geomembranes, geosynthetic clay liners (GCLs) and geocomposites. There are four types of geosynthetic products referenced in this CQA Plan which are included in the OSDF lining and final cover systems. These geosynthetics include (i) textured HDPE geomembranes used in the composite liner and cap; (ii) GCL's used in the composite liner and cap; (iii) geotextiles used as filters or cushions; and (iv) high density polyethylene manholes and pipes used to collect and convey leachate.

3.3 CQA Lines of Communications

The CQA lines of communication between the Construction Manager, Subcontractor, and CQC Consultant are defined in the *OSDF Remedial Action Work Plan*.

4. PROJECT ORGANIZATION AND PERSONNEL

The OSDF construction organization chart is shown in Figure 4-1. Day-to-day construction activities at the OSDF will be managed though the direct interaction of several parties below FERMCO Project Manager level including but not limited to the Construction Manager, Resident Engineer, Subcontractor, and CQC Consultant. The organization chart for the OSDF CQC Consultant is presented in Figure 4-2. The definitions, qualifications, and responsibilities of the parties responsible for construction and CQC of the OSDF are described below.

4.1 Construction Manager

4.1.1 Definition

The Construction Manager shall be an individual responsible for site operations and overall management of the construction. In this CQA plan the term "Construction Manager" shall refer specifically to an authorized representative of the Department of Energy for the OSDF at the FEMP.

4.1.2 Qualifications

The Construction Manager will hold a baccalaureate degree in construction management, engineering, or related field or have 10 years of construction management experience. The Construction Manager will also have 3 years of environmental restoration plus 1 year of government experience.

4.1.3 Responsibilities

The Construction Manager shall be responsible for coordination and oversight of all construction activities including: (i) subcontract administration; (ii) construction

Figure 4-1

OSDF Construction Organization Chart

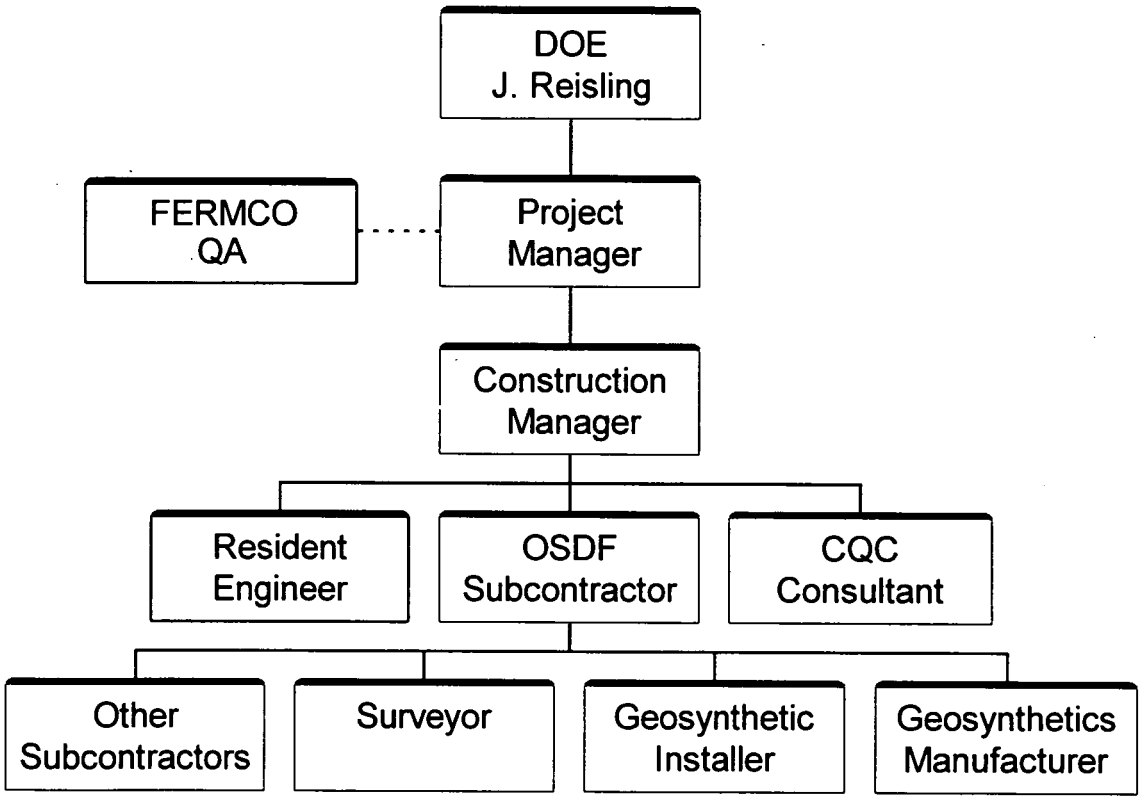

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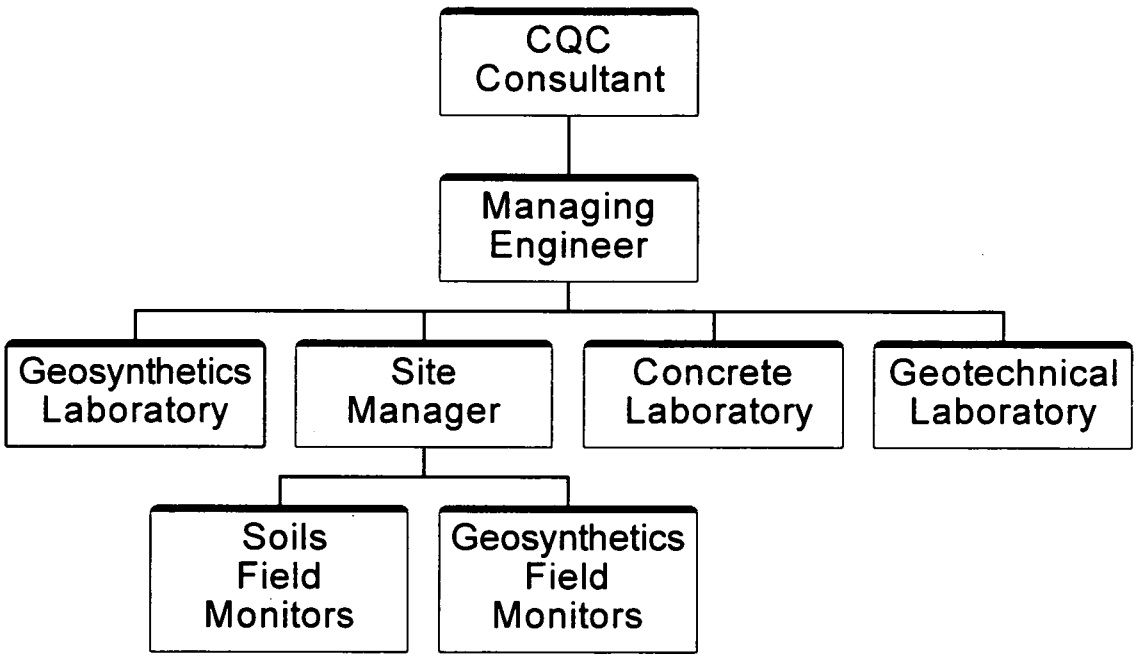
Figure 4-2

OSDF CQA
Organization Chart



management; (iii) review and approval of any modifications or changes to the subcontract documents; and (iv) final approval authority for subcontract submittals.

4.2 Resident Engineer

4.2.1 Definition

The Resident Engineer is the individual representing the firm having responsibility for OSDF design.

4.2.2 Qualifications

The Resident Engineer will hold a minimum of a baccalaureate degree in engineering and be registered as a Professional Engineer and have 10 years experience in construction management, engineering, or related fields. The Resident Engineer shall have expertise which demonstrates significant familiarity with geosynthetics and soils, as appropriate, including design and construction experience related to lining and cover systems.

4.2.3 Responsibilities

The Resident Engineer is responsible for approving all design and specification changes, and making design clarifications which may be required during construction of the OSDF. The Resident Engineer shall assist the Construction Manager in reviewing and approving the Subcontractor's shop drawings and submittals as necessary. The Resident Engineer will be present on-site and attend the project coordination meetings. The Resident Engineer will be capable of discussing and interpreting all elements of the OSDF design. The Resident Engineer shall have the authority to recommend changes or modifications to the Construction Drawings and Technical Specifications for approval by the Construction Manager.

4.3 Subcontractor

4.3.1 Definition

The Subcontractor is the firm or corporation having a legally binding agreement to construct the OSDF. The Subcontractor is represented on-site by a qualified individual who is authorized to act on behalf of the Subcontract in all matters pertaining to the construction of the OSDF.

4.3.2 Qualifications

The Subcontractor shall be qualified as required by the subcontract to perform all aspects of work required to successfully construct the project. The Subcontractor shall be registered in accordance with applicable local, state, and federal requirements and shall demonstrate significant prior related experience. The Subcontractor's field representative shall be qualified individual who is able to perform all tasks associated with OSDF construction activities. The Subcontractor's field representative shall demonstrate prior and experience similar to the Construction Manager. The Subcontractor's field representative shall have the authority to direct and instruct the Subcontractor's crews and its lower tier Subcontractors.

4.3.3 Responsibilities

The Subcontractor is responsible for all construction materials and activities. The Subcontractor is also responsible for scheduling and coordination of the required work with its lower-tier Subcontractors to complete the project within the construction schedule approved by the Construction Manager. The Subcontractor shall provide an experienced supervisory representative at all times during any construction activity on site. The Subcontractor is responsible for furnishing as-built record drawings and a copy of all documentation required during the construction of the OSDF. The

Subcontractor is also responsible for updating all construction drawings for any deviations from the original plans and specifications on a daily basis.

The Subcontractor's field representative is responsible for coordinating and supervising the work of all Subcontractors on site. At a minimum, the Subcontractor's field representative will be responsible for the following:

- informing the Construction Manager of any discrepancies between the plans and specifications and the field conditions;
- distributing all documentation required by the Construction Drawings and Technical Specifications in a timely manner;
- attending all project coordination meetings held on site;
- scheduling all phases of the construction;
- maintaining a daily log of all construction activities on site;
- implementing and verifying all QC procedures required of the Subcontractor and/or lower-tier Subcontractors; and
- submitting proposed alternative materials or construction methods to the Construction Manager for approval prior to acquisition and use.

4.4 CQC Consultant

4.4.1 Definition

The CQC Consultant is the party, independent from the Construction Manager and the Subcontractor, responsible for observing, testing, and documenting activities related

to the CQC of the soil and geosynthetic components of the OSDF lining and final cover systems and other activities related to the construction and closure of the OSDF.

4.4.2 Qualifications

The CQC Consultant shall be a well-established firm specializing in liner and final cover system design, construction management, and CQC. The CQC Consultant shall possess the equipment, personnel, and licenses necessary to conduct the monitoring and testing activities required by the OSDF Construction Drawings and Technical Specifications. The CQC Consultant shall also be experienced in the installation and CQC of soil and geosynthetic materials similar to those materials to be used for the lining and final cover system. The CQC Consultant will be experienced in the preparation of CQC documentation including CQC plans, field documentation, field testing procedures, laboratory testing procedures, construction specifications for lining and cover systems, construction plans, and certification reports.

In addition, the CQC Consultant shall provide the following, in writing, to the Construction Manager:

- corporate background and information;
- a detailed summary of the firm's CQC capabilities;
- a detailed summary of the firm's CQC experience; and
- a representative list of at least 10 completed facilities for which the CQC Consultant has provided CQC monitoring services for the installation of the corresponding geosynthetic material; for each facility, the following information will be provided:
  - name and purpose of facility, its location, and date of installation;
  - name of owner;

- surface area of each geosynthetic material installed; and
- telephone number of person familiar with the project.

- résumés of CQC personnel to be involved in the project including the CQC, Managing Engineer, CQC Site Manager, and CQC Field Monitors; and

- proof of Professional Engineering registration (or ability to be registered) for the engineer to be the designated CQC Managing Engineer.

The CQC Consultant's personnel shall include:

- the CQC Managing Engineer, who operates from the office of the CQC Consultant and who conducts periodic visits to the site as required;

- the CQC Site Manager, who is located at the site; and

- the CQC Field Monitors, who will be located at the site.

The CQC Consultant organization will be led by the CQC Managing Engineer, who will hold a baccalaureate degree in engineering and be registered as a Professional Engineer. The CQA Site Manager will be the representative of the CQC Consultant on site and will have a minimum of 10 years experience in similar construction and be specifically familiar with the construction of soil and geosynthetic liner and closure system components.

At a minimum, the lead geosynthetics Field Monitor shall have performed CQC activities for the installation of at least 5,000,000 ft^2 of HDPE geomembrane and hold current certification by the National Institute for the Certification of Engineering Technicians (NICET) for the Installation Inspection of Geosynthetic Materials. The lead soils Field Monitor shall have performed CQC activities for the installation of at least 2,500,000 ft^2 of low-permeability clay liner and cover systems. Other Field Monitors will be personnel who are specifically trained in the CQC of geosynthetics and low permeability clays and have documented CQC monitoring experience.

The CQC Consultant shall establish an on-site soils laboratory having qualifications as specified in Section 4.5.2 of this CQA Plan.

4.4.3 Responsibilities

The CQC Consultant shall be responsible for monitoring and documenting the activities of the Subcontractor relative to the installation of the liner and cover system components as well as various appurtenances related to the construction of the OSDF. The CQC Consultant will be responsible for monitoring the compliance of construction materials delivered to the site with the submittals and/or shop drawings previously reviewed by the Construction Manager. The CQC Consultant shall assure that the Subcontractors construction methods and workmanship are performed in accordance with the Construction Drawings and Technical Specifications. The CQC Consultant shall be responsible for obtaining samples of the various construction materials in accordance with the testing frequencies identified in this plan. The CQC Consultant shall also be responsible for obtaining, labeling, and shipping samples for off-site laboratory testing in accordance with the requirements of this plan and appropriate specifications.

The CQC Consultant shall be responsible for soils quality control testing to be performed by both the on-site and off-site testing laboratories. The CQC Consultant shall be responsible for operating and staffing the on-site soils laboratory. Test results from the on-site and off-site laboratories shall be submitted to the Construction Manager within a time frame which will not impede or delay construction activities.

The on-site soils laboratory shall be equipped to perform routine index testing including:

- standard or modified Proctor (ASTM D 698 or D 1557);
- particle-size analysis (ASTM D 422 and ASTM C 136);

- Atterberg limits (ASTM D 4318);
- moisture content (ASTM D 2216 and ASTM D 4643);
- soils classification (ASTM D 2487); and
- percent passing no. 200 sieve (ASTM D 1140).

The CQC Consultant shall also be responsible for conducting routine field tests during construction of the OSDF liner and final cover systems which shall include:

- surface moisture content (ASTM D 3017);
- in-place density by nuclear methods (ASTM D 2922);
- lift thickness by direct measurement; and
- sand cone (ASTM D 1556).

The CQC Consultant will be responsible for the quality control of its on-site laboratory testing program and for documenting the calibration of the soils laboratory testing equipment. Equipment calibration certificates shall be maintained in the CQC Consultant's on-site project file. All tests will be conducted in accordance with ASTM or other applicable state or federal standards. Test results shall be submitted to the Construction Manager within a time frame which will not impede or delay construction of the liner and cover systems.

The duties of the CQC Personnel are discussed in the following subsections.

4.4.3.1 CQC Managing Engineer

The CQC Managing Engineer:

- reviews the liner and cover systems construction plans and Construction Drawings and Technical Specifications;
- reviews liner and cover system soils and geosynthetics-related documents (such reviews are for familiarization and for evaluation of constructibility only);
- attends project meetings related to construction quality activities;
- administers the CQC program (i.e., assigns and manages all on-site CQC personnel, reviews all field reports, and provides engineering review of all CQC related activities);
- provides quality control of CQC documentation;
- reviews changes to the liner and cover system design, Construction Drawings, and Technical Specifications; and
- with the CQC Site Manager, prepares the final report.

4.4.3.2 CQC Site Manager

The CQC Site Manager:

- acts as the on-site representative of the CQC Consultant;
- familiarizes all CQC Field Monitors with the site, project documents, and the CQC requirements;

- manages the daily activities of the CQC Field Monitors;
- attends regularly-scheduled CQC-related meetings on-site;
- reviews the ongoing preparation of the construction record drawings;
- reviews test results provided by the Subcontractor;
- verifies the calibration and condition of on-site testing equipment;
- reviews the CQC Field Monitors' daily reports and logs;
- reports to the Construction Manager, and documents in a daily report any reported relevant observations by the CQC Field Monitors;
- prepares a daily report for the project;
- oversees the collection and shipping of all laboratory test samples;
- reviews results of laboratory testing and makes appropriate recommendations;
- reports any unresolved deviations from the CQA Plan, construction plans, and Construction Drawings and Technical Specifications to the Construction Manager;
- assists with the preparation of the final report;
- reviews appropriate certifications and documentation from the Subcontractor and the Geosynthetics Manufacturer and Installer, and makes appropriate recommendations;
- reviews the Geosynthetics Manufacturer's QC documentation;

- reviews the Geosynthetics Installer's personnel qualifications for conformance with those pre-approved for work on site; and

- performs duties of CQC Field Monitor as needed.

4.4.3.3 CQC Field Monitors

The duties of the CQC Field Monitors are monitoring and documenting construction of all soils and geosynthetics components of the liner and cover systems and other OSDF appurtenances, as assigned by the CQC Site Manager.

The duties of the Field Monitors may include:

- monitoring material stockpiles for any deterioration of materials;

- monitoring surface-water drainage in the areas of soil and geosynthetic material stockpiles;

- preparing daily field reports;

- recording CQC activities on field logs;

- reporting problems to the CQC Site Manager;

- assisting with collection of samples from the constructed soil components in accordance with the CQA Plan;

- monitoring soil placement and compaction operations;

- monitoring the unloading and on-site handling and storage of the geosynthetics;

- monitoring geosynthetic repair operations;
- monitoring geosynthetic material deployment and installation operations; and
- collecting conformance samples for testing by CQA laboratories.

In addition to these specific duties, all CQC Field Monitors will document any on-site activities that could result in damage to the soils or geosynthetic components of the liner and cover systems. This is particularly true during the placement and compaction of the initial lift of soil on top of the underlying geosynthetic material. Any observations so noted by the CQC Field Monitors shall be reported immediately to the CQC Site Manager.

4.5 Soils CQC Laboratory

4.5.1 Definition

The Soils CQC Laboratory is the party, independent from the Construction Manager and Subcontractor, responsible for conducting geotechnical laboratory tests in accordance with standards referenced in the Construction Drawings and Technical Specifications and this CQA Plan. The testing results generated by the Soils CQC Laboratory shall be used by the CQC Consultant to verify compliance of the soils construction materials with the plans and specifications and submittals previously approved by the Construction Manager.

It is anticipated that the Soils CQC Laboratory will be required to perform the conformance evaluation testing of the various soils components of the OSDF and more sensitive performance testing required during construction such as hydraulic conductivity testing which require tightly controlled laboratory conditions.

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4.5.2 Qualifications

The Soils CQC Laboratory will be experienced in testing of soils similar to those proposed for use in the construction of the OSDF in accordance with ASTM and other applicable soil test standards. The Soils CQC Laboratory will be capable of providing test results within a maximum of 7 days of receipt of samples and will maintain that capability throughout the duration of the earthwork construction.

Prior to construction, the Soils CQC Laboratory, if different from the CQC Consultant, shall submit their qualifications and QA/QC procedures to the Construction Manager for review and approval. The qualifications presented by the Soils CQC Laboratory shall, as a minimum, include:

- corporate background and statement of qualifications;
- list of testing capabilities including reference to ASTM test methods;
- a laboratory QA/QC plan:
- information on staff size and experience; and
- information regarding test result turnaround time.

4.5.3 Responsibilities

The Soils CQC Laboratory will be responsible for testing various soils components of the OSDF liner and final cover systems. These tests shall include, but not be limited to, material qualification (conformance) tests and material construction quality control (performance) tests as described in Construction Drawings and Technical Specifications. The CQC Consultant will be responsible for coordinating the Soils CQC Laboratory testing.

4.6 Geosynthetics CQC Laboratory

4.6.1 Definition

The Geosynthetics CQC Laboratory is the party, independent from the Construction Manager, Subcontractor, and Geosynthetics Manufacturer and Installer, responsible for conducting tests on samples of geosynthetic materials used in construction of the OSDF liner and cover systems in accordance with standards referenced in the Construction Drawings and Technical Specifications and this CQA Plan. The testing results generated by the Geosynthetics CQC Laboratory shall be used by the CQC Consultant to verify compliance of the geosynthetic materials with plans and specifications and submittals previously approved by the Construction Manager.

It is anticipated that the Geosynthetics CQC Laboratory will be required to perform the conformance evaluation testing of the various geosynthetic components of the OSDF and the performance testing required during construction such as destructive seam testing.

4.6.2 Qualifications

The Geosynthetics CQC Laboratory shall hold current accreditation by Geosynthetic Research Institute (GRI) and have experience in testing geosynthetics similar to those proposed for use during construction of the OSDF. The Geosynthetics CQC Laboratory shall be familiar with ASTM and other applicable geosynthetic test standards. The Geosynthetics CQC Laboratory will be capable of providing destructive test results for geomembrane field seams within 24 hours of receipt of samples and will maintain that capability throughout the duration of geosynthetic material installation.

Prior to construction, the Geosynthetics CQC Laboratory, if different from the CQC Consultant, shall submit their qualifications to the Construction Manager for review and approval. The qualifications presented by the Geosynthetics CQC Laboratory shall, as a minimum, include:

- corporate background and statement of qualifications;
- listing of testing capabilities including reference to ASTM or other applicable test methods;
- a laboratory QA/QC plan:
- information on staff size and experience; and
- information regarding test result turnaround time.

4.6.3 Responsibilities

The Geosynthetics CQC Laboratory will be responsible for testing various geosynthetic components of the liner and cover systems. These tests shall include, but not be limited to, geosynthetic conformance tests and destructive testing of the geomembrane field seams as described in the Construction Drawings and Technical Specifications. The CQC Consultant will be responsible for coordinating the Geosynthetics CQC Laboratory testing.

4.7 Geosynthetics Manufacturers

4.7.1 Definition

The Geosynthetics Manufacturers are the firms or corporations responsible for production of the geosynthetic materials to be used in construction of the OSDF.

4.7.2 Qualifications

The Geosynthetics Manufacturers shall be able to provide sufficient production capacity and qualified personnel to meet the demands of the project schedule. Prior to shipment of any material to the site, each Geosynthetics Manufacturer shall be pre-qualified and approved by the Construction Manager. The geotextile, geomembrane, and GCL manufacturers shall meet the qualifications outlined in Sections 02714, 02770, and 02772 of the Technical Specifications, respectively.

4.7.3 Responsibilities

Each Geosynthetics Manufacturer is responsible for the production and quality control of its respective geosynthetic product. In addition each Geosynthetics Manufacturer is responsible for the condition of the geosynthetic until the material is accepted by the Subcontractor. Each Geosynthetics Manufacturer shall produce a consistent high quality product which shall meet all the requirements of the specifications. Each Geosynthetics Manufacturer shall submit quality control documentation to the Construction Manager for its respective products as required by the Technical Specifications.

4.8 Geosynthetics Installer

4.8.1 Definition

The Geosynthetics Installer will be experienced and qualified to install the geosynthetic materials of the type specified for this project. The Geosynthetics Installer will be approved and/or licensed by the Geosynthetics Manufacturer. A copy of the approval letter or license will be submitted by the Subcontractor to the Construction Manager as required by the Technical Specifications.

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4.8.2 Qualifications

The Geosynthetics Installer shall meet the qualifications outlined in Section 02770 of the Technical Specifications.

The Geosynthetics Installer will designate one representative as its supervisor, who will be responsible for acting as the Geosynthetics Installer's spokesman on site. The Geosynthetics Installer will provide the Construction Manager with a list of proposed seaming personnel and their qualifications. This document will be reviewed by the CQC Consultant. Final approval of the Geosynthetic Installers seaming personnel will be the responsibility of the Construction Manager. Any proposed seaming personnel deemed insufficiently experienced will not be accepted. The most experienced seamer, the "master seamer", shall provide direct supervision, as required, over less experienced seamers. No field seaming shall take place without the master seamer being present.

4.8.3 Responsibilities

The Geosynthetics Installer's supervisor will be responsible for handling installation of the geosynthetics used in construction of the OSDF and for providing supervision and guidance to the installation crew. The Geosynthetics Installer's supervisor is also responsible for the following: (i) obtaining samples, as required by the CQA Plan and the specifications; (ii) field testing; (iii) documenting quality control testing activities; and (iv) coordinating the geosynthetics installation activities with the Construction Manager. The Geosynthetics Installer's supervisor will be responsible for documenting the geosynthetics installation activities, including, but not limited to, on-site personnel, material inventories, production figures, test results, installation deficiencies, and resolution of construction problems.

4.9 Surveyor

4.9.1 Definition

The Surveyor is responsible for lines and grades required for control of the work on an ongoing basis during all phases of the OSDF construction. Close interaction between the Surveyor, Subcontractor, and the CQC Consultant is essential to ensure that construction of the OSDF is completed in accordance with the Construction Drawings and Technical Specifications.

4.9.2 Qualifications

The project Surveyor shall be a licensed Professional Land Surveyor who shall sign and seal all construction survey record drawings. All surveying personnel shall be experienced in the provision of surveying services, including detailed accurate documentation as required in Section 02100 of the Technical Specifications.

4.9.3 Responsibilities

The Surveyor is responsible for all surveying activities and products in accordance with Section 02100 of the Technical Specifications.

5. DOCUMENTATION

An effective CQA Plan depends largely on recognition of all construction activities that should be monitored and the assignment of responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of quality assurance and quality control activities. The CQC Consultant shall be responsible for assuring that the Subcontractor's quality control requirements have been addressed and satisfied.

The CQC Site Manager shall provide the Construction Manager descriptive daily field reports, data sheets, and logs which document that monitoring activities have been carried out. Examples of some of the forms which will be used to document CQC activities are included in Appendix A. The CQC Site Manager shall also maintain at the job site a complete file of Construction Drawings and Technical Specifications, this CQA Plan, the Subcontractor's Quality Control Plan(s), checklists, test procedures, daily logs, and other pertinent construction and CQC documents.

5.1 Daily Recordkeeping

The CQC Consultant's daily reporting procedures shall include: (i) daily summary report; (ii) monitoring logs; (iii) testing data sheets; and (iv) when appropriate, problem identification and corrective measures reports.

5.1.1 Daily Summary Reports

The CQC Consultant's daily summary reports shall include the following information as applicable:

- an identifying sheet number for cross referencing and document control;
- date, project name, location, and other pertinent project identification;

- data on weather conditions;
- summary on meetings held and their results;
- process description(s) and location(s) of construction underway during the time frame of report;
- descriptions and specific locations of areas, or units, of work being tested and/or observed and documented;
- description of locations where tests and samples were taken;
- a narrative summary of field test results;
- off-site materials received, including quality control documentation;
- decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard testing results;
- identifying sheet numbers of data sheets and/or problem reporting and corrective measures reports used to substantiate the decisions described above;
- signature of the respective CQC Site Manager and/or the CQC Field Monitor; and
- any corrections to the Daily Summary Reports shall be single line crossed out, initialed by the correcting personnel, and dated.

5.1.2 CQA Monitoring Logs and Test Data Sheets

Monitoring observations, sampling information, and test results shall be recorded on an appropriate monitoring logs and test data sheets. The CQC Consultant shall use

the monitoring logs and test data sheets to ensure completeness of the required CQC activities. Any corrections to the monitoring logs and test data sheets shall be single line crossed out, initialed by the CQC personnel responsible for the correction and dated. Examples of relevant monitoring logs are presented in Appendix A.

The CQC Consultant's monitoring logs and test data sheets shall include the following information as applicable:

- project specific information such as project name, location;
- the date the CQC activity was performed;
- a unique identifying sheet number for cross-referencing and document control;
- description or title of the CQC activity or test procedure;
- location of the CQC activity or location from which the sample increment was obtained;
- type of CQC activity or procedure used (reference to standard method when appropriate);
- recorded observation or test data, with all necessary calculations;
- results of the CQC activity and comparison with specification requirements (pass/fail); and
- the initials or signature of personnel involved in CQC inspection activity.

5.1.3 Nonconformance Identification and Reporting

A nonconformance is defined herein as material or workmanship that does not meet the specified requirement(s). Nonconformance identification and corrective measures reports should be cross-referenced to specific summary reports, logs, or test data sheets where the nonconformance was identified. The reports should include the following information as applicable:

- a unique identifying sheet number for cross-referencing and document control;
- detailed description of the problem;
- location of the problem;
- probable cause;
- how and when the problem was located;
- estimation of how long problem has existed;
- suggested corrective measure;
- documentation of correction (reference to inspection data sheets);
- final results;
- suggested methods to prevent similar problems; and
- signature of the appropriate CQC Field Monitor and concurrence by the CQC Site Manager.

In some cases, not all of the above information will be available or obtainable. However, when available, such efforts to document nonconformances could help to

avoid similar nonconformances in the future. The CQC Site Manager shall distribute copies of the report to the Construction Manager for further actions.

5.2 Photographic Documentation

The Construction Manager will be responsible for obtaining photographic documentation of the Subcontractor's activities, materials installation methods, and testing procedures. Photographs will serve as a pictorial record of work progress, problems, and corrective measures. Photographic reporting data sheets should be utilized to organize and document photographs taken during construction of the OSDF also may prove useful. Such data sheets could be cross-referenced or appended to summary reports, CQC monitoring logs, or test data sheets and/or problem identification and corrective measures reports. At a minimum, photographic reporting data sheets should include the following information:

- a unique identifying number on data sheets and photographs for cross-referencing and document control;
- the date and location where the photograph was taken; and
- location and description of the work;

These photographs will serve as a pictorial record of work progress, problems, and corrective measures. Color prints shall be organized chronologically and kept in a permanent protective file. Negatives shall be stored in a separate protective file.

5.3 Design and/or Specifications Changes

Design and/or specifications changes may be required during construction. In such cases, the Subcontractor must submit written requests for such changes to the Construction Manager. The Resident Engineer shall review and respond to these requests in a timely manner. Design and/or specifications changes will be made only

with the approval of the Construction Manager. Such changes will take the form of a design change notice (DCN) to the Subcontract.

5.4 Nonconformances

The Construction Manager will be informed in writing of any significant recurring nonconformance with the Construction Drawings, Technical Specifications, or CQA Plan by the CQC Consultant. The cause of the nonconformance will be determined by the CQC Consultant. The Subcontractor will be directed by the Construction Manager to make appropriate changes in materials or procedures in order to correct the nonconformance. When this type of evaluation is made, the results will be documented, and any revision to procedures or specifications must be approved by the Construction Manager.

5.5 CQC Certification Report

At the completion of construction phases the CQC Consultant will submit a construction phase final report to the Construction Manager. This report will acknowledge: (i) that the work has been performed in compliance with the Construction Drawings and Technical Specifications; (ii) physical sampling and testing has been conducted at the appropriate frequencies; and (iii) that the summary document provides the necessary supporting information.

At a minimum, this report will include:

- summaries of CQC activities;
- CQC monitoring logs and testing data sheets including sample location plans;
- laboratory test results;
- problem identification and corrective measures reports;

- a descriptive summary of any changes from Construction Drawings and Technical Specifications; and

- a summary statement indicating compliance with Construction Drawings and Technical Specifications which is signed and sealed by the CQC Managing Engineer.

The Subcontractor's record drawings, which include scale drawings depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, plan dimensions, elevations, soil component thicknesses, etc.), and a geomembrane panel record drawings prepared by the CQC Consultant and included as part of the final certification report.

5.6 Storage of Records

The CQC Site Manager will be responsible for all facility CQC document storage during the construction of the OSDF. This includes the CQC Consultant's copy of the Construction Drawings and Technical Specifications, the CQA Plan, and the originals of all the data sheets and reports. When the OSDF construction is complete and upon issuance of the final certification report, the CQC document originals will be organized and submitted to the Construction Manager. Records shall be filed in accordance with the subject file index and shall be retained for 30 years after closure of the OSDF. Required records shall include, but not be limited to, field logbooks, other data collections forms, equipment calibration records, costs data, drawings, maintenance records, and all associated reports.

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6. SOILS CONSTRUCTION

6.1 Introduction

CQC monitoring and testing shall be performed during installation of the various soil liner and cover system and other earthwork components. Criteria to be used for determination of acceptability of the various soil layers are identified in the Construction Drawings and Technical Specifications and this CQA Plan.

6.2 Soil Components

There are several soil components included in OSDF liner and cover systems. The soil components or layers of the OSDF liner system include the following, from top to bottom:

- a 1-ft thick granular LCS layer and corridor having a hydraulic conductivity of 1×10^{-1} cm/s or greater and 10 cm/s respectively;
- a 1-ft thick granular LDS layer and corridor having a hydraulic conductivity of 1×10^{-1} cm/s or greater and 10 cm/s respectively; and
- a 3-ft thick compacted clay layer having a hydraulic conductivity of 1×10^{-7} cm/s or less.

The soil layers of the OSDF final cover system include the following, from top to bottom:

- a 0.5-ft thick topsoil layer;
- a 1.75-ft thick vegetative soil layer;

- a 0.5-ft thick granular filter layer;
- a 3-ft thick biointrusion barrier;
- a 1-ft thick cover drainage layer having a hydraulic conductivity of 1×10^{-1} cm/s or greater; and
- a 2-ft thick compacted clay cap having a hydraulic conductivity of 1×10^{-7} cm/s or less.

The prepared subgrade soils which will support the OSDF liner system will require preparation in the form of grading, placement, and compaction prior to the installation of the liner system materials. The prepared soil subgrade layer will generally be comprised of in situ materials or borrow area fill materials which must also be monitored and tested in accordance with the Construction Drawings and Technical Specifications and this CQA Plan.

Trench backfilling and the miscellaneous soil construction is also included in this section of the CQA Plan.

6.3 Record Drawings and As-Built Surveys

During construction of the soil components of OSDF, the CQC Consultant shall routinely review record drawings submitted by the Subcontractor. The drawings are used to verify location of work, percent of work completed, layer thickness, or final grades. Prior to the placement of successive soil or geosynthetic layers the CQC Consultant shall review certified as-built surveys which indicate compliance of the preceding layer thickness, lines, and grades. Once an as-built survey has been reviewed by the CQC Consultant it will be the responsibility of the Construction Manager to review the information in a timely manner and notify the Subcontractor of any noncompliance.

6.4 Related Construction Drawings and Technical Specifications

Several sections of the Technical Specifications should be referenced by the CQC Consultant for pertinent soil materials physical properties and construction requirements. Related specifications include the following:

- Section 02100 - Surveying;
- Section 02200 - Earthwork;
- Section 02215 - Trenching and Backfilling;
- Section 02225 - Compacted Clay Liner and Cap;
- Section 02250 - Vegetative Soil Layer;
- Section 02710 - Granular Drainage Layer;
- Section 02712 - Granular Filter; and
- Section 02920 - Topsoil.

6.5 Earthwork

Prior to the start of earthwork operations, the CQC Consultant shall review the information required by Section 02200 of the Technical Specifications. Compliance of the submittals with the Technical Specifications shall be determined by the Construction Manager.

During construction, conformance and performance testing of the subgrade soil materials shall be performed by the CQC Consultant. The CQC Consultant shall monitor proofrolling of areas that are cut to achieve grade. Material placed to achieve

grades indicated on the Construction Drawings shall be tested by the CQC Consultant in accordance with the tests methods and frequencies shown in Table 6-1 and 6-3, to verify that the compacted fill material used by the Subcontractor complies with the Technical Specifications. Areas of proofrolling or compacted fill that do not meet the Technical Specifications will be delineated and reported to the Construction Manager. The areas will be retested after any reworking by the Subcontractor. This process will be repeated until passing results are achieved.

The CQC Consultant shall monitor the repair and rework of subgrade which is damaged by excess moisture (causing softening) and insufficient moisture (causing desiccation and shrinkage), or by freezing. If such conditions are found to exist, the CQC Consultant shall evaluate the suitability of the subgrade by the following methods as applicable:

- moisture/density testing;
- continuous visual inspection during proof-rolling;
- checking the consistency of cohesive soils using a penetrometer, hand-held vane shear device, or other suitable field expedient measurement device in suspect weak soil areas; and/or
- other tests identified in Tables 6-1 through 6-4.

6.6 Conformance Testing

It will be necessary for the CQC Consultant to observe and test the soil components of the OSDF liner and cover systems to ensure they are uniform and conform to the requirements of the Technical Specifications. For soil materials obtained from the on-site borrow area, visual inspections and conformance tests shall be performed by the CQC Consultant prior to the materials being excavated. If soil materials are obtained from off site borrow sources, visual inspection and conformance

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tests shall be performed at the source location or as the materials arrive at the OSDF site. Borrow area inspections may also be utilized by the CQC Consultant to ensure that only suitable soil materials are transported to the OSDF site. For both on-site and off-site borrow areas containing non-uniform materials, it shall be necessary for the Subcontractor and the CQC personnel to coordinate excavation and monitoring of the segregation of substandard materials. All materials failing to comply with conformance standards shall be reported to the Construction Manager.

Initial evaluation of various soil types by CQC personnel during construction shall be largely visual; therefore, the CQC personnel must be experienced with visual-manual soil classification procedures. CQC personnel shall be aware that changes in color or texture can be indicative of a change in soil type. CQC personnel shall observe soils for deleterious materials (e.g., roots, stumps, glass, and large objects). When necessary, the visual-manual procedure for the description and identification of soils shall be conducted by the CQC Consultant in accordance with test method ASTM D 2488.

6.6.1 Test Methods

Conformance tests used to evaluate the suitability of soil materials during construction shall be performed in accordance with the current ASTM or other applicable test procedures indicated in Tables 6-1 and 6-2. Documentation and reporting of the test results shall be the responsibility of the CQC Consultant.

The Standard Proctor Test (ASTM D 698) shall be used for the determination of moisture/density relationships unless otherwise indicated. In-place surface moisture/density nuclear test methods (ASTM D 3017 and D 2922) shall be used for in-situ field testing. The sand cone test method (ASTM D 1556) shall be used to establish correlations of moisture and density in cases of uncertainty, and as a check of the nuclear surface moisture/density gauge calibration. Any conflict regarding acceptance of test results shall be resolved by the Construction Manager.

6.6.2 Test Frequency

The frequency of conformance tests shall conform to the minimum frequencies presented in Tables 6-1 and 6-2. The frequency of testing may be increased at the discretion of the Construction Manager or if variability of the materials is observed. The testing frequencies described herein for compacted fill shall also apply to materials used by the Subcontractor in areas outside the limits of the final cover system of the OSDF.

6.7 Construction Monitoring

During installation of the various soil components, the CQC Consultant shall visually observe and document the Subcontractor's earthwork activities for the following:

- changes in the soil consistency;
- the thickness of lifts as loosely placed and as compacted;
- soil liner conditioning prior to placement including general observations regarding moisture distribution, clod size, etc.;
- the action of the compaction and heavy hauling equipment on the construction surface (sheepsfoot penetration, pumping, cracking, etc.);
- the number of passes used to compact each lift;
- desiccation cracks or the presence of ponded water; and
- final lift or layer thickness.

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6.8 Hydraulic Conductivity Testing Evaluations

As shown in Tables 6-1 and 6-2, hydraulic conductivity (permeability) tests shall be conducted on materials proposed for use as the soil component of the compacted clay liner and cap as well as the soil materials which shall comprise the LDS, LCS, and cover drainage layers. Permeability testing of compacted clay liner and cap materials shall be accomplished in accordance with ASTM 5084 at a confining stress of 5 psi. Permeability testing of the LDS, LCS, and cover drainage layers shall be performed in accordance with ASTM D 2434. Laboratory remolded samples shall be used for conformance evaluation of the clay liner and cap materials prior to construction. The CQC Consultant shall be responsible for documenting pertinent sampling information including the date the sample was obtained, sample identification number, and location.

6.9 Performance Testing

During construction, the CQC Consultant shall observe and test the soil components of the OSDF liner and cover systems to ensure they are installed in accordance with the requirements of the Construction Drawings and Technical Specifications. The CQC Consultant shall also evaluate the procedures, methods, and equipment used by the Subcontractor to install the various soil components.

6.9.1 Test Methods

All performance testing shall be conducted in accordance with the Technical Specifications or as directed by the Construction Manager. The CQC field testing methods, used to evaluate the suitability of soils during their installation, shall be performed by the CQC Consultant in accordance with current ASTM test procedures indicated in Tables 6-3 and 6-4. Test results shall be documented and reported to the Construction Manager.

6.9.2 Test Frequency

Performance testing shall be conducted during the course of the work. The minimum construction performance testing frequencies are presented in Tables 6-3, and 6-4. The frequency may be increased at the discretion of the Construction Manager or if variability of the materials is observed by the CQC Consultant. Sampling locations shall be selected by the CQC Consultant. If necessary, the location of routine in-place density tests shall be determined using a non-biased sampling approach.

A special testing frequency shall be used at the discretion of the Construction Manager when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas shall be considered when:

- rollers slip during rolling operation;
- lift thickness is greater than specified;
- earthfill is at improper and/or variable moisture content;
- it is suspected that less than the specified number of roller passes are made;
- dirt-clogged rollers are used to compact the material;
- rollers may not have used optimum ballast;
- fill materials differ substantially from those specified;
- the degree of compaction is doubtful; and
- as directed by the Construction Manager

During construction, the frequency of testing may also be increased in the following situations:

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- adverse weather conditions;
- breakdown of equipment;
- at the start and finish of grading;
- material fails to meet specifications; and
- the work area is reduced.

6.10 Clay Liner and Cap Perforations

Perforations that must be filled shall include, but not be limited to, the following:

- in-place density test probe locations;
- sand cone or drive test locations;
- survey stake locations; and
- test pit locations.

Perforations in the compacted clay liner and cap resulting from field tests or other construction activities, as described above, shall be filled in accordance with the requirements of Section 02225 of the Technical Specifications and this CQA Plan. Additional density and moisture testing of these areas, if required, shall be conducted at the discretion of the Construction Manager.

6.11 Field Equipment Decontamination

The CQC Consultant shall perform decontamination of field equipment used in the sampling and testing of soils known or suspected of containing low-level radioactive wastes in accordance with the procedures outlined in ASTM D 5608. The practice of decontamination is applicable to most conventional sampling or field testing equipment constructed of metallic and hard, smooth synthetic materials. Materials with rough or porous surfaces, or having a sorption rate, should not be used due to the difficulties with decontaminations.

6.12 Deficiencies

If a defect is discovered in the soils construction, the CQC Consultant shall immediately determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQC Consultant shall determine the extent of the deficient area by additional tests, observations, a review of records, or other means that the CQC Consultant deems appropriate. If the defect is related to adverse site conditions, such as overly wet soils or surface desiccation, the CQC Consultant shall define the limits and nature of the defect.

6.12.1 Notification

As soon as possible, after determining the extent and nature of substandard materials, noncompliant construction practice, or other such deficiency in materials or workmanship which cannot be immediately resolved on-the-spot, the CQC Consultant shall notify the Construction Manager and Subcontractor and schedule appropriate retests when the work deficiency is to be corrected.

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6.12.2 Repairs and Retesting

The CQC Consultant shall verify that the Subcontractor has corrected all noted deficiencies to the satisfaction of the Construction Manager. If a specified criterion cannot be met, or unusual weather conditions hinder work, the Subcontractor shall submit suggested solutions or alternatives to the Construction Manager for review.

At locations where the field testing indicates in-situ conditions which do not comply with the requirements of the Technical Specifications, the failing area shall be reworked to the satisfaction of the Construction Manager. Alternatively, at the Construction Manager's option, undisturbed samples of in-place material shall be obtained for hydraulic conductivity or other appropriate testing. All retests performed by the CQC Consultant must verify that the deficiency has been corrected before any additional work is performed by the Subcontractor in the area of the deficiency.

6.13 Documentation

The documentation of soils CQC testing activities is an important factor in assuring the successful construction, performance, and approval of the OSDF soil liner and closure system components. The CQC monitoring observations, sample location descriptions, field test results, and on-site laboratory test results shall be documented by the CQC Consultant on forms similar to the examples included in Appendix A. Reports and forms shall be submitted to the Construction Manager on a daily and/or weekly basis as requested.

TABLE 6-1
MINIMUM CONFORMANCE TESTING FREQUENCIES FOR OSDF LINER SYSTEM COMPONENTS

TEST NAME/TEST METHOD	SOIL TYPE			
	COMPACTED FILL	COMPACTED CLAY LINER	GRANULAR DRAINAGE MATERIAL	EMBEDMENT FILL
SPECIFICATION SECTION	02200	02225	02710	02215
Particle Size Analysis/ASTM D 422 (sieve only)	1 test per 5,000 yd^3	1 test per 1,500 yd^3 (1)	N/A	N/A
Particle Size Analysis/ASTM C 136	N/A	N/A	1 test per 3,000 yd^3	1 test per 1,000 yd^3
Atterberg Limits/ASTM D 4318	1 test per 5,000 yd^3	1 test per 1,500 yd^3	N/A	N/A
Moisture Content/ASTM D 2216 or ASTM D 4643	1 test per 5,000 yd^3	1 test per 1,500 yd^3	N/A	
Soil Classification/ASTM D 2487	1 test per 5,000 yd^3	1 test per 1,500 yd^3	1 test per 3,000 yd^3	1 test per 1,000 yd^3
Standard Proctor/ASTM D 698	1 test per 5,000 yd^3	1 test per 1,500 yd^3	N/A	N/A
Hydraulic Conductivity/ASTM D 5084	N/A	1 test per 10,000 yd^3 (remold sample)(3)	N/A	N/A
Hydraulic Conductivity/ASTM D 2434	N/A	N/A	1 test per 3,000 yd^3	N/A
Carbonate Content/ASTM D 3042(2)	N/A	N/A	1 test per 5,000 yd^3	N/A
Organic Content/ASTM D 2974	N/A	N/A	N/A	N/A

NA = Not Applicable

NOTE: 1. Also perform hydrometer analysis once every tenth test.

2. Sample to be tested at pH of 4.

3. For Phase I, the frequency shall be 1 test per 1,500 yd^3. This frequency shall be evaluated for modification during later phases.

TABLE 6-2
MINIMUM CONFORMANCE TESTING FREQUENCIES FOR OSDF COVER SYSTEM COMPONENTS

TEST NAME/TEST METHOD	SOIL TYPE						
	COMPACTED CLAY CAP	COVER DRAINAGE LAYER	BIOINTRUSION BARRIER		GRANULAR FILTER	VEGETATIVE SOIL LAYER	TOPSOIL
			PRIMARY BIOINTRUSION BARRIER	CHOKE STONE			
SPECIFICATION SECTION	02225	02710	02280	02280	02712	02250	02920
Particle Size Analysis/ASTM D 422 (sieve only)	1 test per 1,500 yd^3 (1)	N/A	N/A	N/A	N/A	1 per 5,000 yd^3	1 per 5,000 yd^3 (3)
Particle Size Analysis/ASTM C 136	N/A	1 test per 3,000 yd^3	N/A	1 test per 10,000 yd^3	1 test per 5,000 yd^3	N/A	N/A
Moisture Content/ASTM D 2216 or ASTM D 4643	1 test per 1,500 yd^3	N/A	N/A	N/A	N/A	N/A	N/A
Soil Classification/ASTM D 2487	1 test per 1,500 yd^3	1 test per 3,000 yd^3	N/A	N/A	1 test per 5,000 yd^3	1 test per 5,000 yd^3	1 test per 5,000 yd^3
Standard Proctor/ASTM D 698	1 test per 1,500 yd^3	N/A	N/A	N/A	N/A	1 test per 5,000 yd^3	N/A
Hydraulic Conductivity/ASTM D 5084	1 test per 1,500 yd^3 (remold)	N/A	N/A	N/A	N/A	N/A	N/A
Hydraulic Conductivity/ASTM D 2434	N/A	1 test per 3,000 yd^3	N/A	N/A	N/A	N/A	N/A
Carbonate Content/ASTM D 3042 (2)	N/A	1 test per 5,000 yd^3				N/A	N/A
Organic Content/ASTM D 2974	N/A	N/A	N/A	N/A	N/A	N/A	1 test per 5,000 yd^3

N/A = Not Applicable

NOTE: 1. Also, perform hydrometer analysis once every tenth test.

2. Sample to be tested at pH of 4.

3. Perform hydrometer analysis for each test.

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TABLE 6-3
PERFORMANCE TESTING FREQUENCIES FOR OSDF LINER SYSTEM COMPONENTS

TEST NAME/TEST METHOD	COMPACTED FILL	TRENCH BACKFILL	ANCHOR TRENCH BACKFILL	COMPACTED CLAY LINER	GRANULAR DRAINAGE MATERIALS
SPECIFICATION SECTION	02200	02215	02215	02225	02710
In-situ Moisture/ASTM D 3017	2 tests per acre per lift[1]	1 test per 250 lineal ft per lift	1 test per 250 lineal ft per lift	5 tests per acre per lift[1]	N/A
In-situ Density/ASTM D 2922	2 tests per acre per lift[1]	1 test per 250 lineal ft per lift	1 test per 250 lineal ft per lift	5 tests per acre per lift[1]	N/A
Sand Cone/ASTM D 1556	1 test per 25 nuclear tests	N/A	N/A	1 test per 25 nuclear tests	N/A

N/A = Not Applicable

NOTE: 1 A minimum of two nuclear moisture and density tests each day of active soils construction

TABLE 6-4
MINIMUM PERFORMANCE TESTING FREQUENCIES FOR OSDF COVER SYSTEM COMPONENTS

TEST NAME/TEST METHOD	SOIL TYPE						
	COMPACTED CLAY CAP	COVER DRAINAGE LAYER	BIOINTRUSION BARRIER		GRANULAR FILTER	VEGETATIVE SOIL LAYER	TOPSOIL
			PRIMARY BIOINTRUSION BARRIER	CHOKE STONE			
SPECIFICATION SECTION	02225	02710	02280	02280	02712	02250	02920
In-situ Moisture/ASTM D 3017	5 tests per acre per lift[1]	N/A	N/A	N/A	N/A	2 tests per acre per lift[1]	N/A
In-situ Density/ASTM D 2922	5 tests per acre per lift[1]	N/A	N/A	N/A	N/A	2 tests per acre per lift[1]	N/A
Sand Cone/ASTM D 1556	1 test per 25 nuclear tests	N/A	N/A	N/A	N/A	1 test per 25 nuclear tests	N/A

N/A = Not Applicable

NOTE 1 A minimum of two nuclear moisture and density tests each day of active soils construction

7. GEOMEMBRANE LINER AND COVER

7.1 Introduction

The CQC Consultant shall perform conformance testing and shall monitor the installation of geomembranes as required by Section 02770 of the Technical Specifications and this CQA Plan. The testing used to evaluate the conformance of the geomembrane with the requirements of the Technical Specifications shall be carried out by the CQC Consultant in accordance with the current versions of the ASTM or other applicable test procedure indicated in Tables 7-1 and 7-2.

7.2 Related Construction Drawings and Technical Specifications

The Subcontractor shall comply with Section 02770 of the Technical Specifications. This specification shall be referenced for the various physical properties, manufacturing quality control, and installation requirements of the geomembrane materials.

7.3 Manufacturing Plant Visit

The Construction Manager, or authorized representative, shall visit the plant of the Geomembrane Manufacturer for the purpose of verifying manufacturing quality control procedures are in conformance with Section 02770 of the Technical Specifications. If possible, such a visit shall be performed prior to or during the manufacturing of the geomembrane rolls for the OSDF project. The Construction Manager shall review the manufacturing process, quality control procedures, laboratory facilities, and testing procedures.

During the project specific plant visit, the Construction Manager shall:

- verify that properties guaranteed by the Geosynthetics Manufacturer meet all specifications;
- verify that the measurements of properties by the Geosynthetics Manufacturer are properly documented and test methods used are acceptable;
- spot inspect the rolls and verify that they are free of holes, blisters, or any sign of contamination by foreign matter;
- review packaging and transportation procedures to verify that these procedures are not damaging the geomembrane;
- verify that all rolls are properly labeled; and
- verify that extrusion rods and/or beads manufactured for the field seaming of the geomembrane are derived from the same base resin type as the geomembrane.

Upon completion of the manufacturing plant visit, a report describing the findings and observations shall be completed by the Construction Manager.

7.4 Transportation, Handling and Storage

The CQC Consultant shall monitor the transportation, handling, and storage of the geomembrane on-site. The Construction Manager shall designate a geomembrane storage location. It will be the responsibility of the Subcontractor to protect the geomembrane stored on site from theft, vandalism, and damage.

Upon delivery at the site, the Subcontractor, Geosynthetics Installer, and CQC Consultant shall conduct an inspection of the rolls for defects and damage. This

inspection shall be conducted without unrolling the materials unless defects or damages are found or suspected. The CQC Consultant shall indicate to the Construction Manager:

- rolls, or portions thereof, which should be rejected and removed from the site because they have severe or nonrepairable flaws which may compromise geomembrane quality; and

- rolls which include minor or repairable flaws which do not compromise geomembrane quality.

The CQC Consultant shall also monitor that equipment used to handle the geomembrane on-site is adequate and does not pose any risk of damage to the geomembrane when used properly.

7.5 Conformance Testing

7.5.1 Sampling Procedures

Upon delivery of the geomembrane rolls to the OSDF, the CQC Consultant shall ensure that representative geomembrane conformance samples are obtained at the specified frequency and forwarded to the Geosynthetics CQC Laboratory for testing. Geomembrane conformance samples shall be taken across the entire width of the roll and shall not include the first 3 ft of material. Unless otherwise directed by the Construction Manager, samples shall be 3 ft long by the roll width. The required minimum geomembrane conformance sampling frequencies are provided in Table 7-1. The CQC Consultant shall mark the machine direction on the samples with an arrow and affix a label, tag, or otherwise mark each sample with the following information:

- date sampled;

- project number;

- lot/batch number and roll number;
- conformance sample number; and
- CQC personnel identification.

7.5.2 Testing Procedures

Conformance testing of the geomembrane materials delivered to the site will be conducted to ensure compliance with both the Technical Specifications and the manufacturer's list of minimum average roll values. As a minimum, the geomembrane conformance test procedures listed in Table 7-1 shall be performed by the Geosynthetics CQC laboratory.

7.5.3 Test Results

All conformance test results shall be reviewed, accepted, and reported by the CQC Consultant before deployment of the geomembrane. Any non-conformance of the material's physical properties with the requirements of the Technical Specifications shall be reported to the Construction Manager. In all cases, the test results shall meet, or exceed, the property values listed in Appendix B.

7.5.4 Conformance Test Failure

In the case of failing test results, the Subcontractor may request that another sample from the failing roll be retested by the Geosynthetics CQC laboratory with the manufacturer's technical representative present during the test procedure. If the retest fails or if the option to retest is not exercised, then two isolation conformance samples shall be obtained by the CQC Consultant. These isolation samples shall be taken from rolls, which have been determined by correlation with the manufacturer's roll number,

to have been manufactured prior to and after the failing roll. This method for choosing isolation rolls for testing should continue until passing tests are achieved. All rolls which fail numerically between the passing roll numbers shall be rejected by the Construction Manager. The CQC Consultant will verify that the Subcontractor has replaced all rejected rolls. The CQC Consultant shall document all actions taken in conjunction with geomembrane conformance failures.

7.6 Anchorage Trench

The CQC Consultant shall verify and document that the anchor trench has been constructed according to Construction Drawings. The amount of anchor trench open at any time shall be limited to one day of geomembrane installation capacity. The anchor trench shall be constructed with proper drainage to prevent ponding.

Geosynthetic materials in the anchor trench shall be temporarily anchored with sand bags or other suitable methods approved by the Construction Manager. The anchor trench shall be backfilled with suitable material as indicated in the Construction Drawings and Technical Specifications. In-place moisture/density by nuclear methods testing of the compacted anchor trench backfill shall be performed at the frequencies given in Table 6-3.

The anchor trench shall be constructed with a slightly rounded inside corner where the geosynthetics enter the trench. No loose soil shall be allowed to underlie the geosynthetics in the anchor trench. The CQC Consultant shall verify that all temporary ballast (i.e., sandbags) and deleterious materials are removed from the anchor trench prior to backfilling. Backfilling of the anchor trench shall be performed when the geomembrane is in its most contracted state to prevent stress inducement and using extreme care to prevent any damage to the geosynthetic materials.

7.7 Geomembrane Placement

7.7.1 Field Panel Identification

A field panel is the unit area of geomembrane which is to be seamed in the field, i.e., a field panel is a roll or a portion of roll cut in the field.

The CQC Consultant shall assure that each field panel is given an "identification code" (number or letter-number) consistent with the layout plan. This identification code shall be agreed upon by the Construction Manager, Geosynthetics Installer, and CQC Consultant. This field panel identification code shall be as simple and logical as possible. The Geosynthetic Manufacturer's roll numbers shall be traceable to the field panel identification code.

The CQC Consultant shall document the correspondence between roll numbers, factory panels, and field panel identification codes. The field panel identification code shall be used for all quality assurance/quality control records.

7.7.2 Field Panel Placement

The CQC Consultant shall monitor that field panels are installed at the location indicated in the Geosynthetics Installer's layout plan, as approved or modified. The CQC Consultant shall record the field panel identification code, manufacturers roll number, location, date of installation, and dimensions of each field panel.

Geomembrane placement shall not proceed at an ambient temperature below 40°F or above 104°F unless authorized in writing by the Construction Manager. Geomembrane placement shall not proceed during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, or in the presence of excessive winds. The CQC Consultant shall monitor that the above conditions are fulfilled and that the supporting soil has not been damaged by adverse weather conditions.

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The CQC Consultant shall monitor geomembrane deployment for the following:

- any equipment used does not damage the geomembrane by handling, trafficking, excessive heat, leakage of hydrocarbons or other means;
- the prepared surface underlying the geomembrane has not deteriorated since previous acceptance, and is still acceptable immediately prior to geomembrane placement;
- any geosynthetic elements immediately underlying the geomembrane are clean and free of foreign objects or debris;
- all personnel working on the geomembrane do not smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane;
- the method used to unroll the panels does not cause scratches or crimps in the geomembrane and does not damage the supporting soil;
- the method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels);
- adequate temporary loading and/or anchoring (e.g., sand bags, tires), not likely to damage the geomembrane, has been placed to prevent uplift by wind (in case of high winds, continuous loading, e.g., by adjacent sand bags, is recommended along edges of panels to minimize risk of wind flow under the panels); and
- direct contact with the geomembrane is minimized; i.e., the geomembrane is protected by geotextiles, extra geomembrane, or other suitable materials, in areas where excessive traffic may be expected.

The CQC Consultant shall observe the geomembrane panels, after placement and prior to seaming, for damage. The CQC Site Manager shall advise the Construction

Manager which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels which have been rejected shall be marked and their removal from the work area recorded by the CQC Consultant. Repairs shall be made according to procedures described in this Section.

7.8 Field Panel Seaming

7.8.1 Panel Layout

The CQC Consultant shall review the panel layout drawing previously submitted to the Construction Manager by the Geosynthetics Installer and verify that it is consistent with accepted state of practice. In general, seams should be oriented parallel to the line of maximum slope, i.e., oriented along, not across, the slope. In corners and odd-shaped geometric locations, the number of seams should be minimized. No horizontal seam should be less than 10 ft from the toe of the slope, or areas of potential stress concentrations, unless otherwise authorized by the Construction Manager. A seam numbering system compatible with the field panel identification numbering system shall be agreed upon prior to any seaming.

7.8.2 Seaming Equipment and Products

Approved processes for field seaming are extrusion welding and fusion welding. Proposed alternate processes shall be documented and submitted to the Construction Manager for approval. Only equipment which have been specifically recommended by the Manufacturer by make and model shall be used. All seaming equipment shall be permanently marked with an identification number.

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7.8.2.1 Filet Extrusion Process

The filet extrusion-welding apparatus shall be equipped with gauges giving the temperature in the apparatus and at the nozzle. The CQC Consultant shall verify that the extrudate is comprised of the same resin as the geomembrane sheeting. The CQC Consultant shall monitor temperatures, extrudate temperatures, ambient temperatures, and geomembrane surface temperatures at appropriate intervals.

The CQC Consultant shall also monitor that:

- the number of spare operable seaming apparatus agreed by the Construction Manager are maintained on site;
- equipment used for seaming is not likely to damage the geomembrane;
- the extruder is purged prior to beginning a seam until all heat-degraded extrudate has been removed from the barrel;
- the electric generator is placed on a smooth base such that no damage occurs to the geomembrane; and
- a smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage.

7.8.2.2 Fusion Process

The fusion-welding apparatus must be automated, self-propelled devices. The fusion-welding apparatus shall be equipped with gauges giving the applicable temperatures and welding speed. The CQC Consultant shall monitor ambient temperatures, and apparatus temperatures.

The CQC Consultant shall also monitor that:

- the number of spare operable seaming apparatus agreed by the Construction Manager are maintained on site;
- equipment used for seaming will not damage the geomembrane;
- the electric generator is placed on a smooth base such that no damage occurs to the geomembrane;
- for cross seams, the edge of the cross seam is ground to a smooth incline (top and bottom) prior to welding;
- a smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage; and
- a movable protective layer is used as necessary directly below each overlap of geomembrane that is to be seamed to prevent build-up of moisture between the sheets.

7.8.3 Seam Preparation

The CQC Consultant shall monitor that:

- prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material;
- seams are overlapped a minimum of 4 inches;
- if seam overlap grinding is required, the process is completed according to the Geomembrane Manufacturer's instructions or Section 02770 of the

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Technical Specifications, whichever is the more stringent, prior to the seaming operation, and in a way that does not damage the geomembrane;

- the grind depth shall not exceed 10 percent of the geomembrane thickness;
- grinding marks shall not appear beyond the extrudate after it is placed; and
- seams are aligned with the fewest possible number of wrinkles and "fishmouths".

7.8.4 Weather Conditions for Seaming

The normally required weather conditions for seaming are as follows:

- Unless authorized in writing by the Construction Manager, no seaming shall be attempted at an ambient temperature below 40°F or above 104°F.
- Between ambient temperatures of 40°F and 50°F, seaming is possible if the geomembrane is preheated by either sun or hot air device, and if there is no cooling of the geomembrane to below 50°F resulting from wind.
- In all cases, the geomembrane seam areas shall be dry and protected from wind.

The CQC Consultant shall verify that methods used by the Subcontractor for seaming at ambient temperatures below 40°F or above 104°F will produce seams which are entirely equivalent to seams produced at ambient temperatures between 40°F and 104°F and protect the overall quality of the geomembrane. The CQC Consultant shall monitor that seaming conducted during abnormal weather conditions is performed in accordance with the methods approved by the Construction Manager.

7.8.5 Overlapping and Temporary Bonding

The CQC Consultant shall monitor that:

- the panels of geomembrane have a finished overlap of a minimum of 4 in. for both extrusion and fusion welding, but in any event sufficient overlap shall be provided to allow peel tests to be performed on the seam;

- no solvent or adhesive is used unless the product is approved in writing by the Construction Manager (samples shall be submitted to the Construction Manager for testing and evaluation); and

- the procedure used to temporarily bond adjacent panels together does not damage the geomembrane; in particular, the temperature of hot air at the nozzle of any spot welding apparatus is controlled such that the geomembrane is not damaged.

7.8.6 Trial Seams

The CQC Consultant shall verify that the Geosynthetics Installer performs trial seam tests in accordance with Section 02770 of the Technical Specifications. The CQC Consultant shall observe and document the Geosynthetic Installers trial seam testing procedures. The trial seam samples shall be assigned an identification number and marked accordingly by the CQC Consultant. Each sample shall be marked with the date, time, machine temperature(s) and setting(s), number of seaming unit, and name of seaming technician.

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7.8.7 General Seaming Procedures

No geomembrane seaming shall be performed unless the CQC Consultant is on-site. The CQC Consultant shall monitor the general seaming procedure used by the Geosynthetics Installer as follows:

- For fusion welding, a movable protective layer of plastic may be required to be placed directly below each overlap of geomembrane that is to be seamed. This is to prevent any moisture build-up between the sheets to be welded.

- If required, a firm substrate shall be provided by using a flat board, a conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support.

- Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same geomembrane extending a minimum of 6 in. beyond the cut in all directions.

- If seaming operations are carried out at night, adequate illumination shall be provided by the Subcontractor to the satisfaction of the Construction Manager.

- Seaming shall extend to the outside edge of panels to be placed in the anchor trench.

7.8.8 Nondestructive Seam Continuity Testing

The CQC Consultant shall monitor that the Geosynthetics Installer shall nondestructively test all field seams over their full length using a vacuum test unit or air pressure test (for double fusion seams only). Spark testing may be performed if the

seam cannot be tested using the vacuum or air pressure test methods. The purpose of nondestructive tests is to check the continuity of seams. Continuity testing shall be carried out as the seaming work progresses, not at the completion of all field seaming. The CQC Consultant shall:

- monitor nondestructive testing;
- document the results of the nondestructive testing; and
- inform the Subcontractor and Construction Manager of any noncompliance.

Any required seam repairs shall be made in accordance with the Technical Specifications. The CQC Consultant shall:

- observe the repair procedures;
- observe the retesting procedures; and
- document the results.

The seam number, date of observation, dimensions and/or descriptive location of the seam length tested, name of person performing the test, and outcome of the test shall be recorded by the CQC Consultant.

7.8.9 Destructive Testing

Destructive seam testing shall be performed during the geomembrane installation. The purpose of this testing is to evaluate seam strength. Destructive seam testing shall be done as the seaming work progresses, not at the completion of all field seaming.

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7.8.9.1 Location and Frequency

The CQC Consultant shall select all destructive seam test sample locations. Sample locations shall be established as follows.

- A minimum frequency of one test location per 500 ft of seam length. This minimum frequency is to be determined as an average taken throughout the entire facility.

- Test locations shall be determined during seaming at the CQC Consultants discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset welds, or any other potential cause of imperfect welding.

The Geosynthetics Installer shall not be informed in advance of the locations where the seam samples will be taken.

7.8.9.2 Sampling Procedures

Destructive seam testing shall be performed as the seaming progresses in order to obtain the Geosynthetic CQC Laboratory test results before the geomembrane is covered by overlying materials. The CQC Consultant shall:

- observe sample cutting;

- assign a number to each sample, and mark it accordingly; and

- record sample location on layout drawing.

All holes in the geomembrane resulting from destructive seam test sampling shall be immediately repaired in accordance with repair procedures described in

Section 02770 of the Technical Specifications. The continuity of the new seams in the repaired area shall be nondestructively tested according to Section 7.9.8.

7.8.9.3 Size of Samples

At a given sampling location, two types of samples (field test samples and laboratory test samples) shall be taken. First, a minimum of two field samples or test strips should be taken for field testing. Each of these test strips shall be 1 in. wide by 12 in. long, with the seam centered parallel to the width. The distance between these two specimens shall be 42 in. If both specimens pass the field test described in this Section, a second full laboratory destructive sample shall be taken for testing by the Geosynthetics CQC Laboratory.

The full destructive sample shall be located between the two field test strips. The sample shall be 12 in. wide by 42 in. long with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:

- one 12 in. by 12 in. portion to the Geosynthetics Installer;
- one 12 in. by 12 in. portion to the Construction Manager for archive storage; and
- one 12 in. by 18 in. portion for Geosynthetics CQC Laboratory testing.

7.8.9.4 Field Testing

The test strips shall be tested in the field, for peel adhesion, using a gauged tensiometer. In addition to meeting the strength requirements outlined in Appendix B, all specimens shall exhibit a Film Tear Bond and shall not fail in the weld. If any field test sample fails to meet these requirements, the destructive sample has failed.

The CQC Consultant shall witness all field tests and mark all samples and portions with their number. The CQC Consultant shall also log the date, number of seaming unit, seaming technician identification, destructive sampling, and pass or fail description.

7.8.9.5 Geosynthetics CQC Laboratory Testing

Destructive test samples shall be tested by the Geosynthetics CQC Laboratory. Testing shall include "Bonded Seam Strength" and "Peel Adhesion" (ASTM D 4437). The minimum acceptable values to be obtained in these tests are presented in Appendix B. At least five specimens shall be tested for each test method. Specimens shall be selected alternately by test from the samples (i.e., peel, shear, peel, shear...). Both the inside and outside tracks of the double track fusion seams shall be tested for peel adhesion. A passing test shall meet the minimum required values in at least four out of five specimens.

The Geosynthetics CQC Laboratory shall provide test results no more than 24 hours after they receive the samples. The CQC Site Manager shall review laboratory test results as soon as they become available, and make appropriate recommendations to the Construction Manager.

7.8.9.6 Procedures for Destructive Test Failure

The following procedures shall apply whenever a sample fails a destructive test, whether that test was conducted in the field or by the Geosynthetics CQC Laboratory. The CQC Consultant will monitor that the Geosynthetics Installer follow one of two options:

- The Geosynthetics Installer can reconstruct the seam (e.g., remove the old seam and reseam) between any two passed destructive test locations.

- The Geosynthetics Installer can trace the welding path to an intermediate location a minimum of 10 ft from the point of the failed test in each direction and take a small sample for an additional field testing in accordance with the destructive test procedure at each location. If these additional isolation samples pass the field test, then full laboratory samples are taken at both locations. If these laboratory samples meet the specified strength criteria, then the seam is reconstructed between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

All failed seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken. In cases exceeding 150 ft of reconstructed seam, a sample taken from the zone in which the seam has been reconstructed must pass destructive testing. Repairs shall be made in accordance with this Section. The CQC Consultant shall document all actions taken in conjunction with destructive test failures.

7.9 Defects and Repairs

7.9.1 Identification

All seams and non-seam areas of the geomembrane shall be examined by the CQC Consultant for identification of defects, holes, blisters, undispersed raw materials and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane shall be clean at the time of examination. The Construction Manager shall require the geomembrane surface to be broomed or washed by the Subcontractor if the amount of dust or mud inhibits examination.

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7.9.2 Repair Procedures

Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired by the Geosynthetics Installer in accordance with Section 02770 of the Technical Specifications. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the Subcontractor and Construction Manager.

In addition, the following conditions shall be monitored by the CQC Consultant:

- surfaces of the geomembrane which are to be repaired shall be abraded no more than one hour prior to the repair;
- all surfaces must be clean and dry at the time of the repair;
- all seaming equipment used in repairing procedures must be approved;
- the repair procedures, materials, and techniques shall be approved by the Construction Manager in advance of the specific repair;
- patches or caps shall extend at least 6 in. beyond the edge of the defect, and all corners of patches shall be rounded with a radius of at least 3 in.; and
- the geomembrane below large caps should be appropriately cut to avoid water or gas collection between the two sheets.

7.9.3 Verification of Repairs

Each repair shall be numbered and logged. Each repair shall be non-destructively tested using approved methods. Repairs which pass the non-destructive test shall be taken as an indication of an adequate repair. Large caps may be of sufficient extent to require destructive test sampling, at the discretion of the Construction Manager or as

specified in Table 7-2. The CQC Consultant shall observe all non-destructive testing of repairs and shall record the number of each repair, date, and test outcome.

7.10 Liner and Cover System Acceptance

The Subcontractor shall retain all responsibility for the geosynthetics until acceptance by the Construction Manager. The terms for liner system acceptance are described in Section 02770 of the Technical Specifications.

7.11 Materials in Contact with the Geomembrane

The procedures outlined in this section are intended to assure that the installation of materials in contact with the geomembrane do not cause damage. Additional quality assurance and quality control procedures are necessary to assure that systems built with these materials will be constructed in such a way to ensure proper performance.

7.11.1 Soils

The CQC Consultant shall monitor that the Subcontractor takes all necessary precautions to ensure that the geomembrane is not damaged during its installation or during the installation of other components of the liner or cover system or by other construction activities. The CQC Consultant shall monitor the following:

- placement of granular drainage materials above the geomembrane which shall not proceed at an ambient temperature below 40°F or above 104°F unless otherwise approved by the Construction Manager;

- soil placement operations above the geomembrane which shall be made by the Subcontractor to minimize wrinkles in the geomembrane;

- equipment used for placing soil shall not be driven directly on the geomembrane;
- a minimum soil thickness of 1 ft is used between a light track-mounted dozer (e.g., having a maximum ground pressure of 5 psi) and the geomembrane;
- a minimum thickness of 3 ft of soil is used between rubber-tired vehicles and the geomembrane; and
- soil thickness shall be greater than 3 ft in heavily trafficked areas such as access ramps.

7.11.2 Appurtenances

The CQC Consultant shall monitor that:

- installation of the geomembrane in appurtenant areas, and connection of geomembrane to sumps and appurtenances have been made in accordance with the Construction Drawings and Technical Specifications;
- extreme care is taken by the Geosynthetics Installer when seaming around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas; and
- the geomembrane has not been visibly damaged when making connections to sumps and appurtenances;

TABLE 7-1:

GEOMEMBRANE CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY[1]
Specific Gravity	ASTM D792 Method A or ASTM D1505	1 test per 100,000 ft^2
Thickness	ASTM D 519 or GRI-GM8	1 test per 100,000 ft^2
Tensile Strength at Yield	ASTM D638	1 test per 100,000 ft^2
Tensile Strength at Break	ASTM D638	1 test per 100,000 ft^2
Elongation at Yield	ASTM D638	1 test per 100,000 ft^2
Elongation at Break	ASTM D638	1 test per 100,000 ft^2
Carbon Black Content	ASTM D1603	1 test per 100,000 ft^2
Carbon Dispersion	ASTM D5596	1 test per 100,000 ft^2

Notes: 1. Test shall be performed at a frequency of one per lot or at listed frequency, whichever is greater. A lot shall be as defined by ASTM 4354.

TABLE 7-2:

GEOMEMBRANE SEAM TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY[4]
Peel Adhesion	ASTM D44371[1,3]	1 test every 500 ft of seam length
Bonded Seam Strength	ASTM D4437[2,3]	1 test every 500 ft of seam length
Vacuum Testing	—	100 percent of extrusion welded seams
Air Pressure Testing	—	100 percent of fusion welded seams

Notes:

1. For peel adhesion, seam separation shall not extend more than 10 percent into the seam interface. Testing shall be discontinued when the sample has visually yielded.

2. For shear tests, the sheet shall yield before failure of the seam.

3. For either test, sample failure shall be a Film Tear Bond (FTB) as outlined in NSF 54, Appendix A.

4. Testing shall be performed at a frequency of one per lot or at listed frequency, whichever is greater.

8. GEOSYNTHETIC CLAY LINER

8.1 Introduction

The CQC Consultant shall perform conformance testing and shall monitor the installation of the geosynthetic clay liner (GCL) and geosynthetic clay cap (GCC) as required by Section 02772 of the Technical Specifications and this CQA Plan. The testing used to evaluate the conformance of the GCL and GCC with the requirements of the Technical Specifications shall be performed by the CQC Consultant in accordance with the current versions of the ASTM or other applicable test procedure indicated in Table 8-1.

8.2 Related Construction Drawings and Technical Specifications

The Subcontractor shall comply with Section 02772 of the Technical Specifications. This specification shall be referenced for the various physical properties, manufacturing quality control, and installation requirements of the GCL and GCC materials.

8.3 Transportation, Handling, and Storage

The CQC Consultant shall monitor the transportation, handling, and storage of the GCL and GCC on-site. Handling of the rolls shall be performed in a competent manner such that damage does not occur to the GCL and GCC or its protective wrapping. Any protective wrapping that is damaged or stripped off the rolls shall be repaired immediately to the satisfaction of the Construction Manager. During transportation, handling, and storage the GCL and GCC rolls will be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions.

Upon delivery at the site, the Subcontractor, Geosynthetics Installer, and CQC Consultant shall conduct an inspection of the rolls for defects and damage. This inspection shall be conducted without unrolling the materials unless defects or damages are found or suspected. The CQC Consultant shall indicate to the Construction Manager:

- rolls, or portions thereof, which should be rejected and removed from the site because they have severe flaws; and
- rolls which include minor repairable flaws.

The CQC Consultant shall also monitor that equipment used to handle the geosynthetics on-site is adequate and does not pose any risk of damage to the geosynthetics when used properly.

8.4 Conformance Testing

8.4.1 Sampling Procedures

Upon delivery of the rolls of GCL and GCC, the CQC Consultant will assure that samples are removed and forwarded to the Geosynthetic CQC Laboratory for testing of conformance to both the design specifications and the list of guaranteed properties provided by the manufacturer. Unless otherwise directed by the Construction Manager, conformance samples will be 3 ft long by the roll width. The CQC Consultant will mark the machine direction on the samples with a waterproof maker and tap or otherwise secure the cut edges of the sample to eliminate the loss of the granular bentonite. The required minimum sampling frequencies are provided in Table 8-1. The rolls shall be immediately re-wrapped and replaced in their shipping trailers or in the temporary field storage area. The CQC Consultant shall mark the machine direction on the samples with an arrow and affix a label, tag, or otherwise mark each sample with the following information:

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- date sampled;
- project number;
- lot/batch number and roll number;
- conformance sample number; and
- CQC personnel identification.

8.4.2 Testing Procedure

Conformance testing of the GCL and GCC materials delivered to the site will be conducted to ensure compliance with both the Technical Specifications and the manufacturer's list of minimum average roll values. As a minimum, the GCL and GCC conformance test procedures listed in Table 8-1 shall be performed by the Geosynthetics CQC laboratory.

8.4.3 Test Results

The CQC Consultant will examine all results from laboratory conformance testing and will report any non-conformance to the Construction Manager. The GCL and GCC conformance test result shall meet or exceed the minimum physical property values presented in Appendix C.

8.4.4 Conformance Test Failure

In the case of failing test results, the Subcontractor may request that another sample from the failing roll be retested by the Geosynthetics CQC laboratory with the manufacturer's technical representative present during the test procedure. If the retest

fails or if the option to retest is not exercised, then two isolation conformance samples shall be obtained by the CQC Consultant. These isolation samples shall be taken from rolls, which have been determined by correlation with the manufacturer's roll number, to have been manufactured prior to and after the failing roll. This method for choosing isolation rolls for testing should continue until passing tests are achieved. All rolls which fail numerically between the passing roll numbers shall be rejected by the Construction Manager. The CQC Consultant will verify that the Subcontractor has replaced all rejected rolls. The CQC Consultant shall document all actions taken in conjunction with GCL and GCC conformance failures.

8.5 Surface Preparation

The GCL and GCC shall not be placed on surfaces which are softened due to high water content or cracked due to desiccation. The CQC Consultant and the Geosynthetics Installer will jointly verify that the surface on which the GCL and GCC will be installed is acceptable. The Subcontractor shall comply with the compacted clay liner surface preparation and acceptance requirements identified in Section 02225 of the Technical Specifications. Additionally, the surface shall contain no loose stones and no ruts greater than 1-in. depth. The CQC Consultant shall notify the Construction Manager of any observed change in the supporting soil condition that may require repair work and verify that compacted clay liner repair work is completed in accordance with the requirements of the Technical Specifications and this CQA Plan.

8.6 Placement

The CQC Consultant shall verify that the Geosynthetics Installer has taken all necessary precautions to protect the underlying subgrade during GCL and GCC deployment operations. The CQC Consultant shall verify that all GCL and GCC are handled in such a manner as to ensure they are not damaged in any way, and the following conditions are met:

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- on slopes, the GCL and GCC are secured and then rolled down the slope in such a manner as to continually keep the GCL and GCC panel in tension;
- in the presence of wind, all GCL and GCC are weighted with sandbags or the equivalent;
- GCL and GCC are kept continually under tension to minimize the presence of wrinkles;
- GCL and GCC are cut using a utility blade in a manner recommended by the Manufacturer;
- during placement, care is taken not to entrap fugitive clay, sand, stones other debris under the GCL and GCC;
- the exposed GCL and GCC are protected from damage in heavily trafficked areas;
- a visual examination of the GCL and GCC is carried out over the entire surface, after installation, to assure that damaged areas, if any, are identified and repaired; and
- if a white colored GCL and GCC is used, precautions are taken against "snowblindness" of personnel.

8.7 Overlaps

The CQC Consultant shall monitor and verify the GCL and GCC overlapping procedures conform to the requirements of Section 02772 of the Technical Specifications. GCL and GCC panels shall be overlapped at a minimum of 6 inches along panel sides and a minimum of 12 inches along panel ends. Dry bentonite powder

shall be applied, at a minimum rate of one pound per lineal foot, around pipe penetrations or other perforations of GCL and GCC which may be required.

8.8 Repair

The CQC Consultant shall monitor the repair of any holes or tears in the GCL and GCC or the geotextile backing. Repairs shall be made by placing a patch made from the same type GCL and GCC over the damaged area. On slopes greater than 5 percent, the patch shall overlap the edges of the hole or tear by a minimum of 2 ft in all directions. On slopes, 5 percent or flatter, the patch shall overlap the edges of the hole or tear by a minimum of 1 ft in all directions. The patch shall be secured to the satisfaction of the Construction Manager to avoid shifting during backplacing with soil or covering with another geosynthetic.

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TABLE 8-1:

GCL CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY[1]
Direct Shear[2]	ASTM D 5321	1 test per 100,000 ft^2
Hydraulic Conductivity	GRI GCL-2	1 test per 100,000 ft^2

Notes:

1. Testing shall be performed at a frequency of one per lot or at listed frequency, whichever is greater. A lot is defined by ASTM D 4354.

2. Each sample shall be tested for the following: (i) internal shear strength; (ii) interface shear strength of geosynthetic clay liner and the geomembrane liner and the geosynthetic clay cap and the geomembrane cap; and (iii) the interface shear strength of the geosynthetic clay liner and compacted clay liner and the geosynthetic clay cap and the compacted clay cap.

9. GEOTEXTILES

9.1 Introduction

The CQC Consultant shall perform conformance testing and shall monitor the installation of geotextile filter, cushions, and separators as required by Section 02714 of the Technical Specifications and this CQA Plan. The testing used to evaluate the conformance of the geotextiles with the requirements of the Technical Specifications shall be performed by the CQC Consultant in accordance with the current versions of the ASTM or other applicable test procedure indicated in Tables 9-1 and 9-2.

9.2 Related Construction Drawings and Technical Specifications

The Subcontractor shall comply with Section 02714 of the Technical Specifications. This specification shall be referenced for specific details of the geotextile material properties, manufacturing quality control, and installation requirements of the geotextiles.

9.3 Transportation, Handling and Storage

The CQC Consultant shall monitor the transportation, handling, and storage of the geotextile on-site. The Construction Manager shall designate a geotextile storage location. During transportation, handling, and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions.

Handling of the geotextiles rolls shall be performed in a competent manner such that damage does not occur to the geotextile nor to its protective wrapping. Rolls of geotextiles shall not be stacked upon one another to the extent that deformation of the core occurs or to the point where accessibility can cause damage in handling.

Furthermore, geotextile rolls shall be stacked in such a way that access for conformance sampling is possible. Protective wrappings shall be removed less than one hour prior to unrolling the geotextile. After unrolling, a geotextile shall not be exposed to ultraviolet light for more than 10 calendar days, unless otherwise specified by the Construction Manager.

Outdoor storage of rolls shall not exceed the manufacturers recommendations or longer than 6 months whichever is less. For storage periods longer than 6 months a temporary enclosure shall be placed over the rolls, or they shall be moved to an enclosed facility. The location of temporary field storage shall not be in areas where water can accumulate. The rolls shall be elevated of the ground to prevent water from ponding.

Upon delivery at the site, the Subcontractor, Geosynthetics Installer, and CQC Consultant shall conduct an inspection of the rolls for defects and damage. This inspection shall be conducted without unrolling the materials unless defects or damages are found or suspected. The CQC Consultant shall indicate to the Construction Manager:

- rolls, or portions thereof, which should be rejected and removed from the site because they have severe flaws; and

- rolls which include minor repairable flaws.

The CQC Consultant shall also monitor that equipment used to handle the geotextiles on-site is adequate and does not pose any risk of damage to the geotextiles when used properly.

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9.4 Conformance Testing

9.4.1 Sampling Procedures

Samples shall be taken across the entire width of the roll and shall not include the first 3 feet. Unless otherwise specified, samples shall be 3 feet long by the roll width. The required minimum geotextile conformance sampling frequencies are provided in Tables 9-1 and 9-2. The CQC Consultant shall mark the machine direction on the samples with an arrow and affix a label, tag, or otherwise mark each sample with the following information:

- date sampled;
- project number;
- lot/batch number and roll number;
- conformance sample number; and
- CQC personnel identification.

The geotextile rolls which are sampled shall be immediately rewrapped in their protective coverings to the satisfaction of the Construction Manager.

9.4.2 Testing Procedure

Conformance testing of the geotextile materials delivered to the site will be conducted to ensure compliance with both the Technical Specifications and the manufacturer's list of minimum average roll values. As a minimum, the geotextile conformance test procedures listed in Tables 9-1 and 9-2 shall be performed by the Geosynthetics CQC laboratory.

9.4.3 Test Results

The CQC Consultant shall review all laboratory conformance test results and verify compliance of the test results with the specification shown in Appendix D prior to deployment of the geotextiles. Any non-conformance shall be reported to the Construction Manager.

9.4.4 Conformance Test Failure

In the case of failing test results, the Subcontractor may request that another sample from the failing roll be retested by the Geosynthetics CQC laboratory with the manufacturer's technical representative present during the test procedure. If the retest fails or if the option to retest is not exercised, then two isolation conformance samples shall be obtained by the CQC Consultant. These isolation samples shall be taken from rolls, which have been determined by correlation with the manufacturer's roll number, to have been manufactured prior to and after the failing roll. This method for choosing isolation rolls for testing should continue until passing tests are achieved. All rolls which fail numerically between the passing roll numbers shall be rejected by the Construction Manager. The CQC Consultant will verify that the Subcontractor has replaced all rejected rolls. The CQC Consultant shall document all actions taken in conjunction with geotextile conformance failures.

9.5 Placement

The CQC Consultant shall monitor the placement of all geotextiles to assure they are not damaged in any way, and the following conditions are met.

- On slopes, the geotextiles shall be securely anchored in the anchor trench and then rolled down the slope in such a manner as to continually keep the geotextile sheet in tension.

- In the presence of wind, all geotextiles shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with earth cover material.

- Trimming of the geotextiles shall be performed using only a upward cutting hook blade. Special care must be taken to protect other materials from damage which could be caused by the cutting of the geotextiles.

- The CQC Consultant shall monitor that the Geosynthetics Installer is taking necessary precautions to prevent damage to underlying layers during placement of the geotextile.

- During placement of geotextiles, care shall be taken not to entrap in the geotextile stones, excessive dust, or moisture that could damage the geomembrane, generate clogging of drains or filters, or hamper subsequent seaming.

- A visual examination of the geotextile shall be carried out over the entire surface, after installation, to ensure that no potentially harmful foreign objects, (e.g., stones, sharp objects, small tools, sandbags, etc.) are present.

9.6 Seams and Overlaps

All geotextiles shall be continuously sewn (i.e., spot sewing is not allowed). Geotextiles shall be overlapped 6 in. prior to seaming. No horizontal seams shall be allowed on side slopes that are steeper than 10 horizontal to 1 vertical (i.e. seams shall be along, not across, the slope), except as part of a patch.

Any sewing shall be done using polymeric thread with chemical and ultraviolet resistance properties equal to or exceeding those of the geotextile. The seams shall be sewn using a single row type "401" two-thread chainstich. The CQC Consultant shall

monitor the geotextile seaming procedures to verify that seams and overlaps are in accordance with Section 02714 of the Technical Specifications.

9.7 Repair

The CQC Consultant shall monitor that any holes or tears in the geotextile are repaired as follows:

- On slopes: A patch made from the same geotextile is double seamed into place (with each seam 1/4 in. to 3/4 in. apart and no closer than 1 in. from any edge) with a minimum 12-in. overlap. Should any tear exceed 50 percent of the width of the roll, that roll shall be removed from the slope and replaced.

- Non-slopes: A patch made from the same geotextile is sewn in place with a minimum of 12 in. overlap in all directions away from the repair area.

Care shall be taken to remove any soil or other material which may have penetrated the torn geotextile. The CQC Consultant shall observe all repairs and assure that any non-compliance with the above requirements is corrected.

9.8 Placement of Soil Materials

The CQC Consultant shall monitor the Subcontractor's placement of all soil materials located on top of a geotextile, to verify:

- that no damage occurs to the geotextile;

- that no shifting of the geotextile from its intended position occurs and underlying materials are not exposed or damaged; and

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- that excess tensile stress does not occur in the geotextile.

Soil backfilling or covering of the geotextile with another geosynthetic shall be completed within 10 days or as otherwise directed by the Construction Manager. On side slopes soil backfill shall be placed over the geotextile from the bottom of the slope upward.

TABLE 9-1:

GEOTEXTILE FILTER CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY1[4]
Mass per Unit Area	ASTM D5261	1 test per 100,000 ft^2
Grab Strength	ASTM D4632[1]	1 test per 100,000 ft^2
Trapezoidal Tear Strength	ASTM D4533[2]	1 test per 100,000 ft^2
Puncture Resistance	ASTM D4833[3]	1 test per 100,000 ft^2
Burst Strength	ASTM D3786	1 test per 100,000 ft^2
Apparent Opening Size	ASTM D4751	1 test per 100,000 ft^2
Permittivity	ASTM D4491	1 test per 100,000 ft^2

Notes:

1. Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
2. Minimum value measured in machine and cross machine direction.
3. Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with a flat tip centered within the ring clamp.
4. Testing shall be performed at a frequency of one per lot or at listed frequency, whichever is greater. A lot is defined by ASTM 4354.

TABLE 9-2:

GEOTEXTILE CUSHIONS AND SEPARATOR CONFORMANCE TESTING REQUIREMENTS

TEST NAME	TEST METHOD	MINIMUM TESTING FREQUENCY[4]
Mass per Unit Area	ASTM D5261	1 test per 100,000 ft^2
Grab Strength	ASTM D4632[1]	1 test per 100,000 ft^2
Trapezoidal Tear Strength	ASTM D4533[2]	1 test per 100,000 ft^2
Puncture Resistance	ASTM D4833[3]	1 test per 100,000 ft^2
Burst Strength	ASTM D3786	1 test per 100,000 ft^2

NOTES:

1. Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
2. Minimum value measured in machine and cross machine direction.
3. Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with a flat tip centered within the ring clamp.
4. Testing shall be performed at a frequency of one per lot or at listed frequency, whichever is greater. A lot is defined by ASTM 4354.

10. HDPE MANHOLES, PIPES, FITTINGS AND VALVES

10.1 Introduction

The CQC Consultant shall monitor the installation of ancillary materials such as manholes, pipes, fittings, and valves for leachate collection and transmission as required by Section 02605 of the Technical Specifications and this CQA Plan.

10.2 Butt-Fusion Welding Process

The CQC Consultant shall monitor the assembling of lengths of HDPE pipe into suitable installation lengths by the butt-fusion process. Butt-fusion means the butt-joining of the pipe by softening the aligned faces of the pipe ends in a suitable apparatus and pressing them together under controlled pressure. Butt-fusion welding of the HDPE pipes and fittings shall be performed by the Subcontractor in accordance with the pipe manufacturer's recommendations as to equipment and technique.

10.3 Transportation, Handling and Storage

The pipe is to be placed on wooden pallets and bundled together with plastic straps for bulk handling and shipment. The packing shall be such that either fork lifts or cranes equipped with slings can be used for safety handling. The pipe shall be segregated by wall thickness and diameter.

The CQC Consultant shall monitor the offloading of the palletized pipe to assure that handling of the pallets is done in a competent manner and that the pallets are not placed in areas where water can accumulate. The pallets shall not be stacked more then three high or in such a manner that could cause damage to the pipe. Furthermore, the pipe shall be stacked in such a manner that access for conformance sampling is possible. Outdoor storage should be no longer than 12 months. For outdoor storage

periods longer than 12 months a temporary covering shall be placed over the pipes, or they shall be moved to within an enclosed facility.

10.4 Installation

Care will be taken during installation of the HDPE manholes and pipe such that they will not be cut, kinked, or otherwise damaged. Ropes, fabric, or rubber-protected slings and straps shall be used by the Subcontractor when installing manholes and pipes. The use of chains, cables, or hooks inserted into the pipe ends shall not be approved by the Construction Manager.

The Subcontractor shall install the manholes, pipe fittings, and values in such a manner that the materials are not damaged. Slings for handling the pipeline shall not be positioned at butt-fused joints. Sections of the pipes with deep cuts and/or gouges shall be removed and the ends of the pipeline rejoined. Care shall be exercised when lowering pipe into the trench to prevent damage or twisting of the pipe.

11. MECHANICAL AND ELECTRICAL

11.1 Introduction

The CQC Consultant shall monitor the materials used in and installation of all mechanical and electrical systems to assure compliance with Division 15 and Division 16 of the Technical Specifications. The mechanical and electrical systems include, but are not limited to, the following:

- permanent lift station electrically actuated isolation valve, lift station control panel, associated instrumentation, alarm light and siren, and all other work;
- leak detection manholes control panels and associated instrumentation, alarm lights, and all other work;
- leachate collection manholes manual valves and all other work;
- decontamination facility pumps, and electrical and potable water service;
- overhead power distribution system, power wiring, including power circuit connections for pump motors, and equipment mounting boards; and
- temporary support facilities electric, water, and sanitary sewer services.

11.2 Related Construction Drawings and Technical Specifications

The mechanical work performed by the Subcontractor shall comply with Division 15 of the Technical Specifications. These specifications shall be referenced for specific details of the mechanical equipment requirements and installation. The electrical work performed by the Subcontractor shall comply with Construction Drawings and Technical Specifications. These specifications shall be referenced for specific details of the electrical requirements and installation.

11.3 Codes, Rules, Inspections, and Workmanship

The CQC Consultant shall monitor the work of the Subcontractor in the installation of all mechanical and electrical appurtenances in accordance with national codes and other regulations or authorities having jurisdiction over the work. The CQC Consultant shall observe and document construction acceptance testing procedures performed by the Subcontractor. The CQC Consultant shall also observe and document operational all construction acceptance testing procedures performed by the Subcontractor.

11.4 Record Drawings

The CQC Consultant shall monitor the maintenance by the Subcontractor of a set of prints on which the actual installation of all mechanical and electrical work shall be accurately shown, indicating any variation from Construction Drawings. Changes in layout or circuitry shall be clearly and completely indicated as the work progresses. These progress prints shall be inspected by the Resident Engineer and Construction Manager and used to determine the progress of mechanical and electrical work.

At the completion each phase of the work, the CQC Consultant shall obtain from the Subcontractor a set of record drawings of the work to include marked-up prints showing the dimensioned location of all underground systems.

12. CONCRETE

12.1 Introduction

This CQC Consultant shall monitor the construction and perform conformance testing of all concrete materials and finished products to assure compliance with Construction Drawings and Technical Specifications.

12.2 Inspections

The CQC Consultant shall monitor concrete workmanship to assure that the Subcontractor does not place concrete until foundations, forms, reinforcing steel, pipes, conduits, sleeves, anchors, hangers, inserts, and other work required to be built into concrete has been inspected and approved by the Construction Manager. The Subcontractor is required to notify the Construction Manager and CQC Consultant at least 24 hours in advance of concrete placement activities and scheduling the inspections activities described above.

12.3 Field Quality Control Testing

Concrete conformance testing shall be the responsibility of the CQC Consultant. The concrete test program shall meet the following requirements.

- Concrete samples will be obtained by the CQC Consultant at a frequency of one set of standard cylindrical test specimens for the first 5 cubic yards and every 25 cubic yards of concrete or any portion of thereafter for each structure. For each work shift, when concrete is delivered, at least one set of specimens will be made. A set of test specimens will consist of at least three standard cylinders. Each set of test specimens will be tested for 2-day, 7-day, and 28-day compressive strength.

- Compressive strengths shall be determined from the standard test specimens taken according to ASTM C 31 and ASTM C 172, and cured and tested in accordance with ASTM C 39. Core drilling, if required, and testing will be in accordance with ASTM C 94.

- Slump and air content shall be determined with no less frequency than that of casting strength specimen sets. Air content and slump shall be determined in accordance with ASTM C 231 and ASTM C 143, respectively.

The CQC Consultant shall be responsible for reporting all test results to the Subcontractor and the Construction Manager. Materials determined by the Construction Manager to fail the requirements of the Construction Drawings and Technical Specifications shall be rejected.

13. ROAD CONSTRUCTION

13.1 Introduction

The CQC Consultant shall monitor and test materials used in the construction of the various roads and paved surfaces to assure compliance with Construction Drawings and Technical Specifications.

13.2 Subgrade Preparation

In-place moisture/density testing by nuclear methods (ASTM D3017 and D2922) shall be performed by the CQC Consultant for all compacted fill materials. Fill placement and compaction shall be conducted in accordance with Section 02200 of the Construction Drawings and Technical Specifications. For road subgrades, nuclear moisture/density tests shall be performed at a minimum frequency of 1 test per 500 lineal ft per lift. The CQC Consultant shall monitor the Subcontractor's proofrolling of cut sections.

13.3 Geotextile Conformance Testing and Placement

Conformance testing of the geotextile separator shall be in accordance with the Section 02714 of the Technical Specifications. The CQC Consultant shall monitor the Subcontractor's geotextile installation methods and procedures. The CQC Consultant shall monitor the overlapping and sewing of the geotextile seams. All holes in the geotextile shall be patched in accordance with Section 02714 of the Technical Specifications. The CQC Consultant shall monitor that the minimum overlap between adjacent geotextile panels is maintained during placement of overlying materials.

13.4 Subbase Layer

The CQC Consultant shall monitor the subbase aggregate to ensure it is constructed to the thickness, grades, and limits shown on the construction drawings. The CQC Consultant shall monitor the test section required in Section 02230 of the Technical Specifications.

13.5 Base Layer

The CQC Consultant shall monitor the subbase aggregate to ensure it is constructed to the thickness, grades, and limits shown on the Construction Drawings. The CQC Consultant shall monitor the test section required in Section 02230 of the Technical Specifications.

13.6 Quality Control Testing

Quality control testing of the materials used in construction of the roads and paved surfaces shall be the responsibility of the CQC Consultant. The frequency of CQC testing for the subbase aggregate and base aggregate materials is as follows:

- particle size analysis (ASTM C136) at a frequency of one test per 5,000 yd^3; and

- density and moisture (ASTM D 2922 and ASTM D 3017) at a frequency of one test per 100 lineal feet per lift.

Requirements for in-situ density of subbase and base aggregates shall be defined during the compaction of a test strip. The test strip for subbase aggregate shall be in accordance with the requirements of Item 310.03 of the Ohio DOT Specifications. The base aggregate shall be compacted in accordance with the requirements of Item 304.04 of the Ohio DOT Specifications.

13.7 Repairs

If a defective area is discovered, the CQC Consultant will evaluate the extent and nature of the defect. After this determination the Subcontractor shall correct the deficiency to the satisfaction of the Construction Manager. The Subcontractor shall not perform additional work in the area until the Construction Manager approves the correction of the defect. In the event of damage, the Subcontractor shall immediately make repairs and replacements as necessary to the satisfaction of the Construction Manager.

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14. GENERAL SITE WORK

14.1 Introduction

The CQC Consultant shall monitor the activities which are to be performed for various general site work items including, but not limited to rip rap, erosion and sediment control, culverts, chain link fences and gates, and vegetation for compliance with Construction Drawings and Technical Specifications.

14.2 Conformance Testing

Conformance testing of materials to ensure compliance with the Construction Drawings and Technical Specifications shall be performed by the CQC Consultant at the discretion of the Construction Manager. If nonconformances or other deficiencies are found by the CQC Consultant in the Subcontractors materials or completed work, the Subcontractor will be required to repair or replace the deficiency at not cost. Any noncompliant items shall be reported to the Construction Manager.

APPENDIX A

EXAMPLES OF CQC FORMS

GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

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DAILY FIELD REPORT

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO PROJECT NO: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: _____ day _____ month 1996 year

CONTRACTOR: _____

WEATHER: _____

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COPY TO: _____ PER: _____ HRS: _____

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GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

DAILY WEATHER LOG

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO PROJECT NO.: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: _____ day _____ month 1996 year

TIME PERIOD: _____ AM QA ID: _____

GENERAL CONDITIONS: _____ CLEAR _____ LIGHT CLOUD COVER _____ OVERCAST

WIND: _____ LIGHT _____ MODERATE _____ STRONG _____ GUSTY

TEMPERATURE: LOW _____ °F °C HIGH _____ °F °C

PRECIPITATION: _____ NONE _____ DRIZZLE/FOG _____ RAIN

COMMENTS: _____

TIME PERIOD: _____ PM QA ID: _____

GENERAL CONDITIONS: _____ CLEAR _____ LIGHT CLOUD COVER _____ OVERCAST

WIND: _____ LIGHT _____ MODERATE _____ STRONG _____ GUSTY

TEMPERATURE: LOW _____ °F °C HIGH _____ °F °C

PRECIPITATION: _____ NONE _____ DRIZZLE/FOG _____ RAIN

COMMENTS: _____

TIME A.M.	AMBIENT TEMPERATURE °F °C	GEOMEMBRANE LINER TEMPERATURE °F °C	COMMENTS

TIME P.M.	AMBIENT TEMPERATURE °F °C	GEOMEMBRANE LINER TEMPERATURE °F °C	COMMENTS

NOTE: AMBIENT TEMPERATURE LOCATIONS TAKEN AT APPROXIMATEL ____ ABOVE GROUND LEVEL.

GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

SOIL SAMPLE LOG

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO

PROJECT NO.: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION

DATE: _____ day _____ month 1996 year

SITE SAMPLE NO.	OFF-SITE LAB SAMPLE NO.	SOIL DESCRIPTION	SOURCE (LOCATION, DEPTH, ELEVATION)	MATERIAL TYPE	DATE (day/mo)	TEST METHODS	QA ID

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NOTES: _____

GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

LABORATORY DETERMINATION OF MOISTURE CONTENT OF SOIL

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO PROJECT NO: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: _____ day _____ month 1996 year

SOURCE: _____ MATERIAL TYPE: _____ SAMPLE NO.: _____ QA ID: _____

OVEN METHOD (ASTM D 2216)

RECOMMENDED MASS OF MOIST SAMPLE WEIGHT

100% PASING THE NO. 10 (2-mm) SIEVE	20 grams
100% PASSING THE NO. 4 (4.75-mm) SIEVE	100 grams
100% PASSING THE NO. 3/8-in. (9.5-mm) SIEVE	500 grams
100% PASSING THE NO. 3/4-in. (19-mm) SIEVE	2.5 kilograms

	TARE NO.					
A	WT. OF TARE					
B	WT. OF WET SOIL & TARE					
C	WT. OF DRY SOIL & TARE					
D	WT. OF WATER = B-C					
E	WT. OF DRY SOIL = C-A					
F	MOISTURE CONTENT = (D/E) X 100					

MICROWAVE METHOD (ASTM D 4643)

RECOMMENDED MASS OF MOIST SAMPLE WEIGHT

90% PASSING THE NO. 10 (2-mm) SIEVE	100 TO 200 grams
90% PASSING THE NO. 4 (4.75-mm) SIEVE	200 TO 500 grams
90% PASSING THE 3/4-in. (19-mm) SIEVE	500 TO 1000 grams

INITIAL SETTING TO BE AT 3.0 MINUTES, CONTINUE DRYING SAMPLE AT 1.0 MINUTE SETTING UNTIL MOISTURE CONTENT VARIATION BETWEEN SETTINGS IS LESS THAN 0.1%

	TARE NO.					
A	WT. OF TARE					
B	WT. OF WET SOIL & TARE					
C	WT. OF DRY SOIL & TARE					
D	WT. OF WATER = B-C					
E	WT. OF DRY SOIL = C-A					
F	MOISTURE CONTENT = (D/E) X 100					

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GEOSYNTEC CONSULTANTS

FERMCO

FERNALD ON-SITE DISPOSAL FACILITY

FIELD LABORATORY COMPACTION TEST (ASTM D 698 METHOD A)

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO PROJECT NO.: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: ____ day ____ month 1996 year

SOURCE: ____ MATERIAL TYPE: ____ SAMPLE NO.: ____ QA ID: ____

THIS METHOD WILL BE USED IF THE MATERIAL RETAINED ON THE NO. 3/4-in. (19-mm) SIEVE IS LESS THAN 30% AND IF THE MATERIAL RETAINED ON THE NO. 4 (4.75-mm) SIEVE IS LESS THAN 20%.
ALL MATERIAL RETAINED ON THE NO. 4 (4.75-mm) SIEVE IS DISCARDED.
USE OVERSIZE CORRECTION IF MORE THAN 5% IS DISCARDED ACCORDING TO ASTM D 4718.
USE A 4-in. DIAMETER MOLD / 5.5-lb RAMMER / 12-in. DROP / 3 LAYERS / 25 BLOWS PER LAYER.

COMPACTION OF SOIL

A	WT. OF SOIL & MOLD	(grams)					
B	WT. OF MOLD	(grams)					
C	WT. OF SOIL = A − B	(grams)					
D	WET UNIT WT.(1) = C X 0.066	(pcf)					
E	DRY UNIT WT. = D / [1 + (K/100)]	(pcf)					

NOTE: (1) IF CALIBRATED MOLD OF 1/30 FT^3 IS USED, THE WET DENSITY IS CALCULATED FROM THE WEIGHT OF SOIL, THE VOLUME OF THE MOLD AND THE CONVERSION FROM GRAMS TO POUNDS (I.E., CONVERSION FACTOR = (30 / 453.6) = 0.066). THE MOLD MUST BE CALIBRATED TO VERIFY A CAPACITY OF 1/30 ± 0.0005 FT^3 ON INTERVALS NOT TO EXCEED 1000 TIMES THAT THE MOLD IS FILLED.

MOISTURE CONTENT − ASTM D 2216

	TARE NO.						
F	WT. OF TARE	(grams)					
G	WT. OF WET SOIL & TARE	(grams)					
H	WT. OF DRY SOIL & TARE	(grams)					
I	WT. OF WATER = G − H	(grams)					
J	WT. DRY SOIL = H − F	(grams)					
K	MOISTURE CONTENT = (I/J) X 100	(%)					

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GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

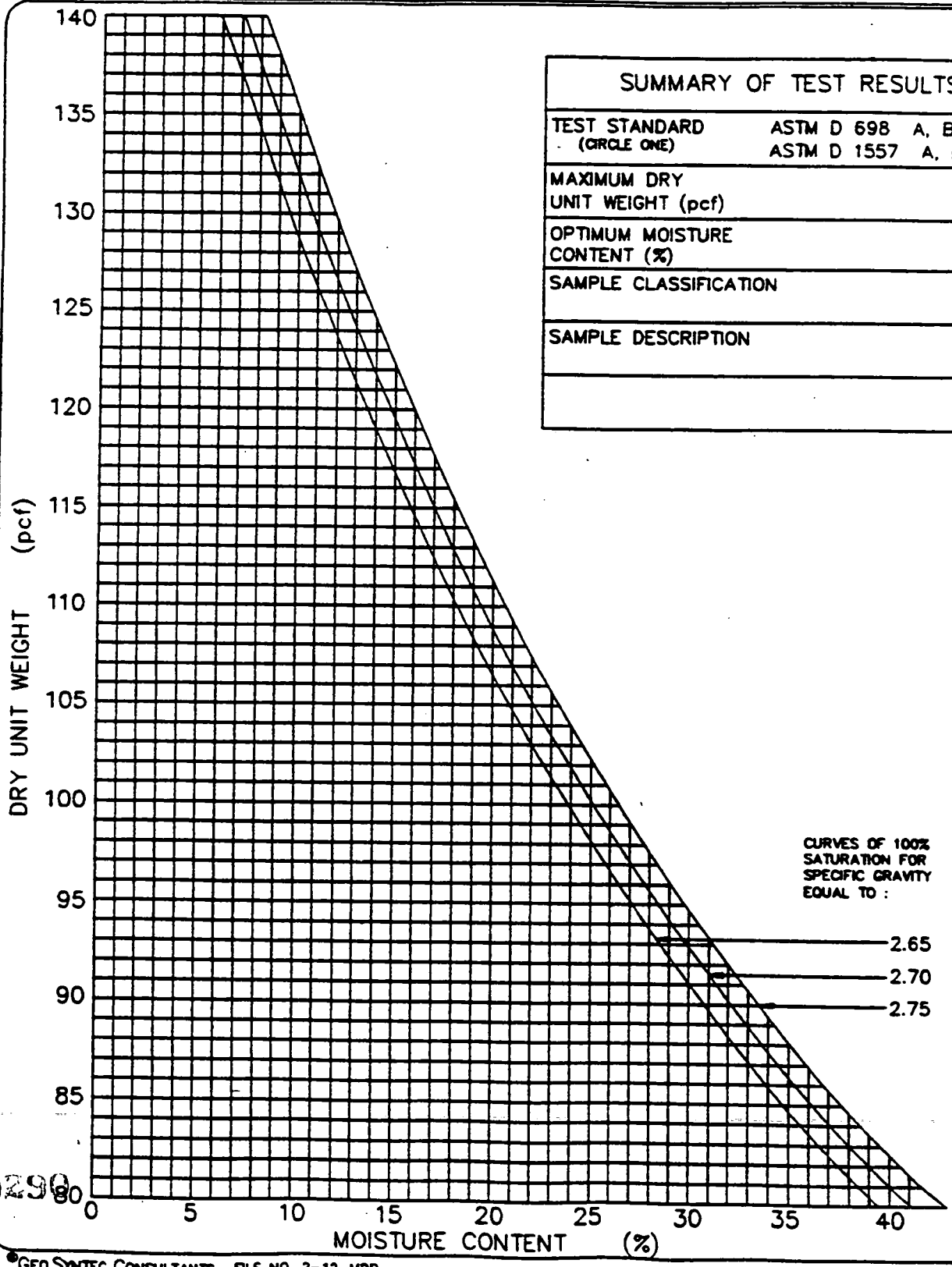
MOISTURE-DENSITY RELATIONSHIP

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO PROJECT NO: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: ____ day ____ month 1996 year

SOURCE: ____ MATERIAL TYPE: ____ SAMPLE NO.: ____ QA ID: ____



SUMMARY OF TEST RESULTS	
TEST STANDARD (CIRCLE ONE)	ASTM D 698 A, B, C ASTM D 1557 A, B, C
MAXIMUM DRY UNIT WEIGHT (pcf)	
OPTIMUM MOISTURE CONTENT (%)	
SAMPLE CLASSIFICATION	
SAMPLE DESCRIPTION	

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GEO SYNTEC CONSULTANTS FILE NO. 2-12-MDR

SHEET NO. ____ OF ____

GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

ATTERBERG LIMITS TEST (ASTM D 4318)

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

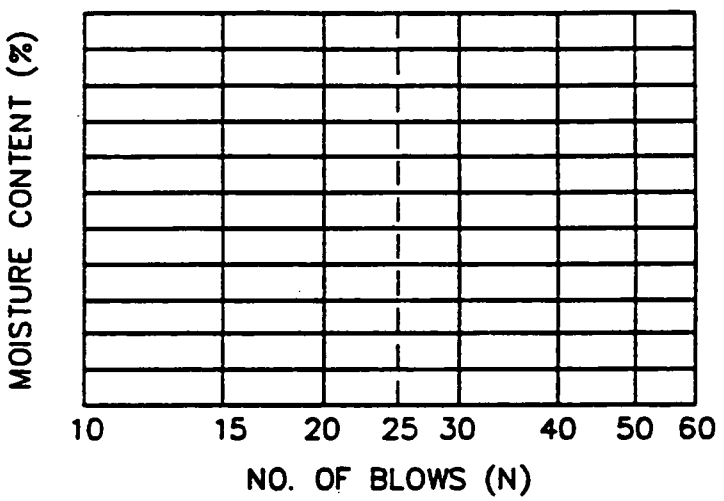
LOCATION: FERNALD, OHIO PROJECT NO: GE3900 TASK NO.: 15.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: _____ day _____ month 1996 year

SOURCE: _____ MATERIAL TYPE: _____ SAMPLE NO.: _____ QA ID: _____

LIQUID LIMIT DETERMINATION

	TARE NO.					
A	WT. OF TARE	(grams)				
B	WT. OF WET SOIL & TARE	(grams)				
C	WT. OF DRY SOIL & TARE	(grams)				
D	WT. OF WATER = B-C	(grams)				
E	WT. OF DRY SOIL = C-A	(grams)				
F	MOISTURE CONTENT = (D/E)X100	(%)				
N	NUMBER OF BLOWS					



PLASTIC LIMIT DETERMINATION

	TARE NO.					
A	WT. OF TARE	(grams)				
B	WT. OF WET SOIL & TARE	(grams)				
C	WT. OF DRY SOIL & TARE	(grams)				
D	WT. OF WATER = B-C	(grams)				
E	WT. OF DRY SOIL = C-A	(grams)				
F	MOISTURE CONTENT = (D/E)X100	(%)				

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LIQUID LIMIT (LL) = _____ PLASTIC LIMIT (PL) = _____ PLASTICITY INDEX (PI) = _____

GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

PARTICLE SIZE ANALYSIS MECHANICAL SIEVE METHOD (ASTM D 422)

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO PROJECT NO: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: ____ day ____ month 1996 year

SOURCE: ____ MATERIAL TYPE: ____ SAMPLE NO.: ____ QA ID: ____

SOIL SAMPLE SIZE (ASTM D 1140)

DIAMETER OF LARGEST PARTICLE (SIEVE SIZE)	(grams)	NO. 10	NO. 4	3/4-in.
APPROXIMATE MINIMUM WT. OF SAMPLE	(grams)	200	500	1500

		BEFORE WASH	AFTER WASH
WT. OF DRY SAMPLE PLUS TARE	(grams)		
WT. OF TARE	(grams)		
WT. OF DRY SAMPLE	(grams)		

SIEVE ANALYSIS

SIEVE NO.	DIAMETER (mm)	WT. RETAINED (grams)	% RETAINED	% FINER	PROJECT SPECIFICATIONS

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%FINER = 100 − Σ% RETAINED

GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

PARTICLE SIZE DISTRIBUTION AND SOIL CLASSIFICATION TEST RESULTS

(ASTM D 422 & ASTM D 2487)

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

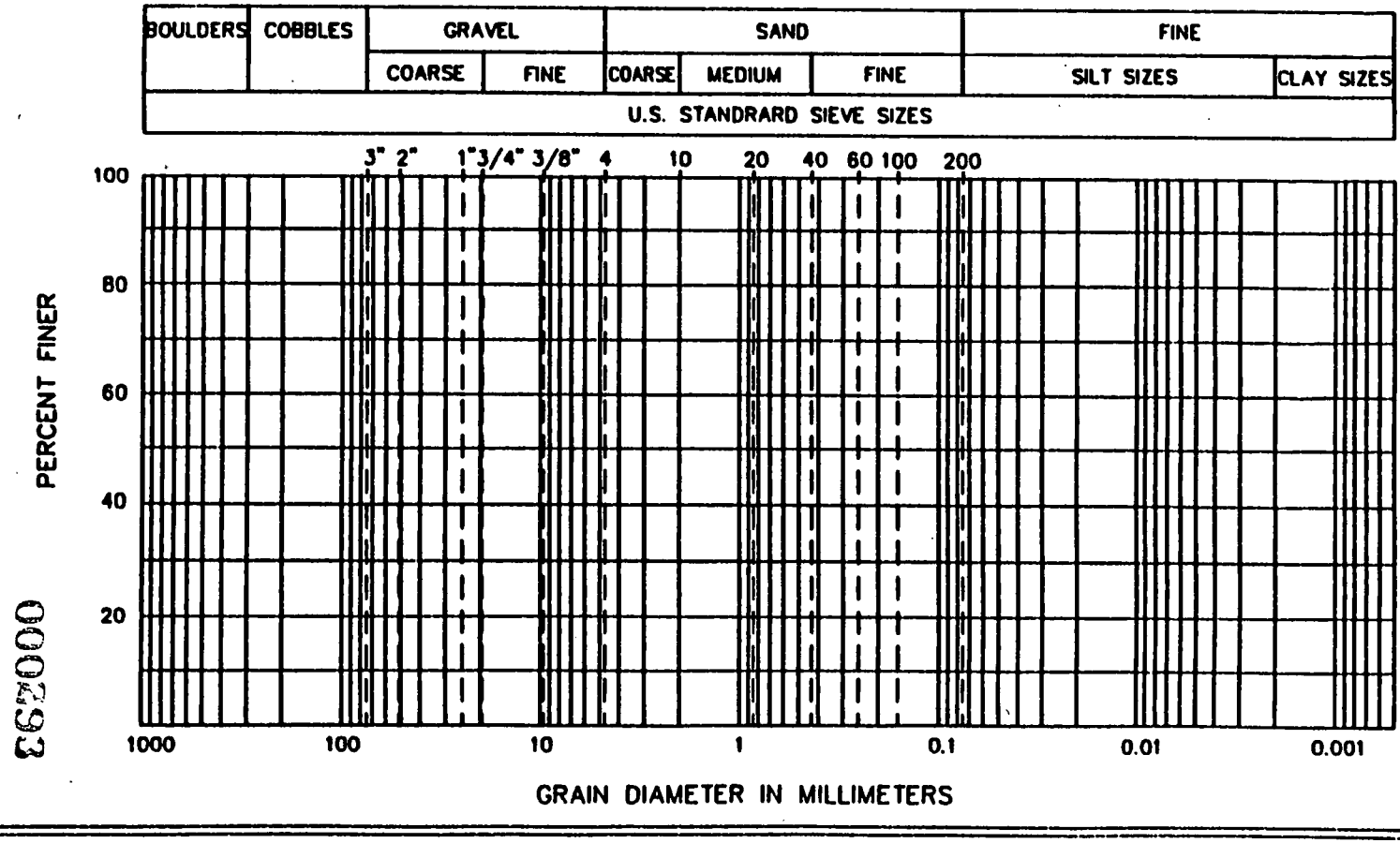
LOCATION: FERNALD, OHIO

PROJECT NO.: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION

DATE: _____ day _____ month 1996 year

SOURCE: _____ MATERIAL TYPE: _____ SAMPLE NO.: _____ QA ID: _____



CURVE COEFFICIENTS

(C_u) .....

(C_c) .....

ATTERBERG LIMITS

(LL) .....

(PL) .....

(PI) .....

SIEVE RESULTS

SIEVE SIZE	% FINER
3-in.	
2-in.	
1 1/2-in.	
1-in.	
3/4-in.	
1/2-in.	
3/8-in.	
NO. 4	
NO. 10	
NO. 20	
NO. 40	
NO. 60	
NO. 100	
NO. 200	

SOIL CLASSIFICATION (ASTM D 2487): _____

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GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

FIELD SAND CONE DENSITY TEST (ASTM D 1556)

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO PROJECT NO: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: ____ day ____ month 1996 year

SOURCE: ____ MATERIAL TYPE: ____ QA ID: ____

SPECIFICATION REQUIREMENTS:

MATERIAL TYPE: (CIRCLE ONE) FILL / SUBGRADE / SUBBASE / CLAY / OTHER: ____

% COMPACTION: ____ MOISTURE CONTENT RANGE: ____

TEST LOCATION: ____ TEST NO.: ____

FIELD TEST DATA – ASTM D 1556

A	BULK UNIT WT. OF SAND (SEE FORM 2-12-FLC)	(pcf)		H	WT. OF WET SOIL & TARE FROM HOLE	(lbs)
B	INITIAL WT. OF SAND & JAR	(lbs)		I	WT. OF TARE NO.: ____	(lbs)
C	FINAL WT. OF SAND & JAR	(lbs)		J	WT. OF WET SOIL FROM HOLE = H-I	(lbs)
D	WT. OF SAND IN FUNNEL & HOLE = B-C	(lbs)		K	WET UNIT WT. = J/G	(pcf)
E	WT. OF SAND IN FUNNEL (1)	(lbs)		M	DRY UNIT WT. = K/[1+(T/100)]	(pcf)
F	WT. OF SAND IN HOLE = D-E	(lbs)		N	PERCENT COMPACTION = M/U	(%)
G	VOLUME OF HOLE = F/A	(ft^3)				

NOTE: (1) THE WEIGHT OF SAND IN FUNNEL (E) IS OBTAINED BY WEIGHING THE SAND, A MINIMUM OF THREE TIMES, IN THE APPARATUS BEFORE AND AFTER THE APPARATUS HAS BEEN TURNED OVER ON THE BASE PLATE ALONG A FLAT SURFACE WITH THE SAND BEING EXPENDED.

FIELD MOISTURE CONTENT – ASTM D 2216

O	WT. OF TARE NO. ____	(grams)		R	WT. OF WATER = P-Q	(grams)
P	WT. OF WET SOIL & TARE	(grams)		S	WT. OF DRY SOIL = Q-O	(grams)
Q	WT. OF DRY SOIL & TARE	(grams)		T	MOISTURE CONTENT = (R/S)X100	(%)

COMPACTION TEST DATA

SAMPLE REFERENCE NO.			U	MAXIMUM DRY UNIT WT.	(pcf)
TEST STANDARD USED			V	OPTIMUM MOISTURE CONTENT	(%)

COMPARISON WITH NUCLEAR GAUGE – ASTM D 2922 AND D 3017

TEST NO. 000194				MOISTURE CONTENT	(%)
WET UNIT WT.	(pcf)			DRY UNIT WT.	(pcf)

GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

FIELD NUCLEAR MOISTURE/DENSITY TEST LOG (ASTM D 3017 AND ASTM D 2922)

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO PROJECT NO.: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: ____ day ____ month 1996 year

SPECIFICATION REQUIREMENTS

SOURCE: _____ MATERIAL TYPE: FILL / SUBGRADE / SUBBASE / CLAY / OTHER: _____ (CIRCLE ONE) LIFT THICKNESS (LOOSE/COMPACTED): ____

% COMPACTION: _____ MOISTURE RANGE: _____ ASTM D 698: A B C / ASTM D 1557: A B C _____ (CIRCLE ONE)

NUCLEAR GAUGE TYPE: _____ NUCLEAR GAUGE SERIAL NO. _____ COR. FACTOR: _____

TEST NO.	TEST LOCATION	PROBE DEPTH/ ELEV/ LIFT NO.	LAB RESULTS		FIELD TEST RESULTS						RETEST NO.	QA ID
			OMC (%)	MAX DRY UNIT WT (PCF)	FMC (%)	WET UNIT WT (PCF)	DRY UNIT WT (PCF)	PERCENT COMPACT (%)	PASS	FAIL		

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GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

PANEL PLACEMENT LOG (WITHOUT TEMPERATURE)

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO PROJECT NO: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: _____ day _____ month 1996 year

PRIMARY: ☐ SECONDARY: ☐ OTHER: ☐ PRODUCT TYPE: _____

PANEL NO.	BATCH / ROLL NO.	DATE (day/mo)	TIME	PLACEMENT LOCATION COMMENTS	APPROX WIDTH (ft)	APPROX LENGTH (ft)	QA ID
				TOTALS:(1)			

NOTE: (1) APPROXIMATE AREA: THIS PAGE: _____ (ft^2) ACCUMULATED: _____ (ft^2)

NOTES: _____

GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

TRIAL SEAM LOG - FUSION (WITHOUT TEMPERATURE)

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO PROJECT NO: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: _____ day _____ month 1996 year

CONTRACTOR: _____ TENSIOMETER DESCRIPTION: _____

TRIAL SEAM NO.	DATE (day/mo)	TIME	MACHINE NO.	OPER ID	MATERIAL DESCRIPTION (1)	FUSION		TEST RESULTS				RETEST NO.	QA ID
						WEDGE (SET/°C/°F)	MEASURED SPEED (ft/min)	PEEL (ppi/psi) INSIDE	PEEL (ppi/psi) OUTSIDE	SHEAR (ppi/psi)	PASS/ FAIL		

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NOTE: (1) MATERIAL DESCRIPTION REFERS TO EITHER SMOOTH/SMOOTH (S/S); SMOOTH/TEXTURED (S/T); OR TEXTURED/TEXTURED (T/T).

GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

PRODUCTION SEAM LOG (WITHOUT TEMPERATURE)

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO PROJECT NO: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: _____ day _____ month 1996 year

CONTRACTOR: _____

PRIMARY: ☐ SECONDARY: ☐ OTHER: ☐ PRODUCT TYPE: _____

DATE (day/mo)	SEAM NO.	TIME	APPROX LENGTH (ft)	MACHINE NO.	OPERATOR ID	LOCATION COMMENTS	QA ID
		TOTAL (1)					

NOTE: (1) APPROXIMATE LENGTH: THIS PAGE _____ (ft) ACCUMULATED _____ (ft)

GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

SEAM AND PANEL REPAIR LOCATION LOG

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO PROJECT NO: GE3900 TASK NO.: 15.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: ____ day ____ month 1996 year

CONTRACTOR: ____

PRIMARY: ☐ SECONDARY: ☐ OTHER: ☐ PRODUCT TYPE: ____

NORTH

NOTE:
SEE OTHER SIDE FOR SYMBOLS

QA ID: ____

SEAM NO.:	
PANEL NO.:	
AVG PANEL LENGTH:	
AVG PANEL WIDTH:	
AREA: (ft^2)	

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GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

DESTRUCTIVE TEST LOG

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO PROJECT NO.: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: ____ day ____ month 1996 year

CONTRACTOR: ____ TEST REQUIREMENTS: ____

PRIMARY: ☐ SECONDARY: ☐ RE-TEST: ☐ OTHER: ☐ ____

DISTRIBUTION: LABORATORY: ☐ ARCHIVE: ☐ INSTALLER: ☐ OTHER: ☐

SAMPLE DATA					FIELD DATA					LABORATORY DATA						
D.S. NO.	SEAM/ LOCATION	MACH NO.	OPER ID	DATE SAMPLED/ SHIPPED (day/mo)	AVG PEEL (PPI/PSI)		AVG SHEAR (PPI/PSI)	PASS/ FAIL	QA ID	DATE OF RESULTS (day/mo)	AVG PEEL (PPI/PSI)		AVG SHEAR (PPI/PSI)	PASS/ FAIL	RE-TEST	QA ID
					INSIDE	OUTSIDE					INSIDE	OUTSIDE				

(15)

GEOSYNTEC CONSULTANTS

FERNALD ON-SITE DISPOSAL FACILITY

NONDESTRUCTIVE TEST LOG

PROJECT: FERNALD ON-SITE DISPOSAL FACILITY

LOCATION: FERNALD, OHIO PROJECT NO.: GE3900 TASK NO.: 16.4

DESCRIPTION: DISPOSAL FACILITY CONSTRUCTION DATE: ____ day ____ month 1996 year

CONTRACTOR: ____ TEST REQUIREMENTS: ____

PRIMARY: ☐ SECONDARY: ☐ RE-TEST: ☐ OTHER: ☐ ____

DATE (day/mo)	SEAM NO. OR LOCATION	LENGTH OF SEAM TESTED (ft)	OPER. ID	AIR PRESSURE TEST					VACUUM-BOX TEST		PASS/ FAIL	ACTION	QA ID
				START		Δ PRES. (psi)	STOP		NO. OF LEAKS	DATE OF RE-TEST			
				TIME	PRES.		PRES.	TIME					

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NOTES: ____

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APPENDIX B

TABLE 02770-1
REQUIRED TEXTURED
HDPE GEOMEMBRANE PROPERTIES

TABLE 02770-1

REQUIRED HDPE TEXTURED GEOMEMBRANE PROPERTIES

Properties	Qualifiers	Units[1]	Specified Values	Test Method
Physical Properties				
Thickness	average	mils	80	GRI-GM8
	minimum	mils	76	GRI-GM8
Specific Gravity	minimum	N/A	0.940	ASTM D 792 Method A or ASTM D 1505
Carbon Black Content	range	%	2-3	ASTM D 1603
Carbon Black Dispersion	N/A	none	Category 1 or 2	ASTM D 5596
Melt Flow Index	maximum	g/10 min	1.0	ASTM D 1238 (Condition E)
Mechanical Properties				
Tensile Properties (each direction)				
1. Force Per Unit Width at Yield	minimum	lb/in	168	ASTM D 638 (Modified by NSF 54 Annex A)
2. Tensile Strength (force per unit width at break)	minimum	lb/in	300	ASTM D 638 (Modified by NSF 54 Annex A)
3. Elongation at Yield	minimum	%	12	ASTM D 638 (Modified by NSF 54 Annex A)
4. Elongation at Break	minimum	%	200	ASTM D 638 (Modified by NSF 54 Annex A)
Tear Resistance	minimum	lb	52	ASTM D 1004 Die C Puncture

TABLE 02770-1 (continued)

Properties	Qualifiers	Units[1]	Specified Values	Test Method
Environmental Properties				
Low Temperature Brittleness	maximum	°C	-60	ASTM D 746 Procedure B
Dimensional Stability (each direction)	maximum change	%	±2	ASTM D 1204 212°F, 15 min.
Environmental Stress Crack	minimum	hrs	500[2]	ASTM D 5397

Notes: 1. % = percent
g = grams
min = minutes
lb/in = pounds per inch
lb = pound
°C = degrees celsius
hrs = hours

1. Time-to-failure at a tensile stress of 900 lb/in^2

TABLE 02770-2

REQUIRED HDPE TEXTURED GEOMEMBRANE SEAM PROPERTIES

Properties	Qualifiers	Units[3]	Specified Values		Test Method
			80 mil	60 mil	
Shear Strength[1]					
fusion	minimum	lb/in	160	120	ASTM D 4437
extrusion	minimum	lb/in	144	108	ASTM D 4437
Peel Adhesion					
FTB[2]					
fusion	minimum	lb/in	104	78	ASTM D 4437
extrusion	minimum	lb/in	90	70	ASTM D 4437

Notes: 1. Also called "Bonded Seam Strength". Value is at material yield point.
2. FTB = Film Tear Bond. (Maximum 10 percent seam separation)
3. lb/in = pounds per inch

[END OF SECTION]

APPENDIX C

TABLE 02772-1
REQUIRED GEOSYNTHETIC CLAY LINER PROPERTY VALUES

TABLE 02772-1

REQUIRED GEOSYNTHETIC CLAY LINER AND CAP PROPERTY VALUES

PROPERTIES	QUALIFIERS	UNITS[6]	SPECIFIED[1] VALUES	TEST METHOD
GCL Properties				
Bentonite Content[4] (GCL)	minimum	lb/ft^2	01.0	ASTM D 5261
Bentonite Moisture Content	maximum	%	25	ASTM D 4643
Bentonite Free Swell	minimum	ml/2g	24	ASTM D 5890
Hydraulic Conductivity (Bentonite only)[5]	minimum	cm/s	5×10^{-9}	GRI GCL-2
Shear Strength (GCL)		See values in Part 2 of this Section.		
Textured HDPE Geomembrane Properties[3]				
Thickness	average minimum	mils mils	40 36	GRI GM 8 GRI GM 8
Specific Gravity	minimum	N/A	0.94	ASTM D 792 or ASTM 1505
Melt Flow Index	maximum	g/10 min	1.0	ASTM D 1238 (Condition E)
Elongation at Yield	minimum	%	13	ASTM D 638
Elongation at Break	minimum	%	100	ASTM D 638
Strength at Yield	minimum	lb/in	95	ASTM D 638
Strength at Break	minimum	lb/in	50	ASTM D 638
Tear Resistance	minimum	lb	12	ASTM D 1004 Die C puncture
Puncture Resistance	minimum	lb	25	ASTM D 4833
Carbon Black Content	range	%	2-3	ASTM D 1603
Carbon Black Dispersion	N/A	none	A1 or A2	ASTM D 5596
Geotextile Properties[3]				
Polymer Composition	minimum	%	95 polyester or polypropylene	

TABLE 02772-1 (continued)

REQUIRED GEOSYNTHETIC CLAY LINER AND CAP PROPERTY VALUES

PROPERTIES	QUALIFIERS	UNITS[6]	SPECIFIED[1] VALUES	TEST METHOD
Woven Geotextile[3]				
Mass Per Unit Area	minimum	oz/yd^2	3.0	ASTM D 5261
Grab Strength	minimum	lb	108	ASTM D 4632[2]
Tear Strength	minimum	lb	54	ASTM D 4533[2]
Puncture Strength	minimum	lb	54	ASTM D 4833
Mullen Burst Strength	minimum	psi	270	ASTM D 3786
Wide-Width Tensile Resistance	minimum	ppi	35	ASTM D 4595
Nonwoven Geotextile[3]				
Mass Per Unit Area	minimum	oz/yd^2	5.4	ASTM D 5261
Grab Strength	minimum	lb	135	ASTM D 4632[2]
Tear Strength	minimum	lb	54	ASTM D 4533[2]
Puncture Strength	minimum	lb	72	ASTM D 4833
Mullen Burst Strength	minimum	psi	250	ASTM D 3786
Wide-Width Tensile Resistance	minimum	ppi	35	ASTM D 4595

Notes:
1. All values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).
2. Minimum value measured in machine and cross machine direction.
3. Geosynthetic clay liners and caps not having these components and otherwise satisfying Part 2.01 of this Section, are exempt from meeting the specified values.
4. Measured at a moisture content not exceeding 25 percent.
5. For GCL with geomembrane backing, perforate cut at backing to allow unimpeded and uniform flow through the backing.
6. lb/ft^2 = pounds per square foot
   cm/s = centimeter per second
   min = minutes
   g = grams
   % = percent
   oz/yd^2 = ounces per square yard
   lb = pound
   psi = pounds per square inch
   ppi = pounds per inch
   ml/2g = milliliters per two grams

[END OF SECTION]

APPENDIX D

TABLES 02714-1 THROUGH 02714-5 REQUIRED PROPERTY VALUES FOR CUSHIONS GEOTEXTILE FILTER AND SEPARATOR

TABLE 02714-1

REQUIRED PROPERTY VALUES FOR GEOTEXTILE FILTER

PROPERTIES	QUALIFIER	UNITS	SPECIFIED[4] VALUES	TEST METHOD
Type				
nonwoven needlepunched				(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd^2	7	ASTM D 5261
Filter Requirements				
Apparent opening size (O_{95})	maximum	mm	0.21	ASTM D 4751
Permittivity	minimum	sec^{-1}	0.5	ASTM D 4491
Mechanical Requirements				
Grab strength	minimum	lb	180	ASTM D 4632[1]
Tear strength	minimum	lb	75	ASTM D 4533[2]
Puncture strength	minimum	lb	75	ASTM D 4833[3]
Burst strength	minimum	psi	350	ASTM D 3786
Durability				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

Notes:

(1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
(2) Minimum value measured in machine and cross machine direction.
(3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
(4) All values represent minimum average roll values.
(5) mm = millimeter
% = percent
oz/yd^2 = ounce per square yard
sec = second
lb = pound
psi = pound per square inch

TABLE 02714-2

REQUIRED PROPERTY VALUES FOR GEOTEXTILE CUSHION IN FINAL COVER SYSTEM

PROPERTIES	QUALIFIER	UNITS	SPECIFIED[4] VALUES	TEST METHOD
Type				
nonwoven needlepunched				(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd^2	8	ASTM D 5261
Mechanical Requirements				
Grab strength	minimum	lb	200	ASTM D 4632[1]
Tear strength	minimum	lb	75	ASTM D 4533[2]
Puncture strength	minimum	lb	90	ASTM D 4833[3]
Burst strength	minimum	psi	350	ASTM D 3786
Durability				
Ultraviolet Resistance @ 500 hours	minimum	%	70	ASTM D 4355

Notes:

(1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
(2) Minimum value measured in machine and cross machine direction.
(3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
(4) All values represent minimum average roll values.
(5) mm = millimeter
% = percent
oz/yd^2 = ounce per square yard
sec = second
lb = pound
psi = pound pe square inch

TABLE 02714-3

REQUIRED PROPERTY VALUES FOR GEOTEXTILE CUSHION IN LINER SYSTEM

PROPERTIES	QUALIFIER	UNITS	SPECIFIED[4] VALUES	TEST METHOD
Type				
nonwoven needlepunched				(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd^2	10	ASTM D 5261
Mechanical Requirements				
Grab strength	minimum	lb	225	ASTM D 4632[1]
Tear strength	minimum	lb	90	ASTM D 4533[2]
Puncture strength	minimum	lb	120	ASTM D 4833[3]
Burst strength	minimum	psi	450	ASTM D 3786
Durability				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

Notes:

(1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
(2) Minimum value measured in machine and cross machine direction.
(3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
(4) All values represent minimum average roll values.
(5) mm = millimeter
% = percent
oz/yd^2 = ounce per square yard
sec = second
lb = pound
psi = pound pe square inch

TABLE 02714-4

REQUIRED PROPERTY VALUES FOR SUPPLEMENTAL GEOTEXTILE CUSHION IN LINER SYSTEM[5]

PROPERTIES	QUALIFIER	UNITS	SPECIFIED[4] VALUES	TEST METHOD
Type				
nonwoven needlepunched				(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd^2	16	ASTM D 5261
Mechanical Requirements				
Grab strength	minimum	lb	350	ASTM D 4632[1]
Tear strength	minimum	lb	120	ASTM D 4533[2]
Puncture strength	minimum	lb	180	ASTM D 4833[3]
Burst strength	minimum	psi	700	ASTM D 3786
Durability				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

Notes:

(1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
(2) Minimum value measured in machine and cross machine direction.
(3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
(4) All values represent minimum average roll values.
(5) mm = millimeter
% = percent
oz/yd^2 = ounce per square yard
sec = second
lb = pound
psi = pound pe square inch

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TABLE 02714-5

REQUIRED PROPERTY VALUES FOR GEOTEXTILE SEPARATOR

PROPERTIES	QUALIFIER	UNITS	SPECIFIED[4] VALUES	TEST METHOD
Type				
nonwoven				(-)
Polymer composition	minimum	%	95 polypropylene or polyester by weight	(-)
Mass per unit area	minimum	oz/yd^2	6	ASTM D 5261
Mechanical Requirements				
Grab strength	minimum	lb	180	ASTM D 4632[1]
Tear strength	minimum	lb	75	ASTM D 4533[2]
Puncture strength	minimum	lb	75	ASTM D 4833[3]
Burst strength	minimum	psi	350	ASTM D 3786
Durability				
Ultraviolet Resistance	minimum	%	70	ASTM D 4355

Notes:

(1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
(2) Minimum value measured in machine and cross machine direction.
(3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
(4) All values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).
(5) mm = millimeter
% = percent
oz/yd^2 = ounce per square yard
sec = second
lb = pound
psi = pound pe square inch

[END OF SECTION]

IMPACTED MATERIALS PLACEMENT PLAN
ON-SITE DISPOSAL FACILITY

20100-PL-007
Revision G
October 1996

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

GeoSyntec Consultants
1100 Lake Hearn Drive, NE, Suite 200
Atlanta, Georgia 30342

Under

Fernald Environmental Restoration Management Corporation
Subcontract 95PS005028

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APPENDICES

APPENDIX A: IMPACTED MATERIALS PLACEMENT QUALITY ASSURANCE PLAN

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1.0 INTRODUCTION

1.1 Overview

This Impacted Materials Placement (IMP) Plan describes the impacted materials acceptance, placement, compaction, and quality assurance/quality control (QA/QC) activities that will be undertaken throughout construction, placing and closure of the On-Site Disposal Facility (OSDF) at the Fernald Environmental Management Project (FEMP), Fernald, Ohio.

1.2 Project Description

The OSDF will be constructed to contain impacted materials derived from remediation of the operable units at the FEMP. These materials will be required to meet OSDF waste acceptance criteria (WAC) prior to disposal in the OSDF. The estimated total volume of impacted material destined for OSDF disposal is 2.5 million cubic yards (1.9 million cubic meters) bank/unbulked. Approximately 80 percent of this material is impacted soil, with the remainder consisting of building demolition debris, flyash, lime sludge, municipal solid waste, and small quantities of miscellaneous other materials.

The construction, placing, and closure of the OSDF is currently scheduled to occur over a period of approximately 7 years, as described in the Accelerated Remediation Plan [$276 million case] (276 Plan). However, due to the potential for variations in the pace of remedial action activities, the OSDF has been designed to be constructed, filled, and closed in phases for up to 25 years.

The design approach for the OSDF is presented in the document, *Final Remedial Design Work for Remedial Actions at Operable Unit 2 (OU2 RDWP)* [DOE, 1995c]. The design of the OSDF, as currently developed, is presented in the *Final Design Package, On-Site Disposal Facility* [GeoSyntec, 1996a]. The design of the OSDF includes liner system, final cover system, leachate management system, surface-water management system.

1.3 Plan Scope

This plan establishes the operational procedures to be used by the Subcontractor to place, compact, and protect impacted material placed in the OSDF. The scope of this IMP Plan includes:

- Presenting radiological/chemical and physical waste acceptance criteria applicable to OSDF impacted materials;
- Categorizing impacted material types based on handling, placement, and compaction requirements;
- Developing acceptable proportions of the various impacted material types to be placed within any area of the OSDF to achieve satisfactory OSDF performance;

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- Developing procedures for placing and compacting impacted materials in the OSDF; and
- Developing QA/QC procedures for impacted material placement in the OSDF.

1.4 Plan Organization

The remainder of this plan is organized as follows:

- The criteria used in establishing the requirements of this IMP Plan are presented in Section 2.0;
- The design features of the OSDF applicable to this IMP Plan are presented in Section 3.0;
- Impacted material waste acceptance criteria are described in Section 4.0;
- Descriptions of the impacted materials to be placed in the OSDF are presented in Section 5.0;
- General procedures for handling, placement, and compaction of impacted materials in the OSDF are presented in Section 6.0;
- Specific procedures for handling, placement, and compaction of soil and soil-like impacted materials are presented in Section 7.0;
- Specific procedures for handling and placement of special impacted materials are presented in Section 8.0;
- Measures to be taken for the control of impacted runoff and fugitive emissions related to, or resulting from, the placement of impacted materials are described in Section 9.0;
- Required documentation procedures are presented in Section 10.0; and
- Regulatory and technical references cited in this plan are listed in Section 11.0.

Appendix A to this IMP Plan contains an Impacted Materials Placement (IMP) Quality Assurance Plan. The IMP Quality Assurance Plan describes those activities that the CQC Consultant will undertake to establish that the Subcontractor complies with this IMP Plan.

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This IMP Plan uses several key phrases which are critical to understand. The terms and their usage within this plan are briefly explained as follows:

"lift" usage common to earthwork.

"grid" refers to a 100 ft. by 100 ft. grid system for each cell, which is the key for management of impacted materials.

"horizon" a horizontal strata limited horizontally to a 100 ft. by 100 ft. grid element, and limited vertically by either the maximum height of the item(s) therein or by the maximum number of lifts therein.

1.5 Plan Responsibilities

This plan describes work to be conducted by three separate organizations:

- *Construction Manager (CM)* — Responsibilities include: overall coordination between all the parties to the FEMP; directing the construction management team; contractual management responsibility over the Subcontractor; specifying the materials requiring OSDF disposal; providing security for OSDF operations; implementing construction safety; providing emergency health and safety response teams; and oversite of the OSDF Construction Quality Assurance Plan.

- *Subcontractor* — Responsibilities include: separating impacted materials into categories; loading and hauling impacted materials to the OSDF; routing impacted materials within the OSDF battery limit; placing impacted material in the OSDF; obtaining final grade lines as shown on the certified-for-construction (CFC) Drawings; compacting (or compacting around and over) impacted material in the OSDF; and controlling the generation of fugitive emissions and managing impacted stormwater runoff.

- *CQC Consultant* — Responsibilities include: checking the Subcontractor's impacted material category classification; spot-checking impacted material shipments for conformance with OSDF WAC prior to those shipments arriving at the OSDF battery limit; verifying the Subcontractor's choice of location for impacted material placement; documenting that the Subcontractor followed the placement and compaction procedures required by this IMP Plan; and conducting compaction tests of materials placed in the OSDF.

1.6 Related Plans

Several other plans have been prepared and should be used in conjunction with this IMP Plan. The other plans containing information relevant to this IMP Plan are listed below along with a brief statement of the relationship to this plan.

- *OSDF Construction Quality Assurance (CQA) Plan.* Describes the quality assurance procedures that will be followed by CQC Consultant during construction, placing impacted material, and closure of the OSDF;

- *OSDF Air Monitoring Plan.* Establishes procedures to measure and evaluate potential fugitive dust and radioactive particulate matter emissions during construction, placing, and closure of the OSDF;

- *OSDF Systems Plan.* Contains procedures for inspecting and monitoring the OSDF including the leachate management system, final cover system, and temporary facilities; and

- *OSDF Surface Water Management and Erosion Control (SWMEC) Plan.* Provides procedures for the management of surface water in and around the OSDF and details of temporary and permanent erosion and sediment controls for the OSDF.

The Subcontractor shall be responsible for preparing an IMP health and safety (H&S) plan that meets all health and safety requirements identified in the FEMP Project Specific Health and Safety Requirements Matrix (PSHSRM). In addition, the H&S personnel will perform periodic audits of the Subcontractor to ensure compliance; H&S personnel will have stop-work authority (in the event of threat to worker and/or public safety) until the proper corrective action is taken. The H&S Officer assigned to the OSDF project will be the single point of contact for all safety, industrial hygiene, fire protection, and radiological issues or concerns.

In addition to H&S personnel assigned to the project, the Subcontractor will be required to provide a H&S field representative who will be responsible for the Subcontractor's compliance with all H&S requirements. The Subcontractor will be required to report all safety concerns and incidents to the H&S Officer.

Radiological technician(s) will also be assigned to the OSDF project. In conjunction with the H&S Officer assigned to the project, the radiological technician(s) will help to ensure radiological compliance throughout the project. Radiological compliance includes the radiological monitoring of equipment and materials entering and leaving the job site, radiological monitoring of soil during excavations to help ensure proper segregation, storage, or disposition; radiation work permit compliance, routine inspection, monitoring, and recording of area radiation detection monitors, and radiological monitoring of personnel, if necessary. The PSHSRM will be the basis for the required monitoring and will identify the action levels that will ensure personnel safety by limiting exposure.

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2.0 PERTINENT REQUIREMENTS

2.1 Overview

Regulatory and other requirements pertinent to this plan primarily take the form of applicable or relevant and appropriate requirements (ARARs) and to be considered criteria (TBCs) as determined by the record of decision for each of the various FEMP operable units, functional requirements, and general design criteria. In general, these criteria are intended to result in impacted material management activities that: (I) are protective of the OSDF liner system, leachate management system, and final cover system; (ii) result in an OSDF waste mass that is stable and does not undergo unacceptable levels of differential settlement; and (iii) provides acceptable management of the generation of fugitive emissions and the routing and containment of impacted runoff.

2.2 ARARs and TBCs

ARARs and TBCs that should be addressed by this plan are provided here, as obtained from the *Final Record of Decision for Remedial Actions at Operable Unit 2 (OU2 ROD)* [DOE, 1995a], the *Final Record of Decision for Remedial Actions at Operable Unit 5 (OU5 ROD)* [DOE, 1996a], the *Operable Unit 3 Record of Decision for Final Remedial Action (OU3 ROD)* [DOE, 1996b], or the *Permitting Plan and Substantive Requirements for the On-site Disposal Facility (OSDF Permitting Plan)* [DOE, 1996c], as identified.

	Citation	Requirement	OU2 ROD	OU5 ROD	OU3 ROD	OSDF Permitting Plan
1	Ohio Particulate Matter Standards—Restriction of Emission of Fugitive Dust OAC 3745-17-08	Requires the use of reasonably available dust control measures to prevent fugitive dust from becoming airborne and defines "reasonably available control measures".	✓	✓	✓	
2	Ohio Solid Waste and Infectious Waste Regulations—Operational Criteria for a Sanitary Landfill Facility OAC 3745-27-19(E)(30)	Prohibits disposal of whole scrap tires and shredded whole scrap tires in a sanitary landfill facility.			✓	✓
3	Ohio Asbestos Emission Control—Standard for Active Asbestos Waste Disposal Sites OAC 3745-20-06	Prohibits visible emissions from asbestos-containing materials during placement, and requires at least 12 inches of cover of compacted non-asbestos containing material over that asbestos-containing material as soon as practicable but no less often than at the end of each operating day.			✓	✓

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	Citation	Requirement	OU2 ROD	OU5 ROD	OU3 ROD	OSDF Permitting Plan
4	Ohio Asbestos Emission Control—Standard for Inactive Asbestos Waste Disposal Sites OAC 3745-20-07(A)&(C)	Prohibits visible emissions from asbestos-containing materials from an inactive asbestos waste disposal site, and requires at least 6 inches of cover of compacted non-asbestos containing material over that asbestos-containing material and growth and maintenance of a cover of vegetation on an area adequate to prevent exposure of the asbestos-containing waste material, or at least 2 feet of cover of compacted non-asbestos containing material, and maintenance of that cover to prevent exposure to the asbestos-containing waste material.	✓		✓	✓
5	Ohio Solid Waste and Infectious Waste Regulations—Sanitary Landfill Facility Construction OAC 3745-27-08(C)(6)	Requires placement of impacted materials to be performed such that the cell always stores runoff from active and open portions of the cell resulting from the 25-year, 24-hour storm event.	✓	✓	✓	✓
6	Radiation Protection of the Public and the Environment DOE Order 5400.5, Chapter I(4) and II(2)	Requires application of "As Low As Reasonably Achievable" (ALARA) goals to all activities in the excavation, removal, handling, and placement of impacted materials.	✓	✓	✓	

2.3 Functional Requirements

A variety of functional requirements have been established by DOE for the OSDF. The functional requirements applicable to this plan are:

- Facilities for impacted material management should:
  - Be located in areas that can easily and efficiently accommodate receipt of impacted material from the various FEMP operable units;
  - Be separated from clean areas;

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- Limit the uncontrolled discharge of fugitive emissions to acceptable levels;
- Limit the generation of wastewaters to acceptable levels;
- Comply with project health and safety requirements;
- Be removed at the completion of impacted material management activities, with the disposal of affected materials in the OSDF; and
- Be designed to minimize the generation of new impacted material;

- Impacted materials should be placed in the OSDF in a safe and cost-effective manner that prevents the uncontrolled release of impacted materials to the environment;
- This plan, in conjunction with the various operable unit remedial action planning documents, must only allow the placement of material satisfying the OSDF WAC.

2.4 General Design Criteria

A number of general design criteria have also been identified for the OSDF. The general design criteria applicable to this plan are:

- To the extent the stockpiling of impacted soil is necessary, the soil should be stockpiled in the FEMP former production area in order to use the existing storm drainage control system;
- Procedures should be employed that reduce the need for the use of respirators by on-site workers;
- Material transport procedures should cause minimal disturbance to the site and work area and be coordinated with impacted material removal and placement activities;
- Material transport equipment requirements should address the need to transport a variety of materials so that the number of pieces of equipment required to implement the design is minimized and should address the control of airborne particulate emissions;
- The Subcontractor must control the release of fugitive emissions (including dust, radiological, chemical, and asbestos materials) so that air quality standards are not violated on the site and so that releases are controlled to acceptable levels at the fence line;
- Acceptable emission control methods during placement operations include:
  - Transport in dump trucks

- Closed containers with metal or tarp lids;
- Keeping impacted material moist; and
- Spraying earthen material with a crusting agent when necessary;

- Impacted material placement procedures should take into account:
  - The rate and time at which impacted material will be available for placement in the cell;
  - The types of impacted material available for disposal (*i.e.*, soil, flyash, lime sludge, solid waste, or building demolition debris);
  - The potential for bulking/shrinkage of impacted material during placement;
  - The availability of temporary stockpile capacity;
  - The extent to which the disposal cell is constructed and available to receive impacted material; and
  - The need for suspended or reduced impacted material placement activities during winter and the need for seasonal (winter) cover.

- Impacted material placement activities should be organized to achieve the following:
  - Impacted material should be placed in a manner that is protective of the liner system and final cover system;
  - Impacted material should be placed to minimize differential settlement to the extent reasonably achievable;
  - A minimum of 3 ft. (0.9 m) of select impacted material should be placed directly over the protective layer component of the liner system, and beneath the contouring layer component layer of the final cover system, to provide protection of these systems from damage by impacted materials. The thickness of select impacted material over the protective layer may be decreased to 2 ft. (0.6 m) if the first lift of material to be placed over the select impacted material consists of soil or small size debris that can be placed in controlled lifts.
  - To limit particulate emissions, generation of wastewaters, and erosion of impacted material, the sequence of placement should minimize the area of exposed impacted material;

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- Materials should be placed in a manner that results in a disposal pile with relatively homogenous large-scale mechanical properties (*i.e.*, compressibility and shear strength), to the extent possible; homogeneity should be achieved by distributing impacted materials throughout the OSDF to avoid large pockets or distinct concentrations of any one type of impacted material in a particular area; the objective is to minimize the potential for differential settlement; and

- At the end of each work day, the impacted material surface should be graded and maintained to control precipitation runoff and impacted material erosion.

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3.0 OSDF FEATURES

3.1 General

The primary features of the OSDF related to the placement of impacted materials are the liner and final cover systems and certain support elements. These features are briefly described in this section. The Subcontractor shall be responsible for implementing the requirements of this section and for the protection and safety of the systems described in this section during OSDF construction, placing, and closure.

3.2 Impacted Materials Placement Zones

Control of the placement of impacted material in the OSDF during construction, placing, and closure is required in order to: (I) protect the OSDF liner system, final cover system, and leachate management system from damage; (ii) maintain the impacted material in a stable configuration; (iii) limit fugitive emissions to an acceptable level; (iv) allow containment of impacted runoff within the active OSDF cell; and (v) limit differential settlement of the OSDF final cover system to an acceptable level. Details of the liner system and final cover system proposed for the OSDF are shown on the Construction Drawings.

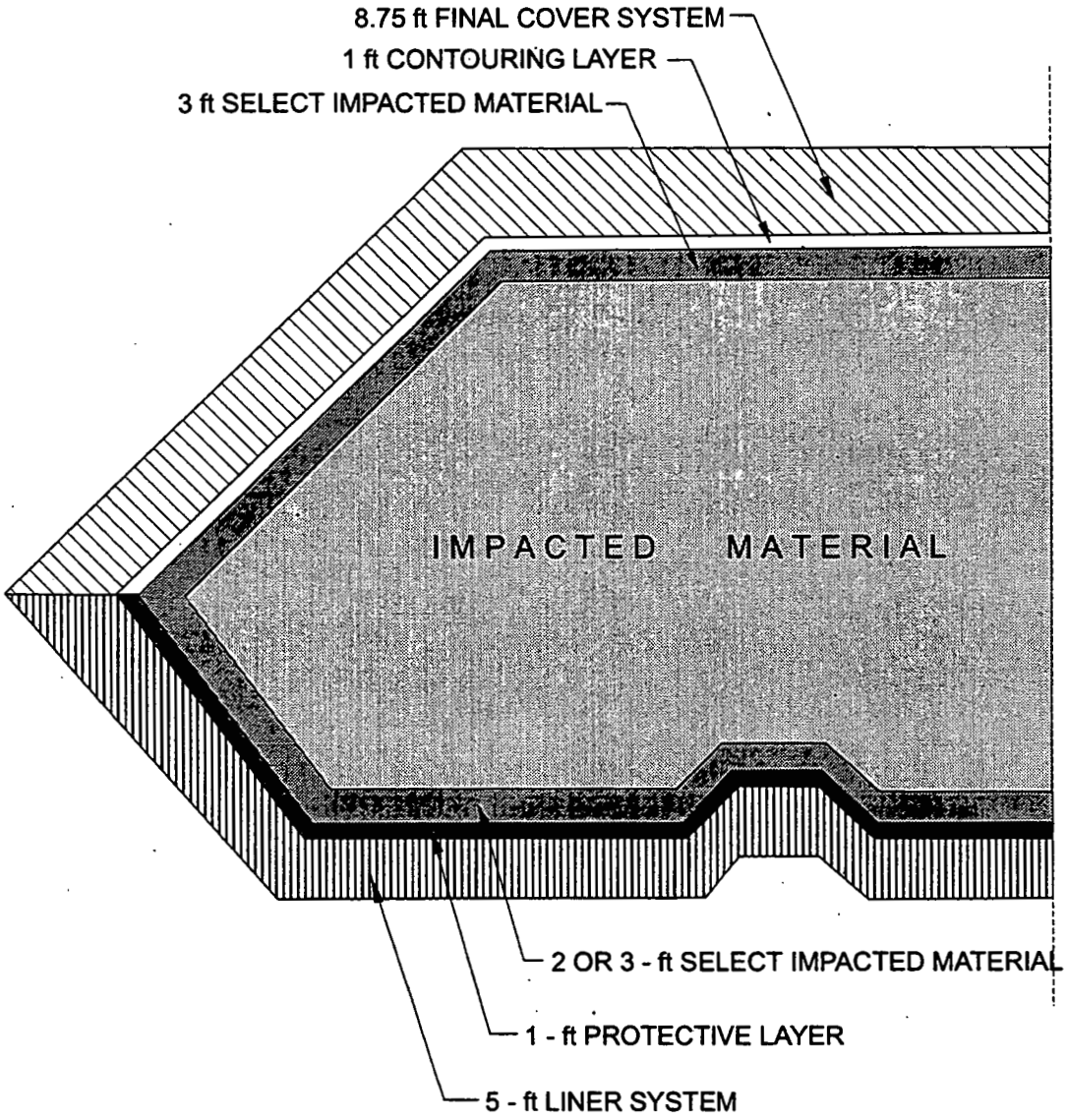
Within each OSDF cell, four zones exist in which impacted material may be placed. These zones and their relative locations with respect to the OSDF liner system and final cover system are shown in Figure 3-1. The four zones are as follows:

- *Protective layer* — a protective layer of impacted soil material shall be placed directly over the primary leachate collection system on the base of each OSDF cell; the soil used for the protective layer shall be either: (I) on-site till material with a maximum particle size not exceeding 3 in. (75 mm) (ASTM C 136); or (ii) granular drainage material meeting the material requirements of the project specifications and placed in specified areas of each cell to facilitate vertical percolation of impacted runoff into the underlying leachate collection system;

- *Select impacted material layer* — select impacted material shall be placed both on top of the protective layer and beneath the contouring layer to provide a physical barrier between debris and other "large-size" impacted material and the OSDF liner and final cover systems; the select impacted material shall consist of impacted soil or soil-like material with a maximum particle size not exceeding 6 in. (150 mm) (ASTM C 136);

- *Impacted material layers* — a variety of different impacted materials can be placed on top of the select impacted material layer in the central portions of an OSDF cell; the impacted material in this zone need only meet the radiological/chemical waste acceptance criteria established for the OSDF, the physical waste acceptance criteria established in this IMP Plan, and the placement and compaction criteria established in this IMP plan; and

IMPACTED MATERIAL ZONES



NOTE: THIS FIGURE FOR ILLUSTRATION ONLY. SUBCONTRACTOR SHALL PLACE IMPACTED MATERIAL LAYERS TO THE LIMITS SHOWN ON CONSTRUCTION DRAWINGS.

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ATLANTA, GEORGIA

FIGURE NO.	3-1
PROJECT NO.	GE3900-10.2
DOCUMENT NO.	F9620002.CDG
FILE NO.	FIG-6-3.CDR

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- *Contouring layer* — a contouring layer of impacted soil material shall be placed directly over the select impacted material layer, prior to installation of the OSDF final cover system; the soil used for the contouring layer shall be a till material with a maximum particle size not exceeding 3 in. (75 mm) (ASTM C 136).

3.3 OSDF Support Facilities

3.3.1 Impacted Material Haul Roads

The impacted material haul roads within the OSDF battery limit are designed to laterally contain material that may spill from trucks during transportation and also impacted runoff resulting from precipitation falling onto the roads. Trucks used for impacted material transport shall be suitable for the roadway design. Surfacing for the impacted material haul roads is designed to provide adequate support to the hauling units and a relatively tight texture to promote runoff. Surfacing materials used in the construction of impacted material haul roads shall be removed and disposed in the OSDF when the segment of roadway is no longer needed for impacted material placement activities.

Runoff from impacted material haul roads within the OSDF battery limit shall be managed as impacted runoff (*i.e.*, a form of wastewater). This water shall be contained, collected, and discharged to the storm drainage control system of the FEMP former production area, or to other on-site wastewater collection/conveyance points acceptable to the CM. Impacted material haul roads outside the OSDF battery limit are addressed as part of other plans prepared for the integrated FEMP remediation.

3.3.2 Impacted Soil Stockpile Areas

During initial construction of the OSDF, and periodically during placing and closure, it will be necessary to temporarily stockpile impacted soil resulting from OSDF excavation activities. An impacted soil stockpile area shall be developed to temporarily stockpile this material. The area used for stockpiling shall be graded flat and separated from surrounding areas by a 24 inch (2.0 ft.) high soil berm. At the end of each day's work, the impacted soil stockpile shall be lightly compacted and rolled smooth to reduce precipitation infiltration into the pile and control fugitive emissions. Any stockpile that will remain inactive for more than 30 days shall be covered with either a crusting agent or geosynthetic cover. Runoff from the stockpile shall be controlled and routed to the FEMP former production area storm drainage control system, or to other on-site wastewater collection/conveyance points acceptable to the CM.

Impacted soil excavated during construction of the first and subsequent OSDF cells and related support facilities shall be used for construction of the liner system protective layer and the select impacted material layer for those cells if meeting the requirements for those layers. Any geosynthetic cover used in the impacted soil stockpile area and other impacted soils from the operation shall be disposed in the OSDF as part of the impacted material placement activities described later in this plan.

3.3.3 Impacted Material Staging Areas

Impacted Material staging areas consist of gravel or concrete hardstands constructed to temporarily store impacted structural members and other building demolition debris. These areas will be used to temporarily stage any material not able to go directly from the material source to an active OSDF cell. Impacted material staging areas constructed outside the limits of the FEMP former production area shall have positive runoff control. Any runoff from these areas will be directed to the storm drainage control system of the FEMP former production area or to other on-site wastewater collection conveyance points acceptable to the CM.

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4.0 WASTE ACCEPTANCE CRITERIA

4.1 General

This section of the IMP Plan presents information regarding the waste acceptance criteria applicable to the OSDF. Radiological/chemical waste acceptance criteria developed by the individual operable units at the FEMP are identified and made a part of this plan. Other physical criteria are established in this plan.

4.2 OSDF Chemical/Radiological Waste Acceptance Criteria

The *Final Record of Decision for Remedial Actions at Operable Unit 2 (OU2 ROD)* [DOE, 1995a] has established a radiological waste acceptance criteria of 346 picoCuries/gram (pCi/g) of uranium-238 or 1,030 milligrams per kilogram (mg/kg) total uranium for Operable Unit remediation materials destined for the OSDF. Similarly, the *Final Record of Decision for Remedial Actions at Operable Unit (OU5 ROD)* [DOE, 1996] established additional radiological and chemical waste acceptance criteria for Operable Unit 5 remediation soils destined for the OSDF. Similarly, the *Operable Unit 3 Record of Decision for Final Remedial Action (OU3 ROD)* [DOE, 1996b] has established a radiological waste acceptance criteria of 105 grams technetium-99 for Operable Unit 3 remediation debris materials. These waste acceptance criteria have been compiled and are presented in Table 4-1. The remediation materials sent to the OSDF from Operable Unit 3 (see Table 5-1) may also include small material contributions from Operable Units 1 and 4; any structural debris material resulting from decontamination and deconstruction of the remediation facilities from these latter operable units destined for the OSDF must meet the Operable Unit 3 waste acceptance criteria.

4.3 Physical Criteria

The physical criteria (dimensions given are considered nominal) that shall be applied to material destined to the OSDF are:

- Materials from various building components (*i.e.*, steel, concrete, masonry rubble, finish components, *etc.*) shall be segregated at the staging area by the Subcontractor;
- The maximum length of irregularly shaped metals or other components of a building superstructure or finish components shall be 10 ft.;
- The maximum thickness of irregularly shaped metals or other components of a building superstructure or finish components shall be 18 in.;
- The maximum thickness of concrete or other components of a building slab or substructure shall be 18 in. when the materials are part of a load of similar material;

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Table 4-1
ON-SITE DISPOSAL FACILITY
WASTE ACCEPTANCE CRITERIA

	Constituent of Concern	Soil[a]		Debris[b]
		OU2	OU5[d]	OU3
	Radionuclides:			
1	Neptunium-237		3.12×10^{9} pCi/g	
2	Strontium-90		5.67×10^{10} pCi/g	
3	Technetium-99		29.1 pCi/g	105 g
4	Uranium-238	346 pCi/g		
	Total Uranium	1,030 mg/kg	1,030 mg/kg	
	Inorganics:			
5	Boron		1.04×10^{3} mg/kg	
6	Mercury[c]		5.66×10^{4} mg/kg	
	Organics:			
7	Bromodichloromethane		9.03×10^{-1} mg/kg	
8	Carbazole		7.27×10^{4} mg/kg	
9	Alpha-chlordane		2.89 mg/kg	
10	Bis(2-chloroisopropyl)ether		2.44×10^{-2} mg/kg	
11	Chloroethane		3.92×10^{5} mg/kg	
12	1,1-Dichloroethene[c]		11.4 mg/kg	
13	1,2-Dichloroethene[c]		11.4 mg/kg	
14	4-Nitroaniline		4.42×10^{-2} mg/kg	
15	Tetrachloroethene[c]		128 mg/kg	
16	Toxaphene[c]		1.06×10^{5} mg/kg	
17	Trichloroethene[c]		128 mg/kg	
18	Vinyl chloride[c]		1.51 mg/kg	

NOTES:
[a] maximum concentration
[b] maximum total mass
[c] RCRA-based constituent of concern
[d] constituents which have established maximums which serve as Waste Acceptance Criteria; other compounds which will not exceed designated Great Miami Aquifer action levels within 1000-year performance period, regardless of starting concentration in the OSDF, are not listed.

SOURCES:
OU2 ROD [DOE, 1995a]
OU5 ROD [DOE, 1996a]
OU3 ROD [DOE, 1996b]

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- The maximum thickness of an individual concrete member or other component of a building slab or substructure shall be 4 ft. when the item is handled individually and is a regular, rectangular shape having no concrete protrusions greater than 18 in.;

- Concrete reinforcement bars shall be cut within a nominal 12 in. of the concrete mass;

- The maximum thickness of uniform pallets of building cladding (*e.g.*, transite panels) properly banded into rectangular shapes shall be 4 ft.;

- Regulated asbestos containing material (ACM) shall be double-bagged at the source and delivered unmixed with other materials;

- ACM brick and commingled debris shall be double-contained and segregated at the source;

- Piping having insulation of ACM shall be segregated at the source and delivered unmixed with other materials;

- General building rubble consisting of wood, drywall, HVAC systems, electrical systems, plumbing systems, and minor equipment shall be sufficiently reduced in size to be gradeable into a 18 in. (1.5 ft.) lift by equipment similar to a Caterpillar D8 bulldozer;

- Equipment shall be drained of all oils and liquids;

- Piping with a nominal diameter of 12 in. or greater will be split in half; and

- The maximum dimension of general building rubble consisting of concrete, masonry, and other similar materials shall be 18 in.

Impacted materials brought to the OSDF should not be at such a high moisture content that impacted material placement and compaction activities are impeded. Generally, soil should have a moisture content that allows the material to be compacted to the required relative compaction using standard soil compaction equipment and procedures. Soil should also have a moisture content that does not result in excessive "bleeding" of liquids. As necessary the CM will direct the Subcontractor to dry the soil by disking and air drying, by blending with drier soil, or by other means so that the soil can be compacted to the required percent of standard Proctor dry density. The Subcontractor shall limit the use of in-cell drying to the extent necessary to not restrict the placement of impacted material in the OSDF.

Special handling, placement, and compaction limitations and procedures apply to objects having a thickness or height larger than 4 ft. These special handling, placement, and compaction limitations and procedures are discussed in Section 8.0 of this IMP Plan.

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4.4 Prohibited Items

The following are specifically prohibited from disposal in the OSDF:

- Impacted material exceeding the Waste Acceptance Criteria (WAC) presented in Table 4-1.
- Impacted material that is "characteristically hazardous" ("RCRA characteristic waste"). Excluded from this prohibition is impacted material that has been treated so that it is no longer "characteristically hazardous".
- Material from any off-site source, including any other DOE site, except as provided in the *OU5 ROD*, which states *"Specifically excluded from this prohibition are laboratory wastes generated at off-site facilities resulting directly from the chemical, radiological and engineering analysis of FEMP waste materials/contaminated media or wastes generated at off-site facilities during the conduct of treatability or demonstration type studies on FEMP material."*
- Pressurizable gas cylinders.
- Process-related metals (OU3-ROD Category C materials).
- Product, residues, and other special materials (a subset of OU3-ROD Category J materials).
- Materials containing free liquids.
- Intact drums (*i.e.*, drums must be empty and crushed).
- Acid brick (OU3-ROD Category F materials).
- Transformers, which have not been either crushed or had their void spaces filled with grout (or other material approved by the CM).
- Whole or shredded scrap tires.
- Used oils.
- Materials not accompanied by the transportation "manifest" information specified in this plan.

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5.0 IMPACTED MATERIAL DESCRIPTIONS

5.1 General

The OSDF will be the final repository for a majority of the impacted material from the five operable units of the integrated FEMP remediation. Construction debris (*i.e.*, waste originating during the construction of the OSDF) will also be disposed in the OSDF. The materials requiring OSDF disposal are expected to vary considerably in their composition, handling, placement, and compaction characteristics. Given this variability, it is useful to develop a categorization framework wherein materials with similar characteristics are assigned to the same category. The purpose of this section of the IMP is to describe and categorize the various impacted materials using a common categorization framework.

5.2 Impacted Material Categories

Impacted materials to be disposed in the OSDF shall be assigned to one of five categories, depending on the procedures that will be used to place them into the OSDF:

Category 1 - Impacted materials that are soils and soil-like and that do not contain hard agglomerations greater than 12 in. (1.0 ft.) in greatest dimension. If the material is other than till or ash from the FEMP site, the material in this category must also have the vast majority of its particles finer than a 1 in. (25 mm) particle size. If this latter criteria is not met, the material should be classified as a Category 2 material. These impacted materials are expected to be readily compactible using standard construction equipment.

Category 2 - Impacted materials that can be transported, placed, spread, and compacted *en masse*. These impacted materials can be spread in loose lifts of 18 to 21 in. (1.5 to 1.8 ft.) thick and are expected to be moderately compactible under the action of equipment similar to the Caterpillar D-8 dozer or 815C compactor. Examples of these materials include broken-up concrete foundations or impacted soil mixed with broken-up concrete.

Category 3 - Impacted materials that must be individually handled and placed in the OSDF, and that are suitable for having Category 1 material placed around and against them. These impacted materials have a nominal height of no more than 4 ft., are regularly (*e.g.*, rectangularly) shaped allowing impacted Category 1 material to be compacted around and against them, and are essentially incompactible using standard compaction equipment.

Category 4 - Impacted materials that are high in organic content and very compressible. Examples of these materials are municipal solid wastes from the Solid Waste Landfill, and green waste from clearing, stripping and grubbing operations around the FEMP.

Category 5 - Impacted materials that require special handling due to their special nature. Examples of these materials include double-bagged asbestos and sludges.

The categories given above shall be used by the Subcontractor to categorize each load of impacted material to be brought to the OSDF for disposal. The CM will use this categorization in establishing disposal limitations and instructions for each truck load of material destined for the OSDF.

5.3 Specific Impacted Materials

5.3.1 General

This section of the IMP Plan contains background information on the types and approximate quantities of specific impacted materials that may require special handling and/or placement activities. These impacted materials primarily consist of landfill waste, water treatment plant sludge, and demolition debris. The purpose of this section of the IMP Plan is to provide the Subcontractor with a physical description of these specific materials.

5.3.2 Solid Waste Landfill

The Solid Waste Landfill is a rectangular disposal area of approximately 1 acre (0.4 ha) that has been inactive since 1986. A soil cover has been placed over the disposal area. A drainage ditch serving the northwest portion of the former production area is located in the northern portion of the Solid Waste Landfill. The volume of waste material in the landfill is estimated to be approximately 14,400 yd^3 (11,000 m^3).

The operational history of the Solid Waste Landfill is not well documented. It is thought that the landfill was organized with one to five individual waste disposal cells and an evaporation pond which also served as a surface-water management basin. Materials reportedly buried at the Solid Waste Landfill include non-burnable and nonradioactive solid wasted generated on FEMP property, nonradioactive construction-related rubble, and double bagged and bulk quantities of nonradioactive asbestos. Field investigation results, however, indicate that some process waste may have been placed in the landfill. The following wastes were encountered during a trenching investigation in 1992:

- Burnable wastes - bagged trash and wood;
- Possibly burnable wastes - respirator cartridges, asphalt roofing materials, medical wastes, firehoses, and rubber hoses/belts; and
- Non-burnable wastes - unidentified high-activity waste, medicine vials, bagged asbestos, ceramic tiles, possible magnesium fluoride, glass acid bottles, steel cables/cans, paint cans, and copper tubing.

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5.3.3 Lime Sludge Ponds

The Lime Sludge Ponds are two unlined, rectangular ponds, each measuring approximately 125 by 225 ft (38 x 69 m). Wastes that were disposed in the Lime Sludge Ponds originated from water treatment plant operations, coal pile stormwater runoff, and boiler plant blowdown. Although this waste is from three distinct waste streams, the bulk of the slurry is lime sludge from the water treatment process. Over time, the solids in the slurry settled in the Lime Sludge Ponds and the remaining decant was pumped from the ponds. The lime sludge is, therefore, considered to be relatively homogenous.

The volume of sludge and berm material contained within the two lime sludge ponds is estimated to be approximately 16,500 yd^3 (12,500 m^3) of lime sludge and 5,600 yd^3 (4,300 m^3) of berm material making a total of 22,100 yd^3 (17,100 m^3) of material. The South Lime Sludge Pond is full and has been inactive since the mid-1960's; it is now overgrown with grasses and shrubs. The North Lime Sludge Pond is not currently active, but was in use as late as January 1995. The west side of the North Lime Sludge Pond is usually covered with 1 to 2 ft. (0.3 to 0.6 m) of water, depending mainly on precipitation. The remaining area is dry and covered with sparse vegetation.

5.3.4 Building Debris

Debris from demolition of buildings in the FEMP former production area is expected to constitute the largest volume of impacted material for OSDF disposal after soil and soil-like material. The *Operable Unit 3 Record of Decision for Final Remedial Action (OU3 ROD)* [DOE, 1996b] indicates that impacted debris can be assigned to one of ten material categories. The *OU3 ROD* indicates that material from seven of these categories will be disposed in the OSDF; material from two other categories (C, F) are to be dispositioned off-site (*i.e.*, expressly prohibited in total from on-site disposal), while a subset (defined as the "principal threat" materials for OU3, consisting of former process residues and wastes) of a third category (J) are also to be dispositioned off-site. Only the first seven material categories of impacted structural debris resulting from decontamination and deconstruction of the former production and associated process facilities allowed for disposal in the OSDF are defined in Table 5-1, which also gives descriptions of the materials making up the categories.

5.3.5 Inactive Flyash Piles

The Inactive Flyash Pile is located approximately 2000 ft. (610 m) southwest of the former production area. The Inactive Flyash Pile received flyash and bottom ash from boiler plant operations starting in 1951. It has been inactive since the mid-1960s and is covered with soil and natural vegetation. The total quantity of ash disposed in this area has been estimated at 43,600 cu yd (33,300 cu m). Materials such as building rubble, concrete, asphalt, steel rebar, and asbestos containing transite were also discarded in this area. These materials are visible at the surface along the Inactive Flyash Pile's western and southern edge.

Table 5-1
OU3 Material Categories/Descriptions

Category A Accessible Metals	Category B Inaccessible Metals	Category D Painted Light-Gauge Metals	Category E Concrete	Category G Non-Regulated ACM	Category H Regulated ACM	Category I Miscellaneous Materials
Structural & miscellaneous steel	•Doors •Conduit/wire/ cable tray •Electrical wiring & fixtures •Electrical transformers •Miscellaneous electrical items •HVAC equipment •Material handling equipment •Process equipment •Miscellaneous equipment •Piping	•Ductwork •Lead flashing •Louvers •Metal wall & roof panels	•Asphalt •Slabs •Columns •Beams •Foundations •Walls •Masonry •Clay piping	•Ceiling demolition •Feeder cable •Fire brick •Floor tile •Transite wall & roof panels	•Ductwork insulation •Piping insulation •Personal protective equipment •Copper scrap metal pile	•PVC conduit •Basin liners •Fabric •Drywall •Building insulation •Miscellaneous debris •Personal protective equipment •PVC piping •Roofing build-up •Process trailers •Non-process trailers •Windows •Wood

SOURCE: Table 4-2, OU3 Material Categories/Description, *OU3 ROD* [DOE, 1996b].
NOTE: Only those OU3 material categories allowed in total for on-site disposal per the *OU3 ROD* are presented.

5.3.6 South Field

The South Field disposal area is located approximately 2000 ft. (610 m) southwest of the former Production Area and covers approximately 11 ac (4.5 ha)

The South Field was used as a burial site for construction rubble and as a disposal area for soil excavated from the former Production Area. Disposal activity ceased during the mid 1960s. Soil, building rubble, concrete, asphalt, flyash, and steel rebar were encountered during sampling operations within the soil fill in the South Field. The estimated volume of fill disposed in the South Field is approximately 120,000 cu yd (91,800 cu m).

5.3.7 Active Flyash

The Active Flyash Pile disposal area is located about 3000 ft. (914 m) southwest of the former Production Area and east of the South Field. Past operations at the FEMP have relied on boiler-produced steam. Ash waste is comprised primarily (70 percent) of bottom ash collected below the boilers. Precipitator ash collected from pollution control devices and flyash removed from the middle levels of the boiler comprise the remaining 30 percent of the ash waste. Until recently, ash waste has been loaded into dump trucks and transported to the Active Flyash Pile disposal area. Estimates established indicate that approximately 65,000 cu yd (49,700 cu m) of ash have been disposed in this area. The pile has a surface area of approximately 4 ac (1.6 ha).

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6.0 GENERAL PLACEMENT PROCEDURES

6.1 Introduction

This section of the IMP Plan describes the general procedures that the Subcontractor shall follow for placement of impacted material in the OSDF. Specific procedures for placement of Category 1 materials (soil and soil-like) are presented in Section 7.0 of this IMP Plan. Specific placement procedures for Category 2 through 5 materials (non soil-like materials) are addressed in Section 8.0 of this IMP Plan.

6.2 Manifesting

The remediation project originating the impacted material shall prepare an impacted material transportation "manifest" for each load of material to be transported to the OSDF. The purpose of the "manifest" is to provide a tracking mechanism for impacted material from the remediation project of origin to placement in the OSDF. The originating remediation project shall be responsible for providing the following information on the "manifest":

- originating remediation project (*i.e.*, the operable unit and project),
- brief description of the impacted material in the load,
- classification of the impacted material into one of the five material categories of this IMP Plan,
- documentation that the material meets the criteria in Section 4.0 of this IMP Plan.

The CQC Consultant shall be responsible for providing the following information on the "manifest":

- the OSDF cell identifier where the material is placed.

The Subcontractor shall develop a system acceptable to the CM for identifying the category of impacted material being hauled. This system shall indicate the category of material in the truck (or container as appropriate) and whether the truck/container is carrying special items such as asbestos, extremely heavy items, extremely compressible items, impacted materials requiring special dust mitigation procedures, sludge, or landfill waste.

At the OSDF battery limit, each truck load (or container, as appropriate) of impacted material will be monitored by the CQC Consultant in accordance with Appendix A of this plan. The monitoring will include spot-checking for prohibited material, monitoring for asbestos, visual verification that the impacted material matches the description on the manifest, visual checking that the material meets the OSDF physical criteria, and visual checking that prohibited items are not included in the load. The CQC Consultant will be required to sign the "manifest" and retain a copy. The Subcontractor shall fully comply with these quality control activities and account for them in its planning and scheduling.

After trucks/containers are cleared at the OSDF battery limit, the Subcontractor shall route the impacted material to a location within the OSDF (*e.g.*, the active face, a stockpile area, or an area where

further screening will take place) for disposal. The Subcontractor will be provided with flexibility in routing trucks/containers for efficient operations. However, the CM will provide the Subcontractor with specific instructions for routing of impacted materials in Categories 2 through 5. The Subcontractor shall be responsible for following these instructions.

The placement and compaction procedure to be used by the Subcontractor for each load of impacted material shall be based on the impacted material category. Placement and compaction procedures for the five material categories listed in Section 5.2 of this IMP Plan are presented in Sections 7.0 and 8.0 of this plan.

6.3 Protection of Facilities

Impacted material placement activities shall be conducted in a manner that protects and maintains the integrity of the OSDF liner system, leachate management system, and final cover system, and all OSDF ancillary facilities and equipment. Impacted material placement activities shall not commence in a cell until liner system construction has been completed in accordance with the contract documents and only after cell construction has been certified in accordance with the requirements of the *OSDF CQA Plan* and all other subcontract requirements.

6.4 Placement Oversight and Quality Assurance

Impacted material placement for all categories of material shall be conducted under the direct oversight of the Subcontractor versed in all aspects of this plan and having qualifications meeting the requirements of the *OSDF CQA Plan*. The Subcontractor shall be assisted by on-the-ground spotters who shall observe each load that is placed to monitor that the work is performed in compliance with the requirements of this plan. The Subcontractor shall be assisted by surveyors and quality control personnel, as required, to control lift thickness and grades, record the coordinates of the impacted material placement, and perform other necessary functions.

The Subcontractor shall be aware that monitoring of the placement, and monitoring and testing of impacted material for specified compaction in the OSDF will be performed by the CQC Consultant in accordance with the requirements of the contract documents.

6.5 Conformance with OSDF Specifications

The Subcontractor shall comply with the project specifications which shall be used in conjunction with this plan and these shall be referenced for specific details regarding the labor, material, and supervision at the OSDF.

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6.6 Standard Operations Procedures

6.6.1 General

The CM will have the authority to halt impacted material placement operations if placement operations are not in accordance with the project specifications and this IMP Plan.

Salvaging of materials being deposited in the OSDF is strictly prohibited. FERMCO personnel will examine, on a random basis, trucks leaving the OSDF for salvaged materials.

Placement of impacted materials shall only occur during daylight hours unless specifically approved by the CM. The last unit load of waste typically will not be accepted less than 45 minutes prior to sundown.

Impacted material placement activities shall cease for the winter when the CM determines that satisfactory compaction of impacted material and/or safe working conditions, is no longer possible due to weather conditions.

6.6.2 Inclement Weather Operations

Placement of impacted material in the OSDF shall cease when the average wind speed measured at or near the working face of the active OSDF cell is in excess of 20 mph (25 kph) or when wind gusts exceed 30 mph (40 kph) for more than 1 minute in the previous 60 minutes. The CQC Consultant or FERMCO will provide and maintain a weather station at or near the active working face of the OSDF to provide a continuous record of windspeed and temperature during the working day; the station will also be equipped with a rain gauge. The CM will determine when unacceptable wind conditions exist.

Impacted material shall not be placed during periods of significant precipitation. Significant precipitation will be determined by the CM in consultation with the CQC Consultant.

The Subcontractor may prepare an inclement weather deck within the OSDF active cell. The purpose of this deck is to provide an area where placement activities can occur when precipitation has left other areas of the OSDF unsuitable (due to mud or soft surfaces) for impacted materials placement activities. The inclement weather deck may be used for placement of Category 2 materials (*en masse* placement).

Impacted material placement activities shall not restart after an inclement weather shutdown until verbal approval to do so is provided by the CM. Factors that will be considered by the CM in restarting operations include:

- Weather forecasts;
- Condition of haul roads;
- If operations could lead to additional erosion of impacted materials;
- Ability to decontaminate the impacted material hauling trucks;

- Nature of impacted materials to be placed; and
- Conditions within the OSDF.

6.6.3 As-Placed Plans

The Subcontractor shall be aware that the CM will maintain plans showing the locations of placement of all Category 3 through 5 impacted material. The plans will provide the OSDF cell, grid and lift alphanumeric identifiers for each load of material placed in the OSDF (referenced to the load manifest number), the category of material in the load, and other information. The CM will use these plans to decide where subsequent loads of special category waste can be placed. For example, the Subcontractor will not be allowed to compact multiple lifts of Category 4 (organic) impacted material on top of each other so as to avoid creating a compressible zone in the OSDF that could induce future differential settlements in the OSDF final cover system.

6.7 Spreading and Grading

The Subcontractor shall be aware that an important objective of this IMP Plan is to achieve uniform settlement of the impacted materials placed within the OSDF. Thus, the Subcontractor shall, as much as possible, maintain homogeneity of the physical characteristics of the impacted materials placed across horizons of the OSDF. The Subcontractor will be directed by the CM to route impacted materials in such a fashion that each lift is relatively uniform over its lateral extent. To the extent possible, compressible materials (such as green wastes, double bagged asbestos, and Solid Waste Landfill materials) shall not be piled vertically but shall be spread laterally (except for double bagged asbestos, which shall be handled in accordance with Section 8.6.3). Incompressible materials shall not be placed directly above other incompressible items without appropriate intervening lifts of Category 1 materials. Materials of higher permeability (such as demolition debris) shall not be placed directly above other high permeability materials without appropriate intervening lifts of lower permeability materials.

Impacted material placement shall generally proceed from east to west and north to south within each OSDF cell. Maximum compacted lift thicknesses for soil, soil-like-materials, and other impacted materials shall be 1.0 ft., except as provided in Section 8.0 of this IMP Plan. Each lift of topmost select impacted material shall be controlled to line and grade such that cell perimeter contours are within 0.2 ft. of the design grade for the bottom of the contouring layer.

Figure 6-1 illustrates the sequencing of impacted material placement and slope development within the first OSDF cell, looking west to east. Select impacted material layers on the cell base and sideslopes shall be advanced at least 2 ft. ahead of general impacted material layers. Similarly, Figure 6-2 illustrates the sequencing of impacted material placement and slope development in subsequent cells.

6.8 Compaction

Each lift of Category 1 impacted material placed in the OSDF shall be compacted by the Subcontractor to the minimum criteria given in Sections 7.0 and 8.0 of this IMP Plan. Monitoring and testing activities are described in Appendix A of this IMP Plan.

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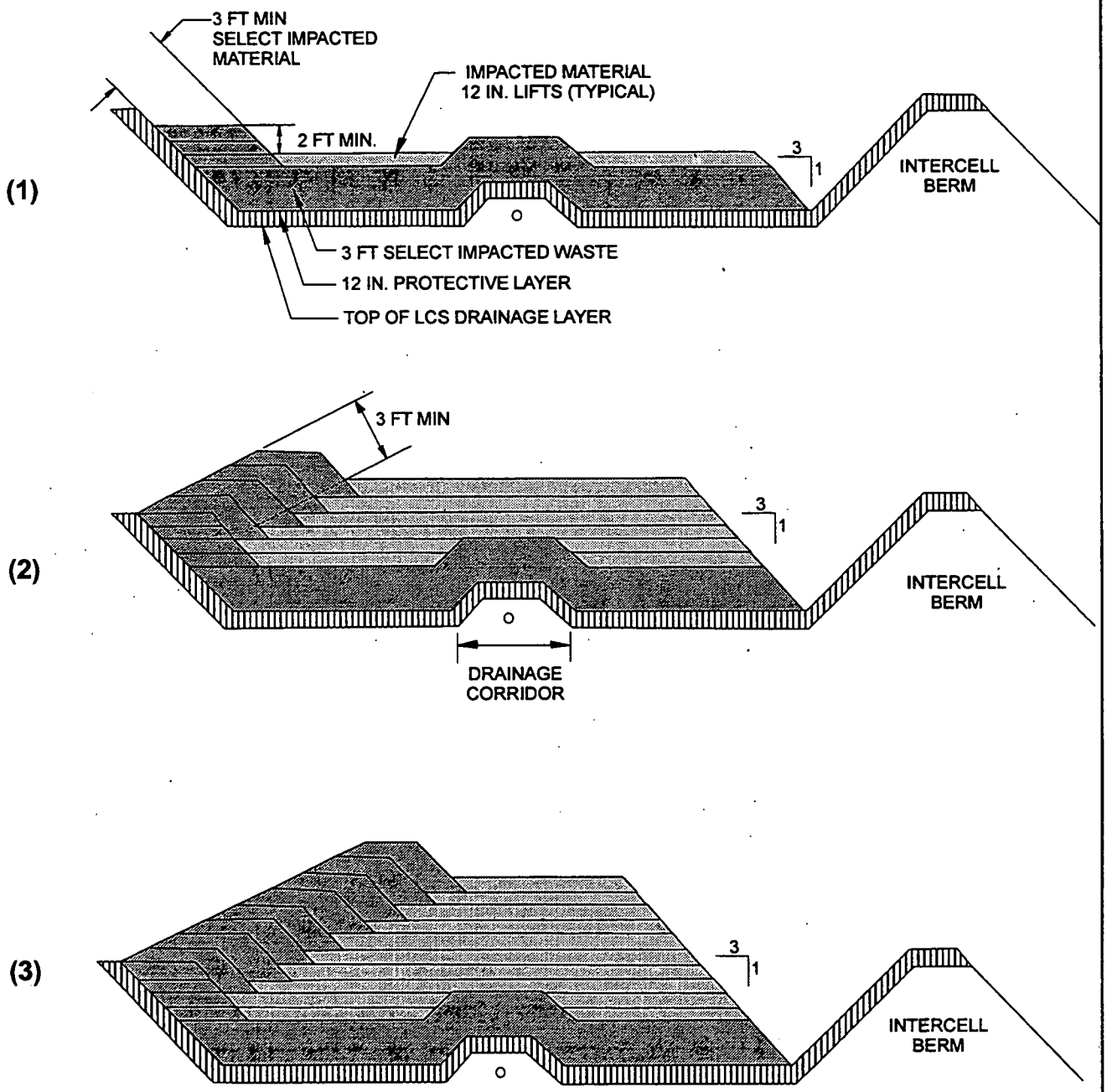
IMPACTED MATERIAL PLACEMENT SEQUENCE - CELL1



NOTE: THIS FIGURE FOR ILLUSTRATION ONLY. SUBCONTRACTOR SHALL PLACE IMPACTED MATERIAL LAYERS TO THE LIMITS SHOWN ON CONSTRUCTION DRAWINGS.

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ATLANTA, GEORGIA

FIGURE NO.	6-1
PROJECT NO.	GE3900-10.2
DOCUMENT NO.	F9620002.CDG
FILE NO.	FIG-6-1.CDR

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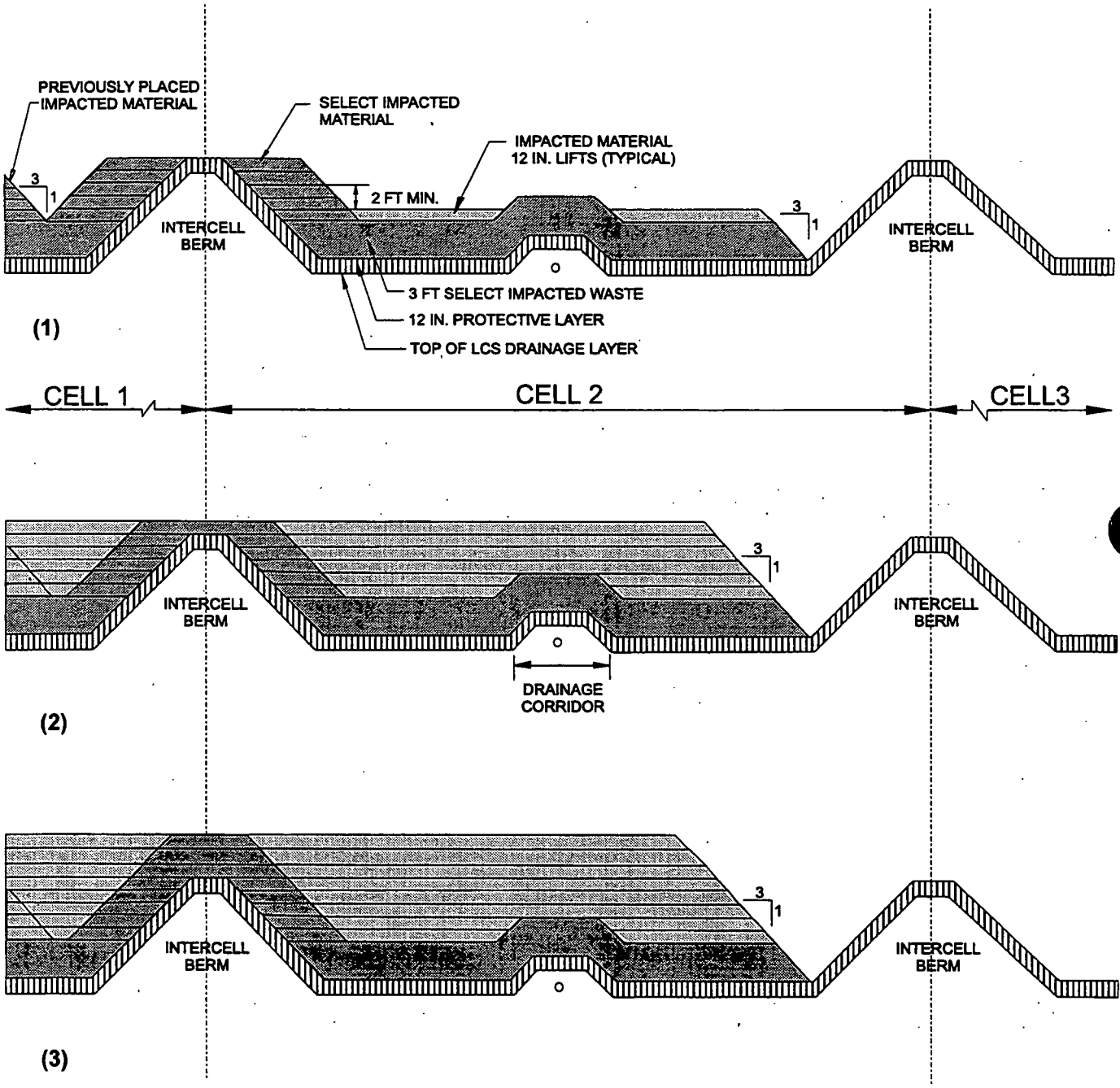
IMPACTED MATERIAL PLACEMENT SEQUENCE - INTERIOR CELLS



NOTE: THIS FIGURE FOR ILLUSTRATION ONLY. SUBCONTRACTOR SHALL PLACE IMPACTED MATERIAL LAYERS TO THE LIMITS SHOWN ON CONSTRUCTION DRAWINGS.

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FIGURE NO.	6-2
PROJECT NO.	GE3900-10.2
DOCUMENT NO.	F9620002.CDG
FILE NO.	FIG-6-1.CDR

6.9 Daily Surface Conditions and Drainage

On a daily basis, the Subcontractor shall maintain the impacted material surface in active OSDF cells to limit fugitive emissions and control and detain impacted runoff. The Subcontractor shall establish stormwater runoff routing in each active cell to convey runoff to the impacted runoff catchment area within the cell. The Subcontractor shall use smooth rolling to seal the surface, silt fences, and other means to limit impacted material erosion. At the end of each working day, the uppermost layer of impacted material shall be sloped at a minimum grade of 2 percent to the south. The southern impacted material face shall be constructed to a slope not steeper than 3H:1V (horizontal:vertical). The Subcontractor shall perform temporary erosion control requirements in accordance with the *OSDF SWMEC Plan*.

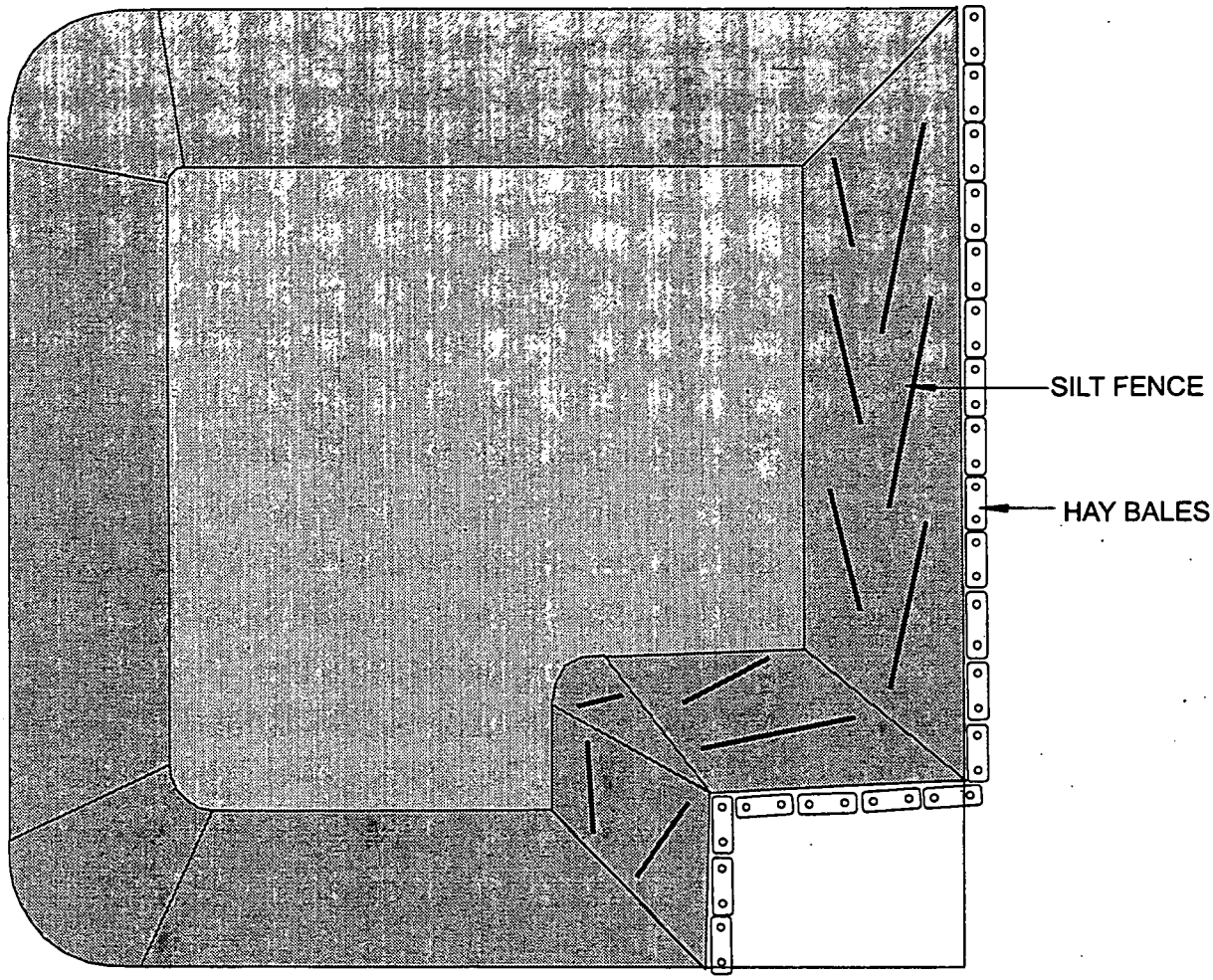
At the end of each working day, the Subcontractor shall prepare exposed impacted material surfaces in a manner that satisfactorily controls the generation of fugitive emissions. Preparation may include smooth rolling to seal the surface, application of water, application of crusting agents, or covering with geosynthetics. The nature and extent of the fugitive emission control actions shall be a function of the results of air monitoring conducted by FERMCO in accordance with the OSDF Air Monitoring Plan. Fugitive emission control actions shall be sufficient to achieve compliance with the OSDF Air Monitoring Plan. At all times, the Subcontractor shall be prepared to implement the measures mentioned in this paragraph to reduce fugitive emissions based on the Subcontractor's approved fugitive emissions plan or as directed by the CM.

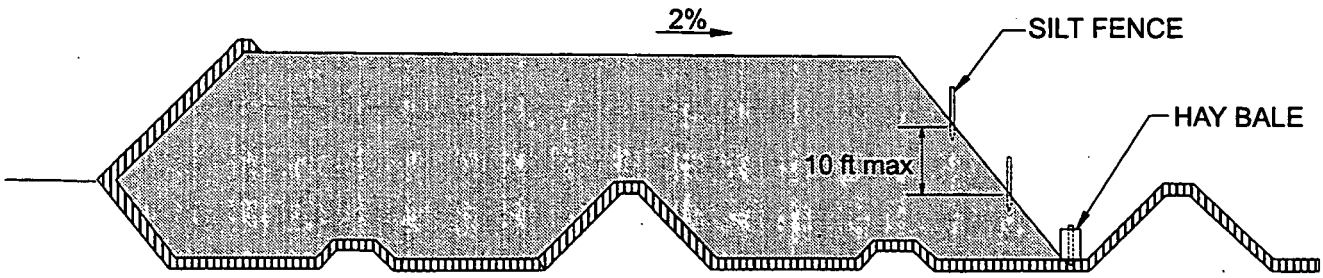
The final daily lift on areas of active impacted material placement shall consist of a 12 in. (1.0 ft.) thick soil (Category 1 material) layer spread and compacted as described in Section 7.0 for Category 1 material placement. The final compaction pass of this layer shall be made using a smooth-drum roller to seal the surface against excessive infiltration and to control fugitive emissions. Smooth-rolled surfaces shall be disked, tracked, or otherwise broken up prior to placement of subsequent lifts.

Impacted material slopes shall be protected from excessive material erosion through the use of silt fences spaced at a maximum vertical spacing of 10 ft. as shown in Figure 6-3. The base of the slope of impacted material, along the perimeter of the impacted runoff catchment area in the cell shall be lined with straw bales to limit the washing of fines into the cell impacted runoff detention area. The impacted runoff catchment area at the southwest corner of each cell has been sized to provide adequate capacity for the detention of the impacted runoff from the 25-year, 24-hour storm event, with 6 in. (0.5 ft.) of freeboard. The catchment area in a current active cell shall be fully maintained until the next active cell becomes operational and the Subcontractor has routed all impacted runoff from the current active cell such that impacted runoff from the 25-year, 24-hour storm event will always be contained within the cells.

Runoff in this area may be pumped into the FEMP former production area stormwater management system or be allowed to percolate through the granular protection layer into the underlying cell leachate collection system. Requirements for this area to maintain unimpeded infiltration into the leachate collection system are given in the *OSDF Systems Plan*.

IMPACTED MATERIAL
EROSION PROTECTION AND SEDIMENT CONTROL





NOTE: THIS FIGURE FOR ILLUSTRATION ONLY. SUBCONTRACTOR SHALL PLACE IMPACTED MATERIAL LAYERS TO THE LIMITS SHOWN ON CONSTRUCTION DRAWINGS.

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FIGURE NO.	6-3
PROJECT NO.	GE3900-10.2
DOCUMENT NO.	F9620002.CDG
FILE NO.	FIG-6-3.CDR

7.0 SOILS AND SOIL-LIKE MATERIAL PLACEMENT

7.1 General

Approximately 85 percent of the impacted material volume to be placed in the OSDF will be Category 1 material (soil and soil-like). Category 1 material may be further divided into: (I) protective and contouring layer soils; (ii) select impacted material layer soils; and (iii) general soil and soil-like material. The placement of this material is expected to be accomplished using similar methods for spreading, grading, and compaction associated with earthwork for OSDF construction. This section of the IMP Plan addresses those activities associated with the placement and compaction of these soils and soil-like Category 1 materials within the OSDF.

7.2 Protective and Contouring Layers

7.2.1 Placement Procedures

As indicated in Section 3.2 of this IMP Plan, the protective and contouring layers shall consist of on-site impacted till or flyash having a maximum particle size not exceeding 3 in. (75 mm) (ASTM C 136). The protective and contouring layers shall also meet the requirements of the project specifications. Topsoil shall not be used for either the protective or contouring layers.

The protective layer shall be placed in a 12 to 15 in. (1.0 to 1.3 ft.) thick loose lift. The contouring layer shall be placed in two loose lifts, each between 6 to 8 in. (0.5 to 0.7 ft.) thick.

7.2.2 Compaction Procedures

To protect the underlying liner system from construction induced damage, the protective layer shall not be compacted with conventional compaction equipment but rather shall be tracked with a medium-sized bulldozer such as a Caterpillar D5 (or lighter). The protective layer shall be constructed in conformance with the project specifications.

The contouring layer shall be compacted to at least 95 percent of the standard Proctor dry density (ASTM D 698). A standard Proctor maximum dry density and optimum moisture content will be established by the CQC Consultant for Category 1 impacted material used in the contouring layer. These materials types will be composited prior to establishing these parameters. These parameters will be obtained by the CQC Consultant in an on-site geotechnical laboratory established for OSDF construction. Each lift of the contouring layer shall be compacted by multiple passes of a self-propelled static pad-foot compactor (*i.e.*, a Caterpillar 815C, or equivalent). It is anticipated that the required compaction moisture content will be within ±3 percentage points of the material's optimum moisture content. Specific requirements for compaction moisture content will be established by the CM during construction. The contouring layer shall be constructed in conformance with the project specifications.

7.3 Select Impacted Material Layers

7.3.1 Placement Procedures

As indicated in Section 3.2 of this IMP Plan, select impacted material shall have a maximum particle size not exceeding 6 in. (150 mm) (ASTM C 136); for material other than impacted till, at least 80 percent of the material shall be finer than a 1 in. (25 mm) particle size. Impacted topsoil may be included in the select impacted material layer but it should not be placed in quantities that deleteriously affect compaction.

The select impacted material layer at the base of the landfill shall be placed in 12 to 15 in. (1.0 to 1.3 ft.) thick loose lifts and compacted to a minimum total thickness of 3 ft. (*i.e.*, three lifts of roughly equal thickness). The thickness of select impacted material over the protective layer may be decreased to 2 ft. if the first lift of impacted material to be placed over the select impacted material is either Category 1 or Category 2 impacted materials. The select impacted material layer below the final cover system shall be placed in a similar manner to a minimum total thickness of 3 ft. measured perpendicular to the exterior slope (see Figure 6-1).

7.3.2 Compaction Procedures

A standard Proctor (ASTM D 698) maximum dry density and optimum moisture content will be established for impacted material used in the select impacted material layers. These material types will be composited prior to establishing these parameters. These parameters will be obtained by the CQC Consultant in an on-site geotechnical laboratory established for OSDF construction. Each lift of select impacted material shall be compacted to 85 percent of the standard Proctor maximum dry density if adjacent to the protective layer and to 90 percent of the standard Proctor maximum dry density if adjacent to the contouring layer. It is anticipated that the compaction moisture content will be within ±3 percentage points of the optimum moisture content. Specific requirements for compaction moisture content will be established by the CM during construction.

7.4 General Soil and Soil-Like Material

7.4.1 Placement Procedures

Category 1 (soil and soil-like) material shall be placed in 12 to 15 in. (1.0 to 1.3 ft.) thick loose lifts and then compacted as indicated below. Prior to placement of a new lift of Category 1 material, the previous lift shall be disked or tracked to leave the surface in a rough condition. The purpose of this preparation is to promote adhesion of the previous and new lifts and to mitigate preferential seepage pathways forming between adjacent lifts.

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7.4.2 Compaction Procedures

Category 1 (soil and soil-like) material shall be compacted to at least 85 percent compaction based on the standard Proctor compaction test, with a running average of at least 90 percent based on the previous 10 samples. The CQC Consultant will establish the standard Proctor maximum dry density (ASTM D 698) and optimum moisture content for Category 1 material requiring compaction. These materials will be composited prior to establishing these parameters. These parameters will be obtained by the CQC Consultant in an on-site geotechnical laboratory established for OSDF construction. It is anticipated that the compaction moisture content of the Category 1 material will be within ±4 percentage points of the material's optimum moisture content. Specific requirements for compaction moisture content will be established by the CM during construction. These requirements will take into account the workability of the material, the required shear strength to obtain adequate levels of OSDF stability, moisture contents needed to achieve dust and other fugitive emission control, and material trafficability.

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8.0 SPECIAL PLACEMENT REQUIREMENTS

8.1 Introduction

This IMP Plan requires special procedures for the placement of the non-soil-like materials (Categories 2 through 5). The non-soil-like materials consist primarily of impacted materials from the Solid Waste Landfill, the Lime Sludge Ponds, and impacted debris resulting from demolition of structures within the FEMP former production area. The impacted debris consists primarily of building superstructure (*i.e.*, steel, masonry, transite, and other finish components), concrete floor slabs, and building substructure (*i.e.*, concrete footings, pads, and other components).

8.2 Location Recording and Surveying

The Subcontractor shall identify the locations of placement of each zone or horizon of Categories 2 through 5 impacted material as it is placed in the OSDF. For each zone or horizon or other placement unit, the Subcontractor shall establish the horizontal location within 100 ft. grids and the vertical location by lift. The Subcontractor shall survey the surface of impacted material compacted in place on a 100 ft. by 100 ft. grid after each week's placement activities. This survey will locate the grid corners to facilitate testing and record keeping. The coordinates used for this survey shall be with respect to the permanent coordinate system established for the OSDF. Where appropriate, sketches of disposal of Category 3 through 5 materials should be provided to show the general orientation and layout of individual and special items.

The Subcontractor shall maintain the grid markers around the perimeter of the cell(s) receiving impacted material. These grid markers are to be placed to a 1 ft. horizontal tolerance.

8.3 Category 2 Material

8.3.1 Placement Procedures

Materials conforming to the Category 2 (*en masse* placement) definition shall be placed in the OSDF in loose lifts not exceeding 18 in. (1.5 ft.) in thickness. Prior to placement of a lift of Category 2 material, the placement unit shall be designated such that the unit can be isolated horizontally on all sides with a minimum of 10 ft. of Category 1 material. Category 2 material shall then be placed within the designated placement unit to a loose thickness of not more than 18 in. (1.5 ft.). Compaction shall be accomplished as the material is spread. After spreading and initial compaction, Category 1 material (of a granular nature when available) shall be spread over the Category 2 material to bring the layer thickness to approximately 21 in. (1.8 ft.). Prior to placement of a second lift of Category 2 material, Category 1 material shall be constructed at the perimeter of Category 2 material to the height of the Category 2 material.

As Category 2 material is expected to be less compressible than the majority of the materials contained in the OSDF, the material should be spread laterally prior to placing the material vertically above other Category 2 material. However, as it is also expected to be more permeable than other OSDF

material, Category 2 material shall not be spread laterally more than 100 ft. In all cases, Category 2 material is to be surrounded in the horizontal directions by at least 10 ft. of less permeable Category 1 material. This will reduce the potential for significant lateral migration of leachate. Not more than one lift of Category 2 material shall be placed on top of another lift of Category 2 material without a minimum 4 ft. thick intervening horizon of Category 1 material.

The Subcontractor should mix Category 1 material as much as practicable with the Category 2 material during excavation and placement activities. The objective of this mixing is to fill voids within the Category 2 material, increase the density of the material placed in the OSDF, and aid in the homogenizing of demolition debris.

8.3.2 Compaction Procedures

After each lift of Category 2 material is placed, the material shall be compacted by four passes of a self-propelled, static pad-foot compactor (*e.g.*, Caterpillar 815C, or equivalent). Soil (Category 1 material) spread on top of the Category 2 material shall be compacted to at least 90 percent of the standard Proctor dry density. It is anticipated that the compaction moisture content will be within ± 3 percentage points of the material's optimum moisture content. Specific requirements for compaction moisture content will be established by the CM during construction. These requirements will take into account the workability of the soil, the required soil shear strength to obtain adequate levels of OSDF stability, moisture contents needed to achieve dust and other fugitive emission control, and material trafficability. After compacting the Category 1 material over the Category 2 material, the Category 1 material shall be proof rolled. Soft spots indicated by tire ruts more than 0.1 ft. in depth or visible deflection under the moving proof rolling equipment shall be stabilized through additional passes of the compactor. The proof rolling equipment shall have a minimum gross vehicle weight of 20 tons and exert a ground pressure of at least 65 psi. Any soft spot that cannot be stabilized with further compactive effort shall be cause for additional treatment to the satisfaction of the CM. This treatment shall consist of removal, replacement, and recompaction of the soil material, and, if needed, infilling soft spots/areas in the Category 2 material with grout or other material approved by the CM.

8.4 Category 3 Items

8.4.1 Placement Procedures

Items not more than 4 ft. high and of regular geometry can be placed as individual members or packages in the OSDF. As much as possible, groups of individual members or packages shall be similarly and regularly sized to enable their placement in the OSDF in regular patterns. Figure 8-1 illustrates the placement of several bundles of packaged transite panels.

Items having voids greater than 1 cubic foot shall be filled with a quick set grout, or flowable cohesionless material approved by the CM. If a grout is used in this manner, it shall be allowed to set for a minimum of 4 hours prior to the commencement of placement of that item.

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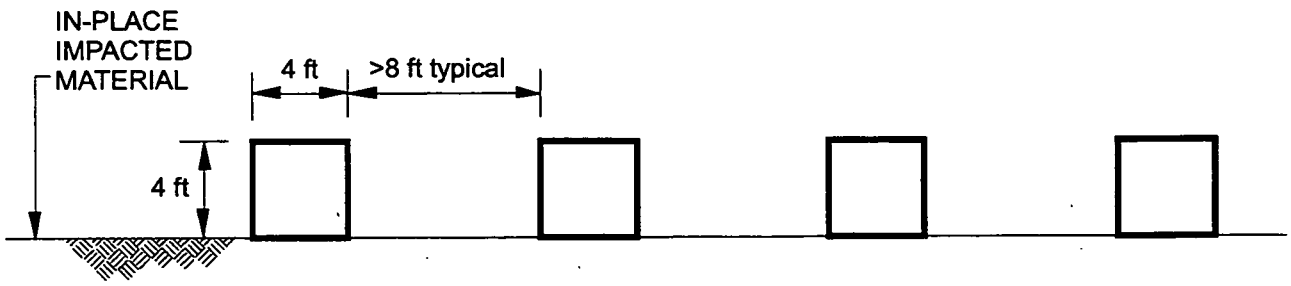
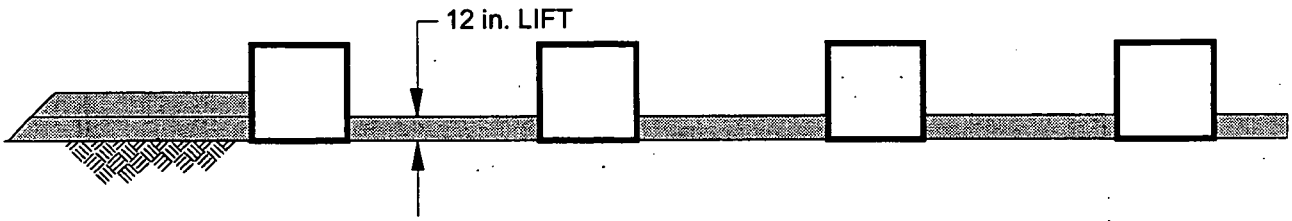
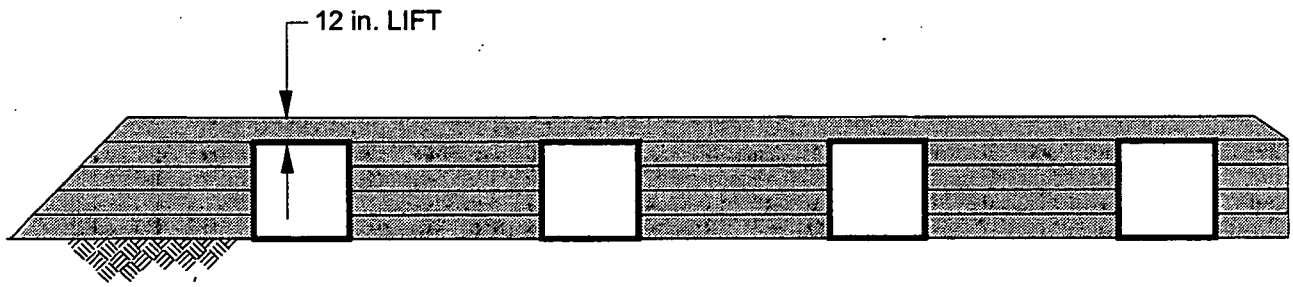
CATEGORY 3 MATERIAL PLACEMENT SEQUENCE



1. PLACED IN A REGULAR PATTERN



2. SPACE FILLED WITH 12 in. LIFTS



3. FINAL 12 in. LIFT PLACED ABOVE GROUPS

NOTE: THIS FIGURE FOR ILLUSTRATION ONLY. SUBCONTRACTOR SHALL PLACE IMPACTED MATERIAL LAYERS TO THE LIMITS SHOWN ON CONSTRUCTION DRAWINGS.

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FIGURE NO.	8-1
PROJECT NO.	GE3900-10.2
DOCUMENT NO.	F9620002.CDG
FILE NO.	FIG-6-3.CDR

Prior to placement of the Category 3 items, the surface of the in-place Category 1 impacted material shall be prepared by rolling with a smooth-drum roller in the area of item placement. The Category 3 items or packages shall be placed on the surface in a regular pattern with an adequate spacing between individual members or packages to allow Category 1 material placement and compaction with available equipment. The space between each member or package shall be filled with Category 1 material placed in maximum 12 in. (1.0 ft.) thick compacted lifts. A final maximum 12 in. (1.0 ft.) thick compacted lift of Category 1 material shall be placed over each grouping of Category 3 items.

As the Category 3 materials are expected to be less compressible than the majority of the impacted materials placed in the OSDF, the Category 3 items should be placed toward the center of the a cell and not in the same horizon with more compressible materials (*i.e.*, Category 4 materials, and sludges and double-bagged asbestos of Category 5 materials). Horizons of Category 3 materials shall be separated by at least a 4 ft. thick intervening horizon of Category 1 material.

8.4.2 Compaction Procedures

Each lift of soil (Category 1 material) between the Category 3 items shall be compacted using equipment capable of achieving compaction to at least 90 percent of the standard Proctor dry density. It is anticipated that the compaction moisture content for this Category 1 material will be within ±3 percentage points of the material's optimum moisture content. Specific requirements for compaction moisture content will be established by the CM during construction. These requirements will take into account the workability of the soil, the required soil shear strength to obtain adequate levels of OSDF stability, moisture contents needed to achieve dust and other fugitive emission control, and material trafficability.

The final compacted lift of soil (Category 1 material) placed above the Category 3 material shall be proof-rolled. The proof rolling equipment shall have a minimum gross vehicle weight of 20 tons and exert a ground pressure of at least 65 psi. Soft spots indicated by tire ruts more than 0.1 ft. in depth or visible deflection under the moving proof rolling equipment shall be stabilized through additional passes of the compactor. Any soft spot that cannot be stabilized with further compactive effort shall be cause for additional treatment to the satisfaction of the CM. This treatment shall consist of removal, replacement, and recompaction of the soil (Category 1 material), and, if needed, infilling soft spots/areas around the Category 3 material with grout or other material approved by the CM.

8.5 Category 4 Materials

8.5.1 Placement Procedures

Soil (Category 1 material) berms which are a minimum of 12 in. (1.0 ft.) high shall be placed around Category 4 material. Category 4 material shall be placed adjacent to the berms to a loose thickness of approximately 18 in. (1.5 ft.). Initial compaction shall be accomplished as the material is spread. Prior to placement of the succeeding lifts of Category 4 material, a minimum 12 in. (1.0 ft.) thick loose lift of soil (Category 1 material) shall be placed over the Category 4 material and compacted as indicated below. Compaction of the second lift of Category 4 materials shall be identical to the first lift. Not more than two

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lifts of Category 4 material shall be placed in a horizon. Category 4 horizons shall not be in the same place vertically as previously placed Category 4 horizons.

8.5.2 Compaction Procedures

After spreading and initial compaction, the Category 4 material shall be compacted by minimum of four passes of a self-propelled, static pad-foot compactor having a nominal weight of at least 45,000 pounds (*e.g.*, Caterpillar 815C, or equivalent). After each sequence of Category 4 material compaction and covering soil (Category 1 material) placement, the cover soil shall be proof-rolled. The proof rolling equipment shall have a minimum gross vehicle weight of 20 tons and exert a ground pressure of at least 65 psi. Soft spots indicated by tire ruts more than 0.1 ft. in depth or visible deflection under the moving proof rolling equipment shall be stabilized through additional passes of the compactor. Any soft spot that cannot be stabilized with further compactive effort shall be cause for additional treatment to the satisfaction of the CM. This treatment shall consist of removal, replacement, and recompaction of the soil (Category 1 material), and, if needed, infilling soft spots/areas in the Category 4 material with grout or other material approved by the CM.

8.6 Category 5 Materials (Special Handling, Placement and Compaction)

8.6.1 Introduction

Category 5 materials are materials that require special handling, placement and compaction procedures. These materials will be classified and designated in accordance with the approved RODs and the Waste Acceptance Criteria. Materials either nominally larger than the physical criteria for the OSDF as identified in Section 4.3 Physical Criteria of this IMP Plan, or not reasonably anticipated by the currently identified categories in this IMP Plan, will require specialized placement plans to be developed on an as needed basis. Such plans would be developed by the OSDF project with the assistance of the resident engineer as appropriate, and submitted to the regulatory agencies for review and approval prior to utilization. It is anticipated that such plans would be submitted concurrent with remedial action planning documents which identify items for special handling, or following the discovery of unexpected materials outside the current categorizations. Once approved, these specialized placement plans either would become addenda to this IMP Plan, or the appropriate section(s) of this IMP Plan would be revised accordingly.

8.6.2 General

Impacted materials suitable for placement in the OSDF that require special handling include:

- Highly-compressible impacted materials not suitable for lateral spreading as a Category 4 material (*e.g.*, double bagged asbestos);
- Piping insulated with asbestos containing material (ACM); and
- Sludges.

Placement and compaction procedures for these types of impacted materials are presented below.

8.6.3 Highly Compressible Materials

Placement

The volume of highly compressible material, such as double bagged asbestos, requiring OSDF disposal is very limited. The primary criterion regarding the placement of asbestos is that the material be placed and compacted in a manner protective of the health of OSDF personnel and the public. A secondary criterion is to prevent significant differential settlement of the OSDF final cover system resulting from compression of this material.

Prior to placement of any highly compressible material in the OSDF, a trench shall be dug into previously placed and compacted Category 1 material. Material excavated from this trench shall be stockpiled at least 6 ft. away from the trench opening. No trenches shall be dug into layers containing Category 2 through 5 material, nor through the protective, contouring, or select impacted material layers. Trenches shall be of uniform width (between 24 and 36 in. (2.0 and 3.0 ft.) wide) and of a uniform depth (between 3.0 and 4.0 ft. deep). The final sizing of the trench shall depend on the nature and size of the material to be disposed. Highly compressible material, such as double-bagged asbestos, shall be deposited in the lower half of the trench.

Compaction

An initial soil (Category 1 material) cover between 12 and 18 in. (1.0 and 1.5 ft.) loose thickness shall be placed on top of the highly-compressible material in the trench. The initial soil cover layer shall be compacted with a minimum of four passes of a portable flat-plate or miniature roller compactor. Intermediate 6 to 12 in. (0.5 to 1.0 ft.) loose soil lifts shall be placed in the trench and then compacted to at least 90 percent of the standard Proctor dry density. A final trench soil lift shall be placed to a compacted height at least 2 in. *or* 0.2 ft. above the trench shoulders. The sequencing of material placement is illustrated in Figure 8-2.

8.6.4 Piping Containing ACM Insulation

Placement

The disposal of ACM-insulated piping in the OSDF shall be performed in a manner protective of the health of OSDF personnel and the public. These materials must be segregated from other demolition debris at the source and delivered to the OSDF in a condition suitable for placement in an excavation dug into previously placed and compacted Category 1 material. The size and shape of the excavation will be based on the predominant dimension and condition of the piping. If the piping comes to the OSDF in relatively straight lengths, the pipes shall be placed in trenches similar to those required for double bagged asbestos. If the piping comes to the OSDF in random shapes, bends, or curvatures, the pipes shall be

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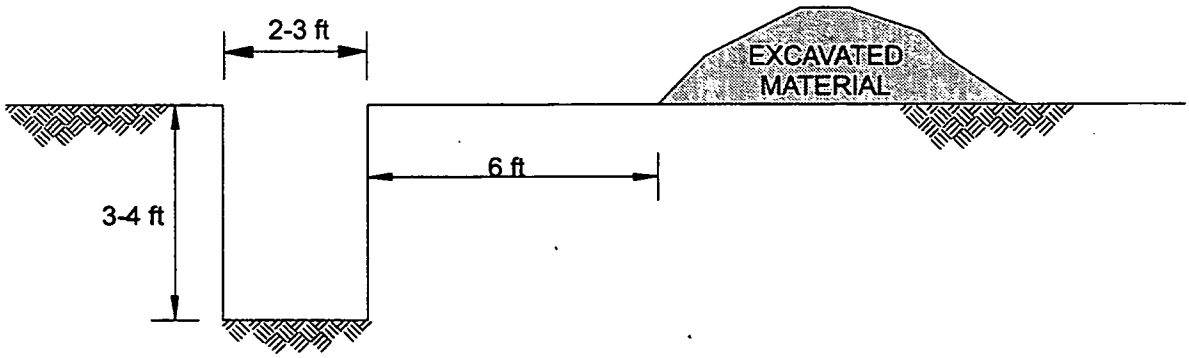
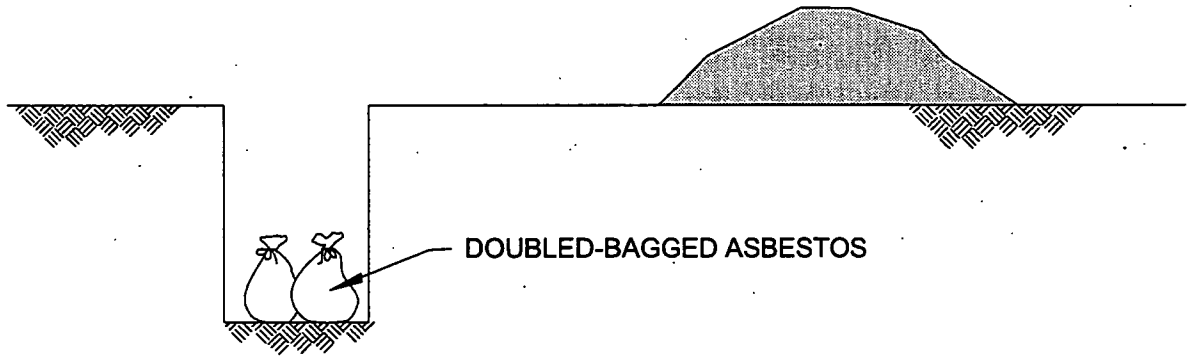
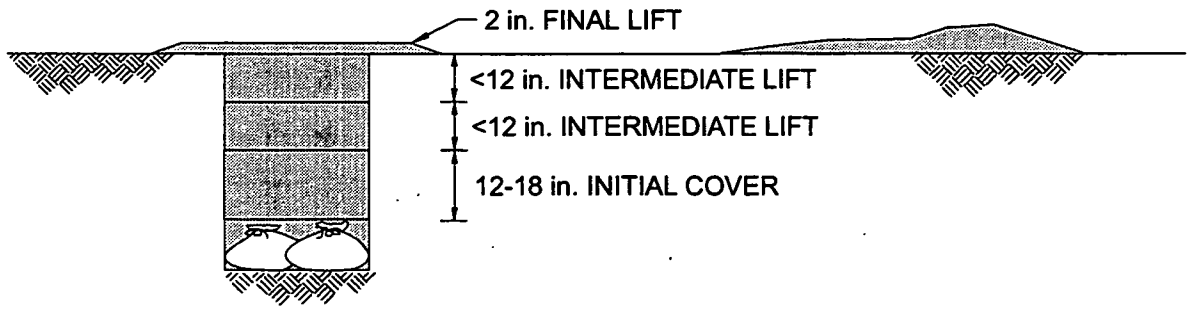
CATEGORY 5 MATERIAL PLACEMENT SEQUENCE



1. TRENCH DUG AND EXCAVATED MATERIAL STOCKPILED



2. CATEGORY 5 MATERIAL DEPOSITED IN TRENCH



3. FINAL TRENCH LIFT PLACED

NOTE: THIS FIGURE FOR ILLUSTRATION ONLY. SUBCONTRACTOR SHALL PLACE IMPACTED MATERIAL LAYERS TO THE LIMITS SHOWN ON CONSTRUCTION DRAWINGS.

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FIGURE NO.	8-2
PROJECT NO.	GE3900-10.2
DOCUMENT NO.	F9620002.CDG
FILE NO.	FIG-6-3.CDR

placed in a rectangular excavation sized to accommodate the pipe but not larger than 12 ft. square and 4 ft. deep. The ACM-insulated piping shall be placed in the lower half of the excavation.

Compaction

An initial soil (Category 1 material) loose lift between 12 and 18 in. (1.0 and 1.5 ft.) thick shall be placed on top of the ACM-insulated piping in the excavation. The initial soil cover layer shall be compacted with a minimum of four passes of a portable flat-plate or miniature roller compactor or a pad-foot compactor such as the Caterpillar 815C as appropriate. Intermediate 6 to 12 in. (0.5 to 1.5 ft.) loose soil lifts shall then be placed in the excavation and compacted to at least 90 percent of the standard Proctor dry density. A final excavation soil lift shall be placed to a compacted height at least 2 in. *or* 0.2 ft. above the excavation shoulders.

8.6.5 Sludges

Placement

The placement, spreading, and compaction of the sludge material from the Lime Sludge Ponds or the AWWT will depend on the water content of the sludge when delivered to the OSDF. Sludge materials from the Lime Sludge Ponds should be mixed with soils from the berms of the ponds as much as practicable during excavation or drying until excessive moisture is removed. The objective of this activity is to decrease the moisture content of the sludges and thereby improve their handling and subsequent compaction characteristics. The following procedure assumes the sludge can be placed and compacted with conventional construction equipment, either by mixing as above in the case of the Lime Sludge Ponds, or by proper preconditioning (dewatering or drying) in the case of the AWWT sludges.

Prior to placement of the first lift of sludge material, the surface of in-place impacted material shall be prepared with starter berms at least 12 in. (1.0 ft.) high. Sludge materials shall be placed within the starter berms to a maximum loose thickness of 12 in. (1.0 ft.).

Compaction

Initial compaction shall be accomplished as the material is spread. After spreading and initial compaction, the material shall be compacted using a self-propelled pad-foot roller (*e.g.*, Caterpillar 815C, or equivalent) to at least 90 percent of the sludge's standard Proctor maximum dry density. Prior to placement of the second and succeeding lifts of sludge materials, a 12 in. (1.0 ft.) thick lift of soil (Category 1 material) shall be placed above the sludge lift and compacted to at least 85 percent of the standard Proctor dry density. After placement of the soil lift, another starter berm shall be constructed as with the first lift of sludge material. Compaction of all succeeding lifts of sludge materials shall be identical to the first lift. Not more than two lifts of sludge material shall be placed in a horizon without a minimum 4 ft. thick intervening horizon of Category 1 material.

After each sequence of sludge and covering soil placement, the cover soil shall be proof-rolled. The proof rolling equipment shall have a minimum gross vehicle weight of 20 tons and exert a ground pressure of at least 65 psi. Soft spots indicated by tire ruts more than 0.1 ft. in depth or visible deflection under the moving proof rolling equipment shall be stabilized through additional passes of the compactor.

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Any soft spot that cannot be stabilized with further compactive effort shall be cause for additional treatment to the satisfaction of the CM. This treatment shall consist of removal, replacement, and recompaction of the soil material, and, if needed, infilling soft spots/areas in the Category 5 material with grout or other material approved by the CM.

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9.0 IMPACTED RUNOFF AND FUGITIVE EMISSIONS CONTROL

9.1 General

This section provides the requirements for impacted runoff and fugitive emissions control within the OSDF battery limit as it relates to impacted material placement. Within the OSDF battery limit, all impacted material placement activities shall be confined to within the OSDF cell lined area. Activities related to the collection, handling, staging, loading, and transportation of impacted materials outside the OSDF battery limit are addressed as part of other work plans prepared as a part of the integrated FEMP remediation.

9.2 Runoff Control

9.2.1 OSDF Cell

Impacted runoff will be generated whenever precipitation comes in contact with impacted materials. Impacted runoff generated within the OSDF cell shall be managed as stated in section 6.9 of this plan and in general conformance with the requirements of the *OSDF SWMEC Plan*. Impacted runoff shall be conveyed using temporary surface-water management structures to the impacted-runoff catchment area in the southwest corner of each active cell. As previously described in this plan, layers of impacted material shall be placed from north to south and east to west within each cell. As these layers are placed, the impacted-runoff catchment area shall be preserved.

9.2.2 Impacted Material Haul Road

Impacted runoff from an impacted material haul road shall be contained within the boundaries of the road until it enters the sump at the western most end of the road. From this sump, the impacted runoff shall be routed to the storm drainage control of the FEMP former production area, or to other on-site wastewater collection/conveyance points acceptable to the CM.

9.3 Fugitive Emissions Control

9.3.1 General

Fugitive emissions may result from impacted material handling and placement activities. Material handling covers such activities as excavation, transporting, dumping, spreading, compacting, and short-term storage. These activities may generate fugitive emissions in the form of particulate matter released to the air (*i.e.*, dust).

As appropriate, the Subcontractor shall use one or more of the following for the control of fugitive emissions from the OSDF:

- Water sprays;
- Crusting agents;
- Operational controls; and
- Wind screens.

Each of the above controls is briefly discussed in the following subsections.

9.3.2 Hauling

The Subcontractor shall control fugitive emissions while hauling impacted materials to the OSDF.

If visible emissions are in excess of the limit discussed in the *OSDF Air Monitoring Plan*, the CM will direct the Subcontractor to provide a corrective action plan.

9.3.3 Water Sprays

The Subcontractor shall use water distributors and spray trucks to control fugitive dust emissions in active OSDF cells and along impacted-material haul roads within the battery limit. The frequency of water application should be weather dependent and be adjusted based on the appearance of visible dust and the results of air monitoring conducted as described in the *OSDF Air Monitoring Plan*.

9.3.4 Crusting Agents

The Subcontractor shall consider the use of crusting agents or other suitable dust suppression chemicals whenever water is not effective or when a particular area will not be disturbed for long enough to justify the additional cost. The Subcontractor shall demonstrate, to the CM, the compatibility of any crusting agent or other suitable dust suppression chemical with components of the OSDF liner system prior to use.

9.3.5 Operational Controls

The Subcontractor may use operational controls to limit fugitive emissions. Limiting placement of impacted material to days when the wind is calm, and limiting the speed of hauling equipment, are examples of operational controls. The Subcontractor shall work closely with the CM in the development and implementation of other beneficial operational controls to be implemented both on a daily and overall basis.

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9.3.6 Wind Screens

The OSDF will be elevated above surrounding lands during its operational life. Increased winds at the higher elevation may cause additional fugitive emissions during periods of operation at the higher elevations. Silt fence on impacted material slopes installed for the control of surface erosion caused by precipitation may provide a measure of protection from winds. The Subcontractor shall consider the use of additional wind screens when other methods of fugitive emissions control prove ineffective.

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10.0 REQUIRED DOCUMENTATION

10.1 General

This section contains information on the documentation required for each truck load of impacted materials to be placed in the OSDF.

10.2 Manifesting System

No impacted material will be accepted at the OSDF without an accompanying impacted material transportation "manifest". The purpose of the "manifest" is to provide a tracking mechanism for impacted material from the remediation project of origin to placement in the OSDF.

Information anticipated to be included on the "manifests" include:

- originating remediation project (*e.g.*, operable unit and project)
- date and time of origination (*e.g.*, loading for debris, excavation for other materials)
- brief visual description of the impacted material in the load
- classification of the impacted material into one of the five material categories of this IMP Plan
- signature by originating remediation project representative that the material meets the criteria in Section 4.0 of this IMP Plan
- Subcontractor (transporter) signature
- date and time of receipt
- CQC Consultant signature

10.3 Impacted Materials Tracking

To aid in tracking impacted material, each impacted material transportation "manifest" will have a unique serial number and two carbon copies. One carbon copy each will be forwarded to the remediation project from which the impacted material originated and to the OSDF Subcontractor. The original will be retained by the CQC Consultant verifying that the impacted material has been disposed in the OSDF.

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10.4 Records Procedures

FERMCO will be responsible for establishing the procedures and requirements for collection, storage, maintenance, and disposition of all OSDF records. Records shall be protected from damage or deterioration by being placed in lockable, fire-proof filing cabinets and by duplication and/or microfilming. Records shall be filed in accordance with the subject file index and shall be retained for 30 years after closure of the OSDF. Required records shall include, but not be limited to, field logbooks, other data collection forms, equipment calibration records, cost data, drawings, impacted material transport "manifests", maintenance records, and associated reports.

All original data collected in the field shall be considered a permanent record. This includes all field logbooks, other data forms, and photographs. All of these documents shall be authorized by the signature and date of the originator. Errors shall be corrected by crossing a single line through the error and entering the correct information. Corrections will be initialed and dated by the person making the correction.

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11.0 SEASONAL COVER

11.1 Description of System

At the end of each construction season and in any area where impacted material will not be placed for at least 30 days, a seasonal cover will be required over any area that has not received final cover. The seasonal cover will consist of natural or impacted soil with suitable surface protection, surfactants (*e.g.*, commercially-available crusting agents), or geosynthetic erosion control surface matting.

11.2 Seasonal Cover Inspection and Monitoring Activities

The seasonal cover shall be inspected and monitored in accordance with the schedule and activity requirements presented in Table 11-1. The purposes of the inspection and monitoring activities are to: (I) ensure the seasonal cover prevents excessive fugitive emissions and slope erosion; (ii) provide adequate and efficient management of impacted runoff within a cell; and (iii) provide adequate protection of liner systems components from freeze/thaw and mechanical damage.

Inspections of the seasonal cover shall consist of a survey of the seasonally-covered area. The visual inspection shall be conducted by either traversing the cover systems on a 100 ft. grid pattern or by using binoculars to inspect areas where surface crusting agents have been applied. Suspect areas shall be delineated on a plan of the site. The inspections shall result in evaluation of the seasonal cover for excessive erosion or gullying. Should such conditions be observed, the Subcontractor shall implement activities to reduce such erosion or gullying, including regrading the eroded area, compacting exposed soil surfaces, rerouting runoff from the area to promote sheet flow, applying additional surface crusting agent, or installing geosynthetic erosion-control surface matting.

The seasonal cover inspections shall also include observation of the area within the active OSDF cell being used for impacted runoff retention. The inspection shall confirm that runoff into the area can infiltrate in an unimpeded manner into the cell LCS. The inspection shall also confirm that excessive sedimentation is not occurring. Should the depth of sedimentation exceed 6 in. (0.5 ft.) in any portion of this area, the sediment should be excavated and transported to an area of the cell outside of the impacted runoff retention area. Any excavation of sediment within the cell shall be performed with extreme care so as not to damage the underlying liner systems. Should the granular protective layer or geotextile LCS filter in the stormwater retention area of the cell become clogged and impede stormwater percolation into the LCS, the CM may instruct the Subcontractor to replace the granular material, and possibly the geotextile filter as well.

Repairs to a cell stormwater retention area shall not be made unless it is part of a plan reviewed by the CM. Any repair activity involving any component of the liner systems or final cover systems shall be in full conformance with the project specification for that component.

TABLE 11-1

SEASONAL COVER
INSPECTION AND MONITORING ACTIVITIES

Component	Inspections: Seasonal-Closure Period	Condition	Maintenance
Seasonal Cover	Bi-weekly	• • unacceptable fugitive emissions	• material surfaces; reroute runoff; compacted soil surface; apply crusting agents or geosynthetic erosion control matting • agent or geosynthetic erosion control matting; install wind screen fencing
Impacted-Runoff Retention Area (in cell)	Bi-weekly	• • lack of timely percolation of drainage into the LCS	• deposit it outside of retention area • replace clogged protective layer granular material with new clean material; replace clogged geotextile filter layer
Protection of Liner System	Bi-weekly	• system must be protected against frost and mechanical damage by at least 2 ft Category 1 material	• check soil cover over anchor trench geosynthetics

N/A - Not Applicable

Notes: (1) Frequencies of inspection and monitoring activities are preliminary.
(2) Seasonal cover shall be inspected after the occurrence of major earthquakes.

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11.3 Recordkeeping

The Subcontractor shall maintain written records of all monitoring, inspections, and repairs in accordance with recordkeeping and reporting requirements of Section 10.4 of this plan.

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APPENDIX A

IMPACTED MATERIALS PLACEMENT QUALITY ASSURANCE PLAN

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Fernald Environmental Management Project
Fernald, Ohio

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A.1 INTRODUCTION

A.1.1 Overview

This IMP Quality Assurance (QA) Plan describes the activities which shall be undertaken throughout the construction, placement, and closure of the OSDF to assure the acceptance, placement, and compaction of the impacted materials in the OSDF are in accordance with the procedures established in the *IMP Plan* and *CQA Plan*. This plan contains requirements and procedures specifically applicable to impacted materials after they are brought into the OSDF battery limit.

A.1.2 Plan Scope

This IMP QA Plan establishes the QA/QC procedures and documentation practices to be used to monitor and test impacted materials which are transported, placed, and compacted by the Subcontractor within the OSDF battery limits. The scope of this plan includes:

- CQC Consultant duties related to impacted materials;
- Monitoring, testing, and documentation procedures to be used in assuring impacted material placement is in accordance with the requirements of the *IMP Plan*; and

A.1.3 Plan Organization

The remainder of this plan is organized as follows:

- The job descriptions, qualifications, and required training of personnel involved in IMP QA are presented in Section A.2;
- Specific monitoring procedures are presented in Section A.3;
- Specific compaction testing requirements for each impacted material category are presented in Section A.4;
- Requirements for as-placed plans are presented in Section A.5; and

Appendix A1 to this IMP QA Plan contains the manifest to be used in tracking impacted material placement in the OSDF.

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A.2 IMP QA PERSONNEL

A.2.1 Staffing Requirements

Monitoring and testing of the placement, and compaction of impacted materials at the OSDF shall be the responsibility of the CQC Consultant. The following personnel shall have responsibilities related to the impacted materials placement QC activities at the OSDF:

- CQC Managing Engineer;
- CQC Site Manager; and
- CQC Field Monitors.

A.2.2 CQC Managing Engineer

A.2.2.1 Job Description

The CQC Managing Engineer shall be in overall charge of the QC activities related to impacted material placement. In addition to the duties described in the *CQA Plan*, the CQC Managing Engineer shall also be responsible for monitoring of the impacted materials placement and compaction in the OSDF.

A.2.2.2 Required Job Qualifications

The required qualifications of the CQC Managing Engineer are contained in the *CQA Plan*.

A.2.3 CQC Site Manager

A.2.3.1 Job Description

The CQC Site Manager shall be in direct day-to-day charge of the QC monitoring conducted at the OSDF during impacted materials placement. In addition to the duties described in the *CQA Plan*, the CQC Site Manager shall also be responsible for:

- Monitoring impacted materials suitability for disposition in the OSDF
- Evaluating the compaction of the impacted materials in the OSDF
- Supervising the compaction testing of impacted materials in the OSDF
- Assigning CQC Field Monitors
- Forwarding required documentation to the CQC Managing Engineer
- Assuring that CQC Field Monitors attend regular health and safety meetings

A.2.3.2 Required Job Qualifications

The qualifications of the CQC Site Manager are contained in the *CQA Plan*.

A.2.4 CQC Field Monitors

A.2.4.1 Job Description

CQC Field Monitors shall perform placement monitoring and compaction testing of impacted materials in the OSDF in accordance with this IMP QA Plan. Placement monitoring and compaction testing shall include documentation that the Subcontractor is performing in accordance with the procedures specified in the *IMP Plan*. Monitors shall also classify, as necessary, the impacted materials for the purposes of assigning a compaction method to the impacted materials.

A.2.4.2 Required Job Qualifications

CQC Field Monitors shall have experience in performing QC in earthwork construction, demolition, or solid waste industries or in an equivalent industry.

A.2.5 Training

Training requirements for personnel employed at the FEMP are contained in the Fernald Site Wide Training Plan - PL-3032 [FERMCO, 1995]. Personnel engaged in impacted materials QA/QC activities at the OSDF shall be trained in accordance with this plan.

Each CQC Consultant employee shall have OSHA 40-Hour Hazardous Waste Workers' Health and Safety Training (HAZWOPER) conducted in accordance with 29 CFR 1910.120. Each employee shall also take an 8-hour Hazardous Waste Workers' Health and Safety Training refresher course each year, and no more than 1 year from the date of completion of the 40-hour HAZWOPER training. The CQC Site Manager shall receive 8-hour HAZWOPER Supervisory training.

Each new employee shall receive 3 days of on-the-job training as required by 29 CFR 1910.120. On-the-job training will include, at a minimum, a discussion of site specific health and safety features, a walk-through of the areas in which the new employees will be working with a discussion of possible hazards in the area, a discussion of job duties and potential hazards associated with the duties, and a discussion regarding appropriate personal protective equipment (PPE) including minimum requirements for work clothing in accordance with the site specific health and safety plan.

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A.3 IMPACTED MATERIALS MONITORING

A.3.1 Required Documentation

Upon entering the OSDF battery limits, the CQC Consultant shall check that the impacted materials are accompanied by a "manifest" and that the hauling unit has been properly identified as to the impacted material category. Impacted material categories are defined in Section 5.2 of the *IMP Plan*. If no material category has been entered onto the manifest, the hauling unit shall be turned around and sent back to its point of origin. The CQC Consultant shall verify that the "manifest" contains all information relating to the impacted material origin as specified by Section 10.2 of the *IMP Plan*. The CQC Consultant shall complete the "manifest" by recording any pertinent notes, comments, or observations about the load. The CQC Consultant shall finally affix a signature to the "manifest" verifying that the load has been delivered in accordance with the *IMP Plan*.

A.3.2 Visual Inspection

The CQC Consultant shall perform a visual review of the impacted materials entering the OSDF. The contents of each hauling unit (truck load or container) shall be viewed after dumping to assure that the contents match the visual description entered on the "manifest".

A.3.3 Monitoring for Moisture Content

Impacted materials accepted at the OSDF shall be at a moisture content suitable for placement and compaction in accordance with the *IMP Plan*. If the CQC Consultant determines that impacted materials are too wet, the Subcontractor shall dry the material to a condition allowing placement and compaction in accordance with the *IMP Plan*.

A.3.4 Demolition Debris Monitoring

General

The CQC Consultant shall monitor demolition debris delivered to the OSDF. Additional information regarding waste classification and special handling of specific types of demolition debris is presented in the following sections.

Asbestos

Trucks carrying double bagged regulated asbestos containing material must display asbestos warning signs. The Subcontractor shall comply with all regulations relating to the handling and transportation of regulated asbestos containing material.

Broken Concrete

Most concrete demolition debris will fall into Category 2 (*en masse* placement). Loads of concrete containing concrete pieces that cannot be spread into 18 in. (1.5 ft.) loose lifts will be classified as Category 5 materials.

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Steel or Transite Sidings

Steel or transite sidings that arrive at the OSDF in neatly packaged stacks less nominally 4 ft. high will be classified as Category 3 items (individual placement). Loose truck loads of miscellaneous demolition debris containing steel sidings that can be spread in lifts not higher than 18 in. (1.5 ft.) will be classified as Category 2 materials (*en masse* placement).

Steel Beams

Steel beams which can be spread or placed into a lift no higher than 18 in. (1.5 ft.) will be classified as Category 2 materials (*en masse* placement). Steel beams that cannot be placed in a lift no higher than 18 in. (1.5 ft.) but which can be placed individually such that the highest part of the beam is not more than 4 ft. above the ground surface will be classified as Category 3 items (individual placement).

Wood

Loads of demolition debris consisting primarily of wood and that can be spread in lifts no higher than 18 in. (1.5 ft.) will be classified as Category 4 materials (organics).

Miscellaneous Demolition Debris

Loads of miscellaneous demolition debris (doors, plumbing, wiring, *etc.*) that can be spread in lifts no higher than 18 in. (1.5 ft.) will be classified as Category 2 materials (*en masse* placement). Miscellaneous demolition debris that can be placed individually such that the highest part of the debris is not more than 4 ft. above the ground surface will be classified as Category 3 items (individual placement).

Tanks

Tanks that cannot be placed such that the void space can be filled and Category 1 material placed and compacted around them shall not be placed in the OSDF. Pressurized or pressurizable cylinders which have not been cut in half such that they cannot contain pressurized materials will not be accepted at the OSDF. Tanks acceptable for placement in the OSDF and which are less than 5 ft. in diameter and 4 ft. high will be classified as Category 3 items (individual placement).

Pipes

Steel pipes which can be spread or placed into a lift no higher than 18 in. (1.5 ft.) will be classified as Category 2 materials (*en masse* placement). Steel pipes larger that cannot be placed in a lift no higher than 18 in. (1.5 ft.) but which can be placed individually such that the highest part of the pipe is not more than 4 ft. above the ground surface will be classified as Category 3 items (individual placement).

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A.4 IMPACTED MATERIAL PLACEMENT AND COMPACTION

A.4.1 Category 1 Materials (Soils and Soil-Like)

General Monitoring Requirements

Monitoring the placement and compaction of impacted soil and soil-like materials includes the following:

- Testing to determine the water content and other physical properties of the impacted soil materials during processing, placement, and compaction;
- Monitoring the thickness of lifts as loosely placed and as compacted;
- Monitoring the action of the compaction and heavy hauling equipment on the construction surface (sheepsfoot penetration, pumping, cracking, etc.).

Placement and Compaction Quality Control

The standard Proctor test (ASTM D 698) shall be used for the determination of moisture/density relationships on the Category 1 material to be disposed in the OSDF. These material types will be composited prior to establishing their parameters. The standard Proctor tests will be performed in the on-site geotechnical laboratory established per the *CQA Plan*.

The dry density, moisture content, and loose lift thickness of Category 1 materials shall be measured at a minimum frequency of once per 10,000 ft^2 *or* once per 100 ft. by 100 ft. grid element per lift; measurement of dry density and moisture content are to be in accordance with ASTM D 2922 and D 3017 (nuclear methods). To establish correlations of moisture and density with the nuclear methods, the sand cone test method (ASTM D 1556) shall be used once per day when Category 1 materials are placed. The sand cone correlation will also be used to evaluate the effect impacted materials may have on the nuclear densitometer.

Compaction testing for Category 1 materials will be documented in accordance with procedures established in the *CQA Plan*.

Rework

At locations where the field testing indicates densities below the requirements of the *IMP Plan*, the failing area shall be reworked.

Lines and Grades

Surveying of lines and grades shall be conducted by the Subcontractor on a periodic basis during the deposition of the impacted materials.. The CQC Consultant shall monitor the surveying to ensure that slopes are properly constructed to promote proper drainage and assure that required separation distances are maintained. Any deviation from the *IMP Plan* procedures shall be reported to the CM for corrective action.

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A.4.2 Category 2 Materials

Placement Quality Control

The CQC Consultant shall monitor and document that the placement of Category 2 materials is in accordance with the *IMP Plan*.

Monitoring of placement by the CQC Consultant shall include verification that:

- Loose lift thickness is no more than 18 in. (1.5 ft.);
- Category 1 materials are worked into the lift as much as practical;
- Horizontal extent of a lift is no more than 100 ft. and each is surrounded with 10 ft. of Category 1 material; and
- Horizons are limited to two lifts and separated vertically by a 4 ft. horizon of Category 1 materials.

Compaction Quality Control

The CQC Consultant shall monitor and document that the Category 2 materials have received the compaction effort specified by the *IMP Plan*. Category 1 materials used to cover each lift of Category 2 material shall be tested in accordance with Section A.4.1.

Compaction testing of Category 1 materials covering the Category 2 material shall be documented in accordance with procedures established in the *CQA Plan*.

Rework

At locations where the field testing indicated densities below the requirements of the *IMP Plan*, the failing area shall be reworked.

A.4.3 Category 3 Items

Placement Quality Control

The CQC Consultant shall monitor and document that the placement procedures presented in Section 8 of this *IMP Plan* are followed by the Subcontractor in the placement of Category 3 items. Monitors will observe and document that the maximum lift thicknesses of Category 1 materials placed around the individually placed items are in accordance with the *IMP Plan*.

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Compaction Quality Control

The CQC Consultant shall monitor and document that the Category 1 materials used in the placement of Category 3 materials have received the compaction effort specified by the *IMP Plan*. Category 1 materials used in the placement of Category 3 materials shall be tested in accordance with Section A.4.1, but at a frequency as follows:

(i) for soil cover lifts, once per each soil cover lift, and
(ii) for side berms, once per 250 ft. length but not less than twice per grid element.

Compaction testing of Category 1 materials used in the placement of Category 4 material shall be documented in accordance with procedures established in the *CQA Plan*.

Rework

At locations where the field testing indicates densities below the requirements of the *IMP Plan*, the failing area shall be reworked.

A.4.4 Category 4 Materials

Placement Quality Control

The CQC Consultant shall monitor and document that the placement procedures presented in Section 8.0 of the *IMP Plan* are followed by the Subcontractor in the placement of Category 4 materials. Monitors shall observe and document that maximum loose lift thicknesses are in accordance with the *IMP Plan*.

Compaction Quality Control

The CQC Consultant shall monitor and document that the Category 4 materials, and the Category 1 materials used in the placement of Category 4 materials, have received the compaction effort specified by the *IMP Plan*. Category 1 materials used in the placement of Category 4 materials shall be tested in accordance with Section A.4.1, but at a frequency as follows:

(i) for side berms, once per 250 ft. length but not less than twice per grid element; and
(ii) for cover lifts, once per each soil cover lift.

Compaction testing for Category 4 and Category 1 materials will be documented in accordance with procedures established in the *CQA Plan*.

Rework

At locations where the field testing indicates densities below the requirements of the *IMP Plan*, the failing area shall be reworked.

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A.4.5 Category 5 Materials (Special Handling, Placement and Compaction)

Placement Quality Control

The CQC Consultant shall monitor and document that the placement procedures, trench/excavation dimensions or berm heights, maximum loose lift thicknesses, and compacted height of final soil lifts are in accordance with the *IMP Plan* (or its appropriate addenda).

Compaction Quality Control

Highly Compressible Materials and Piping Containing Asbestos Insulation

The CQC Consultant shall monitor and document that the Category 1 materials used in the placement of these Category 5 materials (*IMP Plan* Sections 8.6.3 and 8.6.4, respectively) have received the compaction effort specified by the *IMP Plan*. Category 1 materials used in the placement of these Category 5 materials shall be tested in accordance with Section A.4.1, but at a frequency as follows:

(i) for initial soil cover lifts in trenches or excavations, no testing is necessary or desired aside from observing compaction passes; and
(ii) for subsequent soil cover lifts in trenches or excavations, once per each soil cover lift in each trench or excavation.

Compaction testing of Category 1 materials used in the placement of these Category 5 materials shall be documented in accordance with procedures established in the *CQA Plan*.

Sludges

The CQC Consultant shall monitor and document that the Category 1 materials used in the placement of these Category 5 materials, and these Category 5 materials themselves, have received the compaction effort specified by the *IMP Plan*.

Category 1 materials used in the placement of sludges shall be tested in accordance with Section A.4.1, but at a frequency as follows:

(i) for side berms, once per 250 ft. length but not less than a minimum of 2 per grid element; and
(ii) for soil cover lifts, once per each soil cover lift in each placement unit.

These sludges shall be tested in accordance with Section A.4.1, but at a frequency as follows:

(i) once per each lift.

Compaction testing of these Category 5 materials, and Category 1 materials used in the placement of these Category 5 materials, shall be documented in accordance with procedures established in the *CQA Plan*.

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A.5 AS-PLACED PLANS

The CQC Consultant shall prepare as-placed plans for the completed impacted-materials placement activities. These plans shall report how much of each category of impacted material is in each grid element by lift with each cell. The Subcontractor shall allow for this activity in the scheduling of impacted materials placement and shall promptly furnish appropriate sketches, notes, files, and records to the CQC Consultant.

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APPENDIX A1

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IMPACTED MATERIALS MANIFEST

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SYSTEMS PLAN

ON-SITE DISPOSAL FACILITY

20100-PL-008
Revision G
October 1996

United States Department of Energy

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

Fernald Environmental Restoration Management Corporation
Fernald, Ohio
Under Contract DE-AC05-92OR21972

Prepared for

U.S. Department of Energy
Fernald Field Office

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ATTACHMENT B: Owner's Manuals for Decontamination Facilities (to be Provided by the Subconstruction Contractor as Part of Construction Acceptance)

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1.0 INTRODUCTION

1.1 Overview

This Systems Plan describes the inspection, monitoring, and maintenance activities that will be undertaken at the Fernald Environmental Management Project (FEMP) On-Site Disposal Facility (OSDF), Fernald, Ohio. These activities apply to the leachate management system, final cover system, temporary facilities, and access roads within the battery limit of the OSDF.

This plan addresses the systems activities to be implemented throughout construction, material placement, and closure of the OSDF. The inspection, monitoring, and maintenance activities for the 30 year post-closure monitoring period prescribed in the *Final Record of Decision for Remedial Actions at Operable Unit 2 (OU2 ROD)* [DOE, 1995a] will be addressed in the *OSDF Post-Closure Care and Inspection Plan.* Inspection, monitoring, and maintenance activities beyond the 30 year post-closure monitoring period will be addressed through future amendments to this plan and the *OSDF Post-Closure Care and Inspection Plan.*

1.2 Project Description

The OSDF will be constructed to contain impacted materials derived from remediation of the operable units at the FEMP. All material destined for OSDF disposal will be required to meet OSDF waste acceptance criteria (WAC). The OU2 ROD has established an initial WAC for the OSDF of 346 picoCuries/gram (pCi/g) of uranium-238 (U-238) or 1,030 parts per million (ppm) total uranium. The estimated total volume of material destined for OSDF disposal is 2.5 million cubic yards (1.9 million cubic meters) bank/unbulked. Approximately 80 percent of this material is impacted soil, with the remainder consisting of building demolition rubble, fly ash, lime sludge, municipal solid waste, and small quantities of miscellaneous other materials.

The OSDF is designed to be constructed, material placed, and closed in stages. Projected phases of the OSDF construction, placement of impacted material and closure are outlined in Table 1-1.

The design approach for the OSDF is presented in the document, *"Final Remedial Design Work Plan for Remedial Actions at Operable Unit 2"* [DOE, 1995c]. The design of the OSDF, as currently developed, is presented in the *"Final Design Package, On-Site Disposal Facility"* [GeoSyntec, 1996a]. The design of the OSDF includes a liner systems, placement of impacted material, final cover systems, leachate management systems, surface-water management systems, and other ancillary features. The liner and final cover systems details for the OSDF are shown in Figure 1-1.

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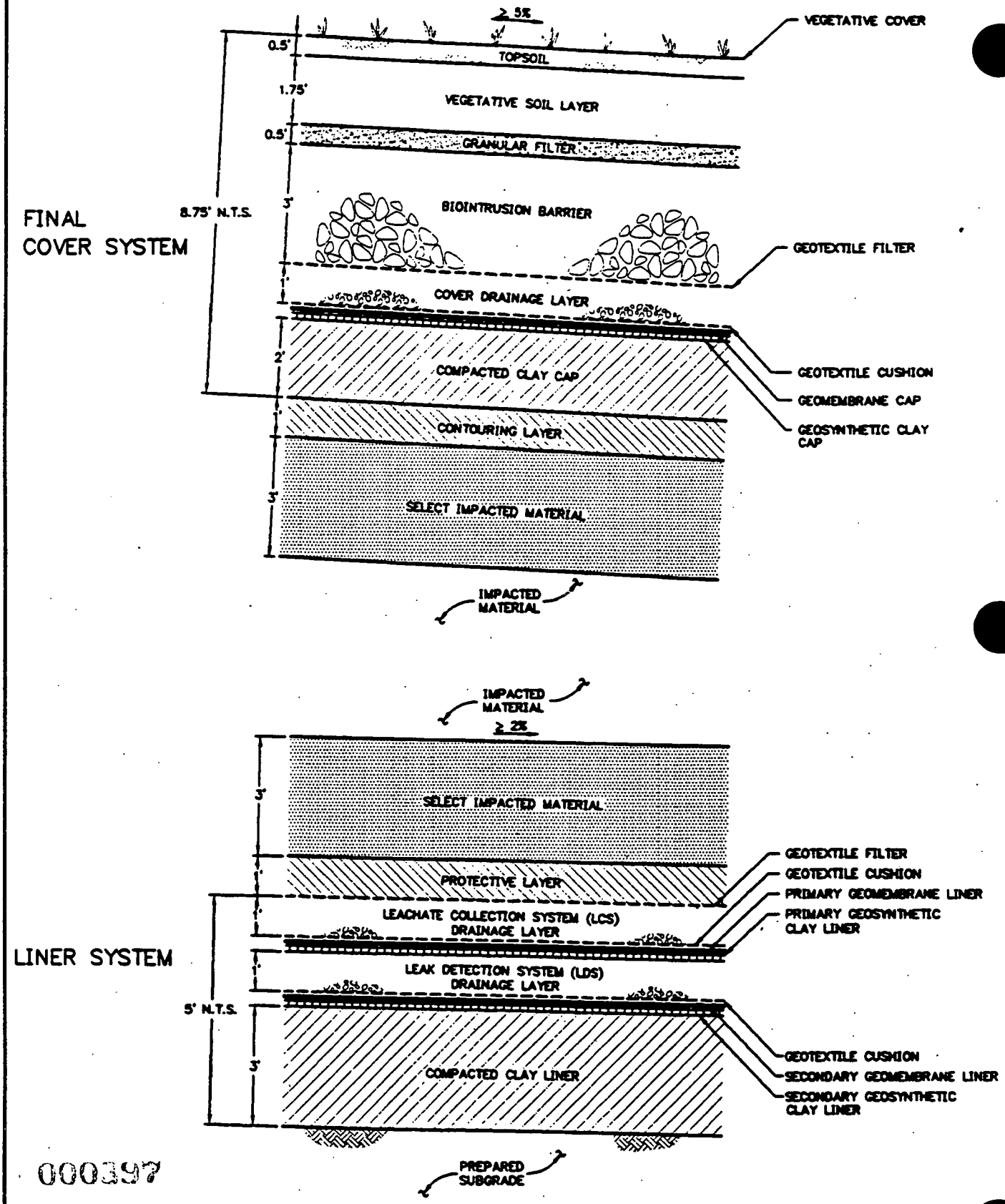
LINER AND COVER SYSTEM DESIGN
ON-SITE DISPOSAL FACILTY



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GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FIGURE NO.	1-1
PROJECT NO.	GE3900-6.1
DOCUMENT NO.	F9530007.CDG
FILE NO.	F95a001.DWG

1.3 Plan Scope

This OSDF Systems Plan establishes the inspection, monitoring, and maintenance activities necessary to achieve the proper performance of the OSDF. The scope of this plan includes:

- Maintaining the OSDF throughout construction, impacted material placement and closure of the OSDF. (While the Systems Plan also includes procedures to be used to maintain the OSDF in the 30 year post-closure monitoring period, those post closure activities are presented for illustrative purposes only, as post closure activities are addressed in a separate *Post-Closure Care and Inspection Plan*);
- Inspecting, and monitoring, the leachate management system;
- Stabilizing the final cover system surface with grass species that limit the erosion of topsoil, are compatible with local vegetation, and require minimal maintenance;
- Maintaining the OSDF seasonal cover, when in use;
- Monitoring temporary support facilities during construction; and
- Maintaining vehicular access around the OSDF.

This Systems Plan has been prepared for regulatory review. Prior to and during construction of the OSDF, this Systems Plan will be updated to contain equipment manuals and operating and maintenance procedures for the specific equipment and system procured and installed by the Subcontractor. This updated plan will serve as a working document that will be periodically updated during the active life and closure of the OSDF. In no case, however, will the updating result in a reduction in inspection, monitoring, maintenance and operational activities below the levels required by this plan unless approval for such reduction is formally obtained from the DOE and EPA/OEPA.

1.4 Plan Organization

The remainder of this Systems Plan is organized as follows:

- The requirements from the OSDF design criteria package (DCP) applicable to this plan, as well as other general requirements applicable to the plan, are presented in Section 2.0;
- Activities for the OSDF leachate management system are presented in Section 3.0;
- Activities for the OSDF final cover system are contained in Section 4.0;
- Activities for the OSDF seasonal cover are described in Section 5.0;
- Activities for the OSDF temporary support facilities, utilities, and site security fence are addressed in Section 6.0;

- Activities for the permanent access roads are presented in Section 7.0; and
- Recordkeeping requirements are presented in Section 8.0.

1.5 Plan Responsibilities

Implementation responsibilities for this Systems Plan are as follows:

- *Construction Manager (CM):* responsible for ensuring that OSDF maintenance, monitoring, and inspection activities are performed in accordance with this plan, on schedule, and by suitably trained personnel; responsible for receiving and reviewing reports and documentation from the Subcontractor, and requesting involvement of Resident Engineer, as required;
- *Subcontractor:* responsible for construction, impacted material placement, and closure of the OSDF facility. The Subcontractor shall implement this plan until the OSDF is fully closed.

The Subcontractor shall be responsible for preparing the necessary health and safety plan that meets all health and safety requirements identified in the FEMP Project Specific Health and Safety Requirements Matrix (PSHSRM). In addition, the H&S personnel will perform periodic audits of the Subcontractor to ensure compliance; H&S personnel will have stop-work authority (in the event of threat to worker and/or public safety) until the proper corrective action is taken. The H&S Officer assigned to the OSDF project will be the single point of contact for all safety, industrial hygiene, fire protection, and radiological issues or concerns.

The Subcontractor will be required to provide a H&S field representative who will be responsible for the Subcontractor's compliance with all H&S requirements. The Subcontractor H&S representative will be required to report all safety concerns and incidents to the H&S Officer.

Radiological Technicians will also be assigned to the OSDF project. In conjunction with the H&S Officer assigned to the project, the Radiological Technician(s) will help to ensure radiological compliance throughout the project. Radiological compliance may include the radiological monitoring of equipment, materials, soil, and air during excavation, placement and closure to help ensure proper segregation, storage, or disposition; routine inspection, monitoring, and recording of area radon monitors and/or other radiation detection monitors; and radiological monitoring of personnel. The PSHSRM will be the basis for the required monitoring and will identify the action levels that will ensure personnel safety by limiting exposure.

1.6 Related Implementation Plans

Several other implementation plans have been prepared for the OSDF that contain information relevant to this plan. Other plans of direct relevance to this plan are listed below along with a brief statement of the relationship of the work plan to this plan:

- *OSDF Borrow Area Management and Restoration (BAMR) Plan* [GeoSyntec, 1996b]: provides procedures to strip, develop, maintain, and restore the OSDF soil borrow area;

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- *OSDF Construction Quality Assurance (CQA) Plan* [GeoSyntec, 1996d]: provides testing and certification standards which are required for the OSDF construction and materials or equipment which may require replacement or repair during construction activities;

- *OSDF Impacted Materials Placement (IMP) Plan* [GeoSyntec, 1996e]: outlines impacted material acceptance criteria (WAC) and provides procedures for impacted materials disposal in the OSDF;

- *OSDF Surface-Water Management and Erosion Control (SWMEC) Plan* [GeoSyntec 1996f]: provides details of temporary and permanent E&S controls for the OSDF (including maintenance requirements for channels and sediment control);

- *OSDF Air Monitoring Plan* [FERMCO, 1996a]: provides for monitoring potential fugitive dust emissions and potential radionuclide particulate matter that may occur during construction, impacted material placement, and closure of the OSDF; and

- *OSDF Post-Closure Care and Inspection Plan* [FERMCO, 1996b]: describes post-closure inspection, operation and maintenance activities.

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2.0 APPLICABLE REQUIREMENTS

2.1 Overview

Regulatory, DOE, and other requirements applicable to this Systems Plan are contained in the Design Criteria Package (DCP) for the OSDF. The DCP is contained with the overall OSDF Design Package [GeoSyntec, 1996a]. These requirements take the form of applicable or relevant and appropriate requirements (ARARs) and to be considered criteria (TBCs) as determined by the record of decision for each of the various FEMP operable units, functional requirements, and general design criteria. The DCP requirements applicable to this Systems Plan are described below.

2.2 Applicable or Relevant and Appropriate Requirements

ARARs that are addressed by this Systems Plan are:

- OAC 3745-27-08(C)(4)(b): Leachate collection systems pipes shall (i) be provided with access for clean-out devices; (ii) be of a length and configuration that do not exceed the capabilities of clean-out devices; and (iii) resist damage caused by differential settlement.

- OAC 3745-27-08(C)(4)(e): Lift stations shall be equipped with automatic high level alarms located no greater than 6 ft (2.0 m) above the invert of the leachate inlet pipe. Lift station pumps shall be of adequate capacity and shall automatically commence pumping before the accumulated leachate activates the high level alarm.

- OAC 3745-27-08(C)(5): Leachate conveyance and storage structures located outside of the limits of disposal shall be no less protective of the environment than the disposal facility, and shall:

  - Be monitored, as required by EPA and OEPA;

  - For storage tanks, be provided with secondary containment;

  - For leachate lines, be provided with double containment; and

  - For storage structures, have a minimum of one week of storage capacity as established by design using assumptions simulating final closure of the facility.

- OAC 3745-27-08(C)(8): Access roads shall allow passage of vehicles during all weather conditions with minimum erosion, dust generation, and with adequate drainage. Grades are not to exceed 12 percent.

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Post-closure care activities for all sanitary landfill facilities shall include, but are not limited to:

- Continuing operation and maintenance of the leachate management systems and surface-water management systems; and
- Maintaining the integrity and effectiveness of the cap systems, including making repairs to the cap systems as necessary to correct the effects of settling, dead vegetation, subsidence, erosion, leachate outbreaks, or other events, and preventing run-on and run-off from eroding or otherwise damaging the cap systems.

- OAC 3745-27-19(E)(26): The integrity of the engineered components of the landfill shall be maintained and any damage to, or failure, or the components shall be repaired.
- OAC 3745-27-19(J)(1)(4): If ponding or erosion occurs on areas of the landfill facility where solid waste is being, or has been, deposited, action will be taken to correct the conditions causing the ponding or erosion.
- OAC 3745-27-19(K)(1): If leachate is detected on the surface of the landfill facility, then the outbreak(s) shall be repaired and:
  - Leachate shall be contained and properly managed at the sanitary landfill facility;
  - If necessary, leachate shall be collected and disposed in accordance with paragraph (K)(5) and (K)(6) of OAC 3745-27-19; and
  - Actions shall be taken to minimize, control, or eliminate the conditions which contribute to the production of leachate.
- OAC 3745-27-19(K)(2): At least one lift station back-up pump shall be kept at the disposal facility at all times.
- OAC 3745-27-19(K)(3): The collection pipe network of the leachate management systems shall be inspected after placement of the initial lift of waste to ensure that crushing has not occurred and shall be inspected annually thereafter to ensure that clogging has not occurred.
- OAC 3745-68-10: After final closure, the owner or operator shall comply with all post-closure requirements, including maintenance and monitoring throughout the post-closure care period. The owner or operator shall:
  1) Maintain the integrity and effectiveness of the final cover, including making repairs to the cap as necessary to correct the effects of settling, subsidence, erosion, or other events;
  2) Continue to operate the leachate collection and removal systems until leachate is no longer detected;

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3) Maintain and monitor the leak detection systems;

4) Maintain and monitor the ground-water monitoring systems;

5) Prevent run-on and run-off from eroding or otherwise damaging the final cover; and

6) Protect and maintain surveyed benchmarks.

2.3 Functional Requirements and Design Considerations

The DCP contains a variety of functional requirements and design considerations that have been established for the OSDF. These functional requirements are specific facility design or performance criteria required by DOE. Design considerations represent those other design, construction, or operational criteria identified by the OSDF architect/engineer (A/E) as necessary for the OSDF to successfully fulfill its intended function. Criteria relevant to the OSDF leachate management system are provided in Section 2.5 of the DCP. Criteria relevant to the final cover system are described in Section 2.6. Criteria applicable to the support facilities and utilities are presented in Section 2.9.

2.4 Other Criteria

Criteria applicable to this plan consist of those industry-standard practices that have proven effective at other waste disposal facilities. Inspection and monitoring requirements from the manufacturers and suppliers of materials and equipment to be installed at the OSDF are also criteria relevant to this plan.

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3.0 LEACHATE MANAGEMENT SYSTEM

3.1 Overview of System

The double-liner systems of each OSDF cell contains a leachate collection systems (LCS) and a leak detection (LDS) systems (see Figure 1-1). These system are designed to convey any liquids that enter the system through pipes (i.e., the LCS pipes and the LDS pipes) to manholes located outside each cell. Liquids that enter the LCS include: (i) leachate generated by infiltration of water through the impacted material into the LCS; and (ii) impacted runoff from active portions of the OSDF which infiltrate into the LCS. Liquid that enters the LDS is primarily precipitation that percolates into the LDS prior to placement of the primary liner. Liquid that collects in the LDS manhole of a cell shall be pumped to the adjacent LCS manhole. In turn, the LCS manholes are connected by a LTS gravity line which conveys leachate from the LCS pipes in the manholes via gravity flow to either a temporary gravity line or a permanent lift station. The temporary lift gravity line is a double wall pipe which conveys flows to the permanent lift station during earlier stages of OSDF operation. From the permanent lift station, leachate is pumped through a permanent double-wall forcemain to the Biodenitrification Surge Lagoon (BSL)

The locations of the LCS, LDS, and LTS gravity lines manholes, temporary gravity line and permanent lift stations are presented on the Construction Drawings.

This Systems Plan addresses all leachate management systems components up to the LTS gravity line or temporary gravity line discharge point into the permanent lift station.

3.2 Basic System Operation

The basic operation of the OSDF leachate management systems is described below.

- The LCS and LDS pipes from liner system to the LCS and LDS manholes for each cell consist of double-wall HDPE pipes (i.e., inner carrier pipes and outer containment pipes). Each pipe drains by gravity from the OSDF cell and terminates in a LCS or LDS manhole.

- The LDS manhole allows for direct discharge of flow from the LDS carrier pipe into a primary containment vessel located inside the manhole. The LDS manhole serves as a secondary containment structure for the primary containment vessel. The LDS manhole has provisions for the monitoring of liquid in the primary containment vessel component of the manhole. The primary containment vessel has a 2 in. (50 mm) diameter liquid level pipe, a 2 in. (50 mm) diameter suction pipe, and a 2 in. (50 mm) diameter discharge pipe. The discharge pipe is connected to the LTS gravity line in the adjacent LCS manhole. The LDS containment pipe has a monitoring port and fixed end seal within the LDS manhole to verify the absence of liquid in the annular space between the carrier pipe and containment pipe.

- Each LDS manhole has a cleanout adjacent to the manhole for maintaining the LDS carrier pipe. The LDS manhole also has access provisions to install a sump pump to allow pumping of construction water that drains from the LDS prior to the placement of impacted material in the OSDF.

- The LCS manhole allows for direct discharge of flow from the LCS carrier pipe into the LTS gravity line that passes through the manhole. The LCS carrier pipe has temporary valves for regulating leachate flow into the gravity line during OSDF construction, impacted material placement, and periods of gravity line maintenance, extension, repair, etc. These valves shall be removed (and replaced with a solid-wall HDPE spool) from the LCS carrier pipe prior to final closure of the OSDF (so that, in the long term, there are no obstructions in the pipe). The LCS carrier pipe in each LCS manhole also has a sampling port for obtaining leachate samples. Each LCS manhole has an inlet for a redundant LCS carrier pipe. The redundant carrier pipe has a valve (secured in a closed position) and sampling port (for periodically confirming the absence of liquid in the pipe). The redundant carrier pipe valve is configured so that it can be opened to allow flow to the LTS gravity line at any time in the event of a failure due to clogging of the primary LCS carrier pipe. This valve shall also be removed (and replaced with solid-wall HDPE spool) after final closure of the entire OSDF. Both the primary and redundant LCS containment pipes have monitoring ports and fixed end seals within the LCS manholes to verify the absence of liquid in the annular space between the carrier pipe and the containment pipe.

- LCS manholes are equipped with liquid level alarms, consisting of a submersible liquid level sensor, logic controller, and alarm light. The liquid level sensor shall be calibrated such that the alarm is activated when the liquid level in the LCS manhole exceeds 2 in. (50 mm). The LCS and LDS manholes have pipe supports for the LTS gravity line and the LDS carrier pipe, respectively.

- The LTS gravity line and LCS and LDS manholes will be installed in stages, progressively advancing from north to south in conjunction with the progressive development of the OSDF. Each stage may involve the installation of manholes and LTS gravity line for several cells. At a given stage, the LTS gravity line will run through all of the manholes previously installed and those installed for a given stage to the southernmost manhole installed in that stage. This southernmost manhole serves as a connector point to the temporary gravity line.

- The LTS gravity line consists of a double-wall HDPE pipe with a 6 in. (150 mm) diameter inner carrier pipe and a 10 in. (150 mm) diameter outer containment pipe. The inner carrier pipe of the LTS gravity line will be continuous over its entire length (i.e., from its upgradient to its discharge point). The outer containment pipe will be continuous between the LCS manholes and joined to the manhole walls.

- The LTS gravity line will be equipped with a vent and 4 in. (100 mm) diameter quick-connect hose connection at its northern end. The purpose of the vent is to prevent pressure or vacuum buildup in the systems. The quick-connect hose allows pressure testing of the systems and jetting water in the line to clean it. The gravity line will have cleanouts on the upgradient end of each LCS manhole for maintenance.

- The butterfly valve located in each LCS manhole will be manually adjusted in conjunction with the flow meter to control the rate of flow into the temporary gravity line. The temporary gravity line control systems are designed to allow flow at a rate no greater than the storm

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design flow rate, which has been established as 200 gallons per minute (gpm) (760 liters per minute (lpm)).

- Unneeded portions of the temporary gravity line are to be taken out of service as part of each subsequent stage of construction. At that time, the LTS gravity line should be extended either to the next temporary gravity line connection location or to the permanent lift station, as appropriate.

- The temporary gravity line between the LTS gravity line and the permanent lift station consists of double-wall HDPE pipe. The inner carrier pipe is 6 in. (150 mm) in diameter and the outer containment pipe is 10 in. (254 mm) in diameter. The temporary gravity line will have a slope of at least 0.25 percent towards the permanent lift station. During winter months, the temporary gravity line must be covered by at least a 3 ft (0.9 m) thick soil cover for frost protection.

- The permanent lift station is provided with secondary containment which is designed so that it can be monitored for the presence of leakage.

- The permanent lift station is capable of storing the quantity of leachate generated during a one-week period using design assumptions simulating final closure of the OSDF.

- Prior to the discharge of liquid into the permanent lift station, the liquid passes through a motor-operated inflow valve which closes automatically in the event of power failure or if liquid levels in the lift station rises above the high level alarm setpoint or any level that would cause an electrical short or damage to equipment in the lift station). The lift station also has a manual means for closing the lift station motor-operated inflow valve. Therefore, this valve can be closed manually, if needed, until appropriate maintenance activities can be implemented.

- The permanent lift station will be equipped with a pumping systems to transfer liquids in the lift station to the BSL.

Each major component of the leachate management systems will be identified (i.e., numbered) during installation. The Subcontractor will be required to provide manufacturer's equipment operating and maintenance instructions as part of Construction Acceptance Testing. Construction Acceptance Testing is the performance of all necessary testing to demonstrate that subcontractor supplied or installed equipment and system are installed satisfactorily and safely in accordance with the Construction Drawings and Specifications.

3.3 LDS and LCS Operation Procedures

The LDS and LCS of each OSDF cell shall be operated by the Subcontractor in conformance with the requirements of this section.

- Systems shall not be accepted for operation until the Subcontractor has completed all the requirements of the Construction Acceptance Testing.

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- Prior to the start of active operations of a cell, the Subcontractor shall maintain a sump pump in the primary containment vessel of the LDS manhole and pump accumulated water to the FEMP stormwater management system. The LDS flow rate shall be less than 10 gpm (38 lpm) (due to drainage of construction water from the LDS) prior to the start of cell operation.

- Prior to the start of active operations of a cell, the subcontractor shall obtain a sample of the liquid in the primary containment vessel and test for constituents that are defined by the Construction Manager.

- Prior to the start of active operations of a cell, the Subcontractor shall set the level transmitter for the primary containment vessel of the LDS manholes to activate the alarm *i.e.*, alarm light for a liquid level 6 in. (150 mm) below the top of the vessel.

- Prior to the start of active operations of a cell, the Subcontractor shall set the level transmitter for the secondary containment vessel of the LCS manhole to activate the alarm for a liquid level 2 in. (50 mm) above the bottom of the vessel.

- If an alarm is activated, the Subcontractor personnel shall respond within one hour to assess the reasons for the alarm sounding and to take corrective actions.

- Prior to the start of active operations of a cell, the Subcontractor shall attach an auxiliary cleanout to the LTS gravity line cleanout adjacent to the cell.

- The butterfly valve on the LCS carrier pipe shall be maintained in the closed position until the start of impacted material placement in the cell. The Subcontractor shall manage runoff that falls into the cell prior to the start of impacted material placement as stormwater. This water shall be pumped using a sump pump or other means to the FEMP stormwater management system.

- Prior to start of active operations of a cell the Subcontractor shall verify the absence of liquids in the LCS, redundant LCS, and LDS containment pipes by opening the monitoring ports on each containment pipe and visually observing for collection of any liquid present.

- After impacted material placement begins in a cell, all water in the cell may be discharged to the FEMP stormwater management system. The butterfly valve on the LCS carrier pipe shall be opened to allow discharge to the LTS gravity line, but shall be positioned (throttled) such that flow rate to the permanent lift station does not exceed 200 gpm (760 lpm).

- The impacted runoff catchment area is designed to allow impacted runoff to enter directly into the LCS collection system. If the system becomes inoperable (*e.g.*, clogging of the sacrificial geotextile has occurred) the subcontractor shall remove impacted runoff by pumping from the impacted runoff catchment area to the auxiliary cleanout.

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- The valve on the redundant LCS carrier pipe shall be maintained closed at all times, unless overridden by conditions dictated in Section 3.4.

- The butterfly valve on the LCS carrier pipe shall be maintained open at all times during the active life, closure period, and post-closure period of the OSDF, except for those periods where the valve needs to be closed for systems maintenance and repair or in the event of an operational emergency.

- The LCS manholes are designed as closed system; liquids should not accumulate in these manholes. The level transmitter in the secondary containment in each LCS manhole shall be set to activate the alarm light for a liquid level of more than 2 in. (50 mm) above the floor of the manhole. If the alarm is activated, Subcontractor personnel shall respond within one hour to assess the problem and to take appropriate corrective actions.

- Throughout active operations of the OSDF, the Subcontractor shall daily measure and record the liquid quantity in, and flow rate into, the primary containment vessel of each LDS manhole. A portable suction pump shall be used to pump this liquid through the LDS suction pipe and into the LDS discharge pipe. The LDS primary containment vessel shall be evacuated as often as necessary to prevent overtopping of the vessel.

- The Subcontractor shall provide the CM with whatever equipment or assistance the CM may periodically request in connection with obtaining samples of liquids from the LCS and LDS sampling or monitoring ports.

The Subcontractor shall follow all Occupational Safety and Health Administration (OSHA), DOE, and FEMP site requirements for confined space entry when performing monitoring and inspection activities in the LDS and LCS manholes.

3.4 LDS and LCS Inspection and Maintenance Activities

The LCS and LDS shall be inspected and maintained in accordance with the schedule and activity requirements outlined in Table 3-1, or until leachate is no longer generated and an alternative activity schedule has been approved by EPA and OEPA. Specific details of the required inspection and maintenance activities are given below.

According to ARAR (OAC 3745-27-19(k)(3)), the LCS and LDS pipe network shall be inspected after placement of the initial lift of impacted material to ensure that crushing has not occurred, and annually thereafter to ensure that clogging has not occurred. Clogging can occur by deposition of particles within the pipe or by biological growth inside the pipe. The Subcontractor shall inspect this pipe network between the manhole and the first 100 ft (30 m) of subdrain pipe inside the cell. The portion of the pipe beyond this point inside the cell is considered to be redundant because the gradation of the LCS granular drainage material is designed to limit the level of leachate on the geomembrane liner to less than 1 ft (0.3 m) without need for a subdrain pipe.

TABLE 3-1

LEACHATE COLLECTION AND LEAK DETECTION SYSTEMS INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections		Conditions to Check	Remedy
	Active Period	Closure Period		
LDS	Weekly	Weekly for the first three months after cell closure, then monthly for the remainder of the first year	• condition of submersible level transmitter and appurtenances • leakage from primary containment vessel • liquid in LDS containment pipe	• check level transmitter operations (e.g., operating temperature range, accuracy, etc.), electrical connections, and alarm light. • check for source of leak; if source identified then take appropriate corrective measures (i.e., spot-seal vessel, replace vessel, etc.) • keep monitoring port drained; perform video inspection of pipe and attempt to identify source of leakage; develop plan to mitigate effects
LCS	Weekly	Weekly for the first three months after cell closure, then monthly for the remainder of the first year	• condition of submersible level transmitter and appurtenances • condition of shutoff valve • liquid in LCS containment pipe • liquid in redundant LCS carrier pipe	• check level transmitter operations (e.g., operating temperature range, accuracy, etc.), electrical connections, strobe light, and radio transmission • check valve operability; correct any deficiencies • keep monitoring port drained; perform video inspection of pipe and attempt to identify source of leakage; develop plan to mitigate effects • drain pipe into LTS gravity line
LDS & LCS Pipes	prior to the start of active operations, then annually	Annually	Video inspect for: • crushing of pipe • clogging of pipe	• flush clogged pipe with water or mechanically clean • insert small diameter pipe in crushed pipe, if possible • replace crushed pipe if crushed portion is outside of the cell • utilize redundant LCS pipe

Notes: (1) Frequencies of inspection and maintenance activities are preliminary.
(2) Leachate collection and leak detection systems shall be inspected after the occurrence of major earthquakes.

Access to the LCS and LDS pipes for inspection shall be through HDPE cleanouts located adjacent to the LDS or LCS manholes. Inspections shall be performed using a video camera or other appropriate inspection equipment. The inspection equipment shall have the ability to monitor its location (e.g., distance counter), be sized to fit within the LCS and LDS inner carrier pipes indicated on Construction Drawings and be capable of being pushed the length to be inspected.

If an inspection indicates that a LCS or LDS pipe is obstructed, the pipe shall be flushed by pumping fresh water from a water truck through a hose inserted in the pipe cleanout. If flushing does not remove the obstruction, other methods shall be used to clean the pipe. These other methods may include blowing the obstruction out with air, vacuuming, rodding, or inserting a snake, fish tape, or other suitable device. If air or water pressure is used, the working pressure inside the pipe shall not exceed the rated pressure of the pipe.

The specific pipe maintenance procedures (other than flushing) to use to remove a pipe obstruction should be selected on a case by case basis. Any procedure proposed by the Subcontractor other than flushing with water must be pre-approved by the CM.

In the event that LCS or LDS pipe obstruction cannot be dislodged, or in the very unlikely event that a pipe has undergone partial or total crushing, the following procedures should be considered in the following order:

- For the LCS or LDS, insert a new small diameter pipe within the obstructed or collapsed pipe;
- For the LCS, activate the redundant LCS pipe; and
- For the LCS or LDS pipe, if the obstruction or collapse is outside of the disposal facility containment systems, replace the pipe.

All equipment inserted into the LCS or LDS line for inspection and/or maintenance shall be decontaminated prior to removal from the OSDF battery limits.

In addition to the foregoing requirements, all mechanical and electrical equipment shall be calibrated, operated, maintained, and serviced in accordance with the manufacturer's instructions for that equipment. Manufacturer's instructions are contained in Attachment A of this Systems Plan. These instructions shall be amended to this plan once the equipment is installed by the OSDF Consultant Subcontractor and accepted by the CM.

3.5 LTS Operation Procedures

The OSDF LTS shall be operated by the Subcontractor in conformance with the requirements of this section.

- Systems shall not be accepted for operation until the Subcontractor has completed the requirements of the Construction Acceptance Testing.

- Before taking the temporary gravity line out of service, the Subcontractor shall manually turn off the inflow valve in the LCS gravity line and the required temporary portion of the gravity line shall be removed.

3.6 LTS Inspection and Maintenance Activities

- The leachate transmission systems shall be inspected and maintained in accordance with the schedule and activity requirements outlined in Tables 3-2 and 3-3, or until leachate is no longer generated and an alternative activity schedule has been approved by EPA and OEPA. Specific details of the required inspection and maintenance activities are given below.

The manholes, leachate transmission system, valves, connections, sampling ports, monitoring ports, pumps, etc., shall be routinely inspected and maintained to provide for proper OSDF operation. All mechanical and electrical equipment shall be calibrated, operated, maintained, and serviced in accordance with the manufacturer's instructions for that equipment. Manufacturer's instructions are contained in Attachment A of this OSDF Plan. In addition, the inspection and maintenance activities for the LTS shall include the following:

- Confirm that appropriate warning signs are visible (e.g., confined space entry, buried pip and conduit);
- Check instruments/valves (e.g., note sticking or jammed devices, corrosion, leaks, and misalignments);
- Note any temperature extremes which may exist inside the manhole (e.g., temperature outside of equipment-specific operating temperature ranges);
- Verify instrument systems status (e.g., elevation and location of automatic level switch in the lift station manhole),
- Monitor flow for pulsating, over pressure, or under pressure;
- Check for the presence of liquids in all secondary containment systems;
- Confirm pump operation/priming;
- Check hoses for physical wear and poor connections prior to each use;
- Rate condition of manhole covers;
- Note condition of concrete slab; and
- Confirm adequate protection is provided around the temporary gravity line. Should any of the above inspections reveal systems deficiencies, the conductor shall be connected utilizing a procedure approved by the Construction Manager.

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TABLE 3-2

LDS/LCS MANHOLES AND LTS GRAVITY LINE INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections		Conditions to Check	Remedy
	Active Period	Closure Period		
LDS Manholes	Weekly	Weekly for the first three months after cell closure, then monthly	• confirm all required signage is visible • cracked, broken manhole cover • leaking seal on manhole cover • general structural condition of containment vessel • odors, bacterial growth (containment vessel)	• repair and/or replace as necessary • replace manhole cover • replace seal • check for structural integrity; if problems are found, take appropriate measures (i.e., spot seal vessel, replace vessel, etc.) and implement permanent solution • flush and/or spray sodium hypochlorite into containment vessel
LCS Gravity Line	Weekly	Monthly	• liquid in LCS gravity line containment pipe • inspection of pipe for clogging or crushing (annual only) • butterfly valve in proper position	• keep containment pipe drained; perform video inspection of pipe and attempt to identify source of leakage; if leakage is minor, continue to operate; if leakage is significant, evaluate repair options with CCM • flush clogged pipe with water, or mechanically clean; repair as necessary • adjust valve to limit flow to permanent lift station to 200 gpm
LDS Gravity Line	Weekly	Monthly	• liquid in LDS gravity line containment pipe • inspection of pipe for clogging or crushing (annual only)	• keep containment pipe drained; perform video inspection of pipe and attempt to identify source of leakage; if leakage is minor, continue to operate; if leakage is significant, evaluate repair options with CCM • flush clogged pipe with water, or mechanically clean; repair as necessary
LTS Gravity Line	Weekly	Monthly	• liquid in LTS gravity line containment pipe • inspection of pipe for clogging or crushing (annual only)	• keep containment pipe drained; perform video inspection of pipe and attempt to identify source of leakage; if leakage is minor, continue to operate; if leakage is significant, evaluate repair options with CCM • flush clogged pipe with water, or mechanically clean; repair as necessary
LCS Manholes	Weekly	Weekly for the first three months after cell closure, then monthly	• confirm all required signage is visible • cracked, broken manhole cover • leaking seal on manhole cover • completion of OSDF construction • general structural condition of manhole	• repair and/or replace as necessary • replace manhole cover • replace seal • remove designated valves and replace with pipe spool piece • check for structural integrity; if damage is observed, assess extent and make repair recommendations

Notes: (1) Frequencies of inspection and maintenance activities are preliminary.
(2) LDS/LCS manholes and LTS gravity line shall be inspected after the occurrence of major earthquakes.

TABLE 3-3

GRAVITY LINE INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections		Conditions to Check	Remedy
	Active Period	Closure Period		
Temporary Gravity Line	Weekly	N/A	• record accumulated flow at disc flow meter; check that flow meter is operational[3]	• repair, replace as necessary
			• leakage from temporary gravity line and plumbing	• investigate source of leakage, repair as necessary
			• condition of liquid transmitter for temporary gravity secondary containment system	• check sensor operations, electrical connections, and alarm light
			• frost protection soil cover	• increase soil cover if inadequate cover exists
			• liquid in temporary gravity line containment pipe	• keep containment pipe drained; perform video inspection of pipe and attempt to identify source of leakage; if leakage is minor, continue to operate; if leakage is significant, evaluate repair options with CCM

Notes:
(1) Frequencies of inspection and maintenance activities are preliminary.
(2) Temporary gravity line shall be inspected after the occurrence of major earthquakes.
(3) The flow meter shall be calibrated using procedures and frequencies in accordance with the manufacturer's recommended procedures.

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.7 Emergency Procedures for Spills

The OSDF leachate management system has been designed with multiple safeguards and redundancies to prevent the accumulation of liquids in the secondary containment or the overflow of liquids from the primary containment components of the leachate management system. These safeguards and redundancies include the following:

- The LDS primary containment will be equipped with a level transmitter which activates an alarm light if the liquid level is less than 6 in. from the top of the containment.
- The secondary containment of the LCS manholes will include level transmitters which will activate an alarm if the liquid level exceeds 2 in. (50 mm) from the bottom of the containment.
- The liquid level alarm consists of a submersible level transmitter, programmable logic controller, and alarm light. The level transmitter originates a signal which is sent to the programmable logic controller, and if programmable logic controller concludes the liquid level exceeds the maximum preset value, it activates the alarm light.
- The Subcontractor personnel shall respond to the alarm within one hour to assess the problem and to take appropriate corrective actions. An Subcontractor representative shall be "on call" 24 hours a day.

3.8 Recordkeeping

The Subcontractor shall maintain written records of all monitoring activities, inspections, and maintenance repairs in accordance with the recordkeeping and reporting requirements of Section 8.0 of this plan.

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4.0 FINAL COVER SYSTEM

4.1 Overview of System

The construction, placement of impacted material, and closure of the OSDF is scheduled to occur over a 7 year period. As each cell is filled to final grade, the final cover system will be installed over that cell. Figure 1-1 of this plan presents the final cover system cross section. As seen in this figure, the topmost surface of the final cover system is vegetation. The goals of the vegetation are: (i) to stabilize the final cover systems surface with grass species that limit the erosion of topsoil; (ii) to closely follow the local vegetation; (iii) to be visually attractive; and (iv) to require minimal maintenance. The vegetation is underlain by, in turn, the topsoil layer and the vegetative soil layer.

Vegetation for newly closed cells will initially consist of selected mixes of native species. This vegetation will require inspection and maintenance in order to manage bare areas and erosion, and to intercede in the process of old field vegetation succession, which, if left unimpacted, would result in climax forest vegetation at the site within a 60 year timeframe. The topsoil and vegetative soil layer also require inspection and maintenance with respect to the potential for surface erosion, gully formation, and settlement and subsidence.

The final cover system grading plan is shown on the Construction Drawings.

4.2 Final Cover System Inspection and Maintenance Activities

The final cover shall be inspected and maintained in accordance with the schedule and activity requirements presented in Table 4-1 of this plan. The inspection and maintenance activities identified in this table are designed to provide a final cover system that maintains its effectiveness and performs as intended. In addition, the inspection activities are designed to detect any significant deterioration in the final cover systems components.

The inspection shall consist of a walkover survey of the entire OSDF final cover system. The visual inspection shall be conducted by traversing the cover system on a 100 ft (30 m) grid pattern. Suspect areas shall be delineated on a topographic plan of the site. The inspections shall result in evaluation of the following items, if present:

- Vegetative stress (i.e., if areas without vegetation or with dead vegetation (not just dormant) or sparse vegetation and/or undesirable plant growth are present);
- Erosion, bare spots, poor performing vegetation;
- Unwanted rooted plants, weeds, or saplings;
- Topsoil erosion or drainage gullies;
- Topsoil settlement or subsidence;

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TABLE 4-1

FINAL COVER SYSTEM INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections Closure Period	Condition	Remedy	Maintenance
Vegetation[1]	Monthly for at least 6 months	• stressed vegetation • erosion, bare spots, and poor performing vegetation • unwanted deep rooted plants, weeds or saplings	• evaluate cause; vegetate or remedy • remove sediment; reseed and mulch • remove as necessary	• analyze soil and fertilize • revegetate as needed • mechanically, chemically or by controlled burn
Topsoil	Monthly for at least 6 months	• topsoil erosion or drainage gullies • topsoil settlement or subsidence • burrowing animals	• replace topsoil; reseed and mulch; utilize non-vegetative stabilization (e.g., jute mat) if necessary • add topsoil and regrade • implement program (e.g., catch/release) to eradicate	• revegetate and refertilize • reconstruct • fill in holes
Cover Drainage Layer	Monthly for at least 6 months	• seepage erosion of drainage material • clogging or covering of cover drainage layer outlet by topsoil	• Construction Manager will evaluate placing coarser granular "cap" over cover drainage outlet and develop corrective action plan • remove topsoil, replace granular soil at outlet as necessary	• replace, regrade material • replace, regrade material

Notes:
(1) See the text of this Section for requirements related to grass mowing.
(2) Frequencies of inspection and maintenance activities are preliminary. These frequencies will be finalized as material supplier's inspection and maintenance instructions are available.
(3) Final cover system shall be inspected after the occurrence of major earthquakes.

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TABLE 4-1 (continued)

FINAL COVER SYSTEM INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections Closure Period	Condition	Remedy	Maintenance
Final Cover System	Monthly for at least 6 months	• toe bulges • tension cracks	• notify the Construction Manager to investigate and develop corrective action plan • notify the Construction Manager to investigate and develop a corrective action plan	• cordon off affected area; maintenance/repair activities will be defined by the investigation results • cordon off affected area; maintenance/repair activities will be defined by the investigation results
Final Cover System	Monthly for at least 6 months	• leachate seep	• notify the Construction Manager to investigate and develop corrective action plan	• contain leachate; cordon off the affected area; maintenance/repair activities will be defined by the investigation results
Surveying	Monthly for at least 6 months	• survey monuments	• N/A	• obtain survey data

Notes: (1) Frequencies of inspection and maintenance activities are preliminary.
(2) Final cover system shall be inspected after the occurrence of major earthquakes.

- Presence of burrowing animals;
- Seepage erosion of cover drainage material;
- Clogging or covering of cover drainage layer outlet by topsoil or any other material(s);
- Tension cracks which may be indicative of the instability of cover systems;
- Toe bulges which may be indicative of the instability of cover systems; and
- Leachate seeps.

Note that the need for, and frequency of, grass cutting will depend on the final seed mix selected for the OSDF final cover systems. Mowing shall occur at least once annually (in the late fall) at a time when the final cover systems is reasonably dry. Mowing equipment shall not cause rutting or disturbance of topsoil. More frequent mowing will be specified if needed, in a subsequent version of this Systems Plan based on the final seed mix selected for the OSDF.

Maintenance activities for the OSDF final cover system shall include surveying of settlement monuments placed on the OSDF final cover system. These monuments shall be surveyed monthly for at least six months after installation, then semi-annually for five years, then annually.

Repairs to the OSDF final cover systems, except vegetation and topsoil, shall not be made unless approved by the CM. Any repair activity involving any component of the final cover systems shall be in full conformance with the original Project Specifications for that component.

Woody species reproduction that develops in the OSDF final cover system shall be eliminated mechanically, chemically or by fire. Many woody species maintain the root systems when cut and rapidly resprout. The root systems continues to grow through repeated cuttings and can become extensive. For this reason, chemical herbicides (spraying of individual trees and shrubs) or fire shall be preferred for control of woody species reproduction, as eradication of the whole plant including the root systems is a primary goal. A combination of mechanical and chemical treatment where cut stumps are treated with herbicide to prevent resprouting may also be considered. The most effective method for managing woody vegetation shall be evaluated for the OSDF by the Subcontractor based on available equipment, expertise, and cost.

It is noted that additional Systems requirements for the OSDF project, which the Subcontractor shall follow, are contained in the: (i) *OSDF Borrow Area Management and Restoration Plan*; and (ii) *OSDF Surface-Water Management and Erosion Control Plan.*

4.3 Recordkeeping

The Subcontractor shall maintain written records of all monitoring, operational activities, maintenance inspections, and maintenance repairs in accordance with recordkeeping and reporting requirements of Section 8.0 of this Systems Plan.

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5.0 TEMPORARY SUPPORT FACILITIES, UTILITIES, AND SITE SECURITY FENCE

5.1 Description of Systems

The function of the temporary support facilities and utilities is to provide support for of the OSDF during construction, impacted material placement, and closure. Temporary support facilities include survey benchmarks, administrative support trailers, equipment maintenance facilities, decontamination facilities, and material storage areas. Utilities include electricity, water, wastewater, and telephone system. A site security fence will be erected during construction and will be dismantled at the end of construction.

The support facilities and utilities must be maintained to provide adequate and reliable support for the construction activities that will be performed for the OSDF. The support facilities and utilities must be maintained in a manner that is consistent with the requirements of applicable utility codes at the FEMP and with applicable health and safety requirements for the FEMP.

A site security fence, consisting of 6-ft (1.8-m) high chain linked fence with three strands of barbed wire on the top of the fence will be erected around the OSDF construction area. The fence gates will be locked with keyed-alike locks. The location of the security fence will be periodically relocated as cell construction progresses from north to south. If it is determined that a fence is to remain around the OSDF (permanently), it will be evaluated for both security and aesthetics.

5.2 Temporary Support Facilities Inspection and Maintenance Activities

Temporary support facilities, utilities, and site security fence shall be inspected and maintained in accordance with the schedule and activity requirements presented in Table 6-1. During winter shutdown, unoccupied facilities shall be inspected to detect any breach or damage to the systems contained in the facilities and to ensure the systems are functioning properly. The permanent survey benchmarks shall be inspected for any evidence of damage or disturbance. If such evidence is observed, it should be noted and reported. The CM will then have the benchmark resurveyed and re-established if necessary.

The administrative support trailers and equipment maintenance facilities shall be inspected for the following items: (i) leaks in roof, windows and doors; (ii) structurally sound stairs, access ways and fire escapes; (iii) security of doors and windows; (iv) condition of tie-downs (for trailers only); (v) condition the heating, ventilating, and air conditioning (HVAC) systems; (vi) condition of associated storage tanks; and (vii) cleanliness.

Equipment decontamination facilities will require routine maintenance of pumps and valves and cleaning out of sump areas. The operation, inspection, and maintenance of all electrical and mechanical equipment shall be in accordance with the manufacturer's instructions. These instructions are provided in Attachment B of this Systems Plan.

Material storage areas shall be inspected to ensure that the area is secure and trafficable. If the area is not secure, security fence shall be installed. If the area is not trafficable due to excessive rutting, poor drainage, etc., the Subcontractor shall notify the CM. The CM will evaluate the situation and issue a plan for corrective actions.

TABLE 5-1

TEMPORARY SUPPORT FACILITIES AND SITE SECURITY FENCE INSPECTION AND MAINTENANCE ACTIVITIES

Component	Inspections Closure Period	Condition	Remedy	Maintenance
Temporary Facilities (Vacant)	Semi-Annually	• inadequate and unreliable support facilities • damage or broken items	• maintain livable condition, clean, and workable equipment • replace if needed, repair	• janitorial services as needed
Utilities	Semi-Annually	• confirm utility is useable • confirm utility grounded	• replace if needed, repair	• maintain as needed; use lock-out program
Storage areas/stockpiles/ temporary decontamination facilities	Daily	• ponding of water • protection from elements • adequate storage or disposal of contaminated equipment	• regrade if needed • repair cover • clean, maintain workable equipment, fix as needed	• clean daily • provide sufficient ballast for cover • daily inspections of equipment • proper disposal of hazardous materials
Fence	Quarterly	• damaged • under fence erosion	• repair or replace as necessary • repair erosion or extend fence as necessary	• replace or repair fence • provide erosion and sedimentation control
Gates	Quarterly	• tampering/damage to locks	• repair or replace as necessary	• install proper lock
Warning Signs	Quarterly	• damaged or missing warning signs	• replace as needed	• install warning signs to fence or gates

N/A - Not applicable

Notes: (1) Frequencies of inspection and maintenance activities are preliminary.
(2) Temporary support facilities and site security fence shall be inspected after the occurrence of major earthquakes.

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Utilities shall be inspected to ensure that no deterioration has occurred and that proper grounding of system is functioning. Utilities shall meet all applicable standards (i.e., Cincinnati Gas and Electric, NEC, ASTM, ASCE, ANSI, ACI, and FEMP site facility standards).

The construction security fence shall be inspected for the following items: (i) holes in the mesh; (ii) three strands of barbed wire on top of the fence; (iii) security of all access points; and (iv) warning signs posted on 100 ft (30 m) centers along the fence. Repair work or replacement of the security fence shall be performed in a timely manner to prevent unauthorized access to the OSDF. After closure of the OSDF, the construction security fence shall be dismantled, and disturbed areas shall be regraded and re-vegetated. A permanent fence (that is aesthetically pleasing to stakeholders) may be installed and maintained for the duration of the post-closure period. If a permanent fence is determined necessary; the details will be provided in a subsequent design submittal.

Maintenance of temporary support facilities and utilities shall include repair or replacement of items a necessary. All new materials and installation work for repair or maintenance activities shall be in full conformance with the original Project Specifications.

5.3 Recordkeeping

The Subcontractor shall maintain written records of all monitoring, inspections, and maintenance repairs in accordance with recordkeeping and reporting requirements of Section 8.0 of this Systems Plan.

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6.0 OSDF ACCESS ROADS

6.1 Description of Roads

Access to the OSDF will be continuously controlled. Access to the OSDF will be provided by: (i) construction haul roads (ii) impacted material haul roads; and (iii) leachate transmission systems access corridor.

Access roads to the OSDF will be developed in phases in conjunction with the phased development of the OSDF. Access to the OSDF must be maintained to provide safe, efficient ingress and egress to the work areas and other areas. Safety and traffic control signals at critical locations (e.g., flagmen) will be utilized as needed throughout construction (e.g., intersection of the relocated north entrance road and the construction haul road) to mark potential hazard areas. Traffic will be routed and controlled in a manner that maintains an orderly flow of vehicles to minimize accidents and to avoid delays in the construction. Road maintenance and control will be the responsibility of the Subcontractor.

The layout of the roads providing access to the Construction Drawings.

6.2 Access Roads Inspection and Maintenance Activities

Access roads to the OSDF shall be inspected and maintained in accordance with the schedule and activity requirements presented in Table 6-1. The Subcontractor shall be responsible for safe and efficient OSDF access road operations during OSDF construction, filling, and closure. The Subcontractor shall maintain all road signage in a clearly visible state. Road signage shall be increased if needed to achieve safe and efficient traffic operations. If necessary, the Subcontractor shall provide traffic control personnel at key locations.

Road maintenance shall be performed utilizing appropriate construction equipment. Areas of soft subgrade soil, pumping, or excessive rutting shall be improved by removing and replacing subgrade soils, installing a geotextile separation layer (if required), and replacing/increasing the road aggregate. Areas of the road that are frequently wet or inundated shall be improved by regrading adjacent areas to change stormwater runoff patterns or cutting roadside ditches to drain near-surface perched ground water.

As necessary, the Subcontractor shall maintain the OSDF access roads free of snow accumulations that would interfere with OSDF activities. The Subcontractor shall prevent the generation of excessive road dust such that fugitive emission levels remain in full compliance with the *OSDF Air Monitoring Plan*. Dust suppression shall be achieved by using a water truck. Alternatively, periodic application of dust suppressants, such as magnesium or calcium chloride, liquid polymer emulsion, or agglomerating chemicals may be considered, but only with approval of the CM.

Any repair activity to roadways within the OSDF battery limit shall utilize materials and procedures in full conformance with the original Project Specifications.

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TABLE 6-1

ACCESS ROADS INSPECTION AND MAINTENANCE ACTIVITIES

Component	Frequency		Condition	Remedy	Maintenance
	Active Period	Closure Period			
Access Roads	Weekly and following rain storms	Monthly and following rain storms	• inadequate traffic control	• improve traffic control	• install signage (e.g., stop signs, traffic flow arrows) or provide traffic control personnel
			• soft soil, pumping, or excessive rutting	• remove and replace subgrade soil, add aggregate geotextile separation layer, if necessary	• grade as necessary to provide positive drainage
			• roadway inundation	• improve stormwater routing and/or eliminate perched ground water	• regrade area to change runoff patterns; cut roadside ditches to drain perched ground water
			• snow	• clear roadway	• plow snow
			• excessive road dust	• reduce dust generation	• use water truck to suppress dust; apply chemical dust suppressant (only after Construction Manager approval)

Notes:(1)Frequencies of inspection and maintenance activities are preliminary. These frequencies will be finalized as manufacturer's equipment operating and maintenance instructions are available.

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6.3 Recordkeeping

The Subcontractor shall maintain written records of all monitoring, inspection, and repairs in accordance with recordkeeping and reporting requirements of Section 7.0 of the Systems Plan.

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7.0 RECORDKEEPING AND REPORTING

The Subcontractor shall be responsible for preparing and maintaining accurate and complete records of all inspection, operation, and maintenance activities. The Subcontractor is also responsible for reporting these activities to the CM.

This section of the plan describes the general record procedures that will be followed by the personnel performing OSDF activities. These procedures will ensure that consistent and reproducible records are developed when the work is performed by various individuals. This section also addresses the Subcontractor reporting requirements.

7.1 Recordkeeping Procedures

The Subcontractor shall be responsible for establishing the detailed procedures and requirements for the collection, storage, maintenance, and disposition of all OSDF records. Records shall be protected from damage or deterioration by being placed in lockable, fire-proof filing cabinets and by duplication and/or microfilming. Records shall be filed in accordance with a subject file index and shall be retained at the FEMP for 30 years after closure of the OSDF. Required records shall include, but not be limited to, field logbooks, other data collection forms, equipment calibration records, cost data, drawings, maintenance records, and all associated reports.

All original data collected in the field by the Subcontractor shall be considered a permanent record. This includes all field logbooks, other data forms, and photographs. All of these documents shall be authorized by the signature and date of the originator. Errors shall be corrected by crossing a single line through the error and entering the correct information. Corrections will be initialed and dated by the person making the correction.

7.2 Reporting Procedures

After each inspection and maintenance activity, a draft report that includes an executive summary, copies of field logs, photographs, checklist forms, and other pertinent data shall be submitted to the CM for review, approval, the forwarding to DOE. Following review and approval, final copies of the inspection report and associated documents shall be submitted to OEPA and USEPA.

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8.0 REFERENCES

Fernald Environmental Restoration Management Corporation (FERMCO), *"Air Monitoring Plan"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996a.

Fernald Environmental Restoration Management Corporation (FERMCO), *"OSDF Post-Closure Care and Inspection Plan"*, DOE Fernald Area Office, Fernald Environmental Management Project, Fernald, OH, 1996b.

GeoSyntec Consultants, *"Final Design Package, On-Site Disposal Facility"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996a.

GeoSyntec Consultants, *"Borrow Area Management and Restoration Plan, On-Site Disposal Facility"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996b.

GeoSyntec Consultants, *"Construction Quality Assurance Plan, On-Site Disposal Facility"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996d.

GeoSyntec Consultants, *"Impacted Materials Placement Plan, On-Site Disposal Facility"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996e.

GeoSyntec Consultants, *"Surface-Water Management and Erosion Control Plan, On-Site Disposal Facility"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1996f.

U.S. Department of Energy (DOE), *"Final Record of Decision for Remedial Actions at Operable Unit 2"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1995a.

U.S. Department of Energy (DOE), *"Final Remedial Design Work Plan for Remedial Actions at Unit 2"*, Fernald Environmental Management Project, DOE Fernald Area Office, Fernald, OH, 1995c.

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ATTACHMENT A

OWNER'S MANUALS FOR LEACHATE MANAGEMENT SYSTEM EQUIPMENT

(TO BE PROVIDED BY THE OSDF CONSTRUCTION CONTRACTOR AS PART OF CONSTRUCTION ACCEPTANCE)

ATTACHMENT B

OWNER'S MANUALS FOR DECONTAMINATION FACILITIES

(TO BE PROVIDED BY THE OSDF CONSTRUCTION CONTRACTOR AS PART OF CONSTRUCTION ACCEPTANCE)

INSTRUCTIONS

1. Please insert the Post-Closure Care and Inspection Plan (Rev. G), previously transmitted on September 18, into the Support Plans binder as Tab 9; make sure to also insert the three change sheets previously transmitted on September 27.

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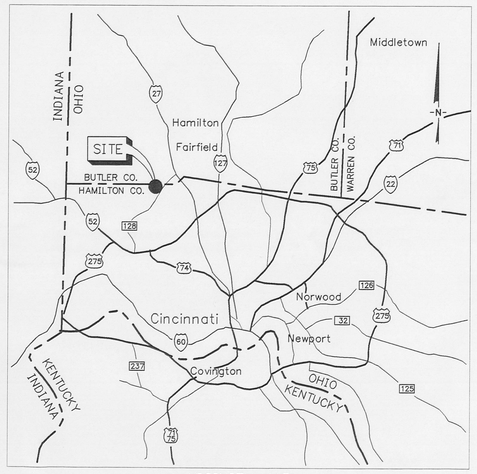
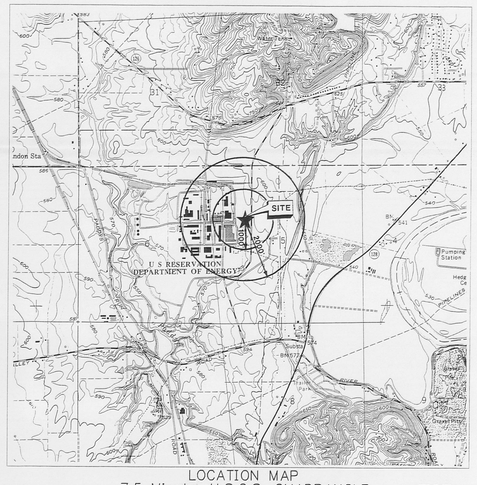
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
ON-SITE DISPOSAL FACILITY
FERMCO PROJECT NUMBER 20100
HAMILTON COUNTY AND BUTLER COUNTY, OHIO
FINAL DESIGN PACKAGE



VICINITY MAP

6 3 0 6 12
SCALE IN MILES



LOCATION MAP
7.5 Minute, U.S.G.S. QUADRANGLE

2000 1000 0 2000 4000
SCALE IN FEET

INDEX OF DRAWINGS

SHEET NO.	REVISION NO.	FERMCO DRAWING NO.	TITLE
GENERAL			
X-1	G	90X-6000-X-00001	TITLE SHEET
X-2	G	90X-6000-X-00002	LEGEND AND SYMBOLS
X-3	G	90X-6000-X-00003	FACILITY PLOT PLAN
X-4	G	90X-6000-X-00004	SITE PLAN
X-5	-		NOT USED
X-6	G	90X-6000-X-00005	SURROUNDING LAND USE MAP
X-7	G	90X-6000-X-00006	GEOTECHNICAL DATA POINT LOCATION PLAN
X-8	G	90X-6000-X-00007	GREAT MIAMI AQUIFER GROUND-WATER CONTOUR MAP
X-9	G	90X-6000-X-00008	PERCHED ZONE POTENTIOMETRIC SURFACE MAP
X-10	G	90X-6000-X-00009	BROWN TILL/GRAY TILL INTERFACE CONTOUR MAP
X-11	G	90X-6000-X-00010	GRAY TILL ISOPACH MAP
X-12	G	90X-6000-X-00011	SURFACE GEOLOGY MAP
X-13	G	90X-6000-X-00012	GEOLOGIC SECTION A-A
X-14	G	90X-6000-X-00013	GEOLOGIC SECTION B-B
X-15	G	90X-6000-X-00014	GEOLOGIC SECTIONS C-C AND D-D
CIVIL			
G-1	G	90X-6000-G-00015	SURFICIAL IMPACTED MATERIAL REMOVAL PLAN WITHIN BATTERY LIMIT
G-2	G	90X-6000-G-00016	SITE DEVELOPMENT PLAN
G-3	-		NOT USED
G-4	-		NOT USED
G-5	G	90X-6000-G-00017	SUBGRADE GRADING PLAN
G-6	G	90X-6000-G-00018	COMPACTED CLAY LINER GRADING PLAN
G-7	G	90X-6000-G-00019	LEAK DETECTION SYSTEM GRADING PLAN
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G-11	G	90X-6000-G-00023	FINAL COVER SYSTEM GRADING PLAN
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G-14	-		NOT USED
G-15	G	90X-6000-G-00025	NORTH-SOUTH SECTION
G-16	G	90X-6000-G-00026	WEST-EAST SECTION AT CELL 1 AND CELL 2 INTERCELL BERM
G-17	G	90X-6000-G-00027	WEST-EAST SECTION AT CELL 4 BASE
G-18	G	90X-6000-G-00028	WEST-EAST SECTION AT CELL 7 DRAINAGE CORRIDOR
G-19	G	90X-6000-G-00029	BORROW AREA SECTIONS AND DETAILS
G-20	G	90X-6000-G-00030	CELL PERIMETER DETAILS I
G-21	G	90X-6000-G-00031	CELL PERIMETER DETAILS II
G-22	G	90X-6000-G-00032	LINER SYSTEM DETAILS I
G-23	G	90X-6000-G-00033	LINER SYSTEM DETAILS II
G-24	G	90X-6000-G-00034	LINER SYSTEM DETAILS III
G-25	G	90X-6000-G-00035	LINER SYSTEM DETAILS IV
G-26	G	90X-6000-G-00036	COVER SYSTEM DETAILS I
G-27	G	90X-6000-G-00037	COVER SYSTEM DETAILS II
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G-32	G	90X-6000-G-00042	STORMWATER MANAGEMENT SYSTEM DETAILS III
G-33	-		NOT USED
G-34	-		NOT USED
G-35	-		NOT USED
G-36	-		NOT USED

SHEET NO.	REVISION NO.	FERMCO DRAWING NO.	TITLE
CIVIL			
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G-38	G	90X-6000-G-00044	CONSTRUCTION CONTROL POINTS I
G-39	G	90X-6000-G-00045	CONSTRUCTION CONTROL POINTS II
G-40	G	90X-6000-G-00107	HORIZONTAL MONITORING WELL DETAILS
ELECTRICAL			
E-1	-		NOT USED
E-2	-		NOT USED
E-3	-		NOT USED
E-4	G	90X-6000-E-00046	LEACHATE TRANSMISSION SYSTEM ELECTRICAL DETAILS I
E-5	-		NOT USED
E-6	-		NOT USED
E-7	G	90X-6000-E-00047	LEACHATE TRANSMISSION SYSTEM ELECTRICAL DETAILS IV
E-8	-		NOT USED
MECHANICAL			
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M-2	G	90X-6000-M-00048	LEACHATE TRANSMISSION SYSTEM PIPING AND INSTRUMENTATION DIAGRAM
M-3	-		NOT USED
M-4	G	90X-6000-M-00049	LEACHATE TRANSMISSION SYSTEM GRAVITY LINE AND MANHOLE MECHANICAL DETAILS I
M-5	G	90X-6000-M-00050	LEACHATE TRANSMISSION SYSTEM GRAVITY LINE AND MANHOLE MECHANICAL DETAILS II
M-6	G	90X-6000-M-00051	LEACHATE TRANSMISSION SYSTEM GRAVITY LINE AND MANHOLE MECHANICAL DETAILS III
M-7	-		NOT USED
M-8	-		NOT USED
M-9	G	90X-6000-M-00052	LEACHATE TRANSMISSION SYSTEM LIFT STATION MECHANICAL DETAILS III
STRUCTURAL			
S-1	G	90X-6000-S-00053	LEACHATE TRANSMISSION SYSTEM STRUCTURAL DETAILS I
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S-3	G	90X-6000-S-00054	LEACHATE TRANSMISSION SYSTEM STRUCTURAL DETAILS III
S-4	-		NOT USED
S-5	G	90X-6000-S-00055	CHAIN LINK FENCE AND GATE DETAILS

FOR INFORMATION ONLY

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

SCALE AS SHOWN

FOR INFORMATION ONLY

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:

FERMCO Restoration Management Corporation — FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT: ON-SITE DISPOSAL FACILITY

TITLE: TITLE SHEET 437

233929_7

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Rudolph Bonaparte
SIGNATURE
8 Oct 1996
DATE

STATE OF OHIO — RUDOLPH BONAPARTE — E-56679 — REGISTERED PROFESSIONAL ENGINEER
SEAL

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE ATLANTA, GEORGIA 30342 USA

FERMCO PROJECT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-X-00001
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-0001
SHEET NO.:	X-1
REVISION NO.:	G

FERMCO Restoration Management Corporation
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RESTORATION MANAGEMENT CORPORATION
P.O. BOX 398704
CINCINNATI, OHIO 45239

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE, N.E. SUITE 200
ATLANTA, GEORGIA 30342-1523

FINAL DESIGN PACKAGE

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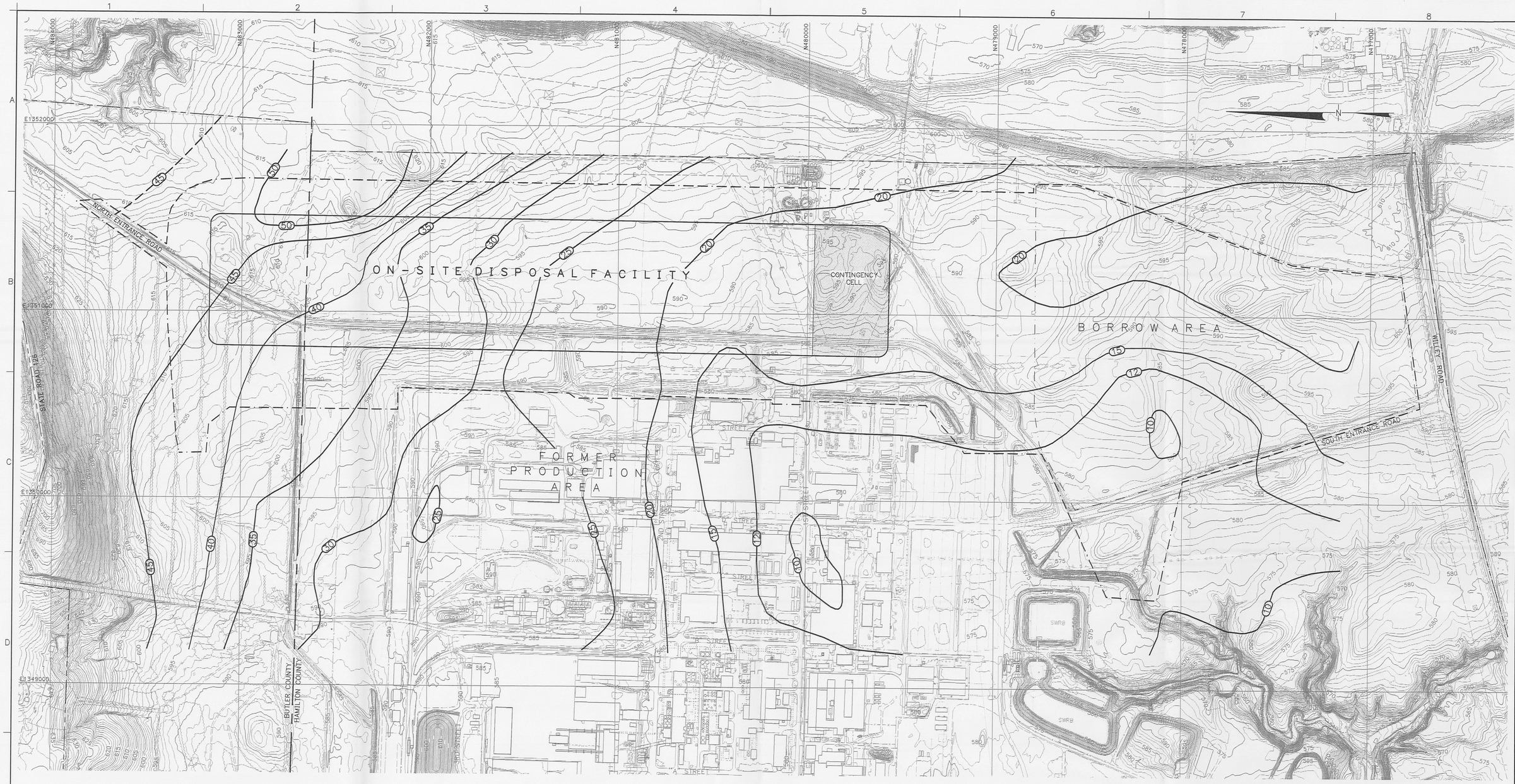


LEGEND

600	EXISTING GROUND ELEVATION (FEET)
20	GRAY TILL ISOPACH (FEET) (DASHED WHERE INFERRED) (NOTE 4)
	BUTLER COUNTY/HAMILTON COUNTY LINE
	FEMP PROPERTY LINE
	BATTERY LIMIT
	IMPACTED MATERIAL DISPOSAL LIMIT
	BORROW AREA LIMIT

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. GRAY TILL ISOPACHS OBTAINED FROM FIGURE 3-4, "THICKNESS OF THE GRAY TILL," OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995. ISOPACH DEFINES LINE OF CONSTANT TILL THICKNESS.

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

200 100 0 200 400
SCALE IN FEET

FOR INFORMATION ONLY

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERMCO Fernald Environmental Restoration Management Corporation
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY

TITLE:
GRAY TILL ISOPACH MAP 446
233929_10

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

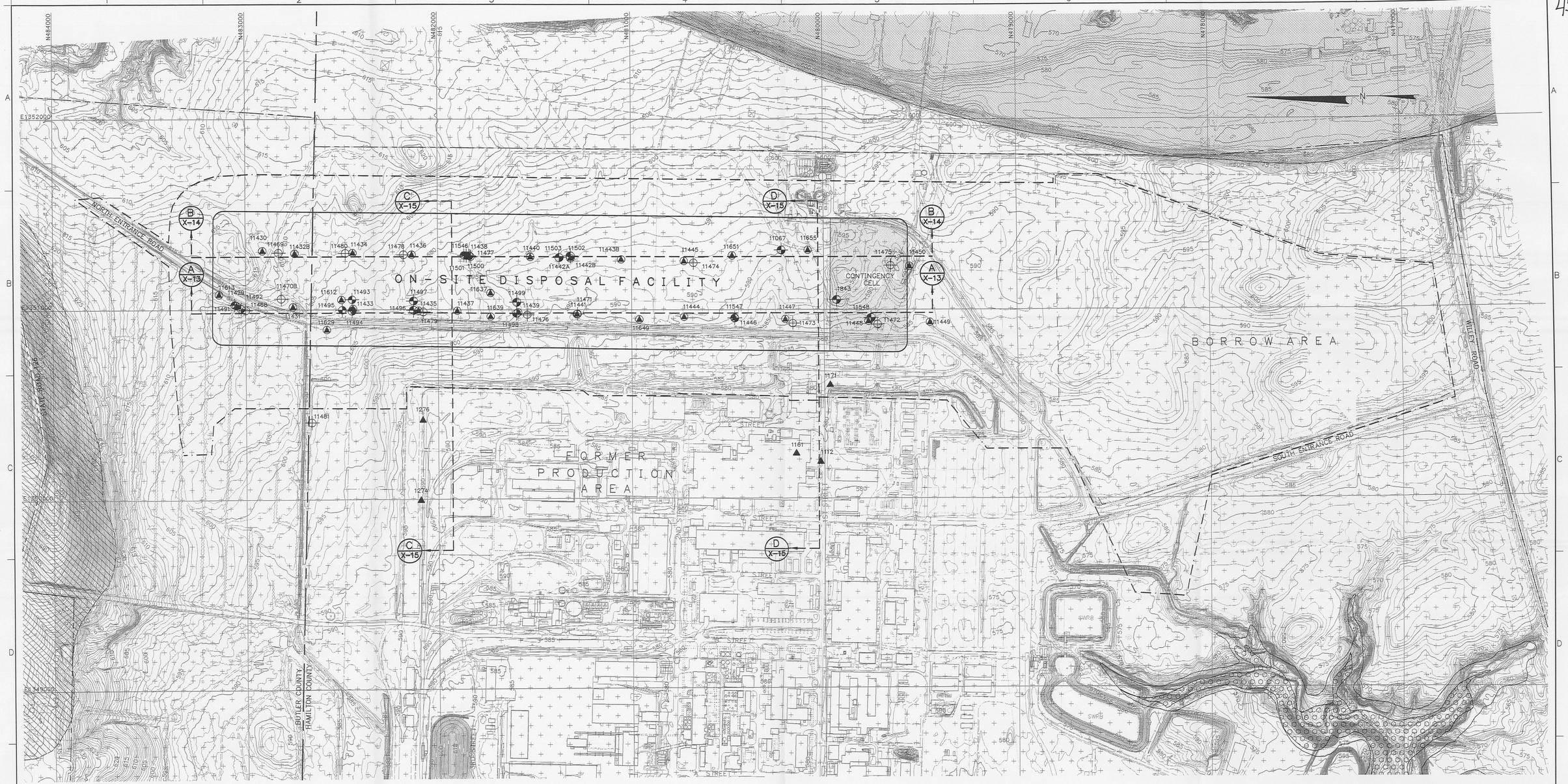
Rudolph Bonaparte
SIGNATURE
5 Oct 1996
DATE

STATE OF OHIO
RUDOLPH BONAPARTE
E-56679
REGISTERED PROFESSIONAL ENGINEER
SEAL

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

FERMCO CONTRACT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-X-00010
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-G008
SHEET NO.:	X-11
REVISION NO.:	G

FINAL DESIGN PACKAGE



LEGEND

600	EXISTING GROUND ELEVATION (FEET)
	BUTLER COUNTY/HAMILTON COUNTY LINE
	FEMP PROPERTY LINE
	BATTERY LIMIT
	IMPACTED MATERIAL DISPOSAL LIMIT
	BORROW AREA LIMIT
	APPROXIMATED CONTACT OF MAP UNITS
	CONTACT OF MAP UNITS
1276	PIEZOMETER (NOTE 6)
11493	TYPE 1 MONITORING WELL (NOTE 6)
11434	CONE PENETROMETER TEST (CPT) SOUNDING (NOTE 7)
11480	GEOTECHNICAL BORING (NOTE 7)

SURFACE GEOLOGY

ALLUVIUM, FLUVIAL DEPOSITS OF RECENT (HOLOCENE) ORIGIN. INCLUDES A VARIETY OF TEXTURAL CLASSES FROM CLAYS TO BOULDERS. THIS ALLUVIUM LIES DIRECTLY UPON SAND AND GRAVEL OUTWASH DEPOSITS OF THE GREAT MIAMI AQUIFER.

TILL, WISCONSIN AGE. SHELBYVILLE TILL EXPOSED ON ERODED SLOPES AND FLOOR OF PADDYS RUN VALLEY. LOCALLY, MAY BE COVERED WITH A THIN VENEER OF RECENT ALLUVIUM.

FINE TO COARSE SAND. CONTAINS LESSER AMOUNTS OF DISSEMINATED GRAVEL AND THIN GRAVEL OR SILT LENSES. THE MAPPED UNIT IS ALLUVIUM THAT LIES UNCONFORMABLY UPON SHELBYVILLE TILL, AN ALLUVIAL TERRACE OF THE GREAT MIAMI RIVER.

TILL. LEAN CLAY TO A SANDY LEAN CLAY WITH INTERSTITIAL SANDS AND GRAVELS. WITHIN THE AREA OF THE OSDF, TILL CONTAINS LESS THAN 5 PERCENT INTERSTITIAL BODIES OF SAND AND GRAVELLY SAND. TILL RANGES FROM APPROXIMATELY 25 FEET TO 60 FEET IN THICKNESS.

BEDROCK WITH A TILL/LOESS CAP OF VARIABLE THICKNESS. ORDOVICIAN AGE BEDROCK CONSISTING OF ALTERNATING LAYERS OF LIMESTONE AND SHALE. BEDROCK IS CAPPED BY WISCONSIN TILL, LOESS, AND COLLUVIUM OF VARIABLE THICKNESS, GENERALLY LESS THAN 10 FEET THICK.

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD])
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. SURFACE GEOLOGY INFORMATION OBTAINED FROM FIGURE 3-18, "PRE-CONSTRUCTION SURFACE GEOLOGY OF THE FEMP", OF THE "REMEDIAL INVESTIGATION REPORT FOR OPERABLE UNIT 5, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT, REMEDIAL INVESTIGATION AND FEASIBILITY STUDY", U.S. DEPARTMENT OF ENERGY, MARCH 1995.
5. SECTION LOCATIONS OBTAINED FROM FIGURE 2-6, "CROSS-SECTION LOCATION MAP", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995.
6. MONITORING WELL AND PIEZOMETER LOCATIONS OBTAINED FROM TABLE A-6, "PREDESIGN INVESTIGATION WELL REFERENCE INFORMATION", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995. SEE DRAWINGS X-13 THROUGH X-15 FOR NORTHING, EASTING, AND GROUND SURFACE ELEVATION INFORMATION.
7. GEOTECHNICAL BORING AND CONE PENETROMETER TEST (CPT) SOUNDING LOCATIONS OBTAINED FROM APPENDIX B, "BORING AND CPT COORDINATES", OF THE "GEOTECHNICAL INVESTIGATION REPORT, ON-SITE DISPOSAL FACILITY, OPERABLE UNIT 2, PROJECT ORDER 140, REVISION A", PARSONS, SEPTEMBER 1995. SEE DRAWINGS X-13 THROUGH X-15 FOR NORTHING, EASTING, AND GROUND SURFACE ELEVATION INFORMATION.
8. LOCATIONS OF GEOTECHNICAL BORINGS, CONE PENTROMETER TEST SOUNDINGS, MONITORING WELLS, AND PIEZOMETERS WILL BE UPDATED FOR THE INDIVIDUAL CERTIFIED FOR CONSTRUCTION PACKAGES IN ACCORDANCE WITH SECTION 1.4 OF THE FINAL DESIGN CALCULATION PACKAGE.

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

200 100 0 200 400
SCALE IN FEET

FOR INFORMATION ONLY

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY

TITLE:
SURFACE GEOLOGY MAP 447
283929_11

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

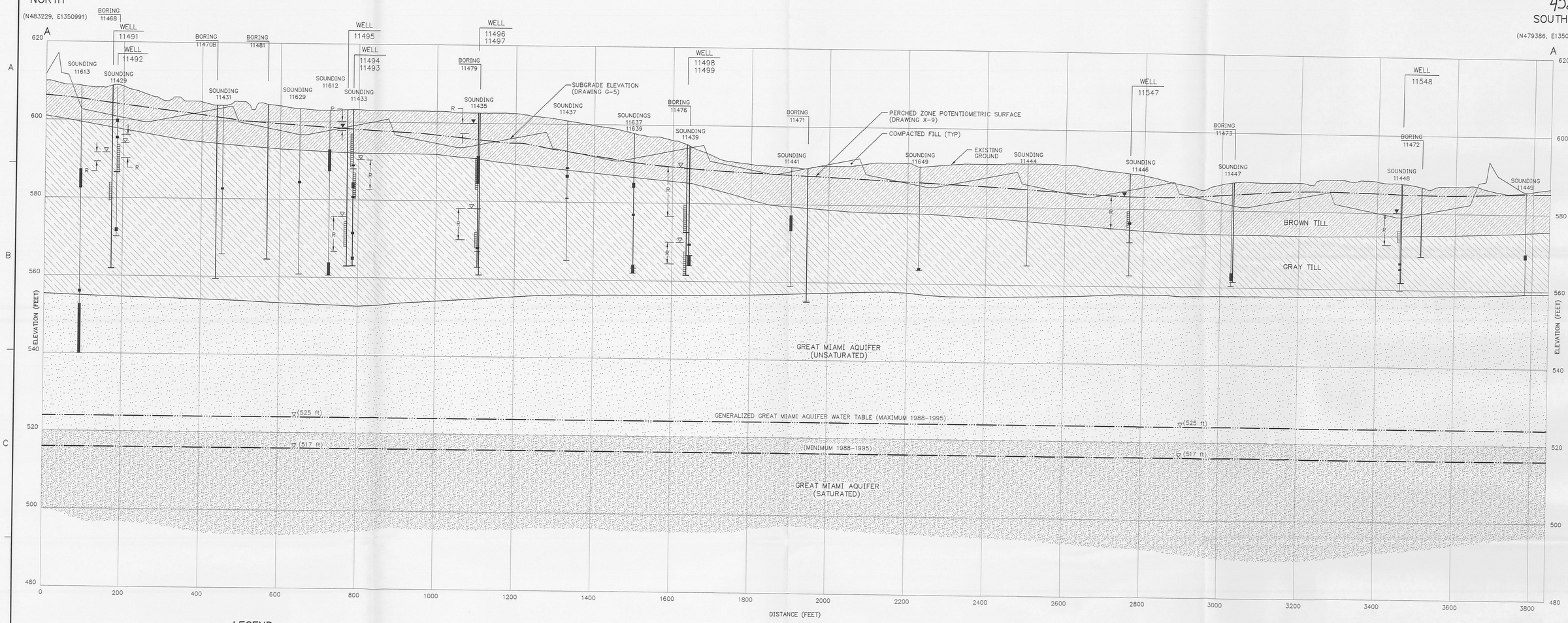
Rudolph Bonaparte
SIGNATURE
5 Oct 1996
DATE

STATE OF OHIO
RUDOLPH BONAPARTE
E-56679
REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

FERMCO CONTRACT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-X-00011
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-0009
SHEET NO.:	X-12
REVISION NO.:	G

FINAL DESIGN PACKAGE



A / X-12 SECTION A-A
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'

LEGEND

- WATER TABLE OR PIEZOMETRIC SURFACE
- WELL 11492 — MONITORING WELL
- BORING 11468 — GEOTECHNICAL BORING
- SOUNDING 11468 — CONE PENETROMETER TEST (CPT) SOUNDING
- INTERPRETED LOCATION OF COARSE-GRAINED MATERIAL OBTAINED FROM CONE PENETROMETER TEST (CPT) SOUNDING
- BROWN TILL - PREDOMINANTLY SANDY LEAN CLAY (CL) WITH LOCALIZED POCKETS OF HIGH PLASTICITY CLAY (CH), CLAYEY SILT (ML), AND CLAYEY AND SILTY SAND AND SCATTERED GRAVEL. TYPICALLY MOIST AND STIFF TO VERY STIFF. SOME LOCAL SAND LENSES. OPEN 1/8" FRACTURES.
- GRAY TILL - PREDOMINANTLY SANDY LEAN CLAY (CL) WITH POCKETS OF SAND (SW), CLAYEY SAND (SC), AND SCATTERED GRAVELS TYPICALLY MOIST AND VERY STIFF TO LOCALLY HARD. SCATTERED SAND LENSES.
- GREAT MIAMI AQUIFER - SAND/GRAVEL MIXTURES, VERY DENSE TO HARD (UNSATURATED)
- GREAT MIAMI AQUIFER - SAND/GRAVEL MIXTURES, VERY DENSE TO HARD (SATURATED)
- WATER LEVEL MEASURED BETWEEN 20 AND 29 MARCH 1995 IN MONITORING WELL SCREENED ACROSS OR NEAR THE BROWN TILL/GRAY TILL INTERFACE
- WATER LEVEL MEASURED IN MONITORING WELL SCREENED IN GRAY TILL OR GREAT MIAMI AQUIFER
- MONITORING WELL SCREEN INTERVAL
- R — RANGE OF POTENTIOMETRIC SURFACE FLUCTUATION IN THE PERCHED ZONE BETWEEN OCTOBER 1994 AND MARCH 1995

NOTES:

1. EXISTING GROUND ELEVATIONS BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. GEOLOGIC SECTION DATA OBTAINED FROM FIGURE 2-4, "COARSE GRAINED MATERIAL INTERPRETED FROM CONE PENETROMETER RESULTS", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995.
5. MONITORING WELL AND PERCHED ZONE INFORMATION OBTAINED FROM TABLE A-4, "BORING DEPTH AND SCREENED INTERVALS FOR PHASE II WELLS", AND TABLE A-19, "SUMMARY OF WATER LEVEL DATA, BROWN/GRAY TILL INTERFACE WELLS, MARCH 29, 1995", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995.
6. GEOTECHNICAL BORING AND CONE PENETROMETER TEST (CPT) SOUNDING LOCATIONS OBTAINED FROM APPENDIX B, "BORING AND CPT COORDINATES", OF THE "GEOTECHNICAL INVESTIGATION REPORT, ON-SITE DISPOSAL FACILITY, OPERABLE UNIT 2, PROJECT ORDER 140, REVISION A", PARSONS, SEPTEMBER 1995.
7. PERCHED ZONE POTENTIOMETRIC SURFACE OBTAINED FROM FIGURE 2-20, "PERCHED GROUNDWATER CONTOURS FOR WELLS SCREENED ACROSS THE BROWN/GRAY INTERFACE", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995.
8. GREAT MIAMI AQUIFER WATER TABLE INFORMATION OBTAINED FROM FIGURE 3-51, "MAXIMUM GROUNDWATER ELEVATIONS, TYPE 2 WELLS, JUNE 1990", AND FIGURE 3-52, "MINIMUM GROUNDWATER ELEVATIONS, TYPE 2 WELLS, NOVEMBER 1988", OF THE "REMEDIAL INVESTIGATION REPORT FOR OPERABLE UNIT 5, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT, REMEDIAL INVESTIGATION AND FEASIBILITY STUDY", U.S. DEPARTMENT OF ENERGY, MARCH 1995.
9. LOCATIONS OF GEOTECHNICAL BORINGS, CONE PENETROMETER TEST SOUNDINGS, AND MONITORING WELLS WILL BE UPDATED FOR THE INDIVIDUAL CERTIFIED FOR CONSTRUCTION PACKAGES IN ACCORDANCE WITH SECTION 1.4 OF THE FINAL DESIGN CALCULATION PACKAGE.

BORINGS, SOUNDINGS, AND WELLS

NO.	TYPE	COORDINATES (1983 NAD) NORTHING	EASTING	GROUND SURFACE ELEVATION
11429	CPT	483,044.98	1,351,020.91	610.13
11431	CPT	482,775.78	1,351,013.81	605.79
11433	CPT	482,442.87	1,351,005.16	603.00
11435	CPT	482,127.54	1,350,997.60	602.10
11437	CPT	481,897.84	1,350,992.31	600.03
11439	CPT	481,585.81	1,350,986.25	593.99
11441	CPT	481,325.77	1,350,980.85	589.00
11444	CPT	480,725.60	1,350,969.75	590.01
11446	CPT	480,464.85	1,350,964.03	587.83
11447	CPT	480,201.27	1,350,957.41	585.36
11448	CPT	479,768.79	1,350,948.78	584.88
11449	CPT	479,448.01	1,350,941.69	584.23
11612	CPT	482,503.41	1,351,052.28	603.24
11613	CPT	483,136.96	1,351,079.36	613.29
11629	CPT	482,579.66	1,350,894.14	603.38
11637	CPT	481,728.56	1,351,088.21	596.64
11639	CPT	481,727.51	1,350,963.93	597.96
11649	CPT	480,999.60	1,350,948.96	590.24
11468	BORING	483,039.84	1,351,018.05	610.04
11470B	BORING	482,790.71	1,351,042.41	606.96
11471	BORING	481,282.81	1,350,976.29	589.14
11472	BORING	479,765.76	1,350,939.74	584.63
11473	BORING	480,196.20	1,350,949.67	585.61
11476	BORING	481,586.16	1,350,980.71	594.12
11479	BORING	482,120.19	1,350,995.94	602.56
11481	BORING	482,660.50	1,350,405.12	599.89
11491	WELL	483,056.88	1,351,025.48	611.13
11492	WELL	483,045.25	1,351,021.13	610.53
11493	WELL	482,448.22	1,351,024.06	603.38
11494	WELL	482,448.31	1,350,993.91	603.51
11495	WELL	482,457.48	1,350,999.69	603.68
11496	WELL	482,126.19	1,350,995.25	602.65
11497	WELL	482,126.13	1,351,006.26	602.34
11498	WELL	481,593.20	1,350,981.05	594.60
11499	WELL	481,593.24	1,350,991.08	594.68
11547	WELL	480,468.19	1,350,957.98	588.22
11548	WELL	479,757.97	1,350,958.37	585.72

FOR INFORMATION ONLY

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	ELVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

SCALE IN FEET (100 50 0 100 200) — SCALE IN FEET (10 5 0 10 20)

OWNER/FACILITY: UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT: FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT: ON-SITE DISPOSAL FACILITY

TITLE: GEOLOGIC SECTION A-A 448

233129.12

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Rudolph Bonaparte
SIGNATURE
5 Oct 1996
DATE

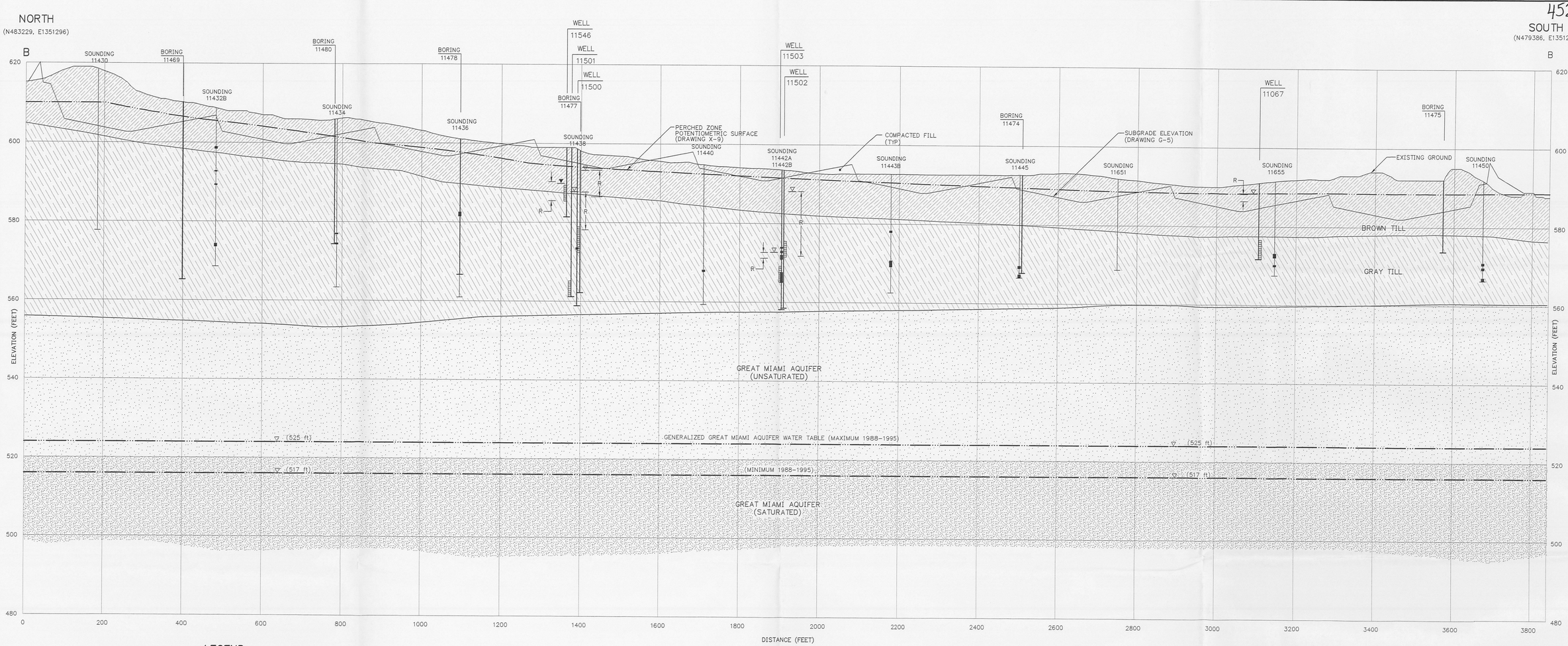
STATE OF OHIO — RUDOLPH BONAPARTE — E-56679 — REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE, ATLANTA, GEORGIA 30342 USA

FERMCO PROJECT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-X-00012
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-6044
SHEET NO.:	X-13
REVISION NO.:	G

FINAL DESIGN PACKAGE

M:\SACADD2\GE3900-13\F96-6044 Fri Oct 04 14:05:56 1996 FERMCO/DUNN



LEGEND

- WATER TABLE OR PIEZOMETRIC SURFACE
- WELL 11492 — MONITORING WELL
- BORING 11468 — GEOTECHNICAL BORING
- SOUNDING 11468 — CONE PENETROMETER TEST (CPT) SOUNDING
- INTERPRETED LOCATION OF COARSE-GRAINED MATERIAL OBTAINED FROM CONE PENETROMETER TEST (CPT) SOUNDING
- BROWN TILL - PREDOMINANTLY SANDY LEAN CLAY (CL) WITH LOCALIZED POCKETS OF HIGH PLASTICITY CLAY (CH), CLAYEY SILT (ML), AND CLAYEY AND SILTY SAND AND SCATTERED GRAVEL. TYPICALLY MOIST AND STIFF TO VERY STIFF. SOME LOCAL SAND LENSES. OPEN 1/8" FRACTURES.
- GRAY TILL - PREDOMINANTLY SANDY LEAN CLAY (CL) WITH POCKETS OF SAND (SW), CLAYEY SAND (SC), AND SCATTERED GRAVELS TYPICALLY MOIST AND VERY STIFF TO LOCALLY HARD. SCATTERED SAND LENSES.
- GREAT MIAMI AQUIFER - SAND/GRAVEL MIXTURES, VERY DENSE TO HARD (UNSATURATED)
- GREAT MIAMI AQUIFER - SAND/GRAVEL MIXTURES, VERY DENSE TO HARD (SATURATED)
- WATER LEVEL MEASURED BETWEEN 20 AND 29 MARCH 1995 IN MONITORING WELL SCREENED ACROSS OR NEAR THE BROWN TILL/GRAY TILL INTERFACE
- WATER LEVEL MEASURED IN MONITORING WELL SCREENED IN GRAY TILL OR GREAT MIAMI AQUIFER
- MONITORING WELL SCREEN INTERVAL
- R — RANGE OF POTENTIOMETRIC SURFACE FLUCTUATION IN THE PERCHED ZONE BETWEEN OCTOBER 1994 AND MARCH 1995

B / X-12 — SECTION B-B
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'

NOTES:

1. EXISTING GROUND ELEVATONS BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD])
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. GEOLOGIC SECTION DATA OBTAINED FROM FIGURE 2-4, "COARSE GRAINED MATERIAL INTERPRETED FROM CONE PENETROMETER RESULTS", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995.
5. MONITORING WELL AND PERCHED ZONE INFORMATION OBTAINED FROM TABLE A-4, "BORING DEPTH AND SCREENED INTERVALS FOR PHASE II WELLS", AND TABLE A-19, "SUMMARY OF WATER LEVEL DATA, BROWN/GRAY TILL INTERFACE WELLS, MARCH 29, 1995", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995.
6. GEOTECHNICAL BORING AND CONE PENETROMETER TEST (CPT) SOUNDING LOCATIONS OBTAINED FROM APPENDIX B, "BORING AND CPT COORDINATES", OF THE "GEOTECHNICAL INVESTIGATION REPORT, ON-SITE DISPOSAL FACILITY, OPERABLE UNIT 2, PROJECT ORDER 140, REVISION A", PARSONS, SEPTEMBER 1995.
7. PERCHED ZONE POTENTIOMETRIC SURFACE OBTAINED FROM FIGURE 2-20, "PERCHED GROUNDWATER CONTOURS FOR WELLS SCREENED ACROSS THE BROWN/GRAY INTERFACE", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT," U.S. DEPARTMENT OF ENERGY, JULY 1995.
8. GREAT MIAMI AQUIFER WATER TABLE INFORMATION OBTAINED FROM FIGURE 3-51, "MAXIMUM GROUNDWATER ELEVATIONS, TYPE 2 WELLS, JUNE 1990", AND FIGURE 3-52, "MINIMUM GROUNDWATER ELEVATIONS, TYPE 2 WELLS, NOVEMBER 1988", OF THE "REMEDIAL INVESTIGATION REPORT FOR OPERABLE UNIT 5, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT, REMEDIAL INVESTIGATION AND FEASIBILITY STUDY", U.S. DEPARTMENT OF ENERGY, MARCH 1995.
9. LOCATIONS OF GEOTECHNICAL BORINGS, CONE PENETROMETER TEST SOUNDINGS, AND MONITORING WELLS WILL BE UPDATED FOR THE INDIVIDUAL CERTIFIED FOR CONSTRUCTION PACKAGES IN ACCORDANCE WITH SECTION 1.4 OF THE FINAL DESIGN CALCULATION PACKAGE.

BORINGS, SOUNDINGS, AND WELLS

NO.	TYPE	COORDINATES (1983 NAD) NORTHING	EASTING	GROUND SURFACE ELEVATION
11430	CPT	483,045.58	1,351,311.90	617.71
11432B	CPT	482,743.79	1,351,295.43	608.60
11434	CPT	482,442.84	1,351,298.74	606.04
11436	CPT	482,133.99	1,351,291.80	600.95
11438	CPT	481,838.95	1,351,285.28	598.47
11440	CPT	481,519.93	1,351,278.57	594.36
11442A	CPT	481,315.22	1,351,275.01	593.18
11442B	CPT	481,315.22	1,351,275.01	593.18
11443B	CPT	481,049.44	1,351,269.27	592.55
11445	CPT	480,727.39	1,351,261.50	591.53
11450	CPT	479,555.62	1,351,238.01	591.39
11651	CPT	480,479.22	1,351,284.74	592.19
11655	CPT	480,082.47	1,351,314.24	592.08
11469	BORING	482,830.31	1,351,298.75	610.19
11474	BORING	480,720.45	1,351,255.61	591.94
11475	BORING	479,656.67	1,351,231.56	594.38
11477	BORING	481,831.18	1,351,279.70	598.27
11478	BORING	482,133.05	1,351,291.73	601.35
11480	BORING	482,448.04	1,351,297.95	606.28
11067	WELL	480,223.12	1,351,313.77	590.71
11500	WELL	481,840.14	1,351,284.36	598.93
11501	WELL	481,853.44	1,351,285.22	598.97
1150	WELL	481,317.57	1,351,282.97	593.79
11503	WELL	481,327.01	1,351,275.97	593.47
11546	WELL	481,865.50	1,351,286.04	598.90

FOR INFORMATION ONLY

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

100 50 0 100 200 SCALE IN FEET
10 5 0 10 20 SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERMCO Restoration Management Corporation
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY

TITLE:
GEOLOGIC SECTION B-B

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Rudolph Bonaparte
SIGNATURE
5 Oct 1996
DATE

STATE OF OHIO — RUDOLPH BONAPARTE — E-56579 — REGISTERED PROFESSIONAL ENGINEER
SEAL

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
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FERMCO PROJECT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-X-00013
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-0045
SHEET NO.:	X-14
REVISION NO.:	G

FINAL DESIGN PACKAGE

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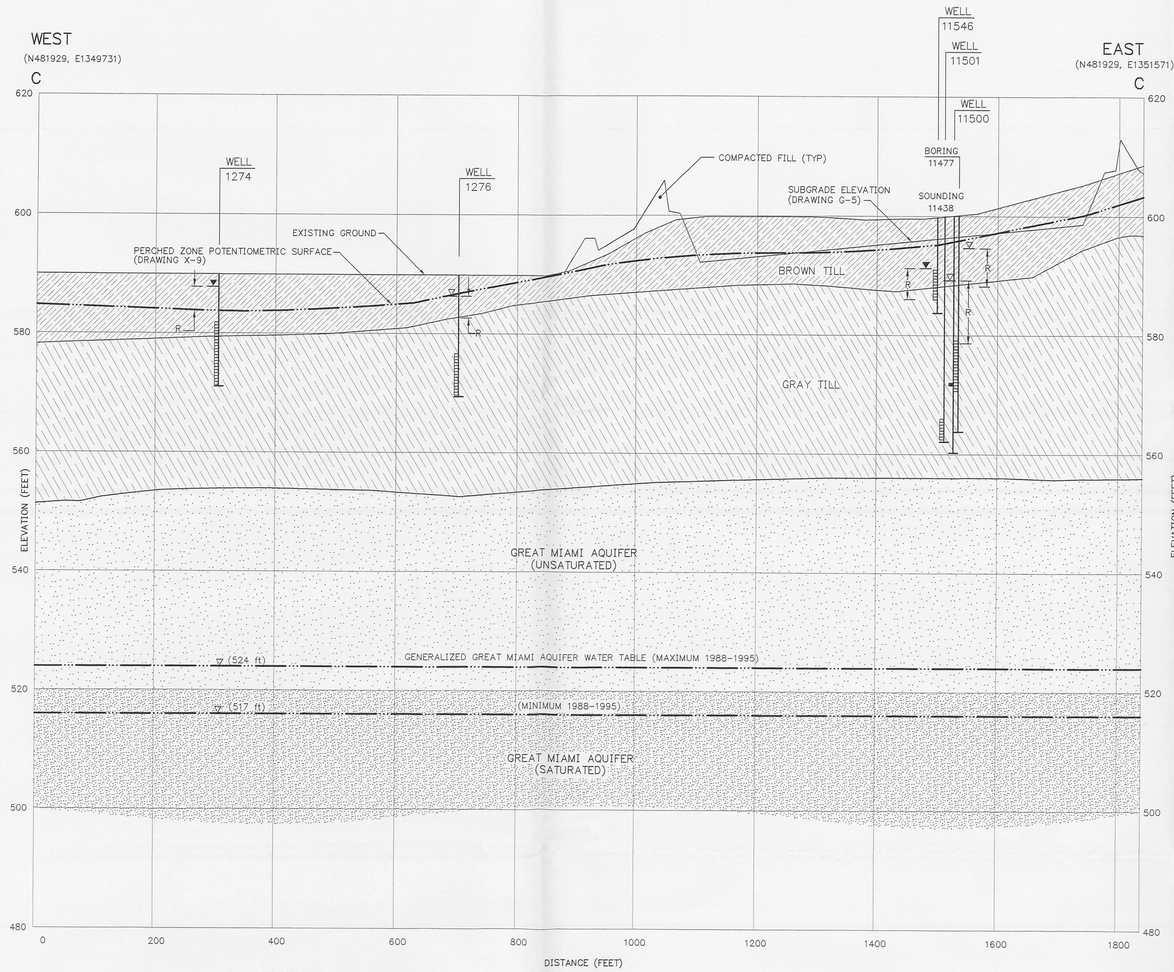

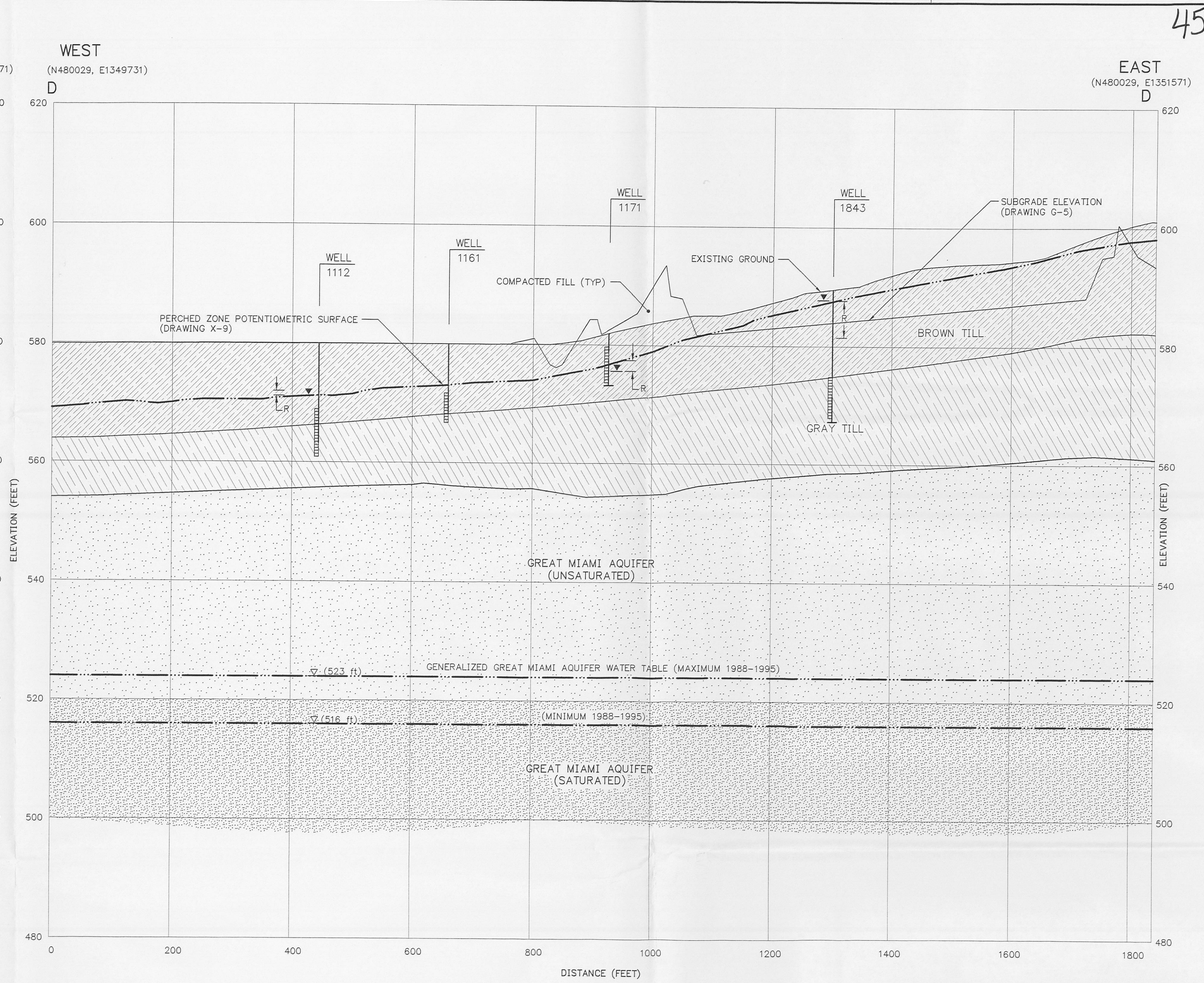

LEGEND

- WATER TABLE OR PIEZOMETRIC SURFACE
- WELL 11492 — MONITORING WELL
- BORING 11468 — GEOTECHNICAL BORING
- SOUNDING 11468 — CONE PENETROMETER TEST (CPT) SOUNDING
- INTERPRETED LOCATION OF COARSE-GRAINED MATERIAL OBTAINED FROM CONE PENETROMETER TEST (CPT) SOUNDING
- BROWN TILL – PREDOMINANTLY SANDY LEAN CLAY (CL) WITH LOCALIZED POCKETS OF HIGH PLASTICITY CLAY (CH), CLAYEY SILT (ML), AND CLAYEY AND SILTY SAND AND SCATTERED GRAVEL. TYPICALLY MOIST AND STIFF TO VERY STIFF. SOME LOCAL SAND LENSES. OPEN 1/8" FRACTURES.
- GRAY TILL – PREDOMINANTLY SANDY LEAN CLAY (CL) WITH POCKETS OF SAND (SW), CLAYEY SAND (SC), AND SCATTERED GRAVELS TYPICALLY MOIST AND VERY STIFF TO LOCALLY HARD. SCATTERED SAND LENSES.
- GREAT MIAMI AQUIFER – SAND/GRAVEL MIXTURES, VERY DENSE TO HARD (UNSATURATED)
- GREAT MIAMI AQUIFER – SAND/GRAVEL MIXTURES, VERY DENSE TO HARD (SATURATED)
- WATER LEVEL MEASURED BETWEEN 20 AND 29 MARCH 1995 IN MONITORING WELL SCREENED ACROSS OR NEAR THE BROWN TILL/GRAY TILL INTERFACE
- WATER LEVEL MEASURED IN MONITORING WELL SCREENED IN GRAY TILL OR GREAT MIAMI AQUIFER
- MONITORING WELL SCREEN INTERVAL
- R — RANGE OF POTENTIOMETRIC SURFACE FLUCTUATION IN THE PERCHED ZONE BETWEEN OCTOBER 1994 AND MARCH 1995

C / X-12 — SECTION C–C
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'

D / X-12 — SECTION D–D
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'

NOTES:

1. EXISTING GROUND ELEVATIONS BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. GEOLOGIC SECTION DATA OBTAINED FROM FIGURE 3-9, "MODELED LOCATIONS OF COARSE GRAINED MATERIALS SECTION D-D'", AND FIGURE 3-10, "MODELED LOCATIONS OF COARSE GRAINED MATERIALS SECTION E-E'", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995.
5. MONITORING WELL AND PERCHED ZONE INFORMATION OBTAINED FROM TABLE A-4, "BORING DEPTH AND SCREENED INTERVALS FOR PHASE II WELLS", AND TABLE A-19, "SUMMARY OF WATER LEVEL DATA, BROWN/GRAY TILL INTERFACE WELLS, MARCH 29, 1995", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995.
6. GEOTECHNICAL BORING AND CONE PENETROMETER TEST (CPT) SOUNDING LOCATIONS OBTAINED FROM APPENDIX B, "BORING AND CPT COORDINATES", OF THE "GEOTECHNICAL INVESTIGATION REPORT, ON-SITE DISPOSAL FACILITY, OPERABLE UNIT 2, PROJECT ORDER 140, REVISION A", PARSONS, SEPTEMBER 1995.
7. PERCHED ZONE POTENTIOMETRIC SURFACE OBTAINED FROM FIGURE 2-20, "PERCHED GROUNDWATER CONTOURS FOR WELLS SCREENED ACROSS THE BROWN/GRAY INTERFACE", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995.
8. GREAT MIAMI AQUIFER WATER TABLE INFORMATION OBTAINED FROM FIGURE 3-51, "MAXIMUM GROUNDWATER ELEVATIONS, TYPE 2 WELLS, JUNE 1990", AND FIGURE 3-52, "MINIMUM GROUNDWATER ELEVATIONS, TYPE 2 WELLS, NOVEMBER 1988", OF THE "REMEDIAL INVESTIGATION REPORT FOR OPERABLE UNIT 5, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT, REMEDIAL INVESTIGATION AND FEASIBILITY STUDY", U.S. DEPARTMENT OF ENERGY, MARCH 1995.
9. LOCATIONS OF GEOTECHNICAL BORINGS, CONE PENETROMETER TEST SOUNDINGS, AND MONITORING WELLS WILL BE UPDATED FOR THE INDIVIDUAL CERTIFIED FOR CONSTRUCTION PACKAGES IN ACCORDANCE WITH SECTION 1.4 OF THE FINAL DESIGN CALCULATION PACKAGE.

BORINGS, SOUNDINGS, AND WELLS

NO.	TYPE	COORDINATES (1983 NAD) NORTHING	EASTING	GROUND SURFACE ELEVATION
11438	CPT	481,838.95	1,351,285.28	598.47
11477	BORING	481,831.18	1,351,279.70	598.27
1112	WELL	480,020.92	1,349,934.25	578.25
1161	WELL	480,148.26	1,350,235.85	580.20
1171	WELL	479,971.11	1,350,601.56	580.60
1274	WELL	482,093.21	1,349,993.26	591.11
1276	WELL	482,081.74	1,350,415.97	590.51
1843	WELL	479,935.00	1,351,053.37	591.37
11500	WELL	481,840.14	1,351,284.36	598.93
11501	WELL	481,853.44	1,351,285.22	598.97
11546	WELL	481,865.50	1,351,286.04	598.90

FOR INFORMATION ONLY

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JA	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

100 50 0 100 200 SCALE IN FEET
10 5 0 10 20 SCALE IN FEET

OWNER/FACILITY: UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT: FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT: ON-SITE DISPOSAL FACILITY

TITLE: GEOLOGIC SECTIONS C-C AND D-D 450

253929_14

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Rudolph Bonaparte
SIGNATURE
8 Oct 1996
DATE

STATE OF OHIO — RUDOLPH BONAPARTE — E-56679 — REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

FERMCO PROJECT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-X-00014
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-G092
SHEET NO.:	X-15
REVISION NO.:	G

FINAL DESIGN PACKAGE

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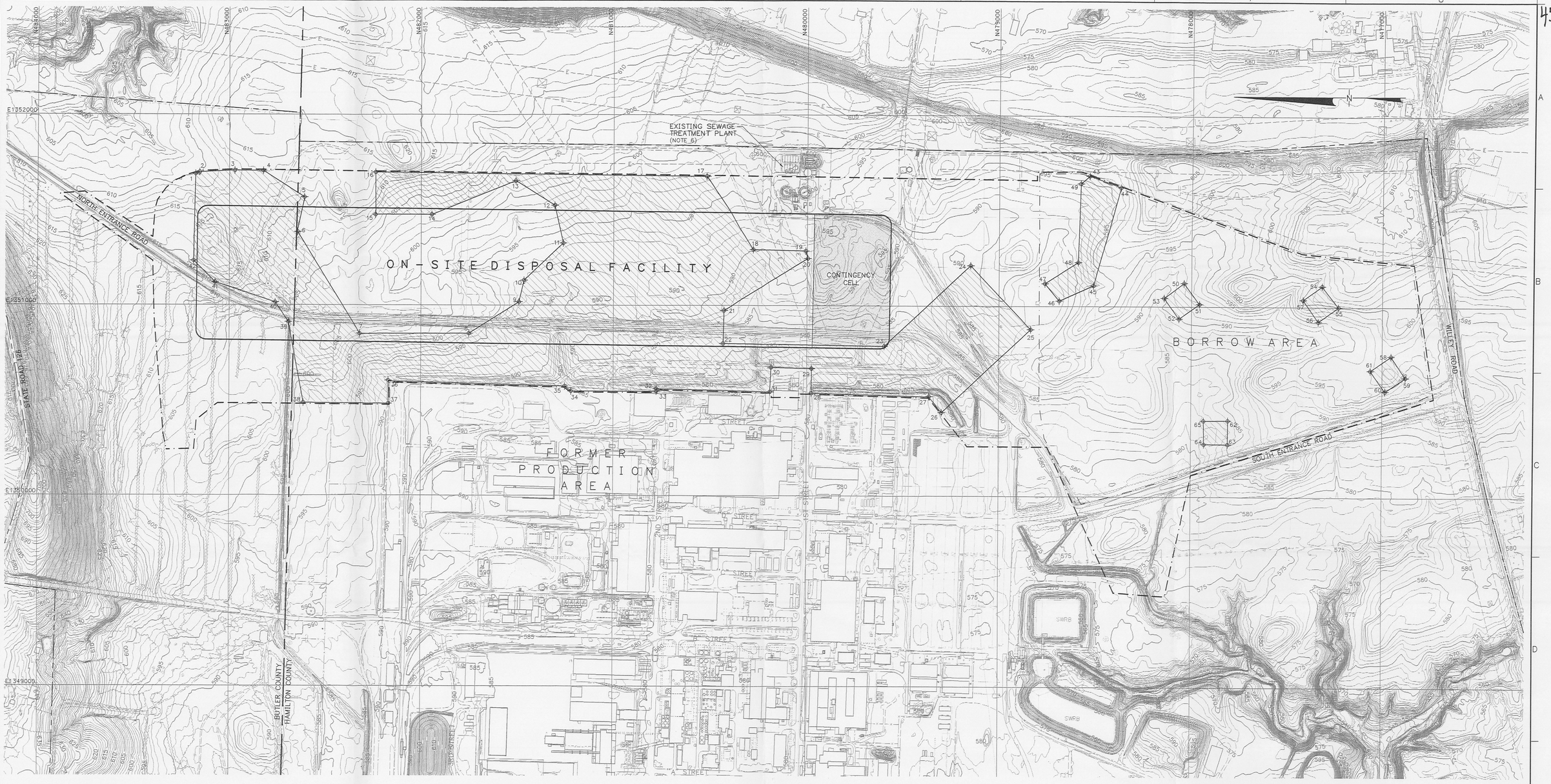

LEGEND

600	EXISTING GROUND ELEVATION (FEET)
	BUTLER COUNTY/HAMILTON COUNTY LINE
	FEMP PROPERTY LINE
	BATTERY LIMIT
	IMPACTED MATERIAL DISPOSAL LIMIT
	BORROW AREA LIMIT
	APPROXIMATE AREA OF SURFICIAL IMPACTED MATERIAL EXCAVATION
	CONSTRUCTION CONTROL POINT

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. LIMITS OF SURFICIAL IMPACTED MATERIAL EXCAVATION SHOWN ON THIS DRAWING OBTAINED FROM FERMCO COMPUTER FILE "CONT7C.DGN". LIMITS ARE SUBJECT TO REVISION BASED ON THE RESULTS OF ONGOING FEMP INVESTIGATIONS.
5. AREAS OF SURFICIAL IMPACTED MATERIAL EXCAVATION SHOWN ON THIS DRAWING WILL BE EXCAVATED PRIOR TO THE START OF OSDF CONSTRUCTION IN THOSE AREAS.
6. AREAS OF SURFICIAL AND SUBSURFACE IMPACTED MATERIAL EXCAVATION WITHIN THE BATTERY LIMIT IN THE VICINITY OF THE EXISTING SEWAGE TREATMENT PLANT ARE NOT SHOWN ON THIS DRAWING. DETAILED PLANS FOR EXCAVATION OF IMPACTED MATERIAL IN THIS AREA, AND BACKFILLING IN THIS AREA, WILL BE PART OF A SEPARATE DESIGN PACKAGE.

SURFICIAL IMPACTED MATERIAL EXCAVATION CONSTRUCTION CONTROL POINTS

NO.	NORTHING	EASTING	NO.	NORTHING	EASTING
1	483175.55	1351690.43	33	480778.17	1350549.06
2	483154.50	1351697.07	34	481219.07	1350549.38
3	482975.60	1351706.52	35	481254.01	1350575.58
4	482824.10	1351704.69	36	482171.72	1350600.49
5	482610.17	1351565.74	37	482171.72	1350483.35
6	482647.39	1351387.99	38	482615.65	1350486.60
7	482322.80	1350849.78	39	482692.82	1350910.66
8	481751.99	1350851.96	40	482761.28	1351013.61
9	481493.49	1351017.77	41	483074.10	1351119.08
10	481466.95	1351131.44	42	483185.40	1351218.52
11	481261.37	1351326.64	43	478533.49	1351685.00
12	481305.32	1351523.82	44	478370.71	1351624.95
13	481510.90	1351653.54	45	478512.09	1351108.90
14	481946.61	1351474.97	46	478688.34	1351028.95
15	482239.12	1351476.36	47	478762.09	1351119.91
16	482239.41	1351697.64	48	478590.99	1351231.60
17	480521.26	1351676.91	49	478579.23	1351645.06
18	480281.60	1351294.64	50	478039.75	1351123.46
19	480008.57	1351287.43	51	477959.09	1351013.38
20	479997.77	1351247.81	52	478066.19	1350936.78
21	480437.03	1350973.01	53	478145.07	1351046.04
22	480440.92	1350799.95	54	477316.61	1351110.95
23	479599.34	1350788.12	55	477231.42	1350999.62
24	479149.14	1351213.45	56	477336.92	1350923.61
25	478835.93	1350878.73	57	477416.92	1351038.09
26	479298.90	1350440.71	58	476954.30	1350743.67
27	479364.35	1350522.94	59	476878.04	1350630.62
28	479976.49	1350540.50	60	476985.27	1350558.43
29	479975.70	1350669.70	61	477062.57	1350667.68
30	480186.17	1350674.37	62	477809.09	1350401.62
31	480192.07	1350546.67	63	477809.63	1350276.47
32	480777.72	1350562.65	64	477932.41	1350277.64
			65	477934.67	1350401.01

FINAL DESIGN PACKAGE

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

SCALE IN FEET: 200 100 0 200 400

FOR INFORMATION ONLY

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY

TITLE:
SURFICIAL IMPACTED MATERIAL REMOVAL PLAN
WITHIN BATTERY LIMIT

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Rudolph Bonaparte
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5 Oct 1996
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STATE OF OHIO
RUDOLPH BONAPARTE
E-56679
REGISTERED PROFESSIONAL ENGINEER
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GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

FERMCO CONTRACT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-G-00015
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-0085
SHEET NO.:	G-1
REVISION NO.:	G

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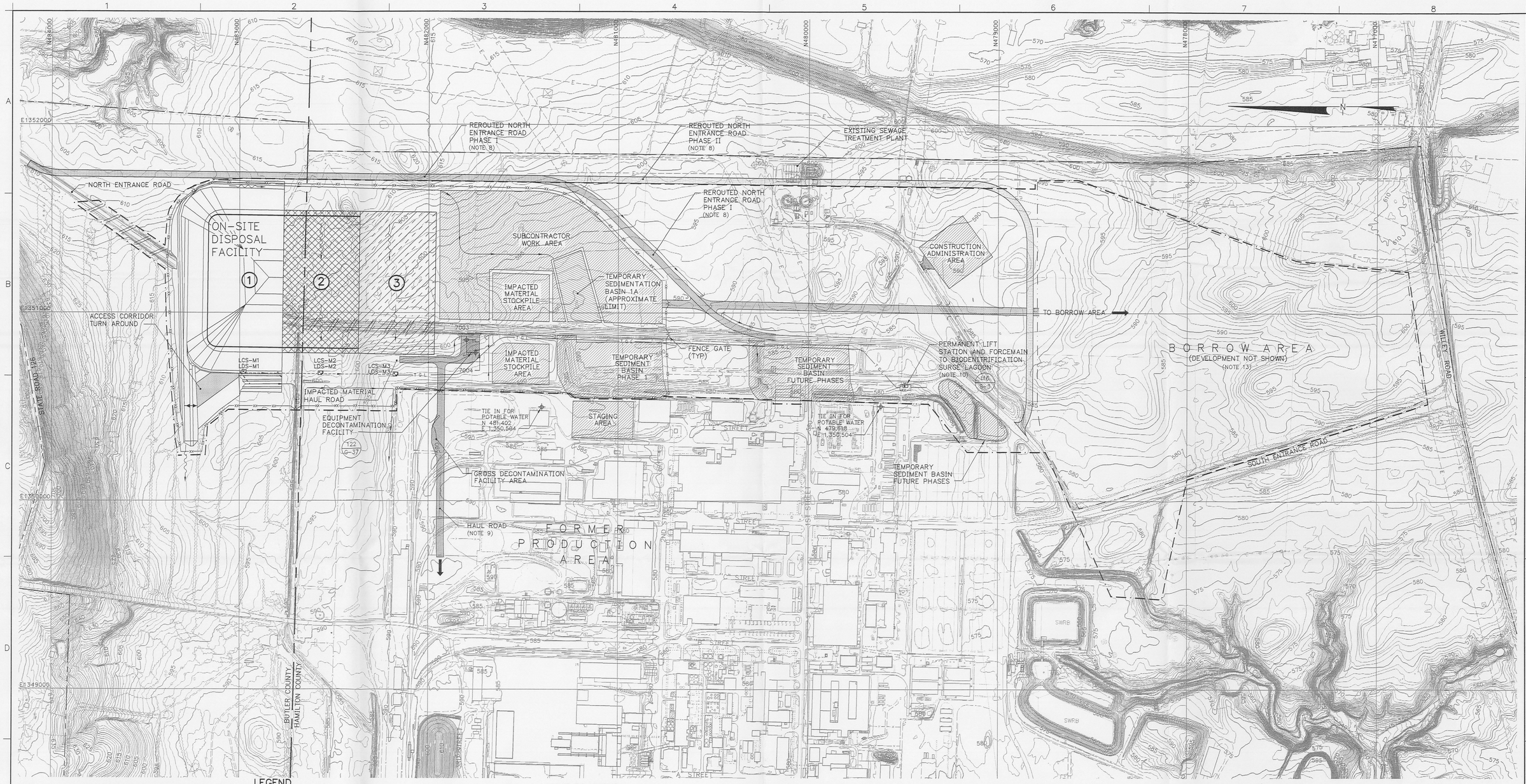

LEGEND

- 600 — EXISTING GROUND ELEVATION (FEET) (NOTE 2)
- BUTLER COUNTY/HAMILTON COUNTY LINE
- FEMP PROPERTY LINE
- BATTERY LIMIT
- IMPACTED MATERIAL DISPOSAL LIMIT
- BORROW AREA LIMIT
- LEACHATE TRANSMISSION SYSTEM GRAVITY LINE
- T G L — LEACHATE TRANSMISSION SYSTEM TEMPORARY GRAVITY LINE (NOTE 11)
- PROPOSED TEMPORARY STORMWATER DRAINAGE CHANNEL (NOTE 7)
- XX — SECURITY FENCE
- CONSTRUCTION CONTROL POINT (NOTE 12)
- LEACHATE TRANSMISSION SYSTEM MANHOLE (LDS AND LCS) AND HORIZTONTAL MONITORING WEL COVER SLAB
- LEACHATE TRANSMISSION SYSTEM PERMANENT LIFT STATION
- (1) CELL DESIGNATION
- (2) CELL ACCEPTING IMPACTED MATERIAL (NOTE 5 AND 6)
- (3) CELL UNDER CONSTRUCTION (NOTE 5, 6, AND 7)
- DRAINAGE CHANNEL GRAVITY INLET STRUCTURE
- ACCESS CORRIDOR, HAUL ROAD, BORROW AREA HAUL ROAD CORRIDOR, OR RELOCATED NORTH ENTRANCE ROAD PHASE I
- RELOCATED NORTH ENTRANCE ROAD PHASE II
- DRAINAGE FLOW DIRECTION
- NORTH ENTRANCE ROAD TO BE REMOVED (NOTE 8)

DEVELOPMENT SEQUENCE:

1. PRIOR TO ANY OSDF CELL WORK, THE SUBCONTRACTOR SHALL CONSTRUCT THE FOLLOWING IN THE GENERAL ORDER LISTED:
   - A. EROSION AND SEDIMENT CONTROL FEATURES;
   - B. CONSTRUCTION HAUL ROADS;
   - C. CONSTRUCTION ADMINISTRATION AREA;
   - D. SUBCONTRACTOR WORK AREA;
   - E. LEACHATE TRANSMISSION SYSTEM;
   - F. EQUIPMENT DECONTAMINATION FACILITY;
   - G. STAGING AREA; AND
   - H. SECURITY FENCE.
2. SUBCONTRACTOR SHALL SEQUENTIALLY CONSTRUCT OSDF CELLS FROM NORTH TO SOUTH COMPLETE WITH LINER AND LEACHATE COLLECTION SYSTEMS.
3. UPON COMPLETION OF THE LINER AND LEACHATE COLLECTION SYSTEMS IN EACH CELL, SUBCONTRACTOR SHALL PLACE IMPACTED MATERIAL IN THE CELL IN ACCORDANCE WITH SECTION 13010 OF THE OSDF SPECIFICATIONS AND THE IMPACTED MATERIAL PLACEMENT PLAN.
4. AS IMPACTED MATERIAL FINAL ELEVATIONS ARE ATTAINED IN THE CELLS, THE SUBCONTRACTOR SHALL CONSTRUCT THE OSDF FINAL COVER SYSTEM FROM NORTH TO SOUTH.

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. THE PURPOSE OF THIS DRAWING IS TO CONCEPTUALLY ILLUSTRATE THE DEVELOPMENT OF THE OSDF AND SUPPORT FACILITIES INCLUDING HAUL ROADS, EQUIPMENT DECONTAMINATION FACILITY, CONSTRUCTION ADMINISTRATION AREA, STAGING AREA, SECURITY FENCE, AND TEMPORARY STORMWATER CONTROL FEATURES. THE SIZE AND LOCATION OF THE SUPPORT FACILITIES AND THE NUMBER OF CELLS TO BE CONSTRUCTED DURING A CONSTRUCTION SEASON MAY VARY BASED ON THE FINAL SEQUENCE AND SCHEDULE FOR REMOVAL OF IMPACTED MATERIAL FROM THE OPERABLE UNITS.
5. SUBCONTRACTOR SHALL SUBMIT A CONSTRUCTION SITE ACCESS (CSA) PLAN TO THE CONSTRUCTION MANAGER FOR APPROVAL PRIOR TO INITIATING CONSTRUCTION ACTIVITIES. THE CSA PLAN SHALL SHOW HOW THE SUBCONTRACTOR PROPOSES TO ROUTE HIS EQUIPMENT AND INGRESS/EGRESS, WHILE MEETING APPLICABLE REQUIREMENTS OF THE OSDF SPECIFICATIONS. ELEMENTS IN THE CSA PLAN SHALL INCLUDE DRAWINGS TO SUPPORT THE DESIGN AND LOCATION OF FENCES AND TEMPORARY HAUL ROADS FOR ACCESS TO CELL LINER SYSTEM CONSTRUCTION, FINAL COVER SYSTEM CONSTRUCTION, AND IMPACTED MATERIAL PLACEMENT.
6. SUBCONTRACTOR SHALL CONTAIN AND CONTROL ALL WASTEWATER GENERATED DURING CONSTRUCTION, FILLING, AND CLOSURE OF THE OSDF. LEACHATE AND WASTEWATER FROM THE EQUIPMENT DECONTAMINATION FACILITY GENERATED WITHIN THE BATTERY LIMIT SHALL BE DIRECTED TO THE OSDF LEACHATE TRANSMISSION SYSTEM TEMPORARY GRAVITY LINE OR TO ANOTHER LOCATION IDENTIFIED BY THE CONSTRUCTION MANAGER. RUNOFF FROM HAUL ROADS WITHIN THE BATTERY LIMIT AND PERCHED GROUND-WATER SEEPAGE INTO THE OSDF EXCAVATION SHALL BE DIRECTED TO THE FORMER PRODUCTION AREA STORM DRAINAGE CONTROL SYSTEM OR TO ANOTHER LOCATION IDENTIFIED BY THE CONSTRUCTION MANAGER.
7. SUBCONTRACTOR SHALL SUBMIT A SURFACE WATER MANAGEMENT AND EROSION CONTROL PLAN (SWMECP) TO THE CONSTRUCTION MANAGER FOR APPROVAL IN ACCORDANCE WITH SECTION 02270 OF THE OSDF SPECIFICATIONS.
8. LOCATIONS OF REROUTED NORTH ENTRANCE ROAD PHASES I AND II OBTAINED FROM DRAWING G0001, "CIVIL SITE PLAN", OF THE "REROUTED NORTH ENTRANCE ROAD CONSTRUCTION DRAWINGS, OPERABLE UNIT 2, PROJECT ORDER 158, REVISION D", PARSONS, APRIL 1996. EXISTING NORTH ENTRANCE ROAD WILL BE REROUTED PRIOR TO OSDF CONSTRUCTION IN THAT AREA. SUBCONTRACTOR SHALL REMOVE ABANDONED NORTH ENTRANCE ROAD AS NECESSARY WITHIN THE BATTERY LIMIT TO CONSTRUCT THE OSDF.
9. LOCATION OF HAUL ROAD OBTAINED FROM DRAWING G0001, "CIVIL SITE PLAN", OF THE "HAUL ROAD CONSTRUCTION DRAWINGS, OPERABLE UNIT 2, PROJECT ORDER 158, REVISION D", PARSONS, APRIL 1996.
10. SEE SEPARATE DESIGN PACKAGE FOR THE DESIGN OF THE FORCEMAIN (LEACHATE TRANSMISSION SYSTEM CONNECTOR) FROM THE PERMANENT LIFT STATION TO THE BIODENITRIFICATION SURGE LAGOON (INCLUDES LIFT STATION PUMP REQUIREMENTS AND DOUBLE-WALL HDPE FORCEMAIN).
11. SEE SEPARATE DESIGN PACKAGE FOR THE DESIGN OF THE LEACHATE TRANSMISSION SYSTEM TEMPORARY GRAVITY LINE FROM LCS-M3 TO THE PERMANENT LIFT STATION.
12. CONSTRUCTION CONTROL POINT TABLES ARE PROVIDED ON DRAWINGS G-38 AND G-39.
13. BORROW AREA SHALL BE DEVELOPED IN ACCORDANCE WITH SECTION 13000 OF THE OSDF SPECIFICATIONS AND THE BORROW AREA MANAGEMENT AND RESTORATION PLAN.

FINAL DESIGN PACKAGE

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

200 100 0 200 400
SCALE IN FEET

FOR INFORMATION ONLY

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UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY

TITLE:
SITE DEVELOPMENT PLAN
233929_16
452

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Rudolph Bonaparte
SIGNATURE
8 Oct 1996
DATE

STATE OF OHIO
RUDOLPH BONAPARTE
E-56679
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GEOSYNTEC CONSULTANTS
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ATLANTA, GEORGIA 30342 USA

FERMCO CONTRACT NO.:	20100
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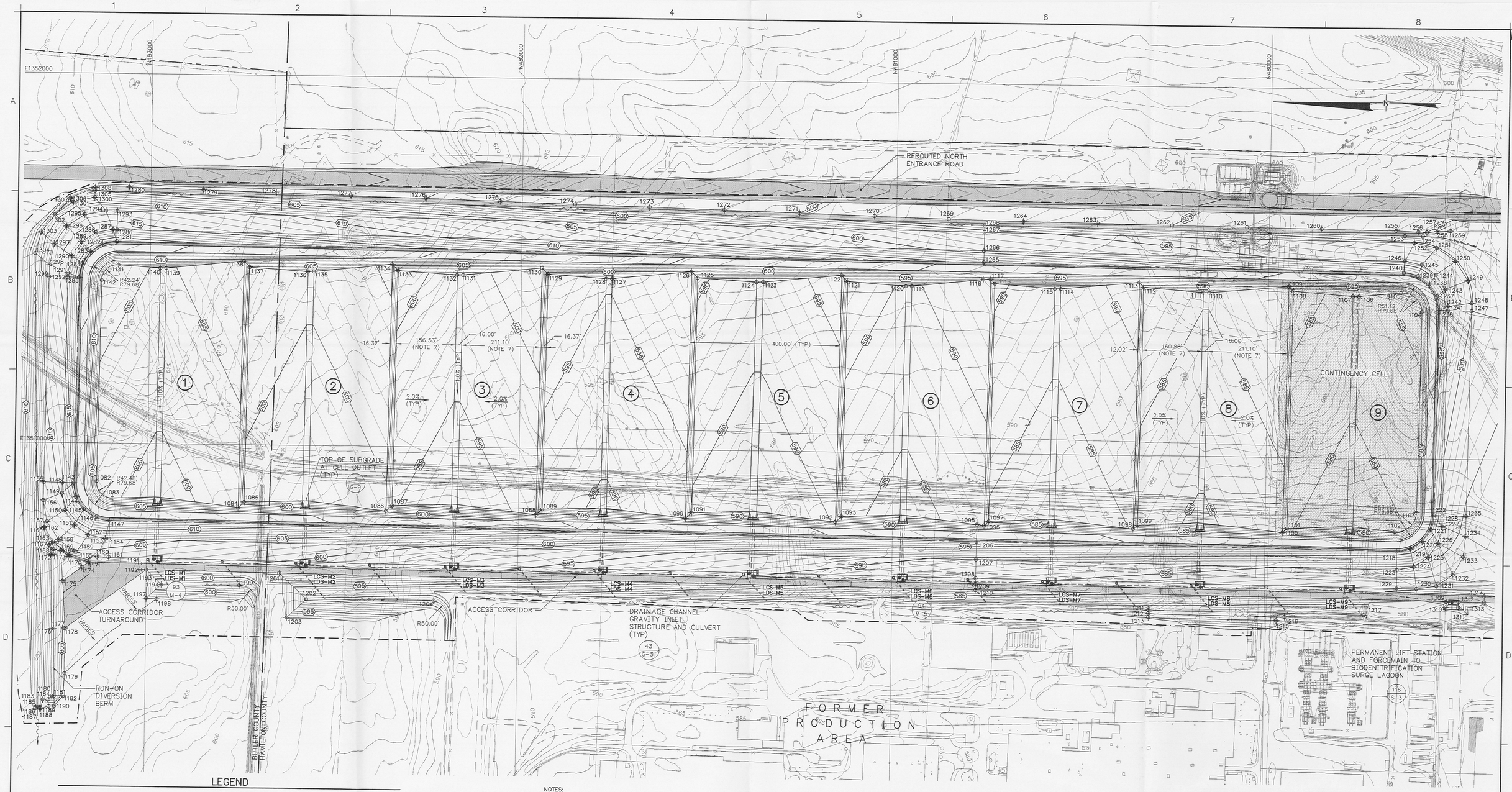
FERMCO DRAWING NO.:	90X-6000-G-00016
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-0069
SHEET NO.:	G-2
REVISION NO.:	G



LEGEND

600	EXISTING GROUND ELEVATION (FEET)
580	SUBGRADE ELEVATION (FEET) (NOTE 4)
	BUTLER COUNTY/HAMILTON COUNTY LINE
	FEMP PROPERTY LINE
	BATTERY LIMIT
	PERIMETER BERM BASELINE
	LEACHATE TRANSMISSION SYSTEM GRAVITY LINE
	LEACHATE TRANSMISSION SYSTEM MANHOLES (LDS AND LCS) AND HORIZONTAL MONITORING WELL COVER SLAB
	LEACHATE TRANSMISSION SYSTEM PERMANENT LIFT STATION
1	CELL DESIGNATION
	ACCESS CORRIDOR OR REROUTED NORTH ENTRANCE ROAD
	DRAINAGE CHANNEL GRAVITY INLET STRUCTURE AND CULVERT
	DRAINAGE FLOW DIRECTION
1198	CONSTRUCTION CONTROL POINT (NOTE 11)

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. SUBGRADE ELEVATIONS CORRESPOND TO THE TOP OF PREPARED SUBGRADE, INCLUDING ANY COMPACTED FILL. SUBGRADE SHALL BE IN ACCORDANCE WITH SECTION 02200 OF THE OSDF SPECIFICATIONS. CLEARING, GRUBBING, AND STRIPPING SHALL BE IN ACCORDANCE WITH SECTION 02110 OF THE OSDF SPECIFICATIONS. THE LIMITS OF CLEARING, GRUBBING, AND STRIPPING SHALL BE NOT MORE THAN 10 FEET BEYOND THE LIMIT OF EARTHWORK CONSTRUCTION, UNLESS ALTERNATIVE REQUIREMENTS ARE GIVEN BY THE CONSTRUCTION MANAGER.
5. CELLS SHALL BE DEVELOPED STARTING WITH CELL 1 AND ENDING WITH CELL 8. THE SCHEDULE OF CELL CONSTRUCTION WILL DEPEND ON THE AVAILABILITY OF IMPACTED MATERIAL FROM THE OPERABLE UNITS.
6. MONITORING WELLS AND PIEZOMETERS WITHIN A CONSTRUCTION AREA WILL BE ABANDONED BY THE OWNER PRIOR TO CONSTRUCTION IN THAT AREA. ABANDONMENT WILL BE IN ACCORDANCE WITH ALL APPLICABLE STATE AND FEDERAL REGULATIONS.
7. DIMENSIONS SHOWN IN CELL 3 ARE TYPICAL FOR CELLS 1 THROUGH 6. DIMENSIONS SHOWN IN CELL 7 ARE TYPICAL FOR CELLS 7 THROUGH 9.
8. SUBCONTRACTOR SHALL LOCATE AND REMOVE EXISTING SUBDRAIN TILE SYSTEM WITHIN A CONSTRUCTION AREA PRIOR TO INITIATING OSDF CONSTRUCTION IN THAT AREA.
9. SUBCONTRACTOR SHALL NOT EXCAVATE TO A DEPTH OF MORE THAN 10 FEET WITHIN 50 FEET OF THE BATTERY LIMIT, UNLESS AN EXCAVATION-SPECIFIC STABILITY ANALYSIS IS PERFORMED AND SUBMITTED TO THE CONSTRUCTION MANAGER FOR APPROVAL.
10. SUBCONTRACTOR SHALL REMOVE GROUT USED TO BACKFILL GEOTECHNICAL DATA POINTS AND MONITORING WELLS LOCATED WITHIN THE PERIMETER BERM BASELINE TO A MINIMUM DEPTH OF 3 FEET BELOW SUBGRADE ELEVATIONS. GEOTECHNICAL DATA POINT LOCATIONS ARE SHOWN ON DRAWING X-7, "GEOTECHNICAL DATA POINT LOCATION PLAN". MONITORING WELLS ARE SHOWN ON DRAWING X-8, "GREAT MIAMI AQUIFER GROUND-WATER CONTOUR MAP" AND ON DRAWING X-9, "PERCHED ZONE POTENTIOMETRIC SURFACE MAP". SUBCONTRACTOR SHALL PLACE COMPACTED FILL IN THE EXCAVATED AREA IN ACCORDANCE WITH SECTION 02200 OF THE OSDF SPECIFICATIONS.
11. CONSTRUCTION CONTROL POINT TABLES ARE PROVIDED ON DRAWINGS G-38 AND G-39.

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

100 50 0 100 200
SCALE IN FEET

FOR INFORMATION ONLY

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERMCO Fernald Environmental Restoration Management Corporation
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY

TITLE:
SUBGRADE GRADING PLAN 453
233929_17

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Rudolph Bonaparte
SIGNATURE
5 Oct 1996
DATE

STATE OF OHIO
RUDOLPH BONAPARTE
E-56679
REGISTERED PROFESSIONAL ENGINEER
SEAL

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

FERMCO PROJECT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-G-00017
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-G075
SHEET NO.:	G-5
REVISION NO.:	G

FINAL DESIGN PACKAGE

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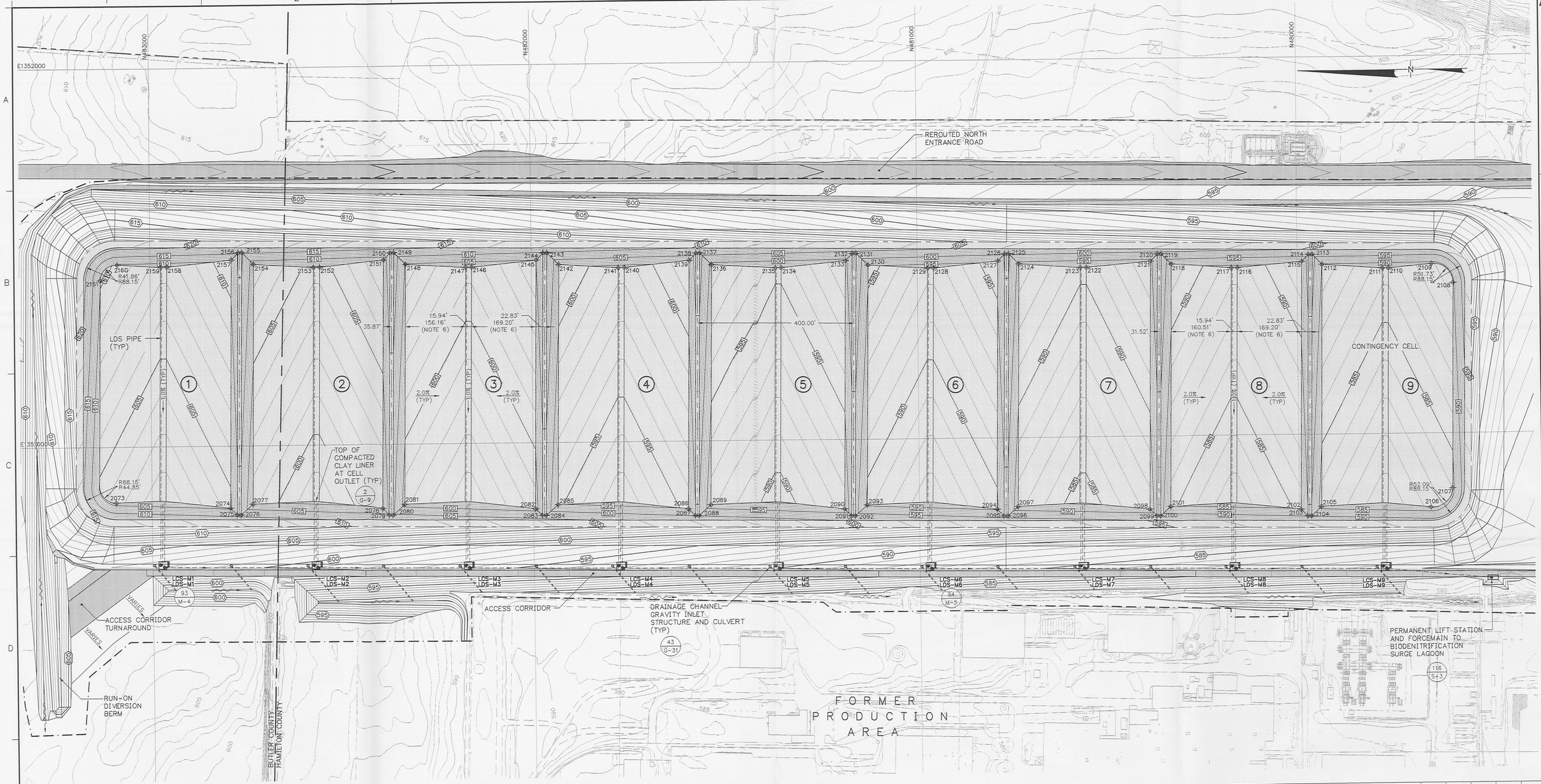

LEGEND

- 600 — EXISTING GROUND ELEVATION (FEET)
- 580 — SUBGRADE ELEVATION (FEET) (NOTE 4)
- 580 — COMPACTED CLAY LINER ELEVATION (FEET)
- BUTLER COUNTY/HAMILTON COUNTY LINE
- FEMP PROPERTY LINE
- BATTERY LIMIT
- PERIMETER BERM BASELINE
- LEACHATE TRANSMISSION SYSTEM GRAVITY LINE
- LEACHATE TRANSMISSION SYSTEM MANHOLES (LDS AND LCS) AND HORIZONTAL MONITORING WELL COVER SLAB
- LEACHATE TRANSMISSION SYSTEM PERMANENT LIFT STATION
- 1 — CELL DESIGNATION
- ACCESS CORRIDOR OR REROUTED NORTH ENTRANCE ROAD
- LIMIT OF COMPACTED CLAY LINER
- DRAINAGE CHANNEL GRAVITY INLET STRUCTURE AND CULVERT
- DRAINAGE FLOW DIRECTION
- 2077 — CONSTRUCTION CONTROL POINT (NOTE 7)

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. SUBGRADE ELEVATIONS CORRESPOND TO TOP OF THE PREPARED SUBGRADE, INCLUDING ANY COMPACTED FILL. CONSTRUCTION CONTROL POINTS FOR SUBGRADE ARE PROVIDED ON DRAWING G-5.
5. CELLS SHALL BE DEVELOPED STARTING WITH CELL. 1 AND ENDING WITH CELL 8. THE SCHEDULE OF CELL CONSTRUCTION WILL DEPEND ON THE AVAILABILITY OF IMPACTED MATERIAL FROM THE OPERABLE UNITS.
6. DIMENSIONS SHOWN IN CELL 3 ARE TYPICAL FOR CELLS 1 THROUGH 6. DIMENSIONS SHOWN IN CELL 8 ARE TYPICAL FOR CELLS 7 THROUGH 9.
7. CONSTRUCTION CONTROL POINT TABLES ARE PROVIDED ON DRAWINGS G-38 AND G-39.

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

100 50 0 100 200
SCALE IN FEET

FOR INFORMATION ONLY

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY

TITLE:
COMPACTED CLAY LINER GRADING PLAN 454
233929-18

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Rudolph Bonaparte
SIGNATURE
5 Oct 1996
DATE

STATE OF OHIO
RUDOLPH BONAPARTE
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FERMCO PROJECT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-G-00018
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-Q101
SHEET NO.:	G-6
REVISION NO.:	G

FINAL DESIGN PACKAGE

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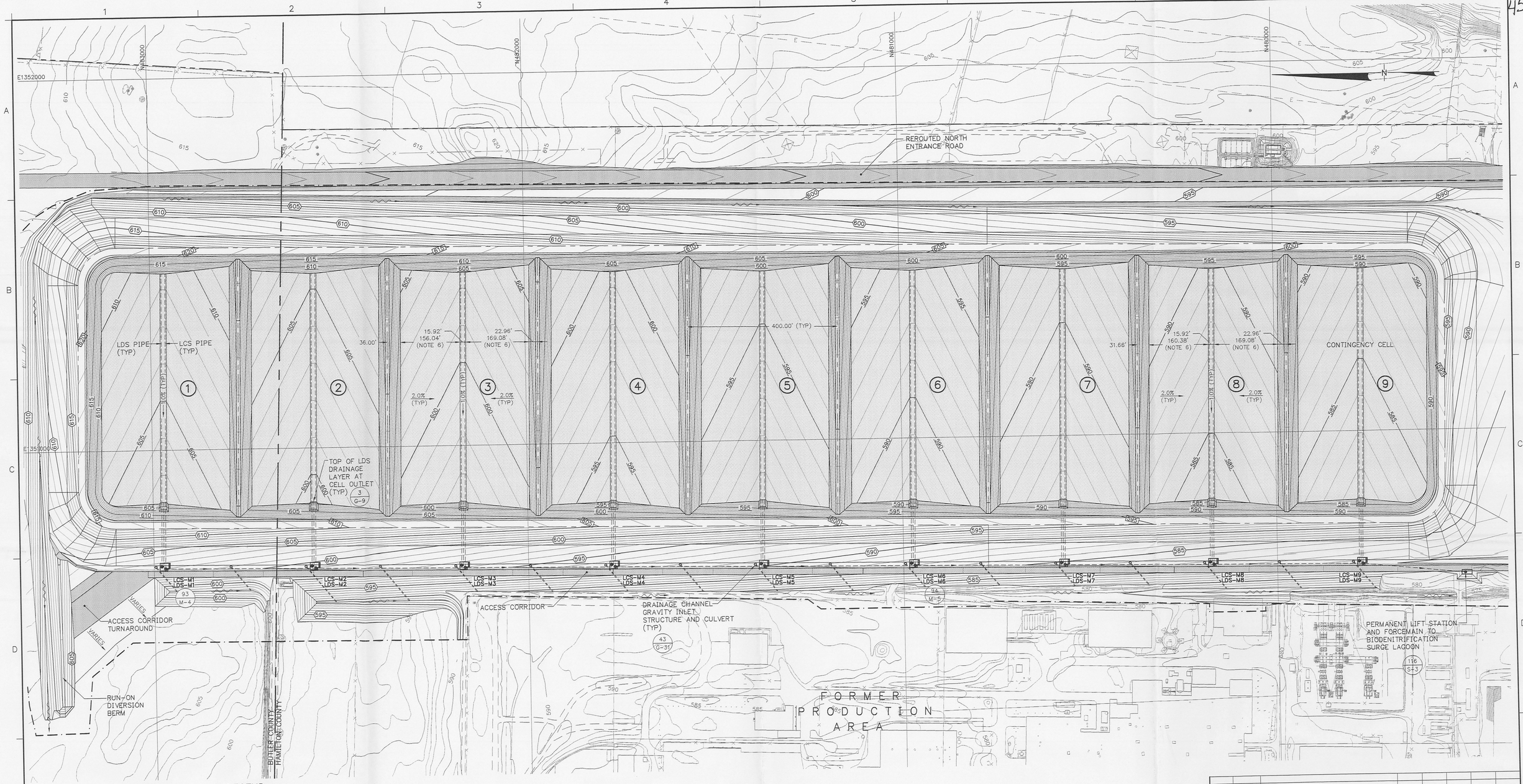

LEGEND

600	EXISTING GROUND ELEVATION (FEET)
580	SUBGRADE ELEVATION (FEET) (NOTE 4)
585	COMPACTED CLAY LINER ELEVATION (FEET)
580	LEAK DETECTION SYSTEM ELEVATION (FEET)
	BUTLER COUNTY/HAMILTON COUNTY LINE
	FEMP PROPERTY LINE
	BATTERY LIMIT
	PERIMETER BERM BASELINE
	LEACHATE TRANSMISSION SYSTEM GRAVITY LINE
	LEACHATE TRANSMISSION SYSTEM MANHOLES (LDS AND LCS) AND HORIZONTAL MONITORING WELL COVER SLAB
	LEACHATE TRANSMISSION SYSTEM PERMANENT LIFT STATION
1	CELL DESIGNATION
	ACCESS CORRIDOR OR REROUTED NORTH ENTRANCE ROAD
	LIMIT OF LEAK DETECTION SYSTEM DRAINAGE LAYER
	DRAINAGE CHANNEL GRAVITY INLET STRUCTURE AND CULVERT
	DRAINAGE FLOW DIRECTION

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. SUBGRADE ELEVATIONS CORRESPOND TO THE TOP OF PREPARED SUBGRADE, INCLUDING ANY COMPACTED FILL. CONSTRUCTION CONTROL POINTS FOR SUBGRADE ARE PROVIDED ON DRAWING G-5.
5. CELLS SHALL BE DEVELOPED STARTING WITH CELL 1 AND ENDING WITH CELL 8. THE SCHEDULE OF CELL CONSTRUCTION WILL DEPEND ON THE AVAILABILITY OF IMPACTED MATERIAL FROM THE OPERABLE UNITS.
6. DIMENSIONS SHOWN IN CELL 3 ARE TYPICAL FOR CELLS 1 THROUGH 6. DIMENSIONS SHOWN IN CELL 8 ARE TYPICAL FOR CELLS 7 THROUGH 9.

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

100 50 0 100 200
SCALE IN FEET

FOR INFORMATION ONLY

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERMCO Fernald Environmental Restoration Management Corporation
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY

TITLE:
LEAK DETECTION SYSTEM GRADING PLAN 455
233929-19

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SIGNATURE
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STATE OF OHIO
RUDOLPH BONAPARTE
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REGISTERED PROFESSIONAL ENGINEER
SEAL

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

FERMCO PROJECT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-G-00019
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-G102
SHEET NO.:	G-7
REVISION NO.:	G

FINAL DESIGN PACKAGE

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452

SYMBOLS LEGEND

EXISTING		PROPOSED
	IMPACTED MATERIAL DISPOSAL LIMIT	
	BATTERY LIMIT	
	BORROW AREA LIMIT	
	FEMP PROPERTY LINE	
	BUTLER COUNTY/HAMILTON COUNTY LINE	
	ADJACENT LANDOWNER PROPERTY LINE	
	FENCE	
	SECURITY FENCE	
	FENCE GATE	
	RAILROAD TRACK	
	PAVED ROAD, SIDEWALK, OR PARKING LOT	
	UNPAVED ROAD, SIDEWALK, OR PARKING LOT	
	CENTERLINE OR BASELINE	
	SILT FENCE	
	PROPOSED TEMPORARY STORM-WATER DRAINAGE CHANNEL	
	CREEK OR DRAINAGE COURSE	
	LEACHATE TRANSMISSION SYSTEM GRAVITY LINE	
	LEACHATE TRANSMISSION SYSTEM TEMPORARY GRAVITY LINE	
	UTILITY EASEMENT	
	WATER TABLE OR PIEZOMETRIC SURFACE	
	VEGETATION	
	DECIDUOUS TREE	
	CONIFEROUS TREE	
	TREE LINE	
	PARKING LOT STRIPING	
	CELL DESIGNATION	1
	TRAILER OR BUILDING	
	DRAINAGE FLOW DIRECTION	
	HEADWALL	
	SIGN	
	POST	
	SLOPE INDICATOR	CREST / TOE
PILE	PILE	
	TRANSMISSION TOWER	
	UTILITY, LIGHT, POWER, OR COMMUNICATION POLE	
	CATCH BASIN	
	MANHOLE	
	EXISTING AIR MONITORING STATION	
1052	TYPE 1 MONITORING WELL	
2436	TYPE 2 MONITORING WELL	
3678	TYPE 3 MONITORING WELL	
4013	TYPE 4 MONITORING WELL	
11474	GEOTECHNICAL BORING	
11631	CONE PENETROMETER TEST (CPT) SOUNDING	
1274	PIEZOMETER	
BM-10	BENCHMARK	
	LEACHATE TRANSMISSION SYSTEM MANHOLES (LDS AND LCS) AND HORIZONTAL MONITORING WELL COVER SLAB	LDS, LCS, HORIZONTAL MONITORING WELL
	LEACHATE TRANSMISSION SYSTEM PERMANENT LIFT STATION	
	CONSTRUCTION WATER STANDPIPE	
	CONSTRUCTION CONTROL POINT	
	DRAINAGE CHANNEL GRAVITY INLET STRUCTURE	
	CULVERT	

DETAIL AND SECTION IDENTIFICATION LEGEND

SEQUENTIAL DETAIL NUMBER — 31
SHEET ON WHICH ABOVE DETAIL IS PRESENTED — G-16

SEQUENTIAL DETAIL NUMBER — 31
SHEET ON WHICH ABOVE DETAIL IS REFERENCED — G-20

DETAIL
LINER SYSTEM ON CELL BASE
SCALE: 1" = 2'
FRDA4300

EXAMPLE: DETAIL NUMBER 31, WHICH IS PRESENTED ON SHEET G-16, WAS REFERENCED ON SHEET G-20.

C / G-24

C / G-24 — SECTION LETTER; SHEET ON WHICH ABOVE SECTION IS PRESENTED

SECTION LETTER — C
SHEET ON WHICH ABOVE SECTION IS REFERENCED — G-5

SECTION
CELL PERIMETER
SCALE: 1" = 2'
FRDA4300

EXAMPLE: SECTION LETTER "C", WHICH IS PRESENTED ON SHEET G-24, WAS REFERENCED ON SHEET G-5.

ABBREVIATIONS

ACCMP	ALUMINUM COATED CORRUGATED METAL PIPE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
BAMR	BORROW AREA MANAGEMENT AND RESTORATION
℄	BASELINE
BM	BENCHMARK
℄	CENTERLINE
CG&E	CINCINNATI GAS AND ELECTRIC
CMP	CORRUGATED METAL PIPE
CO.	COMPANY
CPT	CONE PENETROMETER TEST
CSA	CONSTRUCTION SITE ACCESS
DECON	DECONTAMINATION
DIA	DIAMETER
DOE	DEPARTMENT OF ENERGY
EL	ELEVATION
FEMP	FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
H:V	HORIZONTAL TO VERTICAL LENGTH RATIO FOR A SLOPE
ID	INSIDE DIAMETER
IMP	IMPACTED MATERIAL PLACEMENT
INC.	INCORPORATED
IP	IRON PIN
IPS	IRON PIPE SIZE
LCS	LEACHATE COLLECTION SYSTEM
LCS-M*	LEACHATE COLLECTION SYSTEM MANHOLE DESIGNATION
LDS	LEAK DETECTION SYSTEM
LDS-M*	LEAK DETECTION SYSTEM MANHOLE DESIGNATION
LTS	LEACHATE TRANSMISSION SYSTEM
(MAX)	MAXIMUM
(MIN)	MINIMUM
NAD	NORTH AMERICAN DATUM
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NGVD	NATIONAL GEODETIC VERTICAL DATUM
NO.	NUMBER
NPT	NATIONAL PIPE THREAD
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OSDF	ON-SITE DISPOSAL FACILITY
RCP	REINFORCED CONCRETE PIPE
SWMECP	SURFACE WATER MANAGEMENT AND EROSION CONTROL PLAN
SWRB	STORM-WATER RETENTION BASIN
TBD	TO BE DETERMINED
(TYP)	TYPICAL
WAC	WASTE ACCEPTANCE CRITERIA
WWF	WELDED WIRE FABRIC

UTILITY LEGEND

EXISTING		PROPOSED
UE	UNDERGROUND ELECTRIC	
P	PRIMARY ELECTRIC SERVICE	
L	LIGHTING SERVICE	
WW	WASTE WATER LINE	
TWW	TEMPORARY WET WELL	
PWW	PERMANENT WET WELL	
OHE	OVERHEAD ELECTRIC	
G	ELECTRIC GROUND	
ST	STORM SEWER	
SD	SUB-SURFACE DRAINAGE	
SN	SANITARY SEWER	
FO1	FIRE-PROTECTION	
DW	DRINKING WATER	
CN	STEAM CONDENSATE	
WS	WATER SUPPLY	
MR	COOLING WATER RETURN	
CW	CONTAMINATED WATER	
T	TELEPHONE	
FG	FUEL GAS	
FT	FILTRATE OR EFFLUENT	
FO	FUEL OIL	
LS	LIVE STEAM	
TW	PROCESS WATER	
DT	DEIONIZED FEED	
DW	DEIONIZED WATER	
BR	BRINE	
RW	RAW WATER	
A	ALARM	
VE	VENT LINE	
PA	PLANT AIR	
SA	INSTRUMENT AIR SUPPLY	
	ABANDONED	

CONTOUR LEGEND

EXISTING		PROPOSED
580	EXISTING GROUND ELEVATION (FEET)	
	SUBGRADE ELEVATION (FEET)	580
	COMPACTED CLAY LINER ELEVATION (FEET)	590
	LEAK DETECTION SYSTEM ELEVATION (FEET)	600
	LEACHATE COLLECTION SYSTEM ELEVATION (FEET)	600
	PROTECTIVE LAYER ELEVATION (FEET)	600
	CONTOURING LAYER ELEVATION (FEET)	600
	FINISHED GRADE ELEVATION (FEET)	590
35	GRAY TILL ISOPACH (FEET) (DASHED WHERE INFERRED)	
580	BROWN TILL/GRAY TILL INTERFACE ELEVATION (FEET) (DASHED WHERE INFERRED)	
520	MINIMUM GROUND-WATER ELEVATION (FEET) (DASHED WHERE INFERRED)	
523	MAXIMUM GROUND-WATER ELEVATION (FEET) (DASHED WHERE INFERRED)	

GENERAL NOTES

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR THE GEOSYNTHETICS, WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY.
5. SURVEY COORDINATES AND DIMENSIONS SHOWN SHALL BE USED FOR CONSTRUCTION. DRAWING SHALL NOT BE SCALED TO OBTAIN LOCATIONS AND DIMENSIONS.
6. BATTERY LIMIT DEFINES THE LIMIT OF THIS DESIGN PACKAGE FOR THE OSDF AND SUPPORT FACILITIES AND THE LOCATION OF INTERFACES WITH OTHER DESIGN PACKAGES.
7. THE TERM "IMPACTED MATERIAL" REFERS TO THAT MATERIAL MEETING OSDF WASTE ACCEPTANCE CRITERIA (WAC) DESTINED FOR OSDF DISPOSAL. "SELECT IMPACTED MATERIAL" LOCATIONS SHOWN ON THESE DRAWINGS SHALL CONSIST OF IMPACTED MATERIAL THAT MEETS THE REQUIREMENTS OF SECTION 13010 OF THE OSDF SPECIFICATIONS.
8. THE TERM "SUBCONTRACTOR" REFERS TO THE PARTY SUBCONTRACTED BY FERMCO TO CONSTRUCT, FILL, AND/OR CLOSE ALL, OR A SPECIFIED PORTION, OF THE OSDF.

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

FOR INFORMATION ONLY

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERMCO — FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY

TITLE:
LEGEND AND SYMBOLS

233 929-2

438

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Rudolph Bonaparte
SIGNATURE

8 Oct 1996
DATE

STATE OF OHIO — RUDOLPH BONAPARTE — E-56679 — REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
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FERMCO PROJECT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-X-00002
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-0026
SHEET NO.:	X-2
REVISION NO.:	G

FINAL DESIGN PACKAGE

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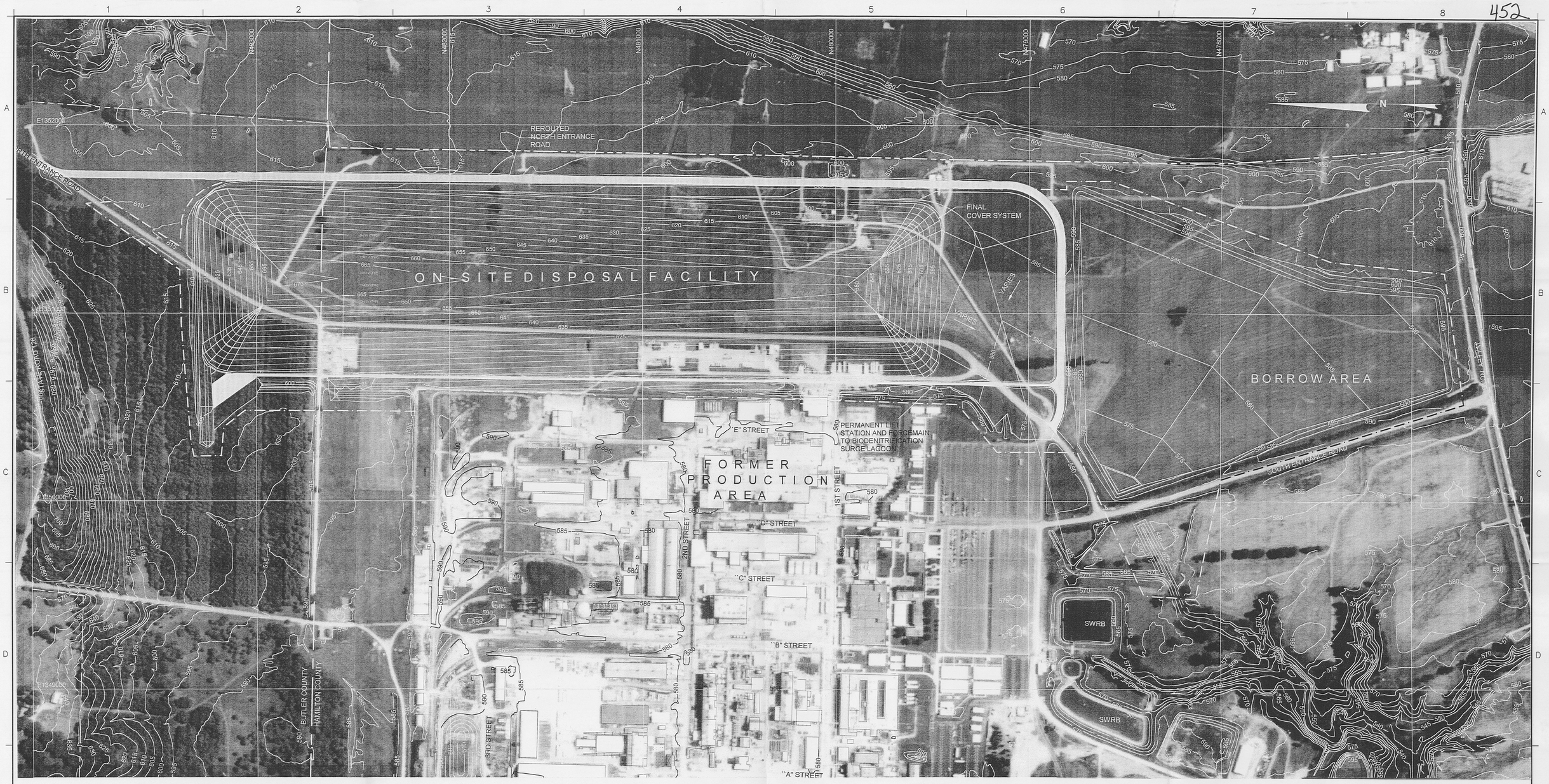
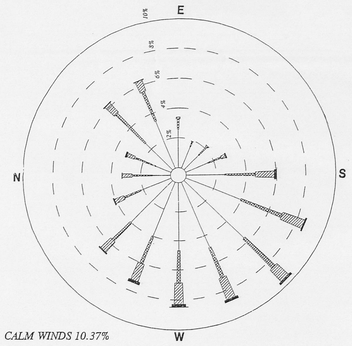


FEMP 94-95 (10 m level)

January 1-December 31; Midnight-11 PM



SOURCE: FEMP EMERGENCY OPERATIONS CENTER

LEGEND

600	EXISTING GROUND ELEVATION (FEET)
595	FINISHED GRADE ELEVATION (FEET)
	BUTLER COUNTY/HAMILTON COUNTY LINE
	FEMP PROPERTY LINE
	BATTERY LIMIT

NOTES:

1. EXISTING GROUND ELEVATIONS BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. THE PURPOSE OF THIS DRAWING IS TO SHOW A SCALED SITE PHOTOGRAPH WITH 5-FOOT CONTOUR INTERVALS, PROPOSED CONFIGURATION OF THE OSDF, BATTERY LIMIT, BORROW AREA, AND THE FORMER PRODUCTION AREA. THIS DRAWING SHALL NOT BE USED TO OBTAIN CONTRUCTION CONTROL INFORMATION AND IS FOR ILLUSTRATION PURPOSES ONLY.
5. FINAL COVER SYSTEM ELEVATIONS CORRESPOND TO THE TOP OF THE TOPSOIL COMPONENT OF THE FINAL COVER SYSTEM.
6. WIND ROSE DATA FROM FEMP EMERGENCY OPERATIONS CENTER.

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

200 100 0 200 400
SCALE IN FEET

FOR INFORMATION ONLY

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
Fernald Environmental Restoration Management Corporation
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY

TITLE:
FACILITY PLOT PLAN 439
233929_3

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Rudolph Bonaparte
SIGNATURE
8 Oct 1996
DATE

STATE OF OHIO
RUDOLPH BONAPARTE
E-56679
REGISTERED PROFESSIONAL ENGINEER
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GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
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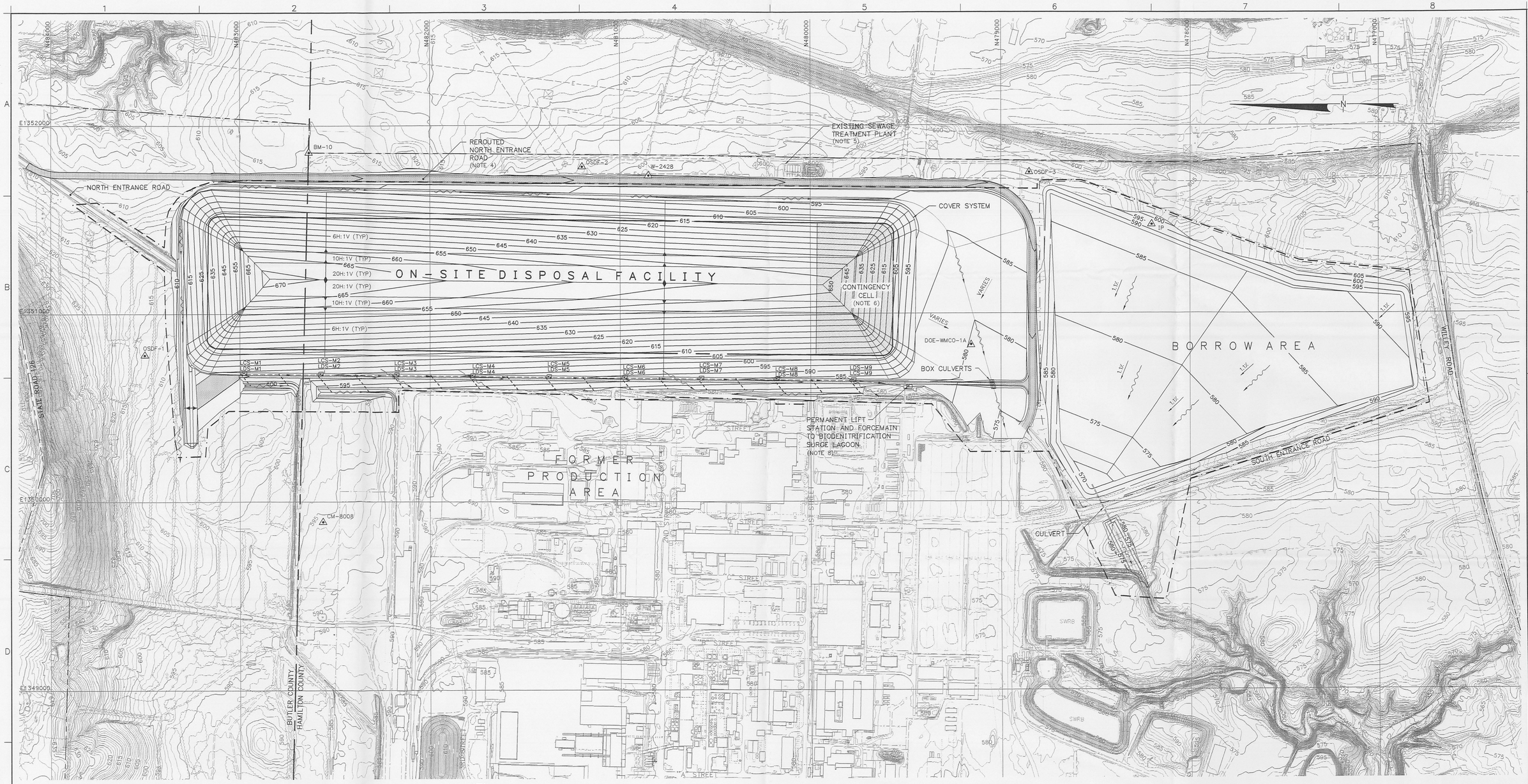
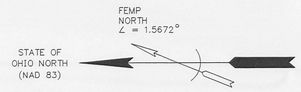
FERMCO PROJECT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-X-00003
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-G083
SHEET NO.:	X-3
REVISION NO.:	G

FINAL DESIGN PACKAGE

R:\F96-G083 Thu Oct 03 15:09:25 1996 J MILLER



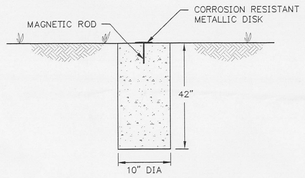


LEGEND

600	EXISTING GROUND ELEVATION (FEET)
600	FINISHED GRADE ELEVATION (FEET)
	BUTLER COUNTY/HAMILTON COUNTY LINE
	FEMP PROPERTY LINE
	BATTERY LIMIT
	IMPACTED MATERIAL DISPOSAL LIMIT
	BORROW AREA LIMIT
	LEACHATE TRANSMISSION SYSTEM GRAVITY LINE
	LEACHATE TRANSMISSION SYSTEM AND HORIZONTAL MONITORING WELL AND COVER SLAB
	LEACHATE TRANSMISSION SYSTEM PERMANENT LIFT STATION
	ACCESS CORRIDOR OR REROUTED NORTH ENTRANCE ROAD
	DRAINAGE FLOW DIRECTION
OSDF-1	BENCHMARK
	DRAINAGE CHANNEL GRAVITY INLET STRUCTURE
	CULVERT

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. LOCATION OF REROUTED NORTH ENTRANCE ROAD PHASE II OBTAINED FROM DRAWING G0001, "CIVIL SITE PLAN", OF THE "REROUTED NORTH ENTRANCE ROAD CONSTRUCTION DRAWINGS, OPERABLE UNIT 2 PROJECT ORDER 158, REVISION 0", PARSONS, APRIL 1996. EXISTING NORTH ENTRANCE ROAD WILL BE REROUTED PRIOR TO OSDF CONSTRUCTION. SUBCONTRACTOR SHALL DECOMMISSION ABANDONED NORTH ENTRANCE ROAD AS NECESSARY WITHIN BATTERY LIMIT TO CONSTRUCT OSDF.
5. EXISTING SEWAGE TREATMENT PLANT WILL BE DECOMMISSIONED PRIOR TO CONSTRUCTION OF THE OSDF IN THAT AREA.
6. CONTINGENCY CELL WILL ONLY BE CONSTRUCTED IF NEEDED FOR DISPOSAL OF IMPACTED MATERIAL FROM THE OPERABLE UNITS. CONTINGENCY VOLUME IS PROVIDED TO ACCOUNT FOR OVEREXCAVATION OF IMPACTED MATERIAL AND/OR IDENTIFICATION OF ADDITIONAL VOLUME OF IMPACTED MATERIAL AS A RESULT OF CONFIRMATORY SAMPLING ACTIVITES. ONLY ON-SITE MATERIAL SATISFYING THE OSDF WASTE ACCEPTANCE CRITERIA WILL BE DISPOSED IN THE OSDF. IF THE CONTINGENCY CELL IS NOT DEVELOPED, THE SOUTHERN LIMIT OF THE ODSF WILL MOVE 400 FEET TO THE NORTH.
7. MONITORING WELLS AND PIEZOMETERS WITHIN THE CONSTRUCTION AREA WILL BE ABANDONED BY THE OWNER PRIOR TO CONSTRUCTION IN A GIVEN AREA. ABANDONMENT WILL BE IN ACCORDANCE WITH APPLICABLE STATE AND FEDERAL REGULATIONS.
8. SEE SEPARATE DESIGN PACKAGE FOR THE DESIGN OF THE FORCEMAIN (LEACHATE TRANSMISSION SYSTEM CONNECTOR) FROM THE PERMANENT LIFT STATION TO THE BIODENITRIFICATION SURGE LAGOON (INCLUDES LIFT STATION PUMP REQUIREMENTS AND DOUBLE-WALL HDPE FORCEMAIN).
10. SUBCONTRACTOR SHALL CONSTRUCT A PERMANENT SECURITY FENCE WITH GATES TO CONTROL ACCESS TO THE OSDF AFTER CLOSURE. THE FENCE SHALL BE LOCATED OUTSIDE THE TOE OF SLOPE OF THE OSDF AND LOCATED SO AS NOT TO INHIBIT FLOW AT LOCATIONS WHERE SURFACE WATER DRAINAGE FEATURES ARE CROSSED. SEE FENCE DETAILS ON DRAWING S-5.
11. SURVEY BENCH MARKS SHALL BE IN ACCORDANCE WITH SECTION 02100 OF THE OSDF SPECIFICATIONS.



SURVEY BENCHMARK

(NOTE 11)
SCALE: NTS

BENCHMARKS

NUMBER	NORTHING	EASTING	ELEVATION	STATUS
IRON PIN (IP)	478205.578945	1351472.814296	603.32	EXISTING
DOE-WMCO-1A	479157.594871	1350835.053430	585.57	EXISTING
W-2428	480850.128823	1351732.754450	600.79	EXISTING
BM-10	482638.021627	1351857.894919	615.87	EXISTING
CM-8008	482566.059750	1349891.816756	593.98	EXISTING
OSDF-1	483500.000000	1350780.000000	–	PROPOSED
OSDF-2	482200.000000	1351780.000000	–	PROPOSED
OSDF-3	478850.000000	1351750.000000	–	PROPOSED

FINAL DESIGN PACKAGE

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

200 100 0 200 400
SCALE IN FEET

FOR INFORMATION ONLY

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT: ON-SITE DISPOSAL FACILITY

TITLE: SITE PLAN

233929_4

440

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Rudolph Bonaparte
SIGNATURE

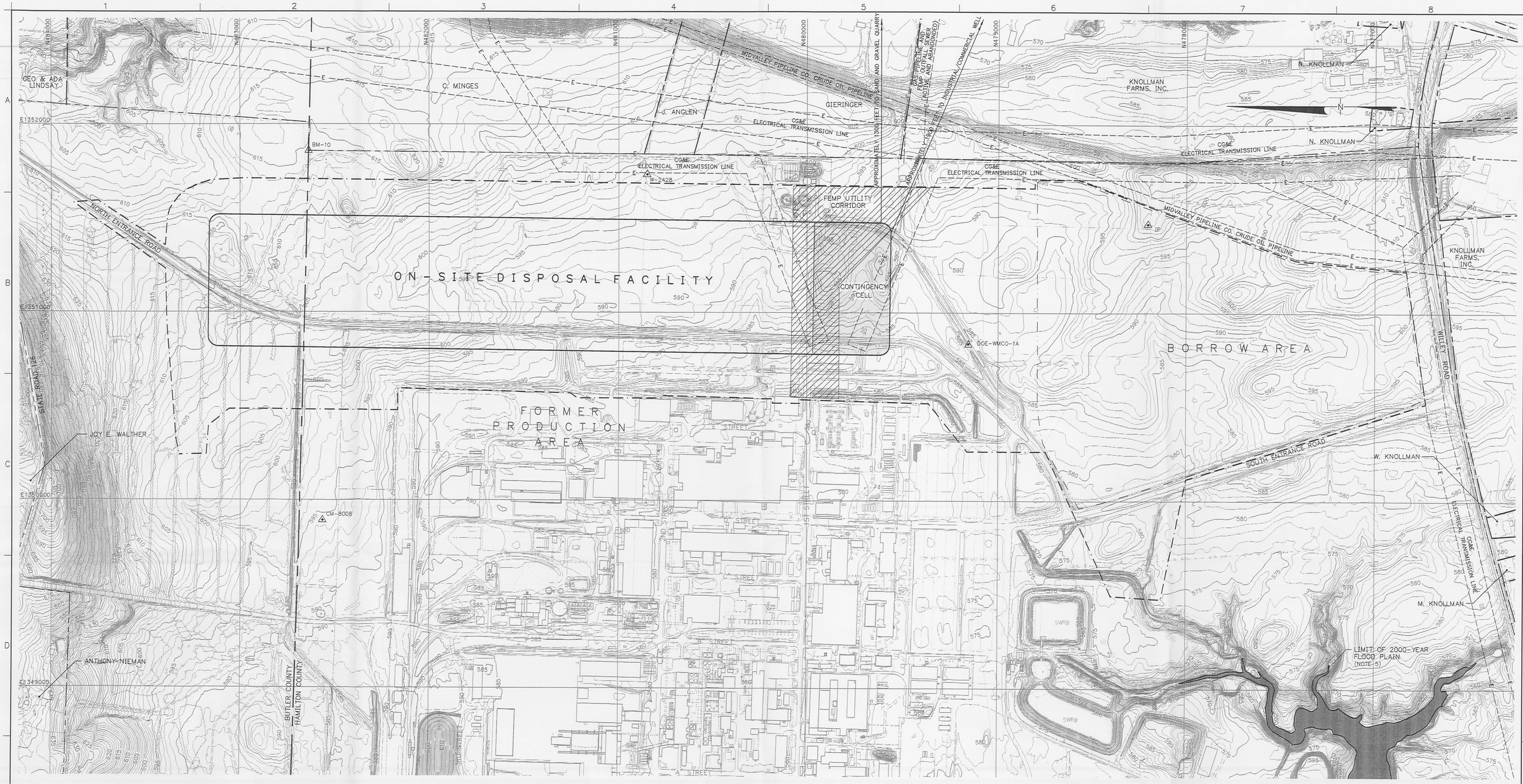
5 Oct 1996
DATE

STATE OF OHIO
RUDOLPH BONAPARTE
E-56679
REGISTERED PROFESSIONAL ENGINEER
SEAL

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

FERMCO CONTRACT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-X-00004
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-G024
SHEET NO.:	X-4
REVISION NO.:	G

452



LEGEND

500	EXISTING GROUND ELEVATION (FEET)
	BUTLER COUNTY/HAMILTON COUNTY LINE
	FEMP PROPERTY LINE
	ADJACENT OWNER PROPERTY LINE
	BATTERY LIMIT
	IMPACTED MATERIAL DISPOSAL LIMIT
	BORROW AREA LIMIT
E	UTILITY EASEMENT
BM-10	BENCHMARK (NOTE 6)

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. THE 100-YEAR AND 500-YEAR FLOOD PLAINS FOR PADDYS RUN ARE OUTSIDE THE EXTENT OF THIS MAP.
5. LIMIT OF 2,000-YEAR FLOOD PLAIN OBTAINED FROM FIGURE 52, "PADDY'S RUN 2,000-YEAR FLOOD PLAIN BOUNDARY (WILLEY ROAD AREA)", OF THE "2,000-YEAR FLOOD AND PROBABLE MAXIMUM FLOOD SITEWIDE FLOOD PLAIN DETERMINATION CALCULATIONS, CERCLA/RCRA UNIT 2, PROJECT ORDER 148, REVISION 0", PARSONS, NOVEMBER 1995.
6. BENCHMARK COORDINATES AND ELEVATIONS ARE SHOWN ON DRAWING X-4, "SITE PLAN".
7. SURROUNDING LAND USES WITHIN 1000 FEET OF THE IMPACTED MATERIAL DISPOSAL LIMIT ARE CLASSIFIED AS AGRICULTURE/OPEN LAND.

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

200 100 0 200 400
SCALE IN FEET

FOR INFORMATION ONLY

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY

TITLE:
SURROUNDING LAND USE MAP 441
23929.5

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

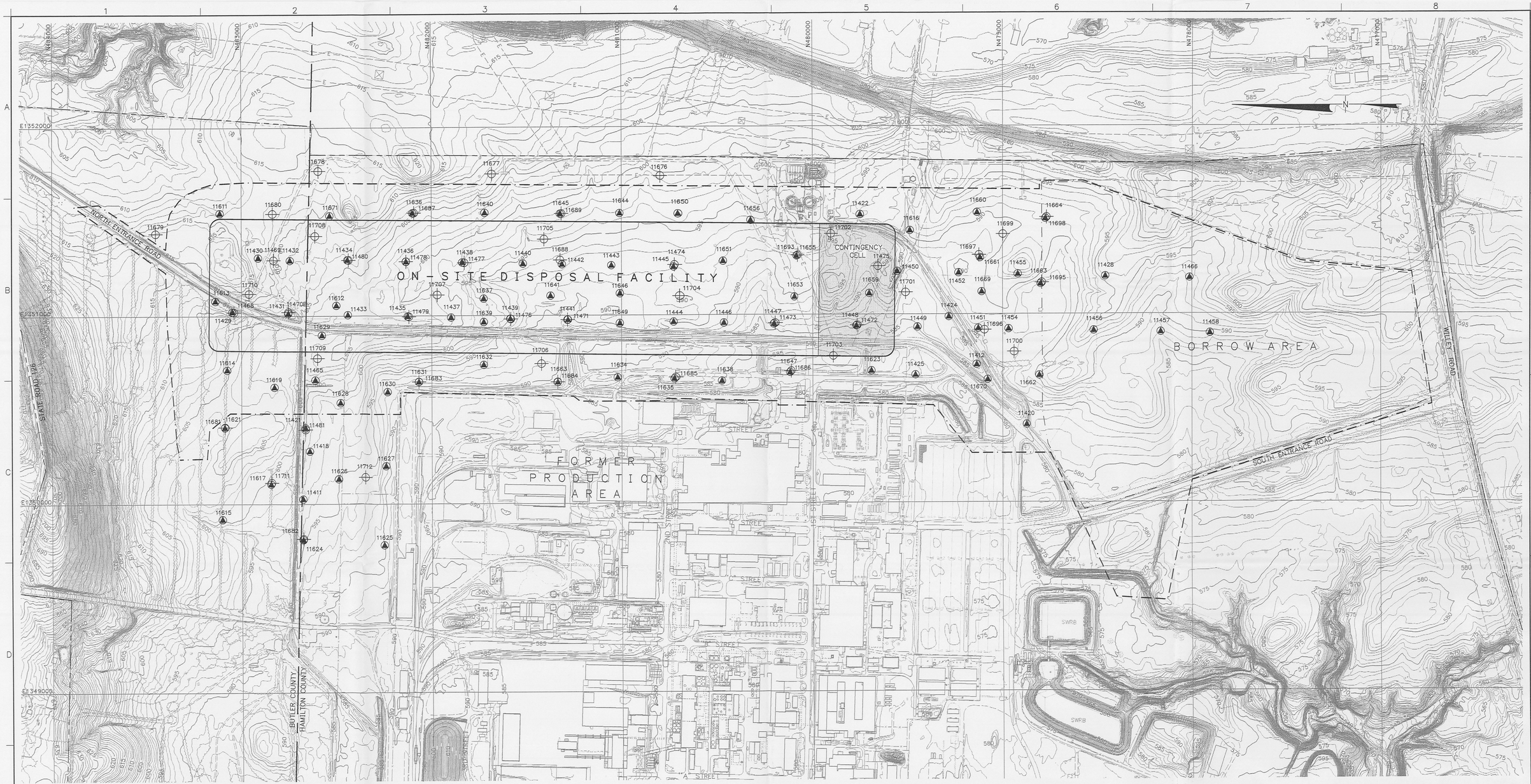
Rudolph Bonaparte
SIGNATURE
5 Oct 1996
DATE

STATE OF OHIO
RUDOLPH BONAPARTE
E-56679
REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

FERMCO CONTRACT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-X-00005
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-0093
SHEET NO.:	X-6
REVISION NO.:	G

FINAL DESIGN PACKAGE



LEGEND

600	EXISTING GROUND ELEVATION (FEET)
	BUTLER COUNTY/HAMILTON COUNTY LINE
	FEMP PROPERTY LINE
	BATTERY LIMIT
	IMPACTED MATERIAL DISPOSAL LIMIT
	BORROW AREA LIMIT
11615	CONE PENETROMETER TEST (CPT) SOUNDING
11431	GEOTECHNICAL BORING

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. DRAWING MODIFIED FROM FIGURE 2-1, "PREDESIGN INVESTIGATION MONITORING WELL, BORING, LYSIMETER [SIC], AND CONE PENETROMETER LOCATIONS", OF THE "PREDESIGN INVESTIGATION, AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995.
5. CONE PENETROMETER TEST (CPT) SOUNDING INFORMATION OBTAINED FROM APPENDIX A AND GEOTECHNICAL BORING INFORMATION OBTAINED FROM APPENDIX F OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995.
6. CPT SOUNDING AND GEOTECHNICAL BORING COORDINATES CONVERTED FROM STATE PLANAR NAD 1927 TO STATE PLANAR NAD 1983 OHIO SOUTH BY GEOSYNTEC.
7. SUBCONTRACTOR SHALL REMOVE GROUT USED TO BACKFILL GEOTECHNICAL BORINGS LOCATED WITHIN THE PERIMETER BERM BASELINE SHOWN ON DRAWING G-5, "SUBGRADE GRADING PLAN", TO A MINIMUM DEPTH OF 3 FEET BELOW SUBGRADE ELEVATION. SUBCONTRACTOR SHALL PLACE COMPACTED FILL IN THE EXCAVATED AREA IN ACCORDANCE WITH SECTION 02200 OF THE OSDF SPECIFICATIONS.
8. DUPLICATE CPT NUMBERS ARE SHOWN AT LOCATIONS WHERE THE INITIAL PENETRATION COULD NOT BE ADVANCED TO THE REQUIRED DEPTH AND A SECOND PENETRATION WAS ADVANCED TO THE REQUIRED DEPTH ADJACENT TO THE INITIAL PENETRATION.
9. LOCATIONS OF GEOTECHNICAL BORINGS AND CONE PENETROMETER TEST SOUNDINGS WILL BE UPDATED FOR THE INDIVIDUAL CERTIFIED FOR CONSTRUCTION PACKAGES IN ACCORDANCE WITH SECTION 1.4 OF THE FINAL DESIGN CALCULATION PACKAGE.

CONE PENETRATION TESTS			
	COORDINATES (1983 NAD)		GROUND SURFACE
NO.	NORTHING	EASTING	
11411	482,650.94	1,350,018.85	596.69
11412	479,009.43	1,350,561.07	582.75
11418	482,650.94	1,350,230.23	598.73
11420	478,836.12	1,350,413.63	582.33
11421	482,641.07	1,350,440.73	599.44
11422	479,747.38	1,351,529.10	592.59
11424	479,352.76	1,351,060.25	586.59
11425	479,462.12	1,351,678.45	579.88
11428	478,458.09	1,351,214.34	594.87
11429	483,044.98	1,351,020.91	610.13
11430	483,045.58	1,351,311.90	617.71
11431	482,775.78	1,351,013.81	605.79
11432	482,743.79	1,351,295.43	608.60
11433	482,442.87	1,351,005.16	603.00
11434	482,442.84	1,351,298.74	606.04
11435	482,127.23	1,350,997.60	602.10
11436	482,133.99	1,351,291.80	600.95
11437	481,897.84	1,350,992.31	600.03
11438	481,838.95	1,351,285.28	598.47
11439	481,585.81	1,350,986.25	593.99
11440	481,519.93	1,351,278.57	594.36
11441	481,325.77	1,350,980.85	589.00
11442	481,315.22	1,351,275.01	593.18
11443	481,049.44	1,351,269.27	592.55
11444	480,725.60	1,350,969.75	590.01
11445	480,727.39	1,351,261.50	591.53
11446	480,464.85	1,350,964.03	587.83
11447	480,201.27	1,350,957.41	585.36
11448	479,768.79	1,350,948.78	584.88
11449	479,448.01	1,350,941.69	584.23
11450	479,555.62	1,351,238.01	591.39
11451	479,155.53	1,350,936.41	587.04
11452	479,232.95	1,351,231.66	589.44
11454	478,967.61	1,350,932.65	587.25
11455	478,919.11	1,351,224.71	592.53
11456	478,519.69	1,350,924.27	592.97
11457	478,165.79	1,350,916.08	586.14
11458	477,903.94	1,350,910.46	589.00
11465	482,611.22	1,350,659.60	601.23
11466	478,011.80	1,351,206.03	591.89
11611	483,113.79	1,351,543.09	612.75
11612	482,503.41	1,351,052.28	603.24
11613	483,136.96	1,351,079.36	613.29
11614	483,077.79	1,350,714.23	605.22
11615	483,101.92	1,349,924.73	599.69
11616	479,490.75	1,351,444.85	590.80
11617	482,847.40	1,350,105.71	599.70
11619	482,829.03	1,350,619.17	603.82

CONE PENETRATION TESTS			
	COORDINATES (1983 NAD)		GROUND SURFACE
NO.	NORTHING	EASTING	
11621	483,088.40	1,350,411.85	603.41
11623	479,694.81	1,350,699.18	582.69
11624	482,679.39	1,349,805.62	595.18
11625	482,252.58	1,349,781.06	589.82
11626	482,493.31	1,350,133.26	595.22
11627	482,243.22	1,350,206.58	590.69
11627	482,243.05	1,350,201.68	590.64
11628	482,482.19	1,350,537.57	598.05
11629	482,576.83	1,350,897.51	603.28
11629	482,579.66	1,350,894.14	603.38
11630	482,233.43	1,350,597.31	591.53
11630	482,233.99	1,350,595.11	591.42
11631	482,069.10	1,350,648.77	590.90
11632	481,728.79	1,350,737.76	593.20
11634	481,022.46	1,350,668.40	588.06
11635	480,725.49	1,350,661.45	587.95
11636	482,101.57	1,350,543.29	605.16
11636	482,104.51	1,350,543.28	605.21
11637	481,728.56	1,351,088.21	596.64
11638	480,480.44	1,350,648.07	585.13
11639	481,727.51	1,350,963.93	597.96
11640	481,722.80	1,351,543.59	602.42
11641	481,377.67	1,351,101.72	591.03
11644	481,011.11	1,351,540.58	597.10
11645	481,327.40	1,351,537.78	599.07
11646	481,010.33	1,351,115.30	590.75
11647	480,125.71	1,350,691.94	592.37
11649	480,999.60	1,350,948.96	590.24
11650	480,706.15	1,351,537.33	595.37
11651	480,472.29	1,351,285.11	591.88
11651	480,479.22	1,351,284.74	592.19
11653	480,101.25	1,351,093.26	588.97
11655	480,082.47	1,351,314.24	592.08
11656	480,326.96	1,351,500.64	593.63
11659	479,705.29	1,351,110.08	588.10
11660	479,136.66	1,351,539.87	590.70
11661	479,121.13	1,351,299.58	588.44
11661	479,121.42	1,351,303.03	588.37
11662	478,807.07	1,350,673.48	590.75
11662	478,805.81	1,350,668.90	590.65
11663	478,800.47	1,351,160.62	587.92
11663	481,338.59	1,350,644.39	588.66
11664	478,776.23	1,351,507.28	590.44
11669	479,112.57	1,351,118.52	590.15
11670	479,081.69	1,351,652.28	588.14
11671	482,538.35	1,351,530.08	609.36
11680	482,539.80	1,351,529.12	609.24
11680	482,837.28	1,351,542.87	612.49

GEOTECHNICAL BORINGS			
	COORDINATES (1983 NAD)		GROUND SURFACE
NO.	NORTHING	EASTING	
11468	483,039.84	1,351,018.05	610.04
11469	482,830.31	1,351,298.75	610.19
11470B	482,790.71	1,351,042.41	606.96
11471	481,282.81	1,350,976.29	589.14
11472	479,765.76	1,350,939.74	584.63
11473	480,196.20	1,350,949.67	585.61
11474	480,720.45	1,351,255.61	591.94
11475	479,656.67	1,351,231.56	594.38
11476	481,586.16	1,350,980.71	594.12
11477	481,831.18	1,351,279.70	598.27
11478	482,133.05	1,351,291.73	601.35
11479	482,120.19	1,350,995.94	602.56
11480	482,448.04	1,351,297.95	606.28
11481	482,660.50	1,350,405.12	599.89
11676	480,798.00	1,351,739.00	598.90
11677	481,684.41	1,351,752.04	607.37
11678	482,596.61	1,351,770.39	612.79
11679	483,450.03	1,351,438.62	616.48
11680	482,836.27	1,351,543.57	612.23
11681	483,087.46	1,350,409.81	603.41
11682	482,678.01	1,349,813.50	595.19
11683	482,068.47	1,350,648.72	591.22
11684	481,339.62	1,350,644.79	588.90
11685	480,721.77	1,350,663.00	588.17
11686	480,124.05	1,350,695.40	582.44
11687	482,092.90	1,351,546.03	605.18
11688	481,326.34	1,351,293.21	593.78
11689	481,325.75	1,351,533.64	598.88
11693	480,088.52	1,351,312.37	592.02
11695	478,802.56	1,351,164.79	588.08
11696	479,098.42	1,350,915.67	587.52
11697	479,129.57	1,351,314.11	588.41
11698	478,775.33	1,351,504.25	590.00
11699	478,999.72	1,351,423.85	589.13
11700	478,941.16	1,350,798.64	587.61
11701	479,513.45	1,351,115.51	586.35
11702	479,904.61	1,351,428.94	594.56
11703	479,893.07	1,350,780.18	584.12
11704	480,697.66	1,351,101.05	589.98
11705	481,410.54	1,351,404.44	596.16
11706	481,425.61	1,350,742.84	590.92
11707	481,972.87	1,351,110.22	600.24
11708	482,613.73	1,351,425.69	608.69
11709	482,602.65	1,350,774.40	604.32
11710	482,960.12	1,351,118.36	612.95
11711	482,843.41	1,350,113.43	600.16
11712	482,351.29	1,350,142.05	593.34

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

SCALE IN FEET: 200 100 0 200 400

FOR INFORMATION ONLY

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERMCO — FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY

TITLE:
GEOTECHNICAL DATA POINT LOCATION PLAN 442
233929_6

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

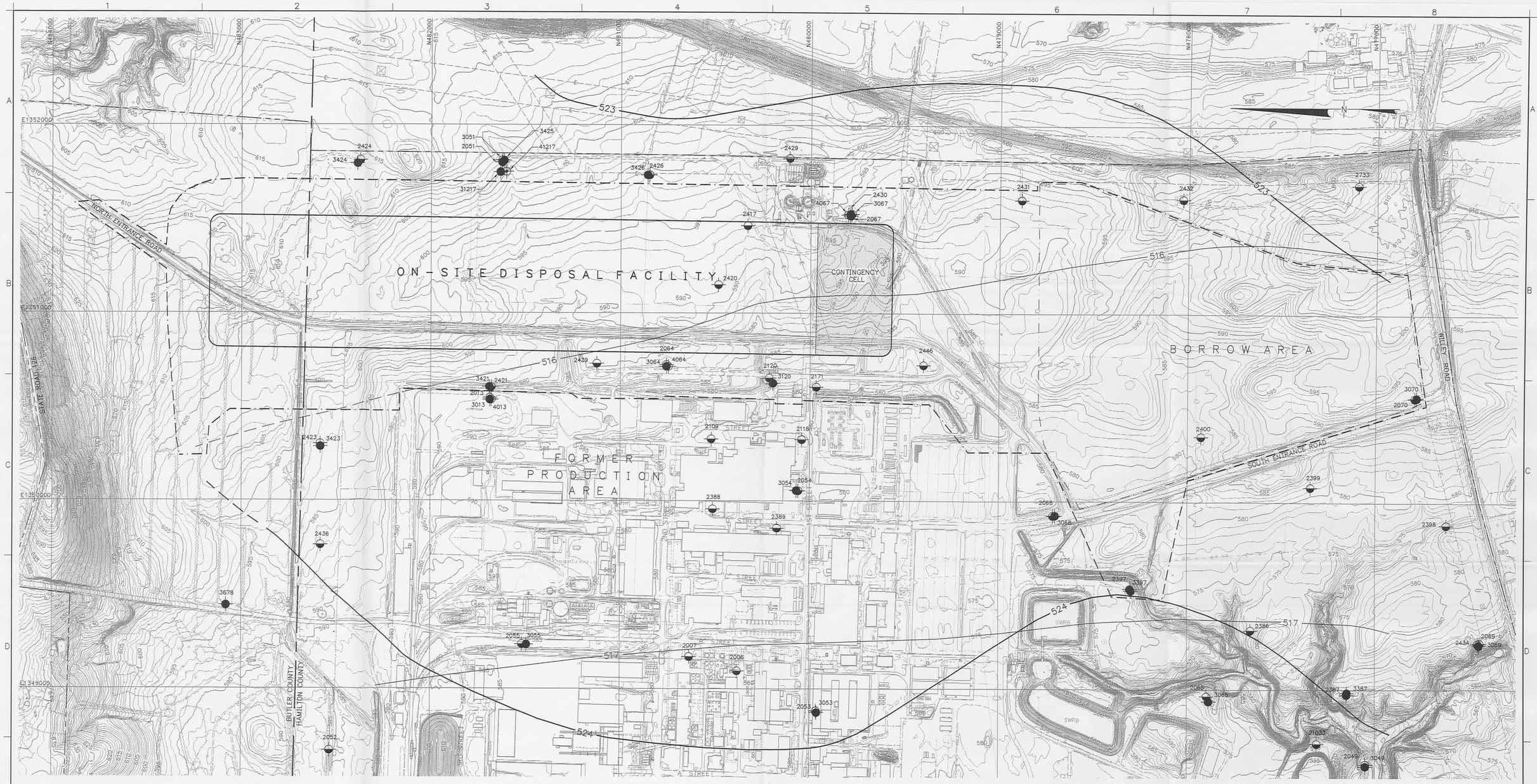
Rudolph Bonaparte
SIGNATURE
5 Oct 1996
DATE

STATE OF OHIO — RUDOLPH BONAPARTE — E-56679 — REGISTERED PROFESSIONAL ENGINEER
SEAL

GeoSyntec Consultants
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

FERMCO CONTRACT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-X-00006
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-0004
SHEET NO.:	X-7
REVISION NO.:	G

FINAL DESIGN PACKAGE



LEGEND

600	EXISTING GROUND ELEVATION (FEET)
524	MAXIMUM GROUND-WATER ELEVATION (FEET) (DASHED WHERE INFERRED)
517	MINIMUM GROUND-WATER ELEVATION (FEET) (DASHED WHERE INFERRED)
	BUTLER COUNTY/HAMILTON COUNTY LINE
	FEMP PROPERTY LINE
	BATTERY LIMIT
	IMPACTED MATERIAL DISPOSAL LIMIT
	BORROW AREA LIMIT
2055	TYPE 2 MONITORING WELL
3678	TYPE 3 MONITORING WELL
4064	TYPE 4 MONITORING WELL

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. GREAT MIAMI AQUIFER GROUND-WATER CONTOURS OBTAINED FROM FIGURE 3-51, "MAXIMUM GROUNDWATER ELEVATIONS, TYPE 2 WELLS JUNE 1990", AND FIGURE 3-52, "MINIMUM GROUNDWATER ELEVATIONS, TYPE 2 WELLS, NOVEMBER 1988", OF THE "REMEDIAL INVESTIGATION REPORT FOR OPERABLE UNIT 5, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT, REMEDIAL INVESTIGATION AND FEASIBILITY STUDY", U.S. DEPARTMENT OF ENERGY, MARCH 1995.
5. MONITORING WELL INFORMATION OBTAINED FROM FERMCO COMPUTER FILE "DATA.WK3".
6. LOCATIONS OF MONITORING WELLS WILL BE UPDATED FOR THE INDIVIDUAL CERTIFIED FOR CONSTRUCTION PACKAGES IN ACCORDANCE WITH SECTION 1.4 OF THE FINAL DESIGN CALCULATION PACKAGE.

MONITORING WELLS (NOTE 5)

NO.	COORDINATES (1983 NAD) NORTHING	COORDINATES (1983 NAD) EASTING	ELEVATION GROUND SURFACE	ELEVATION WELL SCREEN TOP	ELEVATION WELL SCREEN BOTTOM
2006	480,382.82	1,349,094.60	579.60	526.60	511.60
2007	480,634.89	1,349,169.53	579.48	524.48	509.48
2013	481,681.35	1,350,537.90	588.80	514.80	510.80
2049	477,049.86	1,348,603.06	541.20	523.20	508.20
2051	481,626.48	1,351,810.93	607.40	522.40	507.40
2052	482,536.56	1,348,670.69	585.10	525.10	510.10
2053	479,964.50	1,348,883.24	578.10	524.80	509.80
2054	480,060.21	1,350,054.34	579.50	517.50	502.50
2055	481,517.48	1,349,234.96	584.40	521.40	506.40
2064	480,749.51	1,350,714.94	587.80	522.80	507.80
2065	477,895.87	1,348,965.38	571.50	525.00	510.00
2067	479,790.41	1,351,527.98	593.20	–	–
2068	478,712.38	1,349,922.00	578.10	–	–
2069	476,445.65	1,349,236.61	574.20	–	–
2070	476,781.37	1,350,560.02	592.10	499.30	489.90
2109	480,521.75	1,350,329.36	578.70	518.70	503.70
2118	480,042.54	1,350,326.85	579.00	521.00	506.00
2120	480,216.32	1,350,654.03	582.50	524.10	509.10
2171	479,967.31	1,350,607.31	581.10	521.10	506.10
2386	477,663.26	1,349,314.99	575.20	524.20	509.20
2387	477,148.47	1,348,972.17	569.60	523.60	508.60
2388	480,512.56	1,349,955.83	578.90	526.80	511.80
2389	480,173.30	1,349,853.25	579.20	527.20	512.20
2397	478,300.02	1,349,526.06	574.50	527.50	512.20
2398	476,619.41	1,349,877.24	578.81	523.87	508.87
2399	477,343.94	1,350,079.81	581.00	521.70	506.70
2400	477,928.86	1,350,346.82	580.70	520.70	505.70
2417	480,332.90	1,351,464.84	593.00	523.00	508.00
2420	480,486.57	1,351,150.73	591.10	521.10	506.10
2421	481,681.26	1,350,605.32	586.90	521.90	506.90
2423	482,585.94	1,350,301.63	597.30	520.30	505.30
2424	482,376.45	1,351,811.93	614.40	524.40	509.69
2426	480,850.24	1,351,733.70	598.69	524.69	509.69
2429	480,112.01	1,351,824.02	600.15	526.15	511.15
2430	479,783.18	1,351,528.30	593.53	524.53	509.53
2431	478,886.20	1,351,606.01	592.23	524.23	509.23
2432	478,031.61	1,351,613.27	603.45	525.45	510.45
2434	476,441.53	1,349,247.11	574.30	522.80	507.80
2436	482,583.85	1,349,761.84	593.57	528.57	513.57
2439	481,123.95	1,350,730.35	590.57	525.57	510.57
2446	479,399.20	1,350,724.34	582.51	525.51	510.51
2733	477,100.05	1,351,692.04	604.90	527.90	512.90
21033	477,307.46	1,348,712.21	573.58	526.58	511.58

MONITORING WELLS (NOTE 5)

NO.	COORDINATES (1983 NAD) NORTHING	COORDINATES (1983 NAD) EASTING	ELEVATION GROUND SURFACE	ELEVATION WELL SCREEN TOP	ELEVATION WELL SCREEN BOTTOM
3013	481,689.15	1,350,537.18	588.80	480.80	472.80
3049	477,050.57	1,348,592.44	540.70	462.70	452.70
3051	481,617.48	1,351,809.53	607.20	473.30	463.30
3053	479,961.31	1,348,874.54	578.51	467.91	457.91
3054	480,069.69	1,350,055.45	579.90	469.00	459.00
3055	481,494.21	1,349,233.52	586.70	475.90	465.90
3064	480,759.94	1,350,715.19	588.10	460.70	450.70
3065	477,885.44	1,348,937.97	571.70	461.70	451.70
3067	479,789.54	1,351,519.16	593.40	473.40	463.40
3068	478,701.59	1,349,923.56	577.90	457.90	447.90
3069	476,451.52	1,349,244.65	574.60	459.60	449.60
3070	476,791.60	1,350,557.08	591.40	461.40	451.40
3120	480,196.63	1,350,628.18	581.90	461.60	451.60
3387	477,146.65	1,348,982.67	570.00	461.60	451.60
3397	478,305.80	1,349,534.54	575.26	465.26	455.26
3421	481,692.05	1,350,605.70	586.80	456.80	446.80
3423	482,585.09	1,350,286.71	597.10	469.10	459.10
3424	482,392.18	1,351,793.59	614.00	454.00	444.00
3425	481,627.49	1,351,800.01	607.50	455.50	445.50
3426	480,860.32	1,351,733.15	598.20	453.20	443.20
3678	483,079.52	1,349,442.45	595.80	502.80	492.80
31217	481,636.33	1,351,748.13	606.07	454.07	444.07
4013	481,688.71	1,350,547.78	588.30	388.30	378.30
4064	480,759.64	1,350,724.59	588.30	390.30	380.10
4067	479,802.02	1,351,525.38	593.30	393.30	383.30
41217	481,605.27	1,351,750.27	605.37	388.37	378.37

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

200 100 0 200 400
SCALE IN FEET

FOR INFORMATION ONLY

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY 443

TITLE:
GREAT MIAMI AQUIFER GROUND-WATER CONTOUR MAP
233929-7

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

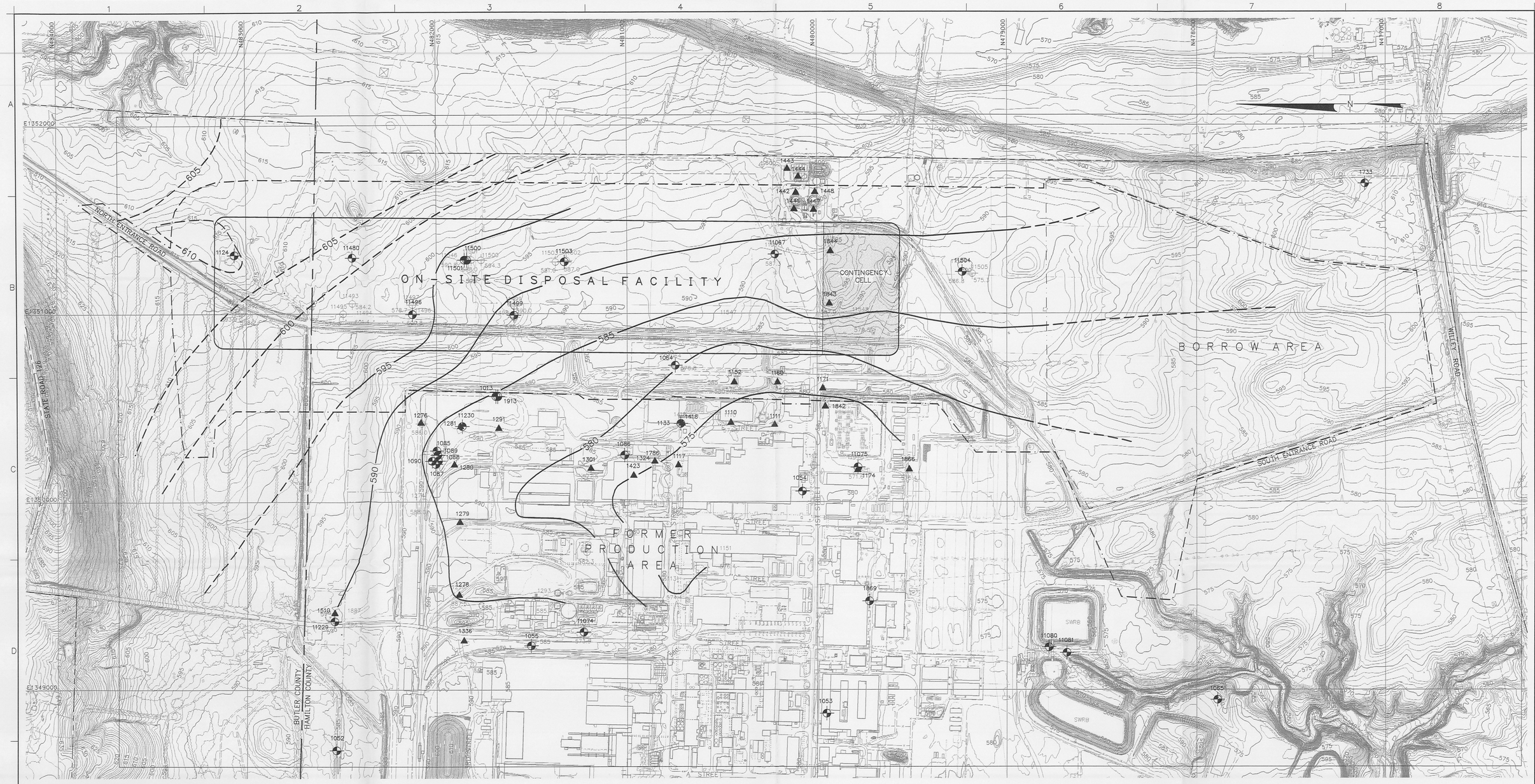
Rudolph Bonaparte
SIGNATURE
5 Oct 1996
DATE

STATE OF OHIO
RUDOLPH BONAPARTE
E-56679
REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

FERMCO CONTRACT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-X-00007
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-0005
SHEET NO.:	X-8
REVISION NO.:	G

FINAL DESIGN PACKAGE



LEGEND

600	EXISTING POTENTIOMETRIC SURFACE (FEET)
595	PERCHED ZONE POTENTIOMETRIC SURFACE ELEVATION (FEET) (DASHED WHERE INFERRED)
	BUTLER COUNTY/HAMILTON COUNTY LINE
	FEMP PROPERTY LINE
	BATTERY LIMIT
	IMPACTED MATERIAL DISPOSAL LIMIT
	BORROW AREA LIMIT
1336	PIEZOMETER (NOTE 5)
1229	TYPE 1 MONITORING WELL (NOTE 5)

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD].)
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. PERCHED ZONE POTENTIOMETRIC SURFACE OBTAINED FROM FIGURE 2-20, "PERCHED GROUNDWATER CONTOURS FOR WELLS SCREENED ACROSS THE BROWN/GRAY INTERFACE", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995.
5. MONITORING WELL AND PIEZOMETER INFORMATION OBTAINED FROM FERMCO COMPUTER FILE "DATA.WK3".
6. PERCHED ZONE POTENTIOMETRIC SURFACE IS BASED ON ELEVATIONS MEASURED BETWEEN OCTOBER 1994 AND FEBRUARY 1995 IN MONITORING WELLS SCREENED ACROSS THE BROWN TILL/GRAY TILL INTERFACE.
7. LOCATIONS OF MONITORING WELLS AND PIEZOMETERS WILL BE UPDATED FOR THE INDIVIDUAL CERTIFIED FOR CONSTRUCTION PACKAGES IN ACCORDANCE WITH SECTION 1.4 OF THE FINAL DESIGN CALCULATION PACKAGE.

TYPE 1 MONITORING WELLS (NOTE 5)

NO.	COORDINATES (1983 NAD) NORTHING	EASTING	GROUND SURFACE	ELEVATION WELL SCREEN TOP	BOTTOM
1013	481,689.45	1,350,559.68	588.90	—	—
1052	482,535.99	1,348,678.58	585.40	568.90	558.90
1053	479,950.36	1,348,873.06	578.70	571.70	560.60
1054	480,079.66	1,350,055.13	579.80	572.20	579.80
1055	481,505.56	1,349,234.29	586.50	578.60	567.50
1064	480,748.20	1,350,724.01	588.00	570.00	560.00
1065	477,889.38	1,348,947.00	571.40	568.40	557.80
1085	481,999.79	1,350,270.53	590.50	585.50	575.50
1086	481,013.95	1,350,247.41	590.40	585.40	575.40
1087	481,992.43	1,350,217.35	590.10	585.10	575.10
1088	482,006.65	1,350,199.84	590.10	585.10	575.10
1089	481,995.46	1,350,247.44	590.30	585.30	575.30
1090	482,024.87	1,350,215.43	590.10	585.10	575.10
1124	483,062.56	1,351,314.14	580.32	—	—
1133	480,719.05	1,350,414.54	580.32	575.32	570.52
1733	477,109.82	1,351,687.50	604.70	578.70	575.70
1869	479,725.51	1,349,472.75	576.87	568.37	566.37
1913	481,679.49	1,350,558.93	588.60	—	—
11067	480,223.10	1,351,313.70	590.71	573.71	571.71
11074	481,228.50	1,349,308.34	582.90	568.10	563.10
11075	479,784.75	1,350,182.54	579.49	569.69	564.69
11080	478,780.90	1,349,226.77	568.60	559.40	557.40
11081	478,686.13	1,349,197.03	568.00	558.80	556.80
11229	482,546.35	1,349,365.47	590.54	578.24	573.24
11230	481,866.55	1,350,399.51	595.24	585.74	583.74
11480	482,448.04	1,351,297.95	606.28	—	—
11496	482,126.19	1,350,995.25	602.65	593.70	585.70
11499	481,593.24	1,350,991.08	594.68	579.70	572.70
11500	481,840.14	1,351,284.36	598.93	579.90	573.40
11501	481,853.44	1,351,285.22	598.97	566.00	562.00
11503	481,327.01	1,351,275.97	593.47	569.50	565.50
11504	479,235.18	1,351,219.87	590.02	576.00	572.00

PIEZOMETERS (NOTE 5)

NO.	COORDINATES (1983 NAD) NORTHING	EASTING	GROUND SURFACE	ELEVATION WELL SCREEN TOP	BOTTOM
1110	480,455.69	1,350,420.77	580.30	572.10	567.10
1111	480,225.57	1,350,409.05	579.70	573.50	568.50
1117	480,732.88	1,350,193.45	578.90	568.70	563.70
1152	480,440.42	1,350,636.60	577.69	572.69	576.69
1160	480,212.65	1,350,635.49	582.12	576.12	572.62
1171	479,971.11	1,350,601.56	580.60	577.60	572.80
1174	479,786.28	1,350,167.68	579.39	574.89	570.09
1276	482,081.74	1,350,415.97	590.51	573.51	570.51
1278	481,884.27	1,349,504.33	588.82	583.32	578.32
1279	481,880.51	1,349,889.40	589.87	580.57	575.67
1280	481,907.42	1,350,193.96	587.08	574.08	569.08
1281	481,873.41	1,350,395.30	584.19	577.19	572.19
1291	481,684.92	1,350,390.86	588.47	585.97	580.97
1301	481,190.80	1,350,180.36	585.58	578.78	573.98
1324	480,857.91	1,350,212.80	580.50	575.50	567.00
1336	481,858.67	1,349,259.84	589.13	581.43	568.43
1423	480,962.31	1,350,148.23	583.09	576.49	570.49
1441	480,121.40	1,351,552.40	594.10	586.60	576.60
1442	480,114.55	1,351,641.67	596.71	592.71	587.71
1443	480,152.53	1,351,763.46	598.80	590.80	580.80
1444	480,099.57	1,351,723.33	600.33	590.33	585.33
1447	480,020.94	1,351,550.16	595.60	593.10	588.10
1448	480,015.79	1,351,642.84	596.60	592.10	582.10
1510	482,549.03	1,349,408.86	591.00	587.50	582.50
1786	480,857.93	1,350,212.70	580.55	576.05	566.05
1842	479,956.65	1,350,503.90	578.78	568.78	566.78
1843	479,935.00	1,351,053.37	591.37	574.87	572.87
1844	479,930.33	1,351,331.92	593.12	578.12	576.12
1866	479,517.36	1,350,173.44	576.80	573.30	571.30

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

200 100 0 200 400
SCALE IN FEET

FOR INFORMATION ONLY

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT:
ON-SITE DISPOSAL FACILITY 444

TITLE:
PERCHED ZONE POTENTIOMETRIC SURFACE MAP
239929.8

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

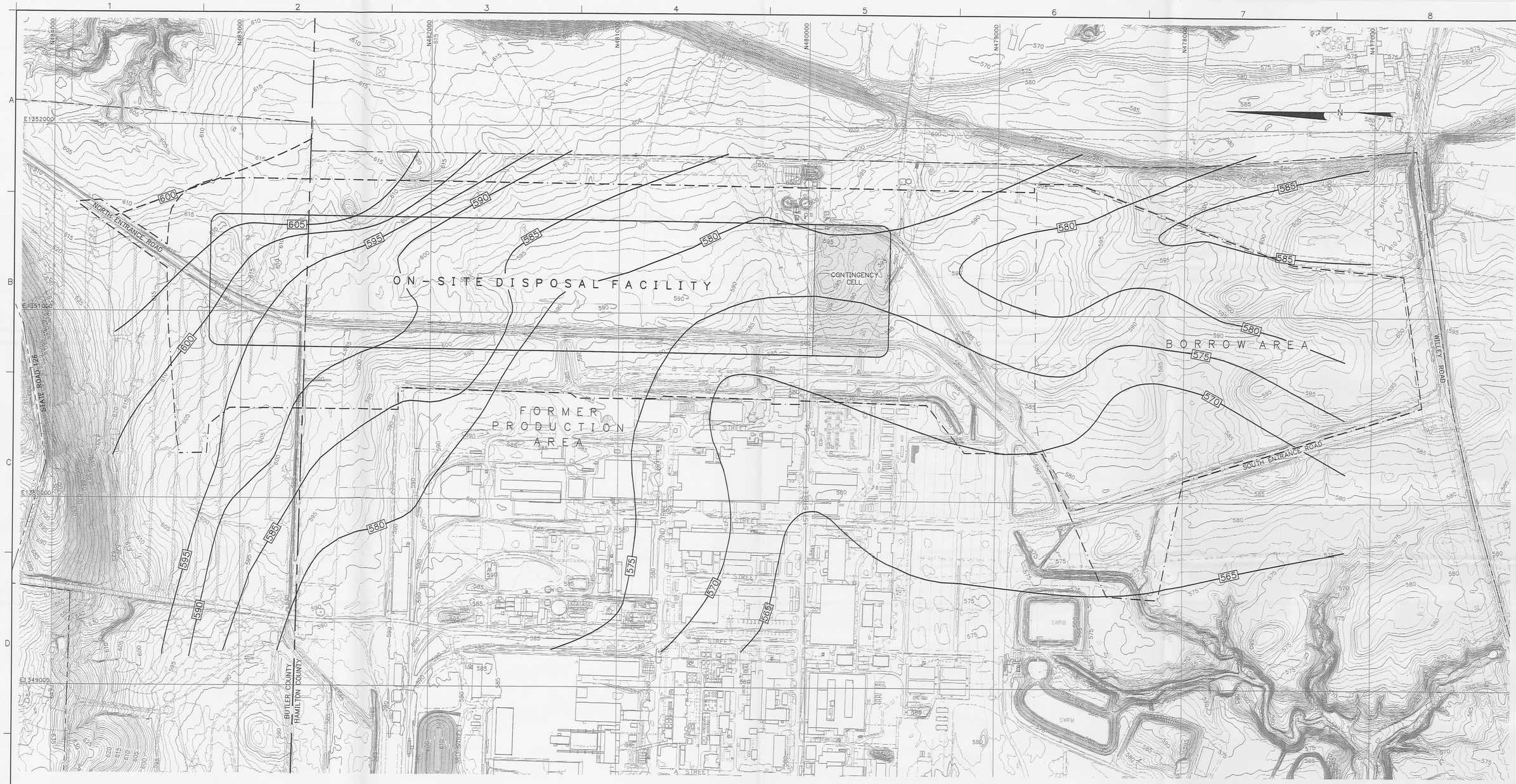
Rudolph Bonaparte
SIGNATURE
5 Oct 1996
DATE

STATE OF OHIO
RUDOLPH BONAPARTE
E-56679
REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

FERMCO CONTRACT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-X-00008
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-G006
SHEET NO.:	X-9
REVISION NO.:	G

FINAL DESIGN PACKAGE



LEGEND

600	EXISTING GROUND ELEVATION (FEET)
580	BROWN TILL/GRAY TILL INTERFACE ELEVATION (FEET) (DASHED WHERE INFERRED)
	BUTLER COUNTY/HAMILTON COUNTY LINE
	FEMP PROPERTY LINE
	BATTERY LIMIT
	IMPACTED MATERIAL DISPOSAL LIMIT
	BORROW AREA LIMIT

NOTES:

1. TOPOGRAPHIC MAP BASED ON 1992 SITE FLYOVER.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD])
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. BROWN TILL/GRAY TILL INTERFACE CONTOURS OBTAINED FROM FIGURE 3-3, "BROWN TILL/GRAY TILL INTERFACE SURFACE", OF THE "PREDESIGN INVESTIGATION AND SITE SELECTION REPORT FOR THE ON-SITE DISPOSAL FACILITY, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT", U.S. DEPARTMENT OF ENERGY, JULY 1995.

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
G	11.10.96	FINAL SUBMITTAL TO EPA	DLVL	JRM	LA	KWC	RB
F	25.06.96	PREFINAL SUBMITTAL TO EPA					

200 100 0 200 400
SCALE IN FEET

FOR INFORMATION

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FERMCO Restoration Management Corporation
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION

PROJECT: ON-SITE DISPOSAL FACILITY 445

TITLE: BROWN TILL/GRAY TILL INTERFACE CONTOUR MAP

233929-9

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

Rudolph Bonaparte
SIGNATURE

6 Oct 1996
DATE

STATE OF OHIO
RUDOLPH BONAPARTE
REGISTERED PROFESSIONAL ENGINEER
SEAL

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

FERMCO CONTRACT NO.:	20100
FERMCO SUBCONTRACT NO.:	95PS005028
FERMCO DRAWING NO.:	90X-6000-X-00009
GEOSYNTEC PROJECT NO.:	GE3900-13.1
GEOSYNTEC DOCUMENT NO.:	F96-G007
SHEET NO.:	X-10
REVISION NO.:	G

FINAL DESIGN PACKAGE