Department of Energy

Ohio Field Office
Fernald Closure Project
175 Tri-County Parkway
Springdale, Ohio 45246
(513) 648-3155

FEB 2 3 2005

DOE-0164-05

Mr. James A. Saric, Remedial Project Director
U.S. Environmental Protection Agency
Region V-SR-6J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 E. 5th Street
Dayton, OH 45402-2911

Dear Mr. Saric and Mr. Schneider:

TRANSMITTAL OF THE REVISED ON-SITE DISPOSAL FACILITY PHASE V CERTIFIED-FOR-CONSTRUCTION DRAWINGS INCLUDING EXPANSION OF CELL 8

References:

1) Letter DOE-0157-04, W. Taylor to J. Saric/T. Schneider, "Transmittal of the Revised Final On-Site Disposal Facility Phase V Design Package – Cell Liners 6 through 8 and Cell Final Covers 3 Through 8," dated February 19, 2004

2) Letter DOE-0315-04, W. Taylor to J. Saric/T. Schneider, "Transmittal of the On-Site Disposal Facility Cell 8 Expansion Design Change," dated June 29, 2004

3) Letter, J. Saric to J. Reising, "OSDF Cell 8 Expansion," dated August 24, 2004

4) Letter, T. Schneider to W. Taylor, "Approval Cell 8 Expansion Design Change," dated October 26, 2004

Enclosed are the revised On-Site Disposal Facility (OSDF) Phase V Certified-for-Construction (CFC) Drawings. This revised package is being transmitted for your information and includes approved changed to the OSDF Cell 8 configuration as described in Design Change Notice (DCN) 20105-005. This package includes the entire Phase V CFC package. The following

drawings of this package have been revised or added since the initial issuance of the Phase V CFC package on February 19, 2004:

- X-1 – Title Sheet I
- G-2A – Site Development Plan III – Cell 8
- G-6A – Subgrade Grading Plan V – Cell 8 Liner System
- G-7A – Compacted Clay Liner Grading Plan II – Cell 8 Liner System
- G-11 – Final Cover System Contouring Layer Grading Plan II – Cells 6 and 7
- G-11A – Final Cover System Contouring Layer Grading Plan III – Cell 8 (new drawing)
- G-13A – Final Cover System Compacted Clay Cap Grading Plan III – Cell 8
- G-15A – Final Cover System Grading Plan III – Cell 8
- G-16 – Final Cover System Staged Closure Grading Plan – Cells 7 and 8
- G-18 – Impacted Material Haul Road Grading Plan and Details II
- G-18A – Impacted Material Haul Road Grading Plan and Details III
- G-20A – OSDF North-South Sections III
- G-23A – OSDG West-East Sections IV
- G-30 – Liner System Details II
- G-43B – Surface-Water Management System Details X
- G-46 – Impacted Material Placement Details II

Also included is the final revised Cell 8 Expansion Supplemental Calculation Package. These calculations were included in the DCN 20105-005 submittal and approved by both the U.S. Environmental Protection Agency (USEPA) and Ohio Environmental Protection Agency (OEPA). A copy of the Cell 8 final cover quantities is also enclosed for your information.

The above-listed drawings and calculations references to previously submitted OSDF Phase V construction drawings and specifications. These reference drawings and specifications may be found in the OSDF Phase V package, which was submitted to the USEPA and OEPA on February 19, 2004 per the above-listed reference.

If you have any questions or require additional information, please contact Johnny Reising at (513) 648-3139.

Sincerely,

Johnny Reising

for William J. Taylor
Director

FCP:Reising

Enclosures: As Stated

cc w/enclosures:
D. Pfister, OH/FCP
J. Reising, OH/FCP
M. Cullerton, Tetra Tech
M. Shupe, HSI GeoTrans
AR Coordinator, Fluor Fernald, Inc./MS78

cc w/o enclosures:
G. Jablonowski, USEPA-V, SR-6J
F. Bell, ATSDR
R. Vandegrift, ODH
K. Alkema, Fluor Fernald, Inc./MS01
J. Chiou, Fluor Fernald, Inc./MS64
C. Murphy, Fluor Fernald, Inc./MS77
D. Powell, Fluor Fernald, Inc./MS64
ECDC, Fluor Fernald, Inc./MS52-7

Document 6774

CELL 8 EXPANSION SUPPLEMENTAL CALCULATION PACKAGE

ON-SITE DISPOSAL FACILITY REVISION OF OSDF PHASE V PROJECT NUMBER 20105

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

prepared by

GEOSYNTEC CONSULTANTS

1255 Roberts Boulevard, NW
Suite 200
Kennesaw, Georgia 30144

under

Fluor Fernald, Inc.
Contract No. 03FF0699

Attachment to:
F-0424
DOE-0164-05

REVISION 1
FEBRUARY 2005

SECTION 2.4

2.4 OSDF CAPACITY VERIFICATION – CELL 8 EXPANSION

COMPUTATION COVER SHEET

SUBJECT OF COMPUTATIONS OSDF Capacity Calculation – Cell 8

Computations By:
(Cognizant Engineer)

Signature [signature] Date 02-15-05

Printed Name and Title: Leslie M. Griffin, Project Engineer

Assumptions and Procedures
Checked By:
(Checker)

Signature [signature] Date 2-15-05

Printed Name and Title: Tamara E. Zettler, Engineer

Computations
Checked by:

Signature [signature] Date 2-15-05

Printed Name and Title: Tamara E. Zettler, Engineer

Computations Backchecked by:
(Cognizant Engineer)

Signature [signature] Date 02-15-05

Printed Name and Title: Leslie M. Griffin, Project Engineer

Approved by:
(PDP)

Signature [signature] Date 2-15-05

Printed Name and Title: Tamara E. Zettler, Engineer

Approved by:
(DTL / TETL)

Signature [signature] Date 15 Feb 2005

Printed Name and Title: John F. Beech, Principal

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
A	DCN – Cell 8 Expansion	16 June 04	LMG LMG	TEZ TZ	
0	Rev. 0 Submittal to FF/DOE/EPA	15 Feb 05	LMG LMG	TEZ TZ	JFB JFB

OSDF CAPACITY CALCULATION
CELL 8 EXPANSION

EXECUTIVE SUMMARY

PURPOSE OF ANALYSIS

The purpose of this calculation package is to present the OSDF capacity for Cell 8.

METHODS OF ANALYSIS

The capacity for Cell 8 was estimated using the computer program Autodesk® Civil Design 3 within Autodesk® Land Desktop 3.

CONCLUSIONS

The following table provides the estimated capacity for Cell 8.

	OSDF CAPACITY (CY)
CELL 8	397,219

Written by: LMG Date: 6/16/2004 Reviewed by: TEZ Date: 06/16/04

Client: Flour Fernald Project: Cell 8 Expansion Project/Proposal No.: GQ3309 Task No.: 02

OSDF CAPACITY CALCULATION
CELLS 7 AND 8

Table Of Contents

Introduction	1 of 1
Autodesk® Procedures	1 of 2
Autodesk® Results	1 of 2

Written by: LMG Date: 6/16/2004 Reviewed by: TEZ Date: 06/16/04

Client: Flour Fernald Project: Cell 8 Expansion Project/Proposal No.: GQ3309 Task No.: 02

OSDF CAPACITY CALCULATION
CELL 8 EXPANSION

INTRODUCTION

PURPOSE OF ANALYSIS

The purpose of this calculation package is to present the OSDF capacity for Cell 8.

METHODS OF ANALYSIS

The capacity for Cell 8 was estimated using the computer program Autodesk® Civil Design 3 within Autodesk® Land Desktop 3.

Written by: LMG Date: 6/16/2004 Reviewed by: TEZ Date: 06/16/04

Client: Fluor Fernald Project: Cell 8 Expansion Project/Proposal No.: GQ3309 Task No.: 02

OSDF CAPACITY CALCULATION
CELL 8
(Autodesk® PROCEDURES AND VOLUME RESULTS)

INTRODUCTION

The purpose of this section is to provide an overview of the Autodesk® procedures used to calculate the OSDF Cell 8 capacity and to present the capacity estimated using Autodesk®.

METHOD OF ANALYSIS

The Earthworks module of Autodesk® Civil Design 3 is used to compute volumes within Autodesk® Land Desktop 3 [Autodesk, 2001]. Earthworks calculates volumes based on a digital terrain model that represents each surface of interest. The surfaces used to compute the capacity of the OSDF Cell 8 are: (i) top of the leachate collection system (LCS) grading plan; and (ii) bottom of the contouring layer grading plan. Earthworks generates a triangular irregular network (TIN) to model each surface and uses the grid method to compute volume. The grid method calculates volumes using a grid system overlain on the two TIN surfaces. The volumes are calculated for each grid using the prismoidal volume between the surfaces, and then each grid volume is summed to give the total volume. For Cell 8, the volume is estimated using a parcel area defined by a vertical plane at the intercell berm between Cells 7 and 8. Figure 1 provides an isopach representing the thickness of impacted material which can be placed in Cell 8 as well as the associated capacity of Cell 8.

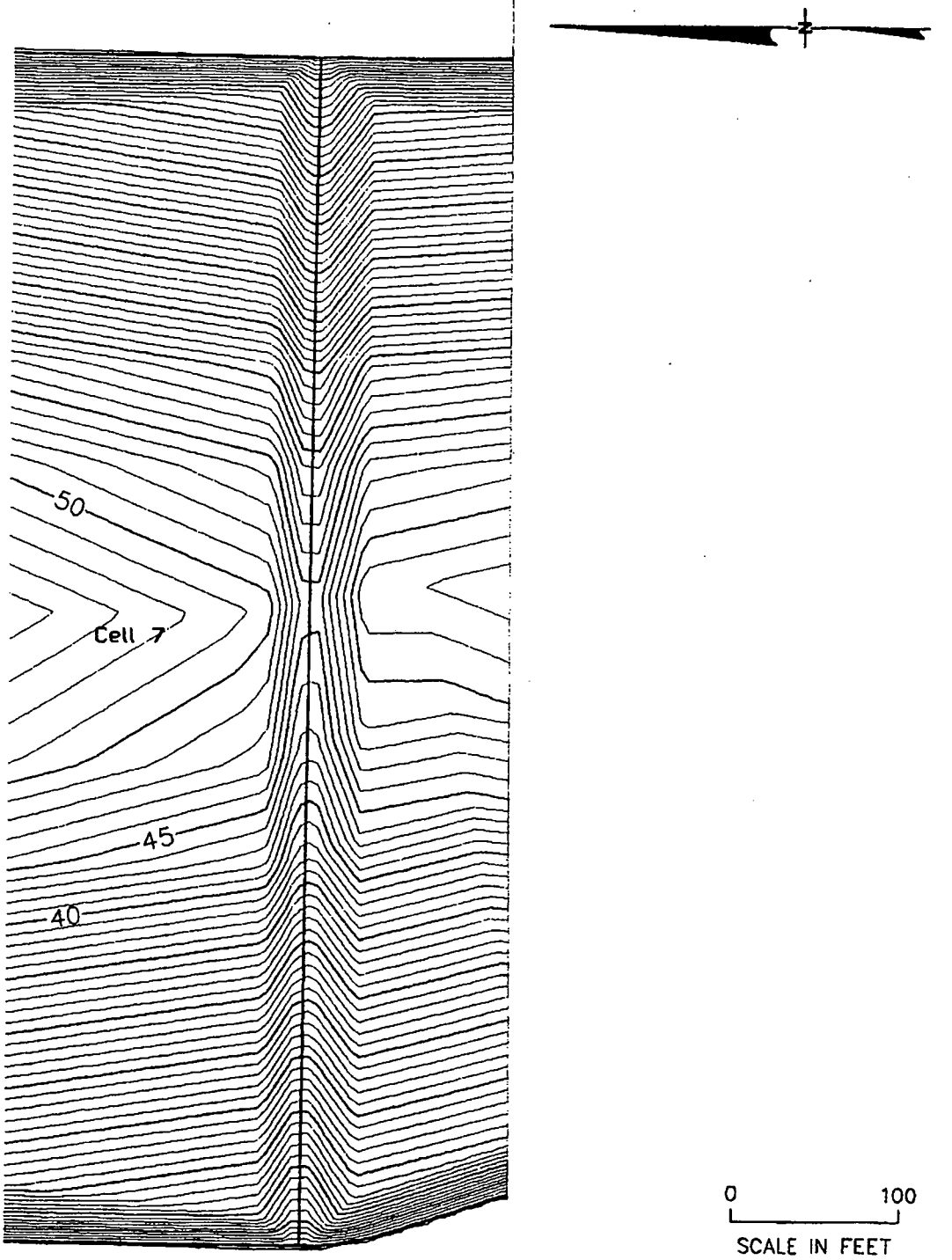
Autodesk® RESULTS

The following table provides the estimated capacity for Cell 8.

	OSDF CAPACITY (CY)
CELL 8	397,219

REFERENCES

Autodesk®, Inc., Autodesk® Civil Design Reference Manual, Henniker, NH, 2001.



Parcel Volume

Parcel	Stratum	Surf1	Surf2

cell 8

top lcs layer vs bottom co

GEOSYNTEC CONSULTANTS

ATLANTA, GA

PROJECT NO. GQ3309-02-02		FIGURE NO.	1
DOCUMENT NO.	–	FILE NO.	F04-F001.DWG

SECTION 7.3

7.3 CELL 8 IMPACTED RUNOFF CATCHMENT AREA REQUIREMENTS

COMPUTATION COVER SHEET

SUBJECT OF COMPUTATIONS CELL 8 IMPACTED RUNOFF CATCHMENT AREA REQUIREMENTS

Computations By:
(Cognizant Engineer)

Signature Tamara E. Zettler — Date 21 Jan 04

Printed Name and Title: Tamara E. Zettler, Engineer

Assumptions and Procedures Checked By:
(Checker)

Signature Kenneth R. Daly — Date 1/21/04

Printed Name and Title: Kenneth R. Daly, Project Engineer

Computations Checked by:

Signature Kenneth R. Daly — Date 1/21/04

Printed Name and Title: Kenneth R. Daly, Project Engineer

Computations Backchecked by:
(Cognizant Engineer)

Signature Tamara E. Zettler — Date 21 Jan 04

Printed Name and Title: Tamara E. Zettler, Engineer

Approved by:
(PDP)

Signature Kenneth R. Daly — Date 1/21/04

Printed Name and Title: Kenneth R. Daly, Project Engineer

Approved by:
(DTL / TETL)

Signature Rudolph Bonaparte — Date 1/22/04

Printed Name and Title: R. Bonaparte, Engineer of Record

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
0	Submittal to FF/DOE/EPA	29 Jan 01	CDC	MAO	DCP
1	CFC Revision 1 Submittal to FF/DOE/EPA	23 Jan 04	TEZ	KRD	RB
2	CFC Revision 2 Submittal to FF/DOE	15 Feb 05	TEZ	KRD	SFB

ADDENDUM TO SECTION 7.2
(ADDED TO REVISION 1 PACKAGE)

The calculation package presented in Section 7.2 was prepared to establish minimum cell storage requirements for containment of impacted runoff during the filling of cells. The analyses shown in Section 7.2 are applicable for the northernmost and interior on-site disposal facility (OSDF) cells (i.e., Cells 1 to 7) where the maximum containment volume of the impacted runoff catchment area (IRCA) is limited by the minimum elevation of a rain flap installed along the intercell berm at the south edge of the IRCA. However, the southernmost OSDF cell (i.e., Cell 8) differs from the other cells in that: (i) Cell 8 has a modified configuration as compared to Cells 1 to 7; (ii) Cell 8 is an end cell; and therefore, the maximum containment volume of the IRCA is limited by the minimum elevation of the intersection of the protective layer and the Cell 8 perimeter berm; and (iii) the downstream cells are not available for management and containment of impacted runoff during closure of Cell 8, as was the case for prior OSDF cells, management and containment of impacted runoff is provided solely within Cell 8 until construction of the final cover system.

This addendum to Section 7.2 was prepared to verify the adequacy of the Cell 8 IRCA based on the varying size of Cell 8 and to estimate the decreasing Cell 8 impacted runoff catchment area (IRCA) storage requirements as Cell 8 is progressively filled and capped during staged closure. Similar methods and input data to that used in Section 7.2 were used herein. This addendum is presented as Section 7.3 of the OSDF Final Design Calculation Package, and is entitled "Cell 8 Impacted Runoff Catchment Area Requirements". Section 7.3 is presented in Volume VII of the OSDF Final Design Calculation Package.

CELL 8 IMPACTED RUNOFF CATCHMENT AREA REQUIREMENTS

EXECUTIVE SUMMARY

PURPOSE OF ANALYSES

The purpose of this calculation package is to demonstrate the adequacy of the Cell 8 impacted runoff catchment area (IRCA) design in providing the necessary impacted runoff storage capacity both before and during staged closure of the final cell (i.e., Cell 8). Furthermore, the package provides requirements for sizing the IRCA during final closure construction activities through use of a design chart to interpolate for cases where the capped cell area is between that of the stages of closure evaluated in this package. The flow capacity of channels discharging to the IRCA and the expected time for drawdown of impacted runoff within the IRCA are calculated to demonstrate that the design meets the required design criteria.

METHODS OF ANALYSES

The cases modeled in this package represent conditions expected to exist during the filling and staged closure of the final cell (i.e., Cell 8). Analyses are separated into three groups:

i.) evaluation of IRCA storage capacity;

ii.) evaluation of IRCA inlet channel capacity; and

iii.) evaluation of impacted runoff drawdown time.

It is important to note that non-impacted runoff is being defined as runoff from cap areas over which two lifts of compacted clay cap have been placed as a part of the final cover system. Non-impacted runoff will be diverted to the OSDF surface water management system and thus will not enter the IRCA. The term "capped" will be used to describe areas of the landfill that have received at least two lifts of compacted clay cap and where runoff has been diverted to the OSDF surface water management system, and "uncapped" will refer to areas of the landfill that discharge runoff to the IRCA.

IRCA Storage Capacity

The Cell 8 IRCA, prior to staged closure, is designed to contain the runoff from two cells (i.e., Cells 7 and 8) during the 25-year, 24-hour storm event with the required 0.5 feet of freeboard. As established in the calculation package presented in Section 7.2. the IRCA for Cells 1 through 7 was designed to have a North/South dimension of 250 feet measured from the centerline of the intercell berm and an East/West dimension of 185 feet measured from the shoulder of the perimeter berm.

Because Cell 8 is an end cell and has been expanded to a width greater than Cells 1 through 7, the IRCA dimensions have been modified to provide adequate storage capacity. Modifications include:

- The North/South dimension of the Cell 8 IRCA has been increased to 377 feet as measured from the northern edge of the impacted material haul road into Cell 8. This will allow the IRCA to be located in the southwest corner of the cell while still extending over the leachate collection corridor.

- The East/West dimension of the Cell 8 IRCA has been increased to 229 feet as measured from the western side of the Cell 8 perimeter berm baseline.

This revised geometry, as shown in Figure 1, is evaluated herein to verify the storage capacity of the IRCA based on the expanded size of Cell 8.

Three stages of IRCA filling during the staged closure are considered for evaluation. These stages and the runoff areas associated with these stages are shown in Figures 2 through 4. Figure 2 shows the IRCA geometry designed to contain the runoff for Stage I, when Cell 7 has received final cover, and approximately 40 percent of Cell 8 has received final cover. This geometry provides a smaller IRCA plan area than those of Cells 1 through 7 as presented in an earlier calculation package (Section 7.2, Required Cell Leachate Storage); however, it will be shown to provide adequate volume. The Stage I geometry provides a remaining impacted material placement capacity of approximately 113,000 cubic yards with an additional approximately 19,000 cubic yards of non-impacted material capacity to provide for surface water management within the cell.

Figure 3 shows an IRCA geometry designed to contain the runoff for Stage II, which provides for a remaining impacted material placement capacity of 38,000 cubic yards with up to an additional approximately 19,000 cubic yards of non-impacted material capacity to provide for surface water management within the cell. At this stage, approximately 70 percent of Cell 8 has received at least two lifts of compacted clay. Calculations showing the total impacted material remaining to be placed for Stages I and II are presented in Attachment A-4.

Figure 4 represents the case when the remaining impacted material has been placed in Cell 8 up to the estimated total impacted material capacity of Cell 8. However, at this point, the two lifts of compacted clay have not been placed, and therefore, runoff in this area is still impacted. Approximately 19,000 cubic yards of non-impacted material will be required to reach proposed final cover contouring layer grades. At this stage, approximately 80 percent of Cell 8 has received two lifts of compacted clay.

The IRCA storage capacity is considered adequate if it complies with the design criteria used to evaluate the IRCAs for Cells 1 through 7 in Section 7.2, which requires the IRCA to provide storage capacity to handle the 25-year, 24-hour storm event with 0.5 ft of freeboard. Hydrologic

and basin routing analyses are performed using methodologies presented in TR-20 [USDA-SCS, 1982] and TR-55 [USDA-SCS, 1986], as coded into the computer program HydroCAD™.

This calculation will provide requirements for sizing the IRCA during final closure construction activities through use of a design chart to interpolate for cases where the capped area is between that of the stages analyzed in this package.

Channel Capacity

The required depths for channels discharging to the IRCA are evaluated for the "worst-case" scenario only (i.e., prior to Staged Closure as shown on Figure 1). This analysis provides the worst-case scenario in regards to channel depth because it has the largest uncovered area, resulting in the largest impacted runoff peak flow rate being routed through the channels. The channels are designed to convey peak flow rates from the 25-year, 24-hour storm event with minimum freeboard of 0.5 ft as established in the DCP [GeoSyntec, 2004]. Hydraulic analysis of this channel is performed using Manning's equation as coded into a computer spreadsheet. Peak flow rate for the channel was taken from the HydroCAD™ output performed for the IRCA capacity calculations.

Drawdown Time

The amount of time expected for impacted runoff to drain from the IRCA after the completion of the 25-year, 24-hour storm event into the Cell 8 LCS is referred to; herein, as the drawdown time. The drawdown time is estimated for the three stages described earlier in this calculation package. The drawdown time estimated for these three stages is controlled by the fact that the flow rate is limited by the capacity of the enhanced permanent leachate transmission system (EPLTS) permanent lift station pumps. A simplified calculation was performed where the volume of the IRCA is discharged at the maximum allowable flow rate of the EPLTS permanent lift station pumps (i.e., 200 gpm). The drawdown time prior to Staged Closure is not calculated herein as the IRCA is at full capacity.

RESULTS

Revised Phase V IRCAs and channels are designed for the 25-year, 24-hour storm event. The results are as follows:

IRCA Storage Capacity

- The Cell 8 IRCA design, prior to staged closure, provides containment for runoff from two cells (i.e., Cells 7 and 8) during the 25-year, 24 hour storm event with the required 0.5 ft of freeboard.

- The calculated peak water elevation for the 25-year, 24-hour storm event allows more than 0.5 ft of freeboard from the minimum embankment crest elevation for the three staged closure cases analyzed.

- The results of the HydroCAD™ analysis of the IRCA storage capacity are summarized in Table 7. The results show that the required IRCA storage capacities are:

  Prior to Staged Closure = 219,368 ft^3;

  Stage I = 76,927 ft^3;

  Stage II = 45,869 ft^3; and

  Stage III = 22,651 ft^3.

Channel Capacity

- Calculated freeboards corresponding to the peak flow rate for the inlet channels are 3.3 ft for Channel C and 3.4 ft for Channel E; therefore, the calculated freeboards exceed the minimum required freeboard of 0.5 ft. The locations for channels C and E are shown on Figure 1.

- Calculated peak flow velocities for the unlined channels are 6.7 ft/s for Channel C and 4.78 ft/s for Channel E. Appropriate erosion control practices should be used by the contractor to minimize the potential for erosion.

Drawdown Time

- The estimated drawdown time for Stages I through III is limited by the capacity of the EPLTS. The EPLTS permanent lift station pumps provide a maximum allowable flow rate of 200 gpm, which results in the following approximate drawdown times:

  Stage I = 2 days;

  Stage II = 1.2 days; and

  Stage III = 0.6 days.

CONCLUSIONS

The purpose of this calculation package was to demonstrate the adequacy of the design in providing the necessary impacted runoff storage capacity both before and during the staged closure of the final cell (i.e., Cell 8) in the OSDF. Additionally, IRCA inlet channel capacity and IRCA drawdown time were calculated to show that the design meets the required design criteria. The following conclusions are made based on the calculations performed in this package:

- The Cell 8 IRCA design, prior to staged closure, provides adequate storage volume to contain the runoff for the 25-year, 24-hour storm event from two cells (i.e., Cells 7 and 8).

- The IRCAs for the three stages evaluated during staged closure provide adequate storage volume to contain the runoff for the 25-year, 24-hour storm event.

- A design chart has been prepared (Figure 5) to provide requirements for sizing the IRCA based on the uncapped area of the OSDF remaining where the capped cell area is between that of the closure stages evaluated herein.

- The temporary channels carrying the runoff into the IRCA provide adequate capacity; however, due to the flow velocities, appropriate erosion control practices should be implemented by the contractor.

- Calculation results show that the design meets the applicable design criteria; therefore, the design is considered acceptable.

CELL 8 IMPACTED RUNOFF CATCHMENT AREA REQUIREMENTS

EXECUTIVE SUMMARY
TABLE OF CONTENTS
CALCULATION PROCEDURES
INTRODUCTION AND PURPOSE
DESIGN SCENARIOS
METHODS OF ANALYSIS
DESIGN CRITERIA
REFERENCES
DATA VERIFICATION
INTRODUCTION
INPUT PARAMETERS
REFERENCES
CALCULATIONS
INTRODUCTION
CALCULATIONS AND RESULTS
CONCLUSIONS
REFERENCES
TABLES, FIGURES, AND ATTACHMENTS
TABLES
FIGURES
ATTACHMENT A-1
ATTACHMENT A-2
ATTACHMENT A-3
ATTACHMENT A-4

CELL 8 IMPACTED RUNOFF CATCHMENT AREA REQUIREMENTS

CALCULATION PROCEDURES

INTRODUCTION AND PURPOSE

The purpose of this calculation package is to demonstrate the adequacy of the Cell 8 impacted runoff catchment area (IRCA) design in providing the necessary impacted runoff storage capacity both before and during staged closure of the final cell (i.e., Cell 8) for the on-site disposal facility (OSDF). Furthermore, the package provides requirements for sizing the IRCA during final closure construction activities through use of a design chart to interpolate for cases where the capped cell area is between that of the stages of closure evaluated in this package. Additionally, the flow capacity of channels discharging to the IRCA and the expected time for drawdown of impacted runoff within the IRCA are calculated to demonstrate that the design meets the required design criteria. The calculations provided in this calculation package are based on the Certified-for-Construction drawings developed as part of the Revised Phase V design in December 2004.

DESIGN SCENARIOS

The cases modeled in this package represent conditions expected to exist both before and during the staged closure of the final cell (i.e., Cell 8). Analyses are separated into three groups:

i.) evaluation of IRCA storage capacity;

ii.) evaluation of IRCA inlet channel capacity; and

iii.) evaluation of impacted runoff drawdown time.

It is important to note that the criteria defining non-impacted runoff has been established as runoff from cap areas over which two lifts of compacted clay cap have been placed as part of the final cover system. Non-impacted runoff will be diverted to the OSDF surface water management system and thus will not enter the IRCA. The term "capped" will be used to describe areas of the landfill that have received at least two lifts of compacted clay cap and where runoff has been diverted to the OSDF surface water management system, and "uncapped" will refer to areas of the landfill that discharge runoff to the IRCA.

The Cell 8 IRCA, prior to staged closure, is designed to contain the runoff from two cells (i.e., Cells 7 and 8) during the 25-year, 24-hour storm event with the required 0.5 feet of freeboard. Because Cell 8 is an end cell and has been expanded to a width greater than Cells 1

through 7, the IRCA dimensions have been modified to provide adequate storage capacity. Modifications include:

- The North/South dimension of the Cell 8 IRCA has been increased to 377 feet as measured from the northern edge of the impacted material haul road into Cell 8.
- The East/West dimension of the Cell 8 IRCA has been increased to 229 feet as measured from the western side of the Cell 8 perimeter berm baseline.

This revised geometry, as shown in Figure 1, is evaluated herein to verify the storage capacity of the IRCA based on the expanded size of Cell 8.

Three stages of IRCA filling during staged closure are considered for evaluation. These stages and the runoff areas associated with these stages are shown in Figures 2 through 4. Figure 2 shows the IRCA geometry designed to contain the runoff for Stage I, when Cell 7 has received final cover, and approximately 40 percent of Cell 8 has received final cover. This geometry provides a smaller IRCA plan area than those of Cells 1 through 7 as presented in an earlier calculation package (Section 7.2, Required Cell Leachate Storage); however, it will be shown to provide adequate volume. The geometry of Stage I provides a remaining impacted material placement capacity of approximately 113,000 cubic yards with up to an additional approximately 19,000 cubic yards of non-impacted soil capacity to provide for surface water management within the cell.

Figure 3 shows an IRCA geometry designed to contain the runoff for Stage II, which provides for a remaining impacted material placement capacity of 38,000 cubic yards with up to an additional approximately 19,000 cubic yards of non-impacted soil capacity to provide for surface water management within the cell. At this stage, approximately 70 percent of Cell 8 has received at least two lifts of compacted clay. Volume calculations estimating the capacity remaining for Stages I and II are presented in Attachment A-4.

Figure 4 represents the case when the remaining impacted material has been placed in Cell 8 up to the estimated total impacted material capacity of Cell 8. However, at this point, the two lifts of compacted clay have not been placed, and therefore, runoff in this area is still impacted. Approximately 19,000 cubic yards of non-impacted material will be required to reach proposed final cover contouring layer grades. At this stage, approximately 80 percent of Cell 8 has received two lifts of compacted clay.

IRCA Storage Capacity

The required IRCA storage capacity will be calculated for the design configurations discussed above. A comparison will be made to the actual IRCA storage capacity to show that adequate storage is provided for the IRCA geometries shown in Figures 1 through 4.

Channel Capacity

Channel capacity calculations will be performed for the most critical channels only (i.e., Channels C and E as identified in Figure 1). These channels are the most downstream channels for the two groups of catchment areas contributing runoff to the IRCA; therefore, these channels will receive more flow than the upstream channels. The calculations will be performed for the geometry shown in Figure 1, as this represents the stage with the largest uncapped area and consequently the greatest volume of runoff.

Drawdown Time

The amount of time expected for impacted runoff to drain from the IRCA after the completion of the 25-year, 24-hour storm event into the Cell 8 LCS is referred to herein as the drawdown time. An estimate of the drawdown time is made for the three stages represented in this calculation package. The estimate for the three stages is controlled by the fact that the flow rate will be limited by the allowable capacity of the enhanced permanent leachate transmission system (EPLTS) permanent lift station pumps. A simplified calculation was performed where the volume of the IRCA is discharged at the maximum allowable flowrate of the EPLTS permanent lift station pumps (i.e., 200 gpm).

METHODS OF ANALYSIS

IRCA Storage Capacity

Required IRCA storage capacity calculations are performed using methodologies presented in TR-20 [USDA-SCS, 1982] and TR-55 [USDA-SCS, 1986], as coded into the computer program HydroCAD™ [HydroCAD™, 1993]. HydroCAD™ breaks the units influencing the runoff into three types: (i) Subcatchments; (ii) Reaches; and (iii) Ponds. Different input parameters are required for each.

Certain input parameters are required for the overall analysis; these parameters include: (i) design storm event; and (ii) rainfall distribution.

The main input parameters needed for the Subcatchment subroutines include: (i) subcatchment runoff curve numbers; (ii) subcatchment areas; (iii) flow length and geometry; (iv) 2-year, 24-hour storm event; and (v) Manning's coefficient.

The main input parameters required for the Reach subroutines include: (i) channel geometry; and (ii) Manning's coefficient.

The main input parameters for the Pond subroutines include: (i) pond areas at various elevations; and (ii) properties of the outflow structures.

The values for these parameters used herein are presented in the Data Verification Section of this calculation package. Further discussion of the significance of these input parameters can be

found in Section 12.4 of the Revised Final Design Calculation Package On-Site Disposal Facility entitled "OSDF-Phase IV-Surface Water Management Design".

Once the required storage capacity has been calculated, requirements will be provided for sizing the IRCA during the final closure construction through use of a design chart (Figure 5) to interpolate for cases where the capped area is between that of the stages analyzed in this package.

Channel Capacity

The adequacy for the hydraulic capacity of the inlet channels is evaluated in terms of an available freeboard for peak flow rates. The available freeboard is calculated as the difference between the available flow depth in the channel and the calculated peak flow depth.

The peak flow depth is calculated based on Manning's equation as coded into a computer spreadsheet. Manning's equation is as follows:

$$Q_{max} = \frac{1.49}{n} A R^{2/3} S_o^{1/2}$$

where: Q_{max} = peak flow rate (cfs);
n = Manning's roughness coefficient (dimensionless);
A = cross-sectional area of flow (ft^2);
R = hydraulic radius (ft) defined as R = A/P where P is wetted perimeter (ft); and
S_o = longitudinal slope (rise/run).

Both A and P are functions of the peak flow depth; therefore, the equation can be used to solve for the peak flow depth.

The values for these parameters used herein are presented in the Data Verification Section of this calculation package.

Peak flow rates were used as inputs and were taken from the HydroCAD™ output performed for the IRCA storage capacity calculations. The minimum available flow depth is obtained directly from the construction drawings at the point that the channels flow into the IRCA.

Drawdown Time

As mentioned earlier, the drawdown time is the amount of time expected for impacted runoff associated with a 25-year, 24-hour storm event to drain from the IRCA into the Cell 8 LCS. The drawdown time may be evaluated using Darcy's Law as shown below:

$$\Delta t = \frac{\Delta V}{kiA}$$

where: Δt = incremental drawdown time (seconds);
ΔV = incremental volume change (ft^3);
k = permeability of the LCS drainage layer (ft/day);
i = hydraulic gradient (ft/ft); and
A = area perpendicular to flow (ft^2).

The drawdown time evaluated based on Darcy's Law, as noted above, is applicable to characterize liquid flow through the granular protective layer/LCS layer overlying the LCS corridor. This 'LCS corridor' drawdown time must be compared with the drawdown time associated with the allowable capacity of the EPLTS permanent lift station pumps, downstream of the LCS corridor. A simplified calculation may be performed where the volume of the IRCA is discharged at the maximum flowrate of the EPLTS permanent lift station pumps (i.e., 200 gpm). The equation below shows the formula used to calculate the 'EPLTS limited' drawdown time:

$$t = \frac{V}{Q}$$

where: t = drawdown time (days);
V = required IRCA storage capacity for a given stage (ft^3); and
Q = flow rate (gpm).

DESIGN CRITERIA

The calculations included in this package have been performed for the 25-year, 24-hour storm event as required by the Design Criteria Package (DCP) [GeoSyntec, 2004]. For the Fernald Environmental Management Project (FEMP) property, this event has a rainfall intensity of 4.7 in. [Parsons, 1995].

IRCA Storage Capacity

The Cell 8 IRCA, both prior to and during staged closure, must be designed to contain impacted runoff from two cells during the 25-year, 24-hour storm event and shall provide at least 0.5 ft of freeboard from the minimum elevation the intersection of the protective layer and the Cell 8 perimeter berm.

Channel Capacity

The calculated freeboard of the channels must equal or exceed the minimum required freeboard of 0.5 ft as stated in the DCP [GeoSyntec, 2004]. The velocity of the flow within each channel will be calculated based on the assumption that the channels will be unlined. This velocity will be checked against a maximum suggested flow rate of 2.0 ft/sec for unlined channels as established in Section 7.2. If the computed flow velocity is larger than this criterion, appropriate erosion control practices will be required in the field.

Drawdown Time

The drawdown time will be calculated and the results will be reported.

REFERENCES

Applied Microcomputer Systems, *HydroCAD™ Stormwater Modeling System*, Version 3.10, Chocorua, NH, 1993.

GeoSyntec Consultants, *OSDF Final Design Criteria Package*, January 2004, Revision 1, United States Department of Energy, Fernald Environmental Management Project, Fernald, Ohio, prepared by GeoSyntec Consultants, 2004.

Parsons, *2,000-Year Flood and Probable Maximum Flood Sitewide Flood Plain Determination*, CERCLA/RCRA Unit 2, Project Order 148, Fernald Environmental Management Project, Rev. A, Fairfield, OH, August 1995.

U.S. Department of Agriculture (USDA-SCS), *Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55)*, 2nd ed. Washington, D.C., Soil Conservation Service, 1986.

U.S. Department of Agriculture (USDA-SCS), *Technical Release Number 20 (TR-20)*, Soil Conservation Service, 1982.

CELL 8 IMPACTED RUNOFF CATCHMENT AREA REQUIREMENTS DATA VERIFICATION

INTRODUCTION

This section presents the selection of parameters used to perform analyses in the Calculation Results section of this calculation package. Many of these parameters have been established in earlier calculation packages; however, some are unique to this package and will be discussed in detail herein. The input parameters will be discussed in terms of the three main types of calculations being performed as part of this package.

INPUT PARAMETERS

IRCA Storage Capacity

As discussed in the Calculation Procedures section, the computer program HydroCAD™ was used to compute the required IRCA storage capacity. HydroCAD™ breaks the units influencing the runoff into three types: (i) Subcatchments; (ii) Reaches; and (iii) Ponds. Different input parameters are required for each.

Some of the input parameters are required for the overall analysis; these parameters include: (i) design storm event; and (ii) rainfall distribution. The design storm event in this analysis is the 25-year, 24-hour storm event, which has a rainfall intensity of 4.7 in. [Parsons, 1995]. The rainfall distribution for the Fernald Environmental Management Project (FEMP) property is Type II, and was established based on a chart that shows the rainfall distribution for different regions of the United States. The calculation package in Section 7.2 shows this chart.

The main input parameters needed for the Subcatchment subroutines include: (i) subcatchment runoff curve numbers; (ii) subcatchment areas; (iii) flow lengths and slopes; (iv) magnitude of precipitation from the 2-year, 24-hour storm event; and (v) Manning's coefficient. The runoff curve number for the entire OSDF was set as CN = 91 as established in Section 7.2 for a newly graded area of the soil type found at the OSDF. The subcatchment areas, flow lengths, and slopes of the flow paths were established from the construction drawings. The 2-year, 24-hour storm event has a rainfall magnitude of 2.55 in. [Parsons, 1995]. Manning's coefficient of roughness was set at 0.011 for the subcatchment areas as established in Section 7.2 for a smooth rolled surface. Tables 1 through 4 show the remaining inputs used by HydroCAD™ for the Subcatchment calculations.

The main input parameters required for the Reach subroutines include: (i) channel geometry; and (ii) Manning's coefficient. The channel geometry (i.e., channel side slopes, longitudinal slope, channel length, and inlet and outlet elevations) was established from the construction drawings. Manning's coefficient was set as 0.018 as established in Section 7.2 for a straight unlined channel. Due to the simplicity of the HydroCad models for Stages I through III, reaches

were not used. Table 5 shows the geometric inputs used in HydroCAD™ for the reaches defined in Figure 1.

The main input parameters for the Pond subroutines include: (i) pond areas for given elevations; and (ii) properties of the outflow structures. The pond areas were measured for various elevations using AutoCAD. Table 6 shows the areas measured, the cumulative storage volume, and the corresponding elevations for the IRCA in each of the three stages of the staged closure. No outflow structures were modeled in this analysis, which provides a conservative estimate of the storage capacity, since no outflow was allowed.

Additional discussion of the selection of the parameters can be found in the notes below Tables 1 through 6. The results of the analyses are presented in the Calculation Results section of this package.

Channel Capacity

As discussed in the Calculation Procedures section of this package, the peak depth of flow required to carry the maximum peak flow rate was computed using Manning's equation and was compared to the available flow depth. The maximum available flow depth was obtained directly from the construction drawings and is approximately 5 feet.

The parameters needed to compute the channel capacity using Manning's equation are as follows: (i) the peak flow rate, Q_{max} (cfs); (ii) Manning's coefficient, n (dimensionless); (iii) the cross-sectional area of flow, A (ft^2); (iv) the hydraulic radius, R (ft); and (v) the longitudinal slope of the channel, S_o (rise/run).

The peak flow rate for Channels C and E as shown on Figure 1 were obtained from the HydroCAD™ output performed for the IRCA storage capacity calculation. The peak flow rates used in the analyses are 45.21 cfs for Channel C and 28.29 cfs for Channel E.

The value used for the Manning's coefficient is 0.018. This is the same value that was used for the channels in the HydroCAD™ analysis discussed above.

The parameters A, R, and S_o are functions of the geometry of the channel and are established directly from the construction drawings. The values of the geometrical input parameters used for this calculation are shown in Table 5. The results of the analyses are presented in the Calculation Results section of this package.

Drawdown Time

As discussed in the Calculation Procedures section of this package, the 'LCS corridor' controlled drawdown time may be computed using Darcy's Law for incremental IRCA elevations. The parameters needed for this analysis include: (i) incremental volume change, ΔV (ft); the permeability of the LCS drainage layer, k (ft/s); the hydraulic gradient, i (ft/ft); and the

area perpendicular to flow, A (ft). The input values used for the drawdown analysis are shown below:

where: ΔV = varies (corresponds to the storage elevation in the IRCA according to HydroCAD™ output);

k = 0.0033 ft/s (minimum permeability of the LCS drainage and granular protective layer as required by the specifications);

i = varies (related to the storage elevation of the IRCA); and

A = 1,236 ft^2 for Stages I and II; 317 ft^2 for Stage III.

The simplified calculation performed to provide an estimate of the drawdown times controlled by the allowable capacity of the EPLTS permanent lift station pumps requires the following input parameters: (i) volume of required IRCA storage capacity, V (ft^3); and (ii) the flow rate of the leachate, Q (gpm). The volume of required IRCA storage capacity was computed as a part of the IRCA storage capacity calculations in this calculation package. The volume of required IRCA storage capacity for the three stages is summarized in Table 7. The flow rate of the leachate is that of the EPLTS permanent lift station pumps, which has been established as 200 gpm.

REFERENCES

Parsons, *2,000-Year Flood and Probable Maximum Flood Sitewide Flood Plain Determination*, CERCLA/RCRA Unit 2, Project Order 148, Fernald Environmental Management Project, Rev. A, Fairfield, OH, August 1995.

CELL 8 IMPACTED RUNOFF CATCHMENT AREA REQUIREMENTS CALCULATIONS

INTRODUCTION

This section presents calculations and results based on procedures and data presented in the Calculation Procedures and Data Verification sections of this calculation package. The calculations and results will be discussed for the three types of analyses performed as part of this package.

CALCULATIONS AND RESULTS

IRCA Storage Capacity

The IRCA is considered adequate if it complies with the design criteria used to evaluate the IRCAs for Cells 1 through 7 in Section 7.2, which requires the IRCA to provide storage capacity to handle the 25-year, 24-hour storm event with 0.5 ft of freeboard. Hydrologic and basin routing analyses are performed using methodologies presented in TR-20 [USDA-SCS, 1982] and TR-55 [USDA-SCS, 1986], as coded into the computer program HydroCAD™. The output from HydroCAD™ can be found in Attachment A-1.

This calculation provides requirements for sizing the IRCA during the final closure construction through use of a design chart (Figure 5) to interpolate for cases where the capped area is between that of the stages analyzed in this package.

The results of the IRCA Storage Capacity calculations are as follows:

- The calculated peak water elevation for the 25-year, 24-hour storm event allows more than 0.5 ft of freeboard from the minimum embankment crest elevation for the cases analyzed herein.
- The results of the HydroCAD™ analyses of the IRCA storage capacity for the cases analyzed are summarized in Table 7. The results show that the required IRCA storage capacity for each of the cases analyzed are as follows:

  Prior to Staged Closure = 219,368 ft^3;

  Stage I = 76,927 ft^3;

  Stage II = 45,869 ft^3; and

  Stage III = 22,651 ft^3.

Additionally, estimates of the volume of impacted material remaining to be placed were made for Stage I and Stage II. Calculations showing the total impacted material remaining to be placed for Stages I and II are presented in Attachment A-4. The results of these estimates are included in Table 7.

Channel Capacity

The channels are designed to safely convey peak flow rates from the 25-year, 24-hour storm event. Hydraulic analyses of Channels C and E as shown in Figure 1 are performed using Manning's equation as coded into a computer spreadsheet. Attachment A-2 shows the detailed calculations for the channel. The results for the channel capacity are as follows:

- Calculated freeboards corresponding to the peak flow rate for the inlet channels are 3.3 ft for Channel C and 3.4 ft for Channel E; therefore, the calculated freeboards exceed the minimum required freeboard of 0.5 ft.

- Calculated peak flow velocities for the unlined channels are 6.7 ft/s for Channel C and 4.8 ft/s for Channel E. Appropriate erosion control practices should be used by the contractor to minimize the potential for erosion.

Drawdown Time

The amount of time expected for impacted runoff to drain from the IRCA after the completion of the 25-year, 24-hour storm event into the Cell 8 LCS is referred to herein as the drawdown time. An estimation of the drawdown time is made for the three stages represented in this calculation package. Analyses indicated that the estimated drawdown time for Stages I through III is limited by the capacity of the EPLTS. The EPLTS permanent lift station pumps provide a maximum flow rate of 200 gpm, which results in the following approximate drawdown times:

Stage I = 2 days;

Stage II = 1.2 days; and

Stage III = 0.6 days.

CONCLUSIONS

The purpose of this calculation package is to demonstrate the adequacy of the design in providing the necessary impacted runoff storage capacity both before and during staged closure of the final cell (i.e., Cell 8) in the OSDF. Additionally, IRCA inlet channel capacity and IRCA drawdown time are calculated to show that the design meets the required design criteria. The following conclusions are made based on the calculations performed in this package:

- The IRCA for Cell 8, prior to staged closure, will provide adequate containment volume for impacted runoff from the 25-year, 24-hour storm event from two cells (i.e., Cells 7 and 8).
- The IRCAs for the three closure stages provide adequate storage volume to contain the runoff for the 25-year, 24-hour storm event.
- A design chart has been created (Figure 5) to offer guidance in sizing the IRCA based on the uncapped area of the OSDF between that of the stages analyzed in the calculation package.
- The temporary channels carrying the runoff into the IRCA provide adequate capacity; however, due to the flow velocities, appropriate erosion control practices should be used by the contractor.
- Calculation results show that the design meets the applicable design criteria; therefore, the design is considered acceptable.

REFERENCES

Applied Microcomputer Systems, *HydroCAD™ Stormwater Modeling System*, Version 3.10, Chocorua, NH, 1993.

GeoSyntec Consultants, *OSDF Final Design Criteria Package*, January 2004, Revision 1, United States Department of Energy, Fernald Environmental Management Project, Fernald, Ohio, prepared by GeoSyntec Consultants, 2004.

U.S. Department of Agriculture (USDA-SCS), *Urban Hydrology for Small Watersheds, Technical Release 55 (TR-55)*, 2nd ed. Washington, D.C., Soil Conservation Service, 1986.

U.S. Department of Agriculture (USDA-SCS), *Technical Release Number 20 (TR-20)*, Soil Conservation Service, 1982.

TABLES

GEOSYNTEC CONSULTANTS

PAGE _____ OF _____

Written by: Tamara E. Zettler Date: 12/15/2004 Reviewed by: _____ Date: _____

Client: Fluor Fernald, Inc. Project: OSDF Revised Phase V Project No.: GQ3309 Task No.: 02

Table 1 - Input parameters describing the geometry used in the HydroCAD Subcatchment calculations for Cell 8 IRCA (full size)

		Sheet Flow 1(1)		Sheet Flow 2(1)		Shallow Concentrated Flow 1		Shallow Concentrated Flow 2		Channel Flow				
Subcatchment Label	Area (acre)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Long. Slope (ft/ft)	Flow Depth (ft)	Left Slope (H:V)	Right Slope (H:V)
A	3.08	89	0.05	11	0.1	47	0.1	167	0.167	400	0.0056	1.5	1.5:1	3:1
B	3.39	88	0.05	12	0.1	46	0.1	166	0.167	637	0.005	1.5	1.5:1	3:1
C	1.57	41	0.05	59	0.1	2	0.1	192	0.167	442	0.009	1.5	1.5:1	3:1
D	3.47	89	0.05	11	0.1	47	0.1	209	0.167	400	0.0056	1.5	1.5:1	3:1
E	0.885	88	0.05	12	0.1	46	0.1	209	0.167	234	0.005	1.5	1.5:1	3:1
F	2.41	48	0.05	52	0.29	137	0.29	-	-	-	-	-	-	-
Pond	2.02	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: (1) Sheet Flow is restricted to a conservative value of 100 ft.

Table 2 - Input parameters describing the geometry used in the HydroCAD Subcatchment calculations for Stage I

		Sheet Flow 1(1)		Sheet Flow 2(1)		Sheet Flow 3(1)		Shallow Concentrated Flow 1		Shallow Concentrated Flow 2		Shallow Concentrated Flow 3		Shallow Concentrated Flow 4		Channel Flow				
Subcatchment Label	Area (acre)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Long. Slope (ft/ft)	Flow Depth (ft)	Left Slope (H:V)	Right Slope (H:V)
A	2.98	100	0.29	-	-	-	-	35	0.29	173	0.03	18	0.29	-	-	-	-	-	-	-
B	1.96	100	0.29	-	-	-	-	35	0.29	159	0.03	86	0.01	7	0.33	268	0.006	0.5	1.5:1	3:1
C	0.22	60	0.33	27	0.03	13	0.01	58	0.01	-	-	-	-	-	-	-	-	-	-	-
Pond	0.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: (1) Sheet Flow is restricted to a conservative value of 100 ft.

GEOSYNTEC CONSULTANTS

PAGE _____ OF _____

Written by: Tamara E. Zettler Date: 12/15/2004 Reviewed by: _____ Date: _____

Client: Fluor Fernald, Inc. Project: OSDF Revised Phase V Project No.: GO3309 Task No.: 02

Table 3 - Input parameters describing the geometry used in the HydroCAD Subcatchment calculations for Stage II

		Sheet Flow 1[1]		Sheet Flow 2[1]		Sheet Flow 3[1]		Shallow Concentrated Flow 1		Shallow Concentrated Flow 2		Shallow Concentrated Flow 3		Channel Flow				
Subcatchment Label	Area (acre)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Long. Slope (ft/ft)	Flow Depth (ft)	Left Slope (H:V)	Right Slope (H:V)
A	1.76	100	0.33	-	-	-	-	2	0.33	69	0.03	17	0.29	-	-	-	-	-
B	0.82	88	0.33	12	0.03	-	-	65	0.03	86	0.01	7	0.33	195	0.005	0.5	1.5:1	3:1
C	0.115	46	0.33	41	0.01	13	0.29	4	0.29	-	-	-	-	-	-	-	-	-
Pond	0.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: (1) Sheet Flow is restricted to a conservative value of 100 ft.

Table 4 - Input parameters describing the geometry used in the HydroCAD Subcatchment calculations for Stage III

		Sheet Flow 1[1]		Shallow Concentrated Flow 1	
Subcatchment Label	Area (ft^2)	Flow Length (ft)	Slope (ft/ft)	Flow Length (ft)	Slope (ft/ft)
A	1.17	100	0.26	51	0.26
Pond	0.49	-	-	-	-

Notes: (1) Sheet Flow is restricted to a conservative value of 100 ft.

Written by: Tamara E. Zettler Date: 12/15/2004 Reviewed by: _____ Date: _____

Client: Fluor Fernald, Inc. Project: OSDF Revised Phase V Project No.: GQ3309 Task No.: 02

Table 5 - Input parameters describing the geometry of the channels

Channel Label	Flow Length (ft)	Longitudinal Slope (ft)	Bottom Width (ft)	Flow Depth (ft)	Inlet Elevation (ft)	Outlet Elevation (ft)	Left Side Slope (H:V)	Right Side Slope (H:V)
B	637	0.005	0	6	603	599.8	1.5:1	3:1
C	442	0.009	0	6	599.8	595.82	1.5:1	1.5:1
E	234	0.005	0	6	595.97	594.8	3:1	1.5:1

Notes:
(1) Dummy nodes were used to collect the flow at each entry point into the IRCA. Dummy nodes do not have any properties; therefore, they are not included in the table above.
(2) Channels A and D were *included as part of their respective subcatchment and were not modelled as reaches.*
(3) These inputs will be used to solve for the peak depth of flow, h, using an Excel spreadsheet.
(4) Values for the Area of Flow, A, and the Wetted Perimeter, P, are functions of the above parameters and the peak depth of flow, h.

Table 6 - Areas and Cumulative Volume of the IRCA taken at various elevations for three stages of the closure sequence used in HydroCAD calculations

Full Size IRCA			Stage I			Stage II			Stage III		
Elevation (ft)	Area (ft^2)	Cumulative Volume (cy)	Elevation (ft)	Area (ft^2)	Cumulative Volume (cy)	Elevation (ft)	Area (ft^2)	Cumulative Volume (cy)	Elevation (ft)	Area (ft^2)	Cumulative Volume (cy)
586	1,525	0	586	1,521	0	586	1,521	0	586	565	0
587	12,981	7,231	587	6,389	3,955	587	6,389	3,955	587	2,390	1,478
588	27,399	27,443	588	10,604	12,430	588	10,604	12,430	588	4,694	5,041
589	38,725	60,505	589	15,559	25,554	589	15,559	25,554	589	7,736	11,256
590	50,399	105,067	590	20,948	43,764	590	20,948	43,764	590	11,213	20,730
591	62,770	161,651	591	24,077	66,320	591	24,077	66,320	591	13,864	33,247
592	75,359	230,737	592	27,032	91,831	592	27,032	91,831	592	16,645	48,501

Notes:
(1) The areas and volumes were computed using AutoCAD.
(2) HydroCAD uses the areas and elevations to establish the IRCA storage volume.

GEOSYNTEC CONSULTANTS

PAGE ____ OF ____

Written by: Tamara E. Zettler Date: 12/15/2004 Reviewed by: _____ Date: _____

Client: Fluor Fernald, Inc. Project: OSDF Revised Phase V Project No.: GQ3309 Task No.: 02

Table 7 - Results of IRCA Analysis

Stage	Uncapped Area (acres)	Volume of IRCA Required (acre-ft)	Volume of IRCA Required (ft^3)	Volume Provided By Design[1] (acre-ft)	Volume Provided By Design[1] (ft^3)	Peak Elevation during 25-Year Storm (ft)	IRCA Containment Elevation[2] (ft)	Volume Available for Impacted Material[3] (cy)
Full Size IRCA	16.83	5.036	219,368	5.150	224,334	591.83	591.9	-
I	5.89	1.766	76,927	2.113	92,042	591.4	592.1	113,000
II	4.43	1.053	45,869	2.113	92,042	590.1	592.1	38,000
III	1.66	0.520	22,651	1.116	48,613	590.2	592.1	0

Notes:

(1) The reported volume for the full size IRCA was calculated for the IRCA Containment elevation. For Stages I through III, the reported volume was calculated assuming that the IRCA Containment Elevation was 592 ft which is 0.1 ft less than the actual containment elevation.

(2) The reported elevation corresponds to 0.5 ft of freeboard.

(3) Volumes of Impacted Material are estimates for information purposes only, the contractor should perform a detailed quantity calculation should exact quantities be required. The computations can be found in Attachment A-4.

FIGURES

GEOSYNTEC CONSULTANTS

Written by: Tamara E. Zettler Date: 12/15/2004 Reviewed by: _____ Date: _____

Client: Fluor Fernald, Inc. Project: OSDF Phase IV Project No.: GQ3309 Task No.: 02

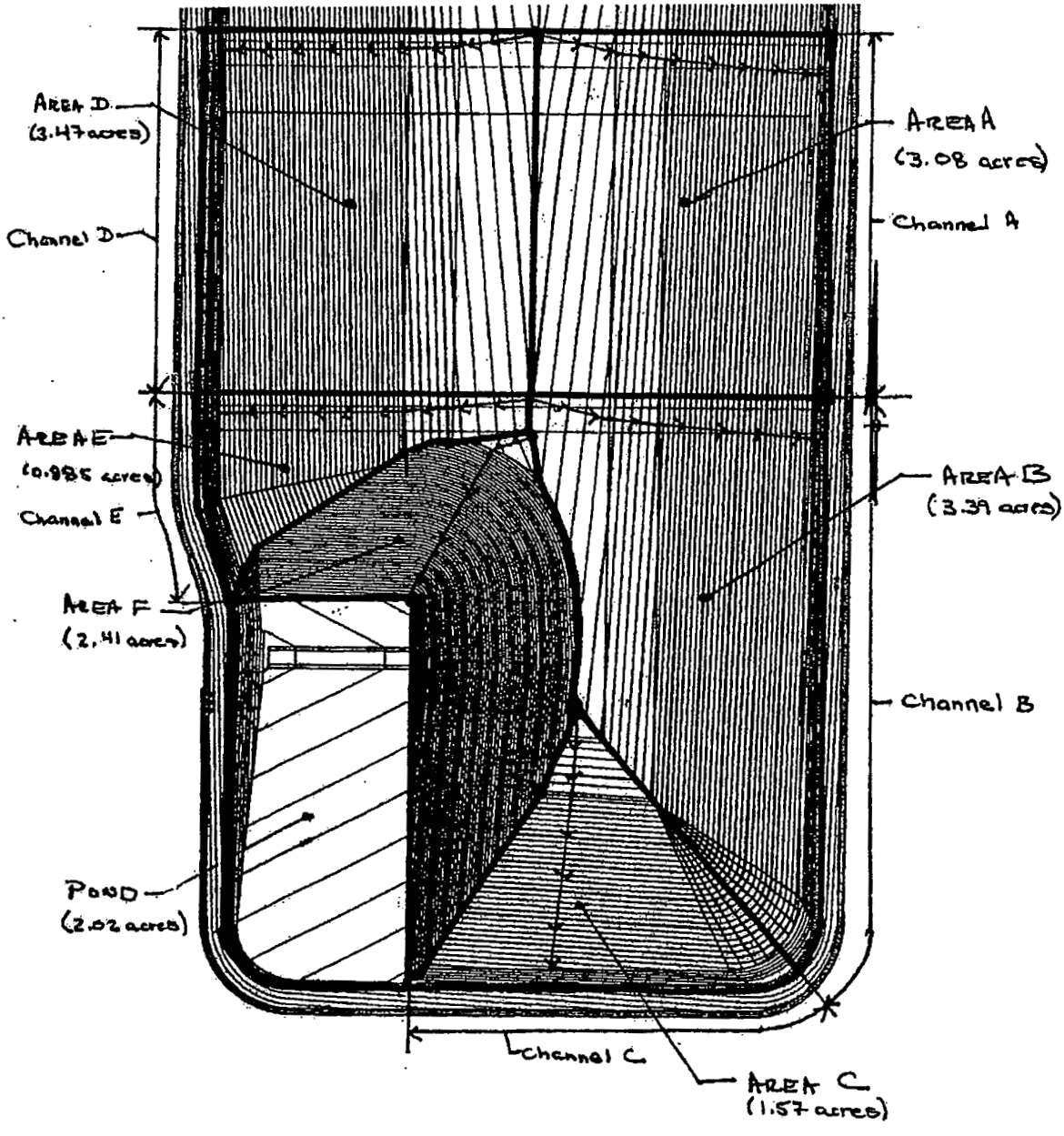


Figure 1 – Full Size IRCA (Not to Scale)

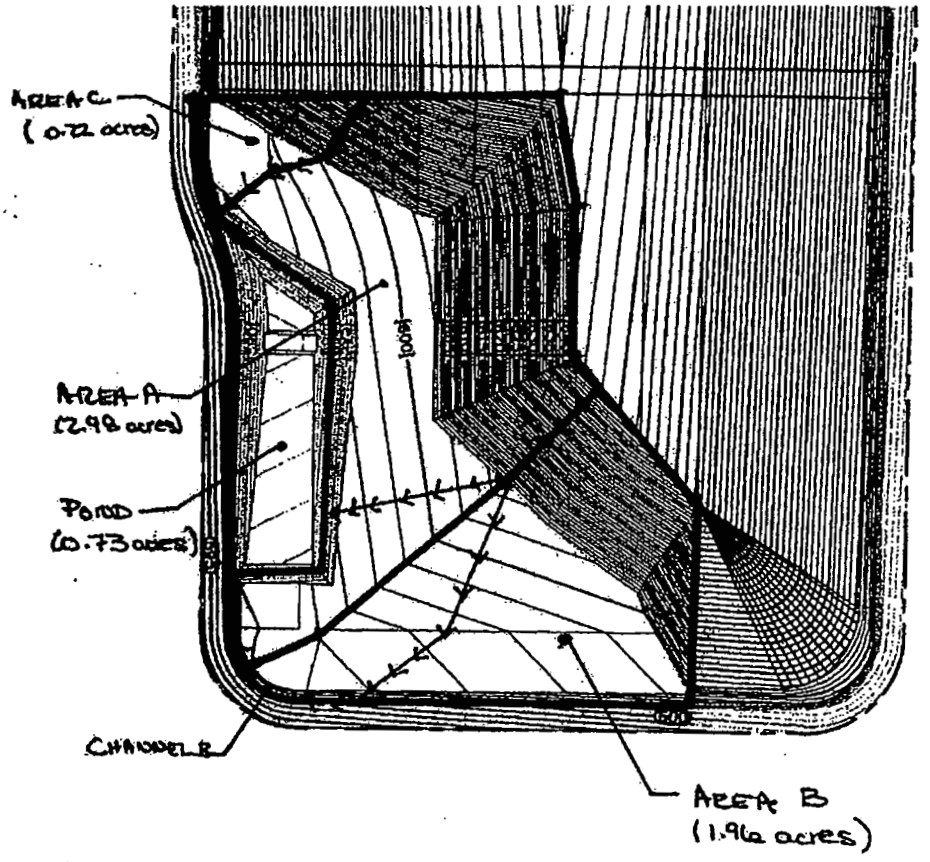


Figure 2 – Stage I (Not to Scale)

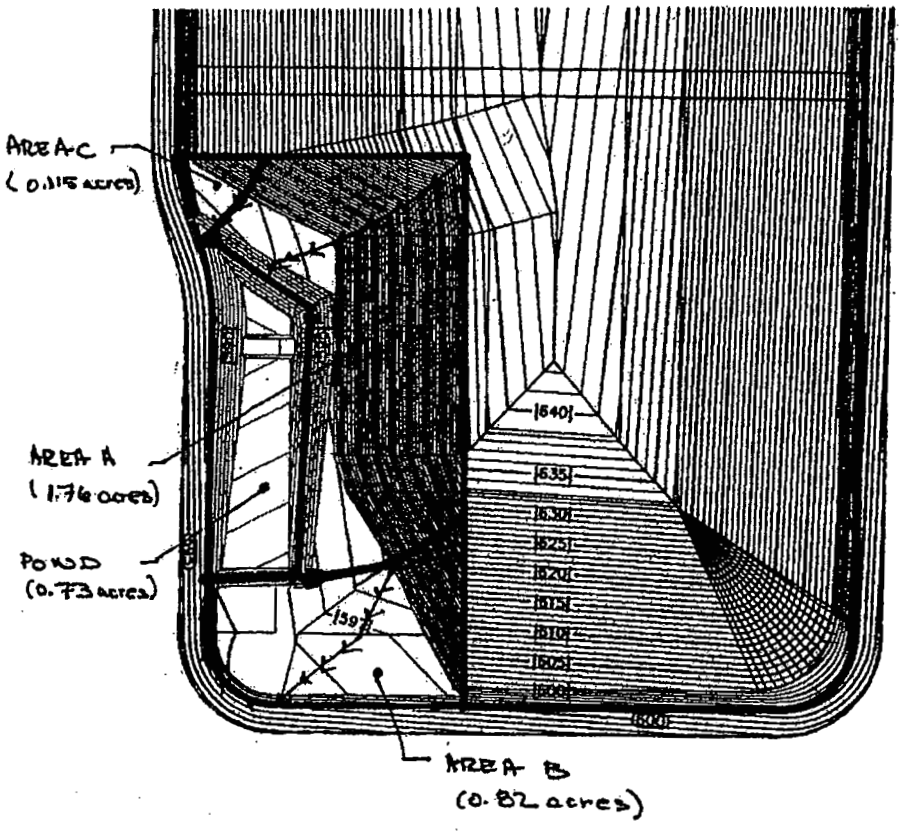


Figure 3 – Stage II (Not to Scale)

Written by: Tamara E. Zettler Date: 12/15/2004 Reviewed by: _____ Date: _____

Client: Fluor Fernald, Inc. Project: OSDF Phase IV Project No.: GQ3309 Task No.: 02

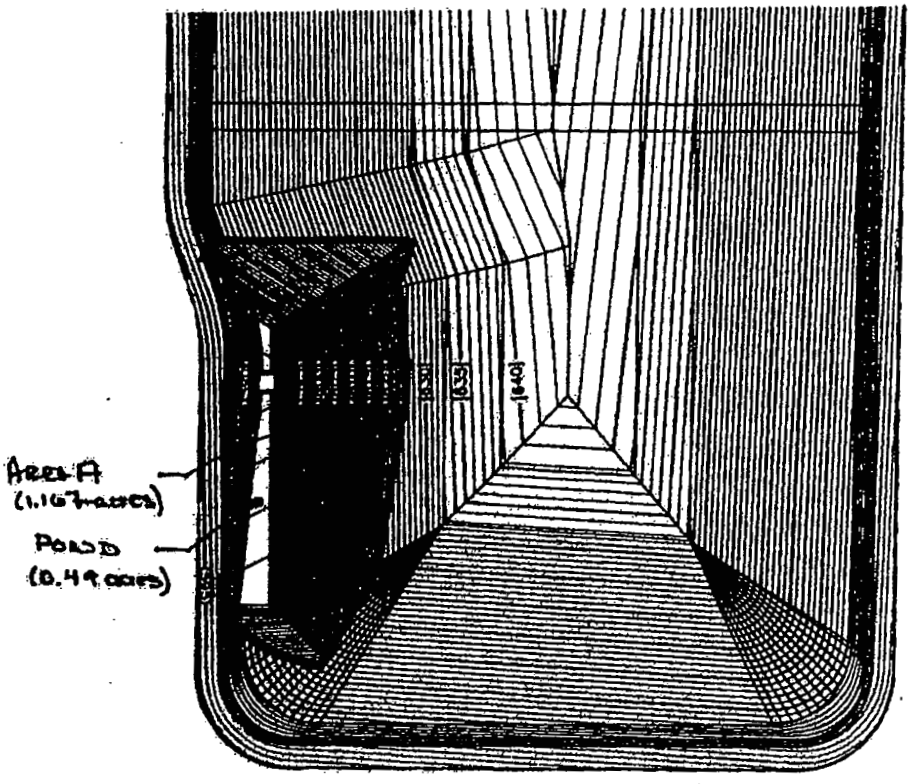
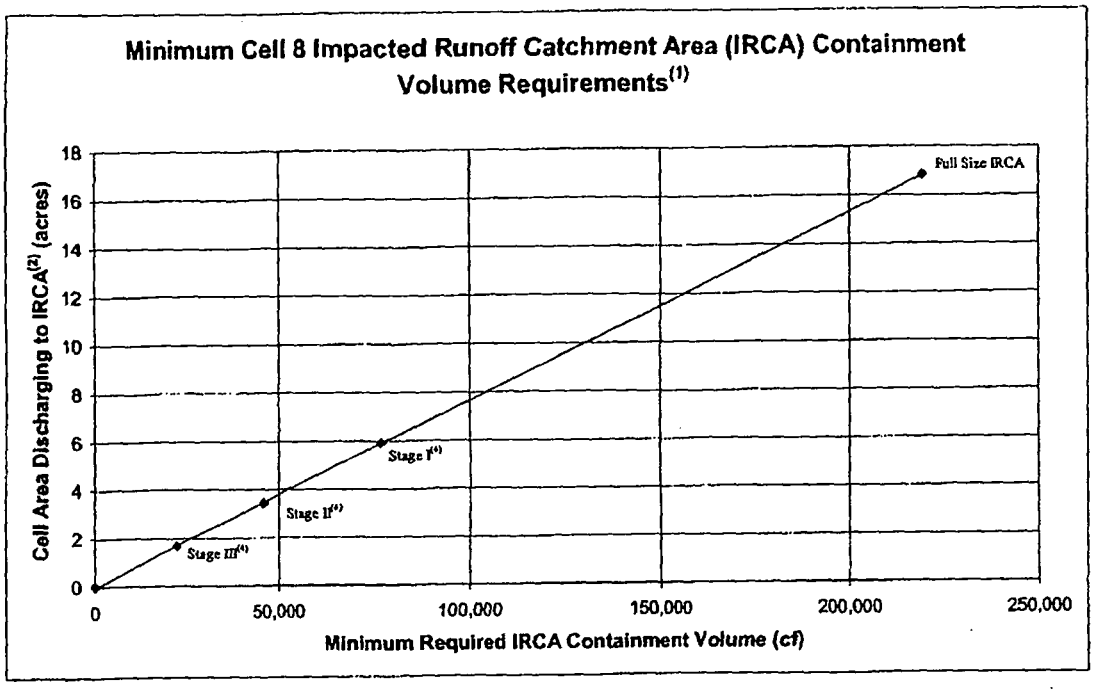


Figure 4 – Stage III (Not to Scale)

Written by: Tamara E. Zettler Date: 12/15/2004 Reviewed by: _____ Date: _____

Client: Fluor Fernald, Inc. Project: OSDF Phase IV Project No.: GQ3309 Task No.: 02



Notes: (1) Minimum required IRCA containment volumes correspond to estimated runoff from cell area discharging to IRCA as computed using HydroCAD.
(2) Cell area discharging to IRCA includes area of IRCA.
(4) Stages shown are as indicated on construction drawings.

Figure 5 – Design Chart for Sizing IRCA

ATTACHMENT A-1

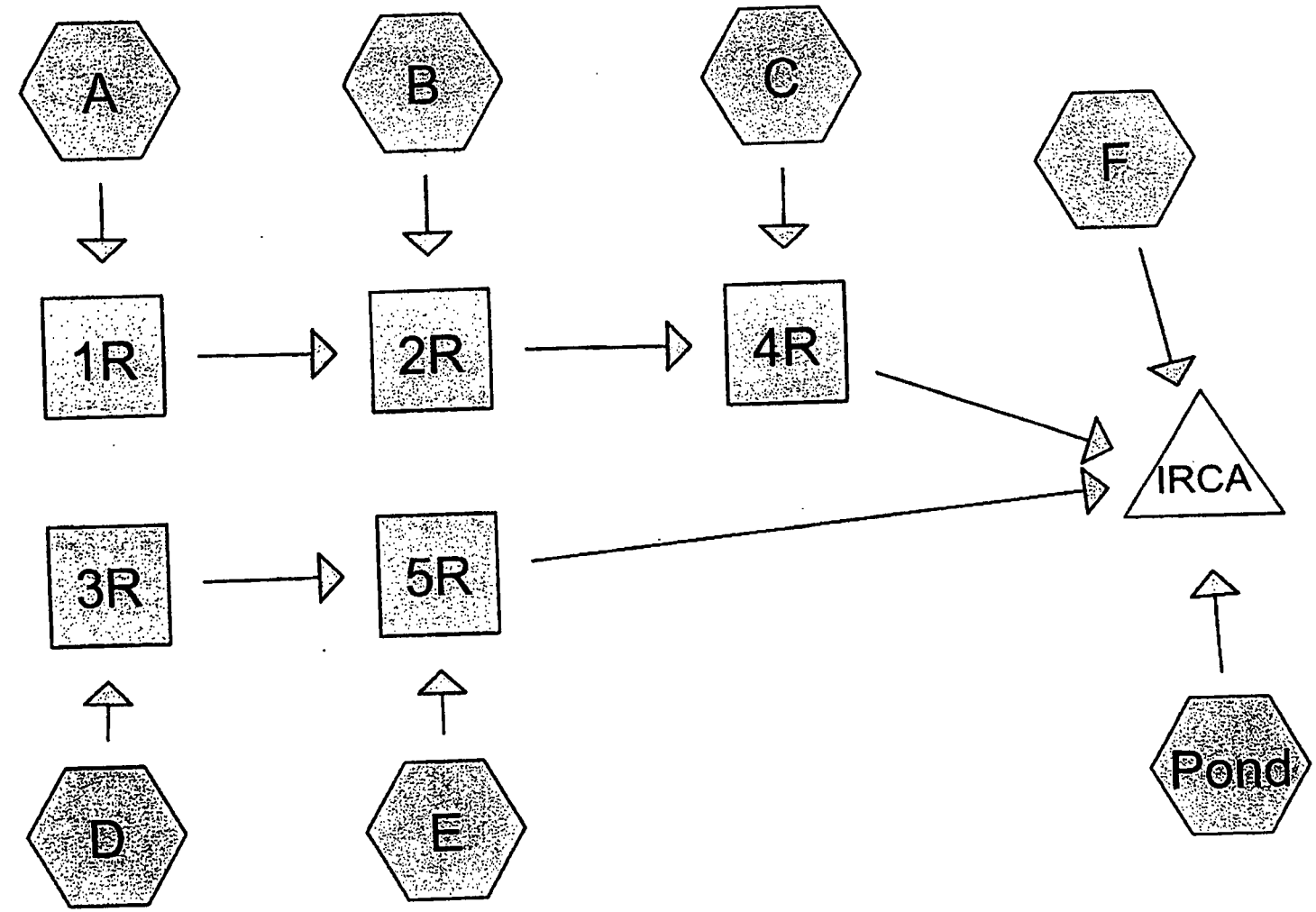
IRCA CAPACITY CALCULATIONS
HYDROCAD OUTPUT

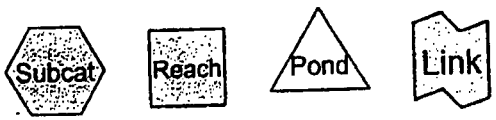
GEOSYNTEC CONSULTANTS PAGE ___ OF ___

Written by: Tamara E. Zettler Date: 12/15/2004 Reviewed by: _____ Date: _____

Client: Fluor Fernald, Inc. Project: OSDF Phase IV Project No.: GQ3309 Task No.: 02

PRIOR TO STAGED CLOSURE CALCULATION





Drainage Diagram for Cell 8Expand_Stage0
Prepared by GeoSyntec Consultants 12/10/2004
HydroCAD® 6.00 s/n 000929 © 1986-2001 Applied Microcomputer Systems

Cell 8Expand_Stage0 *Type II 24-hr Rainfall=4.70"*
Prepared by GeoSyntec Consultants Page 1
HydroCAD® 6.00 s/n 000929 © 1986-2001 Applied Microcomputer Systems 12/10/2004

Time span=0.00-20.00 hrs, dt=0.01 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Type II 24-hr Rainfall=4.70"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Area A
Tc=3.0 min CN=91 Area=3.080 ac Runoff= 20.77 cfs 0.891 af

Subcatchment B: Area B
Tc=3.9 min CN=91 Area=3.390 ac Runoff= 22.22 cfs 0.980 af

Subcatchment C: Area C
Tc=2.7 min CN=91 Area=1.570 ac Runoff= 10.69 cfs 0.454 af

Subcatchment D: Area D
Tc=3.1 min CN=91 Area=3.470 ac Runoff= 23.34 cfs 1.004 af

Subcatchment E: Area E
Tc=2.5 min CN=91 Area=0.885 ac Runoff= 6.07 cfs 0.256 af

Subcatchment F: Area F
Tc=1.1 min CN=91 Area=2.410 ac Runoff= 17.21 cfs 0.697 af

Subcatchment Pond: Pond Area
Tc=0.0 min CN=100 Area=2.020 ac Runoff= 16.15 cfs 0.753 af

Reach 1R: Channel B Inflow= 20.77 cfs 0.891 af
Length= 637.0' Max Vel= 4.3 fps Capacity= 923.30 cfs Outflow= 19.32 cfs 0.888 af

Reach 2R: Channel C Inflow= 38.75 cfs 1.869 af
Length= 442.0' Max Vel= 6.4 fps Capacity= 1,236.14 cfs Outflow= 38.20 cfs 1.866 af

Reach 3R: Channel E Inflow= 23.34 cfs 1.004 af
Length= 234.0' Max Vel= 4.5 fps Capacity= 921.13 cfs Outflow= 22.93 cfs 1.003 af

Reach 4R: Dummy Reach Inflow= 45.21 cfs 2.320 af
Outflow= 45.21 cfs 2.320 af

Reach 5R: Dummy Reach Inflow= 28.29 cfs 1.259 af
Outflow= 28.29 cfs 1.259 af

Pond IRCA: Detention Pond Peak Storage= 5.029 af Inflow= 95.09 cfs 5.029 af
Outflow= 0.00 cfs 0.000 af

Runoff Area = 16.825 ac Volume = 5.036 af Average Depth = 3.59"

219,368 ft3

Subcatchment A: Area A

Runoff = 20.77 cfs @ 11.93 hrs, Volume= 0.891 af

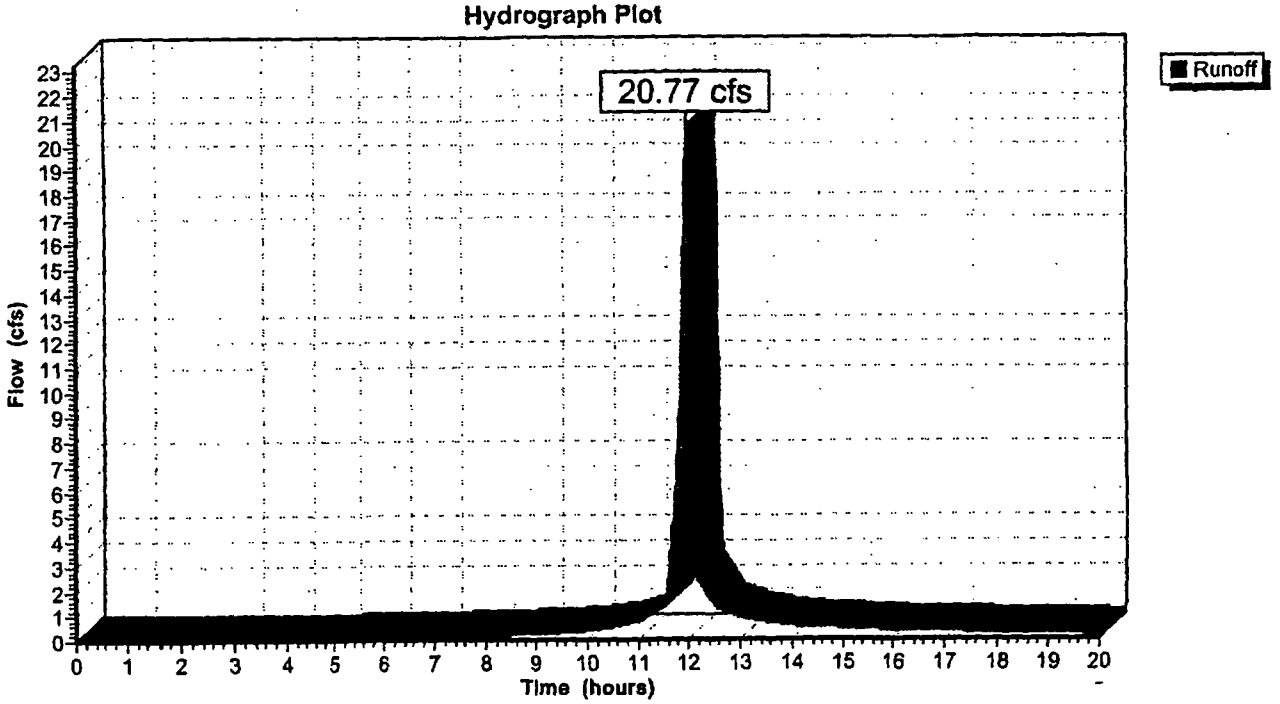
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
3.080	91	Total Sideslope Area A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	89	0.0500	1.7		**Sheet Flow, Segment A-1** Smooth surfaces n= 0.011 P2= 2.55"
0.1	11	0.1000	1.5		**Sheet Flow, Segment A-2** Smooth surfaces n= 0.011 P2= 2.55"
0.2	47	0.1000	5.1		**Shallow Concentrated Flow, Segment A-3** Unpaved Kv= 16.1 fps
0.4	167	0.1670	6.6		**Shallow Concentrated Flow, Segment A-4** Unpaved Kv= 16.1 fps
1.4	400	0.0056	4.8	24.18	**Trap/Vee/Rect Channel Flow, Channel A** Bot.W=0.00' D=1.50' Z= 1.5 & 3.0 '/' n= 0.018
3.0	714	Total			

Subcatchment A: Area A

Hydrograph Plot



Subcatchment B: Area B

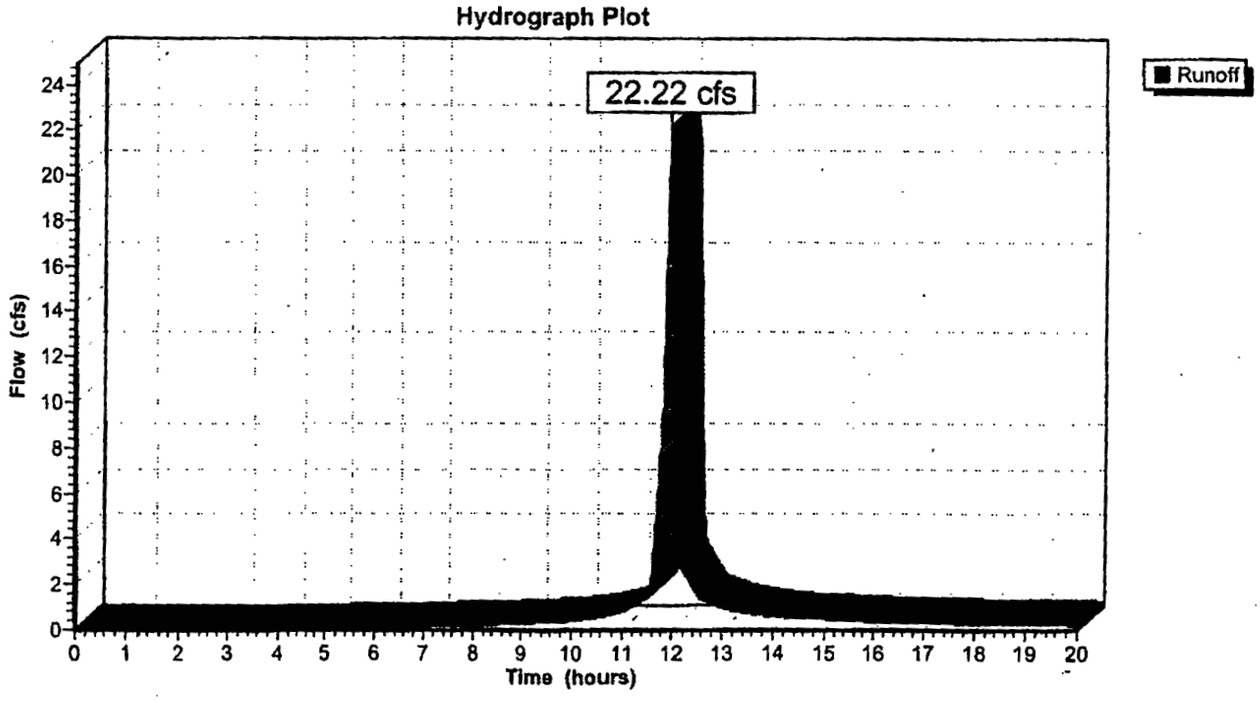
Runoff = 22.22 cfs @ 11.95 hrs, Volume= 0.980 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
3.390	91	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	88	0.0500	1.7		**Sheet Flow, Segment B-1** Smooth surfaces n= 0.011 P2= 2.55"
0.1	12	0.1000	1.5		**Sheet Flow, Segment B-2** Smooth surfaces n= 0.011 P2= 2.55"
0.2	46	0.1000	5.1		**Shallow Concentrated Flow, Segment B-3** Unpaved Kv= 16.1 fps
0.4	166	0.1670	6.6		**Shallow Concentrated Flow, Segment B-4** Unpaved Kv= 16.1 fps
2.4	637	0.0050	4.5	22.85	**Trap/Vee/Rect Channel Flow, Channel B** Bot.W=0.00' D=1.50' Z= 1.5 & 3.0 '/' n= 0.018
3.9	949	Total			

Subcatchment B: Area B



Subcatchment C: Area C

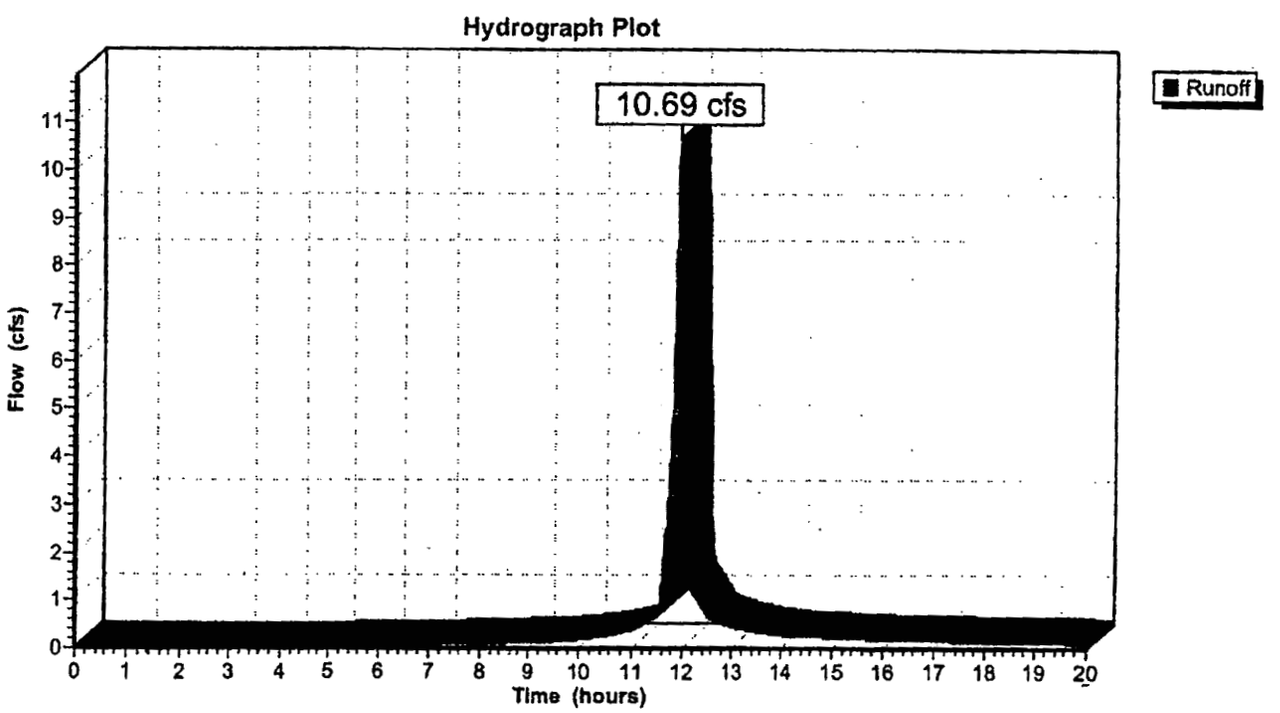
Runoff = 10.69 cfs @ 11.93 hrs, Volume= 0.454 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
1.570	91	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	41	0.0500	1.5		**Sheet Flow, Segment C-1** Smooth surfaces n= 0.011 P2= 2.55"
0.5	59	0.1000	2.1		**Sheet Flow, Segment C-2** Smooth surfaces n= 0.011 P2= 2.55"
0.0	2	0.0100	1.6		**Shallow Concentrated Flow, Segment C-3** Unpaved Kv= 16.1 fps
0.5	192	0.1670	6.6		**Shallow Concentrated Flow, Segment C-4** Unpaved Kv= 16.1 fps
1.2	442	0.0090	6.1	30.65	**Trap/Vee/Rect Channel Flow, Channel C** Bot.W=0.00' D=1.50' Z= 1.5 & 3.0 '/' n= 0.018
2.7	736	Total			

Subcatchment C: Area C



Subcatchment D: Area D

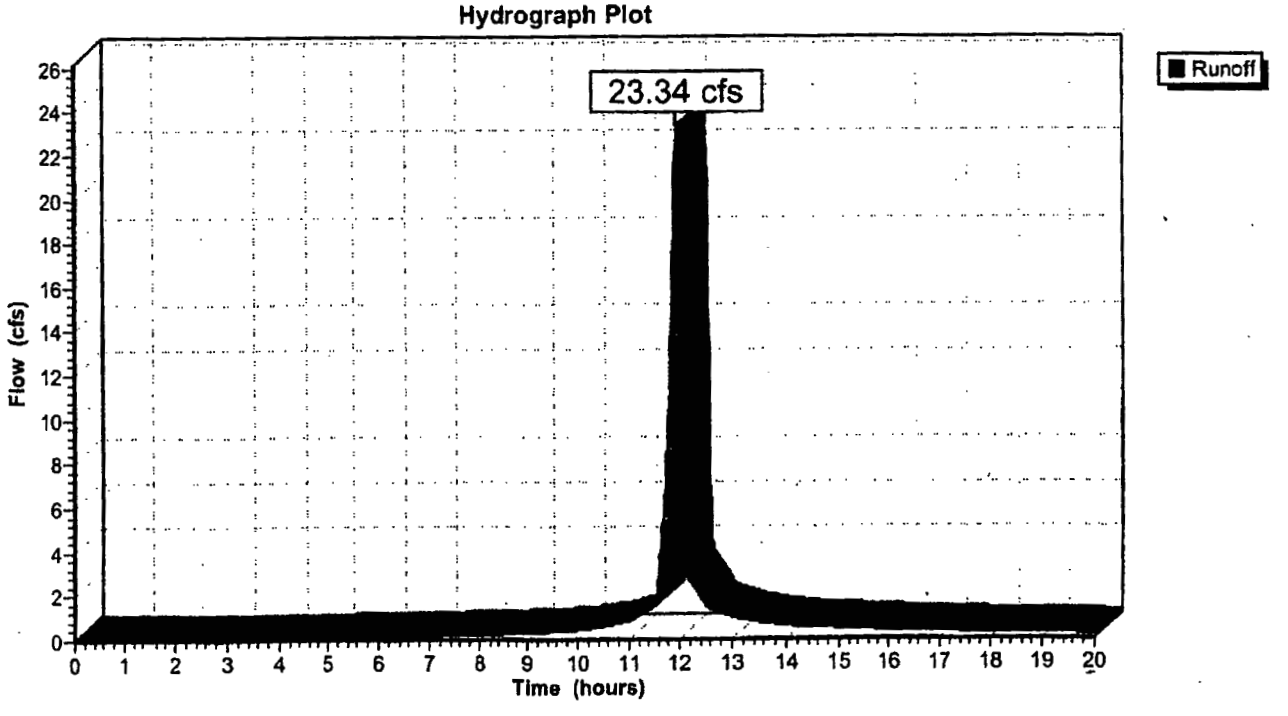
Runoff = 23.34 cfs @ 11.94 hrs, Volume= 1.004 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
3.470	91	Total Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	89	0.0500	1.7		**Sheet Flow, Segment D-1** Smooth surfaces n= 0.011 P2= 2.55"
0.1	11	0.1000	1.5		**Sheet Flow, Segment D-2** Smooth surfaces n= 0.011 P2= 2.55"
0.2	47	0.1000	5.1		**Shallow Concentrated Flow, Segment D-3** Unpaved Kv= 16.1 fps
0.5	209	0.1670	6.6		**Shallow Concentrated Flow, Segment D-4** Unpaved Kv= 16.1 fps
1.4	400	0.0056	4.8	24.18	**Trap/Vee/Rect Channel Flow, Channel D** Bot.W=0.00' D=1.50' Z= 3.0 & 1.5 '/' n= 0.018
3.1	756	Total			

Subcatchment D: Area D



Subcatchment E: Area E

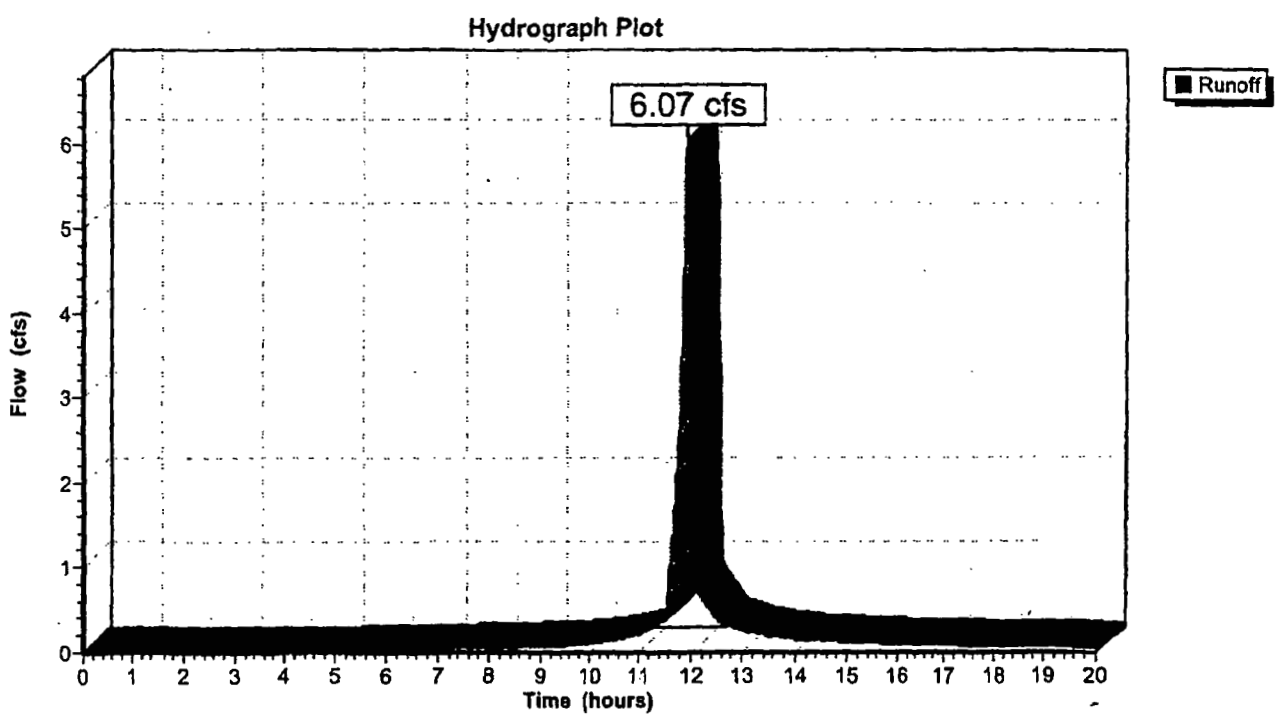
Runoff = 6.07 cfs @ 11.93 hrs, Volume= 0.256 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.885	91	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	88	0.0500	1.7		**Sheet Flow, Segment E-1** Smooth surfaces n= 0.011 P2= 2.55"
0.1	12	0.1000	1.5		**Sheet Flow, Segment E-2** Smooth surfaces n= 0.011 P2= 2.55"
0.2	46	0.1000	5.1		**Shallow Concentrated Flow, Segment E-3** Unpaved Kv= 16.1 fps
0.5	209	0.1670	6.6		**Shallow Concentrated Flow, Segment E-4** Unpaved Kv= 16.1 fps
0.9	234	0.0050	4.5	22.85	**Trap/Vee/Rect Channel Flow, Channel E** Bot.W=0.00' D=1.50' Z= 3.0 & 1.5 '/' n= 0.018
2.5	589	Total			

Subcatchment E: Area E



Subcatchment F: Area F

[49] Hint: Tc<2dt may require smaller dt

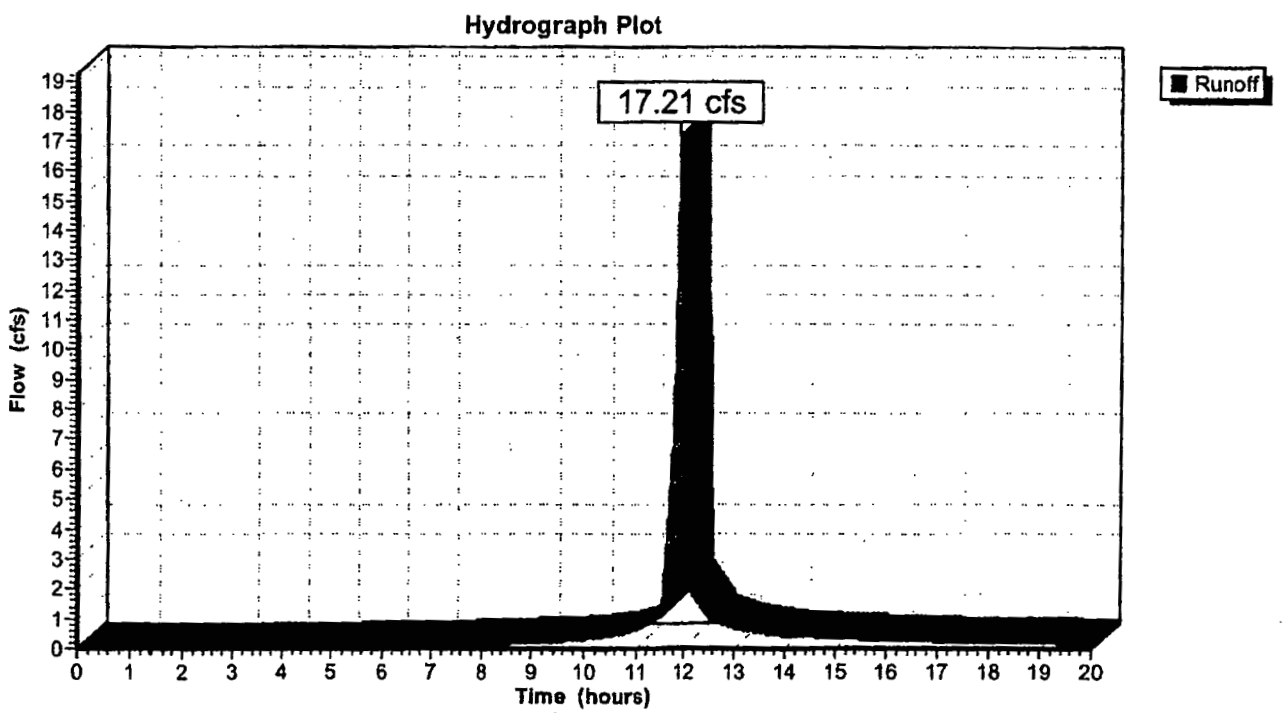
Runoff = 17.21 cfs @ 11.91 hrs, Volume= 0.697 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
2.410	91	Total Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	48	0.0500	1.5		**Sheet Flow, Segment F-1** Smooth surfaces n= 0.011 P2= 2.55"
0.3	52	0.2900	3.1		**Sheet Flow, Segment F-2** Smooth surfaces n= 0.011 P2= 2.55"
0.3	137	0.2900	8.7		**Shallow Concentrated Flow, Segment F-3** Unpaved Kv= 16.1 fps
1.1	237	Total			

Subcatchment F: Area F



Subcatchment Pond: Pond Area

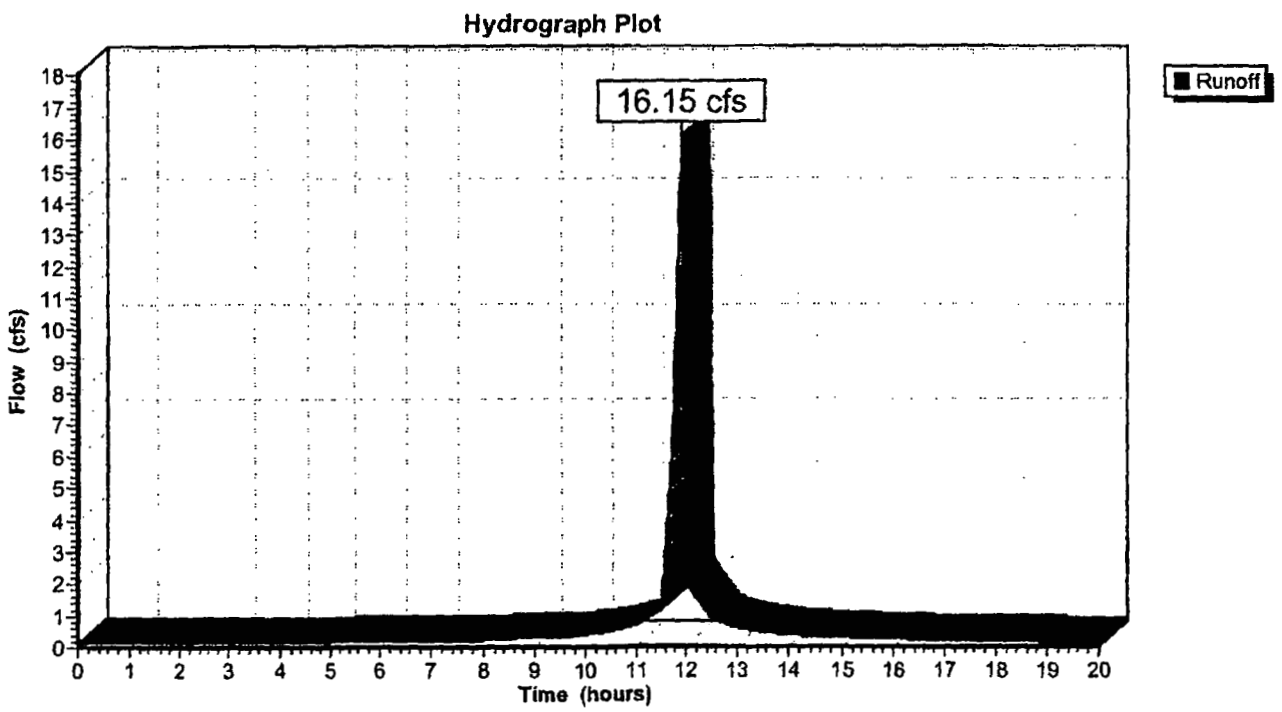
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 16.15 cfs @ 11.90 hrs, Volume= 0.753 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
2.020	100	Pond Area

Subcatchment Pond: Pond Area



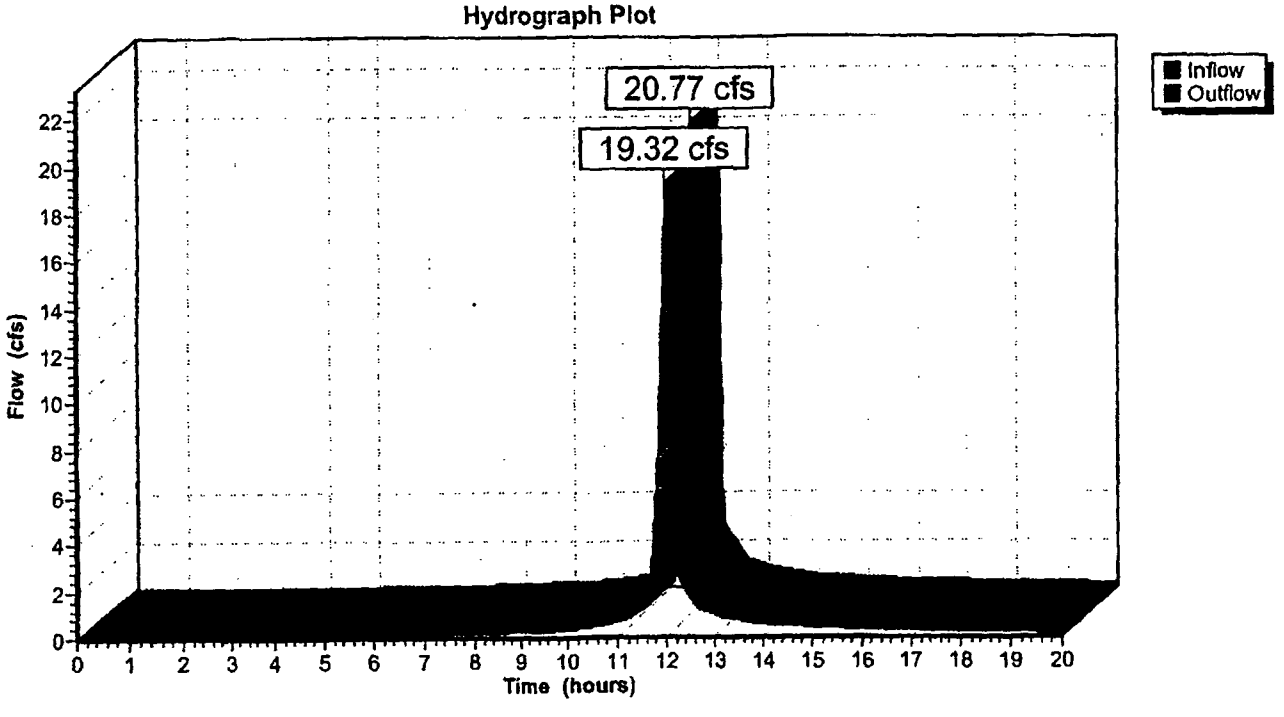
Reach 1R: Channel B

Inflow	=	20.77 cfs @	11.93 hrs, Volume=	0.891 af
Outflow	=	19.32 cfs @	12.00 hrs, Volume=	0.888 af, Atten= 7%, Lag= 3.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.3 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 1.5 fps, Avg. Travel Time= 6.9 min

Peak Depth= 1.41'
Capacity at bank full= 923.30 cfs
Inlet Invert= 603.00', Outlet Invert= 599.80'
0.00' x 6.00' deep channel, n= 0.018 Length= 637.0' Slope= 0.0050 '/'
Side Slope Z-value= 1.5 3.0 '/'

Reach 1R: Channel B



Reach 2R: Channel C

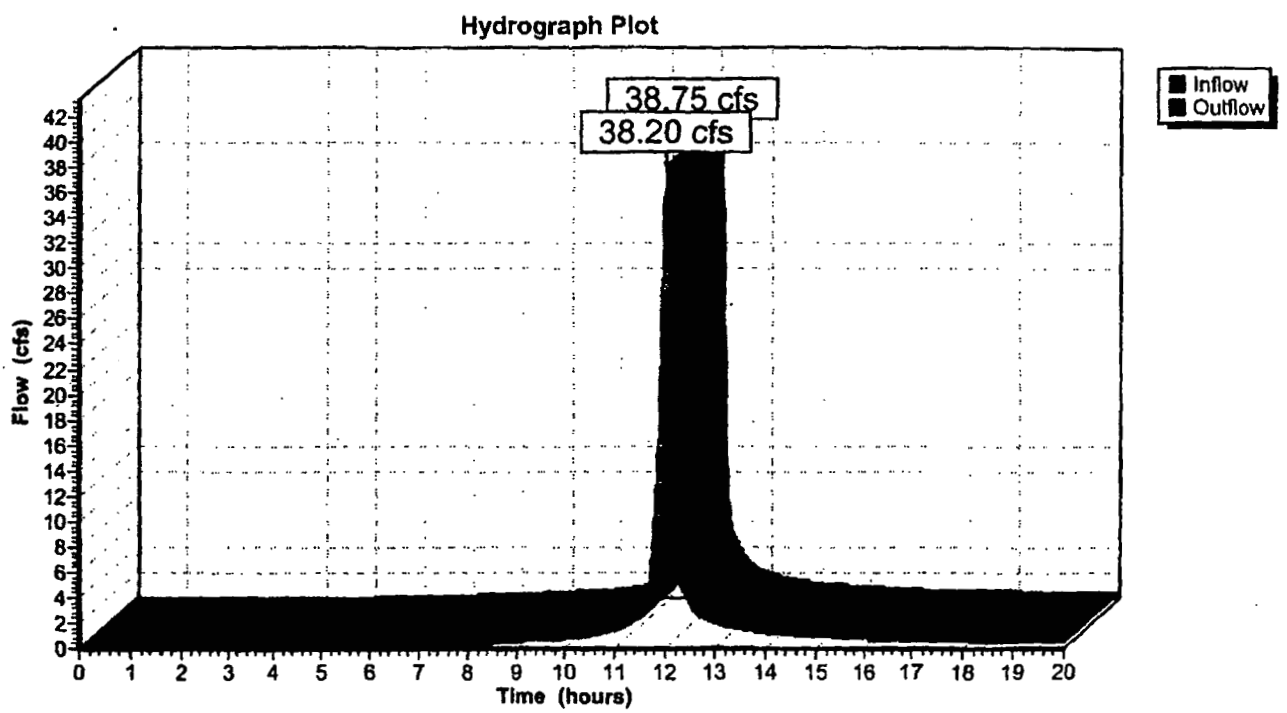
[61] Hint: Submerged 51% of Reach 1R bottom

Inflow	=	38.75 cfs @ 11.96 hrs, Volume=	1.869 af	
Outflow	=	38.20 cfs @ 12.00 hrs, Volume=	1.866 af, Atten= 1%, Lag= 2.0 min	

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.4 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 2.3 fps, Avg. Travel Time= 3.2 min

Peak Depth= 1.63'
Capacity at bank full= 1,236.14 cfs
Inlet Invert= 599.80', Outlet Invert= 595.82'
0.00' x 6.00' deep channel, n= 0.018 Length= 442.0' Slope= 0.0090 '/'
Side Slope Z-value= 1.5 3.0 '/'

Reach 2R: Channel C



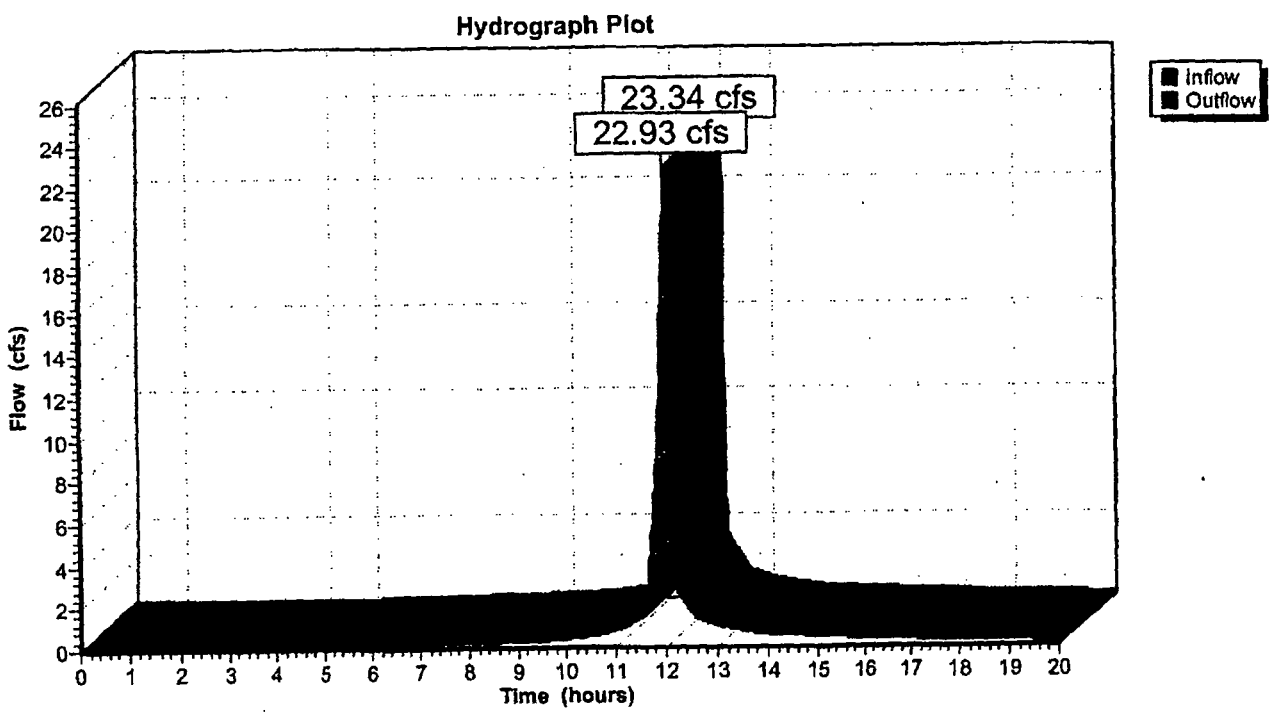
Reach 3R: Channel E

Inflow	=	23.34 cfs @	11.94 hrs, Volume=	1.004 af
Outflow	=	22.93 cfs @	11.96 hrs, Volume=	1.003 af, Atten= 2%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.5 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.6 fps, Avg. Travel Time= 2.5 min

Peak Depth= 1.50'
Capacity at bank full= 921.13 cfs
Inlet Invert= 595.97', Outlet Invert= 594.80'
0.00' x 6.00' deep channel, n= 0.018 Length= 234.0' Slope= 0.0050 '/'
Side Slope Z-value= 3.0 1.5 '/'

Reach 3R: Channel E



Reach 4R: Dummy Reach

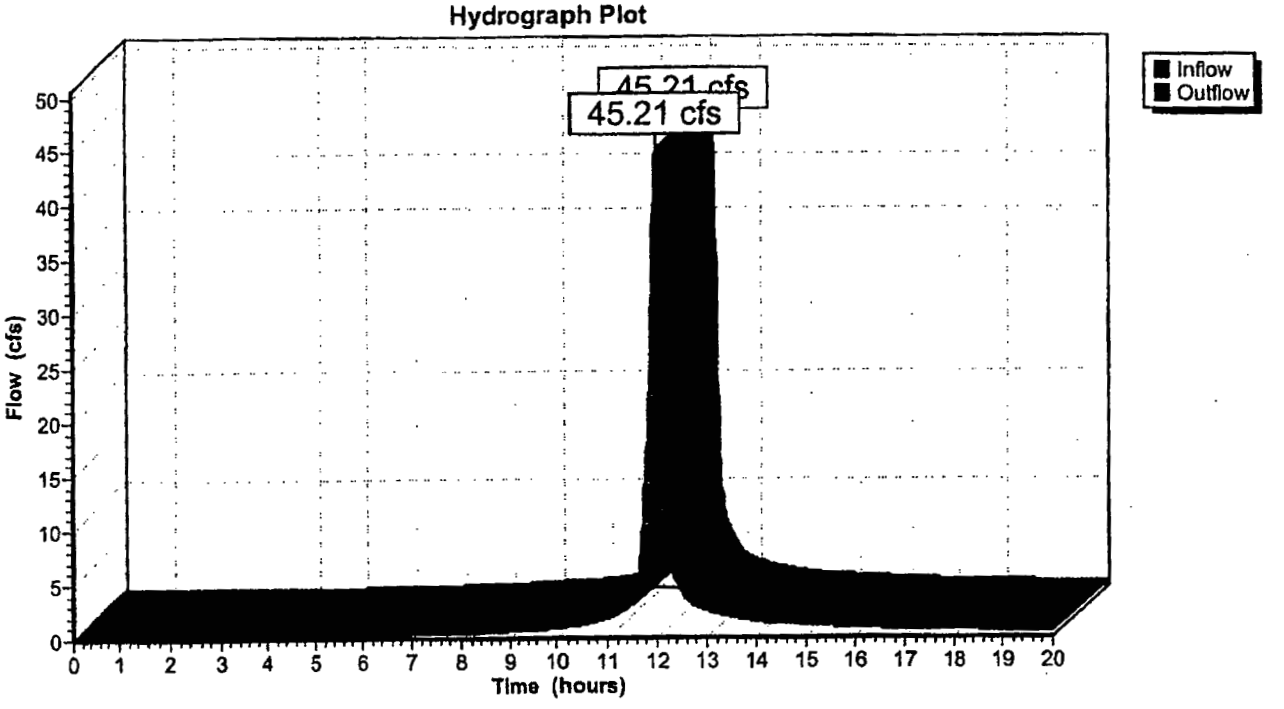
[40] Hint: Not Described (Outflow=Inflow)

Channel C

Inflow	=	45.21 cfs @	11.98 hrs,	Volume=	2.320 af
Outflow	=	45.21 cfs @	11.98 hrs,	Volume=	2.320 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs

Reach 4R: Dummy Reach



Reach 5R: Dummy Reach

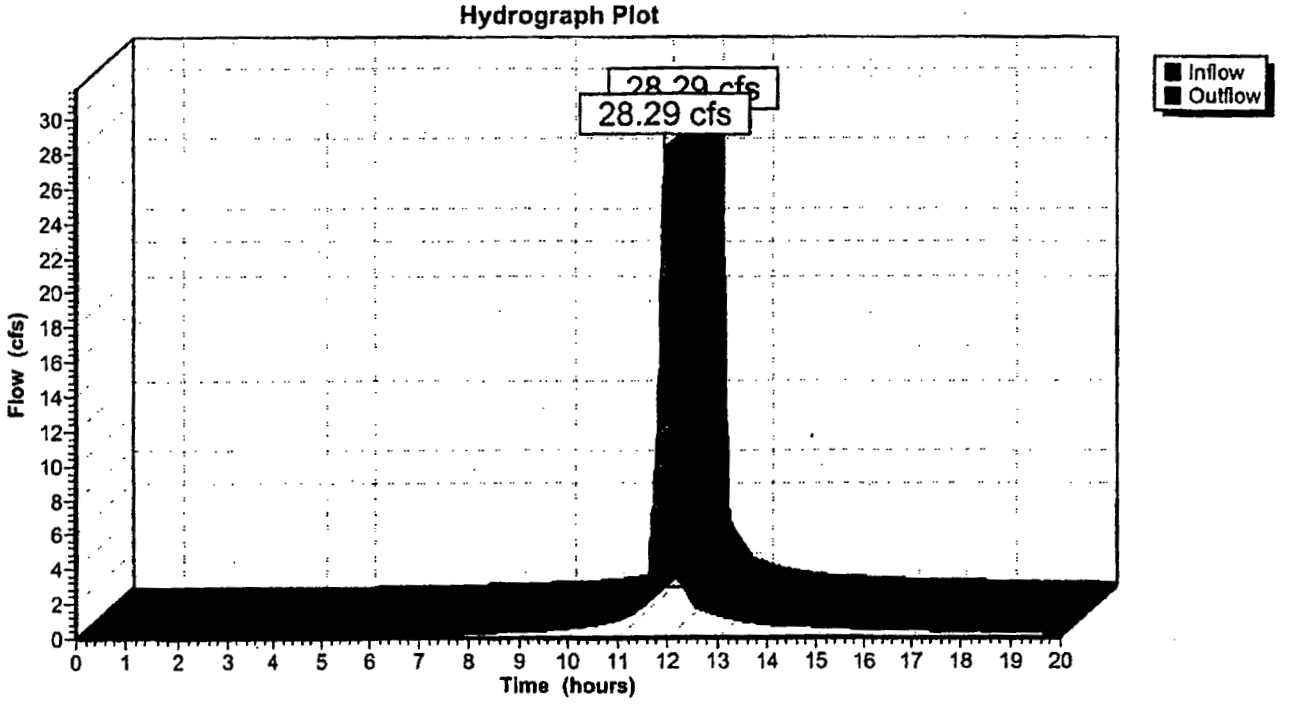
[40] Hint: Not Described (Outflow=Inflow)

Channel E

Inflow	=	28.29 cfs @	11.95 hrs,	Volume=	1.259 af
Outflow	=	28.29 cfs @	11.95 hrs,	Volume=	1.259 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs

Reach 5R: Dummy Reach



Pond IRCA: Detention Pond

Inflow = 95.09 cfs @ 11.93 hrs, Volume= 5.029 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

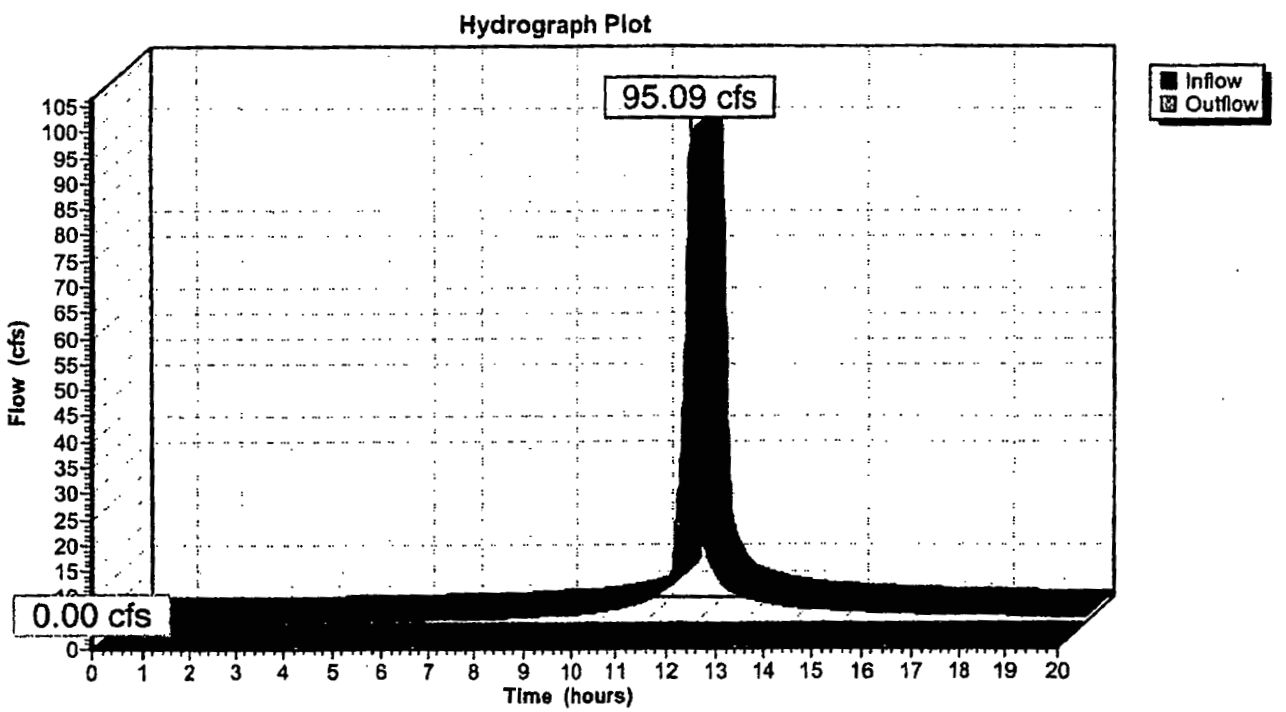
Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs

Peak Elev= 591.83' Storage= 5.029 af
Plug-Flow detention time= (not calculated)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
586.00	0.035	0.000	0.000
587.00	0.298	0.166	0.166
588.00	0.629	0.464	0.630
589.00	0.889	0.759	1.389
590.00	1.157	1.023	2.412
591.00	1.441	1.299	3.711 → 591.9 = 5.15 af
592.00	1.730	1.586	5.297

→ 224,334 ft³

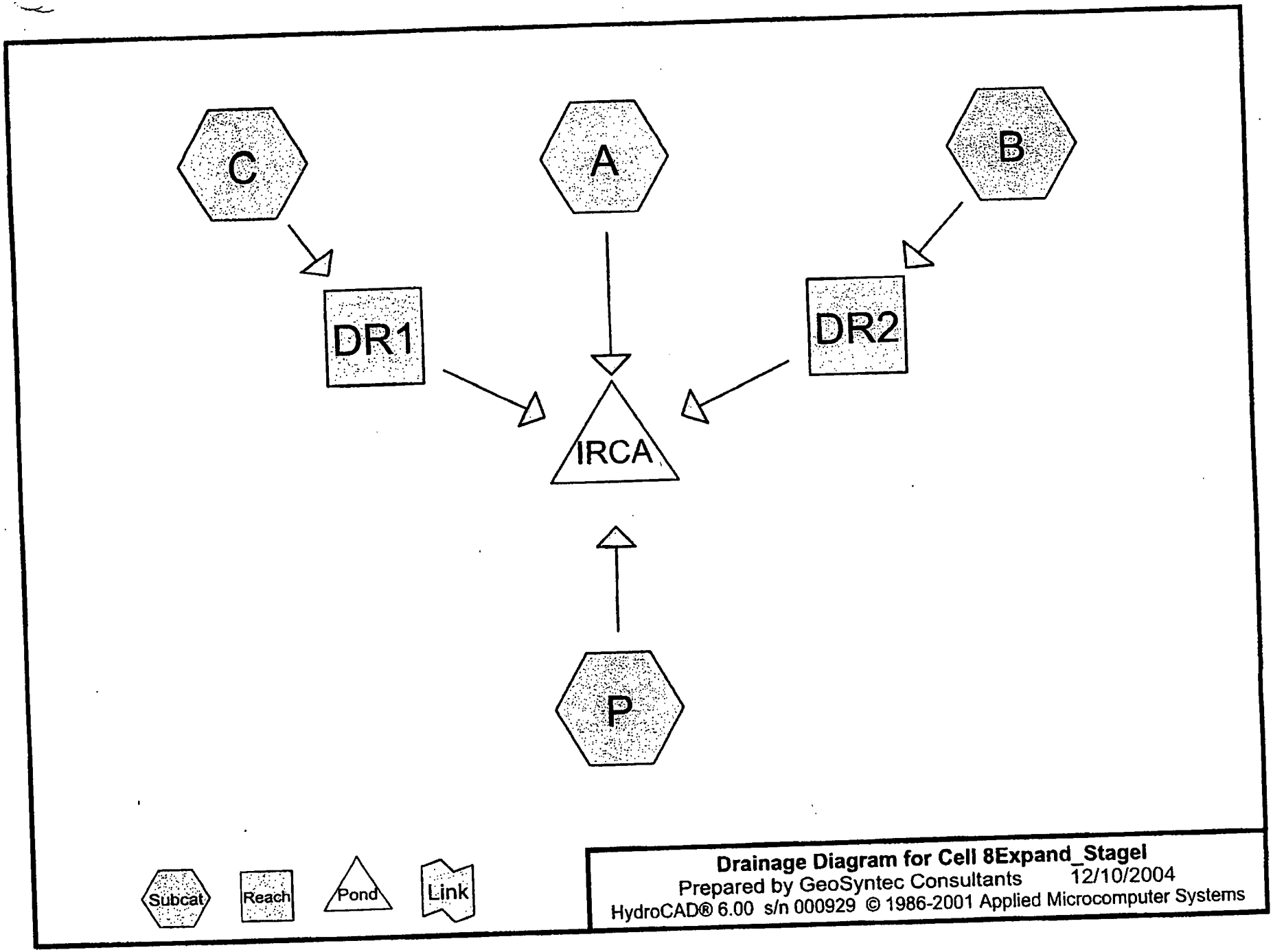
Pond IRCA: Detention Pond



Written by: Tamara E. Zettler Date: 12/15/2004 Reviewed by: _____ Date: _____

Client: Fluor Fernald, Inc. Project: OSDF Phase IV Project No.: GQ3309 Task No.: 02

STAGE I CALCULATION



Drainage Diagram for Cell 8Expand_Stagel
Prepared by GeoSyntec Consultants 12/10/2004
HydroCAD® 6.00 s/n 000929 © 1986-2001 Applied Microcomputer Systems

Cell 8Expand_Stagel *Type II 24-hr Rainfall=4.70"*
Prepared by GeoSyntec Consultants Page 1
HydroCAD® 6.00 s/n 000929 © 1986-2001 Applied Microcomputer Systems 12/10/2004

Time span=0.00-20.00 hrs, dt=0.01 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Type II 24-hr Rainfall=4.70"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Area A
Tc=1.6 min CN=91 Area=2.980 ac Runoff= 21.01 cfs 0.862 af

Subcatchment B: Area B
Tc=4.4 min CN=91 Area=1.960 ac Runoff= 12.64 cfs 0.567 af

Subcatchment C: Area C
Tc=1.7 min CN=91 Area=0.220 ac Runoff= 1.55 cfs 0.064 af

Subcatchment P: Pond Area
Tc=0.0 min CN=100 Area=0.734 ac Runoff= 5.87 cfs 0.274 af

Reach DR1: Dummy Reach
Inflow= 1.55 cfs 0.064 af
Outflow= 1.55 cfs 0.064 af

Reach DR2: Dummy Reach
Inflow= 12.64 cfs 0.567 af
Outflow= 12.64 cfs 0.567 af

Pond IRCA: Detention Pond
Peak Storage= 1.766 af Inflow= 38.99 cfs 1.766 af
Outflow= 0.00 cfs 0.000 af

Runoff Area = 5.894 ac Volume = 1.766 af Average Depth = 3.60"

2 76,927 ft³

Subcatchment A: Area A

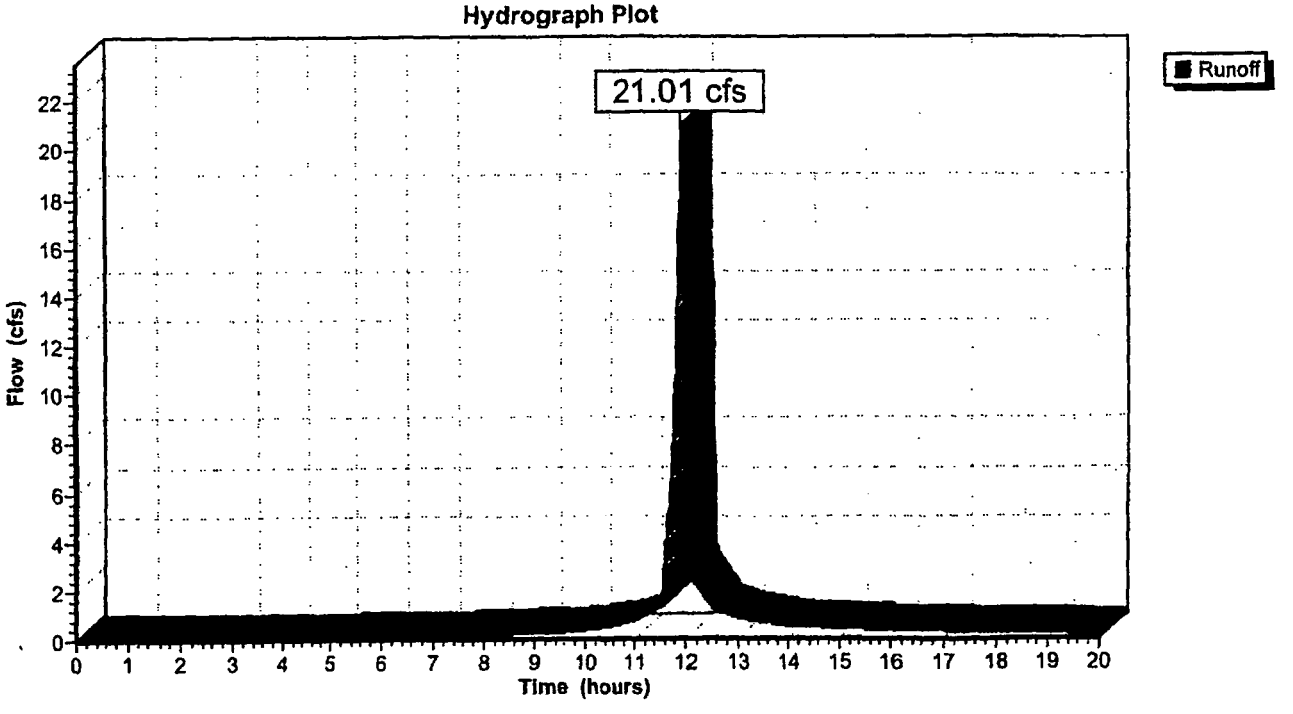
Runoff = 21.01 cfs @ 11.92 hrs, Volume= 0.862 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
2.980	91	Total Sideslope Area A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	100	0.2900	3.6		**Sheet Flow, Segment A-1** Smooth surfaces n= 0.011 P2= 2.55"
0.1	35	0.2900	8.7		**Shallow Concentrated Flow, Segment A-2** Unpaved Kv= 16.1 fps
1.0	173	0.0300	2.8		**Shallow Concentrated Flow, Segment A-3** Unpaved Kv= 16.1 fps
0.0	18	0.2900	8.7		**Shallow Concentrated Flow, Segment A-4** Unpaved Kv= 16.1 fps
1.6	326	Total			

Subcatchment A: Area A



Subcatchment B: Area B

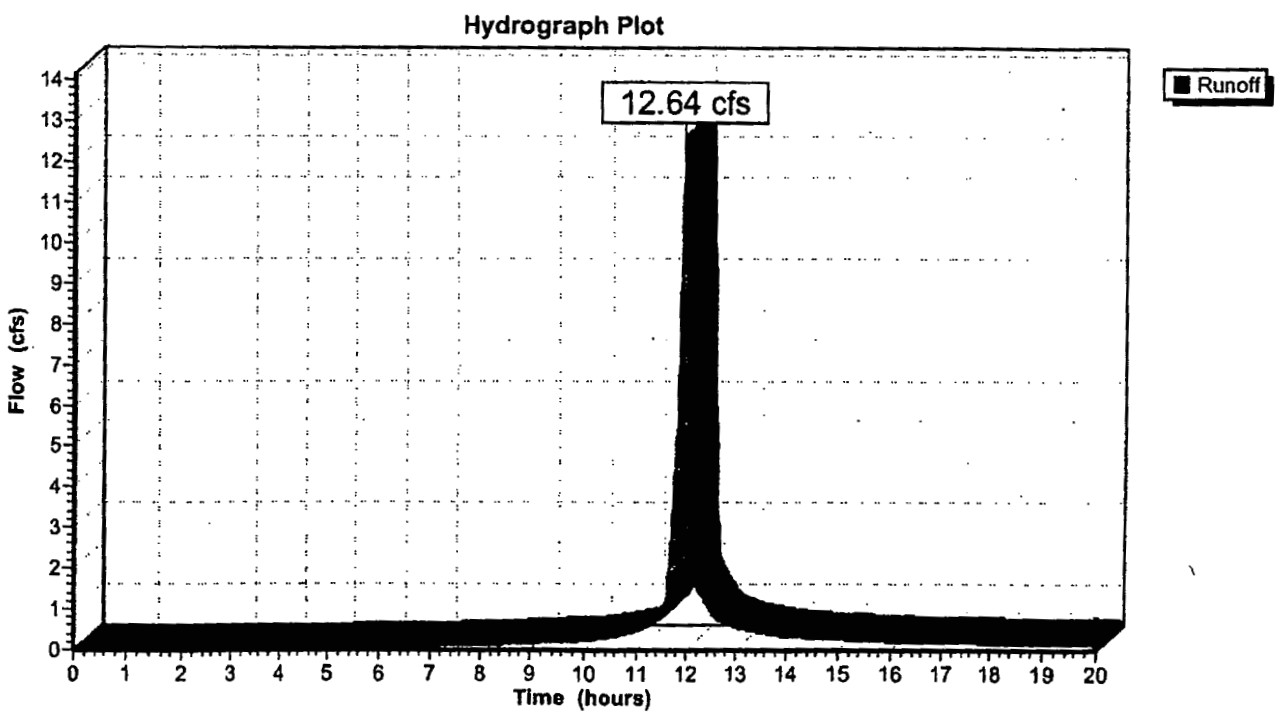
Runoff = 12.64 cfs @ 11.95 hrs, Volume= 0.567 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
1.960	91	Total Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	100	0.2900	3.6		**Sheet Flow, Segment B-1** Smooth surfaces n= 0.011 P2= 2.55"
0.1	35	0.2900	8.7		**Shallow Concentrated Flow, Segment B-3** Unpaved Kv= 16.1 fps
1.0	159	0.0300	2.8		**Shallow Concentrated Flow, Segment B-3** Unpaved Kv= 16.1 fps
0.9	86	0.0100	1.6		**Shallow Concentrated Flow, Segment B-4** Unpaved Kv= 16.1 fps
0.0	7	0.3300	9.2		**Shallow Concentrated Flow, Segment B-5** Unpaved Kv= 16.1 fps
1.9	268	0.0060	2.4	1.34	**Trap/Vee/Rect Channel Flow, Channel B** Bot.W=0.00' D=0.50' Z= 3.0 & 1.5 '/' n= 0.018
4.4	655	Total			

Subcatchment B: Area B



Subcatchment C: Area C

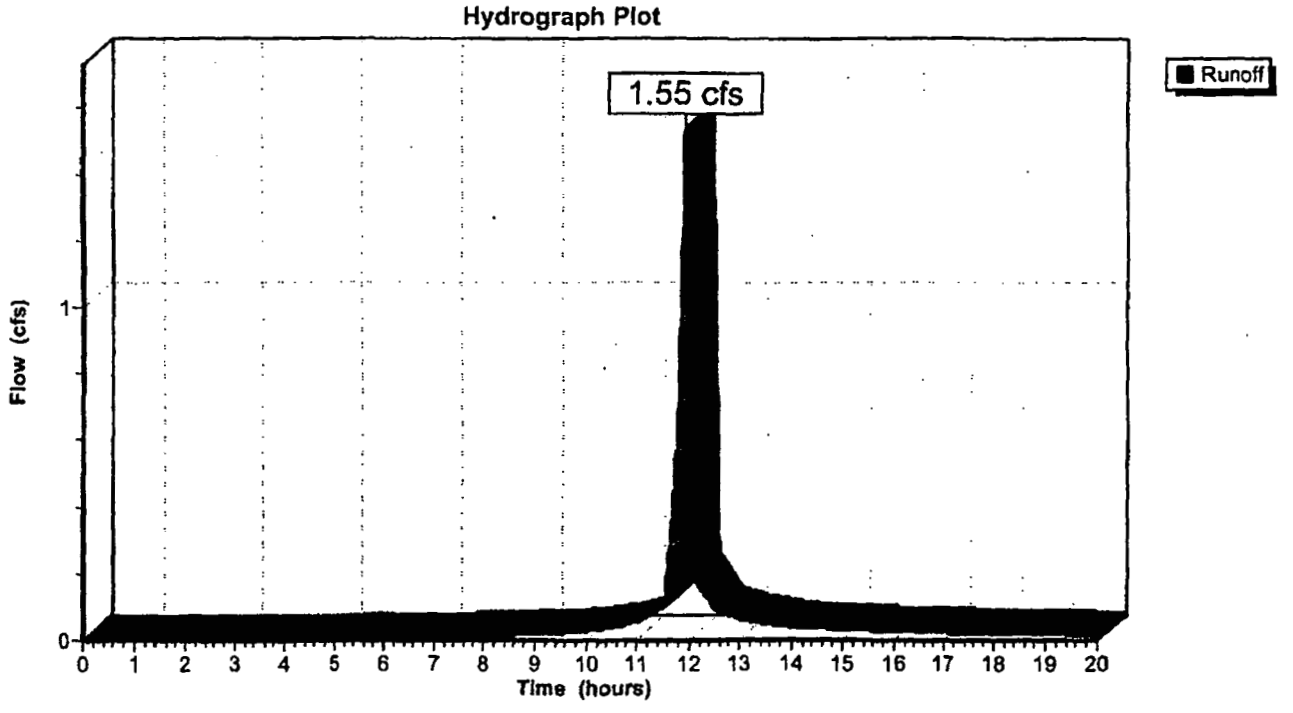
Runoff = 1.55 cfs @ 11.92 hrs, Volume= 0.064 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.220	91	Total Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	60	0.3300	3.4		**Sheet Flow, Segment C-1** Smooth surfaces n= 0.011 P2= 2.55"
0.4	27	0.0300	1.1		**Sheet Flow, Segment C-2** Smooth surfaces n= 0.011 P2= 2.55"
0.4	13	0.0100	0.6		**Sheet Flow, Segment C-3** Smooth surfaces n= 0.011 P2= 2.55"
0.6	58	0.0100	1.6		**Shallow Concentrated Flow, Segment C-4** Unpaved Kv= 16.1 fps
1.7	158	Total			

Subcatchment C: Area C



Subcatchment P: Pond Area

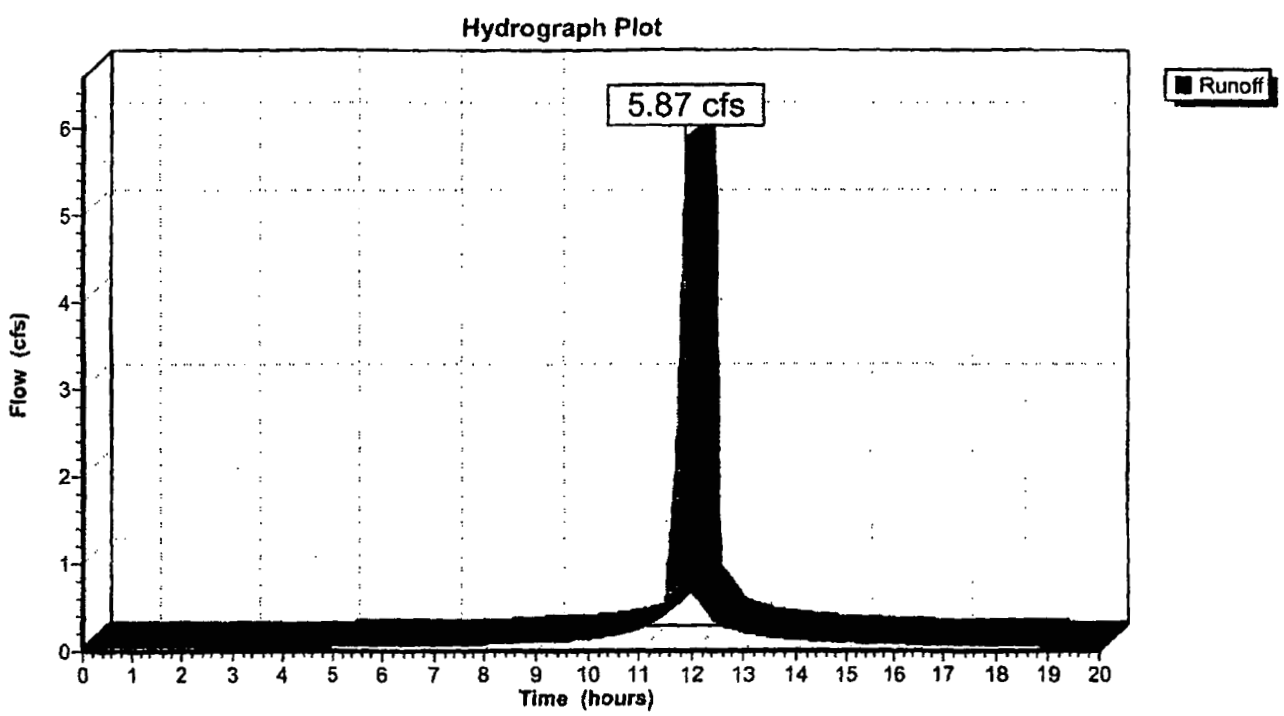
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 5.87 cfs @ 11.90 hrs, Volume= 0.274 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.734	100	Pond Area

Subcatchment P: Pond Area



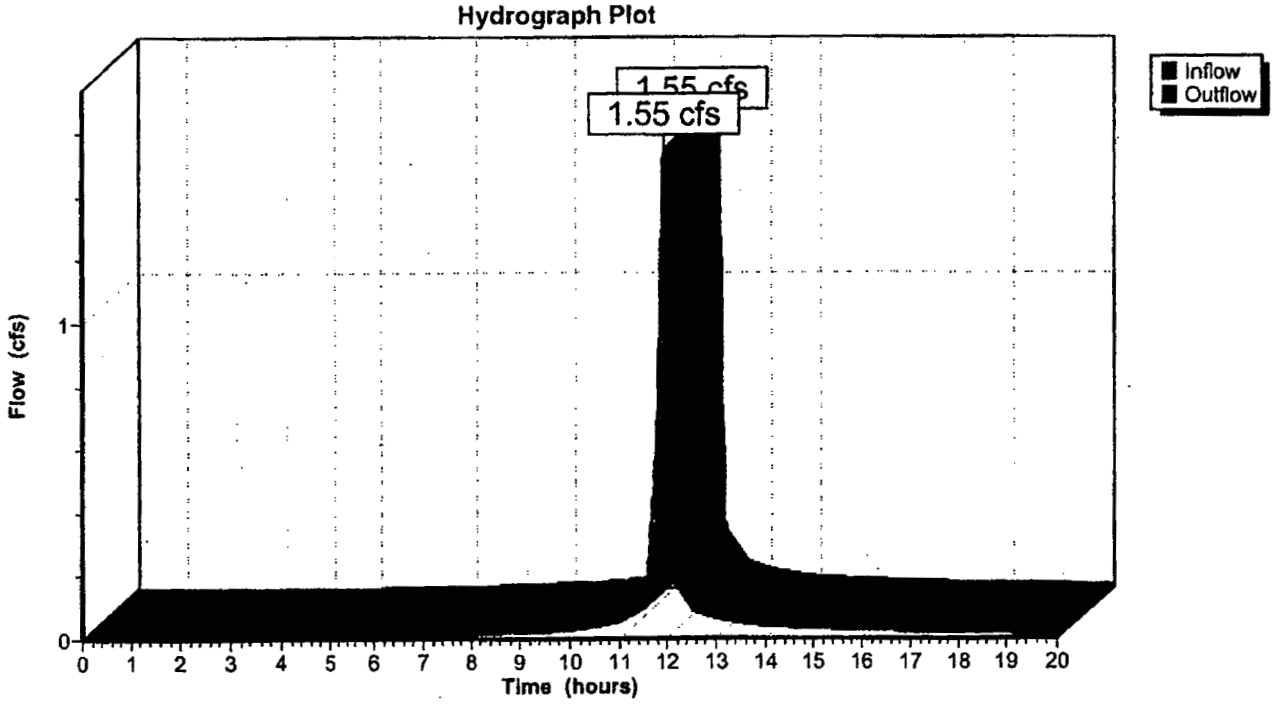
Reach DR1: Dummy Reach

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	1.55 cfs @ 11.92 hrs, Volume=	0.064 af	
Outflow	=	1.55 cfs @ 11.92 hrs, Volume=	0.064 af, Atten= 0%, Lag= 0.0 min	

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs

Reach DR1: Dummy Reach



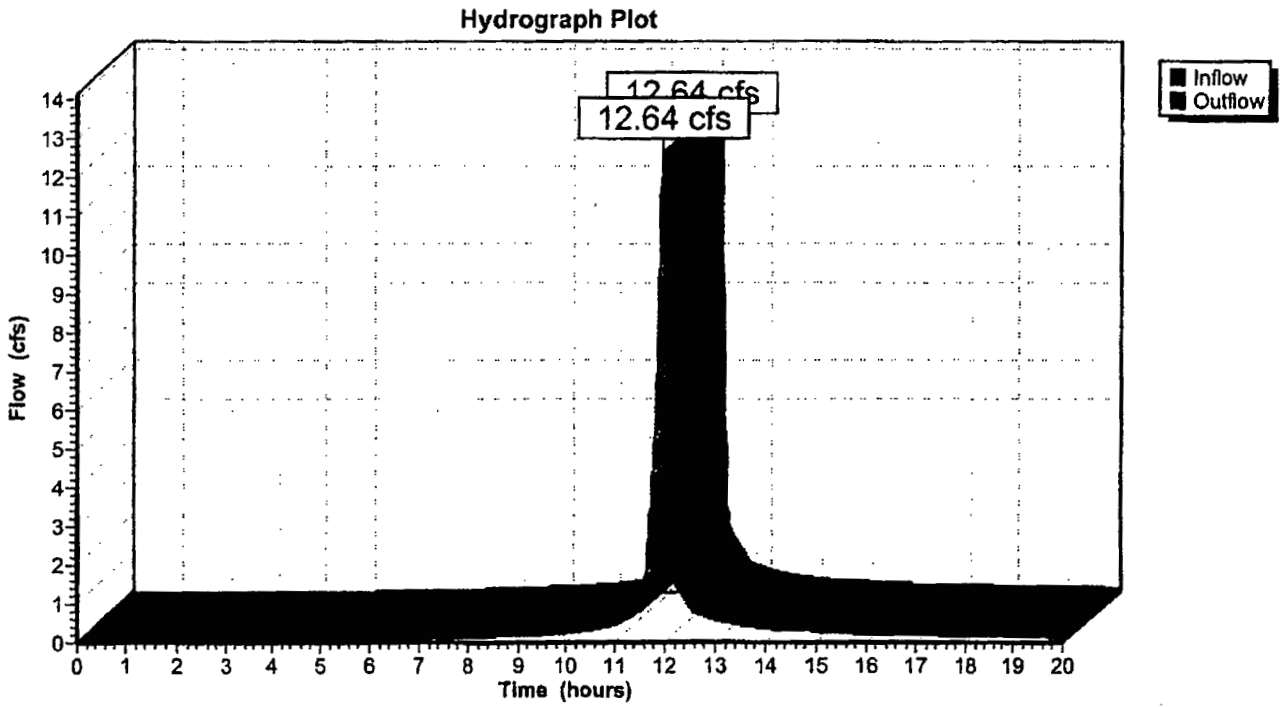
Reach DR2: Dummy Reach

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	12.64 cfs @	11.95 hrs,	Volume=	0.567 af
Outflow	=	12.64 cfs @	11.95 hrs,	Volume=	0.567 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs

Reach DR2: Dummy Reach



Pond IRCA: Detention Pond

Inflow = 38.99 cfs @ 11.92 hrs, Volume= 1.766 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

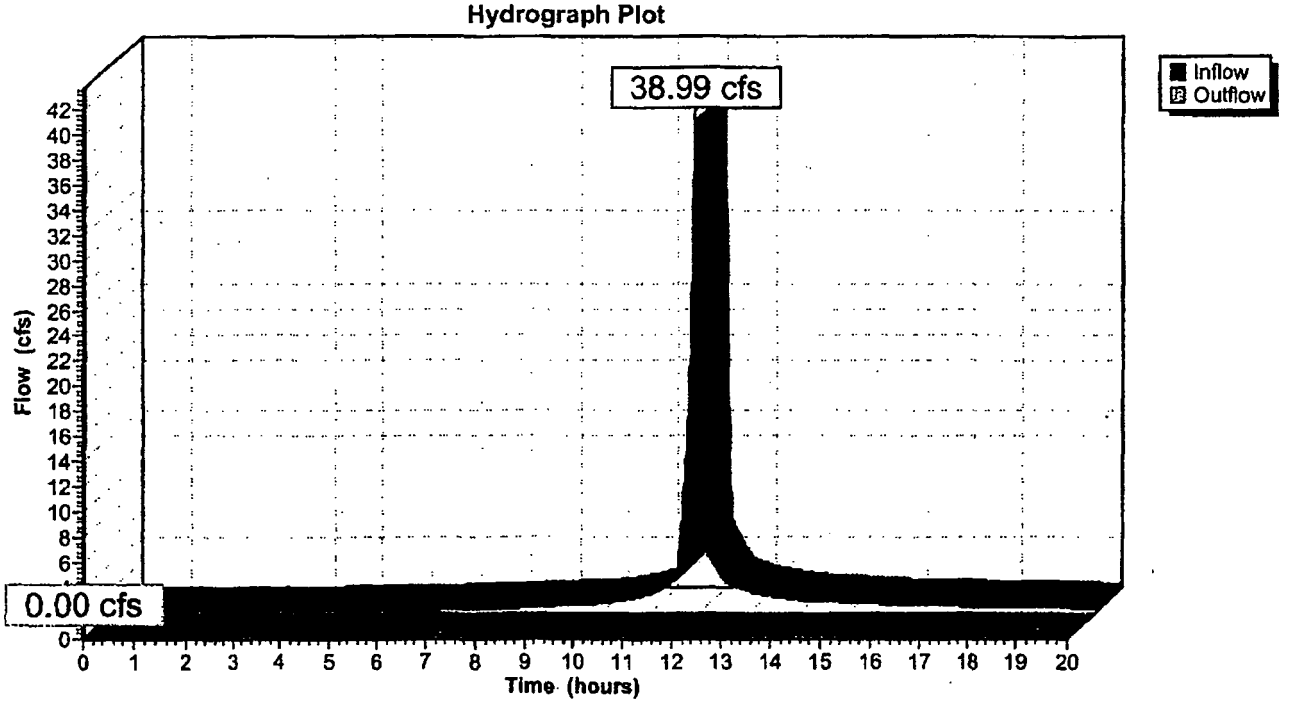
Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs

Peak Elev= 591.41' Storage= 1.766 af
Plug-Flow detention time= (not calculated)
Storage and wetted areas determined by Prismatic sections

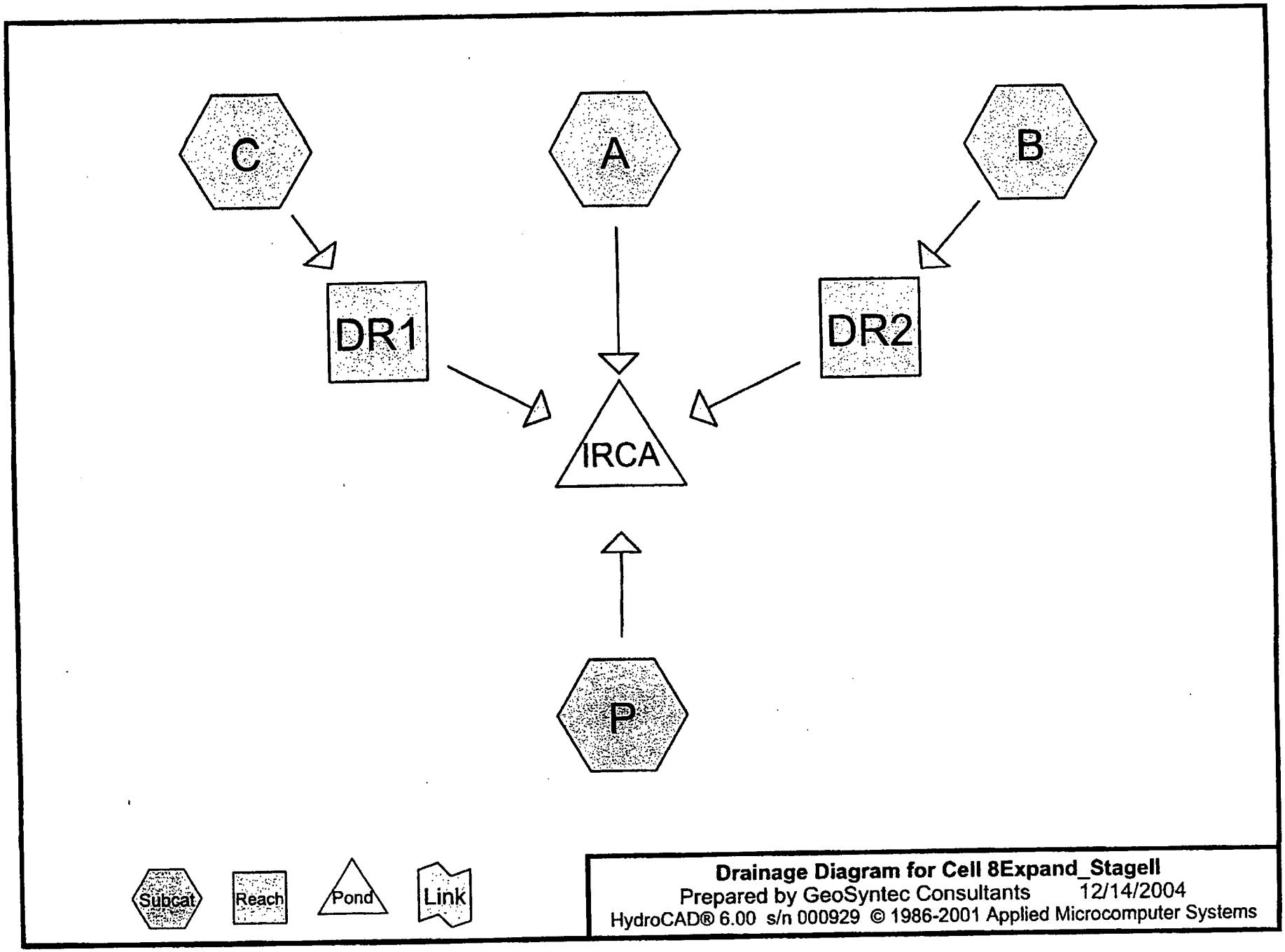
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
586.00	0.035	0.000	0.000
587.00	0.147	0.091	0.091
588.00	0.244	0.195	0.286
589.00	0.358	0.301	0.588
590.00	0.482	0.420	1.007
591.00	0.554	0.518	1.526
592.00	0.622	0.588	2.113

92,042 ft³

Pond IRCA: Detention Pond



STAGE II CALCULATION



Drainage Diagram for Cell 8Expand_StageII
Prepared by GeoSyntec Consultants 12/14/2004
HydroCAD® 6.00 s/n 000929 © 1986-2001 Applied Microcomputer Systems

Cell 8Expand_StageII *Type II 24-hr Rainfall=4.70"*
Prepared by GeoSyntec Consultants Page 1
HydroCAD® 6.00 s/n 000929 © 1986-2001 Applied Microcomputer Systems 12/14/2004

Time span=0.00-20.00 hrs, dt=0.01 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Type II 24-hr Rainfall=4.70"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Area A
Tc=0.8 min CN=91 Area=1.760 ac Runoff= 12.71 cfs 0.509 af

Subcatchment B: Area B
Tc=3.4 min CN=91 Area=0.820 ac Runoff= 5.46 cfs 0.237 af

Subcatchment C: Area C
Tc=1.2 min CN=91 Area=0.115 ac Runoff= 0.82 cfs 0.033 af

Subcatchment P: Pond Area
Tc=0.0 min CN=100 Area=0.734 ac Runoff= 5.87 cfs 0.274 af

Reach DR1: Dummy Reach
Inflow= 0.82 cfs 0.033 af
Outflow= 0.82 cfs 0.033 af

Reach DR2: Dummy Reach
Inflow= 5.46 cfs 0.237 af
Outflow= 5.46 cfs 0.237 af

Pond IRCA: Detention Pond
Peak Storage= 1.053 af Inflow= 23.94 cfs 1.053 af
Outflow= 0.00 cfs 0.000 af

Runoff Area = 3.429 ac Volume = 1.053 af Average Depth = 3.69"

L 45,869 ft³

Subcatchment A: Area A

[49] Hint: Tc<2dt may require smaller dt

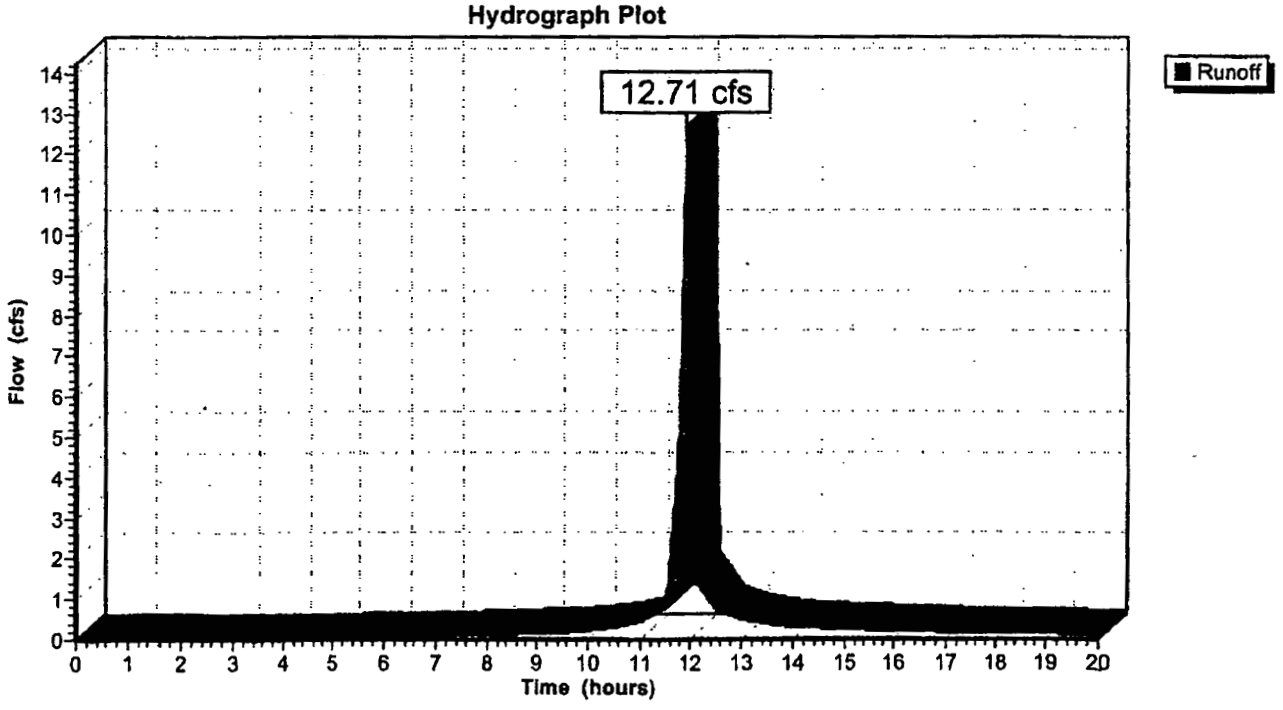
Runoff = 12.71 cfs @ 11.91 hrs, Volume= 0.509 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
1.760	91	Total Sideslope Area A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	100	0.3300	3.8		**Sheet Flow, Segment A-1** Smooth surfaces n= 0.011 P2= 2.55"
0.0	2	0.3300	9.2		**Shallow Concentrated Flow, Segment A-2** Unpaved Kv= 16.1 fps
0.4	69	0.0300	2.8		**Shallow Concentrated Flow, Segment A-3** Unpaved Kv= 16.1 fps
0.0	17	0.2900	8.7		**Shallow Concentrated Flow, Segment A-4** Unpaved Kv= 16.1 fps
0.8	188	Total			

Subcatchment A: Area A



Subcatchment B: Area B

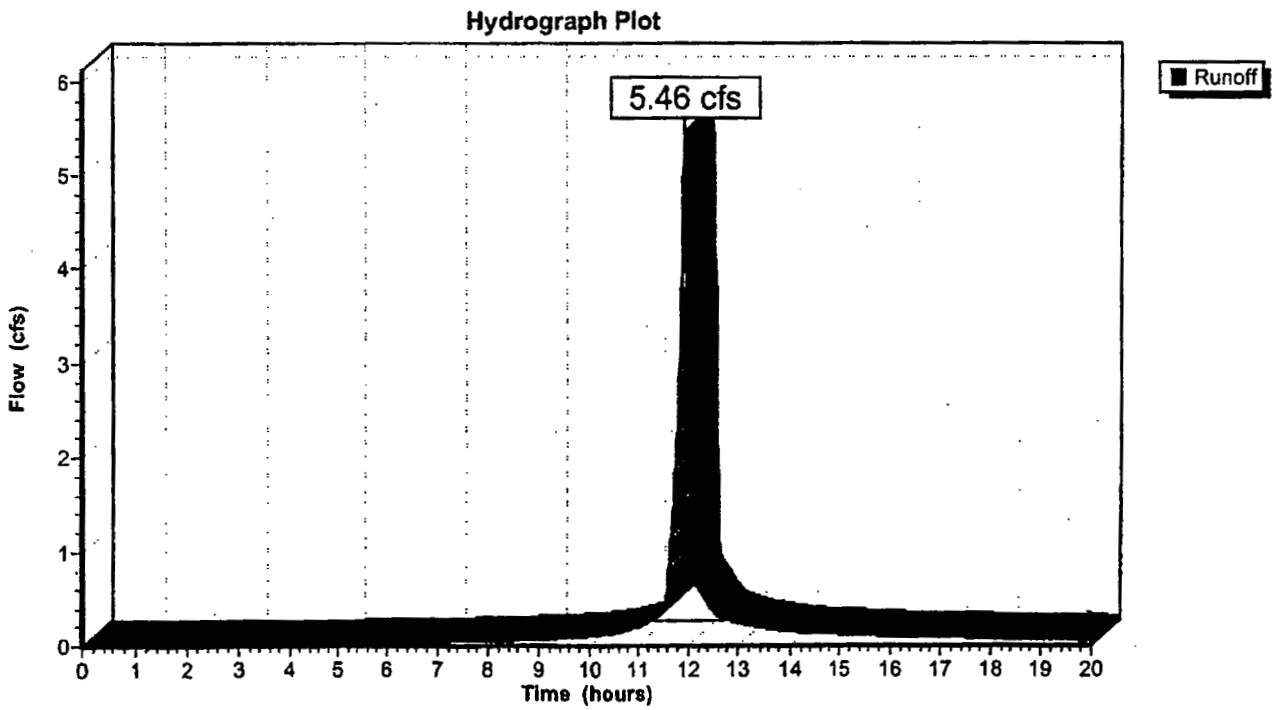
Runoff = 5.46 cfs @ 11.94 hrs, Volume= 0.237 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.820	91	Total Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.4	88	0.3300	3.7		**Sheet Flow, Segment B-1** Smooth surfaces n= 0.011 P2= 2.55"
0.2	12	0.0300	0.9		**Sheet Flow, Segment B-2** Smooth surfaces n= 0.011 P2= 2.55"
0.4	65	0.0300	2.8		**Shallow Concentrated Flow, Segment B-3** Unpaved Kv= 16.1 fps
0.9	86	0.0100	1.6		**Shallow Concentrated Flow, Segment B-4** Unpaved Kv= 16.1 fps
0.0	7	0.3300	9.2		**Shallow Concentrated Flow, Segment B-5** Unpaved Kv= 16.1 fps
1.5	195	0.0050	2.2	1.22	**Trap/Vee/Rect Channel Flow, Channel B** Bot.W=0.00' D=0.50' Z= 1.5 & 3.0 '/' n= 0.018
3.4	453	Total			

Subcatchment B: Area B



Subcatchment C: Area C

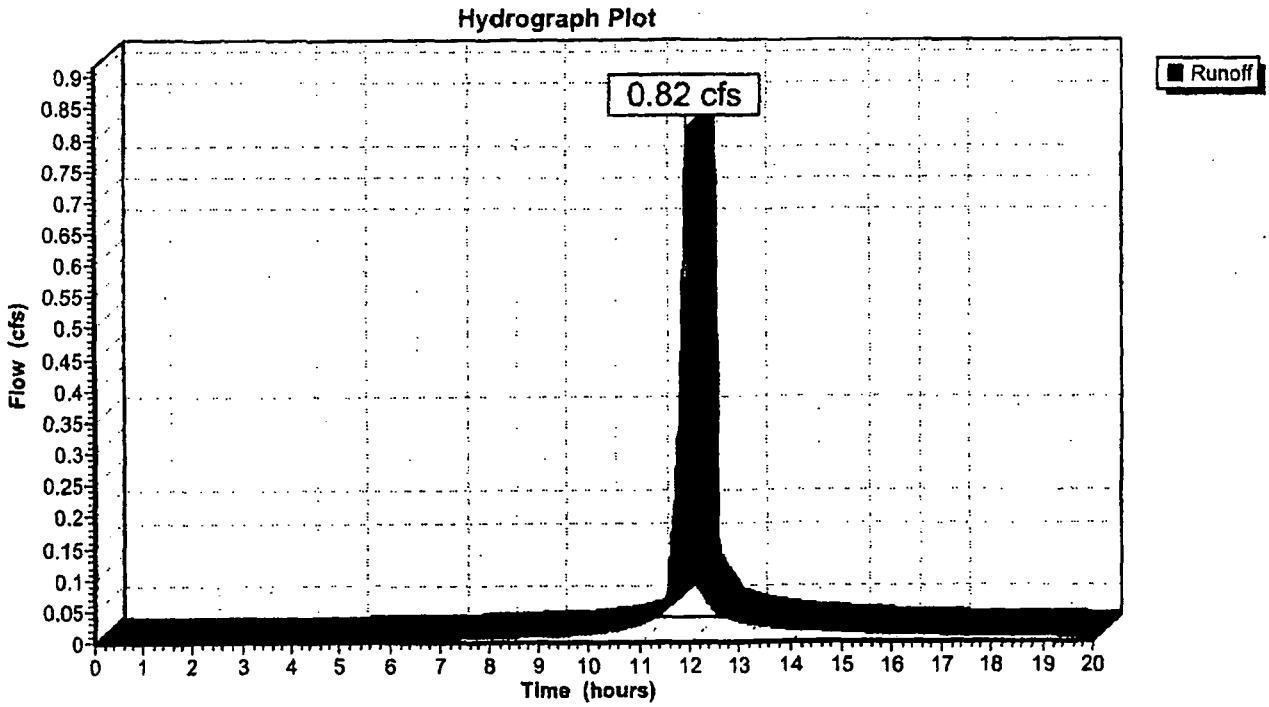
Runoff = 0.82 cfs @ 11.91 hrs, Volume= 0.033 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.115	91	Total Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.2	46	0.3300	3.2		**Sheet Flow, Segment C-1** Smooth surfaces n= 0.011 P2= 2.55"
0.9	41	0.0100	0.8		**Sheet Flow, Segment C-2** Smooth surfaces n= 0.011 P2= 2.55"
0.1	13	0.2900	2.4		**Sheet Flow, Segment C-3** Smooth surfaces n= 0.011 P2= 2.55"
0.0	4	0.2900	8.7		**Shallow Concentrated Flow, Segment C-4** Unpaved Kv= 16.1 fps
1.2	104	Total			

Subcatchment C: Area C



Subcatchment P: Pond Area

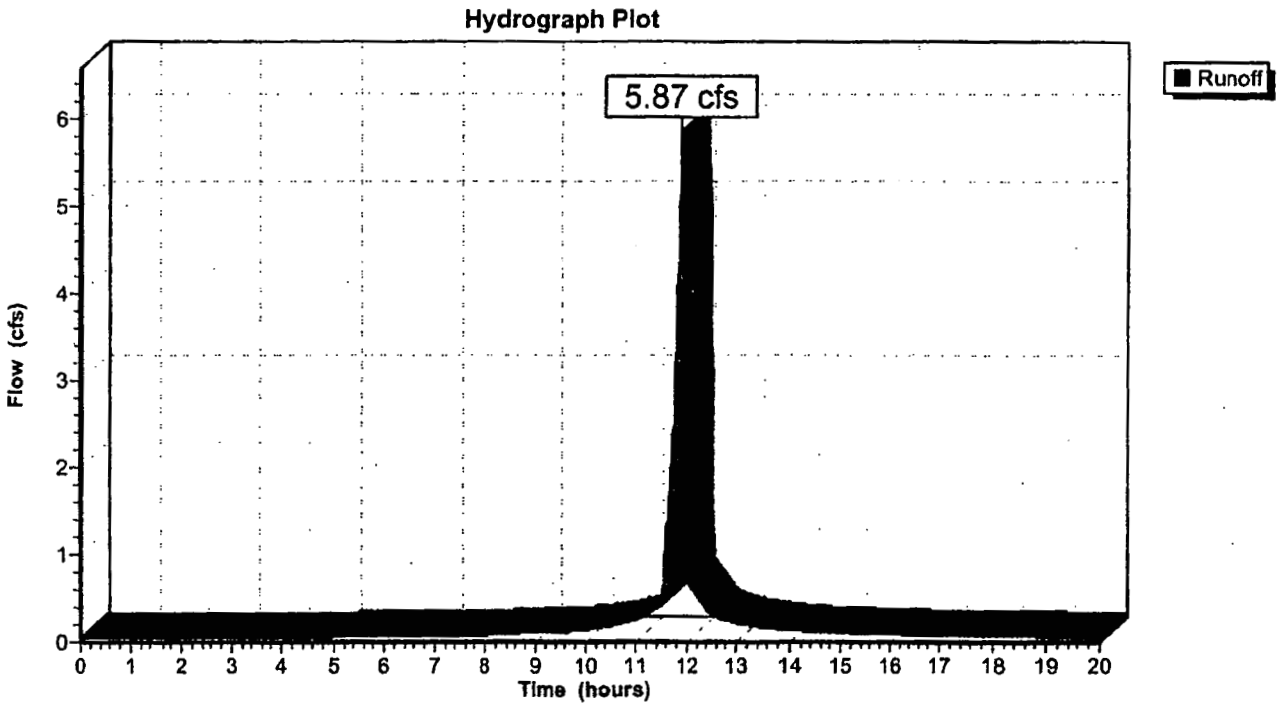
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 5.87 cfs @ 11.90 hrs, Volume= 0.274 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.734	100	Pond Area

Subcatchment P: Pond Area



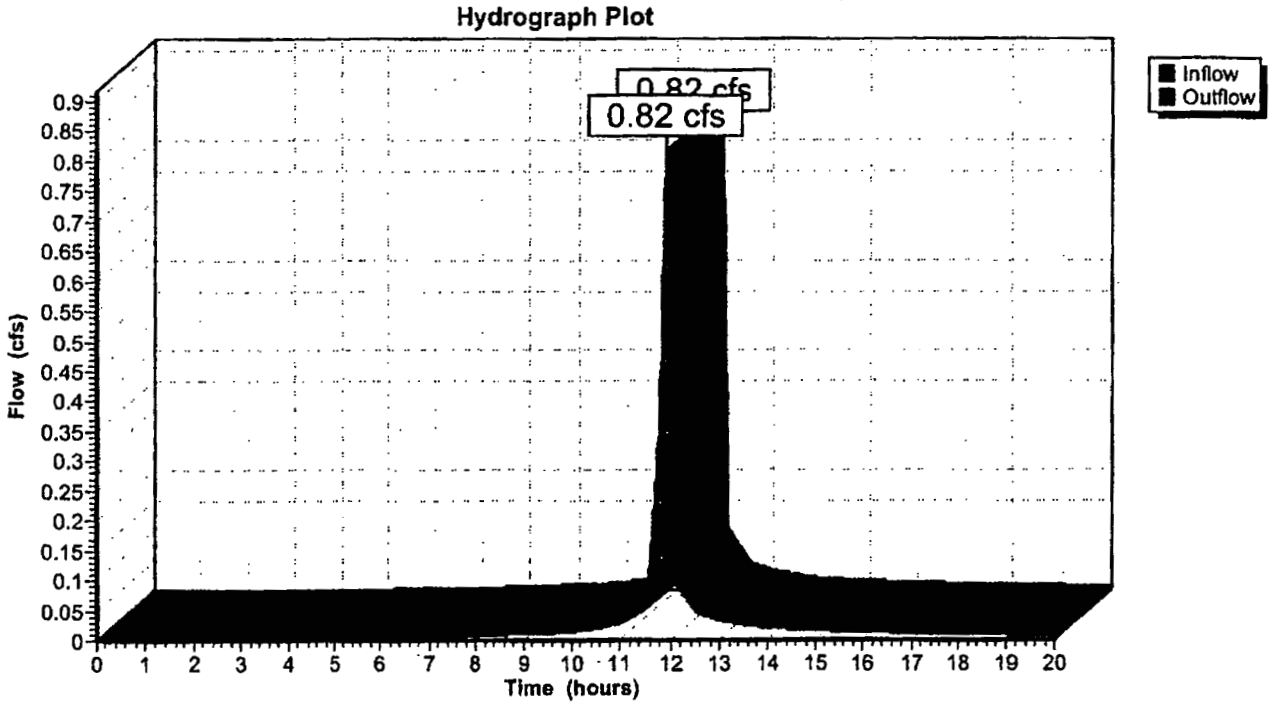
Reach DR1: Dummy Reach

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	0.82 cfs @ 11.91 hrs, Volume=	0.033 af	
Outflow	=	0.82 cfs @ 11.91 hrs, Volume=	0.033 af, Atten= 0%, Lag= 0.0 min	

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs

Reach DR1: Dummy Reach



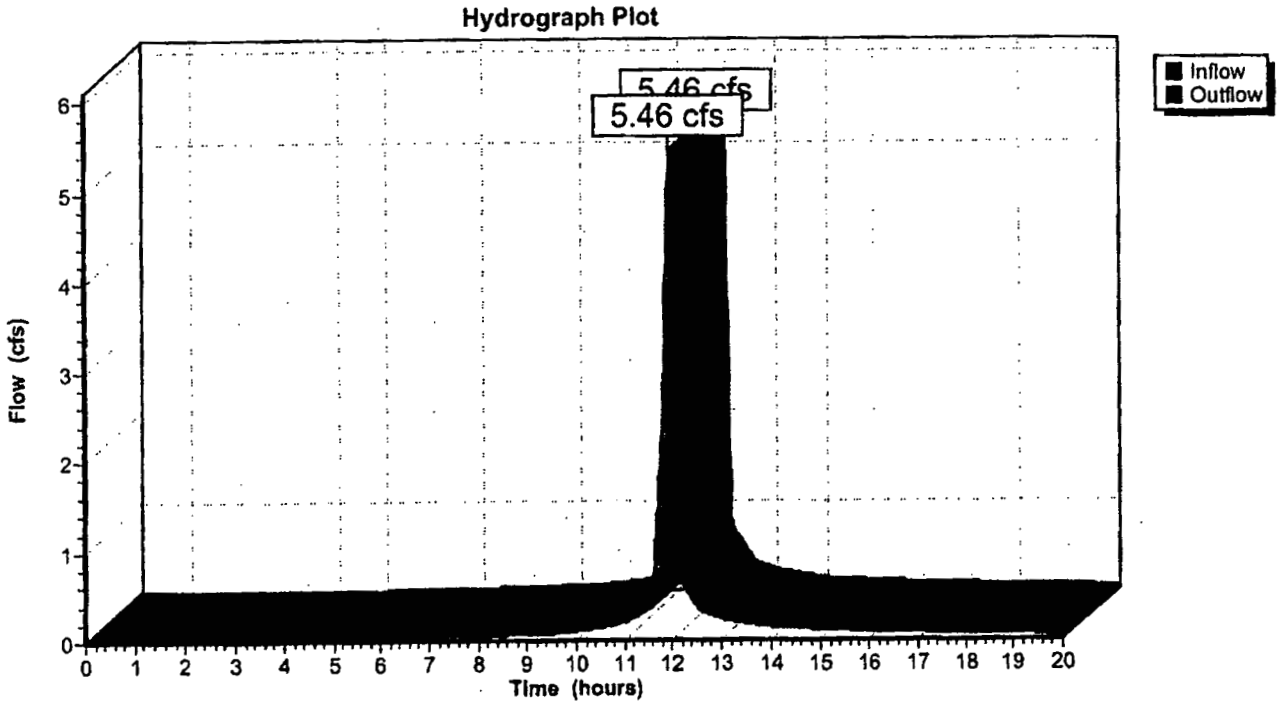
Reach DR2: Dummy Reach

[40] Hint: Not Described (Outflow=Inflow)

Inflow	=	5.46 cfs @	11.94 hrs,	Volume=	0.237 af
Outflow	=	5.46 cfs @	11.94 hrs,	Volume=	0.237 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs

Reach DR2: Dummy Reach



Pond IRCA: Detention Pond

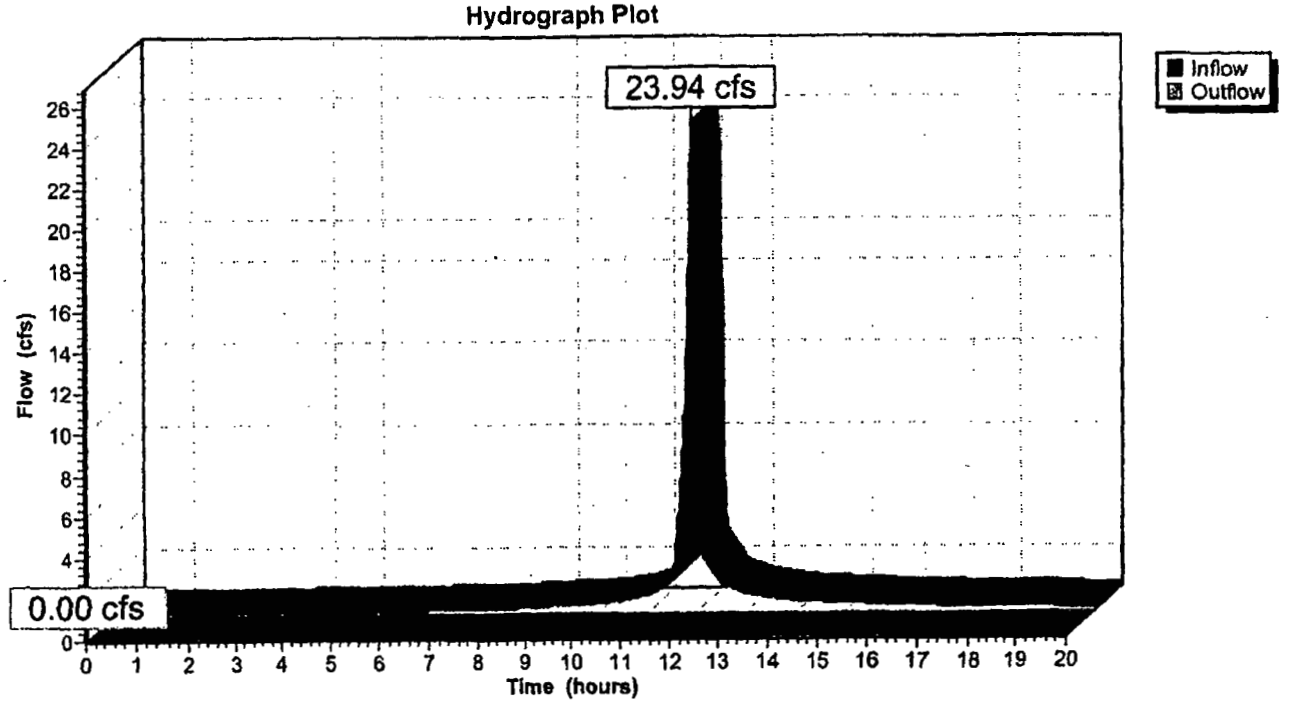
Inflow	=	23.94 cfs @	11.91 hrs,	Volume=	1.053 af
Outflow	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af, Atten= 100%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs

Peak Elev= 590.09' Storage= 1.053 af
Plug-Flow detention time= (not calculated)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
586.00	0.035	0.000	0.000
587.00	0.147	0.091	0.091
588.00	0.244	0.195	0.286
589.00	0.358	0.301	0.588
590.00	0.482	0.420	1.007
591.00	0.554	0.518	1.526
592.00	0.622	0.588	2.113 → 92,042 ft³

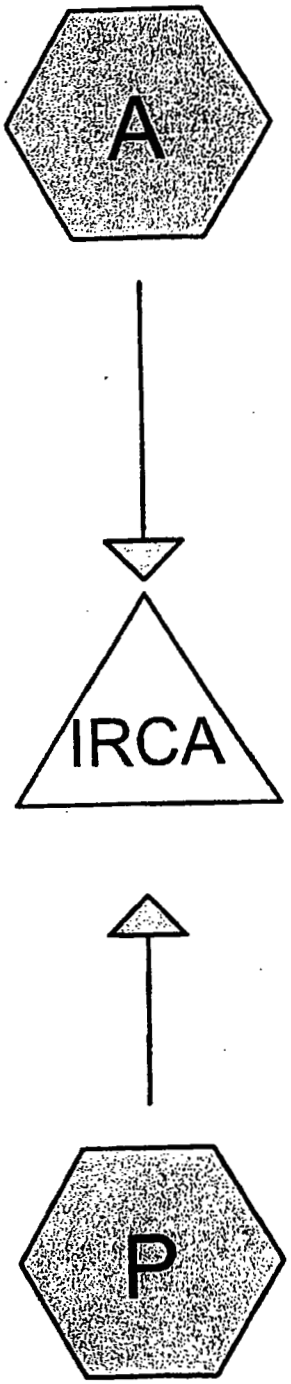
Pond IRCA: Detention Pond

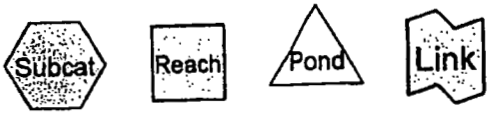


Written by: Tamara E. Zettler Date: 12/15/2004 Reviewed by: _____ Date: _____

Client: Fluor Fernald, Inc. Project: OSDF Phase IV Project No.: GQ3309 Task No.: 02

STAGE III CALCULATION





Drainage Diagram for Cell 8Expand_StageIII
Prepared by GeoSyntec Consultants 12/8/2004
HydroCAD® 6.00 s/n 000929 © 1986-2001 Applied Microcomputer Systems

Cell 8Expand_StageIII *Type II 24-hr Rainfall=4.70"*
Prepared by GeoSyntec Consultants Page 1
HydroCAD® 6.00 s/n 000929 © 1986-2001 Applied Microcomputer Systems 12/8/2004

Time span=0.00-20.00 hrs, dt=0.01 hrs, 2001 points
Runoff by SCS TR-20 method, UH=SCS, Type II 24-hr Rainfall=4.70"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: Area A
Tc=0.6 min CN=91 Area=1.167 ac Runoff= 8.46 cfs 0.338 af

Subcatchment P: Pond Area
Tc=0.0 min CN=100 Area=0.490 ac Runoff= 3.92 cfs 0.183 af

Pond IRCA: Detention Pond
Peak Storage= 0.520 af Inflow= 12.22 cfs 0.520 af
Outflow= 0.00 cfs 0.000 af

Runoff Area = 1.657 ac Volume = 0.520 af Average Depth = 3.77"

2 22,651 ft3

Subcatchment A: Area A

[49] Hint: Tc<2dt may require smaller dt

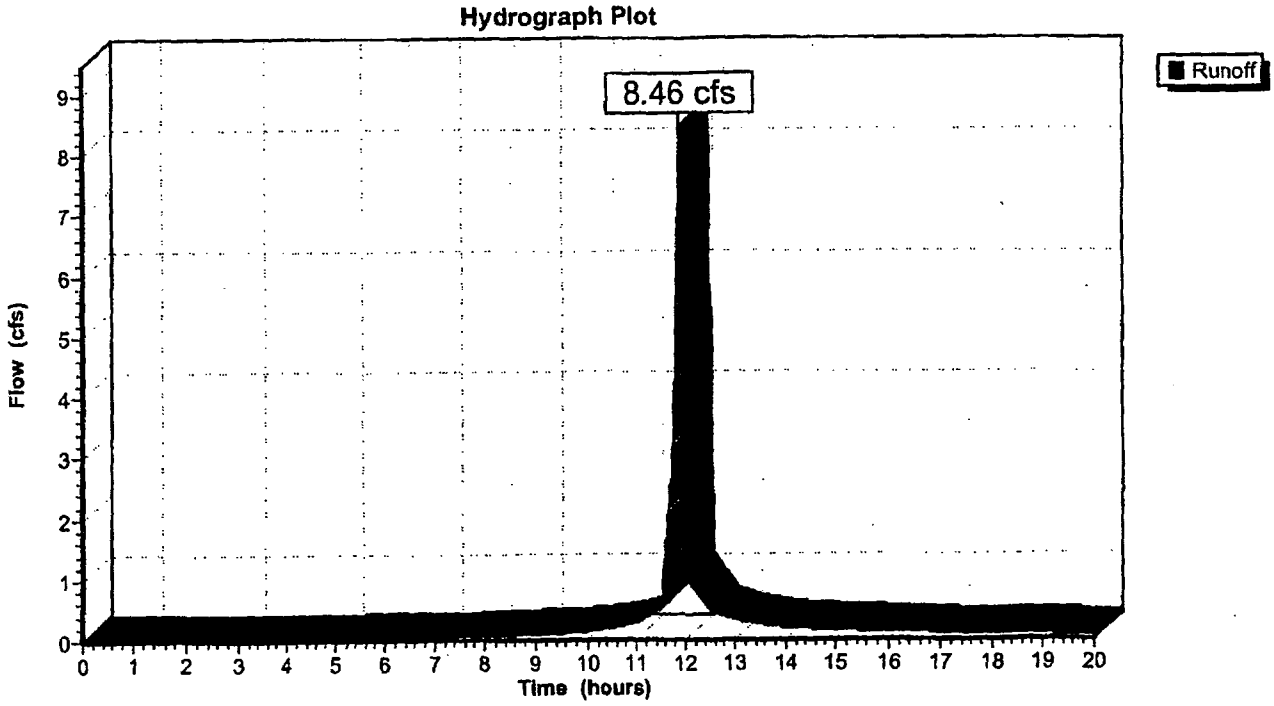
Runoff = 8.46 cfs @ 11.91 hrs, Volume= 0.338 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
1.167	91	Total Sideslope Area A

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.5	100	0.2600	3.4		**Sheet Flow, Segment A-1** Smooth surfaces n= 0.011 P2= 2.55"
0.1	51	0.2600	8.2		**Shallow Concentrated Flow, Segment A-2** Unpaved Kv= 16.1 fps
0.6	151	Total			

Subcatchment A: Area A



Subcatchment P: Pond Area

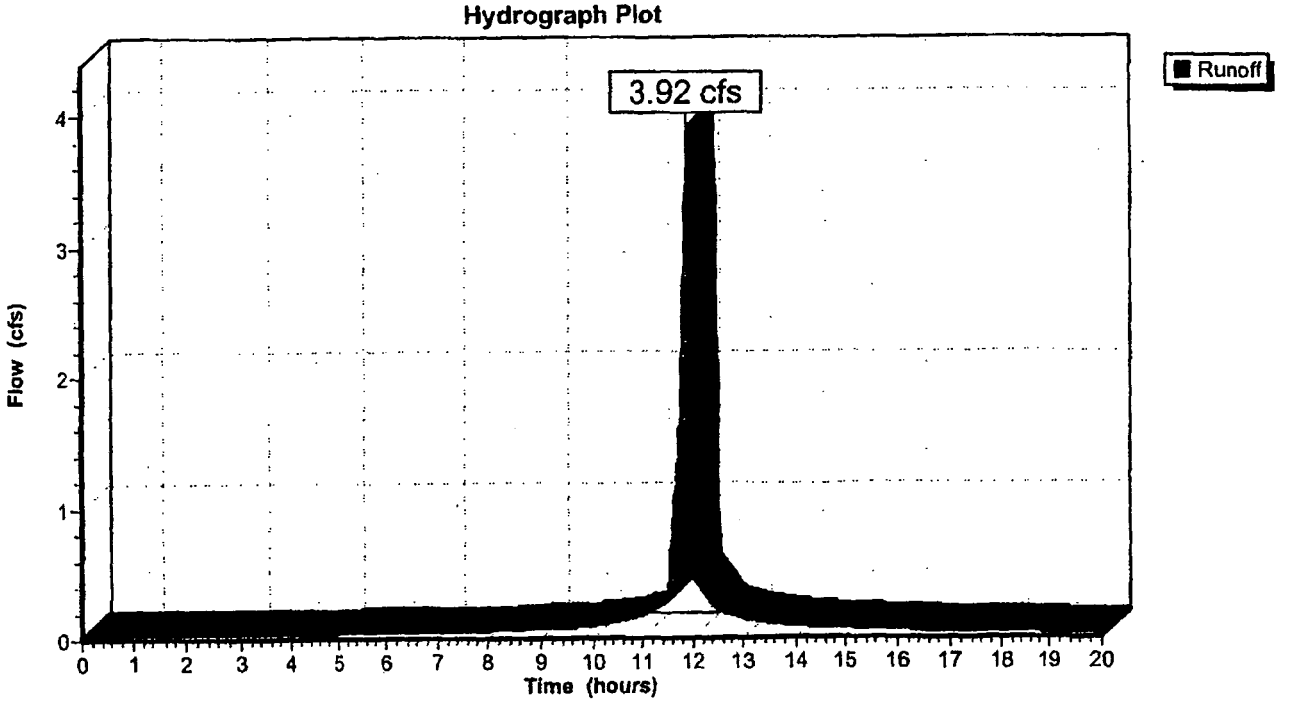
[46] Hint: Tc=0 (Instant runoff peak depends on dt)

Runoff = 3.92 cfs @ 11.90 hrs, Volume= 0.183 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.490	100	Pond Area

Subcatchment P: Pond Area



Pond IRCA: Detention Pond

Inflow = 12.22 cfs @ 11.90 hrs, Volume= 0.520 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min

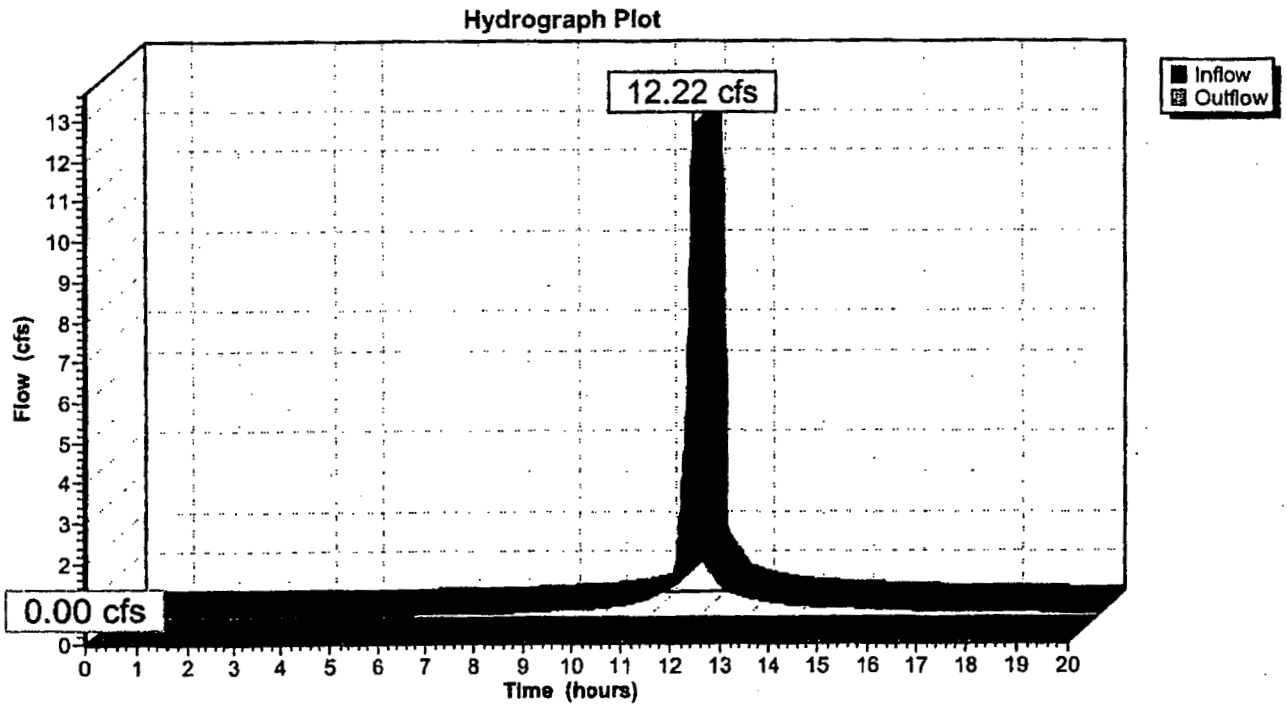
Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.01 hrs

Peak Elev= 590.15' Storage= 0.520 af
Plug-Flow detention time= (not calculated)
Storage and wetted areas determined by Prismatic sections

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
586.00	0.013	0.000	0.000
587.00	0.055	0.034	0.034
588.00	0.108	0.082	0.116
589.00	0.178	0.143	0.259
590.00	0.258	0.218	0.477
591.00	0.319	0.289	0.765
592.00	0.383	0.351	1.116

48,613 ft³

Pond IRCA: Detention Pond



ATTACHMENT A-2

INLET CHANNEL SPREADSHEET

Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

Project: Fernald OSDF Phase V

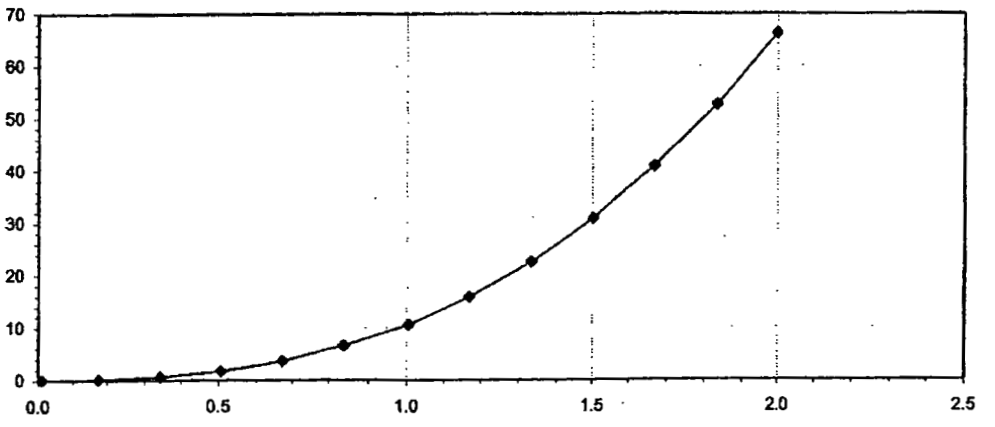
Ditch ID: Southern Inlet to Pond at Cell 8 (Channel C - Figure 1)

Peak Discharge, Q_{max} =	45.21	cfs
Bottom Width, B =	0.00	ft
Left Side Slope, Z_1 =	1.50	horizontal : 1 vertical
Right Side Slope, Z_2 =	3.00	horizontal : 1 vertical
Manning's Roughness Coeff., n =	0.018	
Longitudinal Channel Slope, S =	0.0090	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=AV ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.00	0.05	0.00	0.21	0.00	0.00	
0.18	0.07	0.87	0.08	1.45	0.10	0.04	
0.34	0.26	1.70	0.15	2.26	0.59	0.09	
0.51	0.58	2.52	0.23	2.95	1.71	0.13	
0.67	1.02	3.34	0.31	3.56	3.63	0.17	
0.84	1.58	4.17	0.38	4.12	6.53	0.21	
1.01	2.27	4.99	0.46	4.65	10.56	0.26	
1.17	3.08	5.81	0.53	5.15	15.87	0.30	
1.34	4.02	6.64	0.61	5.62	22.60	0.34	
1.50	5.08	7.46	0.68	6.08	30.87	0.38	
1.67	6.26	8.28	0.76	6.52	40.81	0.42	
1.83	7.57	9.11	0.83	6.94	52.55	0.47	
2.00	9.00	9.93	0.91	7.35	66.19	0.51	
1.740	6.81	8.64	0.79	6.70	45.65	0.44	DESIGN Q

5 - 1.7 = 3.3'

Discharge versus Depth Relationship



Design/Check: Trapezoidal/Triangular Channel

Methodology: Manning's Equation

Project: Fernald OSDF Phase V

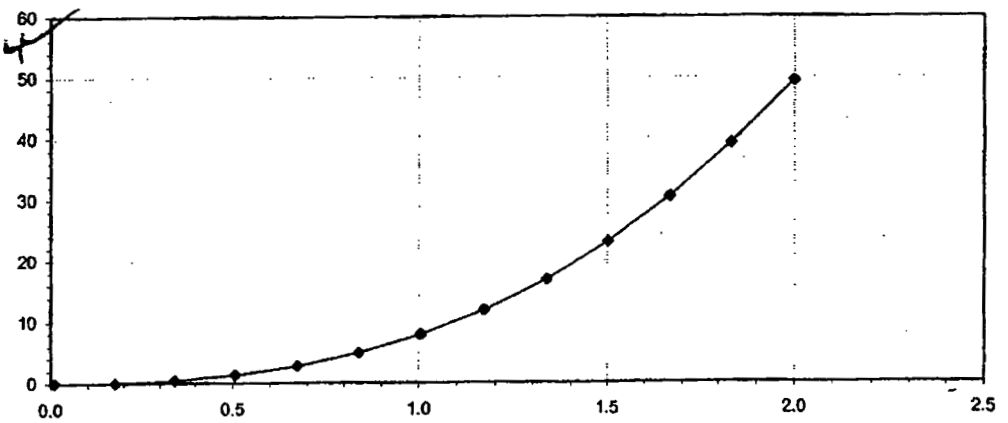
Ditch ID: Northern Inlet to Pond at Cell 8 (Channel E - Figure 1)

Peak Discharge, Q_{max} =	28.29	cfs
Bottom Width, B =	0.00	ft
Left Side Slope, Z_1 =	3.00	horizontal :1 vertical
Right Side Slope, Z_2 =	1.50	horizontal :1 vertical
Manning's Roughness Coeff., n =	0.018	
Longitudinal Channel Slope, S =	0.0050	ft/ft

Depth of Flow Y ft	Area of Flow A ft^2	Wetted Perimeter P ft	Hydraulic Radius R=A/P ft	Average Velocity V ft/s	Discharge (Flow Rate) Q=A·V ft^3/s	Avg. Tractive Stress τ_0 lb/ft^2	Comments
0.01	0.00	0.05	0.00	0.16	0.00	0.00	
0.18	0.07	0.87	0.08	1.08	0.08	0.02	
0.34	0.26	1.70	0.15	1.69	0.44	0.05	
0.51	0.58	2.52	0.23	2.20	1.27	0.07	
0.67	1.02	3.34	0.31	2.65	2.71	0.10	
0.84	1.58	4.17	0.38	3.07	4.87	0.12	
1.01	2.27	4.99	0.46	3.46	7.87	0.14	
1.17	3.08	5.81	0.53	3.84	11.83	0.17	
1.34	4.02	6.64	0.61	4.19	16.84	0.19	
1.50	5.08	7.46	0.68	4.53	23.01	0.21	
1.67	6.26	8.28	0.76	4.86	30.42	0.24	
1.83	7.57	9.11	0.83	5.17	39.16	0.26	
2.00	9.00	9.93	0.91	5.48	49.33	0.28	
1.630	5.98	8.09	0.74	4.78	28.59	0.23	DESIGN Q

5 - 1.6 = 3.4

Discharge versus Depth Relationship



Written by: Tamara E. Zettler Date: 12/15/2004 Reviewed by: _____ Date: _____

Client: Fluor Fernald, Inc. Project: OSDF Phase IV Project No.: GO3309 Task No.: 02

ATTACHMENT A-3

IRCA DRAWDOWN CALCULATION

Written by: ALT Date: 04 / 12 / 13 (YY MM DD) Reviewed by: _____ Date: __/__/__ (YY MM DD)

Client: FLOUR FERNALD Project: OSDF REV PHASE V Project/Proposal No.: GQ 3309 Task No.: 02

- STAGED CLOSURE - STAGE I DRAWDOWN TIME (CONT'D)

- TO SIMPLIFY DRAWDOWN TIME ESTIMATE, ASSUME THAT LEACHATE FLOW DOES NOT INFLUENCE DRAWDOWN

$Q = 200\ GPM$

$V = 76{,}927\ ft^3$

$$t = \frac{V}{Q} = \frac{76{,}927\ ft^3 \left(\frac{7.481\ gal}{ft^3}\right)}{200\ GPM}$$

$t = 2877\ min$

$t = 2.0\ DAYS$

Written by: RLT Date: 04/12/13 (YY MM DD) Reviewed by: _____ Date: __/__/__ (YY MM DD)

Client: FLOUR FERNALD Project: OSDF BEV PHASE V Project/Proposal No.: G03309 Task No.: 02

- STAGE CLOSURE - IMPACTED RUNOFF CATCHMENT AREA DRAWDOWN ESTIMATE - STAGE II

- STAGE II IMPACTED RUNOFF CATCHMENT AREA (IRCA) IS EQUIVALENT IN SIZE (AND STORAGE CAPACITY) AND HAS THE LCS CORRIDOR. THEREFORE DRAWDOWN TIME WILL AGAIN BE GOVERNED BY THE EPLTS PUMP CAPACITY OF 200 GPM)

- ESTIMATED DRAWDOWN TIME...

$Q = 200$ GPM

$V = 45,869$ ft^3

$$t = \frac{V}{Q}$$

$$t = \frac{45,869 \text{ ft}^3 \left(\frac{2.481 \text{ gals}}{\text{ft}^3}\right)}{200 \text{ GPM}}$$

$t = 1,716$ MIN

$t = 1.19$ DAYS

Written by: RLT Date: 04 / 12 / 13 (YY MM DD) Reviewed by: _____ Date: __/__/__ (YY MM DD)

Client: FLUOR FERNALD Project: OSDF REV PHASE V Project/Proposal No.: GO3309 Task No.: 02

- STAGED CLOSURE - IMPACTED RUNOFF CATCHMENT AREA DRAWDOWN ESTIMATE -
  - STAGE III

- ESTIMATED IMPACTED RUNOFF VOLUME = 22,651 ft^3.

- DRAWDOWN THROUGH LCS CORRIDOR IS ESTIMATED USING DARCY'S LAW

(1) $Q = KiA$

$K = 0.1\ cm/sec = 0.0033\ ft/sec$ (for LCS & GRANULAR PROTECTIVE LAYERS)

$i = 1$ (CONSERVATIVELY)

$A = 317\ ft^2$ (REFERENCE ATTACHED FIGURE FOR AREA A-3 FIGURE 2)

(2) $Q = \frac{dV}{dt} = \frac{\Delta V}{\Delta t}$

SOLVE FOR TIME...

(3) $\Delta t = \frac{\Delta V}{KiA}$

$\Delta t = \frac{22,651\ ft^3}{(0.0033\ ft/sec)(1)(317\ ft^2)} = 21,653\ sec$

$\Delta t = 6.0\ HR$

- ESTIMATED FLOW RATE

$Q = KiA$

$Q = (0.0033\ ft/sec)(1)(317\ ft^2)$

$Q = 1.05\ ft^3/sec$

$Q = 471\ GPM$

$Q > 200\ GPM \rightarrow$ MAX PUMPRATE OF EPLTS LIFT STATION PUMP

∴ DRAWDOWN IS GOVERNED BY/ LIMITED BY EPLTS LIFT STATION PUMP

Document 6774

Written by: RLT Date: 04/12/13 (YY MM DD) Reviewed by: _____ Date: __/__/__ (YY MM DD)

Client: FLOUR FERNALD Project: OSDF REV PHASE V Project/Proposal No.: 623309 Task No.: 02

- STAGED CLOSURE - STAGE III DRAWDOWN TIME (CONT'D)

• TO SIMPLIFY DRAWDOWN TIME ESTIMATE, ASSUME THAT LEACHATE FLOW DOES NOT INFLUENCE DRAWDOWN

$Q = 200$ GPM

$V = 22,651$ ft^3

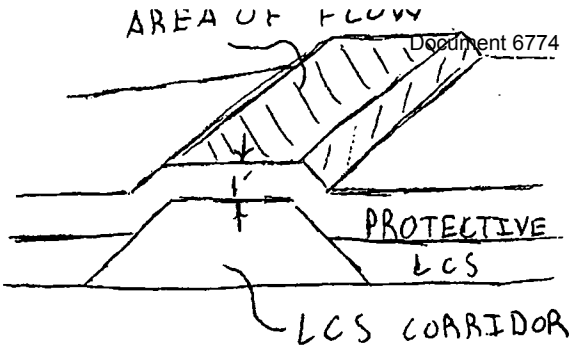
$$t = \frac{V}{Q} = \frac{22,651 \text{ ft}^3 \left(\frac{7.481 \text{ gal}}{\text{ft}^3}\right)}{200 \text{ GPM}}$$

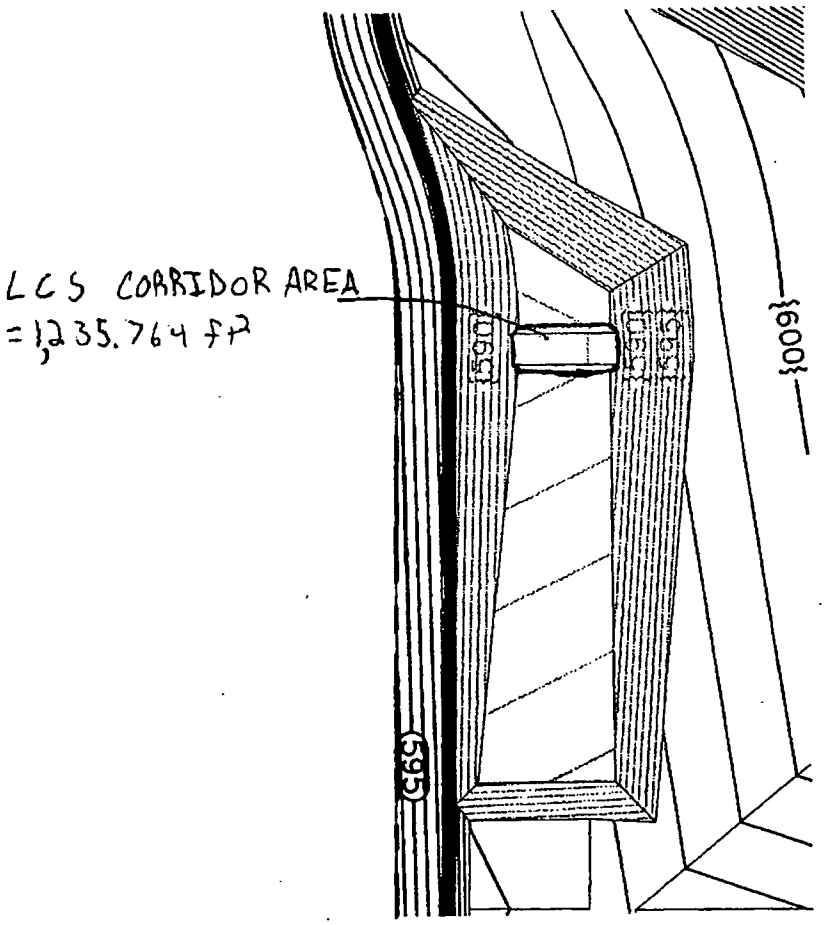
$t = 847$ MIN

$t = 0.59$ DAYS

GQ 3309-02

Document 6774

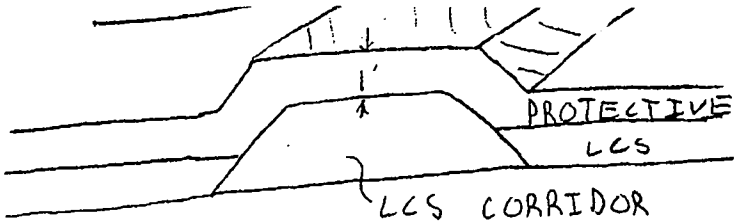


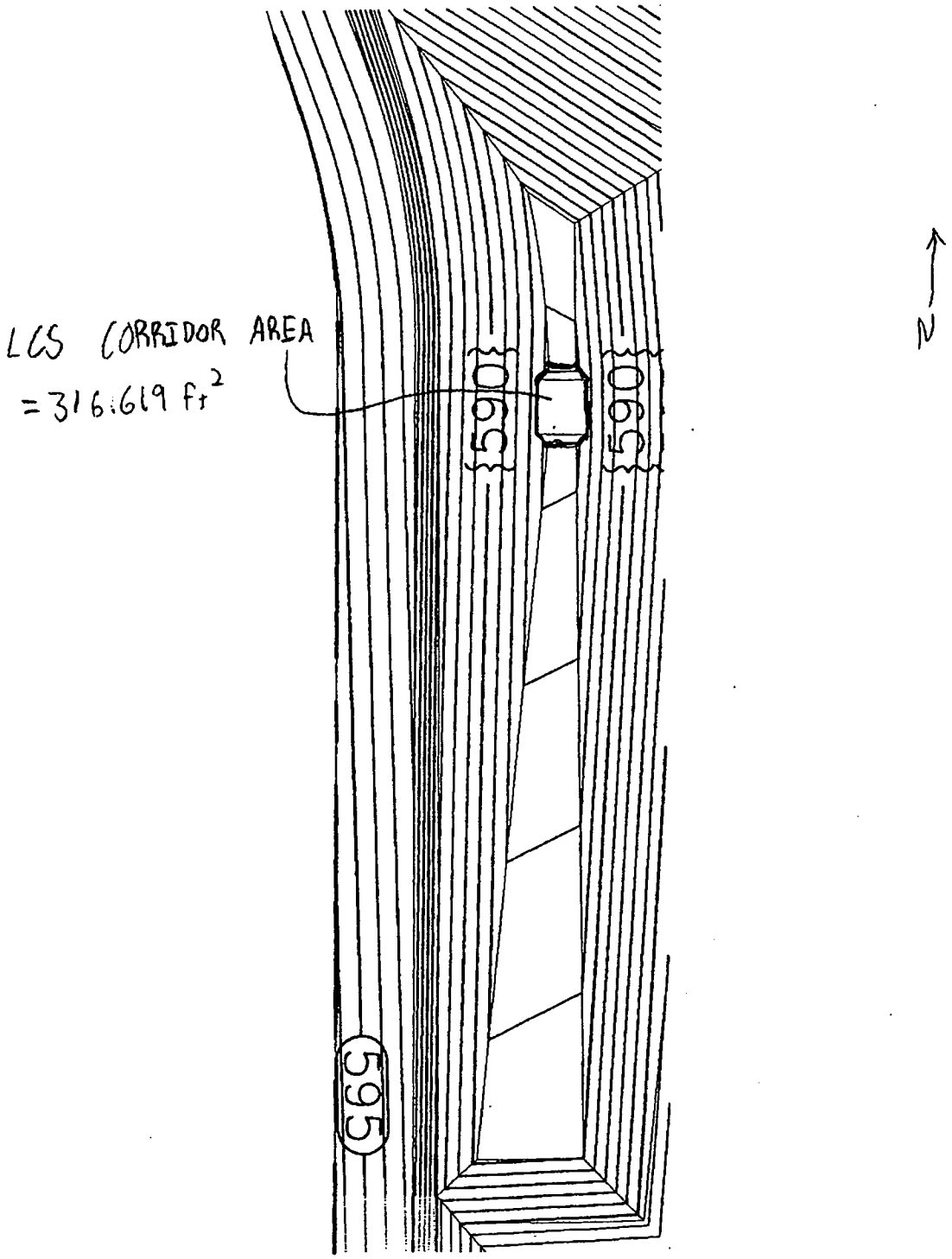


STAGE 1 & STAGE 2

FIGURE 1

GQ 3309-02



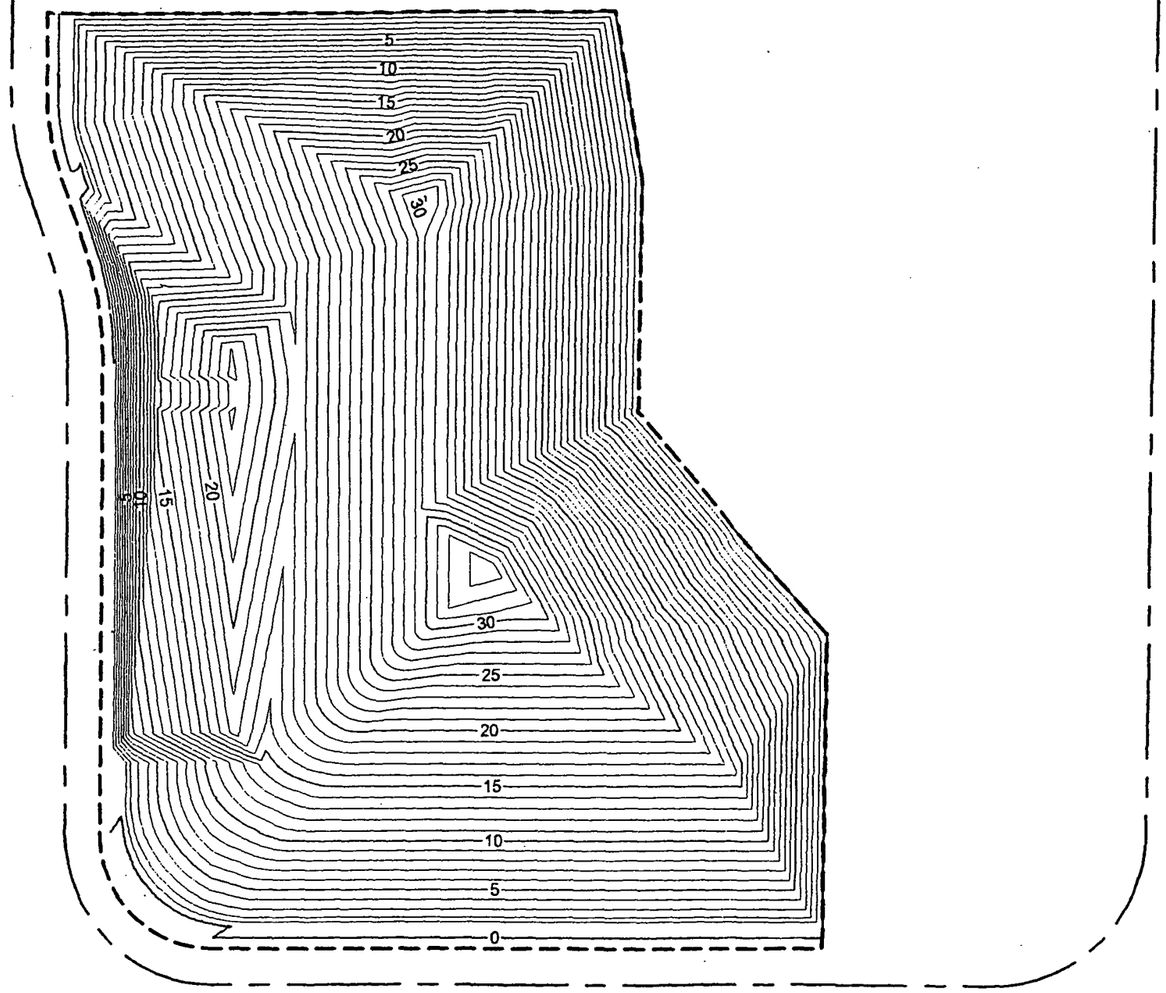


STAGE III CATCHMENT AREA

FIGURE 2

ATTACHMENT A-4

VOLUME ESTIMATES



Site Volume Table: Unadjusted

Site	Stratum	Surf1	Surf2	Cut cu.yds	Fill cu.yds	Net cu.yds	Method
5FT	vol-004	stage-1	btm-cont_30nov2004				
				17	131877	131860 (F)	Composite

STAGE I

GROSS VOL. (CY) = 131,860

- STAGE III CLEAN FILL = 18,922
(FIGURE A4-3) (CY)

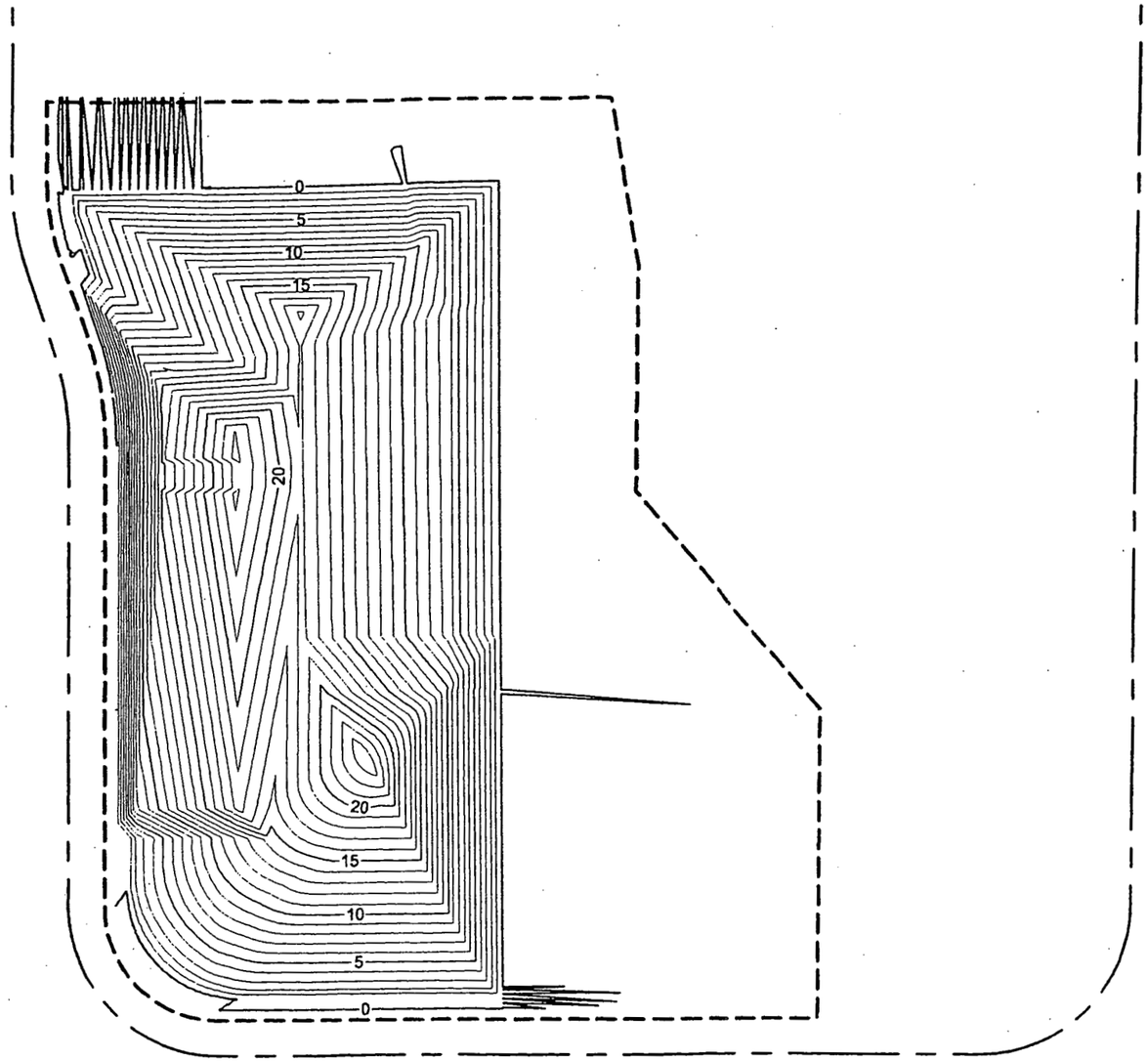
NET VOL (CY) 112,938

$NET_I \approx 113,000^{CY}$

GEOSYNTEC CONSULTANTS
ATLANTA, GA

DATE:	9-DEC-2004	SCALE:	1" = 100'
PROJECT NO	GQ3309.02.02	FILE NO.	F04-V001
DOCUMENT NO.		FIGURE NO.	A-4-1

P:\CadDwg\CADDGC 02REV 2\F04-V001.dwg, 12/8/2004 2:46:38 PM



STAGE II

GROSS VOL. (CY) = 56,813

- STAGE III CLEAN FILL = 18,922 (CY)
(FIGURE A4-3)

NET VOL (CY) 37,891

NET II ≈ 38,000 CY

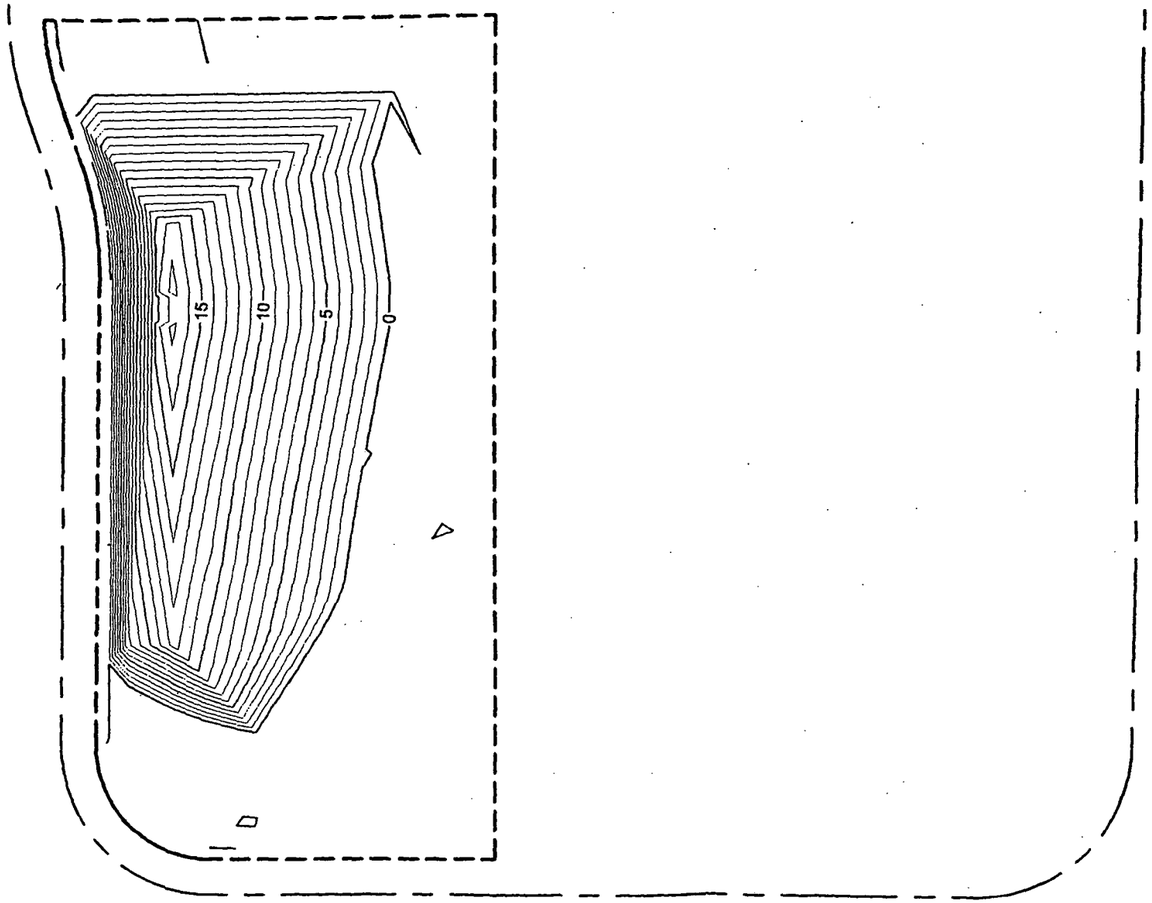
Site Volume Table: Unadjusted

Site	Stratum	Surf1	Surf2	Cut cu.yds	Fill cu.yds	Net cu.yds	Method
5FT	vol-005	stage-2	btm-cont_30nov2004				
				17	56830	56813 (F)	Composite

GEOSYNTEC CONSULTANTS
ATLANTA, GA

DATE:	9-DEC-2004	SCALE:	1" = 100'
PROJECT NO	GQ3309.02.02	FILE NO.	F04-V002
DOCUMENT NO.		FIGURE NO.	A4-2

P:\Cadd\Dwg1\CADD\GI 32REV 2\F04-V002.dwg, 12/8/2004 4:17:58 PM



STAGE III

Site Volume Table: Unadjusted

Site	Stratum	Surf1	Surf2	Cut cu.yds	Fill cu.yds	Net cu.yds	Method
5FT	vol-006	stage-3	btm-cont_30nov2004				
				0	18922	18922 (F)	Composite

≈ 19,000 CY

GEOSYNTEC CONSULTANTS
ATLANTA, GA

DATE:	9-DEC-2004	SCALE:	1" = 100'
PROJECT NO	GQ3309.02.02	FILE NO.	F04-V003
DOCUMENT NO.		FIGURE NO.	A4-3

C:\cdd\Dwg1\CADD\GQ33 REV 2\F04-V003.dwg, 12/9/2004 5:32:43 PM

SECTION 7.4

7.4 LEACHATE GENERATION RATES – CELL 8 SUPPLEMENT

COMPUTATION COVER SHEET

SUBJECT OF COMPUTATIONS OSDF PHASE V, LEACHATE GENERATION RATES – CELL 8 SUPPLEMENT

Computations By:
(Cognizant Engineer)

Signature R. Kulasingam — Date 1-23-04

Printed Name and Title: Ramachandran Kulasingam, Senior Staff Engineer

Assumptions and Procedures Checked By:
(Checker)

Signature GANESH GOPALAKRISHNAN — Date 1-23-04

Printed Name and Title: For Leslie M. Griffin, Engineer

Computations Checked by:

Signature Hollie N. Kinnecom — Date 1-23-04

Printed Name and Title: Hollie N. Kinnecom, Staff Engineer

Computations Backchecked by:
(Cognizant Engineer)

Signature R. Kulasingam — Date 1-23-04

Printed Name and Title: Ramachandran Kulasingam, Senior Staff Engineer

Approved by:
(PDP)

Signature — Date 1-23-04

Printed Name and Title: For Leslie M. Griffin, Engineer

Approved by:
(DTL/TETL)

Signature Rudolph Bonaparte — Date 23 Jan 04

Printed Name and Title: R. Bonaparte, Principal

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
1A	DCN CELL 8 EXPANSION	16 JUN 2004	RK/	LHG/ RC	
1	CELL 8 EXPANSION	15 FEB 2005	RK/	LHG/LHG	JFB/JFB

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

ADDENDUM TO SECTION 7.1
(ADDED TO REVISION 1 PACKAGE)

The Calculation Package "Leachate Generation Rates" presented in Section 7.1 estimated leachate generation rates for different stages of the life of the Fernald On-Site Disposal Facility (OSDF). These rates were used to evaluate the performance of the leachate collection system (LCS), leak detection system (LDS), and leachate transfer system (LTS) in other Calculation Packages. The rates were calculated based on a cell 400 feet wide and 6.5 acres in size. This size cell applies to the northernmost and interior OSDF cells (i.e., Cells 1 to 7). The southernmost OSDF cell (i.e., Cell 8) is sized differently from the other cells.

This addendum to Section 7.1 presents leachate generation rates for Cell 8. Similar methods and input data to that used in Section 7.1 were used herein. This addendum is presented as Section 7.4 of the OSDF Final Design Calculation Package, and is titled, "Leachate Generation Rates – Cell 8 Supplement". Section 7.4 is presented in Volume VII of the OSDF Final Design Calculation Package.

Appendix A

HELP Model Outputs

CASE1B8R

Plr 05/13/04

```
0
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE:      H:\Projects\Fernald\Cell8\Case1B.D4
TEMPERATURE DATA FILE:        H:\Projects\Fernald\Cell8\Case1B.D7
SOLAR RADIATION DATA FILE:    H:\Projects\Fernald\Cell8\Case1B.D13
EVAPOTRANSPIRATION DATA:      H:\Projects\Fernald\Cell8\Case1B.D11
SOIL AND DESIGN DATA FILE:    H:\Projects\Fernald\Cell8\Case1B8R.D10
OUTPUT DATA FILE:             H:\Projects\Fernald\Cell8\Case1B8R.OUT


TIME:  15:32     DATE:   5/12/2004


******************************************************************************

     TITLE:  Fernald OSDF - Case 1B

******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                LAYER  1
                                --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  31
          THICKNESS                  =    120.00   INCHES
          POROSITY                   =      0.5780 VOL/VOL
          FIELD CAPACITY             =      0.0760 VOL/VOL
          WILTING POINT              =      0.0250 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.1790 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.410000002000E-02 CM/SEC


                                LAYER  2
                                --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
```

CASE1B8R

MATERIAL TEXTURE NUMBER 26

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4450	VOL/VOL
FIELD CAPACITY	=	0.3930	VOL/VOL
WILTING POINT	=	0.2770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3930	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.190000003000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER

MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0320	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	1.00000000000	CM/SEC
SLOPE	=	2.24	PERCENT
DRAINAGE LENGTH	=	385.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 5

TYPE 3 - BARRIER SOIL LINER

MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.25	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08	CM/SEC

LAYER 6

CASE1B8R

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0320	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	1.00000000000	CM/SEC
SLOPE	=	2.24	PERCENT
DRAINAGE LENGTH	=	385.0	FEET

LAYER 7

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 8

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	36.25	INCHES
POROSITY	=	0.4290	VOL/VOL
FIELD CAPACITY	=	0.4200	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4290	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.819999997000E-07	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #31 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 5.% AND A SLOPE LENGTH OF 540. FEET.

SCS RUNOFF CURVE NUMBER	=	96.80	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.725	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.936	INCHES

CASE1B8R

LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.300	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	42.698	INCHES
TOTAL INITIAL WATER	=	42.698	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
CINCINNATI OHIO

STATION LATITUDE	=	39.29	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	104	
END OF GROWING SEASON (JULIAN DATE)	=	295	
EVAPORATIVE ZONE DEPTH	=	12.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.10	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	70.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	67.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	73.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR COVINGTON KENTUCKY

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.13	2.73	3.95	3.58	3.84	4.09
4.28	2.97	2.91	2.54	3.12	3.00

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CINCINNATI OHIO

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
28.90	32.10	41.80	53.50	63.00	71.40
75.40	74.10	67.50	55.30	43.40	33.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CINCINNATI OHIO
AND STATION LATITUDE = 39.29 DEGREES

****

CASE1B8R
AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.42	2.87	3.77	3.69	3.83	4.10
	4.42	2.86	2.79	2.35	3.22	2.94
STD. DEVIATIONS	1.59	1.34	1.48	1.54	1.84	2.18
	1.94	1.59	1.78	1.10	1.36	1.21
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	0.623	0.556	1.887	2.884	3.050	2.900
	3.205	2.290	1.874	1.653	1.373	0.965
STD. DEVIATIONS	0.271	0.310	0.589	0.753	0.960	1.012
	1.037	0.982	0.811	0.520	0.332	0.255
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	1.1201	1.2394	1.4275	1.8232	1.8697	1.7071
	1.5949	1.4525	1.3479	1.2918	1.0952	0.9858
STD. DEVIATIONS	0.6491	0.4902	0.4945	0.2690	0.3086	0.4044
	0.5309	0.6138	0.5907	0.6096	0.5642	0.5468
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 6						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

CASE1B8R
AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.1096	0.1332	0.1397	0.1843	0.1829	0.1726
	0.1561	0.1421	0.1363	0.1264	0.1107	0.0965
STD. DEVIATIONS	0.0635	0.0530	0.0484	0.0272	0.0302	0.0409
	0.0520	0.0601	0.0597	0.0596	0.0570	0.0535

DAILY AVERAGE HEAD ON TOP OF LAYER 7

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES		CU. FEET	PERCENT
PRECIPITATION	40.26	(5.552)	146142.4	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	23.260	(2.6639)	84432.33	57.774
LATERAL DRAINAGE COLLECTED FROM LAYER 3	16.95500	(3.94392)	61546.664	42.11419
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00001	(0.00000)	0.032	0.00002
AVERAGE HEAD ON TOP OF LAYER 4	0.141	(0.033)		
LATERAL DRAINAGE COLLECTED FROM LAYER 6	0.00001	(0.00000)	0.023	0.00002
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 7	0.000	(0.000)		
CHANGE IN WATER STORAGE	0.045	(3.0368)	163.32	0.112

****

****

CASE1B8R

PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)
PRECIPITATION	4.70	17061.000
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.06463	234.60274
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00012
AVERAGE HEAD ON TOP OF LAYER 4	0.196	
MAXIMUM HEAD ON TOP OF LAYER 4	0.385	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	6.3 FEET	
DRAINAGE COLLECTED FROM LAYER 6	0.00000	0.00010
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 7	0.000	
MAXIMUM HEAD ON TOP OF LAYER 7	0.027	
LOCATION OF MAXIMUM HEAD IN LAYER 6 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	7.68	27876.4355

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.5780

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0275

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****

****

FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	25.8107	0.2151
2	4.8788	0.4066
3	0.3844	0.0320

CASE1B8R

4	0.0000	0.0000
5	0.1875	0.7500
6	0.3840	0.0320
7	0.0000	0.0000
8	15.5512	0.4290
SNOW WATER	0.000	

****
****

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1 of 2
CALCULATION PROCEDURES	1 of 2
HELP MODEL INPUT PARAMETERS	1 of 1
COMPUTATION RESULTS	1 of 2
APPENDIX A: HELP MODEL OUTPUTS	1 of 19
Case 1B	1 of 19
Case 3D	9 ~~11~~ of 19

5/12/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEACHATE GENERATION RATES – CELL 8 SUPPLEMENT EXECUTIVE SUMMARY

PURPOSE OF ANALYSIS

The purpose of this analysis is to estimate leachate generation rates for different stages of the life of the Fernald On-Site Disposal Facility (OSDF) Cell 8. These rates will be used to evaluate the performance of the leachate collection system (LCS) and leak detection system (LDS).

METHOD OF ANALYSIS

The U.S. Environmental Protection Agency (USEPA) Hydrologic Evaluation of Landfill Performance (HELP) model, Version 3.07, was used to estimate leachate generation rates for Cell 8 of the OSDF.

CONCLUSIONS

Leachate Generation Rates for Cell 8

- Peak daily for active stage (i.e., 10 ft of waste) = 1754 gpad
- Peak daily for post-closure stage = ~~0.024~~ 0.054 gpad
- Average annual for active stage (i.e., 10 ft of waste) = 1261 gpad
- Average annual for post-closure stage = 0.002 gpad
- Baseline design flow rate during active operations = ~~11,050~~ 14,032 gpd
- Baseline design flow rate after closure = ~~0.15~~ 0.43 gpd

PM 05/12/04

Note that the above design flow rates do not account for large peak flows associated with the storm design basis flow rate or incremental flows that may occur from the consolidation of impacted materials. The storm design basis flow rate is addressed in Calculation Package "LTS Gravity Line Flow Capacity" and Calculation Package "LTS Pipe Hydrograph". The potential effects of

impacted material consolidation on the leachate generation rates are addressed in Appendix B of the Calculation Package "Leachate Generation Rates".

Document 6774

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEACHATE GENERATION RATES – CELL 8 SUPPLEMENT
CALCULATION PROCEDURES

INTRODUCTION

The purpose of this analysis is to estimate leachate generation rates for different stages of the life of the Fernald On-Site Disposal Facility (OSDF) Cell 8.

GENERAL DESCRIPTION OF CELL 8

The southernmost cell of the OSDF, Cell 8, is sized differently than the northernmost and interior cells (Cells 1 through 7). Cells 1 through 7 are approximately 700 feet long and 400 feet wide with a cell area of 6.5 acres. Cell 8 is designed approximately 650 feet long and ~~425~~ 540 feet wide with a cell area of 6.3 acres. 8.0

05/12/04

LEACHATE GENERATION ANALYSIS

Generally, the analysis procedures presented in the Calculation Package "Leachate Generation Rates" are followed in these calculation packages. The U.S. Environmental Protection Agency (USEPA) Hydrologic Evaluation of Landfill Performance (HELP) model, Version 3.07 [Schroeder, et al., 1994a, b], is used to estimate leachate generation rates for Cell 8 of the OSDF.

Analyses were presented in the Calculation Package "Leachate Generation Rates" for three cases representing three different stages in the life of the OSDF. Based on these calculation results, it was determined that Case 1 is the critical case during active operation and Case 3 after closure of the OSDF. Therefore, leachate generation calculations for Cell 8 are performed for Cases 1 and 3 only in this calculation package.

The Calculation Package "Leachate Generation Rates" sub-classified Case 1 as 1A and 1B, and Case 3 as 3A, 3B, 3C, and 3D based on the different material types used to model certain layers in the

OSDF. Based on the analysis results presented in that Calculation Package, it was determined that Case 1B, and Case 3D (or 3C) are the critical cases that need to be considered for further analyses. Therefore, in this Calculation Package analyses are performed for Cases 1B (active condition) and 3D (post-closure condition).

REFERENCES

Schroeder, P.R., Lloyd, C.M., and Zappi, P.A. (1994a). "*The Hydrologic Evaluation of Landfill Performance (HELP) Model: User's Guide for Version 3.*" U.S. Environmental Protection Agency, Office of the Research and Development, Washington D.C., Report No. EPA/600/R-94/168a, 83 p. (plus appendix).

Schroeder, P.R., Dozier, T.S., Zappi, P.A., McEnroe, B.M., Sjostrom, J.W., and Peyton, R.L. (1994b). "*The Hydrologic Evaluation of Landfill Performance (HELP) Model: Engineering Documentation for Version 3.*" U.S. Environmental Protection Agency, Office of the Research and Development, Washington D.C., Report No. EPA/600/R-94/168b, 116 p.

Written By: RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEACHATE GENERATION RATES – CELL 8 SUPPLEMENT

HELP MODEL INPUT PARAMETERS

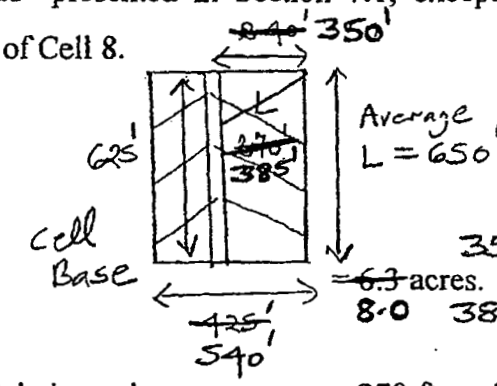
OBJECTIVE

To select values for the input parameters of HELP to model Cell 8 of the Fernald OSDF. Values are selected for Cases 1B and 3D for Cell 8. The following input parameters used for these cases are the same as the ones used in the Calculation Package "Leachate Generation Rates" presented in Section 7.1.

Weather Data Requirements

- Evaporation data
- Precipitation data
- Temperature data
- Solar radiation data

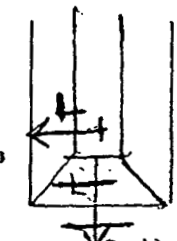
The following input parameters used for these cases are the same as the ones used in the Calculation Package "Leachate Generation Rates" presented in Section 7.1, except for the changes presented below to account for the new geometry of Cell 8.



625' @ 1%
350' ~~240'~~ @ 2%
385 ~~270'~~ @ 2.24%

Soil and Design data Requirements

- Landfill General Information
  - Cell area ~~= 6.3~~ 8.0 acres.
- Layer Data
  - Drainage path length for the LCS drainage layer ~~= 270~~ 385 ft; and
  - Drainage path length for the final cover ~~= 480~~ 510 ft.
  - Hydraulic conductivity of LCS and LDS drainage layers = 1 cm/s (based on test results from Fernald Site)
- Runoff Curve Number
  - calculated by the program based on the new input parameters



L = ~~480'~~ 510' @ 13.4%

05/12/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEACHATE GENERATION RATES – CELL 8 SUPPLEMENT

COMPUTATION RESULTS

The leachate generation rates were estimated for Case 1 (active condition) and Case 3 (post-closure condition). The HELP program output files are included at the end of this Calculation Package as appendix A. The results for the HELP analyses are summarized in Table 1.

Calculation of Baseline Design Flow Rates for Cell 8

- Peak daily for active stage (i.e., 10 ft of waste) = 1754 gpad
- Peak daily for post-closure stage = ~~0.024~~ gpad 0.054
- Average annual for active stage (i.e., 10 ft of waste) = 1261 gpad
- Average annual for post-closure stage = 0.002 gpad
- Baseline design flow rate during active operations = ~~11,050 gpd~~ ~~14~~,032 gpd
- Baseline design flow rate after closure = ~~0.15~~ gpd 0.43 gpd

RM 05/12/04

Written By : RK Date: 12 -03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

Table 1. Summary of HELP Model Results

Case	Average Annual Totals (in)							Peak Daily Values (in)				
	P[1]	R[2]	E[3]	LD[4]	H_{avg}[5]	I[6]		P	R	LD	H_{avg} (H_{max}[7])	I
Case 1B	40.26	0	23.26	~~16.95~~ 16.96	~~0.99~~ 0.14	~~$6.0X10^{-5}$~~ $1.0X10^{-5}$		4.7	0	0.0646	~~1.375~~ 0.196 ~~(2.497)~~ 0.385	~~$2.4X10^{-7}$~~ $3.3X10^{-8}$
Case 3D	40.34	~~4.76~~ 4.75	27.50	$3.0X10^{-3}$	0	$2.5X10^{-6}$		13.0	8.29	~~$9.0X10^{-7}$~~ $2.0X10^{-6}$	0 ~~(0.005)~~ 0	$5.5X10^{-9}$

05/12/04

Notes:

[1]P = Precipitation

[2]R = Runoff

[3]E = Evaporation

[4]LD = Lateral drainage in LCS drainage corridor

[5]H_{avg} = Average head above the primary geomembrane liner

[6]I = Infiltration through primary geomembrane liner

[7]H_{max} = Maximum head above the primary geomembrane liner

CASE3D8R

05/13/04

```
**************************************************************************
**************************************************************************
**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE           **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY               **
**                    USAE WATERWAYS EXPERIMENT STATION                 **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY          **
**                                                                      **
**                                                                      **
**************************************************************************
**************************************************************************


PRECIPITATION DATA FILE:     H:\Projects\Fernald\Cell8\Case3D.D4
TEMPERATURE DATA FILE:       H:\Projects\Fernald\Cell8\Case3D.D7
SOLAR RADIATION DATA FILE:   H:\Projects\Fernald\Cell8\Case3D.D13
EVAPOTRANSPIRATION DATA:     H:\Projects\Fernald\Cell8\Case3D.D11
SOIL AND DESIGN DATA FILE:   H:\Projects\Fernald\Cell8\Case3D8R.D10
OUTPUT DATA FILE:            H:\Projects\Fernald\Cell8\Case3D8R.OUT


TIME:  16: 8     DATE:    5/12/2004


**************************************************************************

     TITLE:  Fernald OSDF - Case 3D

**************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  10
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.3980 VOL/VOL
          FIELD CAPACITY               =      0.2440 VOL/VOL
          WILTING POINT                =      0.1360 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2324 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.119999997000E-03 CM/SEC
        NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  4.63
                 FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                  LAYER  2
                                  --------
```

CASE3D8R

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	21.00	INCHES
POROSITY	=	0.4000	VOL/VOL
FIELD CAPACITY	=	0.3000	VOL/VOL
WILTING POINT	=	0.2000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2929	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-04	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 2

THICKNESS	=	6.00	INCHES
POROSITY	=	0.4370	VOL/VOL
FIELD CAPACITY	=	0.0620	VOL/VOL
WILTING POINT	=	0.0240	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1842	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.579999993000E-02	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	36.00	INCHES
POROSITY	=	0.3500	VOL/VOL
FIELD CAPACITY	=	0.0300	VOL/VOL
WILTING POINT	=	0.0100	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0300	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	100.000000000	CM/SEC

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0528	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000	CM/SEC
SLOPE	=	13.40	PERCENT
DRAINAGE LENGTH	=	510.0	FEET

LAYER 6

CASE3D8R

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.25	INCHES
POROSITY	=	0.4300	VOL/VOL
FIELD CAPACITY	=	0.4210	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4300	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.750000027000E-07	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 26

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4450	VOL/VOL
FIELD CAPACITY	=	0.3930	VOL/VOL
WILTING POINT	=	0.2770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3930	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.190000003000E-05	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 26

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4450	VOL/VOL
FIELD CAPACITY	=	0.3930	VOL/VOL
WILTING POINT	=	0.2770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3930	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.190000003000E-05	CM/SEC

LAYER 10

CASE3D8R

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 31

THICKNESS	=	408.00	INCHES
POROSITY	=	0.5780	VOL/VOL
FIELD CAPACITY	=	0.0760	VOL/VOL
WILTING POINT	=	0.0250	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0760	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.410000002000E-02	CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 26

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4450	VOL/VOL
FIELD CAPACITY	=	0.3930	VOL/VOL
WILTING POINT	=	0.2770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3930	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.190000003000E-05	CM/SEC

LAYER 12

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0320	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	1.00000000000	CM/SEC
SLOPE	=	2.24	PERCENT
DRAINAGE LENGTH	=	385.0	FEET

LAYER 13

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 14

CASE3D8R

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 17

THICKNESS	=	0.25	INCHES
POROSITY	=	0.7500	VOL/VOL
FIELD CAPACITY	=	0.7470	VOL/VOL
WILTING POINT	=	0.4000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7500	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000003000E-08	CM/SEC

LAYER 15

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	12.00	INCHES
POROSITY	=	0.3970	VOL/VOL
FIELD CAPACITY	=	0.0320	VOL/VOL
WILTING POINT	=	0.0130	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0320	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	1.00000000000	CM/SEC
SLOPE	=	2.24	PERCENT
DRAINAGE LENGTH	=	385.0	FEET

LAYER 16

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	1.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD	

LAYER 17

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	36.25	INCHES
POROSITY	=	0.4290	VOL/VOL
FIELD CAPACITY	=	0.4200	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4290	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.819999997000E-07	CM/SEC

CASE3D8R

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 13.% AND A SLOPE LENGTH OF 510. FEET.

SCS RUNOFF CURVE NUMBER	=	80.70	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	30.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	8.162	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	12.099	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	5.088	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	82.454	INCHES
TOTAL INITIAL WATER	=	82.454	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM CINCINNATI OHIO

STATION LATITUDE	=	39.29	DEGREES
MAXIMUM LEAF AREA INDEX	=	3.50	
START OF GROWING SEASON (JULIAN DATE)	=	104	
END OF GROWING SEASON (JULIAN DATE)	=	295	
EVAPORATIVE ZONE DEPTH	=	30.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.10	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	70.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	67.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	73.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	72.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR COVINGTON KENTUCKY

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.13	2.73	3.95	3.58	3.84	4.09
4.28	2.97	2.91	2.54	3.12	3.00

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR CINCINNATI OHIO

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC

CASE3D8R

28.90	32.10	41.80	53.50	63.00	71.40
75.40	74.10	67.50	55.30	43.40	33.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR CINCINNATI OHIO
AND STATION LATITUDE = 39.29 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 100

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	3.42	2.87	3.77	3.69	3.83	4.10
	4.51	2.86	2.79	2.35	3.22	2.94
STD. DEVIATIONS	1.59	1.34	1.48	1.54	1.84	2.18
	2.35	1.59	1.78	1.10	1.36	1.21
RUNOFF						
TOTALS	1.120	1.872	1.188	0.033	0.024	0.078
	0.149	0.024	0.034	0.017	0.042	0.166
STD. DEVIATIONS	1.338	1.405	1.738	0.086	0.067	0.162
	0.967	0.068	0.085	0.054	0.098	0.541
EVAPOTRANSPIRATION						
TOTALS	0.591	0.554	1.884	3.468	4.478	4.139
	4.251	3.158	2.016	1.242	0.969	0.748
STD. DEVIATIONS	0.208	0.278	0.564	0.622	1.154	1.494
	1.475	1.478	0.941	0.327	0.182	0.178
LATERAL DRAINAGE COLLECTED FROM LAYER 5						
TOTALS	0.9298	0.6222	2.1590	1.0906	0.4276	0.1304
	0.1822	0.0666	0.0869	0.1549	0.7798	1.4604
STD. DEVIATIONS	1.0578	0.8332	1.1118	1.0386	0.6576	0.3134
	0.6282	0.1837	0.3076	0.3843	1.1033	1.0827
PERCOLATION/LEAKAGE THROUGH LAYER 7						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 12						

CASE3D8R

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 14

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LATERAL DRAINAGE COLLECTED FROM LAYER 15

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 17

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.2050	0.1504	0.4760	0.2484	0.0943	0.0297
	0.0402	0.0147	0.0198	0.0341	0.1776	0.3220
STD. DEVIATIONS	0.2332	0.2014	0.2451	0.2366	0.1450	0.0714
	0.1385	0.0405	0.0701	0.0847	0.2513	0.2387

DAILY AVERAGE HEAD ON TOP OF LAYER 13

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

DAILY AVERAGE HEAD ON TOP OF LAYER 16

AVERAGES	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

****

CASE3D8R

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 100

	INCHES		CU. FEET	PERCENT
PRECIPITATION	40.34	(5.640)	146443.7	100.00
RUNOFF	4.747	(2.9201)	17233.12	11.768
EVAPOTRANSPIRATION	27.498	(3.4202)	99818.46	68.162
LATERAL DRAINAGE COLLECTED FROM LAYER 5	8.09031	(3.22816)	29367.822	20.05401
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00003	(0.00001)	0.125	0.00009
AVERAGE HEAD ON TOP OF LAYER 6	0.151	(0.061)		
LATERAL DRAINAGE COLLECTED FROM LAYER 12	0.00003	(0.00001)	0.116	0.00008
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 13	0.000	(0.000)		
LATERAL DRAINAGE COLLECTED FROM LAYER 15	0.00000	(0.00000)	0.000	0.00000
PERCOLATION/LEAKAGE THROUGH LAYER 17	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 16	0.000	(0.000)		
CHANGE IN WATER STORAGE	0.007	(1.1735)	24.12	0.016

****

0

****

PEAK DAILY VALUES FOR YEARS 1 THROUGH 100

	(INCHES)	(CU. FT.)
PRECIPITATION	13.00	47190.000
RUNOFF	8.285	30074.0723
DRAINAGE COLLECTED FROM LAYER 5	0.71752	2604.58472
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000003	0.00916
AVERAGE HEAD ON TOP OF LAYER 6	4.903	

CASE3D8R

MAXIMUM HEAD ON TOP OF LAYER 6	9.401	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	12.3 FEET	
DRAINAGE COLLECTED FROM LAYER 12	0.00000	0.00752
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 13	0.000	
MAXIMUM HEAD ON TOP OF LAYER 13	0.000	
LOCATION OF MAXIMUM HEAD IN LAYER 12 (DISTANCE FROM DRAIN)	0.0 FEET	
DRAINAGE COLLECTED FROM LAYER 15	0.00000	0.00000
PERCOLATION/LEAKAGE THROUGH LAYER 17	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 16	0.000	
MAXIMUM HEAD ON TOP OF LAYER 16	0.005	
LOCATION OF MAXIMUM HEAD IN LAYER 15 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	7.68	27876.4355

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3527
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1696

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****

****

FINAL WATER STORAGE AT END OF YEAR 100

LAYER	(INCHES)	(VOL/VOL)
1	2.3608	0.3935
2	6.4209	0.3058
3	0.7823	0.1304
4	1.0800	0.0300

5	0.3845	0.0320
6	0.0000	0.0000
7	10.4275	0.4300
8	4.7160	0.3930
9	4.7160	0.3930
10	31.0080	0.0760
11	4.7160	0.3930
12	0.3840	0.0320
13	0.0000	0.0000
14	0.1875	0.7500
15	0.3840	0.0320
16	0.0000	0.0000
17	15.5512	0.4290
SNOW WATER	0.000	

****
****

SECTION 8.4

8.4 MAXIMUM HEAD IN LCS – CELL 8 SUPPLEMENT

COMPUTATION COVER SHEET

Document 6774

SUBJECT OF COMPUTATIONS OSDF PHASE V, MAXIMUM HEAD IN LCS – CELL 8 SUPPLEMENT

Computations By:
(Cognizant Engineer)

Signature R. Kulasingam — Date 1-23-04

Printed Name and Title: Ramachandran Kulasingam, Senior Staff Engineer

Assumptions and Procedures Checked By:
(Checker)

Signature GANESH GOPALAKRISHNAN — Date 1-23-04

Printed Name and Title: for Leslie M. Griffin, Engineer

Computations Checked by:

Signature Hollie N. Kinnecom — Date 1-23-04

Printed Name and Title: Hollie N. Kinnecom, Staff Engineer

Computations Backchecked by:
(Cognizant Engineer)

Signature R. Kulasingam — Date 1-23-04

Printed Name and Title: Ramachandran Kulasingam, Senior Staff Engineer

Approved by:
(PDP)

Signature — Date 1-23-04

Printed Name and Title: for Leslie M. Griffin, Engineer

Approved by:
(DTL/TETL)

Signature Rudolph Bonaparte — Date 23 Jan 04

Printed Name and Title: R. Bonaparte, Principal

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
1A	DCN CELL 8 EXPANSION	16 JUN 2004	RK/	LHG / RC	
1	CELL 8 EXPANSION	15 FEB 2005	RK/	LHG/	JFB/

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

ADDENDUM TO SECTION 8.1
(ADDED TO REVISION 1 PACKAGE)

The Final Design Calculation Package "Leachate Collection System (LCS) Maximum Head in the LCS" presented in Section 8.1 evaluated the performance of the drainage layer and drainage corridor components of the LCS. Specifically the package estimated (i) average and maximum leachate head and liquid thickness for the drainage layer; and (ii) average and maximum leachate head and liquid thickness and flow capacity for the drainage corridor. The performance of the drainage layer and drainage corridor was evaluated using baseline design flow rates applicable to the northernmost and interior OSDF cells (i.e., Cells 1 to 7). Baseline design flow rates for the southernmost OSDF cell (i.e., Cell 8) are presented in Section 7.4 and will be utilized in this package.

This addendum to Section 8.1 evaluated the performance of the drainage layer and drainage corridor for Cell 8. Similar methods and input data to that used in Section 8.1 were used herein. This addendum is presented as Section 8.4 of the OSDF Final Design Calculation Package, and is titled, "Leachate Collection System (LCS) Maximum Head in the LCS – Cell 8 Supplement". Section 8.4 is presented in Volume VII of the OSDF Final Design Calculation Package.

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1 of 2
CALCULATION PROCEDURES	1 of 1
DATA VERIFICATION	1 of 2
CALCULATION RESULTS	1 of 8

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEACHATE COLLECTION SYSTEM (LCS) MAXIMUM HEAD IN LCS - CELL 8 SUPPLEMENT EXECUTIVE SUMMARY

PURPOSE OF ANALYSIS

The purpose of this analysis is to evaluate the performance of the drainage layer and the drainage corridor components of the leachate collection system (LCS) for Cell 8 of the Fernald On-site Disposal Facility (OSDF).

METHOD OF ANALYSIS

Drainage Layer: The maximum and average hydraulic head, and the maximum and average liquid thickness in the drainage layer were calculated using the USEPA HELP model and a closed-form analytical solution.

Drainage Corridor: The maximum and average hydraulic head, and maximum and average liquid thickness in the drainage corridor were calculated using a closed-form analytical solution. The flow capacity of the drainage corridor was calculated to verify its ability to convey leachate.

Calculations were performed for the active operation condition and for the post-closure (i.e., post-settlement) condition. Baseline design flow rates established in the "Leachate Generation Rates – Cell 8 Supplement" Calculation Package were utilized in the calculations. These flow rates do not account for large peak flows associated with the storm design basis flow rate.

CONCLUSIONS

ACTIVE OPERATION CONDITION:

Drainage Layer:

- maximum leachate head, h_{max} = ~~2.5~~ 0.38 in. < 12 in. (O.K.)
- average leachate head, h_{avg} = ~~1.3~~ 0.19 in.
- maximum liquid thickness, T_{max} = ~~2.5~~ 0.38 in.
- average liquid thickness, T_{avg} = ~~1.3~~ 0.19 in.

PK 05/22/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

Drainage Corridor:

- maximum leachate head, h_{max} = ~~3.3~~ 4.16 in. < 12 in. (O.K.)
- average leachate head, h_{avg} = ~~1.9~~ 2.33 in.
- maximum liquid thickness, T_{max} = ~~3.3~~ 4.16 in.
- average liquid thickness, T_{avg} = ~~1.9~~ 2.33 in.
- drainage corridor capacity, Q_{DC} = 23.6 gpm
- required flow capacity, Q_R = ~~7.7~~ 9.8 gpm
- flow capacity factor of safety, Q_{DC}/Q_R = ~~3.1 (equal to target rate of 3, O.K.)~~ 2.4

The DCP does not require a target factor of safety for the flow capacity of the drainage corridor material. However, the DCP does require a target factor of safety for the flow capacity of the leachate collection pipes equal to 3. This factor of safety is calculated in section 8.5.

POST-CLOSURE CONDITION:

Drainage Layer:

- maximum leachate head, h_{max} = 3.81×10^{-5} ~~$\times 10^{-5}$~~ in. < 12 in. (O.K.) 1.21×10^{-5}
- average leachate head, h_{avg} = ~~1.91×10^{-5}~~ in. 6.05×10^{-6}
- maximum liquid thickness, T_{max} = ~~3.81×10^{-5}~~ in. 1.21×10^{-5}
- average liquid thickness, T_{avg} = ~~1.91×10^{-5}~~ in. 6.05×10^{-6}

Drainage Corridor:

- maximum leachate head, h_{max} = ~~1.32×10^{-4}~~ in. < 12 in. (O.K.) 3.72×10^{-4}
- average leachate head, h_{avg} = ~~6.59×10^{-5}~~ in. 1.86×10^{-4}
- maximum liquid thickness, T_{max} = ~~1.32×10^{-4}~~ in. 3.72×10^{-4}
- average liquid thickness, T_{avg} = ~~6.59×10^{-5}~~ in. 1.86×10^{-4}
- drainage corridor capacity, Q_{DC} = 9.42 gpm
- required flow capacity, Q_R = ~~1.08×10^{-4}~~ gpm 3.04×10^{-4}
- flow capacity factor of safety, Q_{DC}/Q_R = ~~87.5×10^{3} (much greater than target value of 10, O.K.)~~ 3.1×10^{4}

05/12/04

The DCP does not require a target factor of safety for the flow capacity of the drainage corridor material. However, the DCP does require a target factor of safety for the flow capacity of the leachate collection pipe equal to 10. If during post closure the capacity of the pipes was to decrease, then the flow capacity of the corridor is more than adequate.

05/12/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEACHATE COLLECTION SYSTEM (LCS) MAXIMUM HEAD IN LCS - CELL 8 SUPPLEMENT

CALCULATION PROCEDURES

INTRODUCTION

The purpose of this package is to present the calculation procedures for the leachate collection system for Cell 8 of the OSDF. In particular, this package addresses the following analyses:

- drainage layer (average and maximum leachate head and liquid thickness); and
- drainage corridor (average and maximum leachate head and liquid thickness, and flow capacity).

METHODS OF ANALYSIS

This calculation package uses the same method of analysis as the one presented in Section 8.1, "Leachate Collection System (LCS) Maximum Head in LCS" in the Final Design Calculation Package.

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEACHATE COLLECTION SYSTEM (LCS)
MAXIMUM HEAD IN LCS - CELL 8 SUPPLEMENT
DATA VERIFICATION

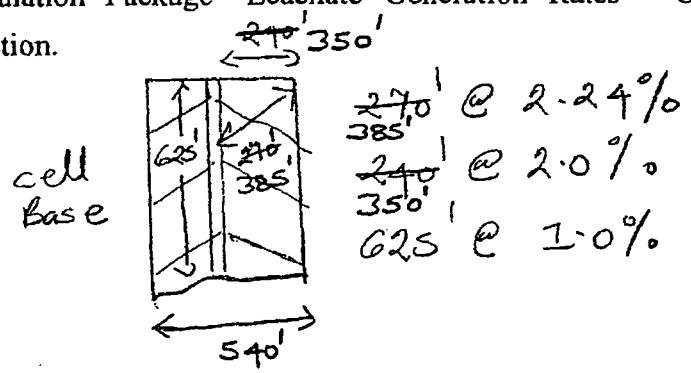
INTRODUCTION

The purpose of this package is to present the data parameters needed to perform the calculations for the leachate collection system for Cell 8 of the OSDF. In particular, this package addresses the following analyses:

- drainage layer (average and maximum leachate head and liquid thickness); and
- drainage corridor (average and maximum leachate head and liquid thickness, and flow capacity).

In order to perform the analyses the data presented in the Calculation Package "Leachate Collection System (LCS) Maximum Head in LCS" is used, except that the slope lengths, cell area, and flow rates are revised based on the Calculation Package "Leachate Generation Rates – Cell 8 Supplement" as described in the following section.

ACTIVE OPERATION CONDITION:



DRAINAGE LAYER

Leachate Head:

q_i = the maximum impingement rate of flow into the drainage layer = 0.0646 in. /day (peak daily value from HELP leachate generation analyses results; Case 1B) = 1.9×10^{-6} cm/sec

L = the length of the slope = ~~270~~ 385 ft (3240 in.)

K = Hydraulic Conductivity = 1 cm/s

DRAINAGE CORRIDOR

Leachate Head: The impingement rate of flow into the drainage corridor is calculated by multiplying the impingement rate of flow into the drainage layer by (width of cell / width of drainage corridor). Therefore,

$q_{i\,dc}$ = (0.0646 in./day) x (~~425~~ 540 ft/ 16 ft) = ~~1.716~~ 2.180 in. /day (peak daily value) = ~~5.04×10^{-5}~~ 6.41×10^{-5} cm/sec

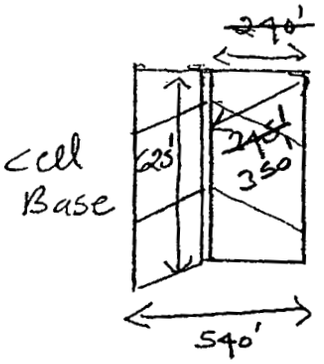
L = the length of the drainage corridor = 625 ft (7500 in.)

05-12-04

Written By: RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

POST-CLOSURE CONDITION:



625' @ 0.4%

~~240'~~ 350' @ 2.0%

~~245'~~ 350' @ 2.04%

DRAINAGE LAYER

Leachate Head:

q_i = the maximum impingement rate of flow into the drainage layer = ~~9.0×10^{-7}~~ 2.0×10^{-6} in. /day (peak daily value from HELP leachate generation analyses results; Case 3D) = ~~2.65×10^{-11}~~ 5.88×10^{-11} cm/sec

L = the length of the slope = ~~245~~ 350 ft (2940 in.)

K = Hydraulic Conductivity = 1 cm/s

DRAINAGE CORRIDOR

Leachate Head: The impingement rate of flow into the drainage corridor is calculated by multiplying the impingement rate of flow into the drainage layer by (width of cell / width of drainage corridor) as shown in Figure 2. Therefore,

$q_{i\ dc}$ = (~~9.0×10^{-7}~~ 2.0×10^{-6} in./day) x (~~425~~ 540 ft/ 16 ft) = ~~2.4×10^{-5}~~ 6.8×10^{-5} in. /day (peak daily value) = ~~7.06×10^{-10}~~ 1.98×10^{-9} cm/sec

L = the length of the drainage corridor = 625 ft (7500 in.)

05/12/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEACHATE COLLECTION SYSTEM (LCS)
MAXIMUM HEAD IN LCS - CELL 8 SUPPLEMENT
CALCULATION RESULTS

Hand calculations were performed for the active condition case. A spreadsheet was used to repeat the calculations for the active case and perform calculations for post-closure case. These calculation results are presented in the following pages.

GEOSYNTEC CONSULTANTS

Written by: RK Date: 03/12/03 (YY/MM/DD) Reviewed by: LMG Date: 03/12/03 (YY/MM/DD) Document 0684

Client: Ebner Fornald Project: OSDF - Revise Phase V Project/Proposal No.: GQ3211 Task No.: 06

DRAINAGE LAYER (ACTIVE OPERATION CONDITION)

LEACHATE HEAD

$$\lambda = \frac{q_i}{k \tan^2\beta} = \frac{1.9\times10^{-6}\ \text{cm/s}}{(\cancel{0.1\ \text{cm/s}}\ 1\ \text{cm/s})\tan^2(1.28^\circ)}$$

$$\lambda = \cancel{0.038}\ 0.0038$$

$$j = 1 - 0.12\exp\left[-\left[\log\left(\frac{8\lambda}{5}\right)^{\frac{5}{8}}\right]^2\right]$$

$$j = 1 - 0.12\exp\left[-\left[\log\left(\frac{8\times\cancel{0.038}\ 0.0038}{5}\right)^{\frac{5}{8}}\right]^2\right]$$

$$j = \cancel{0.933}\ 0.982$$

$$T_{max} = j\left[\frac{\sqrt{1+4\lambda}-1}{2}\cdot\frac{\tan\beta}{\cos\beta}\right]L$$

$$= (\cancel{0.933}\ 0.982)\left[\frac{\sqrt{1+(4)(\cancel{0.933}\ 0.0038)}-1}{2}\cdot\frac{\tan(1.28^\circ)}{\cos(1.28^\circ)}\right]385'\ \cancel{270'}$$

$$= \cancel{2.48''}\ 0.38''$$

$$h_{max} = T_{max}\cos\beta$$

$$= (\cancel{2.48}\ 0.38)\cos(1.28^\circ)$$

$$= \cancel{2.48''}\ 0.38'' < 12''\ \text{OK}$$

For $\lambda = \cancel{0.038}\ 0.0038$

$$\frac{T_{ave}}{T_{max}} = \cancel{0.54}\ 0.50$$

$$T_{ave} = (\cancel{0.54}\ 0.50)(\cancel{2.48}\ 0.38) = \cancel{1.34''}\ 0.19''$$

RK 05/12/03

Written by: RK Date: 03/12/03 (YY MM DD) Reviewed by: LMG Date: 03/12/03 (YY MM DD)

Client: Fluor Fernald Project: OSDF – RPV Project/Proposal No.: GQ 3211 Task No.: 06

$$h_{ave} = T_{ave} \cos\beta$$

$$= (\cancel{1.34}\ 0.19)\cos(1.28^\circ)$$

$$= \cancel{1.34}''\ 0.19''$$

$$h_{max} = \cancel{2.5}''\ 0.38'' < 12'' \leftarrow \text{allowable head ok}$$

$$T_{max} = \cancel{2.5}''\ 0.38'' < 12'' \leftarrow \text{thickness of drainage layer ok}$$

RK 05/12/04

Written by: RK Date: 03/12/03 (YY MM DD) Reviewed by: LMG Date: 12/03/09 (YY MM DD)

Client: Fluor Fernald Project: OSF-RPV Project/Proposal No.: GR3211 Task No.: 06

DRAINAGE CORRIDOR (ACTIVE OPERATION CONDITION)

LEACHATE HEAD 6.41×10^{-5}

$$q_i = \cancel{5.04 \times 10^{-5}} \text{ cm/s} \quad 6.41 \times 10^{-5}$$

$$\lambda = \frac{q_i}{k \tan^2 \beta} = \frac{\cancel{5.04 \times 10^{-5}} \text{ cm/s}}{(10 \text{ cm/s})(\tan^2(0.573^\circ))}$$

$$\lambda = \cancel{0.050} \quad 0.064$$

$$j = 1 - 0.12 \exp\left[-\left[\log\left(\frac{8\lambda}{5}\right)^{\frac{5}{8}}\right]^2\right]$$

$$j = \cancel{0.924} \quad 0.918$$

$$T_{max} = j\left[\frac{\sqrt{1+4\lambda} - 1}{2} \frac{\tan\beta}{\cos\beta}\right] L$$

$$= \left(\cancel{0.924}\ 0.918\right)\left[\frac{\sqrt{1+(4)(\cancel{0.050}\ 0.064)} - 1}{2} \frac{\tan(0.573)}{\cos(0.573)}\right] \times 7500$$

$$= \cancel{3.34}'' \ 4.16''$$

$$h_{max} = T_{max} \cos\beta$$

$$= \left(\cancel{3.34}\ 4.16\right) \cos(0.573)$$

$$= \cancel{3.34}'' \ 4.16''$$

PK 05/12/04

Written by: RKG Date: 03/12/03 (YY/MM/DD) Reviewed by: LMG Date: 03/13/03 (YY/MM/DD)

Client: Fluor Fernald Project: OSDF-RPV Project/Proposal No.: GQ3271 Task No.: 06

For $\lambda = \cancel{0.050}\ 0.064$

$$\frac{T_{ave}}{T_{max}} = 0.56$$

$$T_{ave} = (0.56)(\cancel{3.34}\ 4.16)$$

$$= \cancel{1.87''}\ 2.33''$$

$$h_{ave} = T_{ave}\cos\beta$$

$$= (\cancel{1.87}\ 2.33)\cos(0.573)$$

$$= \cancel{1.84''}\ 2.33''$$

$h_{max} = \cancel{3.34}\ 4.16'' < 12''$ ← allowable head ok

$T_{max} = \cancel{3.34}\ 4.16'' < 12''$ ← thickness of drainage corridor ok

05/22/04

GEOSYNTEC CONSULTANTS

Written by: RK Date: 03/12/03 (YY/MM/DD) Reviewed by: LMG Date: 03/12/03 (YY/MM/DD) Document 6774

Client: Ehrhorn Fernald Project: OSDF – RPV Project/Proposal No.: GQ3211 Task No.: 06

DRAINAGE CORRIDOR (ACTIVE OPERATION CONDITION)

FLOW CAPACITY

Flow capacity $Q_{DC} = kiA$

$= 1.49 \times 10^{-3}\ m^3/s$

(No change from section 8.1)

Required capacity $Q_R = q_2 A_d$

$Q_R = [1.9 \times 10^{-6} \times 10^{-2}\ m/s][\cancel{6.34}\ 8.06\ acre \times 0.405\ \frac{ha}{acre} \times 10{,}000\ \frac{m^2}{ha}]$

$= [1.9 \times 10^{-8}\ m/s][\cancel{2.57}\ 3.26 \times 10^4\ m^2]$

$= \cancel{4.88 \times 10^{-4}}\ 6.20 \times 10^{-4}\ m^3/s$

Ratio of drainage corridor capacity to required capacity

$\frac{Q_{DC}}{Q_R} = \frac{1.49 \times 10^{-3}}{\cancel{4.88 \times 10^{-4}}\ 6.20 \times 10^{-4}}$

$= \cancel{3.05}\ 2.40$ $\cancel{\rightarrow 3\ \text{OK}}$

The DCP does not require a target factor of safety for the flow capacity of the drainage corridor material. However, the DCP does require a target factor of safety for the flow capacity of the leachate collection pipe equal to 3. This factor of safety is calculated in section 8.5.

RK 05/12/04

LCS Drainage Layer

Parameter	Active	Post-Closure
Drainage Path Length (ft)	385	350
Drainage Path Slope (%)	2.24	2.04
Slope Angle (rad)	0.02	0.02
Slope Angle (deg)	1.28	1.17
Thickness (in.)	12	12
Total Cell Width (ft)	540	540
Total Cell Length (ft)	650	650
Total Cell Area (acre)	8.06	8.06
k (cm/s)	1	1
qi, (in/day) [from HELP]	0.0646	2.00E-06
qi, (cm/s)	1.90E-06	5.88E-11
λ [Giroud et al.]	0.004	0.000
j [Giroud et al.]	0.982	1.000
T_{max}/L	8.30E-05	2.88E-09
T_{max} (in.)	0.38	1.21E-05
h_{max} (in.)	0.38	1.21E-05
T_{ave}/T_{max}	0.5	0.5
T_{ave} (in.)	0.19	6.05E-06
h_{ave} (in.)	0.19	6.05E-06

PM
05/12/04

LCS Drainage Corridor

Parameter	Active	Post-Closure
Drainage Path Length (ft)	625	625
Drainage Path Slope (%)	1.00	0.40
Slope Angle (rad)	0.01	0.00
Slope Angle (deg)	0.57	0.23
Thickness (in.)	12	12
Total Corridor Width (ft)	16	16
Total Corridor C/S Area (ft^2)	16	16
Total Corridor C/S Area (m^2)	1.49	1.49
Total Corridor Plan Area (acre)	0.23	0.23
k (cm/s)	10	10
qi, (in/day)	2.18	6.75E-05
qi, (cm/s)	6.41E-05	1.98E-09
λ [Giroud et al.]	0.064	0.000
j [Giroud et al.]	0.918	1.000
T_{max}/L	5.55E-04	4.96E-08
T_{max} (in.)	4.16	3.72E-04
h_{max} (in.)	4.16	3.72E-04
T_{ave}/T_{max}	0.56	0.5
T_{ave} (in.)	2.33	1.86E-04
h_{ave} (in.)	2.33	1.86E-04
Flow Capacity (m^3/s)	1.49E-03	5.95E-04
Required Capacity (m^3/s)	6.20E-04	1.92E-08
Factor of Safety (For Capacity)	2.40	3.10E+04

05/12/04

SECTION 8.5

8.5 LCS PIPE DESIGN – CELL 8 SUPPLEMENT

COMPUTATION COVER SHEET

SUBJECT OF COMPUTATIONS OSDF PHASE V, LCS PIPE DESIGN – CELL 8 SUPPLEMENT

Computations By:
(Cognizant Engineer)

Signature R. Kulasingam — Date 1-23-04

Printed Name and Title: Ramachandran Kulasingam, Senior Staff Engineer

Assumptions and Procedures Checked By:
(Checker)

Signature GANESH GOPALAKRISHNAN — Date 1-23-04

Printed Name and Title: for Leslie M. Griffin, Engineer

Computations Checked by:

Signature Hollie N. Kinnecom — Date 1-23-04

Printed Name and Title: Hollie N. Kinnecom, Staff Engineer

Computations Backchecked by:
(Cognizant Engineer)

Signature R. Kulasingam — Date 1-23-04

Printed Name and Title: Ramachandran Kulasingam, Senior Staff Engineer

Approved by:
(PDP)

Signature — Date 1-23-04

Printed Name and Title: for Leslie M. Griffin, Engineer

Approved by:
(DTL/TETL)

Signature Rudolph Bonaparte — Date 23 Jan 04

Printed Name and Title: R. Bonaparte, Principal

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
1A	DCN CELL 8 EXPANSION	16 JUN 2004	RK / RK	LMG / RC	
1	CELL 8 EXPANSION	15 FEB 2005	RK / RK	LMG / LMG	JFB / JFB

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

ADDENDUM TO SECTION 8.3
(ADDED TO REVISION 1 PACKAGE)

The Final Design Calculation Package "Leachate Collection System (LCS) LCS Pipe Design" presented in Section 8.3 evaluated the performance of the LCS collector pipe. The LCS pipe flow capacity was compared to the required capacity as part of the evaluation in that Calculation Package using baseline design flow rates applicable to the northernmost and interior OSDF cells (i.e., Cells 1 to 7). Baseline design flow rates for the southernmost OSDF cell (i.e., Cell 8) are different from that of the other cells, and are presented in Section 7.4.

This addendum to Section 8.3 evaluated the performance of the LCS collector pipe for Cell 8 using the baseline flow rates for that cell. Similar methods and input data to that used in Section 8.3 were used herein. This addendum is presented as Section 8.5 of the OSDF Final Design Calculation Package, and is titled, "Leachate Collection System (LCS) LCS Pipe Design – Cell 8 Supplement". Section 8.5 is presented in Volume VII of the OSDF Final Design Calculation Package.

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1 of 1
CALCULATION PROCEDURES	1 of 1
DATA VERIFICATION	1 of 1
CALCULATION RESULTS	1 of 3

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEACHATE COLLECTION SYSTEM (LCS)
LCS PIPE DESIGN - CELL 8 SUPPLEMENT
EXECUTIVE SUMMARY

PURPOSE OF ANALYSIS

The purpose of this analysis is to evaluate the performance of the LCS collector pipe for Cell 8 of the OSDF. The evaluation will be performed for both active operation and post-closure conditions.

METHOD OF ANALYSIS

The flow capacity, perforation size, and structural stability (wall crushing, wall buckling, and excessive ring deflection) were calculated for the LCS collector pipe in the Section 8.3, "Leachate Collection System (LCS) LCS Pipe Design" of the Final Design Calculation Package. The parameters used to calculate the perforation size and structural stability of the LCS collector pipe have not changed. However, the flow capacity of the LCS pipe is compared to the required flow capacity for Cell 8 in this Calculation Package.

CONCLUSIONS

- Pipe flow capacity for active operation condition, Q_p = 196.4 gpm
- Required flow capacity for active operation condition, Q_{pr} = ~~7.7~~ 9.8 gpm
- Flow capacity factor of safety for active operation condition, Q_p/Q_{pr} = ~~25~~ 20 > 3 (OK)
- Pipe flow capacity for post-closure condition, Q_p = 124.2 gpm
- Required flow capacity for post-closure condition, Q_{pr} = ~~1.08×10^{-4}~~ 3.04×10^{-4} gpm
- Flow capacity factor of safety for post-closure condition, Q_p/Q_{pr} = ~~1.15×10^{6}~~ 4.09×10^{5} >> 10 (OK)

PR 05/12/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEACHATE COLLECTION SYSTEM (LCS)
LCS PIPE DESIGN - CELL 8 SUPPLEMENT
CALCULATION PROCEDURES

INTRODUCTION

The purpose of this package is to evaluate the factor of safety for flow capacity by comparing the new required flow capacity for Cell 8 with the LCS pipe flow capacity.

METHOD OF ANALYSIS

The required flow capacity for Cell 8 was evaluated in Section 8.4, "Leachate Collection System (LCS) Maximum Head in LCS – Cell 8 Supplement". The LCS pipe flow capacity was evaluated in Section 8.3 "Leachate Collection System (LCS) LCS Pipe Design" of the Final Design Calculation Package.

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEACHATE COLLECTION SYSTEM (LCS)
LCS PIPE DESIGN - CELL 8 SUPPLEMENT
DATA VERIFICATION

Pipe flow capacity (Q_p) = 1.25×10^{-2} m^3/s (from Calculation Package "Leachate Collection System (LCS) LCS Pipe Design" – Section 8.3)

Required flow capacity (Q_{pr}) = ~~4.88×10^{-4}~~ 6.20×10^{-4} m^3/s (from Calculation Package "Leachate Collection System (LCS) Maximum Head in LCS – Cell 8 Supplement" – Section 8.4)

RK 05/22/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEACHATE COLLECTION SYSTEM (LCS)
LCS PIPE DESIGN - CELL 8 SUPPLEMENT
CALCULATION RESULTS

Hand calculations were performed for the active condition case. A spreadsheet was used to repeat the calculations for the active case and perform calculations for the post-closure case. These calculation results are presented in the following pages.

GEOSYNTEC CONSULTANTS

Written by: RK Date: 03/12/03 (YY/MM/DD) Reviewed by: LMG Date: 03/12/09 (YY/MM/DD)

Client: Flour Fanald Project: DSDF – RPV Project/Proposal No.: GQ 3211 Task No.: 06

LCS PIPE FLOW CAPACITY (ACTIVE OPERATION)

LCS Pipe Flow capacity, $Q_p = 1.25 \times 10^{-2}\ m^3/s$

(no change from the previous calculation package) (section 8.3)

Required capacity $Q_{pr} = q_i A_d$

$$Q_{pr} = [1.9 \times 10^{-6} \times 10^{-2}\ m/s][\cancel{6.34}\ 8.06 \times 0.405 \times 10{,}000\ m^2]$$

$$= \cancel{4.88 \times 10^{-4}}\ 6.20 \times 10^{-4}\ m^3/s$$

$$\frac{Q_p}{Q_{pr}} = \frac{1.25 \times 10^{-2}}{\cancel{4.88 \times 10^{-4}}\ 6.20 \times 10^{-4}}$$

$$= \cancel{25.4}\ 20.0 > 3 \quad \text{O.K}$$

RK
05/12/09

LCS Pipe

Parameter	Active	Post-Closure
Pipe Inner Diameter (in.)	5.421	5.421
Cross Section Area (in^2)	23.08	23.08
Cross Section Area (m^2)	1.49E-02	1.49E-02
Hydraulic Radius (in.)	1.36	1.36
Manning's Coefficient ($s/m^{0.33}$)	0.013	0.013
Drainage Path Slope (%)	1.00	0.40
Slope Angle (rad)	0.01	0.00
Slope Angle (deg)	0.57	0.23
Flow Capacity (m^3/s)	1.24E-02	7.84E-03
Required Capacity (m^3/s)	6.20E-04	1.92E-08
Factor of Safety (For Capacity)	20.00	4.09E+05

05/12/04

SECTION 9.6

9.6 MIGRATION THROUGH PRIMARY LINER – CELL 8 SUPPLEMENT

COMPUTATION COVER SHEET

Document 6774

SUBJECT OF COMPUTATIONS OSDF PHASE V, MIGRATION THROUGH PRIMARY LINER – CELL 8 SUPPLEMENT

Computations By:
(Cognizant Engineer)

Signature R. Kulasingam — Date 1-23-04

Printed Name and Title: Ramachandran Kulasingam, Senior Staff Engineer

Assumptions and Procedures Checked By:
(Checker)

Signature GANESH GOPALAKRISHNAN — Date 1-23-04

Printed Name and Title: for Leslie M. Griffin, Engineer

Computations Checked by:

Signature Hollie N. Kinnecom — Date 1-23-04

Printed Name and Title: Hollie N. Kinnecom, Staff Engineer

Computations Backchecked by:
(Cognizant Engineer)

Signature R. Kulasingam — Date 1-23-04

Printed Name and Title: Ramachandran Kulasingam, Senior Staff Engineer

Approved by:
(PDP)

Signature — Date 1-23-04

Printed Name and Title: for Leslie M. Griffin, Engineer

Approved by:
(DTL/TETL)

Signature Rudolph Bonaparte — Date 23 Jan 04

Printed Name and Title: R. Bonaparte, Principal

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
1A	DCN CELL 8 EXPANSION	16 JUN 2004	RK / RC	LMG / RC	
1	CELL 8 EXPANSION	15 FEB 2005	RK / RC	LMG / LMG	JFB / JFB

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

ADDENDUM TO SECTION 9.1
(ADDED TO REVISION 1 PACKAGE)

The Calculation Package "Leak Detection System (LDS) Migration through Primary Liner" presented in Section 9.1 summarized the analysis of leachate migration through the primary liner and into the LDS and discussed other potential sources of flow into the LDS for different stages of the life of the Fernald On-site Disposal Facility (OSDF). The leachate migration rates were calculated based on a cell 400 feet wide and 6.5 acres in size. This size cell applies to the northernmost and interior OSDF cells (i.e., Cells 1 to 7). The southernmost OSDF cell (i.e., Cell 8) is sized differently from the other cells.

This addendum to Section 9.1 summarizes the analysis of leachate migration through the primary liner for Cell 8. Similar methods and input data to that used in Section 9.1 were used herein. This addendum is presented as Section 9.6 of the OSDF Final Design Calculation Package, and is titled, "Leak Detection System (LDS) Migration through Primary Liner – Cell 8 Supplement". Section 9.6 is presented in Volume VII of the OSDF Final Design Calculation Package.

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1 of 1

CALCULATION PROCEDURES 1 of 1

DATA VERIFICATION 1 of 1

CALCULATION RESULTS 1 of 2

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEAK DETECTION SYSTEM (LDS) MIGRATION THROUGH PRIMARY LINER - CELL 8 SUPPLEMENT EXECUTIVE SUMMARY

PURPOSE OF ANALYSIS

The purpose of this package is to summarize the analysis of leachate migration through the primary liner and into the LDS for Cell 8 of the OSDF.

METHODS OF ANALYSIS

The infiltration rate of leachate through the primary liner into the LDS was estimated using the USEPA HELP model analysis performed in the "Leachate Generation Rates – Cell 8 Supplement" Calculation Package. The assumptions made to perform the leachate generation analysis were summarized in the "Leak Detection System (LDS) – Migration Through Primary Liner" Final Design Calculation Package. The updated results for Cell 8 of the OSDF are presented here.

CONCLUSIONS

Infiltration rates through the primary liner are as follows:

- Peak daily rate during active conditions = ~~6.5×10^{-3}~~ 8.9×10^{-4} gpad
- Average annual rate during active conditions = ~~4.5×10^{-3}~~ 7.5×10^{-4} gpad
- Average annual rate during post-closure conditions = 1.9×10^{-4} gpad

05/13/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEAK DETECTION SYSTEM (LDS) MIGRATION THROUGH PRIMARY LINER - CELL 8 SUPPLEMENT

CALCULATION PROCEDURES

INTRODUCTION

The purpose of this package is to present the calculation procedures for evaluating the migration of leachate through the primary liner.

METHOD OF ANALYSIS

Calculation procedures were the same as those presented in Section 9.1 "Leak Detection System (LDS) – Migration through Primary Liner" Final Design Calculation Package.

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEAK DETECTION SYSTEM (LDS)
MIGRATION THROUGH PRIMARY LINER - CELL 8
SUPPLEMENT
CALCULATION RESULTS

Infiltration rates through the primary liner are as follows:

- Peak daily rate during active conditions = ~~6.5×10^{-3}~~ 8.9×10^{-4} gpad
- Average annual rate during active conditions = ~~4.5×10^{-3}~~ 7.5×10^{-4} gpad
- Average annual rate during post-closure conditions = 1.9×10^{-4} gpad

Note, that peak daily rate for the post-closure stage cannot be calculated with certainty due to rounding errors by the HELP program, but is expected to be greater than 1.9×10^{-4} gpad.

05/13/04

GEOSYNTEC CONSULTANTS

Document 6774

Written by: RIG Date: 03/12/03 (YY/MM/DD) Reviewed by: LMG Date: 03/12/09 (YY/MM/DD)

Client: Fluor Fernald Project: OSDF - RPV Project/Proposal No.: GQ 3211 Task No.: 06

Infiltration rates through primary liner

Peak daily rate during active conditions

$= \cancel{2.4 \times 10^{-7}}\ 3.3 \times 10^{-8}$ in/day [from HELP]

$= \cancel{6.5 \times 10^{-3}}\ 8.9 \times 10^{-4}$ gpad

Average annual rate during active conditions

$= \cancel{6.0 \times 10^{-5}}\ 1.0 \times 10^{-5}$ in/yr

$= \cancel{4.5 \times 10^{-3}}\ 7.5 \times 10^{-4}$ gpad

05/13/04

Average annual rate during post-closure conditions

$= \cancel{2.5} \times 10^{-6}$ in/yr

$= 1.9 \times 10^{-4}$ gpad

Peak annual rate during post-closure conditions

$= \cancel{5.5} \times 10^{-9}$ in/d

$= 1.5 \times 10^{-4}$ gpad

(less than the average → considered to be due to the rounding errors in HELP)

SECTION 9.7

9.7 MAXIMUM HEAD IN LDS – CELL 8 SUPPLEMENT

COMPUTATION COVER SHEET

SUBJECT OF COMPUTATIONS OSDF PHASE V, MAXIMUM HEAD IN LDS – CELL 8 SUPPLEMENT

Computations By:
(Cognizant Engineer)

Signature R. Kulasingam — Date 1-23-04

Printed Name and Title: Ramachandran Kulasingam, Senior Staff Engineer

Assumptions and Procedures Checked By:
(Checker)

Signature GANESH GOPALAKRISHNAN — Date 1-23-04

Printed Name and Title: for Leslie M. Griffin, Engineer

Computations Checked by:

Signature Hollie N. Kinnecom — Date 1-23-04

Printed Name and Title: Hollie N. Kinnecom, Staff Engineer

Computations Backchecked by:
(Cognizant Engineer)

Signature R. Kulasingam — Date 1-23-04

Printed Name and Title: Ramachandran Kulasingam, Senior Staff Engineer

Approved by:
(PDP)

Signature for — Date 1-23-04

Printed Name and Title: Leslie M. Griffin, Engineer

Approved by:
(DTL/TETL)

Signature Rudolph Bonaparte — Date 23 Jan 04

Printed Name and Title: R. Bonaparte, Principal

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
1A	DCN CELL 8 EXPANSION	16 JUN 2004	RK / RK	LMG / RC	
1	CELL 8 EXPANSION	15 FEB 2005	RK / RK	LMG / LMG	JFB / JFB

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

ADDENDUM TO SECTION 9.2
(ADDED TO REVISION 1 PACKAGE)

The Calculation Package "Leak Detection System (LDS) Maximum Head in LDS" presented in Section 9.2 evaluated the performance of the drainage layer and the drainage corridor components of the leak detection system (LDS) for different stages of the life of the Fernald On-site Disposal Facility (OSDF). The performance of the drainage layer and drainage corridor was evaluated using baseline design flow rates applicable to the northernmost and interior OSDF cells (i.e., Cells 1 to 7). Baseline design flow rates for the southernmost OSDF cell (i.e., Cell 8) are presented in Section 7.4 and will be utilized in this package.

This addendum to Section 9.2 evaluated the performance of the drainage layer and drainage corridor for Cell 8. Similar methods and input data to that used in Section 9.2 were used herein. This addendum is presented as Section 9.7 of the OSDF Final Design Calculation Package, and is titled, "Leak Detection System (LDS) Maximum Head in LDS – Cell 8 Supplement". Section 9.7 is presented in Volume VII of the OSDF Final Design Calculation Package.

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1 of 2
CALCULATION PROCEDURES	1 of 1
DATA VERIFICATION	1 of 2
CALCULATION RESULTS	1 of 7

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEAK DETECTION SYSTEM (LDS)
MAXIMUM HEAD IN LDS - CELL 8 SUPPLEMENT
EXECUTIVE SUMMARY

PURPOSE OF ANALYSIS

The purpose of this package is to evaluate the performance of the drainage layer and the drainage corridor components of the leak detection system (LDS) for Cell 8 of the OSDF.

METHODS OF ANALYSIS

Drainage Layer: The maximum and average thickness of liquid in the LDS drainage layer were calculated using a closed-form analytical solution.

Drainage Corridor: The maximum and average hydraulic head and thickness of liquid in the drainage corridor were calculated using a closed-form analytical solution. The flow capacity of the drainage corridor was calculated using Darcy's equation to verify its ability to convey liquid with an adequate factor of safety.

Calculations were performed for the active operation condition and for the post-closure (i.e., post-settlement) condition. Baseline design flow rates established in the "Leachate Generation Rates – Cell 8 Supplement" Calculation Package were utilized in the calculations. These flow rates do not account for large peak flows associated with the storm design basis flow rate.

CONCLUSIONS

ACTIVE OPERATION CONDITION:

LDS Drainage Layer:

- maximum thickness of liquid, T_{max} = ~~0.021~~ 0.002 in. < 12 in. (OK)
- average thickness of liquid, $T_{ave,w}$ = ~~1.9×10^{-4}~~ 6.4×10^{-6} in.

RK 05/13/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LDS Drainage Corridor:

- maximum leachate head, h_{max} = ~~1.41x10^{-5}~~ 2.46x10^{-6} in. < 12 in. (OK)
- average leachate head, h_{avg} = ~~7.0x10^{-6}~~ in. 1.23x10^{-6} in
- maximum liquid thickness, T_{max} = ~~1.41x10^{-5} in.~~ 2.46x10^{-6} in.
- average liquid thickness, T_{avg} = ~~7.0x10^{-6} in.~~ 1.23x10^{-6} in
- drainage corridor capacity, Q_{DC} = 23.6 gpm
- required flow capacity, Q_R = ~~2.9x10^{-5} gpm~~ 5.08x10^{-6}
- flow capacity factor of safety, Q_{DC}/Q_R = ~~8.2x10^{5} > 3 (OK)~~ 4.7x10^{6}

POST-CLOSURE CONDITION:

The DCP does not require a target factor of safety for the flow capacity of the drainage corridor material. However, the DCP does require a target factor of safety for the flow capacity of the leak detection pipes equal to 3. This factor of safety is calculated in Section 9.9.

LDS Drainage Layer:

- maximum thickness of liquid, T_{max} = ~~0.004 in.~~ < 12 in. (OK)
- average thickness of liquid, $T_{ave,w}$ = ~~2.62x10^{-6} in.~~ 0.001 in. 5.22x10^{-7} in.

LDS Drainage Corridor:

- maximum leachate head, h_{max} = ~~2.4x10^{-5}~~ 1.3x10^{-6} in. < 12 in. (OK)
- average leachate head, h_{avg} = ~~1.2x10^{-5} in.~~ 6.3x10^{-7} in.
- maximum liquid thickness, T_{max} = ~~2.4x10^{-5} in~~ 1.3x10^{-6} in.
- average liquid thickness, T_{avg} = ~~1.2x10^{-5} in.~~ 6.3x10^{-7} in.
- drainage corridor capacity, Q_{DC} = 9.42 gpm
- required flow capacity, Q_R = ~~8.13x10^{-7}~~ 1.03x10^{-6} gpm
- flow capacity factor of safety, Q_{DC}/Q_R = ~~1.2x10^{7} > 10 (OK)~~ 9.11x10^{6}

PR 05/12/04

The DCP does not require a target factor of safety for the flow capacity of the drainage corridor material. However, the DCP does require a target factor of safety for the flow capacity of the leachate collection pipe equal to 10. If during post closure the capacity of the pipes was to decrease, then the flow capacity of the corridor is more than adequate. PR 05/12/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEAK DETECTION SYSTEM (LDS)
MAXIMUM HEAD IN LDS - CELL 8 SUPPLEMENT
CALCULATION PROCEDURES

INTRODUCTION

The purpose of this package is to present the calculation procedures for evaluating the maximum head in the LDS.

METHOD OF ANALYSIS

The calculation procedures are the same as those presented in Section 9.2 "Leak Detection System (LDS) Maximum Head in LDS" Final Design Calculation Package.

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEAK DETECTION SYSTEM (LDS)

MAXIMUM HEAD IN LDS - CELL 8 SUPPLEMENT

DATA VERIFICATION

INTRODUCTION

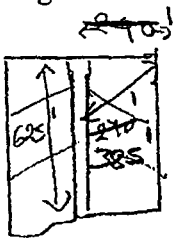
The purpose of this package is to present the data parameters needed to perform the calculations for the LDS for Cell 8 of the OSDF. In particular, this package addresses the following analyses:

- drainage layer (average and maximum liquid thickness); and
- drainage corridor (average and maximum leachate head and liquid thickness, and flow capacity).

In order to perform the analyses the data presented in the Calculation Package "Leachate Detection System (LDS) Maximum Head in LDS" is used, except that the slope lengths, cell area, and flow rates are revised based on the Calculation Package "Leachate Generation Rates – Cell 8 Supplement" as described in the following section.

ACTIVE OPERATION CONDITIONS:

Cell Base



~~240'~~ 350' @ 2%
~~270'~~ 385' @ 2.24%
625' @ 1%

Drainage Layer:

Q = leakage rate through a hole in the primary liner (assumes 1 hole per acre)

= ~~4.5x10⁻³~~ gpad (average annual daily infiltration calculated using the HELP model) X 1.0 acres 7.5×10^{-4}

= ~~4.5x10⁻³~~ gpd 7.5×10^{-4} gpd

= ~~6.5x10⁻³~~ gpad (peak daily infiltration calculated using the HELP model) X 1.0 acres

= ~~6.5x10⁻³~~ gpd 8.9×10^{-4} 8.9×10^{-4} gpd 385'

L = the horizontal length of the slope = ~~270~~ ft (3240 in.)

K = Hydraulic conductivity = 1 cm/s

Drainage Corridor:

The impingement rate of flow into the drainage corridor is calculated by multiplying the peak daily value from HELP for the drainage layer by a factor (width of cell / width of drainage corridor). Impingement rate is taken equal to the infiltration through the top liner (from HELP calculations performed as part of "Leachate Generation Rates – Cell 8 Supplement" Calculation Package).

Written By: RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

q_i = the maximum impingement rate of flow into the drainage corridor

= (~~6.5x10^{-7}~~ 8.9×10^{-4} gpad or ~~2.4 x 10^{-7}~~ in/d) x (~~425~~ 540 ft / 16 ft)

= ~~6.4x10^{-6} in/d~~ 3.3×10^{-8} 2.1×10^{-6} in/d

L = the length of the drainage corridor = 625 ft (7500 in.)

POST-CLOSURE CONDITION:

Drainage Layer:

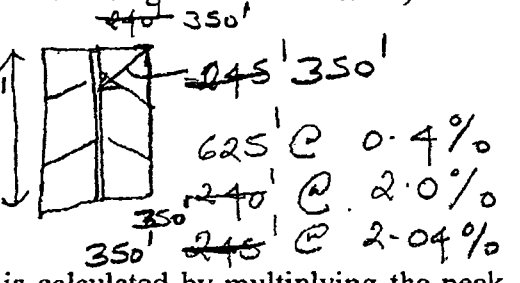
Q = leakage rate through a hole in the primary liner (assumes 1 hole per acre)

= 1.9x10^{-4} gpad (average annual daily infiltration calculated using the HELP model) X 1.0 acres

= 1.9x10^{-4} gpd

L = the horizontal length of the slope = ~~245~~ 350 ft (2940 in.)

K = Hydraulic Conductivity = 1 cm/s



Drainage Corridor:

The impingement rate of flow into the drainage corridor is calculated by multiplying the peak daily value from HELP for the drainage layer by a factor (width of cell / width of drainage corridor). Impingement rate is taken as equal to the infiltration through the top liner (from HELP calculations performed as part of "Leachate Generation Rates – Cell 8 Supplement" Calculation Package).

q_i = the maximum impingement rate of flow into the drainage corridor

= (1.9 x10^{-4} gpad or 2.5 x 10^{-6} in/yr) x (~~425 ft~~ 540 / 16 ft)

= ~~6.6x10^{-5} in/yr~~ 8.4×10^{-5} in/yr

L = the length of the drainage corridor = 625 ft (7500 in.)

PM 05/13/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEAK DETECTION SYSTEM (LDS)

MAXIMUM HEAD IN LDS - CELL 8 SUPPLEMENT (SEE VOLUME VIII)

CALCULATION RESULTS

Hand calculations were performed for the active condition case. A spread sheet was used to repeat the calculations for the active case and perform calculations for post-closure case. These calculation results are presented in the following pages.

Written by: RK Date: 03/12/03 (YY/MM/DD) Reviewed by: LM Cn Date: 03/12/09 (YY/MM/DD)

Client: Fluor Fernald Project: OSDF RPV Project/Proposal No.: GP 3211 Task No.: 06

Drainage Layer

Active Condition:

$Q_{peak, Daily} = \cancel{6.5\times10^{-3}}\ 8.9\times10^{-4}$ gpd (for 1 hole)

$Q_{Average, Annual} = \cancel{4.5\times10^{-3}}\ 7.5\times10^{-4}$ gpd (for 1 hole)

Peak Daily ⇒

$$T_{max} = \sqrt{\frac{Q}{K}}$$

$$= \sqrt{\frac{\left(\cancel{6.5\times10^{-3}}\ 8.9\times10^{-4}\ gpd\right)\left(\frac{ft^3}{7.48\ gal}\right)\left[\frac{1}{24\times3600}\right]\frac{d}{s}}{\left(\cancel{0.1}\ 1\ cm/s\right)\left(\frac{ft}{30.48\ cm}\right)}}$$

$$= \sqrt{\cancel{3.07\times10^{-6}}\ 4.2\times10^{-8}}$$

$$= \cancel{1.75\times10^{-3}}\ 2.05\times10^{-4}\ ft$$

$$= \cancel{0.021}\ 0.002'' < 12''\ \text{o.k}$$

$$M = \frac{T_{max}}{L\sin\beta}$$

$$= \frac{\cancel{1.75\times10^{-3}}\ 2.05\times10^{-4}\ ft}{\left(\cancel{270\ ft}\ 385\right)\sin(1.28^\circ)}$$

$$= \cancel{2.90\times10^{-4}}\ 2.38\times10^{-5}$$

RK 05/13/04.

Written by: RK Date: 03/12/03 (YY MM DD) Reviewed by: LMG Date: 03/12/03 (YY MM DD) Document 0774

Client: Flour Fonth Project: OSDF-RPV Project/Proposal No.: GQ 3211 Task No.: 06

$$T_{ave,\omega} = \frac{3}{4} T_{max} = \frac{1 + \frac{3}{9}M}{\sqrt{1+\left(\frac{2}{M}\right)\left(1+\frac{M}{2}\right)}}$$

$$= \cancel{1.90\times10^{-4}}\ 6.39\times10^{-6}\ in$$

Drainage Corridor

$$q_i = \cancel{6.4\times10^{-6}}\ 1.1\times10^{-6}\ in/d$$

$$\lambda = \frac{q_i}{k\tan^2\beta}$$

$$= \frac{\cancel{6.4\times10^{-6}}\ 1.1\times10^{-6}\ \frac{in}{d} \times \frac{2.54\ \frac{cm}{in}}{2.4\times3600\ \frac{s}{d}}}{(10\,cm/s)\tan^2(0.573^\circ)}$$

$$= \cancel{1.88\times10^{-7}}\ 3.27\times10^{-8}$$

$$j = 1 - 0.12\exp\left[-\left[\log\left(\frac{8\lambda}{5}\right)^{\frac{5}{8}}\right]^2\right]$$

$$j = 1$$

$$T_{max} = j\left[\frac{\sqrt{1+4\lambda}-1}{2}\ \frac{\tan\beta}{\cos\beta}\right]L$$

$$= (1)\left[\frac{\sqrt{1+(4)(\cancel{1.88\times10^{-7}}\ 3.27\times10^{-8})}-1}{2}\ \frac{\tan(0.573)}{\cos(0.573)}\right]62$$

RK 05/13/04

GEOSYNTEC CONSULTANTS

Written by: RK Date: 03/12/03 (YY/MM/DD) Reviewed by: LMG Date: 03/12/03 (YY/MM/DD) Document 06714

Client: Ebner Fernald Project: OSDF RPV Project/Proposal No.: GQ3211 Task No.: 06

$T_{max} = \cancel{1.47\times10^{-5}}\ 2.46\times10^{-6}$ in $< 12''$ O.K.

$h_{max} = T_{max}\cos\beta$

$= \left(\cancel{1.47\times10^{-5}}\ 2.46\times10^{-6}\right)\cos(0.573)$

$= \cancel{1.41\times10^{-5}}\ 2.46\times10^{-6}$ in

For $\lambda = \cancel{1.88\times10^{-7}}\ 3.27\times10^{-8}$

$\frac{T_{ave}}{T_{max}} = 0.5$

$T_{ave} = (0.5)\left(\cancel{1.41\times10^{-5}}\ 2.46\times10^{-6}\right)$

$= \cancel{0.705\times10^{-5}}\ 1.23\times10^{-6}$ in

$h_{ave} = T_{ave}\cos\beta$

$= \left(\cancel{0.705\times10^{-5}}\ 1.23\times10^{-6}\right)\cos(0.573^\circ)$

$= \cancel{0.705\times10^{-5}}\ 1.23\times10^{-6}$ in

RK 05/13/04

Written by: RK Date: 03/12/03 (YY/MM/DD) Reviewed by: LMG Date: 03/12/03 (YY/MM/DD)

Client: Fluor Fonald Project: 050F - RPV Project/Proposal No.: GQ 3211 Task No.: 06

Drainage corridor Flow Capacity

$$Q_{DC} = KiA$$

$$= 1.49 \times 10^{-3} \ m^3/s$$

[23.6 gpm]

$$q_i = \cancel{6.5 \times 10^{-3}} \ 8.9 \times 10^{-4} \ gpad$$

$$= \cancel{2.4 \times 10^{-7}} \ 3.3 \times 10^{-8} \ in/d$$

Required capacity (Q_R)

$$Q_R = q_i A d$$

$$= \left[\cancel{2.4 \times 10^{-7}} \ 3.3 \times 10^{-8} \ in/d \times \frac{2.54}{100} \times \frac{1}{24 \times 3600} \right] m$$

$$\times \left[(\cancel{6.4} \ 8.06 \ Acre) \times 0.405 \frac{ha}{acre} \times 10{,}000 \frac{m^2}{ha} \right]$$

$$= 7.06 \times 10^{-14} \ m/s \times 25920 \ m^2$$

$$= \cancel{1.83 \times 10^{-9}} \ 3.17 \times 10^{-10} \ m^3/s$$

$$\frac{Q_{DC}}{Q_R} = \frac{1.49 \times 10^{-3}}{\cancel{1.83 \times 10^{-9}} \ 3.17 \times 10^{-10}} = \cancel{8.1 \times 10^{5}} \ 4.7 \times 10^{6} \ \cancel{>> 3} \ \cancel{OK}$$

The DCP does not require a target factor of safety for the flow capacity of the drainage corridor material. However, the DCP does require a target factor of safety for the flow capacity of the leak detection pipe equal to 3. This factor of safety is calculated in Section 9.9.

RKW 05/13/04

LDS Drainage Layer

Parameter	Active		Post-Closure	
	Daily Peak	Yearly Average	Daily Peak	Yearly Average
Drainage Path Length (ft)	385	385	350	350
Drainage Path Slope (%)	2.24	2.24	2.04	2.04
Slope Angle (rad)	0.02	0.02	0.02	0.02
Slope Angle (deg)	1.28	1.28	1.17	1.17
Thickness (in.)	12	12	12	12
Total Cell Width (ft)	540	540	540	540
Total Cell Length (ft)	650	650	650	650
Total Cell Area (acre)	8.06	8.06	8.06	8.06
k (cm/s)	1	1	1	1
qi, (in/day) [from HELP]	3.30E-08	2.70E-08	5.50E-09	6.80E-09
qi, (cm/s)	9.70E-13	7.94E-13	1.62E-13	2.00E-13
No of holes per acre	1	1	1	1
Q per hole, (ft3/s)	1.386E-09	1.134E-09	2.311E-10	2.857E-10
T_{max} (in.)	0.002	0.002	0.001	0.001
M	2.38E-05	2.16E-05	1.18E-05	1.31E-05
$T_{ave,w}$ (in.)	6.39E-06	8.37E-07	5.22E-07	5.80E-07

05/13/09

LDS Drainage Corridor

Parameter	Active	Post-Closure
Drainage Path Length (ft)	625	625
Drainage Path Slope (%)	1.00	0.40
Slope Angle (rad)	0.01	0.00
Slope Angle (deg)	0.57	0.23
Thickness (in.)	12	12
Total Corridor Width (ft)	16	16
Total Corridor C/S Area (ft^2)	16	16
Total Corridor C/S Area (m^2)	1.49	1.49
Total Corridor Plan Area (acre)	0.23	0.23
k (cm/s)	10	10
qi, (in/day)	1.11E-06	2.30E-07
qi, (cm/s)	3.27E-11	6.75E-12
λ [Giroud et al.]	3.274E-08	0.000
j [Giroud et al.]	1.000	1.000
T_{max}/L	3.27E-10	1.69E-10
T_{max} (in.)	2.46E-06	1.27E-06
h_{max} (in.)	2.46E-06	1.27E-06
T_{ave}/T_{max}	0.5	0.5
T_{ave} (in.)	1.23E-06	6.33E-07
h_{ave} (in.)	1.23E-06	6.33E-07
Flow Capacity (m^3/s)	1.49E-03	5.95E-04
Required Capacity (m^3/s)	3.17E-10	6.52E-11
Factor of Safety (For Capacity)	4.70E+06	9.11E+06

05/13/04

SECTION 9.8

9.8 TIME OF TRAVEL IN LDS – CELL 8 SUPPLEMENT

COMPUTATION COVER SHEET

Document 6774

SUBJECT OF COMPUTATIONS OSDF PHASE V, TIME OF TRAVEL IN LDS – CELL 8 SUPPLEMENT

Computations By:
(Cognizant Engineer)

Signature: R. Kulasingam — Date: 1-23-04

Printed Name and Title: Ramachandran Kulasingam, Senior Staff Engineer

Assumptions and Procedures Checked By:
(Checker)

Signature: GANESH GOPALAKRISHNAN — Date: 1-23-04

Printed Name and Title: for Leslie M. Griffin, Engineer

Computations Checked by:

Signature: Hollie N. Kinnecom — Date: 1-23-04

Printed Name and Title: Hollie N. Kinnecom, Staff Engineer

Computations Backchecked by:
(Cognizant Engineer)

Signature: R. Kulasingam — Date: 1-23-04

Printed Name and Title: Ramachandran Kulasingam, Senior Staff Engineer

Approved by:
(PDP)

Signature: [illegible] — Date: 1-23-04

Printed Name and Title: for Leslie M. Griffin, Engineer

Approved by:
(DTL/TETL)

Signature: Rudolph Bonaparte — Date: 23 Jan 04

Printed Name and Title: R. Bonaparte, Principal

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
1A	DCN CELL 8 EXPANSION	16 JUN 2004	RK / [illegible]	LMG / RC	
1	CELL 8 EXPANSION	15 FEB 2005	RK / [illegible]	LMG / LMG	JFB / JFB

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

ADDENDUM TO SECTION 9.3
(ADDED TO REVISION 1 PACKAGE)

The Calculation Package "Leak Detection System (LDS) Time of Travel in LDS" presented in Section 9.3 estimated the maximum time of travel in the leak detection system (LDS) for different stages of the life of the Fernald On-site Disposal Facility (OSDF). The times of travel were calculated based on a cell 400 feet wide and 6.5 acres in size. This size cell applies to the northernmost and interior OSDF cells (i.e., Cells 1 to 7). The southernmost OSDF cell (i.e., Cell 8) is sized differently from the other cells.

This addendum to Section 9.3 estimated the maximum time of travel in the leak detection system (LDS) for Cell 8. Similar methods and input data to that used in Section 9.3 were used herein. This addendum is presented as Section 9.8 of the OSDF Final Design Calculation Package, and is titled, "Leak Detection System (LDS) Time of Travel in LDS". Section 9.8 is presented in Volume VII of the OSDF Final Design Calculation Package.

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1 of 1
CALCULATION PROCEDURES	1 of 1
DATA VERIFICATION	1 of 2
CALCULATION RESULTS	1 of 7

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEAK DETECTION SYSTEM (LDS)
TIME OF TRAVEL IN LDS - CELL 8 SUPPLEMENT
EXECUTIVE SUMMARY

PURPOSE OF ANALYSIS

The purpose of this package is to estimate the maximum time of travel in the leak detection system (LDS) for Cell 8 of the OSDF. In accordance with the Design Criteria Package (DCP), REV1E, the maximum time of travel in the LDS should not exceed 20 days.

METHOD OF ANALYSIS

The maximum time of travel of liquids in the LDS is estimated for the active operation condition and the post-closure condition. Design grades and slopes are utilized for the active operation condition and post-settlement grades and slopes are utilized for the post-closure condition.

CONCLUSIONS

- time of travel for active operation condition = ~~17.6 days~~ 3.1 days < 20 days (O.K.)
- time of travel for post-closure condition = ~~18.8 days~~ 4.6 days < 20 days (O.K.)

RK 05/13/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEAK DETECTION SYSTEM (LDS)
TIME OF TRAVEL IN LDS - CELL 8 SUPPLEMENT
CALCULATION PROCEDURES

INTRODUCTION

The purpose of this package is to present the calculation procedures for the time of travel in the leak detection system (LDS). The LDS drainage corridor is the primary collector and the LDS pipe acts as a backup.

METHOD OF ANALYSIS

The calculation procedures are the same as those presented in Section 9.3, "Leachate Detection System (LDS) Time of Travel in LDS" of the Final Design Calculation Package.

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEAK DETECTION SYSTEM (LDS)
TIME OF TRAVEL IN LDS - CELL 8 SUPPLEMENT
DATA VERIFICATION

INTRODUCTION

As described in the calculation procedures package, an analysis of the time of travel in the LDS will be performed.

In order to perform the analyses the data described in the Final Design Calculation Package "Leachate Detection System (LDS) Time of Travel in LDS" is used, except that the drainage path lengths are changed as described below to reflect the new geometry of Cell 8.

ACTIVE OPERATION CONDITION:

Time of Travel in the LDS Drainage Layer:

L_{DL} = length of flow in the LDS drainage layer = ~~270~~ 385 ft

Time of Travel in the LDS Drainage Corridor:

L_{DC} = length of flow in the drainage corridor = ~~501.3~~ ft $= 625 - \sqrt{385^2 - 350^2}$ = 465 ft

Time of Travel in the LDS Collector Pipe:

L_{CP} = length of LDS collector pipe = ~~501.3 ft~~ 465 ft

Time of Travel in the LDS Pipe (Extending from outside the cell to Valve House 8 (VH-8)):

L_p = length of LDS pipe extending from outside the cell to VH-8 = 180 ft

POST-CLOSURE CONDITION:

Time of Travel in the LDS Drainage Layer:

L_{DL} = length of flow in the LDS = ~~245 ft~~ 350 ft

05/13/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

Time of Travel in the LDS Drainage Corridor:

L_{DC} = length of flow in the drainage corridor = ~~576 ft~~ 625 ft

Time of Travel in the LDS Collector Pipe:

L_{CP} = length of LDS collector pipe = ~~576 ft~~ 625 ft

Time of Travel in the LDS Pipe (Extending from outside the cell to Valve House 8 (VH-8)):

L_p = length of LDS pipe extending from outside the cell to VH-8 = 180 ft

RK 05/13/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEAK DETECTION SYSTEM (LDS)
TIME OF TRAVEL IN LDS - CELL 8 SUPPLEMENT (SEE VOLUME VIII)
CALCULATION RESULTS

GEOSYNTEC CONSULTANTS

Written by: RK Date: 03/12/03 Reviewed by: LMG Date: 03/12/09

Client: Elmer Fornald Project: OSDF – Revised Phase V Project/Proposal No.: GQ 3211 Task No.: 06

Time of Travel in LDS

ACTIVE CONDITION:

Time of travel in LDS drainage layer:

$$t_{DL} = \frac{L_{DL}\, n_{DL}}{k_{DL}\, i_{DL}}$$

$$= \frac{(\cancel{270}\ 385\ ft)(0.397)}{(\cancel{0.1}\ 1\ cm/s)\left(\frac{ft}{30.48\,cm}\right)(0.0224)} \times \frac{1}{3600}$$

$$= \cancel{405.15}\ 57.8\ hr$$

Time of travel in LDS drainage corridor:

$$t_{DC} = \frac{L_{DC}\, n_{DC}}{k_{DC}\, i_{DC}}$$

$$= \frac{(\cancel{501.3\,ft}\ 465)(0.397)}{(10\,cm/s)\left(\frac{ft}{30.48}\right)(0.01)} \times \frac{1}{3600\ \frac{s}{hr}}$$

$$= \cancel{16.85}\ 15.6\ hr$$

Time of travel in LDS collector pipe:

$$t_{cp} = \frac{L_{cp}\, n}{R_h^{0.66}\, i_{cp}^{0.5}}$$

PR 05/13/09

Written by: RK Date: 03/12/03 Reviewed by: LMG Date: 03/12/05

Client: Ebner Fernald Project: OSDF-Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

$$= \frac{\left[\cancel{5013}\,465\,ft \times \frac{12\,\frac{in}{ft} \times 2.54\,\frac{cm}{in}}{100\,\frac{cm}{m}}\right]\left(0.013\,\frac{s}{m^{0.33}}\right)}{(0.0345\,m)^{0.66}\,(0.010)^{0.5}}$$

$$= \cancel{183.5}\,170.2 \text{ secs}$$

$$= 0.05 \text{ hr}$$

Time of travel in LDS pipe extending outside of cell to VH-4.

$$t_p = \frac{L_p\, n}{R_h^{0.66}\, i_p^{0.5}}$$

$$= \frac{\left(180\,ft \times \frac{12 \times 2.54}{100}\,\frac{m}{ft}\right)\left(0.013\,\frac{s}{m^{0.33}}\right)}{(0.0345\,m)^{0.66}\,(0.040)^{0.5}}$$

$$= 32.9 \text{ secs}$$

$$= 9.1 \times 10^{-3} \text{ hr}$$

$$= 0.009 \text{ hr}$$

Total time of travel, t

$$= \text{Max}\left[\begin{array}{l} \cancel{405.15}\,57.8 + \cancel{16.85}\,15.6 + 0.009, \\ \cancel{405.15}\,57.8 + 0.05 + 0.009 \end{array}\right]$$

RK 05/13/04

Document 6774

GEOSYNTEC CONSULTANTS

Written by: RK Date: 03/12/03 (YY MM DD) Reviewed by: LMG Date: 03/12/09 (YY MM DD)

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

$= \text{Max}\left[\overset{73.6}{\cancel{122}}\text{ hr},\ \overset{57.9}{\cancel{105}}\text{ hr}\right]$

$= \overset{73.6}{\cancel{122}}\text{ hr}$

$= \overset{3.1}{\cancel{1.76}}\text{ days} < 20$ O.K.

RK 05/13/04

Written by: RK Date: 03/12/03 (YY MM DD) Reviewed by: LMG Date: 03/12/03 (YY MM DD)

Client: Ehrenfeld Project: OSDF – Revised Phase Project/Proposal No.: GR3211 Task No.: 06

Time of Travel in LDS

POST-CLOSURE CONDITION:

Time of travel in LDS drainage layer:

$$t_{DL} = \frac{L_{DL}\, n_{DL}}{k_{DL}\, i_{DL}}$$

$$= \frac{(\cancel{240}\ 350\ ft)(0.39\,\gamma)}{(\cancel{0.1}\ 1\ cm/s)\left(\frac{ft}{30.48\ cm}\right)(0.0204)} \times \frac{1}{3600\left(\frac{s}{h}\right)}$$

$$= \cancel{403.7}\ 57.7\ hr$$

Time of travel in LDS drainage corridor:

$$t_{DC} = \frac{L_{DC}\, n_{DC}}{k_{DC}\, i_{DC}}$$

$$= \frac{(\cancel{576}\ 625\ ft)(0.39\,\gamma)}{(10\ cm/s)\left(\frac{ft}{30.48\ cm}\right)(0.004)} \times \frac{1}{3600\left(\frac{s}{hr}\right)}$$

$$= \cancel{48.4}\ 52.5\ hrs$$

Time of travel in LDS collector pipe:

$$t_{CP} = \frac{L_{CP}\, n}{R_h^{0.66}\, i_{CP}^{0.5}}$$

05/13/04

Written by: RK Date: 03/12/03 (YY/MM/DD) Reviewed by: LMG Date: 03/12/09 (YY/MM/DD)

Client: Ehmor Fernald Project: 650F - Revised Phase V Project/Proposal No.: GP3211 Task No.: 06

$$= \frac{\left(\cancel{576}\ 625\ ft \times \frac{12 \times 2.54}{100}\ \frac{m}{ft}\right)\left(0.013\ \frac{s}{m^{0.33}}\right)}{(0.0345\ m)^{0.66}\ (0.004)^{0.5}}$$

$$= \cancel{333}\ 361\ \text{secs}$$

$$= \cancel{0.09}\ 0.10\ hr$$

Time of travel in LDS pipe extending outside of cell to VH-4

$$t_p = \frac{L_p n}{R_h^{0.66}\ S_p^{0.5}}$$

$$= \frac{\left(180\ ft \times \frac{12 \times 2.54}{100}\ \frac{m}{ft}\right)\left(0.013\ \frac{s}{m^{0.33}}\right)}{(0.0345\ m)^{0.66}\ (0.040)^{0.5}}$$

$$= 32.9\ \text{secs}$$

$$= 9.1 \times 10^{-3}\ hr$$

$$= 0.009\ hr$$

Total time of travel, t

$$= \text{Max}\left[\begin{array}{l} \cancel{403.7}\ 57.7 + \cancel{48.4}\ 52.5 + 0.009, \\ \cancel{403.7}\ 57.7 + \cancel{0.09}\ 0.1 + 0.009 \end{array}\right]$$

RK 05/13/04

GEOSYNTEC CONSULTANTS

Document 6774

Written by: RK Date: 03/12/03 (YY MM DD) Reviewed by: LMG Date: 03/12/03 (YY MM DD)

Client: Fluor Fernald Project: OSDF - Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

$= M_{max}\left[\cancel{452.1}\ 110.2\ hr,\ \cancel{403.8}\ 57.8\ hr\right]$

$= \cancel{452.1}\ 110.2\ hr$

$= \cancel{18.8}\ 4.6\ days < 20$ O.K.

RK 05/13/04

Document 6774

SECTION 9.9

9.9 LDS PIPE DESIGN– CELL 8 SUPPLEMENT

COMPUTATION COVER SHEET

SUBJECT OF COMPUTATIONS OSDF PHASE V, LDS PIPE DESIGN – CELL 8 SUPPLEMENT

Computations By:
(Cognizant Engineer)

Signature R. Kulasingam — Date 1-23-04

Printed Name and Title: Ramachandran Kulasingam, Senior Staff Engineer

Assumptions and Procedures Checked By:
(Checker)

Signature GANESH GOPALAKRISHNAN — Date 1-23-04

Printed Name and Title: for Leslie M. Griffin, Engineer

Computations Checked by:

Signature Hollie N. Kinnecom — Date 1-23-04

Printed Name and Title: Hollie N. Kinnecom, Staff Engineer

Computations Backchecked by:
(Cognizant Engineer)

Signature R. Kulasingam — Date 1-23-04

Printed Name and Title: Ramachandran Kulasingam, Senior Staff Engineer

Approved by:
(PDP)

Signature — Date 1-23-04

Printed Name and Title: for Leslie M. Griffin, Engineer

Approved by:
(DTL/TETL)

Signature Rudolph Bonaparte — Date 23 Jan 04

Printed Name and Title: R. Bonaparte, Principal

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
1A	DCN CELL 8 EXPANSION	16 JUN 2004	RK/RK	LMG/RC	
1	CELL 8 EXPANSION	15 FEB 2005	RK/RK	LMG/LMG	VPB/VPB

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

ADDENDUM TO SECTION 9.4
(ADDED TO REVISION 1 PACKAGE)

The Final Design Calculation Package "Leak Detection System (LDS) LDS Pipe Design" presented in Section 9.4 evaluated the performance of the LDS collector pipe for the OSDF. The LDS pipe flow capacity was compared to the required capacity as part of the evaluation in that Calculation Package using the leakage rates applicable to the northernmost and interior OSDF cells (i.e., Cells 1 to 7). Leakage rates for the southernmost OSDF cell (i.e., Cell 8) are different from that of the other cells, and are presented in Section 7.4.

This addendum to Section 9.4 evaluated the performance of the LDS collector pipe for Cell 8 using the leakage rates for that cell. Similar methods and input data to that used in Section 9.4 were used herein. This addendum is presented as Section 9.9 of the OSDF Final Design Calculation Package, and is titled, "Leak Detection System (LDS) LDS Pipe Design – Cell 8 Supplement". Section 9.9 is presented in Volume VII of the OSDF Final Design Calculation Package.

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1 of 1
CALCULATION PROCEDURES	1 of 1
DATA VERIFICATION	1 of 1
CALCULATION RESULTS	1 of 3

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEAK DETECTION SYSTEM (LDS)
LDS PIPE DESIGN - CELL 8 SUPPLEMENT
EXECUTIVE SUMMARY

PURPOSE OF ANALYSIS

The purpose of this analysis is to evaluate the performance of the LDS collector pipe for Cell 8 of the OSDF. The evaluation will be performed for both active operation and post-closure conditions.

METHOD OF ANALYSIS

The flow capacity, perforation size, and structural stability (wall crushing, wall buckling, and excessive ring deflection) were calculated for the LDS collector pipe in the Section 9.4, "Leak Detection System (LDS) LDS Pipe Design" of the Final Design Calculation Package. The parameters used to calculate the perforation size and structural stability of the LDS collector pipe have not changed. However, the flow capacity of the LDS pipe is compared to the required flow capacity for Cell 8 in this Calculation Package.

CONCLUSIONS

- pipe flow capacity for active operation condition, Q_p = 198 gpm
- required flow capacity for active operation condition, Q_R = ~~2.9×10^{-5}~~ gpm 5.1×10^{-6} gpm
- flow capacity factor of safety for active operation condition, Q_p/Q_{pr} = ~~6.84×10^{6}~~ 3.92×10^{7} >>3 (OK)
- pipe flow capacity for post-closure condition, Q_p = 124 gpm
- required flow capacity for post-closure condition, Q_R = ~~8.1×10^{-7}~~ 1.03×10^{-6} gpm
- flow capacity factor of safety for post-closure condition, Q_p/Q_{pr} = ~~1.5×10^{8}~~ 1.2×10^{8} >> 10 (OK)

05/13/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEAK DETECTION SYSTEM (LDS)
LDS PIPE DESIGN - CELL 8 SUPPLEMENT
CALCULATION PROCEDURES

INTRODUCTION

The purpose of this package is to evaluate the factor of safety for flow capacity by comparing the new required flow capacity for Cell 8 with the LDS pipe flow capacity.

METHOD OF ANALYSIS

The required flow capacity for Cell 8 was evaluated in Section 9.7 "Leak Detection System (LDS) Maximum Head in LDS – Cell 8 Supplement" of the Final Design Calculation Package. The LDS pipe flow capacity was evaluated Section 9.4 "Leak Detection System (LDS) LDS Pipe Design" of the Final Design Calculation Package.

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: GQ3211 Task No.: 06

LEAK DETECTION SYSTEM (LDS)
LDS PIPE DESIGN - CELL 8 SUPPLEMENT
DATA VERIFICATION

Pipe flow capacity (Q_p) = 1.25×10^{-2} m^3/s (from Calculation Package "Leak Detection System (LDS) LDS Pipe Design" – Section 9.4)

Required flow capacity (Q_{pr}) = ~~1.83×10^{-9}~~ 3.17×10^{-10} m^3/s (from Calculation Package "Leak Detection System (LDS) Maximum Head in LDS" – Cell 8 Supplement" – Section 9.7)

RK 05/13/04

Written By : RK Date: 12-03-03 Reviewed by: LMG Date: 12-09-03

Client: Fluor Fernald Project: OSDF – Revised Phase V Project/Proposal No.: G03211 Task No.: 06

LEAK DETECTION SYSTEM (LDS)
LDS PIPE DESIGN - CELL 8 SUPPLEMENT
CALCULATION RESULTS

Hand calculations were performed for the active condition case. A spread sheet was used to repeat the calculations for the active case and perform calculations for the post-closure case. These calculation results are presented in the following pages.

Written by: RK Date: 03/12/03 (YY/MM/DD) Reviewed by: LMG Date: 03/12/09 (YY/MM/DD)

Client: Fluor Fernald Project: OSDF – RPV Project/Proposal No.: GQ 3211 Task No.: 06

LDS Pipe Design – ACTIVE CONDITION

LDS pipe flow capacity

$$Q_p = \frac{R_h^{0.66}\, i_p^{0.5}\, A_p}{n}$$

$$= \frac{(0.0345)^{0.66}\,(0.01)^{0.5}\,(1.5\times10^{-2})}{0.013}$$

$$= 1.25\times10^{-2}\ m^3/s \quad (198\ gpm)$$

same as before

Required capacity

$$Q_{pr} = q_i A_d$$

$$= \left(\cancel{3.4\times10^{-7}}\ 3.3\times10^{-7} \times \frac{2.54}{100} \times \frac{1}{24\times3600}\right)\left(\cancel{6.4}\ 8.06 \times 0.405 \times 10{,}000\right)$$

$$= \cancel{1.83\times10^{-9}}\ 3.17\times10^{-10}\ m^3/s$$

$$\frac{Q_p}{Q_{pr}} = \frac{1.25\times10^{-2}}{\cancel{1.83\times10^{-9}}\ 3.17\times10^{-10}} = \cancel{6.8\times10^{6}}\ 3.92\times10^{7} >> 3 \quad \text{OK}$$

RK 05/13/04

LDS Pipe

Parameter	Active	Post-Closure
Pipe Inner Diameter (in.)	5.421	5.421
Cross Section Area (in^2)	23.08	23.08
Cross Section Area (m^2)	1.49E-02	1.49E-02
Hydraulic Radius (in.)	1.36	1.36
Manning's Coefficient ($s/m^{0.33}$)	0.013	0.013
Drainage Path Slope (%)	1.00	0.40
Slope Angle (rad)	0.01	0.00
Slope Angle (deg)	0.57	0.23
Flow Capacity (m^3/s)	1.24E-02	7.84E-03
Required Capacity (m^3/s)	3.17E-10	6.52E-11
Factor of Safety (For Capacity)	3.92E+07	1.20E+08

05/13/04

SECTION 12.5

12.5 OSDF PHASE V, SURFACE-WATER MANAGEMENT SYSTEM DESIGN AND POST-CLOSURE HYDROLOGY

COMPUTATION COVER SHEET

Document 6774

SUBJECT OF COMPUTATIONS OSDF PHASE V, SURFACE-WATER MANAGEMENT SYSTEM DESIGN AND POST-CLOSURE HYDROLOGY

Computations By: (Cognizant Engineer)
Signature: Victoria S. Cheplak — Date: 1-21-04
Printed Name and Title: Victoria S. Cheplak, Senior Staff Engineer

Assumptions and Procedures Checked By: (Checker)
Signature: [signature] — Date: 1-21-04
Printed Name and Title: Ganesh Gopalakrishnan, Senior Engineer

Computations Checked by:
Signature: Hollie Kinnecom — Date: 1-21-04
Printed Name and Title: Hollie Kinnecom, Staff Engineer

Computations Backchecked by: (Cognizant Engineer)
Signature: Victoria S. Cheplak — Date: 1-21-04
Printed Name and Title: Victoria S. Cheplak, Senior Staff Engineer

Approved by: (PDP)
Signature: [signature] — Date: 1-21-04
Printed Name and Title: Ganesh Gopalakrishnan, Senior Engineer

Approved by: (DTL/TETL)
Signature: Rudolph Bonaparte — Date: 1/22/04
Printed Name and Title: R. Bonaparte, Engineer of Record

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
0	Submittal to FF/DOE/EPA	30 Jan 02	DBM	DGP	JFB
1	CFC Revision 1 Submittal to FF/DOE/EPA	23 Jan 04	VSC VSC	GG GG	RB
2A	DCN-Cell 8 Expansion	16 June 04	VSC VSC	GG GG	
2	CFC Revision 2 Submittal to FF/DOE/EPA	11 Feb 05	VSC VSC	GG GG	J FB 8/16/05

ADDENDUM TO SECTION 12.5

(REVISION 2A DUE TO CELL 8 EXPANSION DCN)

This addendum details the calculations that were revised within Section 12.5, OSDF Phase V, Surface-Water Management System Design and Post-Closure Hydrology, of the Final Design Calculation Package for the Fernald Environmental Management Project (FEMP), due to the re-design of Cell 8. This re-design, referred to as the Cell 8 Expansion DCN, encompasses the extension of Cell 8 by approximately 100-feet to the South. This addendum discusses the modifications made to this calculation package as Revision 2A and as associated with this DCN.

For Revision 2A to this calculation package, the critical case for the Surface-Water Management System Design was evaluated to confirm compliance with the Surface-Water Management and Erosion Control (SWMEC) Plan and the OSDF Design Criteria Package (DCP). This critical case is presented as the Construction Design Scenario, which considers the 25-Year, 24-Hour Storm. The surface water management system was modified to reflect the design changes resulting from the expansion of Cell 8 and analyzed to verify the adequacy of the designed surface water management features. For this submittal, only the East and West OSDF Construction Design Scenarios were modified; it should be noted that Design Cases A through C, detailed in this section, are not impacted, and therefore, are not presented.

In order to present the results of this DCN analysis in an efficient manner, only the attachments that summarize the modifications and updated results for the surface water management system with regard to the DCN are presented. These attachments are listed subsequently and explained in further detail.

- **Attachment A-2 – Layout of Design Scenario and Design Case SWM Systems.** These layouts demonstrate the revised configuration of the OSDF. Each surface water structure is labeled as identified in the hydrologic analysis.

- **Attachment A-8 – Nodal Network Diagrams.** These diagrams demonstrate the revised configuration of the surface water management system as a result of the DCN.

- **Attachment B-4 – Data for Time of Concentration Calculations.** These data demonstrate the revised flow paths used to calculate the time of concentration for the revised configuration of subcatchments used in the hydrologic analysis.

- **Attachment C-1A – HydroCAD Output Reports – 25-Year, 24-Hour Storm Event, East OSDF Construction-Phase Design Scenario.** This attachment

provides the results of the hydrologic modeling for the East OSDF Construction Design Scenario for the 25-Year, 24-Hour Storm, considered the critical case for these calculations.

- **Attachment C-1B – HydroCAD Output Reports – 25-Year, 24-Hour Storm Event, West OSDF Construction-Phase Design Scenario.** This attachment provides the results of the hydrologic modeling for the West OSDF Construction Design Scenario for the 25-Year, 24-Hour Storm, considered the critical case for these calculations.

- **Attachment C-2 – Weighted Curve Number Calculations.** These calculations present the revised areas and Curve Numbers for the revised configuration of subcatchments used in the hydrologic analysis.

- **Attachment C-3 – Tabulated Analysis Results for Channels.** These results present the revised channel characteristics (i.e., geometry), flow within each channel, and hydraulic characteristics including peak flow depth and available freeboard, for the revised configuration of channels used in the hydrologic and hydraulic analysis. The table has been modified to reflect these results for the East OSDF and West OSDF Construction Design Scenario only. The remainder of the table (i.e., features that have not been modified), has been shaded in gray.

- **Attachment C-4A – CulvertMaster Output Reports for Culverts.** These reports present the hydraulic analysis for the culverts. These reports are provided only for those culverts in the East and West OSDF Construction Design Scenario that were modified in design or were impacted by the DCN through altered flow rates.

- **Attachment C-4B – Tabulated Analysis Results for Culverts.** These results present the revised physical characteristics (i.e., geometry) and profile (i.e., inverts) of the revised configuration of culverts. The results also present the hydraulic capacity, structural capacity, and required outlet protection for these culverts as a result of flows analyzed based on the DCN. The table has been modified to reflect these results for the East OSDF and West OSDF Construction Design Scenario only. The remainder of the table (i.e., the features that have not been modified) has been shaded in gray.

Based on the analyses for the design change of the expansion of Cell 8, all channels and culverts are designed in accordance with the requirements of the SWMEC Plan and the DCP.

ATTACHMENT A-2

LAYOUT OF DESIGN SCENARIO AND DESIGN CASE SWM SYSTEMS

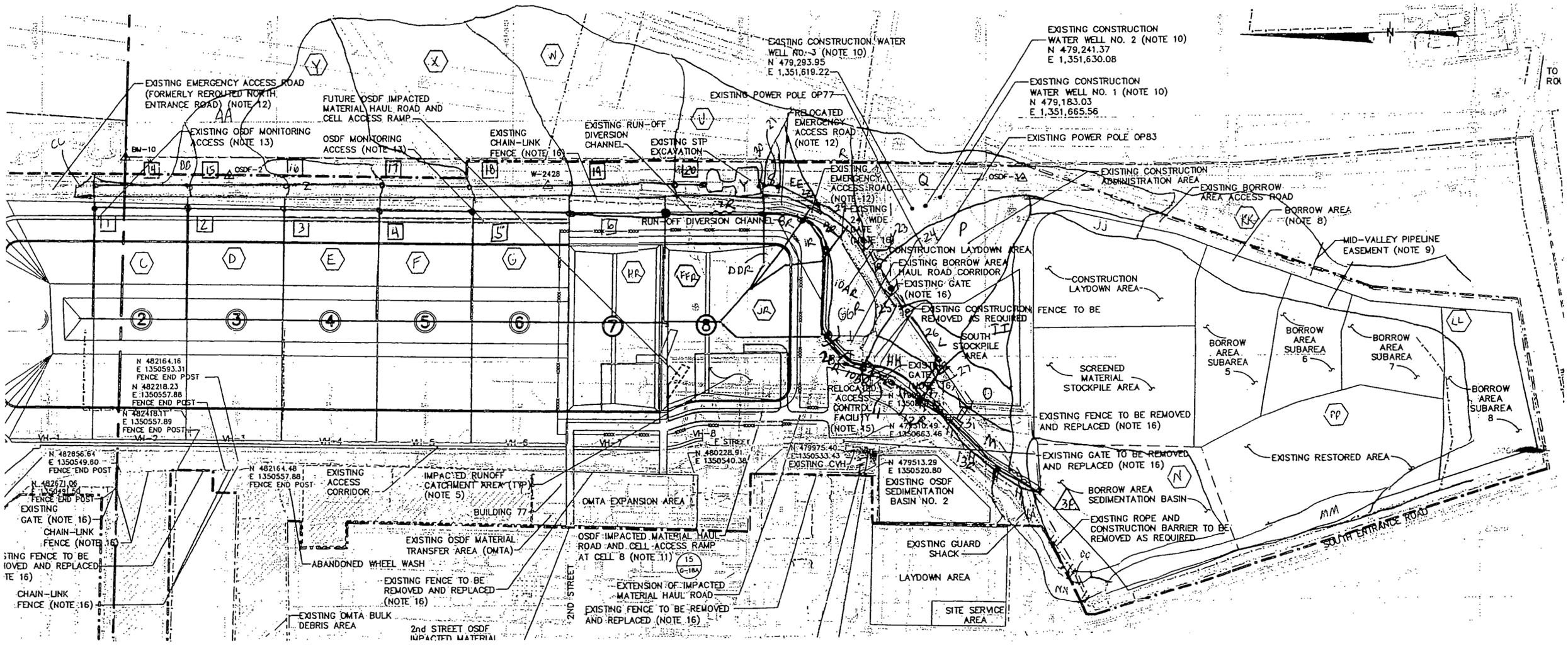
LEGEND

- SUBCATCHMENT LABEL AND BOUNDARY
- REACH ALIGNMENT AND LABEL
- CULVERT
- POND LABEL

PHASE V

EAST OSDF DESIGN SCENARIO

SCALE 1" = 400' 0 400'



LEGEND

- SUBCATCHMENT LABEL AND BOUNDARY
- REACH ALIGNMENT AND LABEL
- CULVERT
- POND LABEL

PHASE V

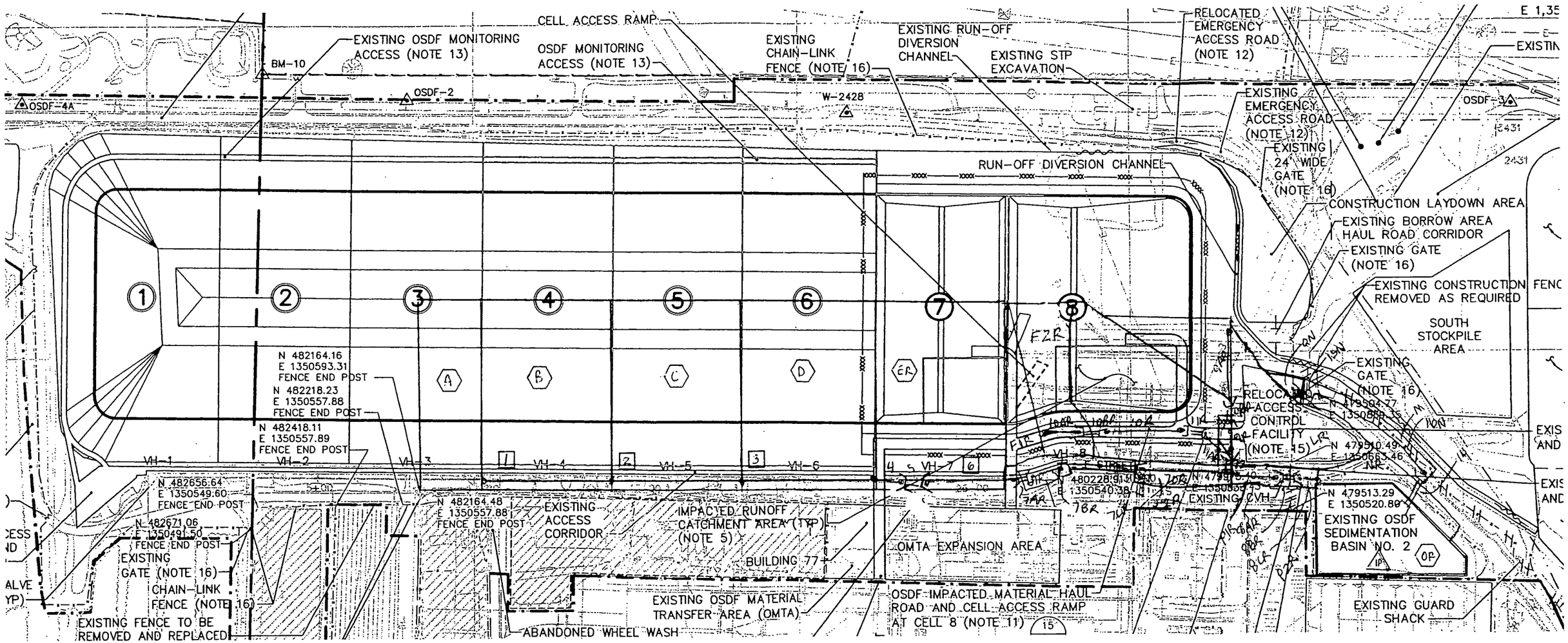
Document 6774

WEST OSDF DESIGN SCENARIO

SCALE 1" = 300'

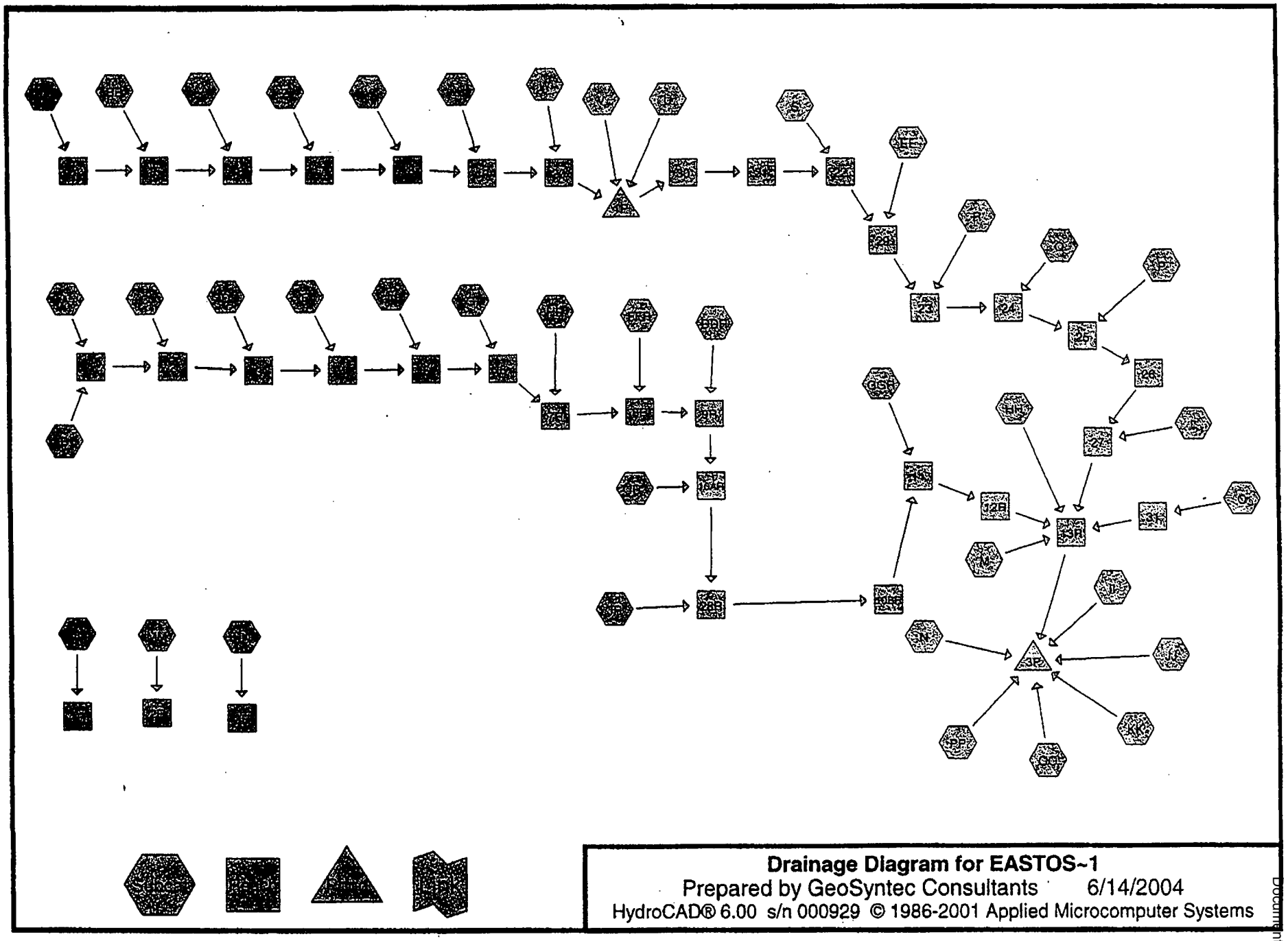
0 300

N

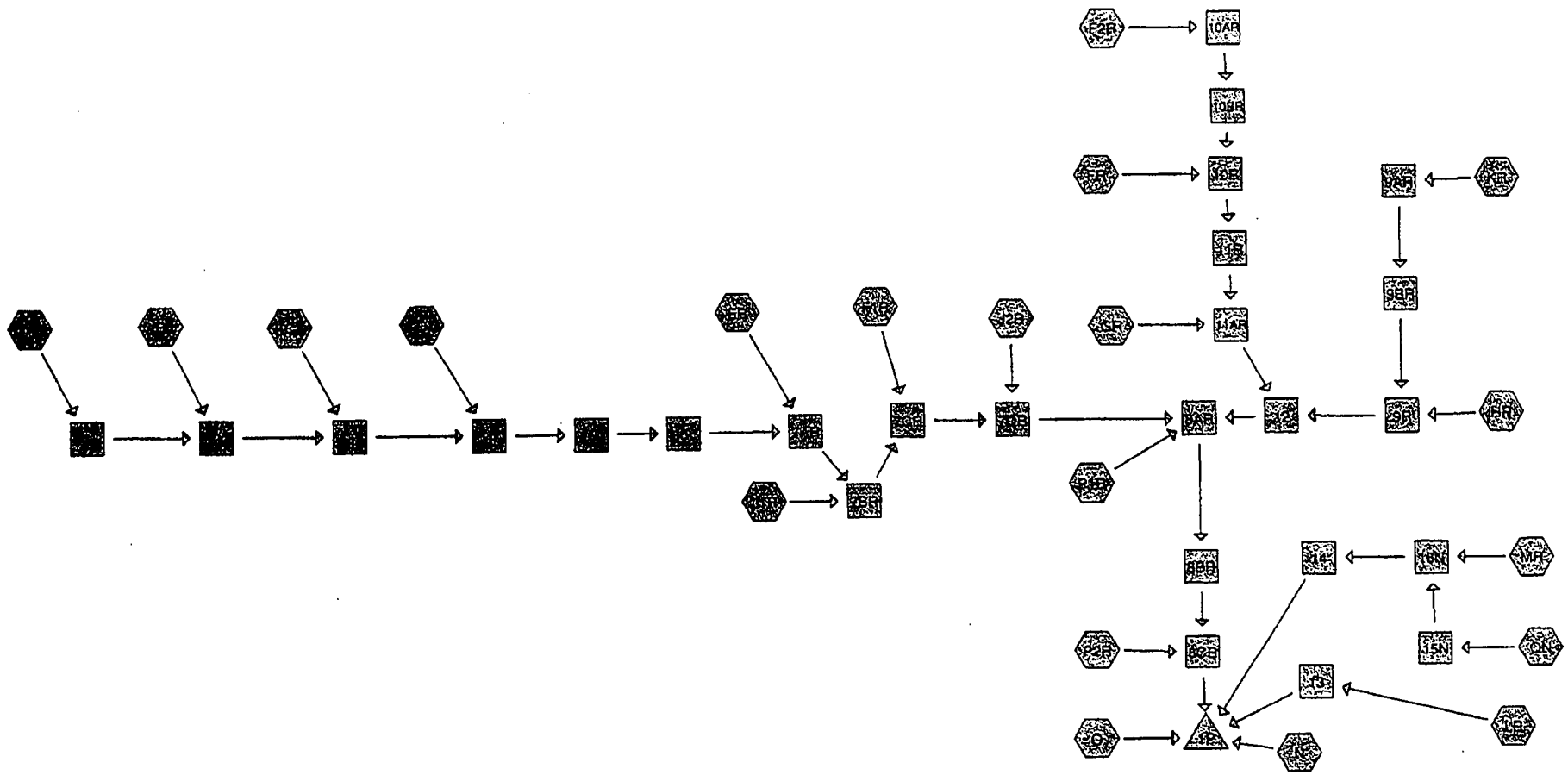


ATTACHMENT A-8

NODAL NETWORK DIAGRAMS



Drainage Diagram for EASTOS~1
Prepared by GeoSyntec Consultants 6/14/2004
HydroCAD® 6.00 s/n 000929 © 1986-2001 Applied Microcomputer Systems



Drainage Diagram for West OSDF
Prepared by GeoSyntec Consultants 6/14/2004
HydroCAD® 6.00 s/n 000929 © 1986-2001 Applied Microcomputer Systems

ATTACHMENT B-4

DATA FOR CALCULATION OF TIME OF CONCENTRATION

HYDROCAD™ INPUT PARAMETERS FOR THE CALCULATION OF TIME OF CONCENTRATION
EAST OSDF CONSTRUCTION DESIGN SCENARIO

2-year, 24-hr Design Rainfall Depth, P_{5-24} = 2.60 inches

SUBCATCHMENT LABEL AND DESCRIPTION		SHEET FLOW 1				SHEET FLOW 2				SHEET FLOW 3				SHALLOW CONCENTRATED FLOW			SHALLOW CONCENTRATED FLOW			SHALLOW CONCENTRATED FLOW			CHANNEL FLOW 1						CHANNEL FLOW 1					
No.	Description	Flow Length (ft)	Surface Description	Manning's n	Land Slope (ft/ft)	Flow Length (ft)	Surface Description	Manning's n	Land Slope (ft/ft)	Flow Length (ft)	Surface Description	Manning's n	Land Slope (ft/ft)	Flow Length (ft)	Surface Description	Land Slope (ft/ft)	Flow Length (ft)	Surface Description	Land Slope (ft/ft)	Flow Length (ft)	Surface Description	Land Slope (ft/ft)	Flow Length (ft)	Bottom Width (ft)	Flow Depth (ft)	Sideslopes (ft/ft)	Manning's n	Longitudinal Slope (ft/ft)	Flow Length (ft)	Bottom Width (ft)	Flow Depth (ft)	Sideslopes (ft/ft)	Manning's n	Longitudinal Slope (ft/ft)
A	VEGETATED FINAL COVER	90	GRASS: SHORT	0.150	0.0500	60	GRASS: SHORT	0.150	0.1000	150	GRASS: SHORT	0.150	0.1700	80	UNPAVED	0.1700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B	VEGETATED FINAL COVER	50	GRASS: SHORT	0.150	0.1800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	450	0	1.02	6.0, 3.0	0.030	0.0045	-	-	-	-	-	-
C	VEGETATED FINAL COVER	90	GRASS: SHORT	0.150	0.0500	60	GRASS: SHORT	0.150	0.1000	150	GRASS: SHORT	0.150	0.1700	170	UNPAVED	0.1700	-	-	-	-	-	-	400	0	1.02	6.0, 4.0	0.030	0.0045	-	-	-	-	-	-
D	VEGETATED FINAL COVER	90	GRASS: SHORT	0.150	0.0500	60	GRASS: SHORT	0.150	0.1000	150	GRASS: SHORT	0.150	0.1700	170	UNPAVED	0.1700	-	-	-	-	-	-	250	0	1.29	5.0, 3.0	0.030	0.0045	150	0	1.59	4.0, 3.0	0.030	0.0050
E	VEGETATED FINAL COVER	90	GRASS: SHORT	0.150	0.0500	60	GRASS: SHORT	0.150	0.1000	150	GRASS: SHORT	0.150	0.1700	170	UNPAVED	0.1700	-	-	-	-	-	-	380	0	1.60	4.0, 3.0	0.030	0.0050	-	-	-	-	-	-
F	VEGETATED FINAL COVER	90	GRASS: SHORT	0.150	0.0500	60	GRASS: SHORT	0.150	0.1000	150	GRASS: SHORT	0.150	0.1700	170	UNPAVED	0.1700	-	-	-	-	-	-	390	0	1.60	4.0, 3.0	0.030	0.0050	-	-	-	-	-	-
G	VEGETATED FINAL COVER	90	GRASS: SHORT	0.150	0.0500	60	GRASS: SHORT	0.150	0.1000	150	GRASS: SHORT	0.150	0.1700	170	UNPAVED	0.1700	-	-	-	-	-	-	410	0	1.60	4.0, 3.0	0.030	0.0050	-	-	-	-	-	-
HR	NON VEGETATED FINAL COVER	90	SMOOTH	0.011	0.0500	50	SMOOTH	0.011	0.1000	150	SMOOTH	0.011	0.1700	160	UNPAVED	0.1700	-	-	-	-	-	-	400	0	5.70	6.0, 3.0	0.030	0.0100	-	-	-	-	-	-
IR	NON VEGETATED FINAL COVER	300	SMOOTH	0.011	0.1300	-	-	-	-	-	-	-	-	30	UNPAVED	0.1300	20.0000	PAVED	0.0500	-	-	-	144	3	3.80	3.0, 6.0	0.030	0.0050	-	-	-	-	-	-
JR	NON VEGETATED FINAL COVER	80	SMOOTH	0.011	0.0500	55	SMOOTH	0.011	0.1000	165	SMOOTH	0.011	0.1700	145	UNPAVED	0.1700	12.0000	PAVED	0.0500	-	-	-	356	9	3.85	6.0, 3.0	0.030	0.0050	-	-	-	-	-	-
L	RUNON NORTH OF BORROW AREA	140	GRASS: SHORT	0.150	0.0200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	290	0	2.00	3.0, 3.0	0.030	0.0075	-	-	-	-	-	-
M	RUNON NORTH OF BORROW AREA	170	GRASS: SHORT	0.150	0.0500	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	200	20	2.50	3.0, 3.0	0.030	0.0045	-	-	-	-	-	-
N	DIRECT RUNON TO POND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O	RUNON NORTH OF BORROW AREA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	230	0	1.00	5.0, 5.0	0.030	0.0086	-	-	-	-	-	-
P	RUNON NORTH OF BORROW AREA	300	GRASS: SHORT	0.150	0.0150	-	-	-	-	-	-	-	-	350	UNPAVED	0.0070	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Q	RUNON NORTH OF BORROW AREA	300	GRASS: SHORT	0.150	0.0260	-	-	-	-	-	-	-	-	1280	UNPAVED	0.0260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
R	RUNON NORTH OF BORROW AREA	300	GRASS: SHORT	0.150	0.0400	-	-	-	-	-	-	-	-	350	UNPAVED	0.0400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S	RUNON NORTH OF BORROW AREA	280	GRASS: SHORT	0.150	0.0150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	0	3.00	3.0, 3.0	0.030	0.0100	-	-	-	-	-	-
U	RUNON EAST OF OSDF	300	GRASS: SHORT	0.150	0.0140	-	-	-	-	-	-	-	-	240	UNPAVED	0.0140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V	DIRECT RUNON TO POND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
W	RUNON EAST OF OSDF	300	GRASS: SHORT	0.150	0.1780	-	-	-	-	-	-	-	-	400	UNPAVED	0.1780	-	-	-	-	-	-	270	0	3.00	3.0, 30.0	0.030	0.0114	-	-	-	-	-	-
X	RUNON EAST OF OSDF	300	GRASS: SHORT	0.150	0.0190	-	-	-	-	-	-	-	-	730	UNPAVED	0.0190	-	-	-	-	-	-	330	0	2.00	3.0, 3.0	0.030	0.0100	-	-	-	-	-	-
Y	RUNON EAST OF OSDF	300	GRASS: SHORT	0.150	0.0130	-	-	-	-	-	-	-	-	510	UNPAVED	0.0130	-	-	-	-	-	-	340	0	2.00	5.0, 4.0	0.030	0.0110	-	-	-	-	-	-
Z	RUNON EAST OF OSDF	300	GRASS: SHORT	0.150	0.0310	-	-	-	-	-	-	-	-	250	UNPAVED	0.0310	-	-	-	-	-	-	50	0	2.00	5.0, 4.0	0.030	0.0070	-	-	-	-	-	-
AA	RUNON AREA EAST OF OSDF	300	GRASS: SHORT	0.150	0.0800	-	-	-	-	-	-	-	-	170	UNPAVED	0.0800	-	-	-	-	-	-	300	0	2.00	3.0, 3.0	0.030	0.0070	-	-	-	-	-	-
BB	RUNON AREA EAST OF OSDF	110	GRASS: SHORT	0.150	0.0800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	360	0	1.50	3.0, 5.0	0.030	0.0040	-	-	-	-	-	-
CC	RUNON AREA EAST OF OSDF	110	GRASS: SHORT	0.150	0.0800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DDR	NON VEGETATED FINAL COVER	210	SMOOTH	0.011	0.1700	12	SMOOTH	0.011	0.0500	-	-	-	-	-	-	-	-	-	-	-	-	-	241	0	5.47	2.0, 6.0	0.030	0.0050	-	-	-	-	-	-
EE	RUNON NORTH OF BORROW AREA	300	GRASS: SHORT	0.150	0.0230	-	-	-	-	-	-	-	-	80	UNPAVED	0.0230	-	-	-	-	-	-	40	0	4.00	3.0, 3.0	0.030	0.0100	-	-	-	-	-	-
FFR	NON VEGETATED FINAL COVER	90	SMOOTH	0.011	0.0500	50	SMOOTH	0.011	0.1000	160	SMOOTH	0.011	0.1700	120	UNPAVED	0.1700	12	PAVED	0.0500	-	-	-	467	0	5.49	6.0, 3.0	0.030	0.0050	-	-	-	-	-	-
GGR	CONSTRUCTION LAYDOWN	240	GRASS: SHORT	0.150	0.0180	-	-	-	-	-	-	-	-	55	UNPAVED	0.0145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HH	RUNON NORTH OF BORROW AREA	90	GRASS: SHORT	0.150	0.0100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	230	20	2.50	3.0, 3.0	0.030	0.0045	-	-	-	-	-	-
II	RUNON AREA TO BORROW AREA	210	GRASS: SHORT	0.150	0.0400	-	-	-	-	-	-	-	-	70	UNPAVED	0.1660	380	UNPAVED	0.0025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JJ	RUNON AREA TO BORROW AREA	300	GRASS: SHORT	0.150	0.0250	-	-	-	-	-	-	-	-	40	UNPAVED	0.0250	110	UNPAVED	0.1660	840	UNPAVED	0.0025	-	-	-	-	-	-	-	-	-	-	-	-
KK	RUNON AREA TO BORROW AREA	300	GRASS: SHORT	0.150	0.0280	-	-	-	-	-	-	-	-	150	UNPAVED	0.0140	110	UNPAVED	0.1660	630	UNPAVED	0.0030	-	-	-	-	-	-	-	-	-	-	-	-
LL	RUNOFF	300	GRASS: SHORT	0.150	0.0240	-	-	-	-	-	-	-	-	200	UNPAVED	0.0240	-	-	-	-	-	-	900	0	3.00	3.0, 3.0	0.030	0.0090	-	-	-	-	-	-
MM	RUNOFF	100	GRASS: SHORT	0.150	0.0700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	980	0	3.00	5.0, 4.0	0.030	0.0060	-	-	-	-	-	-
NN	RUNOFF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	600	0	3.00	3.0, 3.0	0.030	0.0130	-	-	-	-	-	-
OO	RUNON AREA TO BORROW AREA	120	GRASS: SHORT	0.150	0.1660	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PP	VEGETATED BORROW AREA	150	GRASS: SHORT	0.150	0.1660	150	GRASS: SHORT	0.150	0.0025	-	-	-	-	1190	UNPAVED	0.0025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

HYDROCAD™ INPUT PARAMETERS FOR THE CALCULATION OF TIME OF CONCENTRATION
WEST OSDF CONSTRUCTION DESIGN SCENARIO

2-year, 24-hr Design Rainfall Depth, P_{2-24} = 2.60 inches

SUBCATCHMENT LABEL AND DESCRIPTION		SHEET FLOW 1				SHEET FLOW 2				SHEET FLOW 3				SHALLOW CONCENTRATED FLOW 1			CHANNEL FLOW 1						PIPE FLOW				CHANNEL FLOW 2					
No.	Description	Flow Length (ft)	Surface Description	Manning's n	Land Slope (ft/ft)	Flow Length (ft)	Surface Description	Manning's n	Land Slope (ft/ft)	Flow Length (ft)	Surface Description	Manning's n	Land Slope (ft/ft)	Flow Length (ft)	Surface Description	Land Slope (ft/ft)	Flow Length (ft)	Bottom Width (ft)	Flow Depth (ft)	Sideslopes (ft/ft)	Manning's n	Longitudinal Slope (ft/ft)	Flow Length (ft)	Diameter (inch)	Manning's n	Longitudinal Slope (ft/ft)	Flow Length (ft)	Bottom Width (ft)	Flow Depth (ft)	Sideslopes (ft/ft)	Manning's n	Longitudinal Slope (ft/ft)
A	VEGETATED FINAL COVER	90	GRASS: SHORT	0.150	0.0500	60	GRASS: SHORT	0.150	0.1000	150	GRASS: SHORT	0.150	0.1700	190	UNPAVED	0.1700	180	0	2.00	3.0, 6.0	0.030	0.0075	-	-	-	-	-	-	-	-	-	-
B	VEGETATED FINAL COVER	90	GRASS: SHORT	0.150	0.0500	60	GRASS: SHORT	0.150	0.1000	150	GRASS: SHORT	0.150	0.1700	200	UNPAVED	0.1700	190	0	2.00	3.0, 6.0	0.030	0.0075	60	72	0.013	0.0100	200	0	4.00	6.0, 2.0	0.030	0.0075
C	VEGETATED FINAL COVER	90	GRASS: SHORT	0.150	0.0500	60	GRASS: SHORT	0.150	0.1000	150	GRASS: SHORT	0.150	0.1700	200	UNPAVED	0.1700	190	0	2.00	3.0, 6.0	0.030	0.0075	60	72	0.013	0.0100	195	0	4.00	6.0, 2.0	0.030	0.0075
D	VEGETATED FINAL COVER	90	GRASS: SHORT	0.150	0.0500	60	GRASS: SHORT	0.150	0.1000	150	GRASS: SHORT	0.150	0.1700	205	UNPAVED	0.1700	190	0	2.00	3.0, 6.0	0.030	0.0075	60	72	0.013	0.0100	195	0	4.00	6.0, 2.0	0.030	0.0075
ER	NON VEGETATED FINAL COVER	110	SMOOTH	0.011	0.0625	45	SMOOTH	0.011	0.1110	150	SMOOTH	0.011	0.1700	200	UNPAVED	0.1700	510	0	3.50	3.0, 6.0	0.030	0.0075	85	72	0.013	0.0029	-	-	-	-	-	-
F1R	NON VEGETATED FINAL COVER	90	SMOOTH	0.011	0.0530	50	SMOOTH	0.011	0.1000	150	SMOOTH	0.011	0.1670	200	UNPAVED	0.1670	160	0	3.50	3.0, 6.0	0.030	0.0075	53	72	0.013	0.0580	-	-	-	-	-	-
F2R	NON VEGETATED FINAL COVER	90	SMOOTH	0.011	0.0500	55	SMOOTH	0.011	0.1000	150	SMOOTH	0.011	0.1667	200	UNPAVED	0.1667																
FR	NON VEGETATED FINAL COVER	70	SMOOTH	0.011	0.0500	60	SMOOTH	0.011	0.1000	150	SMOOTH	0.011	0.1670	175	UNPAVED	0.1700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GR	NON VEGETATED FINAL COVER/ RUNON NORTH OF BORROW AREA	15	SMOOTH	0.011	0.1300	-	-	-	-	-	-	-	-	350	UNPAVED	0.1400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HR	RUNON NORTH OF BORROW AREA	25	SMOOTH	0.011	0.0700	15	GRASS: SHORT	0.150	0.0010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
J1R	CONSTRUCTION LAYDOWN	54	GRASS: SHORT	0.150	0.1670	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
J2R	CONSTRUCTION LAYDOWN	100	GRASS: SHORT	0.150	0.0427	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
KR	NON VEGETATED FINAL COVER/ RUNON NORTH OF BORROW AREA	65	SMOOTH	0.011	0.1000	150	SMOOTH	0.011	0.1700	-	-	-	-	180	UNPAVED	0.1700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LR	CONSTRUCTION LAYDOWN	300	GRASS: SHORT	0.150	0.0140	-	-	-	-	-	-	-	-	60	UNPAVED	0.0170	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MR	RUNON NORTH OF BORROW AREA	40	GRASS: SHORT	0.150	0.0985	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
N	CONSTRUCTION LAYDOWN	170	GRASS: SHORT	0.150	0.0250	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O	DIRECT RUNON TO POND	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P1R	CONSTRUCTION LAYDOWN	100	GRASS: SHORT	0.150	0.0385	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P2R	CONSTRUCTION LAYDOWN	110	GRASS: SHORT	0.150	0.0473	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QN	RUNON NORTH OF BORROW AREA	100	GRASS: SHORT	0.150	0.0167	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ATTACHMENT C

HydroCAD™ OUTPUT REPORTS

ATTACHMENT C-1A

HydroCAD™ OUTPUT REPORTS

EAST OSDF CONSTRUCTION-PHASE DESIGN SCENARIO

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Type II 24-hr Rainfall=4.70"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: vegetated final cover system
Tc=17.3 min CN=83 Area=1.964 ac Runoff= 6.81 cfs 0.473 af

Subcatchment AA: runon area east of OSDF
Tc=16.8 min CN=74 Area=2.708 ac Runoff= 6.97 cfs 0.478 af

Subcatchment B: vegetated final cover system
Tc=6.2 min CN=83 Area=1.179 ac Runoff= 5.75 cfs 0.265 af

Subcatchment BB: runon east of OSDF
Tc=9.1 min CN=79 Area=0.781 ac Runoff= 3.03 cfs 0.181 af

Subcatchment C: vegetated final cover
Tc=20.7 min CN=83 Area=5.209 ac Runoff= 16.37 cfs 1.255 af

Subcatchment CC: runon east of OSDF
Tc=6.7 min CN=79 Area=0.121 ac Runoff= 0.52 cfs 0.026 af

Subcatchment D: vegetated final cover
Tc=20.1 min CN=83 Area=5.131 ac Runoff= 16.39 cfs 1.236 af

Subcatchment DDR: unvegetated final cover system
Tc=1.8 min CN=89 Area=0.950 ac Runoff= 5.97 cfs 0.276 af

Subcatchment E: vegetated final cover
Tc=19.7 min CN=83 Area=5.092 ac Runoff= 16.48 cfs 1.227 af

Subcatchment EE: runon north of borrow area
Tc=25.4 min CN=77 Area=0.925 ac Runoff= 2.10 cfs 0.182 af

Subcatchment F: vegetated final cover
Tc=19.7 min CN=83 Area=5.053 ac Runoff= 16.35 cfs 1.217 af

Subcatchment FFR: unvegetated final cover system
Tc=3.6 min CN=89 Area=4.670 ac Runoff= 29.08 cfs 1.356 af

Subcatchment G: vegetated final cover
Tc=19.8 min CN=83 Area=5.309 ac Runoff= 17.13 cfs 1.279 af

Subcatchment GGR: construction laydown area
Tc=23.3 min CN=78 Area=2.620 ac Runoff= 6.52 cfs 0.534 af

Subcatchment HH: runon north of borrow area
Tc=13.9 min CN=79 Area=0.548 ac Runoff= 1.86 cfs 0.116 af

Document 6997

Subcatchment HR: un-vegetated final cover
Tc=3.2 min CN=89 Area=4.590 ac Runoff= 28.80 cfs 1.333 af

Subcatchment II: runon area to borrow area
Tc=23.0 min CN=68 Area=1.669 ac Runoff= 2.73 cfs 0.230 af

Subcatchment IR: un vegetated final cover
Tc=2.1 min CN=89 Area=0.710 ac Runoff= 4.41 cfs 0.206 af

Subcatchment JJ: runon area to borrow area
Tc=41.9 min CN=62 Area=0.914 ac Runoff= 0.69 cfs 0.094 af

Subcatchment JR: un-vegetated final cover
Tc=3.5 min CN=89 Area=2.400 ac Runoff= 14.98 cfs 0.697 af

Subcatchment KK: runon area to borrow area
Tc=36.4 min CN=64 Area=5.893 ac Runoff= 5.63 cfs 0.674 af

Subcatchment L: runon north of borrow area
Tc=15.4 min CN=76 Area=1.683 ac Runoff= 4.88 cfs 0.320 af

Subcatchment LL: runoff area
Tc=28.1 min CN=61 Area=7.049 ac Runoff= 6.61 cfs 0.693 af

Subcatchment M: runon north of borrow area
Tc=12.1 min CN=79 Area=1.000 ac Runoff= 3.60 cfs 0.212 af

Subcatchment MM: runoff area
Tc=9.9 min CN=81 Area=1.943 ac Runoff= 3.30 cfs 0.192 af

Subcatchment N: direct runon to pond
Tc=1.0 min CN=98 Area=7.818 ac Runoff= 57.89 cfs 2.908 af

Subcatchment NN: runoff area
Tc=1.4 min CN=66 Area=1.274 ac Runoff= 3.78 cfs 0.162 af

Subcatchment O: runon north of borrow area
Tc=1.3 min CN=79 Area=1.317 ac Runoff= 6.54 cfs 0.279 af

Subcatchment OO: runon area to borrow area
Tc=5.4 min CN=66 Area=0.399 ac Runoff= 1.08 cfs 0.051 af

Subcatchment P: runon north of borrow area
Tc=33.7 min CN=75 Area=5.238 ac Runoff= 9.16 cfs 0.955 af

Subcatchment PP: vegetated borrow area
Tc=65.5 min CN=64 Area=40.964 ac Runoff= 25.40 cfs 4.631 af

Subcatchment Q: runon north of borrow area
Tc=31.6 min CN=72 Area=7.700 ac Runoff= 12.29 cfs 1.252 af

Subcatchment R: runon north of borrow area
Tc=21.6 min CN=74 Area=2.612 ac Runoff= 5.83 cfs 0.460 af

Subcatchment S: runon north of borrow area
Tc=27.9 min CN=78 Area=0.402 ac Runoff= 0.89 cfs 0.082 af

Subcatchment U: runon east of OSDF
Tc=32.3 min CN=72 Area=4.149 ac Runoff= 6.57 cfs 0.674 af

Subcatchment V: direct runon to pond
Tc=1.0 min CN=98 Area=0.274 ac Runoff= 2.03 cfs 0.102 af

Subcatchment W: runon east of OSDF
Tc=12.6 min CN=72 Area=10.593 ac Runoff= 28.88 cfs 1.733 af

Subcatchment X: runon east of OSDF
Tc=33.4 min CN=71 Area=11.853 ac Runoff= 17.50 cfs 1.851 af

Subcatchment Y: runon area east of OSDF
Tc=36.8 min CN=73 Area=6.522 ac Runoff= 9.84 cfs 1.101 af

Subcatchment Z: runon area east of OSDF
Tc=23.7 min CN=72 Area=1.606 ac Runoff= 3.11 cfs 0.262 af

Reach 1: east drainage channel Inflow= 10.81 cfs 0.758 af
Length= 420.0' Max Vel= 2.1 fps Capacity= 754.78 cfs Outflow= 10.06 cfs 0.756 af

Reach 1R: (new node) Inflow= 6.61 cfs 0.693 af
Length= 100.0' Max Vel= 5.4 fps Capacity= 1,101.12 cfs Outflow= 6.59 cfs 0.693 af

Reach 2: east drainage channel Inflow= 26.37 cfs 2.010 af
Length= 420.0' Max Vel= 2.7 fps Capacity= 1,205.98 cfs Outflow= 25.59 cfs 2.005 af

Reach 2R: (new node) Inflow= 3.30 cfs 0.192 af
Length= 100.0' Max Vel= 4.3 fps Capacity= 1,101.12 cfs Outflow= 3.25 cfs 0.192 af

Reach 3: east drainage channel Inflow= 40.77 cfs 3.241 af
Length= 420.0' Max Vel= 3.3 fps Capacity= 1,563.67 cfs Outflow= 39.76 cfs 3.234 af

R: (new node) Inflow= 3.78 cfs 0.162 af
Length= 100.0' Max Vel= 4.5 fps Capacity= 1,101.12 cfs Outflow= 3.72 cfs 0.162 af

Reach 4: east drainage channel Inflow= 53.10 cfs 4.451 af
Length= 420.0' Max Vel= 3.5 fps Capacity= 1,106.53 cfs Outflow= 52.07 cfs 4.451 af

Reach 5: east drainage channel Inflow= 63.69 cfs 5.669 af
Length= 440.0' Max Vel= 3.5 fps Capacity= 182.58 cfs Outflow= 62.69 cfs 5.656 af

Reach 6: east drainage channel Inflow= 73.28 cfs 6.935 af
Length= 480.0' Max Vel= 4.6 fps Capacity= 258.21 cfs Outflow= 72.46 cfs 6.923 af

Reach 7R: runoff diversion channel Inflow= 75.24 cfs 8.256 af
Length= 467.0' Max Vel= 3.6 fps Capacity= 1,152.93 cfs Outflow= 74.27 cfs 8.238 af

Reach 8R: runoff diversion channel Inflow= 76.85 cfs 9.594 af
Length= 241.0' Max Vel= 3.1 fps Capacity= 1,600.80 cfs Outflow= 76.26 cfs 9.583 af

Reach 9R: runoff diversion channel Inflow= 76.73 cfs 9.859 af
Length= 144.0' Max Vel= 3.6 fps Capacity= 425.10 cfs Outflow= 76.33 cfs 9.852 af

Reach 10AR: (new node) Inflow= 78.67 cfs 10.058 af
Length= 356.0' Max Vel= 7.9 fps Capacity= 1,940.52 cfs Outflow= 78.32 cfs 10.049 af

Reach 10BR: runoff diversion channel Inflow= 77.31 cfs 10.743 af
Length= 142.0' Max Vel= 4.7 fps Capacity= 331.10 cfs Outflow= 77.00 cfs 10.737 af

Reach 11: new CMP arch Inflow= 79.65 cfs 11.270 af
Length= 40.0' Max Vel= 6.7 fps Capacity= 522.31 cfs Outflow= 79.56 cfs 11.269 af

Reach 12R: runoff diversion channel Inflow= 79.56 cfs 11.269 af
Length= 240.0' Max Vel= 3.7 fps Capacity= 317.79 cfs Outflow= 79.11 cfs 11.254 af

Reach 13R: runoff diversion channel Inflow= 145.19 cfs 21.222 af
Length= 450.0' Max Vel= 4.3 fps Capacity= 346.63 cfs Outflow= 144.36 cfs 21.170 af

Reach 14: east runon channel Inflow= 0.52 cfs 0.026 af
Length= 420.0' Max Vel= 0.9 fps Capacity= 22.76 cfs Outflow= 0.38 cfs 0.025 af

Reach 15: east runon channel Inflow= 3.20 cfs 0.188 af
Length= 420.0' Max Vel= 1.8 fps Capacity= 61.62 cfs Outflow= 2.82 cfs 0.186 af

Reach 16: east runon channel Inflow= 9.76 cfs 0.684 af
Length= 420.0' Max Vel= 2.6 fps Capacity= 256.58 cfs Outflow= 9.33 cfs 0.681 af

Reach 17: east runon channel Inflow= 12.43 cfs 0.923 af
Length= 420.0' Max Vel= 3.2 fps Capacity= 438.18 cfs Outflow= 12.07 cfs 0.921 af

Reach 18: east runon channel Inflow= 21.43 cfs 2.022 af
Length= 440.0' Max Vel= 3.7 fps Capacity= 169.20 cfs Outflow= 20.99 cfs 2.017 af

Reach 19: east runon channel Inflow= 38.43 cfs 3.668 af
Length= 470.0' Max Vel= 2.8 fps Capacity= 911.12 cfs Outflow= 37.75 cfs 3.655 af

Subcatchment BB: runon east of OSDF

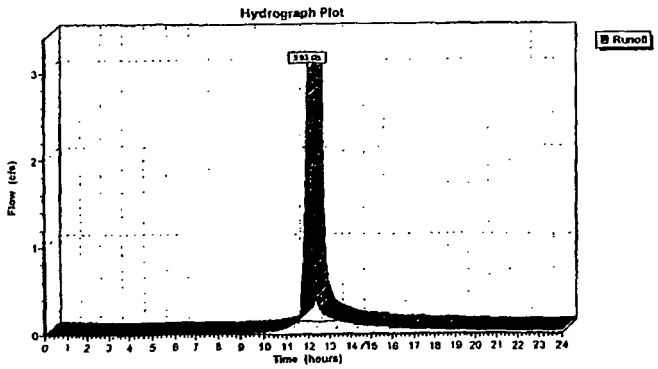
Runoff = 3.03 cfs @ 12.01 hrs, Volume= 0.161 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.761	79	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	110	0.0800	0.3		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
2.4	360	0.0040	2.5	22.78	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=1.50' Z= 3.0 & 5.0 '/' n= 0.030
9.1	470	Total			

Subcatchment BB: runon east of OSDF



Subcatchment C: vegetated final cover

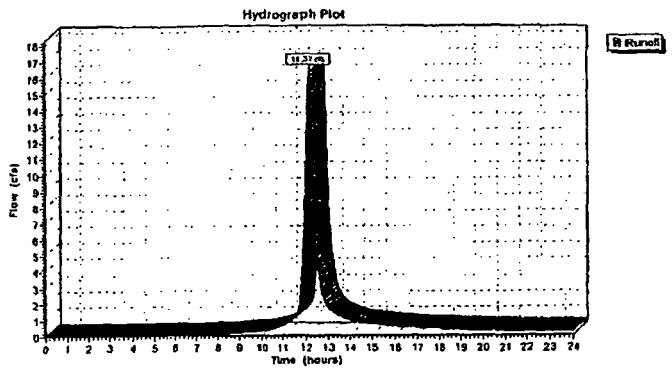
Runoff = 16.37 cfs @ 12.13 hrs, Volume= 1.255 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
5.209	83	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	90	0.0500	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
3.8	60	0.1000	0.3		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
6.4	150	0.1700	0.4		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
0.4	170	0.1700	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
3.2	400	0.0045	2.1	10.88	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=1.02' Z= 6.0 & 4.0 '/' n= 0.030
20.7	870	Total			

Subcatchment C: vegetated final cover



Subcatchment CC: runon east of OSDF

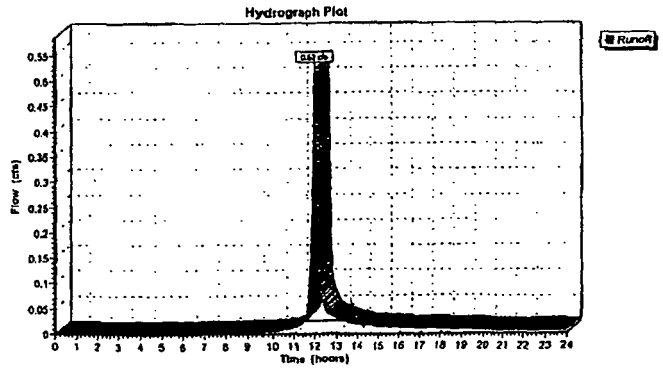
Runoff = 0.52 cfs @ 11.98 hrs, Volume= 0.026 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.121	79	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.7	110	0.0800	0.3		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"

Subcatchment CC: runon east of OSDF



Subcatchment D: vegetated final cover

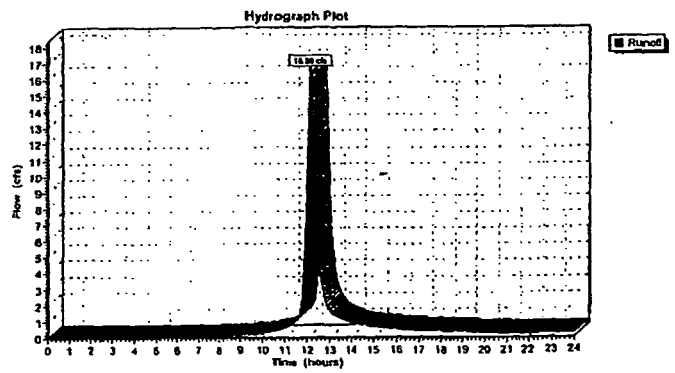
Runoff = 16.39 cfs @ 12.13 hrs, Volume= 1.236 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
5.131	83	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	90	0.0500	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
3.8	60	0.1000	0.3		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
6.4	150	0.1700	0.4		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
0.4	170	0.1700	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
1.7	250	0.0045	2.4	16.16	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=1.29' Z= 5.0 & 3.0 '/' n= 0.030
0.9	150	0.0050	2.9	25.90	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=1.59' Z= 4.0 & 3.0 '/' n= 0.030
20.1	870	Total			

Subcatchment D: vegetated final cover



Subcatchment FFR: unvegetated final cover system

[49] Hint: Tc<2dt may require smaller dt

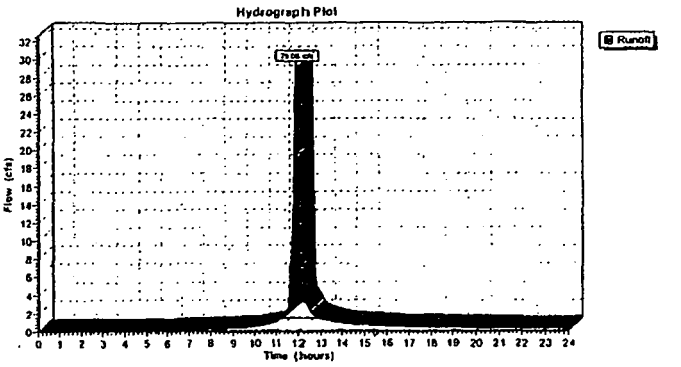
Runoff = 29.08 cfs @ 11.94 hrs, Volume= 1.356 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
24-hr Rainfall=4.70"

(ac)	CN	Description
4.670	89	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	90	0.0500	1.8		Sheet Flow, Smooth surfaces n= 0.011 P2= 2.60"
0.4	50	0.1000	2.1		Sheet Flow, Smooth surfaces n= 0.011 P2= 2.60"
0.8	160	0.1700	3.2		Sheet Flow, Smooth surfaces n= 0.011 P2= 2.60"
0.3	120	0.1700	6.0		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.0	12	0.0500	4.5		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.2	467	0.0050	6.7	914.80	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=5.49' Z= 6.0 & 3.0 '/' n= 0.030
3.6	899	Total			

Subcatchment FFR: unvegetated final cover system



Subcatchment G: vegetated final cover

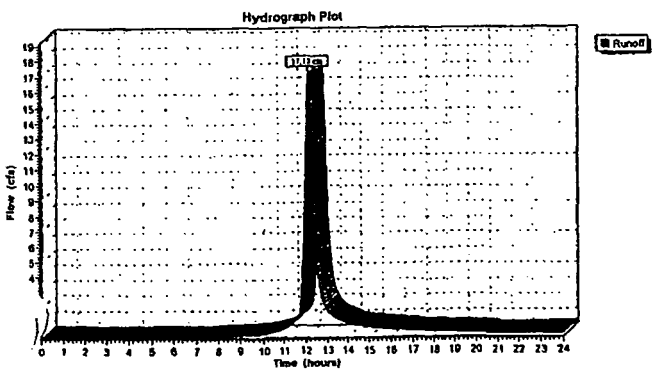
Runoff = 17.13 cfs @ 12.12 hrs, Volume= 1.279 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
5.309	83	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	90	0.0500	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
3.8	60	0.1000	0.3		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
6.4	150	0.1700	0.4		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
0.4	170	0.1700	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
2.3	410	0.0050	2.9	26.33	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=1.60' Z= 4.0 & 3.0 '/' n= 0.030
19.8	880	Total			

Subcatchment G: vegetated final cover



Subcatchment GGR: construction laydown area

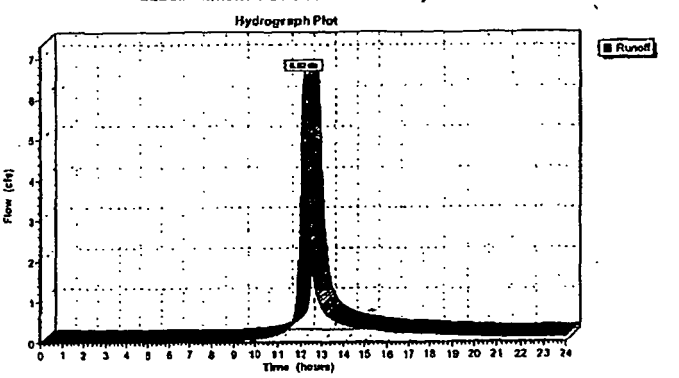
Runoff = 6.52 cfs @ 12.17 hrs, Volume= 0.534 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
2.620	78	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.8	240	0.0180	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
0.5	55	0.0145	1.9		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
23.3	295	Total			

Subcatchment GGR: construction laydown area



Subcatchment JJ: runon area to borrow area

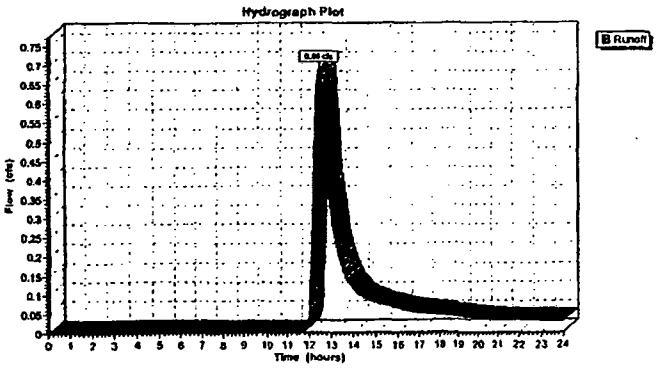
Runoff = 0.69 cfs @ 12.44 hrs, Volume= 0.094 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
1.914	82	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
23.9	300	0.0250	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
0.3	40	0.0250	2.5		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.3	110	0.1660	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
17.4	840	0.0025	0.8		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
41.9	1,290	Total			

Subcatchment JJ: runon area to borrow area



Subcatchment JR: un-vegetated final cover

[49] Hint: Tc<2dt may require smaller dt

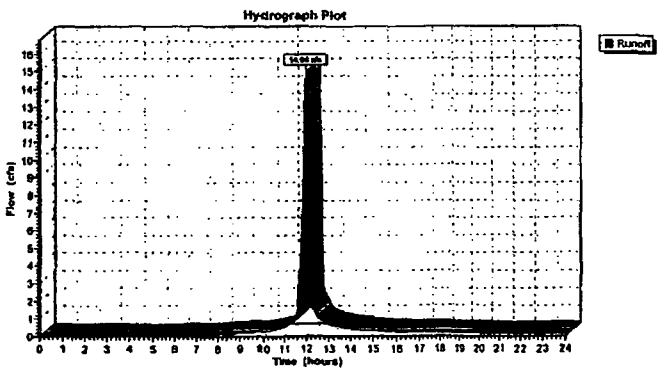
Runoff = 14.98 cfs @ 11.94 hrs, Volume= 0.697 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
2.400	89	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	80	0.0500	1.7		Sheet Flow, Smooth surfaces n= 0.011 P2= 2.60"
0.4	55	0.1000	2.1		Sheet Flow, Smooth surfaces n= 0.011 P2= 2.60"
0.9	165	0.1700	3.2		Sheet Flow, Smooth surfaces n= 0.011 P2= 2.60"
0.4	145	0.1700	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.0	12	0.0500	4.5		Shallow Concentrated Flow, Paved Kv= 20.3 fps
1.0	356	0.0050	6.1	613.65	Trap/Vee/Rect Channel Flow, Bot.W=9.00' D=3.65' Z= 6.0 & 3.0 '/' n= 0.030
3.5	813	Total			

Subcatchment JR: un-vegetated final cover



Subcatchment KK: runon area to borrow area

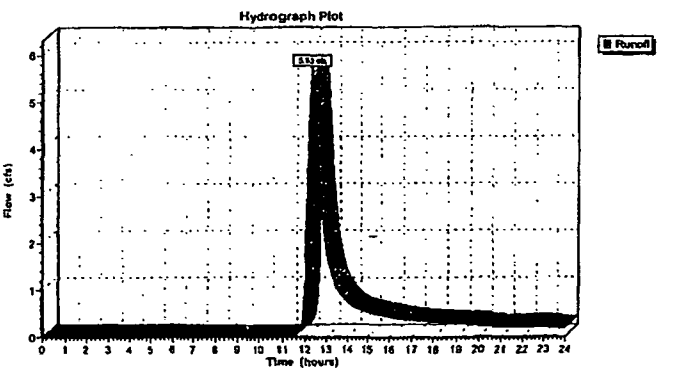
Runoff = 5.63 cfs @ 12.36 hrs, Volume= 0.674 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
5.893	64	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.9	300	0.0280	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
1.3	150	0.0140	1.9		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.3	110	0.1660	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
11.9	630	0.0030	0.9		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
36.4	1,190	Total			

Subcatchment KK: runon area to borrow area



Subcatchment N: direct runon to pond

[49] Hint: Tc<2dt may require smaller dt

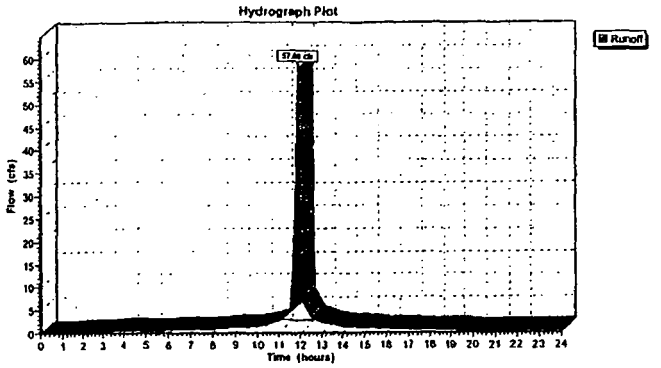
Runoff = 57.89 cfs @ 11.90 hrs, Volume= 2.908 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
7.818	98	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0					Direct Entry.

Subcatchment N: direct runon to pond



Subcatchment NN: runoff area

[49] Hint: Tc<2dt may require smaller dt

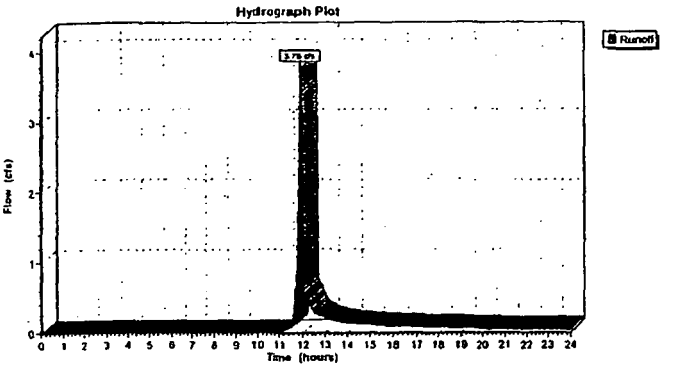
Runoff = 3.78 cfs @ 11.92 hrs, Volume= 0.162 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
1.274	66	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.4	600	0.0130	7.1	192.92	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=3.00' Z= 3.0 '/' n= 0.030

Subcatchment NN: runoff area



Subcatchment O: runon north of borrow area

[49] Hint: Tc<2dt may require smaller dt

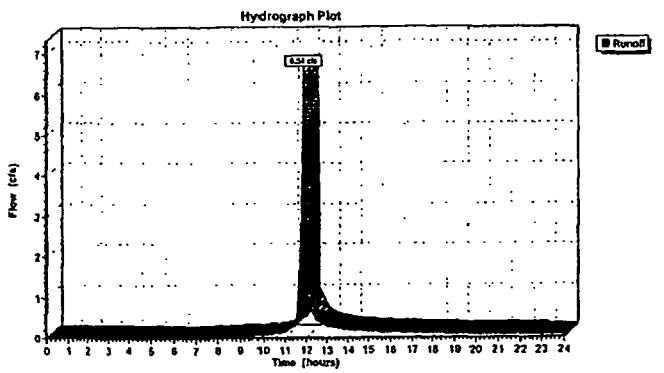
Runoff = 6.54 cfs @ 11.91 hrs, Volume= 0.279 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
1.317	79	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	230	0.0086	2.9	14.28	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=1.00' Z= 5.0 '/' n= 0.030

Subcatchment O: runon north of borrow area



Subcatchment OO: runon area to borrow area

[49] Hint: Tc<2dt may require smaller dt

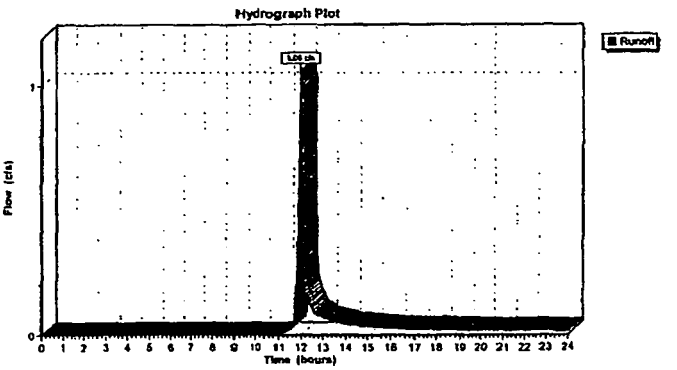
Runoff = 1.06 cfs @ 11.97 hrs, Volume= 0.051 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.399	66	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	120	0.1660	0.4		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"

Subcatchment OO: runon area to borrow area



Subcatchment S: runon north of borrow area

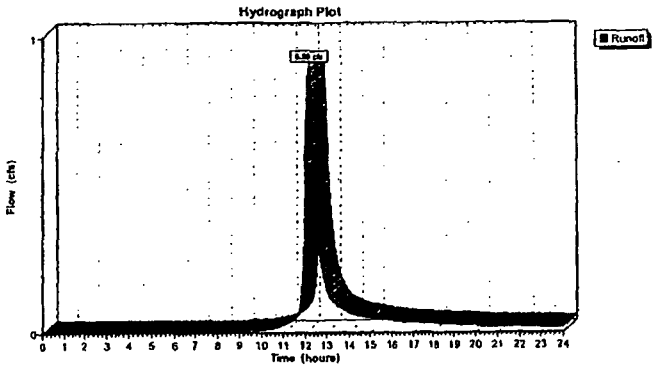
Runoff = 0.89 cfs @ 12.22 hrs, Volume= 0.082 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.402	78	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
27.8	280	0.0150	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
0.1	30	0.0100	6.3	169.20	Trap/Vee/Rect Channel Flow, BotW=0.00' D=3.00' Z= 3.0 '/' n= 0.030
27.9	310	Total			

Subcatchment S: runon north of borrow area



Subcatchment U: runon east of OSDF

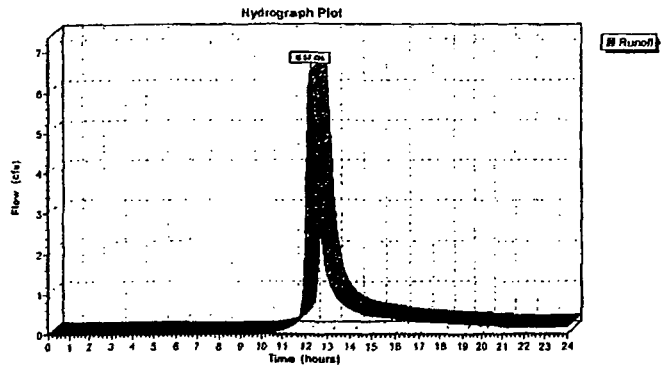
Runoff = 6.57 cfs @ 12.28 hrs, Volume= 0.674 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
4.149	72	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
30.2	300	0.0140	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
2.1	240	0.0140	1.9		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
32.3	540	Total			

Subcatchment U: runon east of OSDF



Subcatchment V: direct runon to pond

[49] Hint: Tc<2dt may require smaller dt

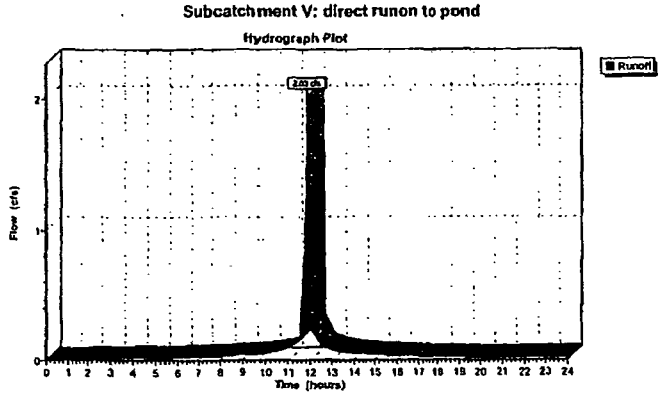
Runoff = 2.03 cfs @ 11.90 hrs, Volume= 0.102 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.274	98	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0					Direct Entry,

Subcatchment V: direct runon to pond



Subcatchment W: runon east of OSDF

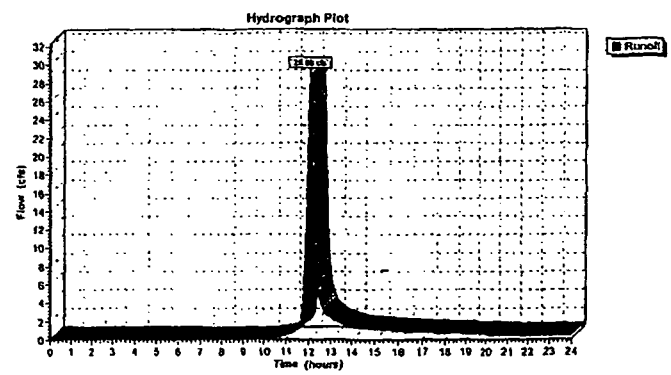
Runoff = 28.88 cfs @ 12.05 hrs, Volume= 1.733 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
10.593	72	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	300	0.1780	0.5		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
1.0	400	0.1780	6.8		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.7	270	0.0114	6.9	1,025.43	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=3.00' Z= 3.0 & 30.0 '/' n= 0.030
12.6	970	Total			

Subcatchment W: runon east of OSDF



Reach 1R: (new node)

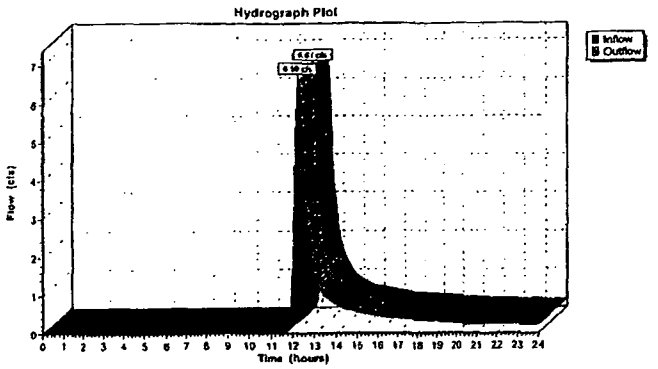
[52] Hint: Inlet conditions not evaluated
[65] Warning: Inlet elevation not specified

Inflow = 6.61 cfs @ 12.25 hrs, Volume= 0.693 af
Outflow = 6.59 cfs @ 12.26 hrs, Volume= 0.693 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.4 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 2.5 fps, Avg. Travel Time= 0.7 min

Peak Depth= 0.33'
Capacity at bank full= 1,101.12 cfs
A factor of 2.00 has been applied to the supplied storage and discharge data
72.0" Diameter Pipe n= 0.010 Length= 100.0' Slope= 0.0100 '/'

Reach 1R: (new node)



Reach 2: east drainage channel

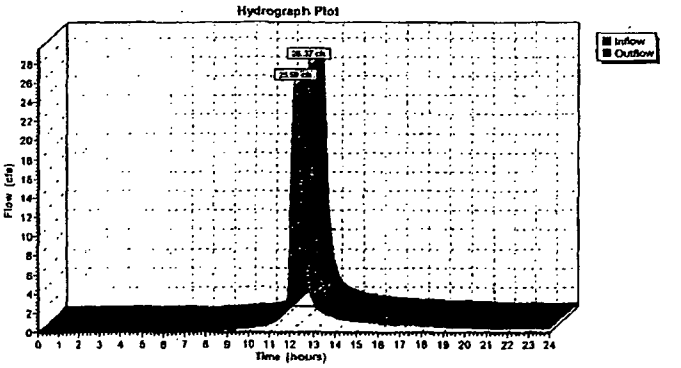
[65] Warning: Inlet elevation not specified

Inflow = 26.37 cfs @ 12.12 hrs, Volume= 2.010 af
Outflow = 25.59 cfs @ 12.20 hrs, Volume= 2.005 af, Atten= 3%, Lag= 4.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.7 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 1.1 fps, Avg. Travel Time= 6.3 min

Peak Depth= 1.54'
Capacity at bank full= 1,205.98 cfs
0.00' x 6.50' deep channel, n= 0.030 Length= 420.0' Slope= 0.0045 '/'
Side Slope Z-value= 3.0 5.0 '/'

Reach 2: east drainage channel



Reach 2R: (new node)

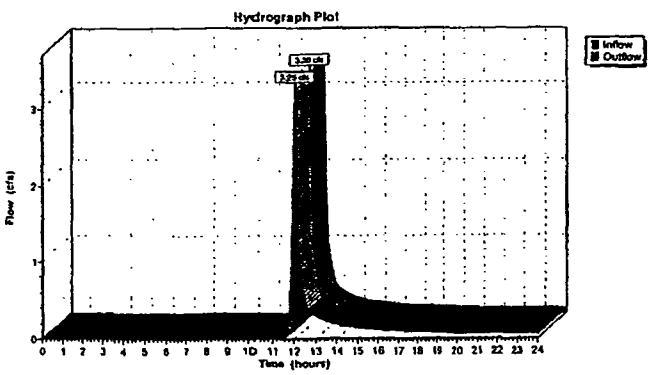
[52] Hint: Inlet conditions not evaluated
[65] Warning: Inlet elevation not specified

Inflow = 3.30 cfs @ 12.03 hrs, Volume= 0.192 af
Outflow = 3.25 cfs @ 12.04 hrs, Volume= 0.192 af, Atten= 1%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.3 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 0.9 min

Peak Depth= 0.24'
Capacity at bank full= 1,101.12 cfs
A factor of 2.00 has been applied to the supplied storage and discharge data
72.0" Diameter Pipe n= 0.010 Length= 100.0' Slope= 0.0100 '/'

Reach 2R: (new node)



Reach 3: east drainage channel

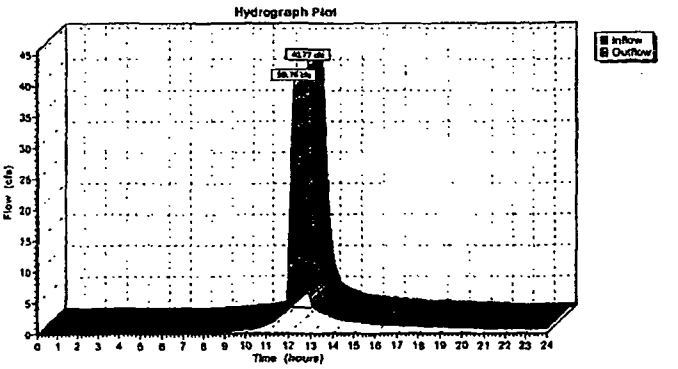
[65] Warning: Inlet elevation not specified

Inflow = 40.77 cfs @ 12.17 hrs, Volume= 3.241 af
Outflow = 39.76 cfs @ 12.24 hrs, Volume= 3.234 af, Atten= 2%, Lag= 4.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.3 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 1.3 fps, Avg. Travel Time= 5.3 min

Peak Depth= 1.87'
Capacity at bank full= 1,563.67 cfs
0.00' x 7.40' deep channel, n= 0.030 Length= 420.0' Slope= 0.0050 '/'
Side Slope Z-value= 3.0 4.0 '/'

Reach 3: east drainage channel



Reach 7R: runoff diversion channel

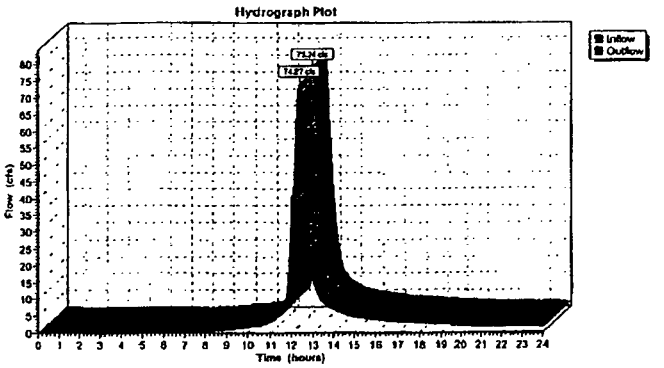
[65] Warning: Inlet elevation not specified

Inflow = 75.24 cfs @ 12.32 hrs, Volume= 8.256 af
Outflow = 74.27 cfs @ 12.38 hrs, Volume= 8.238 af, Atten= 1%, Lag= 3.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.6 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 1.5 fps, Avg. Travel Time= 5.2 min

Peak Depth= 2.15'
Capacity at bank full= 1,152.93 cfs
0.00' x 5.99' deep channel, n= 0.030 Length= 467.0' Slope= 0.0050 '/'
Side Slope Z-value= 3.0 6.0 '/'

Reach 7R: runoff diversion channel



Document 6774

Reach 8R: runoff diversion channel

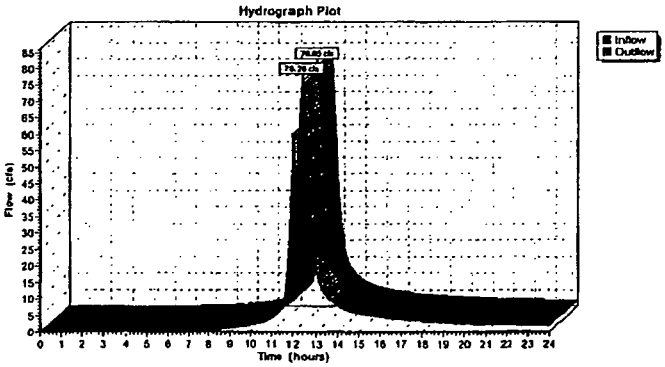
[65] Warning: Inlet elevation not specified

Inflow = 76.85 cfs @ 12.38 hrs, Volume= 9.594 af
Outflow = 76.26 cfs @ 12.42 hrs, Volume= 9.583 af, Atten= 1%, Lag= 2.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.1 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 1.3 fps, Avg. Travel Time= 3.0 min

Peak Depth= 1.75'
Capacity at bank full= 1,600.80 cfs
A factor of 2.00 has been applied to the supplied storage and discharge data
0.00' x 5.47' deep channel, n= 0.030 Length= 241.0' Slope= 0.0050 '/'
Side Slope Z-value= 6.0 2.0 '/'

Reach 8R: runoff diversion channel



Reach 9R: runoff diversion channel

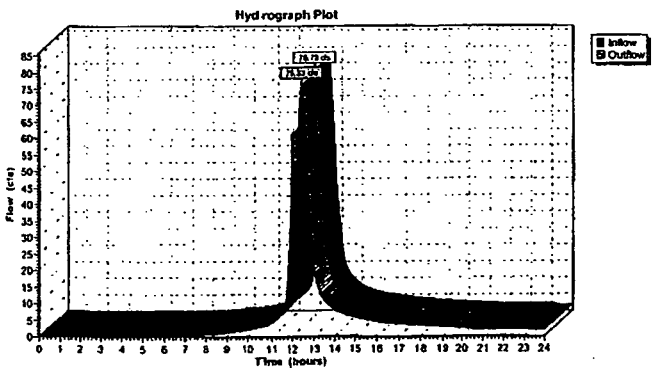
[65] Warning: Inlet elevation not specified

Inflow = 76.73 cfs @ 12.42 hrs, Volume= 9.859 af
Outflow = 76.33 cfs @ 12.44 hrs, Volume= 9.852 af, Atten= 1%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.6 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.5 fps, Avg. Travel Time= 1.6 min

Peak Depth= 1.86'
Capacity at bank full= 425.10 cfs
3.00' x 3.80' deep channel, n= 0.030 Length= 144.0' Slope= 0.0050 '/'
Side Slope Z-value= 6.0 3.0 '/'

Reach 9R: runoff diversion channel



Reach 10AR: (new node)

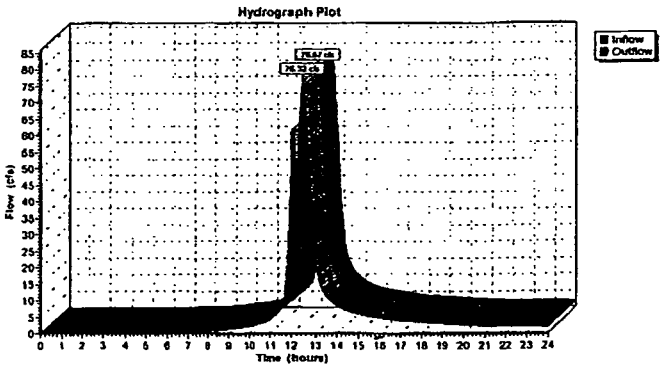
[65] Warning: Inlet elevation not specified

Inflow = 76.67 cfs @ 12.44 hrs, Volume= 10.058 af
Outflow = 76.32 cfs @ 12.46 hrs, Volume= 10.049 af, Atten= 0%, Lag= 1.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 7.9 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 2.7 fps, Avg. Travel Time= 2.2 min

Peak Depth= 0.78'
Capacity at bank full= 1,940.52 cfs
9.00' x 3.85' deep channel, n= 0.030 Length= 356.0' Slope= 0.0500 '/'
Side Slope Z-value= 6.0 3.0 '/'

Reach 10AR: (new node)



Reach 14: east runon channel

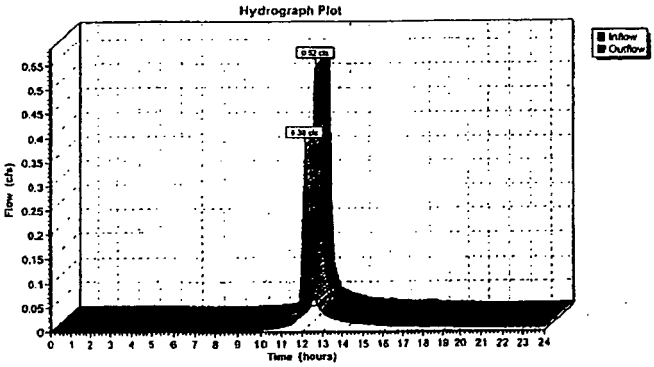
[65] Warning: Inlet elevation not specified

Inflow = 0.52 cfs @ 11.98 hrs, Volume= 0.026 af
Outflow = 0.38 cfs @ 12.17 hrs, Volume= 0.025 af, Atten= 27%, Lag= 11.3 min

'g by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
'elocity= 0.9 fps, Min. Travel Time= 7.6 min
'elocity = 0.4 fps, Avg. Travel Time= 19.1 min

Peak Depth= 0.33'
Capacity at bank full= 22.78 cfs
0.00' x 1.50' deep channel, n= 0.030 Length= 420.0' Slope= 0.0040 '/'
Side Slope Z-value= 3.0 5.0 '/'

Reach 14: east runon channel



Reach 15: east runon channel

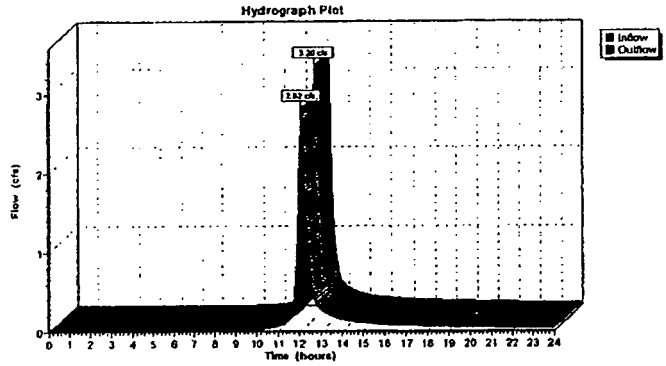
[65] Warning: Inlet elevation not specified

Inflow = 3.20 cfs @ 12.01 hrs, Volume= 0.186 af
Outflow = 2.82 cfs @ 12.12 hrs, Volume= 0.186 af, Atten= 12%, Lag= 6.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.8 fps, Min. Travel Time= 3.9 min
Avg. Velocity = 0.7 fps, Avg. Travel Time= 9.9 min

Peak Depth= 0.64'
Capacity at bank full= 61.62 cfs
0.00' x 2.00' deep channel, n= 0.030 Length= 420.0' Slope= 0.0063 '/'
Side Slope Z-value= 3.0 5.0 '/'

Reach 15: east runon channel



Reach 16: east runon channel

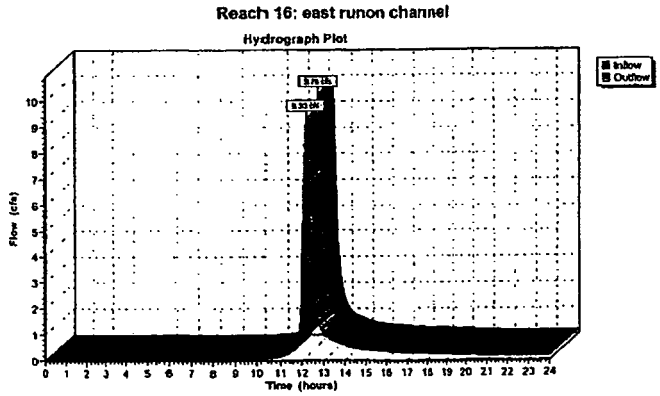
[65] Warning: Inlet elevation not specified

Inflow = 9.76 cfs @ 12.10 hrs, Volume= 0.664 af
Outflow = 9.33 cfs @ 12.19 hrs, Volume= 0.661 af, Atten= 4%, Lag= 4.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.6 fps, Min. Travel Time= 2.7 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 6.7 min

Peak Depth= 0.98'
Capacity at bank full= 256.58 cfs
0.00' x 3.40' deep channel, n= 0.030 Length= 420.0' Slope= 0.0074 '/'
Side Slope Z-value= 2.5 5.0 '/'

Reach 16: east runon channel



Reach 17: east runon channel

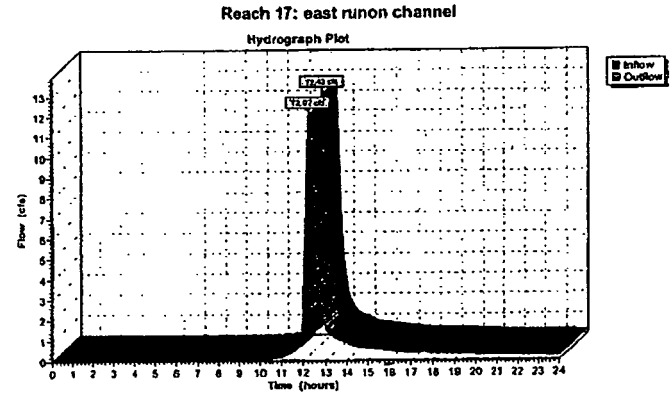
[65] Warning: Inlet elevation not specified

Inflow = 12.43 cfs @ 12.18 hrs, Volume= 0.923 af
Outflow = 12.07 cfs @ 12.25 hrs, Volume= 0.921 af, Atten= 3%, Lag= 4.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.2 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 1.3 fps, Avg. Travel Time= 5.3 min

Peak Depth= 0.92'
Capacity at bank full= 436.18 cfs
0.00' x 3.50' deep channel, n= 0.030 Length= 420.0' Slope= 0.0125 '/'
Side Slope Z-value= 4.0 5.0 '/'

Reach 17: east runon channel



Reach 22: east runon channel

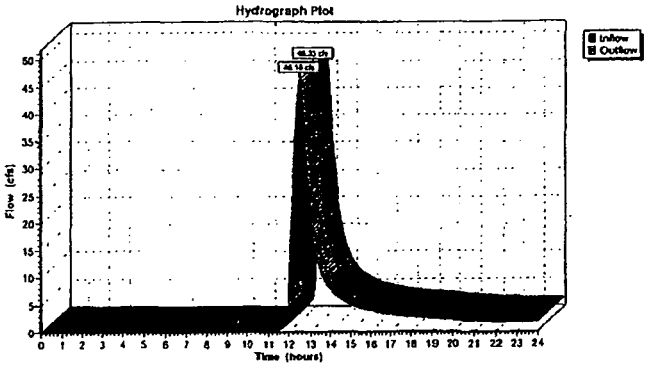
[65] Warning: Inlet elevation not specified

Inflow = 46.33 cfs @ 12.49 hrs, Volume= 6.231 af
Outflow = 46.18 cfs @ 12.51 hrs, Volume= 6.226 af, Atten= 0%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.5 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.6 fps, Avg. Travel Time= 2.0 min

Peak Depth= 1.85'
Capacity at bank full= 364.40 cfs
0.00' x 4.00' deep channel, n= 0.030 Length= 190.0' Slope= 0.0100 '/'
Side Slope Z-value= 3.0 '/'

Reach 22: east runon channel



Reach 23: new CMP culverts

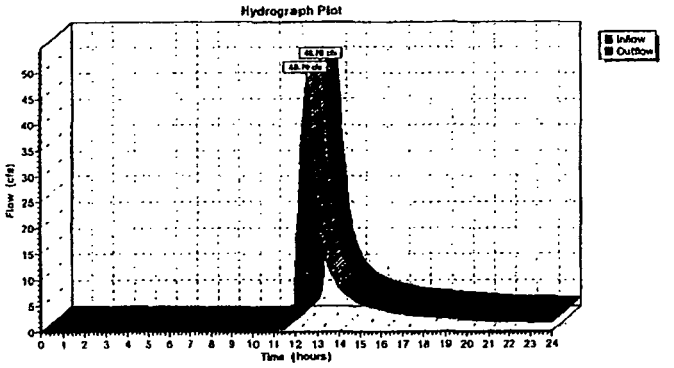
[52] Hint: Inlet conditions not evaluated
[65] Warning: Inlet elevation not specified

Inflow = 48.76 cfs @ 12.51 hrs, Volume= 6.862 af
Outflow = 48.70 cfs @ 12.52 hrs, Volume= 6.859 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.4 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 0.8 min

Peak Depth= 1.31'
Capacity at bank full= 468.67 cfs
A factor of 2.00 has been applied to the supplied storage and discharge data
72.0" Diameter Pipe n= 0.018 Length= 92.0' Slope= 0.0059 '/'

Reach 23: new CMP culverts



Reach 24: runon channel

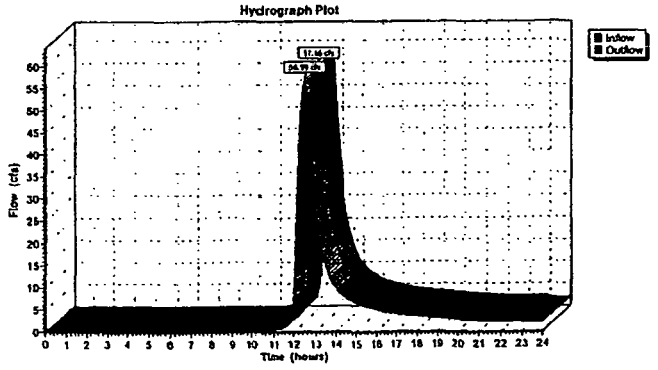
[65] Warning: Inlet elevation not specified

Inflow = 57.15 cfs @ 12.47 hrs, Volume= 8.111 af
Outflow = 56.99 cfs @ 12.49 hrs, Volume= 8.104 af, Atten= 0%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Max. Velocity= 4.0 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.2 fps, Avg. Travel Time= 2.3 min

Peak Depth= 1.19'
Capacity at bank full= 153.54 cfs
8.50' x 2.00' deep channel, n= 0.030 Length= 160.0' Slope= 0.0075 '/'
Side Slope Z-value= 3.0 '/'

Reach 24: runon channel



Reach 25: new CMP arch

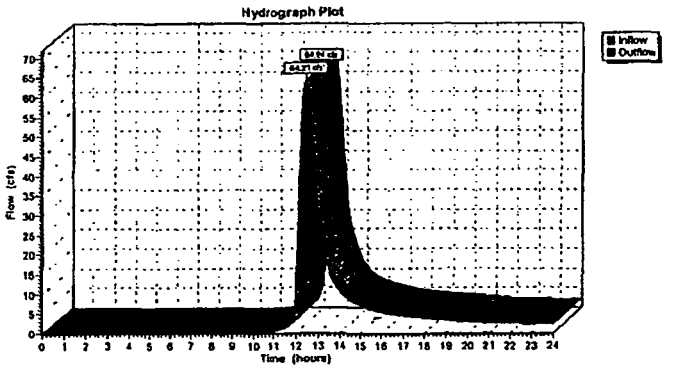
[52] Hint: Inlet conditions not evaluated
[65] Warning: Inlet elevation not specified

Inflow = 64.24 cfs @ 12.45 hrs, Volume= 9.059 af
Outflow = 64.21 cfs @ 12.46 hrs, Volume= 9.057 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.9 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.0 fps, Avg. Travel Time= 0.4 min

Peak Depth= 1.49'
Capacity at bank full= 475.34 cfs
A factor of 2.00 has been applied to the supplied storage and discharge data
72.0" Diameter Pipe n= 0.018 Length= 53.0' Slope= 0.0080 '/'

Reach 25: new CMP arch



Reach 30: east runon channel

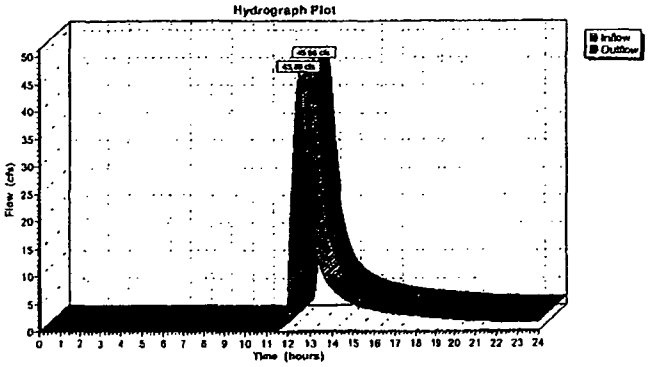
[65] Warning: Inlet elevation not specified

Inflow	=	45.98 cfs @	12.48 hrs,	Volume=	6.152 af
Outflow	=	45.89 cfs @	12.48 hrs,	Volume=	6.151 af, Atten= 0%, Lag= 0.2 min

ng by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs / 2
Velocity= 4.5 fps, Min. Travel Time= 0.1 min
Velocity = 1.5 fps, Avg. Travel Time= 0.3 min

Peak Depth= 1.84'
Capacity at bank full= 104.05 cfs
0.00' x 2.50' deep channel, n= 0.030 Length= 30.0' Slope= 0.0100 '/'
Side Slope Z-value= 3.0 '/'

Reach 30: east runon channel



Reach 31: culvert

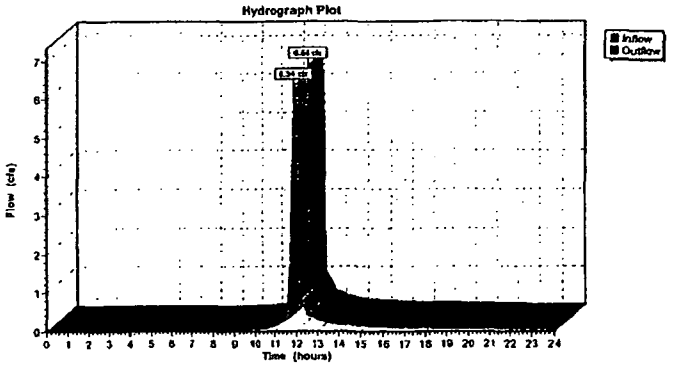
[52] Hint: Inlet conditions not evaluated
[65] Warning: Inlet elevation not specified

Inflow	=	6.54 cfs @	11.91 hrs,	Volume=	0.279 af
Outflow	=	6.34 cfs @	11.91 hrs,	Volume=	0.279 af, Atten= 3%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.1 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 0.8 min

Peak Depth= 0.34'
Capacity at bank full= 1,025.91 cfs
A factor of 2.00 has been applied to the supplied storage and discharge data
72.0" Diameter Pipe n= 0.012 Length= 80.0' Slope= 0.0125 '/'

Reach 31: culvert



Pond 1P: (new node)

Inflow	=	49.32 cfs @	12.39 hrs,	Volume=	6.362 af
Outflow	=	45.98 cfs @	12.48 hrs,	Volume=	6.152 af, Atten= 7%, Lag= 5.4 min
Primary	=	45.98 cfs @	12.48 hrs,	Volume=	6.152 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

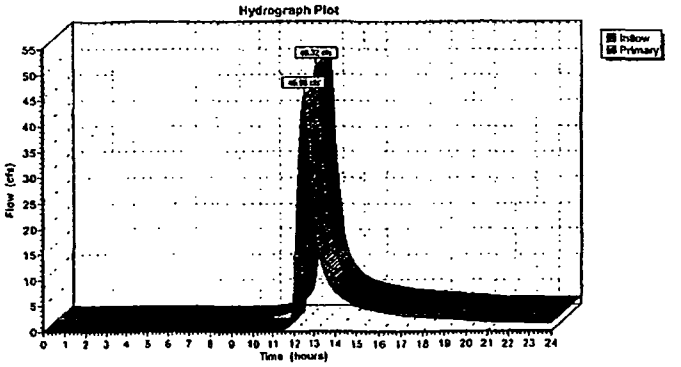
Starting Elev= 592.00' Storage= 0.691 af
Peak Elev= 593.91' Storage= 1.584 af (0.893 af above starting storage)
Plug-Flow detention time= 102.4 min calculated for 5.461 af (86% of inflow)
Storage and wetted areas determined by Conic sections

Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)	Wet.Area (acres)
589.30	0.186	0.000	0.000	0.186
590.00	0.210	0.139	0.139	0.211
591.00	0.278	0.243	0.382	0.279
592.00	0.342	0.309	0.691	0.344
593.00	0.463	0.401	1.092	0.465
594.00	0.624	0.542	1.634	0.627

Primary OutFlow (Free Discharge)
└─1=Special (user-defined)

#	Routing	Invert	Outlet Devices
1	Primary	592.00'	Special (user-defined)
			Head (feet) 0.00 0.01 0.18 0.51 1.01 1.34 1.67 2.00
			Disch. (cfs) 0.00 0.00 0.08 1.33 8.21 17.57 31.73 51.47

Pond 1P: (new node)



WEST OSDF CONSTRUCTION-PHASE DESIGN SCENARIO
25-YEAR, 24-HOUR STORM EVENT

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Type II 24-hr Rainfall=4.70"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: vegetated final cover
Tc=18.3 min CN=83 Area=2.730 ac Runoff= 9.20 cfs 0.658 af

Subcatchment B: vegetated final cover
Tc=19.0 min CN=83 Area=5.342 ac Runoff= 17.63 cfs 1.287 af

Subcatchment C: vegetated final cover
Tc=19.0 min CN=83 Area=5.399 ac Runoff= 17.82 cfs 1.301 af

Subcatchment D: vegetated final cover
Tc=19.0 min CN=83 Area=5.530 ac Runoff= 18.25 cfs 1.332 af

Subcatchment ER: non-vegetated final cover
Tc=4.2 min CN=89 Area=5.320 ac Runoff= 32.56 cfs 1.544 af

Subcatchment F1R: non-vegetated final cover
Tc=2.9 min CN=89 Area=0.918 ac Runoff= 5.78 cfs 0.267 af

Subcatchment F2R: (new node)
Tc=2.6 min CN=89 Area=1.550 ac Runoff= 9.78 cfs 0.450 af

Subcatchment FR: non-vegetated final cover/construction laydown
Tc=2.4 min CN=89 Area=3.500 ac Runoff= 21.54 cfs 1.016 af

Subcatchment GR: (new node)
Tc=0.1 min CN=89 Area=0.050 ac Runoff= 0.33 cfs 0.015 af

Subcatchment HR: non-vegetated final cover area
Tc=8.3 min CN=89 Area=0.140 ac Runoff= 0.75 cfs 0.041 af

Subcatchment J1R: construction laydown area
Tc=2.8 min CN=82 Area=0.312 ac Runoff= 1.86 cfs 0.073 af

Subcatchment J2R: construction laydown area
Tc=8.0 min CN=82 Area=0.970 ac Runoff= 4.41 cfs 0.227 af

Subcatchment KR: runon north of borrow area
Tc=1.8 min CN=89 Area=1.590 ac Runoff= 10.00 cfs 0.462 af

Subcatchment LR: construction laydown area
Tc=30.7 min CN=82 Area=1.860 ac Runoff= 4.46 cfs 0.433 af

Subcatchment MR: runon north of borrow area
Tc=2.8 min CN=79 Area=0.675 ac Runoff= 3.30 cfs 0.143 af

Subcatchment N: construction laydown area
Tc=15.2 min CN=82 Area=1.043 ac Runoff= 3.73 cfs 0.244 af

Subcatchment O: pond
Tc=1.0 min CN=98 Area=2.252 ac Runoff= 16.67 cfs 0.638 af

Subcatchment P1R: construction laydown area
Tc=8.4 min CN=82 Area=0.490 ac Runoff= 2.20 cfs 0.115 af

Subcatchment P2R: construction laydown area
Tc=8.3 min CN=82 Area=0.214 ac Runoff= 0.96 cfs 0.050 af

Subcatchment QN: runon north of borrow area
Tc=11.8 min CN=79 Area=0.127 ac Runoff= 0.46 cfs 0.027 af

Reach 1: west channel
Length= 400.0' Max Vel= 2.5 fps Capacity= 424.60 cfs Inflow= 9.20 cfs 0.658 af Outflow= 8.87 cfs 0.656 af

Reach 2: west channel
Length= 400.0' Max Vel= 3.3 fps Capacity= 424.60 cfs Inflow= 25.75 cfs 1.943 af Outflow= 25.10 cfs 1.939 af

Reach 3: west channel
Length= 400.0' Max Vel= 3.7 fps Capacity= 424.60 cfs Inflow= 41.23 cfs 3.240 af Outflow= 40.35 cfs 3.234 af

Reach 4: west channel
Length= 90.0' Max Vel= 4.0 fps Capacity= 426.17 cfs Inflow= 55.70 cfs 4.566 af Outflow= 55.45 cfs 4.565 af

Reach 5: culvert
Length= 95.0' Max Vel= 4.9 fps Capacity= 396.64 cfs Inflow= 55.45 cfs 4.565 af Outflow= 55.23 cfs 4.563 af

Reach 6: west channel
Length= 380.0' Max Vel= 4.0 fps Capacity= 424.60 cfs Inflow= 55.23 cfs 4.563 af Outflow= 54.31 cfs 4.555 af

Reach 7AR: Haul Road Culvert 1
Length= 81.5' Max Vel= 5.4 fps Capacity= 166.63 cfs Inflow= 57.96 cfs 6.100 af Outflow= 57.80 cfs 6.098 af

Reach 7BR: Channel between GIS 14 & 15
Length= 100.0' Max Vel= 2.6 fps Capacity= 200.78 cfs Inflow= 57.98 cfs 6.171 af Outflow= 57.49 cfs 6.167 af

Reach 7CR: Rimia Parking Lot Culvert
Length= 296.0' Max Vel= 8.1 fps Capacity= 296.41 cfs Inflow= 58.08 cfs 6.434 af Outflow= 57.75 cfs 6.430 af

Reach 7DR: Runoff Drainage Channel south of Rimia
Length= 298.0' Max Vel= 3.3 fps Capacity= 372.29 cfs Inflow= 58.39 cfs 6.657 af Outflow= 57.61 cfs 6.647 af

Reach 8AR: west channel
Length= 146.0' Max Vel= 3.6 fps Capacity= 388.16 cfs Inflow= 87.19 cfs 8.737 af Outflow= 85.60 cfs 8.729 af

Reach 8BR: Culvert at Sed Basin 2 entrance
Length= 30.0' Max Vel= 6.9 fps Capacity= 535.70 cfs Inflow= 85.60 cfs 8.729 af Outflow= 85.46 cfs 8.728 af

Reach 8CR: Channel into Sed Basin 2
Length= 62.7' Max Vel= 6.6 fps Capacity= 728.12 cfs Inflow= 86.29 cfs 8.778 af Outflow= 85.96 cfs 8.777 af

Reach 9AR: Extended Drainge Channel South of Cell 8
Length= 197.0' Max Vel= 4.3 fps Capacity= 263.84 cfs Inflow= 10.00 cfs 0.462 af Outflow= 9.65 cfs 0.461 af

Reach 9BR: (new node)
Length= 88.0' Max Vel= 5.5 fps Capacity= 357.73 cfs Inflow= 9.65 cfs 0.461 af Outflow= 9.51 cfs 0.461 af

Reach 9R: Channel U/S of 30" Culvert
Length= 27.3' Max Vel= 4.3 fps Capacity= 1,027.28 cfs Inflow= 10.16 cfs 0.502 af Outflow= 10.10 cfs 0.502 af

Reach 10AR: (new node)
Length= 71.4' Max Vel= 5.2 fps Capacity= 243.75 cfs Inflow= 9.78 cfs 0.450 af Outflow= 9.65 cfs 0.450 af

Reach 10BR: (new node)
Length= 38.0' Max Vel= 5.3 fps Capacity= 343.51 cfs Inflow= 9.65 cfs 0.450 af Outflow= 9.58 cfs 0.450 af

Reach 10R: access road diversion channel
Length= 407.0' Max Vel= 2.8 fps Capacity= 162.16 cfs Inflow= 31.61 cfs 1.466 af Outflow= 28.73 cfs 1.461 af

Reach 11AR: (new node)
Length= 16.0' Max Vel= 2.7 fps Capacity= 571.70 cfs Inflow= 28.17 cfs 1.475 af Outflow= 28.02 cfs 1.475 af

Reach 11R: culvert
Length= 50.0' Max Vel= 2.1 fps Capacity= 69.89 cfs Inflow= 28.73 cfs 1.461 af Outflow= 28.10 cfs 1.460 af

Reach 12: Culvert from F Street Drainage Channel
Length= 119.2' Max Vel= 4.3 fps Capacity= 387.90 cfs Inflow= 36.39 cfs 1.976 af Outflow= 35.75 cfs 1.975 af

Reach 13: (new node)
Length= 120.0' Max Vel= 4.8 fps Capacity= 386.61 cfs Inflow= 4.48 cfs 0.433 af Outflow= 4.45 cfs 0.432 af

Reach 14: Culvert from North Entrance Road channel
Length= 112.0' Max Vel= 3.5 fps Capacity= 822.56 cfs Inflow= 3.20 cfs 0.169 af Outflow= 3.11 cfs 0.169 af

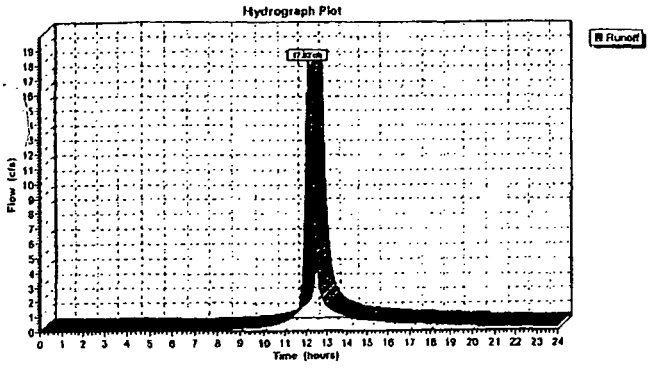
Reach 15N: Culvert adjacent to North Entrance Road
Length= 55.0' Max Vel= 2.4 fps Capacity= 406.62 cfs Inflow= 0.46 cfs 0.027 af Outflow= 0.46 cfs 0.027 af

Reach 16N: Channel east of North Entrance Road
Length= 382.0' Max Vel= 2.2 fps Capacity= 71.46 cfs Inflow= 3.58 cfs 0.170 af Outflow= 3.20 cfs 0.169 af

Pond 1P: Sedimentation Basin 2
Peak Storage= 8.937 af Inflow= 97.31 cfs 10.460 af
Primary= 3.10 cfs 1.606 af Outflow= 3.10 cfs 1.606 af

Runoff Area = 40.012 ac Volume = 10.521 af Average Depth = 3.16"

Subcatchment C: vegetated final cover



Document 6774

Subcatchment D: vegetated final cover

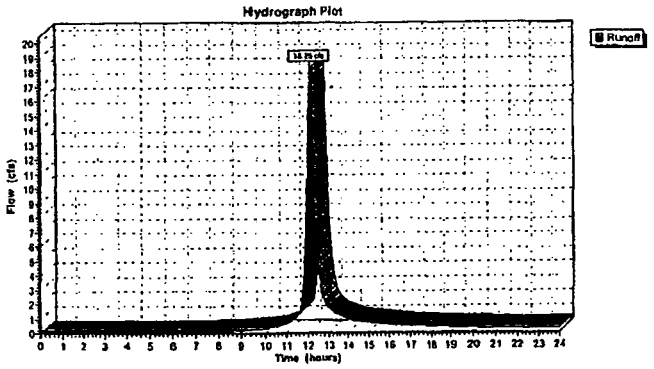
Runoff = 18.25 cfs @ 12.11 hrs, Volume= 1.332 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
5.530	83	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.9	90	0.0500	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
3.8	60	0.1000	0.3		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
6.4	150	0.1700	0.4		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"
0.5	205	0.1700	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.8	190	0.0075	4.2	75.84	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=2.00' Z= 3.0 & 6.0 '/' n= 0.030
0.1	60	0.0100	15.0	423.51	Circular Channel (pipe), Diam= 72.0" Area= 28.3 sf Perim= 18.8' r= 1.50' n= 0.013
0.5	195	0.0075	6.6	424.60	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=4.00' Z= 6.0 & 2.0 '/' n= 0.030
19.0	950	Total			

Subcatchment D: vegetated final cover



Subcatchment ER: non-vegetated final cover

[49] Hint: Tc<2dt may require smaller dt

Runoff = 32.56 cfs @ 11.94 hrs, Volume= 1.544 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
5.320	89	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	110	0.0625	2.0		Sheet Flow, Smooth surfaces n= 0.011 P2= 2.60"
0.4	45	0.1110	2.1		Sheet Flow, Smooth surfaces n= 0.011 P2= 2.60"
0.8	150	0.1700	3.2		Sheet Flow, Smooth surfaces n= 0.011 P2= 2.60"
0.5	200	0.1700	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
1.4	510	0.0075	8.1	337.31	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=3.50' Z= 3.0 & 6.0 '/' n= 0.030
0.2	85	0.0029	8.1	228.07	Circular Channel (pipe), Diam= 72.0" Area= 28.3 sf Perim= 18.8' r= 1.50' n= 0.013
4.2	1,100	Total			

Subcatchment FR: non-vegetated final cover/construction laydown

[49] Hint: Tc<2dt may require smaller dt

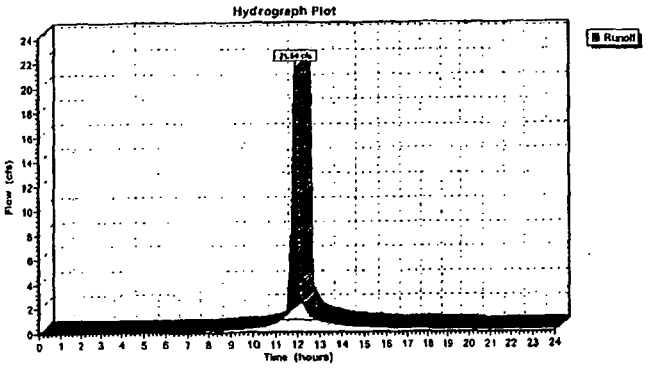
Runoff = 21.54 cfs @ 11.92 hrs, Volume= 1.016 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
3.500	89	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	70	0.0500	1.7		Sheet Flow, Smooth surfaces n= 0.011 P2= 2.60"
0.5	60	0.1000	2.1		Sheet Flow, Smooth surfaces n= 0.011 P2= 2.60"
0.8	150	0.1670	3.1		Sheet Flow, Smooth surfaces n= 0.011 P2= 2.60"
0.4	175	0.1700	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
2.4	455	Total			

Subcatchment FR: non-vegetated final cover/construction laydown



Subcatchment GR: (new node)

[49] Hint: Tc<2dt may require smaller dt

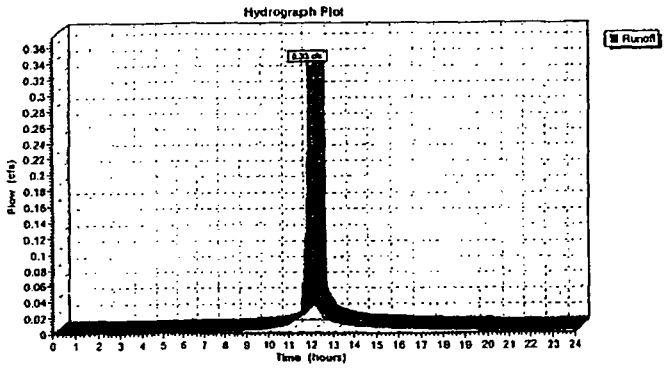
Runoff = 0.33 cfs @ 11.89 hrs, Volume= 0.015 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.050	89	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1	15	0.1300	1.8		Sheet Flow, Smooth surfaces n= 0.011 P2= 2.55"

Subcatchment GR: (new node)



Subcatchment HR: non-vegetated final cover area

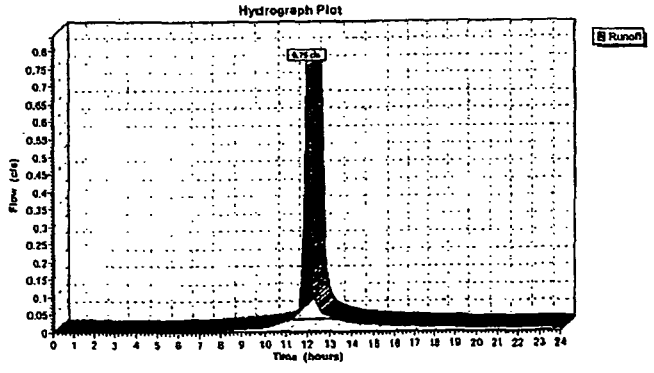
Runoff = 0.75 cfs @ 11.99 hrs, Volume= 0.041 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.140	89	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	25	0.0700	1.6		Sheet Flow, Smooth surfaces n= 0.011 P2= 2.60"
8.0	15	0.0010	0.0		Sheet Flow, Grass: Short n= 0.150 P2= 2.55"
8.3	40	Total			

Subcatchment HR: non-vegetated final cover area



Subcatchment J1R: construction laydown area

[49] Hint: Tc<2dt may require smaller dt

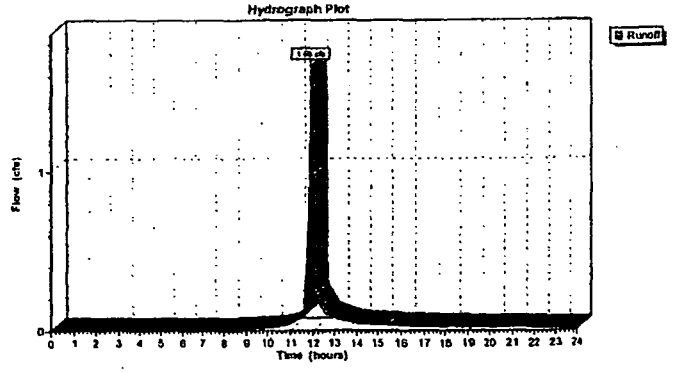
Runoff = 1.66 cfs @ 11.93 hrs, Volume= 0.073 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.312	82	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.8	54	0.1670	0.3		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"

Subcatchment J1R: construction laydown area



Subcatchment N: construction laydown area

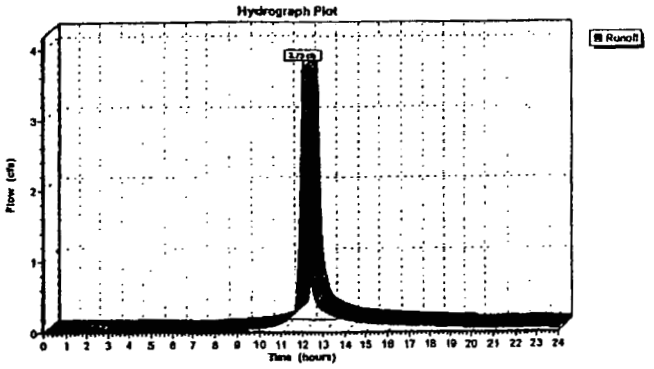
Runoff = 3.73 cfs @ 12.07 hrs, Volume= 0.244 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
1.043	82	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.2	170	0.0250	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"

Subcatchment N: construction laydown area



Subcatchment O: pond

(49) Hint: Tc<2dt may require smaller dt

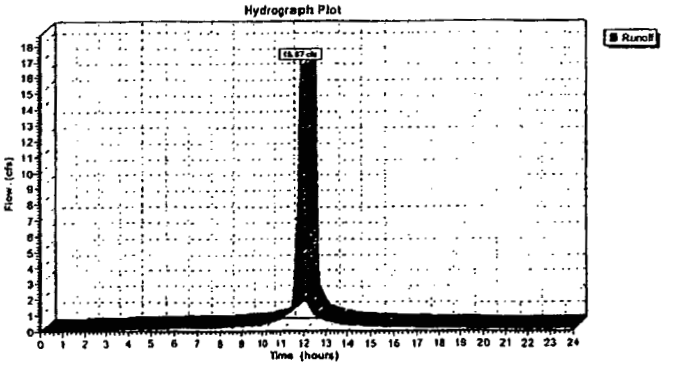
Runoff = 16.67 cfs @ 11.90 hrs, Volume= 0.838 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
2.252	98	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.0					Direct Entry,

Subcatchment O: pond



Subcatchment P1R: construction laydown area

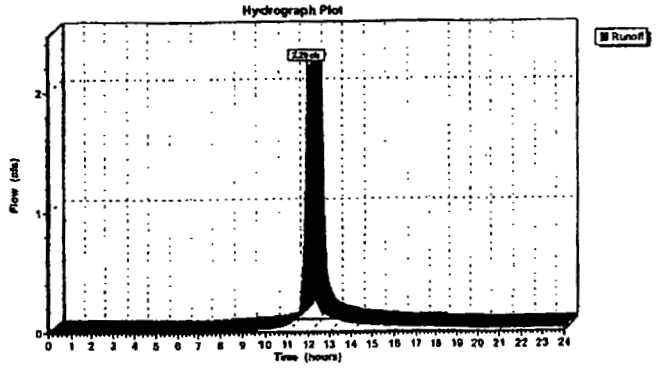
Runoff = 2.20 cfs @ 12.00 hrs, Volume= 0.115 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.490	82	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0385	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"

Subcatchment P1R: construction laydown area



Subcatchment P2R: construction laydown area

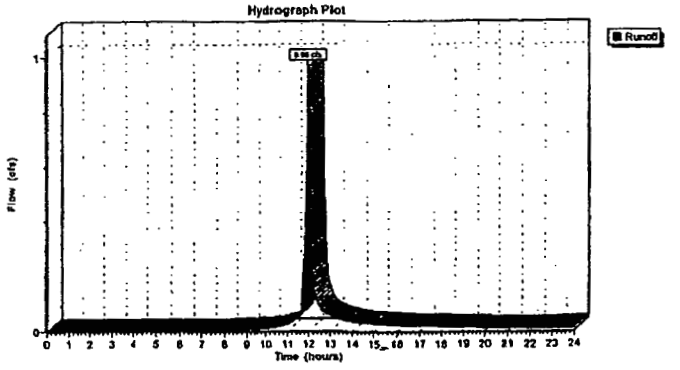
Runoff = 0.96 cfs @ 12.00 hrs, Volume= 0.050 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=4.70"

Area (ac)	CN	Description
0.214	82	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.3	110	0.0473	0.2		Sheet Flow, Grass: Short n= 0.150 P2= 2.60"

Subcatchment P2R: construction laydown area



Reach 4: west channel

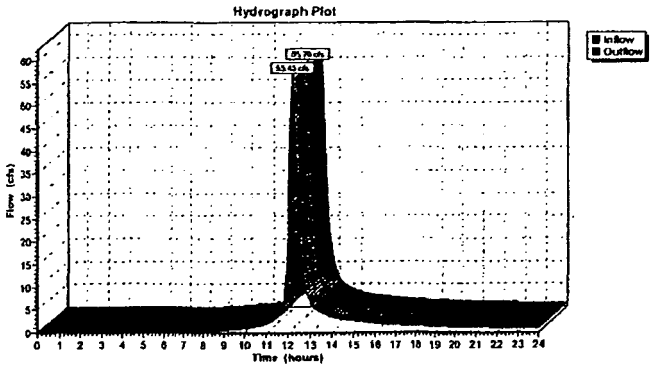
[65] Warning: Inlet elevation not specified

Inflow = 55.70 cfs @ 12.19 hrs, Volume= 4.566 af
Outflow = 55.45 cfs @ 12.20 hrs, Volume= 4.565 af, Atten= 0%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.0 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.6 fps, Avg. Travel Time= 0.9 min

Peak Depth= 1.86'
Capacity at bank full= 428.17 cfs
0.00' x 4.00' deep channel, n= 0.030 Length= 90.0' Slope= 0.0076 '/'
Side Slope Z-value= 2.0 6.0 '/'

Reach 4: west channel



Document 6774

Reach 5: culvert

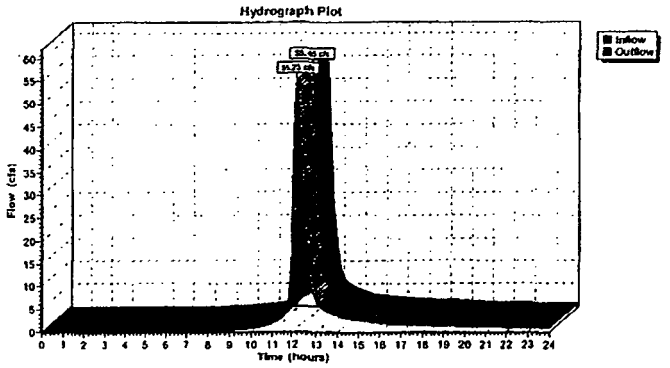
[52] Hint: Inlet conditions not evaluated
[65] Warning: Inlet elevation not specified

Inflow = 55.45 cfs @ 12.20 hrs, Volume= 4.565 af
Outflow = 55.23 cfs @ 12.21 hrs, Volume= 4.563 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.9 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.7 fps, Avg. Travel Time= 0.9 min

Peak Depth= 1.52'
Capacity at bank full= 396.64 cfs
A factor of 2.00 has been applied to the supplied storage and discharge data
72.0" Diameter Pipe n= 0.024 Length= 95.0' Slope= 0.0075 '/'

Reach 5: culvert



Reach 6: west channel

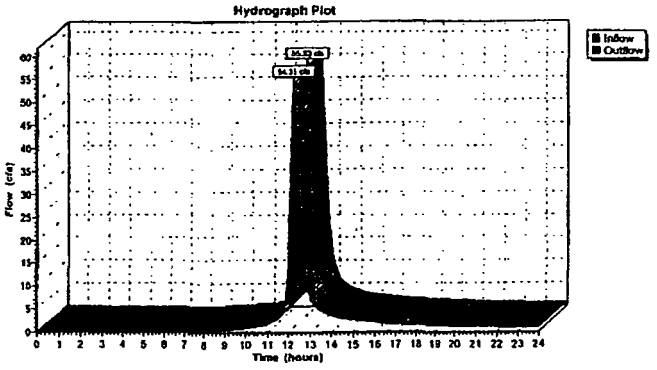
[65] Warning: Inlet elevation not specified

Inflow = 55.23 cfs @ 12.21 hrs, Volume= 4.563 af
Outflow = 54.31 cfs @ 12.25 hrs, Volume= 4.555 af, Atten= 2%, Lag= 2.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.0 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 1.6 fps, Avg. Travel Time= 3.9 min

Peak Depth= 1.86'
Capacity at bank full= 424.60 cfs
0.00' x 4.00' deep channel, n= 0.030 Length= 380.0' Slope= 0.0075 '/'
Side Slope Z-value= 6.0 2.0 '/'

Reach 6: west channel



Reach 7AR: Haul Road Culvert 1

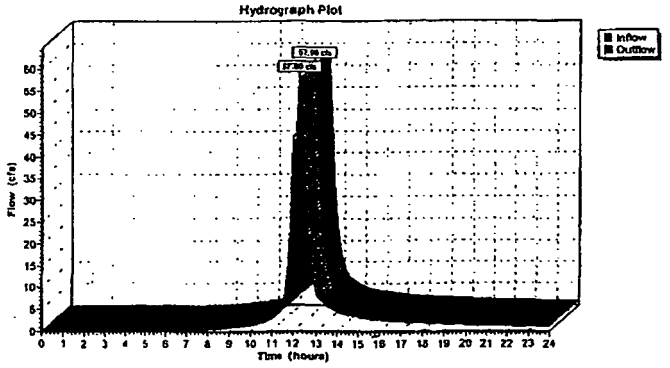
[52] Hint: Inlet conditions not evaluated
[65] Warning: Inlet elevation not specified

Inflow = 57.96 cfs @ 12.25 hrs, Volume= 6.100 af
Outflow = 57.80 cfs @ 12.26 hrs, Volume= 6.098 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.4 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.9 fps, Avg. Travel Time= 0.7 min

Peak Depth= 2.44'
Capacity at bank full= 166.63 cfs
72.0" Diameter Pipe n= 0.024 Length= 81.5' Slope= 0.0053 '/'

Reach 7AR: Haul Road Culvert 1



Reach 8BR: Culvert at Sed Basin 2 entrance

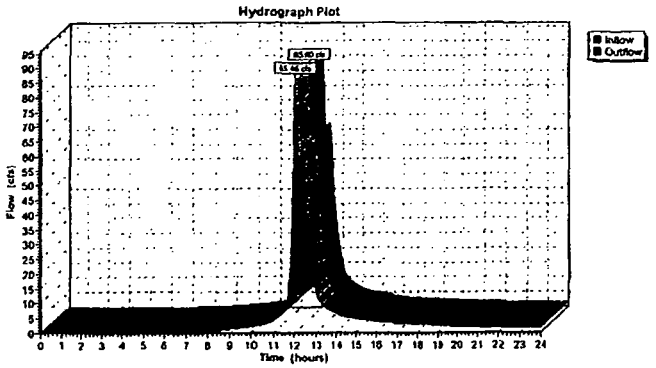
[52] Hint: Inlet conditions not evaluated
[65] Warning: Inlet elevation not specified

Inflow = 85.60 cfs @ 12.04 hrs, Volume= 8.729 af
Outflow = 85.46 cfs @ 12.04 hrs, Volume= 8.728 af, Atten= 0%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.9 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.5 fps, Avg. Travel Time= 0.2 min

Peak Depth= 1.62'
Capacity at bank full= 535.70 cfs
A factor of 2.00 has been applied to the supplied storage and discharge data
72.0" Diameter Pipe n= 0.013 Length= 30.0' Slope= 0.0040 '/'

Reach 8BR: Culvert at Sed Basin 2 entrance



Reach 8CR: Channel into Sed Basin 2

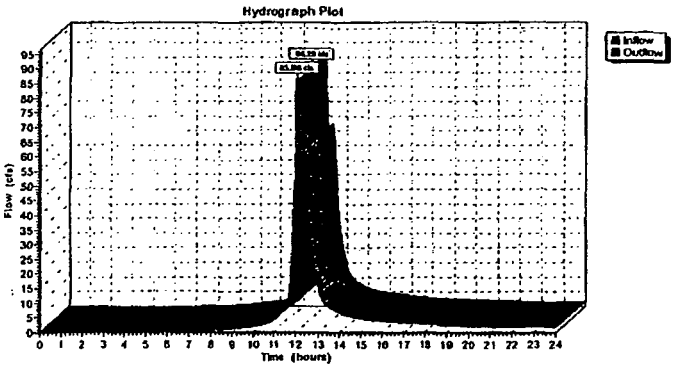
[65] Warning: Inlet elevation not specified

Inflow = 86.29 cfs @ 12.04 hrs, Volume= 8.778 af
Outflow = 85.96 cfs @ 12.05 hrs, Volume= 8.777 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 6.6 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.7 fps, Avg. Travel Time= 0.4 min

Peak Depth= 2.12'
Capacity at bank full= 728.12 cfs
1.17' x 5.00' deep channel, n= 0.030 Length= 62.7' Slope= 0.0159 '/'
Side Slope Z-value= 2.4 2.3 '/'

Reach 8CR: Channel into Sed Basin 2



Reach 9AR: Extended Drainge Channel South of Cell 8

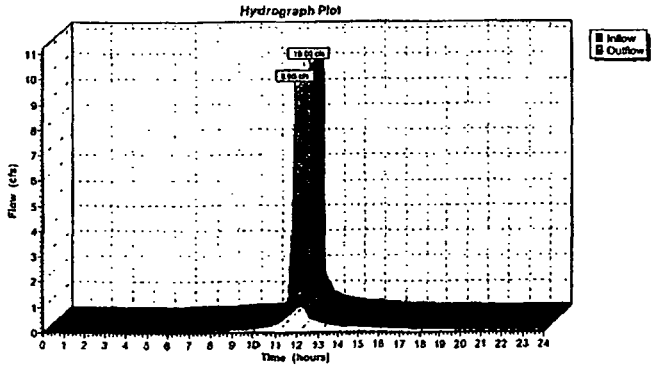
[65] Warning: Inlet elevation not specified

Inflow = 10.00 cfs @ 11.91 hrs, Volume= 0.462 af
Outflow = 9.65 cfs @ 11.93 hrs, Volume= 0.461 af, Atten= 3%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.3 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.5 fps, Avg. Travel Time= 2.2 min

Peak Depth= 0.87'
Capacity at bank full= 263.84 cfs
0.00' x 3.00' deep channel, n= 0.030 Length= 197.0' Slope= 0.0243 '/'
Side Slope Z-value= 3.0 '/'

Reach 9AR: Extended Drainge Channel South of Cell 8



Reach 9BR: (new node)

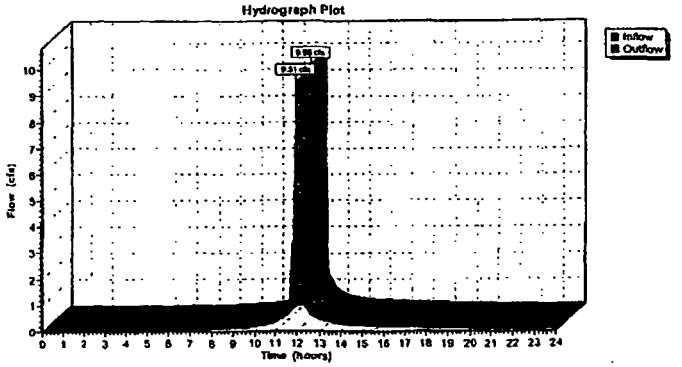
[52] Hint: Inlet conditions not evaluated
[65] Warning: Inlet elevation not specified

Inflow = 9.65 cfs @ 11.93 hrs, Volume= 0.461 af
Outflow = 9.51 cfs @ 11.94 hrs, Volume= 0.461 af, Atten= 1%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.5 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.6 fps, Avg. Travel Time= 0.9 min

Peak Depth= 0.68'
Capacity at bank full= 357.73 cfs
72.0" Diameter Pipe n= 0.024 Length= 88.0' Slope= 0.0243 '/'

Reach 9BR: (new node)



Reach 11AR: (new node)

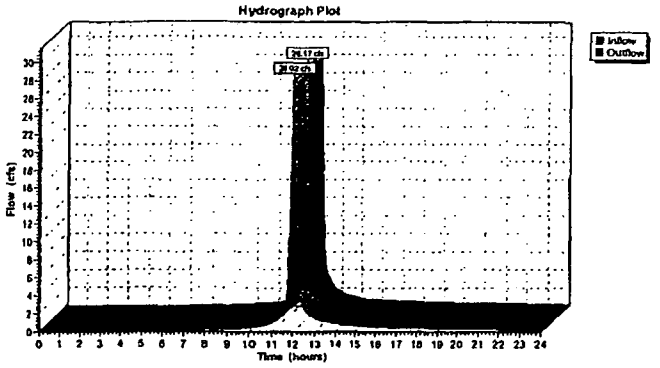
[65] Warning: Inlet elevation not specified

Inflow = 28.17 cfs @ 12.00 hrs, Volume= 1.475 af
Outflow = 28.02 cfs @ 12.00 hrs, Volume= 1.475 af, Atten= 1%, Lag= 0.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.7 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 0.7 fps, Avg. Travel Time= 0.4 min

Peak Depth= 1.02'
Capacity at bank full= 571.70 cfs
7.00' x 4.50' deep channel, n= 0.030 Length= 16.0' Slope= 0.0044 '/'
Side Slope Z-value= 3.0 '/'

Reach 11AR: (new node)



Document 6774

Reach 11R: culvert

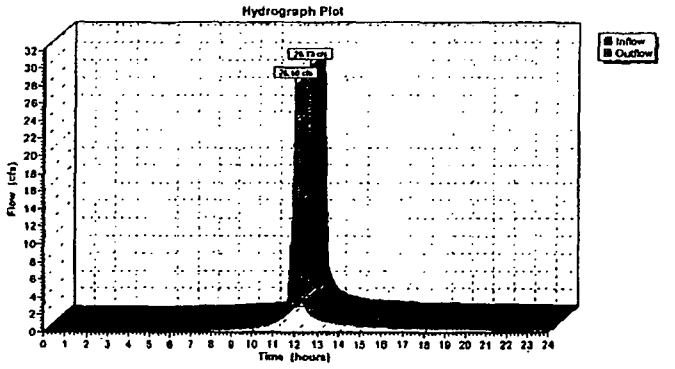
[52] Hint: Inlet conditions not evaluated
[65] Warning: Inlet elevation not specified

Inflow = 28.73 cfs @ 11.99 hrs, Volume= 1.461 af
Outflow = 28.10 cfs @ 12.00 hrs, Volume= 1.460 af, Atten= 2%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.1 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.6 fps, Avg. Travel Time= 1.3 min

Peak Depth= 2.92'
Capacity at bank full= 59.89 cfs
72.0" Diameter Pipe n= 0.013 Length= 50.0' Slope= 0.0002 '/'

Reach 11R: culvert



Reach 12: Culvert from F Street Drainage Channel

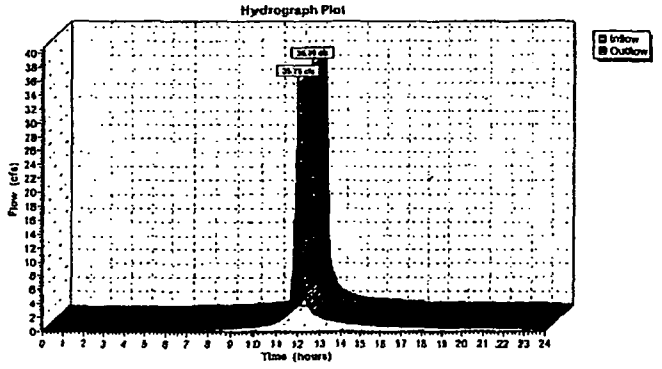
[52] Hint: Inlet conditions not evaluated
[65] Warning: Inlet elevation not specified

Inflow = 36.39 cfs @ 11.99 hrs, Volume= 1.976 af
Outflow = 35.75 cfs @ 12.00 hrs, Volume= 1.975 af, Atten= 2%, Lag= 0.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.3 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 1.3 fps, Avg. Travel Time= 1.6 min

Peak Depth= 1.24'
Capacity at bank full= 387.90 cfs
A factor of 2.00 has been applied to the supplied storage and discharge data
72.0" Diameter Pipe n= 0.013 Length= 119.2' Slope= 0.0021 '/'

Reach 12: Culvert from F Street Drainage Channel



Reach 13: (new node)

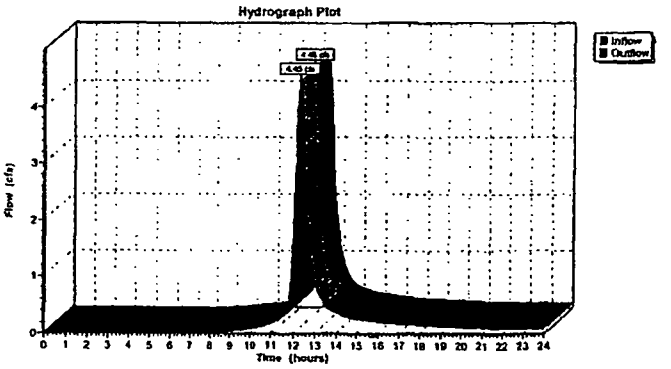
[52] Hint: Inlet conditions not evaluated
[65] Warning: Inlet elevation not specified

Inflow = 4.46 cfs @ 12.25 hrs, Volume= 0.433 af
Outflow = 4.45 cfs @ 12.26 hrs, Volume= 0.432 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.6 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 1.8 fps, Avg. Travel Time= 1.1 min

Peak Depth= 0.45'
Capacity at bank full= 386.61 cfs
72.0" Diameter Pipe n= 0.013 Length= 120.0' Slope= 0.0083 '/'

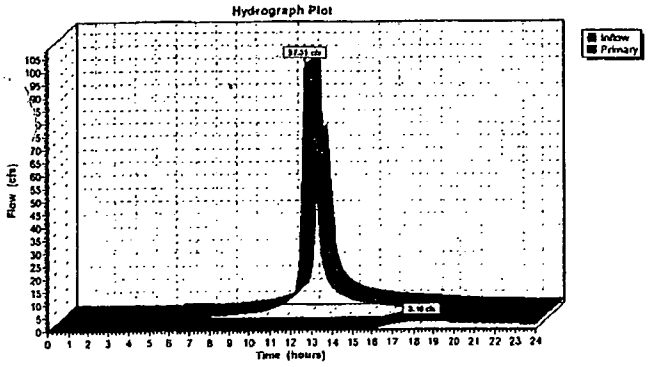
Reach 13: (new node)



Document 6774

Pond 1P: Sedimentation Basin 2

Hydrograph Plot



ATTACHMENT C-2

WEIGHTED CURVE NUMBER CALCULATIONS

SUBCATCHMENT AREA AND HYDROCAD™ INPUT PARAMETERS FOR THE CALCULATION OF WEIGHTED CN

East OSDF Construction Design Scenario

Subcatchment Label	Area (acres)	Percent of Total Area %	HSG	Land Use Description	CN	Weighted CN
A	1.96	100%	B/C	vegetated final cover	83	83
B	2.18	100%	B/C	vegetated final cover	83	83
C	5.21	100%	B/C	vegetated final cover	83	83
D	5.13	100%	B/C	vegetated final cover	83	83
E	5.09	100%	B/C	vegetated final cover	83	83
F	5.05	100%	B/C	vegetated final cover	83	83
G	5.31	100%	B/C	vegetated final cover	83	83
HR	4.59	100%	B/C	unvegetated final cover	89	89
IR	0.71	100%	B/C	unvegetated final cover	89	89
JR	2.40	100%	B/C	unvegetated final cover	89	89
L	1.68	30% 70%	B C	runon north of borrow area runon north of borrow area	69 79	76
M	1.00	100%	C	runon north of borrow area	79	79
N	7.82	100%	N/A	direct runon to pond	98	98
O	1.32	100%	C	runon north of borrow area	79	79
P	5.24	45% 55%	B C	runon north of borrow area runon north of borrow area	69 79	75
Q	7.70	70% 30%	B C	runon north of borrow area runon north of borrow area	69 79	72
R	2.61	55% 45%	B C	runon north of borrow area runon north of borrow area	69 79	74
S	0.40	10% 90%	B C	runon north of borrow area runon north of borrow area	69 79	78
U	4.15	70% 30%	B C	runon east of OSDF runon east of OSDF	69 79	72
V	0.27	100%	N/A	direct runon to pond	98	98
W	10.59	70% 30%	B C	runon east of OSDF runon east of OSDF	69 79	72
X	11.85	80% 20%	B C	runon east of OSDF runon east of OSDF	69 79	71
Y	6.52	60% 40%	B C	runon east of OSDF runon east of OSDF	69 79	73
Z	1.61	70% 30%	B C	runon east of OSDF runon east of OSDF	69 79	72
AA	2.71	55% 45%	B C	runon east of OSDF runon east of OSDF	69 79	74
BB	0.76	100%	C	runon east of OSDF	79	79
CC	0.12	100%	C	runon east of OSDF	79	79
DDR	0.96	100%	B/C	unvegetated final cover	89	89
EE	0.93	20% 80%	B C	runon north of borrow area runon north of borrow area	69 79	77
FFR	4.67	100%	B/C	unvegetated final cover	89	89
GGR	2.62	55% 45%	B C	construction laydown construction laydown	74 82	78
HH	0.55	100%	C	runon north of borrow area	79	79
II	1.67	50% 50%	B C	runon area to borrow area runon area to borrow area	61 74	68
JJ	0.91	93% 7%	B C	runon area to borrow area runon area to borrow area	61 74	62
KK	5.89	80% 20%	B C	runon area to borrow area runon area to borrow area	61 74	64
LL	7.05	100%	B	runoff	61	61
MM	1.94	100%	B	runoff	61	61
NN	1.27	60% 40%	B C	runoff runoff	61 74	66
OO	0.40	65% 35%	B C	runon area to borrow area runon area to borrow area	61 74	66
PP	40.96	80% 20%	B C	vegetated borrow area vegetated borrow area	61 74	64

N/A - Not Applicable

RESULTS FOR THE CALCULATION OF WEIGHTED CN
West OSDF Construction Design Scenario

Subcatchment Label	Area (acres)	Percent of Total Area %	HSG	Land Use Description	CN	Weighted CN
A	2.73	100%	B/C	vegetated final cover	83	83
B	5.34	100%	B/C	vegetated final cover	83	83
C	5.40	100%	B/C	vegetated final cover	83	83
D	5.53	100%	B/C	vegetated final cover	83	83
ER	5.32	100%	B/C	unvegetated final cover	89	89
F1R	0.92	100%	B/C	unvegetated final cover	89	89
F2R	1.55	100%	B/C	unvegetated final cover	89	89
FR	3.50	100%	B/C	unvegetated final cover	89	89
GR	0.05	100%	B/C	unvegetated final cover	89	89
HR	0.14	100%	B/C	unvegetated final cover	89	89
J1R	0.31	100%	C	construction laydown	82	82
J2R	0.97	100%	C	construction laydown	82	82
KR	1.59	100%	C	unvegetated final cover	89	89
LR	1.86	100%	C	construction laydown	82	82
MR	0.68	100%	C	runon north of borrow area	79	79
N	1.04	100%	C	construction laydown	82	82
O	2.25	100%	N/A	direct runon to pond	98	98
P1R	0.49	100%	C	construction laydown	82	82
P2R	0.21	100%	C	construction laydown	82	82
QN	0.13	100%	C	runon north of borrow area	79	79

ATTACHMENT C-3

TABULATED ANALYSIS RESULTS FOR CHANNELS

OSDF CONSTRUCTION/FILLING PERIOD CONDITIONS
SUMMARY OF CHANNEL ANALYSIS RESULTS

Channel Identification			Channel Characteristics							Hydrologic Calculations		Hydraulic Calculations							
Channel Name[1]	Status	Design Scenario	Section Shape	Minimum Channel Depth (ft)	Longitudinal Slope[2] (%)	Manning n	Bottom Width B (ft)	Side Slope M_1:1	Side Slope M_2:1	HydroCAD Node	HydroCAD Q[4] (cfs)	Area of Flow A (sq ft)	Perimeter P (ft)	Hydraulic Radius, R (ft)	Peak Flow Depth[5] Y (ft)	Estimated Q[5] (cfs)	Channel Freeboard[7] (ft)	Peak Flow Velocity (fps)	Lining Type[6]
7R	new	E OSDF	vee	6.0	0.50%	0.030	0	6	3	8R	76.85	21.19	20.06	1.06	2.17	77.18	3.8	3.64	grass
8R	new	E OSDF	vee	5.5	0.50%	0.030	0	6	2	9R	76.73	20.61	18.88	1.09	2.27	76.74	3.2	3.72	grass
9R	new	E OSDF	trapezoidal	3.8	0.50%	0.030	3	6	3	10AR	76.67	21.35	20.29	1.05	1.87	77.55	1.9	3.63	grass
10AR	new	E OSDF	trapezoidal	3.9	0.50%	0.030	9	6	3	28R	77.45	22.29	22.31	1.00	1.44	78.24	2.4	3.51	grass
10BR	new/existing	E OSDF	trapezoidal	2.6	1.00%	0.030	9.7	3	3	11	79.65	16.64	17.54	0.95	1.24	79.79	1.4	4.79	grass
12R	existing	E OSDF	trapezoidal	2.5	0.63%	0.030	14	3	4.3	12R + HH	81.42	21.60	22.94	0.94	1.18	81.81	1.3	3.79	grass
13R	existing	E OSDF	trapezoidal	2.1	0.67%	0.030	23.11	2.3	4	13R	145.19	34.12	31.47	1.08	1.26	146.41	0.8	4.29	grass
18	new	E OSDF	vee	3.0	1.00%	0.030	0	3	3	19	38.43	8.77	10.81	0.81	1.71	37.89	1.3	4.32	grass
19	new	E OSDF	vee	3.0	0.90%	0.030	0	3	3	20	43.35	10.05	11.57	0.87	1.83	43.07	1.2	4.29	grass
20	new	E OSDF	vee	3.0	0.83%	0.030	0	3	3	1P - U - V	40.72	9.94	11.51	0.86	1.82	40.77	1.2	4.10	grass
30	new	E OSDF	vee	2.5	1.00%	0.030	0	3	3	30	45.98	10.05	11.57	0.87	1.83	45.40	0.7	4.52	grass
21	new	E OSDF	vee	3.0	1.00%	0.030	0	3	3	22	46.33	10.27	11.70	0.88	1.85	46.74	1.2	4.55	grass
22	new	E OSDF	vee	4.0	1.00%	0.030	0	3	3	29	47.10	10.27	11.70	0.88	1.85	46.74	2.2	4.55	grass
29	new	E OSDF	vee	3.5	1.00%	0.030	0	3	3	23	48.76	10.49	11.83	0.89	1.87	48.10	1.6	4.58	grass
24	new	E OSDF	trapezoidal	2.0	0.75%	0.030	8.5	3	3	24	57.15	14.21	15.96	0.89	1.18	56.54	0.8	3.98	grass
26	new	E OSDF	vee	2.5	0.75%	0.030	0	3	3	27	65.00	14.52	13.91	1.04	2.20	64.26	0.3	4.43	grass
7BR	new	W OSDF	vee	3.8	0.23%	0.030	0	6	2	7BR	57.98	22.47	19.72	1.14	2.37	58.39	1.4	2.60	grass
7DR	existing	W OSDF	trapezoidal	3.0	0.62%	0.030	2.56	4	10	7DR	58.39	17.53	22.52	0.78	1.41	57.95	1.6	3.31	grass
8AR	existing	W OSDF	trapezoidal	3.0	0.48%	0.030	13.28	4.2	2.6	8AR	87.19	24.35	22.94	1.06	1.36	87.19	1.6	3.58	grass
8CR	existing	W OSDF	trapezoidal	5.0	1.59%	0.030	1.17	2.4	2.3	8CR	86.29	13.15	12.05	1.09	2.13	87.34	2.9	6.64	rip rap
9AR	new	W OSDF	vee	3.0	2.43%	0.030	0	3	3	9AR	10.00	2.32	5.57	0.42	0.88	10.04	2.1	4.32	grass
9R	new	W OSDF	vee	5.0	2.42%	0.030	0	3	3	9R	10.16	2.38	5.63	0.42	0.89	10.33	4.1	4.35	grass
10AR	new	W OSDF	trapezoidal	1.8	6.50%	0.030	5	3	3	10AR	9.78	1.84	6.96	0.26	0.31	9.58	1.4	5.21	rip rap
10R	new	W OSDF	trapezoidal	2.5	0.44%	0.030	7	3	3	10R	31.61	11.19	13.89	0.81	1.09	31.93	1.4	2.85	grass
11AR	new	W OSDF	trapezoidal	4.5	0.44%	0.030	7	3	3	11AR	28.17	10.26	13.45	0.76	1.02	28.22	5.5	2.75	grass
16N	existing	W OSDF	vee	2.9	0.69%	0.030	0	2.2	1.4	16N	3.58	1.56	3.85	0.41	0.93	3.51	2.0	2.26	grass

E OSDF = East OSDF Construction-Phase Design Scenario
W OSDF = West OSDF Construction-Phase Design Scenario
DC A = Design Case "A"
DC B = Design Case "B"

Notes:
1. Channels are named after the corresponding subcatchment or reach.
2. Longitudinal slopes taken from the Drawings.
4. Peak inflow rates calculated by HydroCAD for each reach. See attachment C-1.
5. Calculated flow rates using an iterative procedure and compared with flow from HydroCAD.
6. Maximum permissible velocity for grass lined channels is 5 fps.
7. Calculated as the difference between minimum available flow depth and peak flow depth.

Document 6774

ATTACHMENT C-4A

CulvertMaster® OUTPUT REPORTS FOR CULVERTS

CulvertMaster® OUTPUT REPORTS FOR CULVERTS

EAST OSDF DESIGN SCENARIO

Culvert Designer/Analyzer Report
east node 11

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	ft	Storm Event	Design	
Computed Headwater Elev:	586.64	ft	Discharge	79.65	cfs
Headwater Depth/Height	1.32		Tailwater Elevation	584.74	ft
Inlet Control HW Elev.	586.64	ft	Control Type	Inlet Control	
Outlet Control HW Elev.	586.63	ft			

Grades					
Upstream Invert	583.67	ft	Downstream Invert	583.58	ft
Length	40.00	ft	Constructed Slope	0.002355	ft/ft

Hydraulic Profile					
Profile	M2		Depth, Downstream	1.80	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	1.80	ft
Velocity Downstream	7.80	ft/s	Critical Slope	0.004563	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.010	
Section Material	HDPE (Smooth Interior)		Span	2.25	ft
Section Size	27 inch		Rise	2.25	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	586.63	ft	Upstream Velocity Head	0.76	ft
Ke	0.20		Entrance Loss	0.15	ft

Inlet Control Properties					
Inlet Control HW Elev.	586.64	ft	Flow Control	Submerged	
Inlet Type	Groove end projecting		Area Full	11.9	ft^2
K	0.00450		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	3	
C	0.03170		Equation Form	1	
Y	0.69000				

Culvert Design Report
east node 28R

Design: Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	ft	Storm Event	Design	
Computed Headwater Elevation	588.02	ft	Discharge	77.45	cfs
Headwater Depth/Height	1.03		Tailwater Elevation	586.01	ft
Inlet Control HW Elev.	587.87	ft	Control Type	Outlet Control	
Outlet Control HW Elev.	588.02	ft			

Grades					
Upstream Invert	585.20	ft	Downstream Invert	584.79	ft
Length	85.73	ft	Constructed Slope	0.004782	ft/ft

Hydraulic Profile					
Profile	M2		Depth, Downstream	1.54	ft
Slope Type	Mild		Normal Depth	2.01	ft
Flow Regime	Subcritical		Critical Depth	1.54	ft
Velocity Downstream	6.90	ft/s	Critical Slope	0.009123	ft/ft

Section					
Section Shape	Arch		Mannings Coefficient	0.019	
Section Material	Steel and Aluminum Var CR		Span	4.08	ft
Section Size	49 x 33 inch		Rise	2.75	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	588.02	ft	Upstream Velocity Head	0.48	ft
Ke	0.90		Entrance Loss	0.44	ft

Inlet Control Properties					
Inlet Control HW Elev.	587.87	ft	Flow Control	N/A	
Inlet Type	Thin wall projecting		Area Full	17.8	ft^2
K	0.03400		HDS 5 Chart	34	
M	1.50000		HDS 5 Scale	3	
C	0.04960		Equation Form	1	
Y	0.57000				

CulvertMaster® OUTPUT REPORTS FOR CULVERTS

WEST OSDF SCENARIO

Culvert Designer/Analyzer Report
west node 8BR

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	577.00	ft	Storm Event	Design	
Computed Headwater Elev:	575.43	ft	Discharge	85.60	cfs
Headwater Depth/Height	1.10		Tailwater Elevation	573.32	ft
Inlet Control HW Elev.	575.30	ft	Control Type	Outlet Control	
Outlet Control HW Elev.	575.43	ft			

Grades					
Upstream Invert	572.12	ft	Downstream Invert	572.00	ft
Length	30.00	ft	Constructed Slope	0.004000	ft/ft

Hydraulic Profile					
Profile	M2		Depth, Downstream	2.13	ft
Slope Type	Mild		Normal Depth	2.50	ft
Flow Regime	Subcritical		Critical Depth	2.13	ft
Velocity Downstream	7.97	ft/s	Critical Slope	0.005654	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	575.43	ft	Upstream Velocity Head	0.83	ft
Ke	0.20		Entrance Loss	0.17	ft

Inlet Control Properties					
Inlet Control HW Elev.	575.30	ft	Flow Control	Unsubmerged	
Inlet Type	Groove end w/headwall		Area Full	14.1	ft^2
K	0.00180		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Culvert Designer/Analyzer Report
west node 9BR design

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	ft	Storm Event	Design	
Computed Headwater Elev:	580.52	ft	Discharge	9.65	cfs
Headwater Depth/Height	1.63		Tailwater Elevation	576.97	ft
Inlet Control HW Elev.	580.52	ft	Control Type	Inlet Control	
Outlet Control HW Elev.	580.48	ft			

Grades					
Upstream Invert	578.08	ft	Downstream Invert	576.00	ft
Length	88.00	ft	Constructed Slope	0.023636	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.04	ft
Slope Type	Steep		Normal Depth	1.04	ft
Flow Regime	Supercritical		Critical Depth	1.20	ft
Velocity Downstream	7.38	ft/s	Critical Slope	0.016952	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.018	
Section Material	CMP		Span	1.50	ft
Section Size	18 inch		Rise	1.50	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	580.48	ft	Upstream Velocity Head	0.63	ft
Ke	0.90		Entrance Loss	0.57	ft

Inlet Control Properties					
Inlet Control HW Elev.	580.52	ft	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	1.8	ft^2
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Designer/Analyzer Report
west node 11R design

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	ft	Storm Event	Design	
Computed Headwater Elev	582.31	ft	Discharge	28.73	cfs
Headwater Depth/Height	2.40		Tailwater Elevation	579.94	ft
Inlet Control HW Elev.	581.53	ft	Control Type	Outlet Control	
Outlet Control HW Elev.	582.31	ft			

Grades					
Upstream Invert	577.50	ft	Downstream Invert	577.50	ft
Length	50.00	ft	Constructed Slope	0.000000	ft/ft

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	2.44	ft
Slope Type	N/A		Normal Depth	N/A	ft
Flow Regime	N/A		Critical Depth	1.84	ft
Velocity Downstream	9.15	ft/s	Critical Slope	0.013997	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	582.31	ft	Upstream Velocity Head	1.30	ft
Ke	0.20		Entrance Loss	0.26	ft

Inlet Control Properties					
Inlet Control HW Elev.	581.53	ft	Flow Control	Submerged	
Inlet Type	Groove end projecting		Area Full	3.1	ft^2
K	0.00450		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	3	
C	0.03170		Equation Form	1	
Y	0.69000				

Culvert Designer/Analyzer Report
west node 12 design

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	581.90	ft	Storm Event	Design	
Computed Headwater Elev	579.99	ft	Discharge	36.39	cfs
Headwater Depth/Height	1.60		Tailwater Elevation	577.18	ft
Inlet Control HW Elev.	579.46	ft	Control Type	Outlet Control	
Outlet Control HW Elev.	579.99	ft			

Grades					
Upstream Invert	576.00	ft	Downstream Invert	575.75	ft
Length	119.24	ft	Constructed Slope	0.002097	ft/ft

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	2.05	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	2.05	ft
Velocity Downstream	8.47	ft/s	Critical Slope	0.007900	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.50	ft
Section Size	30 inch		Rise	2.50	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	579.99	ft	Upstream Velocity Head	0.85	ft
Ke	0.20		Entrance Loss	0.17	ft

Inlet Control Properties					
Inlet Control HW Elev.	579.46	ft	Flow Control	Submerged	
Inlet Type	Groove end projecting		Area Full	4.9	ft^2
K	0.00450		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	3	
C	0.03170		Equation Form	1	
Y	0.69000				

Culvert Designer/Analyzer Report
west node 13

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	581.50	ft	Storm Event	Design	
Computed Headwater Elev	580.20	ft	Discharge	4.46	cfs
Headwater Depth/Height	0.80		Tailwater Elevation	N/A	ft
Inlet Control HW Elev.	580.16	ft	Control Type	Entrance Control	
Outlet Control HW Elev.	580.20	ft			

Grades					
Upstream Invert	579.00	ft	Downstream Invert	578.00	ft
Length	120.00	ft	Constructed Slope	0.008300	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.72	ft
Slope Type	Steep		Normal Depth	0.72	ft
Flow Regime	Supercritical		Critical Depth	0.81	ft
Velocity Downstream	5.32	ft/s	Critical Slope	0.005570	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.50	ft
Section Size	18 inch		Rise	1.50	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	580.20	ft	Upstream Velocity Head	0.33	ft
Ke	0.20		Entrance Loss	0.07	ft

Inlet Control Properties					
Inlet Control HW Elev.	580.16	ft	Flow Control	Unsubmerged	
Inlet Type	Groove end projecting		Area Full	1.8	ft^2
K	0.00450		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	3	
C	0.03170		Equation Form	1	
Y	0.69000				

ATTACHMENT C-4B

TABULATED ANALYSIS RESULTS FOR CULVERTS

OSDF CONSTRUCTION/FILLING PERIOD CONDITIONS
SUMMARY OF CULVERT ANALYSES RESULTS

CULVERT IDENTIFICATION			PHYSICAL CHARACTERISTICS O				AL CAPACITY (6)			OUTLET PROTECTION (6)				
Culvert Name	Status (1)	Design Scenario	Material - Type	Entrance Loss Coefficient (Ke)	Manning's n	Entrance Configu (2)	ffic	Minimum Required Cover (ft)	Structurally Stable	Outlet Velocity (ft/s)	Riprap Length at Inlet (ft)	Riprap Length at Outlet (ft)	d_{50} (in)	Thickness (in)
								-	-	7.8	-	-	-	-
11a	existing	E OSDF	HDPE	0.2	0.010	Projecting	ay	2	yes	6.4	6	12	6	12
11b	existing	E OSDF	RCP	0.2	0.013	Projecting	ay	2	yes	4.9	0	0	0	0
23	new	E OSDF	Helical CMP	0.9	0.018	Projecting	way	3	yes	6.8	7	14	6	12
25	new	E OSDF	Helical CMP - Arch	0.9	0.018	Projecting	ay	3	yes	6.9	8	16	6	12
27	new	E OSDF	Helical CMP - Arch	0.9	0.018	Projecting		-	-	2.3	-	-	-	-
28R	new - temporary	E OSDF	Helical CMP - Arch	0.9	0.019	Projecting								
31	existing	E OSDF	HDPE	0.9	0.012	Projecting	way	3	yes	7.48	7	14	6	12
							ay	3	yes	8.30	6	12	6	12
5	new - temporary	W OSDF	Helical CMP	0.9	0.024	Projecting		-	-	8.40	-	-	-	-
7AR	new	W OSDF	CMP	0.9	0.024	Projecting		-	-	7.97	-	-	-	-
7CR	existing	W OSDF	RCP - Horizontal Ellips	0.2	0.013	Concrete Hea	way	3	yes	7.38	3	6	6	12
8BR	existing	W OSDF	RCP	0.2	0.013	Concrete Hea		N/A	N/A	5.16	2.5	5	6	12
9BR	new	W OSDF	Helical CMP	0.9	0.018	Projecting	way	2	yes	9.15	4	8	6	12
10BR	new	W OSDF	RCP	0.2	0.013	Projecting	way	2	yes	8.47	5	10	6	12
11R	new	W OSDF	RCP	0.2	0.013	Projecting	way	2	yes	5.32	3	6	6	12
12	new	W OSDF	RCP	0.2	0.013	Projectin		-	-	4.04	-	-	-	-
13	new	W OSDF	RCP	0.2	0.013	Projectin		-	-	2.89	-	-	-	-
14	existing	W OSDF	CMP	0.9	0.024	Projectin								
15N	existing	W OSDF	HDPE	0.2	0.010	Projectin								

- E OSDF = East OSDF Construction-Phase Design Scenario
- W OSDF = West OSDF Construction-Phase Design Scenario
- DC A = Design Case "A"
- N/A = Not Applicable
- d_{50} = Average particle diameter

Notes
(1) New indicat
(2) Entrance co
(3) Dimensions
(4) Headwater
(5) Grading is
(6) Neither stru

SECTION 13.3

13.3 OSDF PHASE V, EAST 2000-YEAR DRAINAGE CHANNEL EVALUATION

COMPUTATION COVER SHEET

SUBJECT OF COMPUTATIONS OSDF PHASE V, EAST 2000-YEAR DRAINAGE CHANNEL EVALUATION

Computations By:
(Cognizant Engineer)

Signature: Victoria Cheplak — Date: 1-21-04

Printed Name and Title: Victoria Cheplak, Senior Staff Engineer

Assumptions and Procedures Checked By:
(Checker)

Signature: [signature] — Date: 1-21-04

Printed Name and Title: Ganesh Gopalakrishnan, Senior Engineer

Computations Checked by:

Signature: Hollie Kinnecom — Date: 1-21-04

Printed Name and Title: Holly Kinnecom, Staff Engineer

Computations Backchecked by:
(Cognizant Engineer)

Signature: Victoria Cheplak — Date: 1-21-04

Printed Name and Title: Victoria Cheplak, Senior Staff Engineer

Approved by:
(PDP)

Signature: [signature] — Date: 1-21-04

Printed Name and Title: Ganesh Gopalakrishnan, Senior Engineer

Approved by:
(DTL/TETL)

Signature: Rudolph Bonaparte — Date: 1/22/04

Printed Name and Title: R. Bonaparte, Engineer of Record

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
0	Submittal to FF/DOE/EPA	30 Jan 02	DGP for DBM	DGP	JFB
1	CFC Revision 1 Submittal to FF/DOE/EPA	23 Jan 04	VSC VSC	GG	RB
2A	DCN-Cell 8 Expansion	16 June 04	VSC VAC	GG	
2	CFC Revision 2 Submittal to FF/DOE/EPA	11 Feb 05	VSC VAC	GG	JFB/JFB

ADDENDUM TO SECTION 13.3

(REVISION 2A DUE TO CELL 8 EXPANSION DCN)

This addendum details the calculations that were revised within Section 13.3, OSDF Phase V, East 2000-Year Drainage Channel Evaluation, of the Final Design Calculation Package for the Fernald Environmental Management Project (FEMP), due to the re-design of Cell 8. This re-design, referred to as the Cell 8 Expansion DCN, encompasses the extension of Cell 8 by approximately 100-feet to the South. This addendum discusses the modifications made to this calculation package as Revision 2A and as associated with this DCN.

For Revision 2A to this calculation package, the critical case for the drainage channel aligned along the east perimeter of the OSDF during the 2000-Year, 24-Hour Storm (i.e. the 2000-Year Drainage Channel) was evaluated to confirm the adequacy of the channel using the revised channel and OSDF geometry. This critical case is presented as the Heavy Vegetation Scenario, which considers Manning's n values of 0.24 for sheet flow and 0.07 for channel flow. The surface water management system was modified to reflect the design changes resulting from the expansion of Cell 8 and analyzed to verify the adequacy of the channel. For this submittal, only the Heavy Vegetation Scenario was modified; it should be noted that the Light and Moderate Vegetation Scenarios, detailed in this section, were not modified as they are less conservative than the critical Heavy Vegetation Scenario and are therefore not presented.

In order to present the results of this DCN analysis in an efficient manner, only the attachments that summarize the modifications and updated results for the 2000-Year Drainage Channel Evaluation with regard to the DCN are presented. These attachments are listed subsequently and explained in further detail.

- **Attachment A-1 – Layout of 2000-Year Storm Design Scenarios.** This layout demonstrates the revised configuration of the OSDF. Each surface water structure is labeled as identified in the hydrologic analysis.

- **Attachment A-2 – Nodal Network Diagram.** This diagram demonstrates the revised configuration of the surface water management system as a result of the DCN.

- **Attachment B-2 – Data for Calculation of Time of Concentration.** These data demonstrate the revised flow paths used to calculate the time of concentration for the revised configuration of subcatchments used in the hydrologic analysis.

- **Attachment C-1C – HydroCAD Output Reports – 2000-Year, 24-Hour Storm Event, 2000-Year Design Scenario – Heavy Vegetation.** This attachment provides the results of the hydrologic modeling for the 2000-Year Drainage Channel under the Heavy Vegetation Design Scenario for the 2000-Year, 24-Hour Storm, which is considered the critical case for these calculations.

- **Attachment C-2 – Weighted Curve Number Calculations.** These calculations present the revised areas and Curve Numbers for the revised configuration of subcatchments used in the hydrologic analysis.

- **Attachment C-3 – Tabulated Channel Analysis Results.** These results present the revised channel characteristics (i.e., geometry), flow within each channel, and hydraulic characteristics including peak flow depth and available freeboard, for the revised configuration of the 2000-Year Drainage Channel used in the hydrologic and hydraulic analysis.

Based on the analyses for the design change of the expansion of Cell 8, the 2000-Year Drainage Channel is adequate to convey the 2000-Year, 24-Hour Storm Event and provide the required freeboard.

ATTACHMENT A-1

LAYOUT OF 2000-YEAR STORM DESIGN SCENARIOS

LEGEND

SUBCATCHMENT LABEL AND BOUNDARY

REACH ALIGNMENT AND LABEL

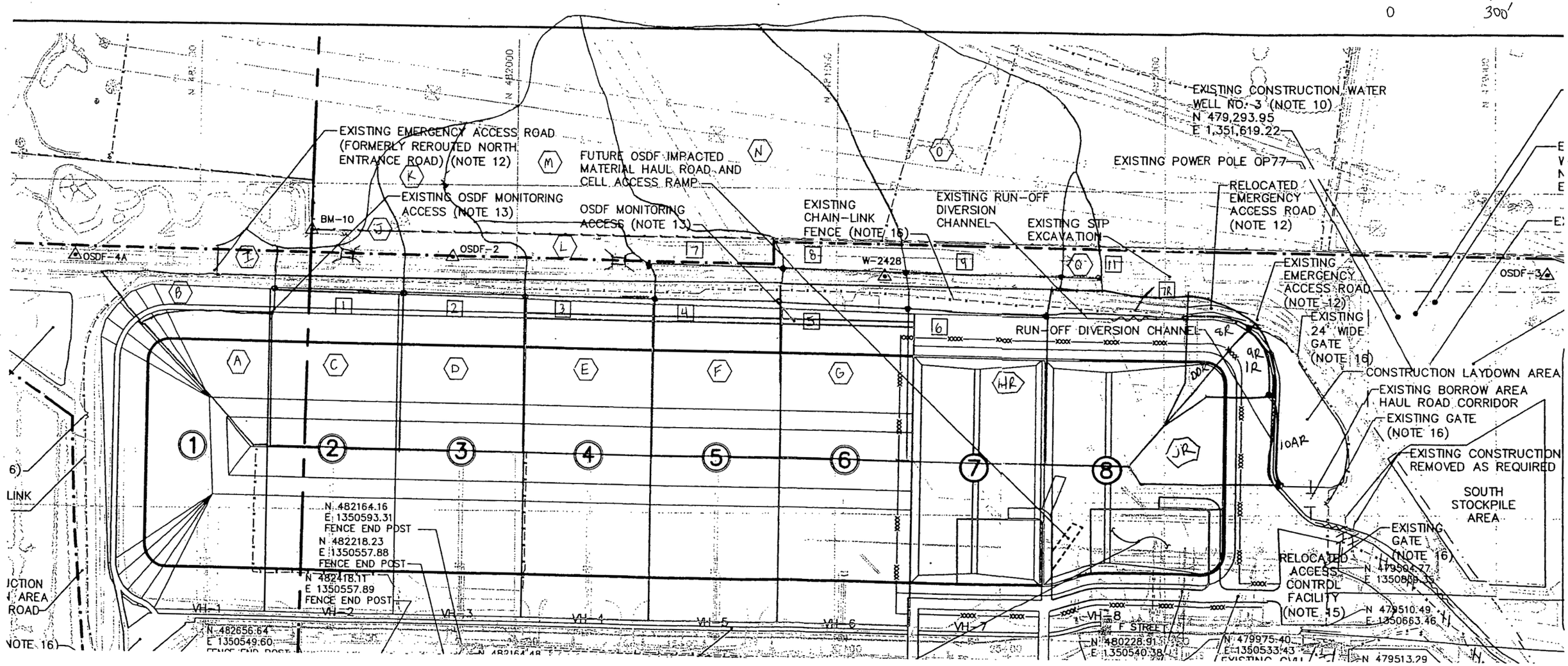
CULVERT

PHASE V
2000 YEAR STORM DESIGN SCEN.

N

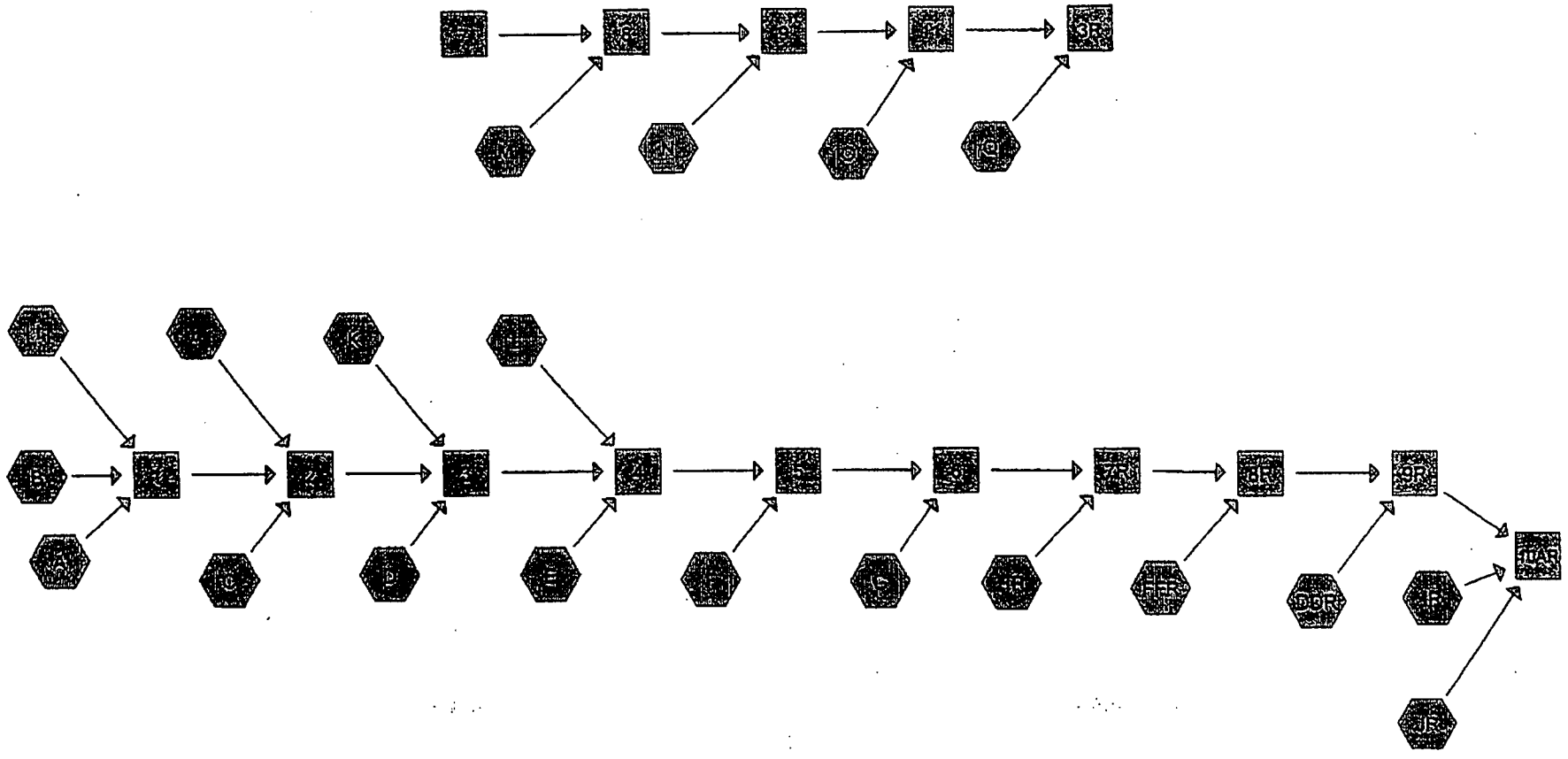
SCALE 1"=300'

0 300'



ATTACHMENT A-2

NODAL NETWORK DIAGRAM



Drainage Diagram for 2000 year storm-heavy
Prepared by GeoSyntec Consultants 6/15/2004
HydroCAD® 6.00 s/n 000929 © 1986-2001 Applied Microcomputer Systems

ATTACHMENT B-2

DATA FOR CALCULATION OF TIME OF CONCENTRATION

BOE 31010 - Purchases Services	BOE 31010 - Purchased Services Product	Fmon	Nmon	Month	Qty	Each	Extended	Oct-Dec Qtr1	Jan-Mar Qtr2	Apr-Jun Qtr3	Jul-Sep Qtr4	Requisition No.	Date Submitted
	Chemical Abstract Service STN Easy Account	2	11	Nov	1	$400	$400	$ 400					
	Monsen Engineering - Pathfinder Office (expired 7/04)	2	11	Nov	1	$765	$765	$ 765					
	Monsen Engineering - GeoExplorer UNIT T S/N 4427E01456 (11/06)	2	11	Nov	1	$292	$292	$ 292					
	Monsen Engineering - Terrasync UNIT T (12/06)	2	11	Nov	1	$265	$265	$ 265					
	Monsen Engineering - ProXRS S/N 0224098285 Omnistar	2	11	Nov	1	$900	$900	$ 900					
	AutoDesk (DLT), all products	3	12	Dec	1	$10,520	$10,520	$ 10,520					
	ESRI Arc/Info Primary Maintenance (NT) (12/12)	3	12	Dec	1	$2,426	$2,426	$ 2,426					
	ESRI Arc/Info Secondary Maintenance (NT) (12/12)	3	12	Dec	1	$1,200	$1,200	$ 1,200					
	ESRI ArcView Concurrent Use Primary Maintenance (12/12)	3	12	Dec	1	$700	$700	$ 700					
	ESRI ArcView Concurrent Use Secondary Maintenance (12/12)	3	12	Dec	4	$500	$2,000	$ 2,000					
	ESRI ArcGIS Spatial Analyst Concurrent Use Primary Maintenance (12/12)	3	12	Dec	1	$500	$500	$ 500					
	ESRI ArcGIS 3D Analyst Concurrent Use Primary Maintenance	3	12	Dec	1	$500	$500	$ 500					
	ESRI ArcIMS One Server Two CPUs Maintenance 12/12	3	12	Dec	1	$1,764	$1,764	$ 1,764					
	ESRI ArcSDE Developer Support Group Maintenance for One Server TWO CPUs and Five Read and Write Connections	3	12	Dec	1	$2,262	$2,262	$ 2,262					
	ESRI ArcView Concurrent Use Secondary Maintenance (11/23/06 - 12/12/07)	3	12	Dec	1	$527	$527	$ 527					
	ESRI Arc GIS Data Interoperability Concurrent Use Primary Maintenance (9/23/06 - 12/12/07)	3	12	Dec	1	$611	$611	$ 611					
	ESRI Arc GIS Data Interoperability Concurrent Use Secondary Maintenance (9/23/06 - 12/12/07)	3	12	Dec	1	$244	$244	$ 244					
	ESRI ArcInfo Floating Secondary Maintenance (2/4/07 - 12/12/07) xfered from Mound	3	12	Dec	1	$1,026	$1,026	$ 1,026					
	ESRI ArcView Concurrent Use Secondary Maintenance (2/4/07 - 12/12/07) xfered from Mound	3	12	Dec	1	$427	$427	$ 427					
	ESRI ArcGIS 3D Analyst Concurrent Use Secondary Maintenance (2/4/07 - 12/12/07_ xfered from Mound	3	12	Dec	1	$171	$171	$ 171					
	ESRI ArcGIS Publisher Concurrent Use Primary Maintenance (2/4/07 - 12/12/07) xfered from Mound	3	12	Dec	1	$427	$427	$ 427					
	ESRI ArcInfo Floating Secondary Maintenance (10/1/05 - 12/12/07) xfered from RFETS	3	12	Dec	1	$13,200	$13,200	$ 13,200					
	ESRI ArcGIS Analyst Concurrent Use Secondary Maintenance (2/4/07 - 12/12/07)	3	12	Dec	1	$177	$177	$ 177					
	Xerox Color Laser Printer (7700) NOW WIDDOP'S	8	5	May	1	$1,279	$1,279			$ 1,279			
	Xerox Color Laser Printer (7700) S/N: LGM302656	8	5	May	1	$1,279	$1,279			$ 1,279			
	Geocortex IMF Maintenance (6/22)	9	6	Jun	1	$2,900	$2,900			$ 2,900			
	Geocortex IMF Prepaid Technical Support Hours (25 Hrs. @ $95 hr.)	9	6	Jun	1	$2,375	$2,375			$ 2,375			
	Geocortex Uptime Business Edition - Software Maintenance	9	6	Jun	1	$500	$500			$ 500			
	Geocortex Statistics Enterprise Edition - Software Maintenance	9	6	Jun	1	$500	$500			$ 500			
	Bentley Systems - CulvertMaster (7/31)	10	7	Jul	1	$200	$200				$ 200		
	Bentley Systems - FlowMaster (9/30)	10	7	Jul	1	$240	$240				$ 240		
	Bentley Systems - WaterCAD (7/31)	10	7	Jul	1	$480	$480				$ 480		
	DayCad HP 4500 Printer/Plotter Support (Good thru 8/11/2009)	11	8	Aug	1	$1,999	$1,999				$ 1,999		
	Xerox Color Laser Printer (7750) Outside S. Lyons Office S/N: RRW602555	11	8	Aug	1	$1,249	$1,249				$ 1,249		
	Ctech EVS (9/30)	12	9	Sep	1	$3,038	$3,038				$ 3,038		
	LK Survey Oce 7051 copier (9/30/2000)	12	9	Sep	1	$495	$495				$ 495		
						Total (down)	$ 57,838	$ 41,305	$ -	$ 8,833	$ 7,701		
						Total (across)	$ 57,838						

Document 6774

HYDROCAD™ INPUT PARAMETERS FOR THE CALCULATION OF TIME OF CONCENTRATION
2000 YEAR STORM DESIGN SCENARIO - HEAVY VEGETATION

2-year, 24-hr Design Rainfall Depth, P_{2-24} = 2.60 inches

SUBCATCHMENT LABEL AND DESCRIPTION		SHEET FLOW 1				SHEET FLOW 2				SHEET FLOW 3				SHALLOW CONCENTRATED FLOW			SHALLOW CONCENTRATED FLOW			CHANNEL FLOW 1						CHANNEL FLOW 2					
No.	Description	Flow Length (ft)	Surface Description	Manning's n	Land Slope (ft/ft)	Flow Length (ft)	Surface Description	Manning's n	Land Slope (ft/ft)	Flow Length (ft)	Surface Description	Manning's n	Land Slope (ft/ft)	Flow Length (ft)	Surface Description	Land Slope (ft/ft)	Flow Length (ft)	Surface Description	Land Slope (ft/ft)	Flow Length (ft)	Bottom Width (ft)	Flow Depth (ft)	Sideslopes (ft/ft)	Manning's n	Longitudinal Slope (ft/ft)	Flow Length (ft)	Bottom Width (ft)	Flow Depth (ft)	Sideslopes (ft/ft)	Manning's n	Longitudinal Slope (ft/ft)
A	vegetated final cover	90	grass: dense	0.240	0.0500	60	grass: dense	0.240	0.1000	150	grass: dense	0.240	0.1700	190	unpaved	0.1700	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B	vegetated final cover	90	grass: dense	0.240	0.0750	-	-	-	-	-	-	-	-	-	-	-	-	-	-	130	0	2.03	6.0, 6.0	0.070	0.0250	320	0	2.03	4.0, 6.0	0.070	0.0075
C	vegetated final cover	90	grass: dense	0.240	0.0500	60	grass: dense	0.240	0.1000	150	grass: dense	0.240	0.1700	190	unpaved	0.1700	-	-	-	370	0	2.33	6.0, 4.0	0.070	0.0035	-	-	-	-	-	-
D	vegetated final cover	90	grass: dense	0.240	0.0500	60	grass: dense	0.240	0.1000	150	grass: dense	0.240	0.1700	180	unpaved	0.1700	-	-	-	200	0	2.86	6.0, 5.0	0.070	0.0083	150	0	2.86	6.0, 4.0	0.070	0.0045
DDR	vegetated final cover	210	grass: dense	0.240	0.1700	12	smooth	0.011	0.0500	-	-	-	-	-	-	-	-	-	-	241	0	5.50	6.0, 2.0	0.070	0.0050	-	-	-	-	-	-
E	vegetated final cover	90	grass: dense	0.240	0.0500	60	grass: dense	0.240	0.1000	150	grass: dense	0.240	0.1700	170	unpaved	0.1700	-	-	-	50	0	3.32	6.0, 4.0	0.070	0.0045	320	0	3.32	6.0, 3.0	0.070	0.0105
F	vegetated final cover	90	grass: dense	0.240	0.0500	60	grass: dense	0.240	0.1000	150	grass: dense	0.240	0.1700	175	unpaved	0.1700	-	-	-	360	0	3.68	4.0, 6.0	0.070	0.0050	-	-	-	-	-	-
FFR	vegetated final cover	90	grass: dense	0.240	0.0500	50	grass: dense	0.240	0.1000	160	grass: dense	0.240	0.1700	120	unpaved	0.1700	12	paved	0.0500	467	0	5.49	6.0, 3.0	0.070	0.0050	-	-	-	-	-	-
G	vegetated final cover	90	grass: dense	0.240	0.0500	60	grass: dense	0.240	0.1000	150	grass: dense	0.240	0.1700	175	unpaved	0.1700	-	-	-	370	0	3.86	3.0, 6.0	0.070	0.0050	-	-	-	-	-	-
HR	vegetated final cover	90	grass: dense	0.240	0.0500	50	grass: dense	0.240	0.1000	150	grass: dense	0.240	0.1700	160	unpaved	0.1700	-	-	-	400	0	5.70	3.0, 6.0	0.070	0.0100	-	-	-	-	-	-
I	runoo east of OSDF	210	grass: dense	0.240	0.0050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55	0	2.03	4.0, 6.0	0.070	0.0075	-	-	-	-	-	-
IR	vegetated final cover	300	grass: dense	0.240	0.1300	-	-	-	-	-	-	-	-	30	unpaved	0.1300	20	paved	0.0500	144	3	3.80	6.0, 3.0	0.070	0.0050	-	-	-	-	-	-
J	runoo east of OSDF	300	grass: dense	0.240	0.0158	-	-	-	-	-	-	-	-	100	unpaved	0.0158	-	-	-	150	0	2.33	6.0, 4.0	0.070	0.0035	-	-	-	-	-	-
JR	vegetated final cover	80	grass: dense	0.240	0.0500	22	grass: dense	0.240	0.1000	165	grass: dense	0.240	0.1700	145	unpaved	0.1700	12	paved	0.0500	-	-	-	-	-	-	-	-	-	-	-	-
K	runoo east of OSDF	300	grass: dense	0.240	0.0070	-	-	-	-	-	-	-	-	290	unpaved	0.0200	-	-	-	250	0	2.86	6.0, 4.0	0.070	0.0045	-	-	-	-	-	-
L	runoo east of OSDF	300	grass: dense	0.240	0.0250	-	-	-	-	-	-	-	-	140	unpaved	0.0250	170	unpaved	0.0375	90	0	3.32	6.0, 3.0	0.070	0.0105	-	-	-	-	-	-
M	runoo east of OSDF	300	grass: dense	0.240	0.0100	-	-	-	-	-	-	-	-	350	unpaved	0.0139	180	unpaved	0.0167	360	0	0.82	4.0, 3.0	0.070	0.0125	-	-	-	-	-	-
N	runoo east of OSDF	300	grass: dense	0.240	0.0198	-	-	-	-	-	-	-	-	770	unpaved	0.0198	-	-	-	395	0	1.17	58.0, 3.0	0.070	0.0100	-	-	-	-	-	-
O	runoo east of OSDF	300	grass: dense	0.240	0.0200	-	-	-	-	-	-	-	-	420	unpaved	0.0200	-	-	-	250	0	1.17	60.0, 3.0	0.070	0.0100	-	-	-	-	-	-
Q	runoo east of OSDF	300	grass: dense	0.240	0.0200	-	-	-	-	-	-	-	-	250	unpaved	0.0200	-	-	-	170	0	4.08	5.7, 13.5	0.070	0.0100	-	-	-	-	-	-

ATTACHMENT C-1C

2000-YEAR STORM DESIGN SCENARIO – HEAVY VEGETATION
2000-YEAR, 24-HOUR STORM EVENT

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Type II 24-hr Rainfall=13.00"
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment A: vegetated final cover
Tc=25.4 min CN=99 Area=2.601 ac Runoff= 27.84 cfs 2.780 af

Subcatchment B: vegetated final cover
Tc=12.1 min CN=99 Area=1.637 ac Runoff= 24.87 cfs 1.754 af

Subcatchment C: vegetated final cover
Tc=29.9 min CN=99 Area=4.960 ac Runoff= 48.10 cfs 5.297 af

Subcatchment D: vegetated final cover
Tc=28.2 min CN=99 Area=4.746 ac Runoff= 47.77 cfs 5.070 af

Subcatchment DDR: (new node)
Tc=13.8 min CN=99 Area=0.960 ac Runoff= 13.90 cfs 1.028 af

Subcatchment E: vegetated final cover
Tc=27.5 min CN=99 Area=4.946 ac Runoff= 50.54 cfs 5.285 af

Subcatchment F: vegetated final cover
Tc=28.0 min CN=99 Area=4.814 ac Runoff= 48.59 cfs 5.143 af

Subcatchment FFR: vegetated final cover
Tc=27.7 min CN=99 Area=4.670 ac Runoff= 47.49 cfs 4.990 af

Subcatchment G: vegetated final cover
Tc=28.0 min CN=99 Area=4.946 ac Runoff= 49.93 cfs 5.284 af

Subcatchment HR: vegetated final cover
Tc=26.2 min CN=99 Area=4.590 ac Runoff= 48.22 cfs 4.905 af

Subcatchment I: runon east of OSDF
Tc=20.4 min CN=90 Area=0.530 ac Runoff= 6.24 cfs 0.517 af

Subcatchment IR: (new node)
Tc=19.2 min CN=99 Area=0.710 ac Runoff= 8.84 cfs 0.760 af

Subcatchment J: runon east of OSDF
Tc=44.5 min CN=90 Area=1.242 ac Runoff= 9.07 cfs 1.207 af

Subcatchment JR: (new node)
Tc=22.1 min CN=99 Area=2.400 ac Runoff= 27.75 cfs 2.567 af

Subcatchment K: runon east of OSDF
Tc=62.4 min CN=86 Area=2.623 ac Runoff= 14.65 cfs 2.425 af

Document 6774

Subcatchment L: runon east of OSDF
Tc=37.2 min CN=86 Area=1.779 ac Runoff= 14.28 cfs 1.653 af

Subcatchment M: runon east of OSDF
Tc=59.5 min CN=86 Area=7.234 ac Runoff= 41.83 cfs 6.693 af

Subcatchment N: runon east of OSDF
Tc=48.4 min CN=85 Area=11.684 ac Runoff= 77.52 cfs 10.687 af

Subcatchment O: runon east of OSDF
Tc=44.0 min CN=86 Area=10.935 ac Runoff= 78.19 cfs 10.149 af

Subcatchment Q: runon east of OSDF
Tc=40.7 min CN=87 Area=1.520 ac Runoff= 11.56 cfs 1.428 af

Reach 1: runoff channel
Inflow= 52.44 cfs 5.051 af
Length= 405.0' Max Vel= 1.5 fps Capacity= 1,099.51 cfs Outflow= 49.07 cfs 5.034 af

Reach 2: runoff channel
Inflow= 104.36 cfs 11.538 af
Length= 385.0' Max Vel= 2.2 fps Capacity= 880.57 cfs Outflow= 102.73 cfs 11.513 af

Reach 3: runoff channel
Inflow= 155.41 cfs 19.009 af
Length= 405.0' Max Vel= 2.7 fps Capacity= 681.67 cfs Outflow= 153.39 cfs 18.973 af

Reach 3R: (new node)
Inflow= 180.08 cfs 28.844 af
Outflow= 180.08 cfs 28.844 af

Reach 4: runoff channel
Inflow= 206.22 cfs 25.911 af
Length= 395.0' Max Vel= 2.4 fps Capacity= 590.36 cfs Outflow= 203.76 cfs 25.859 af

Reach 5: runoff channel
Inflow= 236.60 cfs 31.002 af
Length= 405.0' Max Vel= 2.5 fps Capacity= 360.07 cfs Outflow= 234.19 cfs 30.942 af

Reach 6: runoff channel
Inflow= 262.61 cfs 36.226 af
Length= 490.0' Max Vel= 2.6 fps Capacity= 433.33 cfs Outflow= 259.87 cfs 36.144 af

Reach 7: east runon ditch
Length= 395.0' Max Vel= 0.0 fps Capacity= 104.13 cfs Outflow= 0.00 cfs 0.000 af

Reach 7R: (new node)
Inflow= 279.05 cfs 41.049 af
Length= 467.0' Max Vel= 2.6 fps Capacity= 376.60 cfs Outflow= 277.04 cfs 40.962 af

Reach 8: east runon ditch
Inflow= 41.83 cfs 6.693 af
Length= 405.0' Max Vel= 1.3 fps Capacity= 768.96 cfs Outflow= 41.21 cfs 6.667 af

Reach 8R: (new node)
Inflow= 294.24 cfs 45.952 af
Length= 241.0' Max Vel= 2.8 fps Capacity= 433.14 cfs Outflow= 292.95 cfs 45.904 af

Reach 9: east runon ditch
Inflow= 110.42 cfs 17.353 af
Length= 475.0' Max Vel= 1.7 fps Capacity= 5,717.07 cfs Outflow= 108.78 cfs 17.290 af

Reach 9R: (new node)
Inflow= 294.37 cfs 46.932 af
Length= 144.0' Max Vel= 2.7 fps Capacity= 1,284.57 cfs Outflow= 293.60 cfs 46.902 af

Reach 10AR: (new node)
Inflow= 300.45 cfs 50.229 af
Length= 356.0' Max Vel= 2.7 fps Capacity= 424.75 cfs Outflow= 298.99 cfs 50.144 af

Reach 11: (new node)
Inflow= 171.73 cfs 27.440 af
Length= 170.0' Max Vel= 2.5 fps Capacity= 543.34 cfs Outflow= 171.26 cfs 27.416 af

Runoff Area = 79.507 ac Volume = 79.624 af Average Depth = 12.02"

Subcatchment A: vegetated final cover

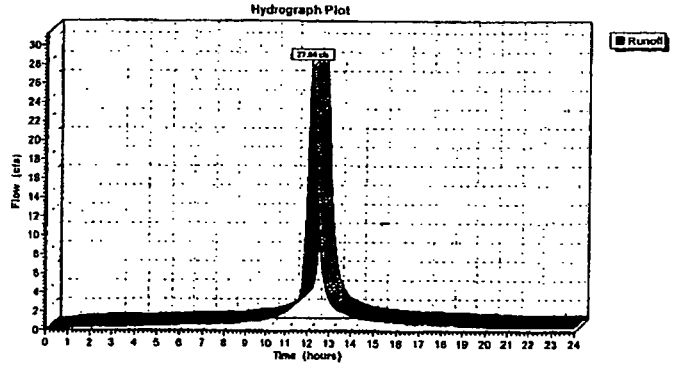
Runoff = 27.84 cfs @ 12.17 hrs; Volume= 2.780 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=13.00"

Area (ac)	CN	Description
2.601	99	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	90	0.0500	0.1		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
5.5	60	0.1000	0.2		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
9.3	150	0.1700	0.3		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
0.5	190	0.1700	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
25.4	490	Total			

Subcatchment A: vegetated final cover



Subcatchment E: vegetated final cover

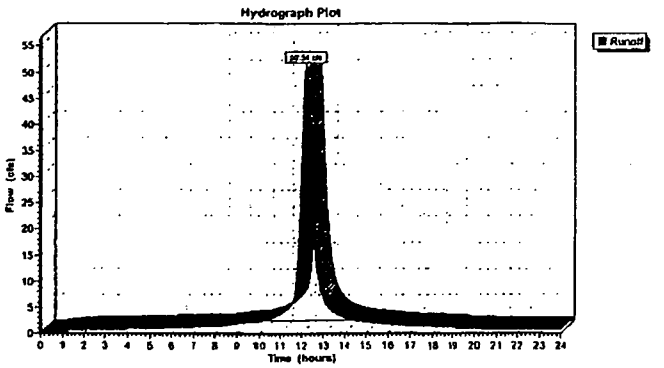
Runoff = 50.54 cfs @ 12.20 hrs, Volume= 5.285 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=13.00"

Area (ac)	CN	Description
1.946	99	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	90	0.0500	0.1		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
5.5	60	0.1000	0.2		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
9.3	150	0.1700	0.3		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
0.4	170	0.1700	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.4	50	0.0045	2.0	108.55	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=3.32' Z= 6.0 & 4.0 '/' n= 0.070
1.8	320	0.0105	3.0	148.58	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=3.32' Z= 6.0 & 3.0 '/' n= 0.070
27.5	840	Total			

Subcatchment E: vegetated final cover



Subcatchment F: vegetated final cover

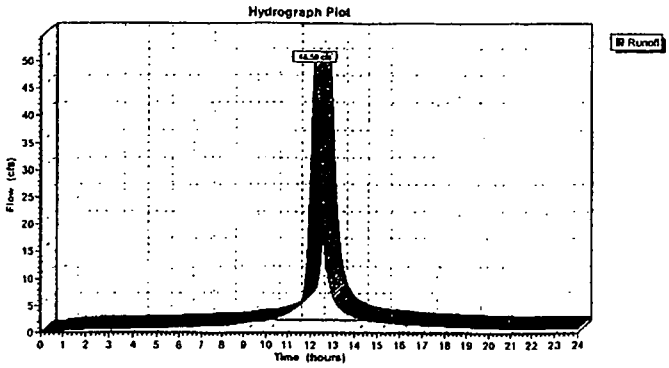
Runoff = 48.59 cfs @ 12.20 hrs, Volume= 5.143 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=13.00"

Area (ac)	CN	Description
4.814	99	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	90	0.0500	0.1		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
5.5	60	0.1000	0.2		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
9.3	150	0.1700	0.3		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
0.4	175	0.1700	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
2.7	360	0.0050	2.2	150.56	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=3.68' Z= 4.0 & 6.0 '/' n= 0.070
28.0	835	Total			

Subcatchment F: vegetated final cover



Subcatchment FFR: vegetated final cover

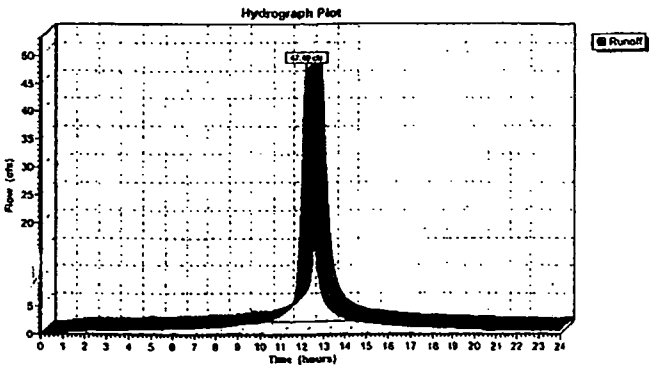
Runoff = 47.49 cfs @ 12.20 hrs, Volume= 4.990 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=13.00"

Area (ac)	CN	Description
4.670	99	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	90	0.0500	0.1		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
4.8	50	0.1000	0.2		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
9.8	160	0.1700	0.3		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
0.3	120	0.1700	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.0	12	0.0500	4.5		Shallow Concentrated Flow, Paved Kv= 20.3 fps
2.7	487	0.0050	2.9	392.06	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=5.49' Z= 6.0 & 3.0 '/' n= 0.070
27.7	899	Total			

Subcatchment FFR: vegetated final cover



Subcatchment G: vegetated final cover

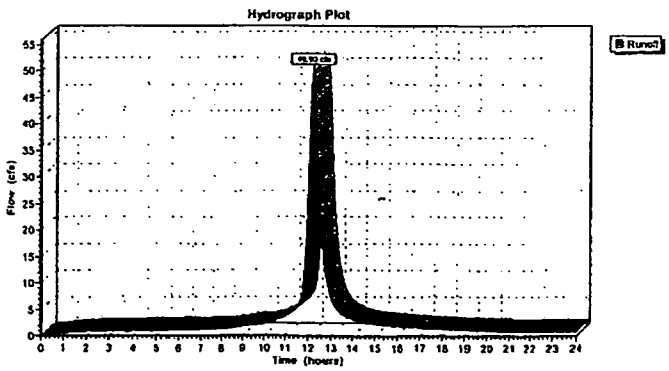
Runoff = 49.93 cfs @ 12.20 hrs, Volume= 5.284 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=13.00"

Area (ac)	CN	Description
4.946	99	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.1	90	0.0500	0.1		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
5.5	60	0.1000	0.2		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
9.3	150	0.1700	0.3		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
0.4	175	0.1700	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
2.7	370	0.0050	2.3	153.25	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=3.86' Z= 3.0 & 6.0 '/' n= 0.070
28.0	845	Total			

Subcatchment G: vegetated final cover



Subcatchment JR: (new node)

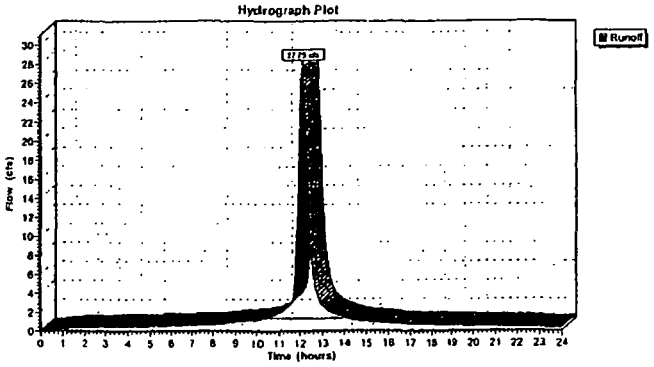
Runoff = 27.75 cfs @ 12.14 hrs, Volume= 2.567 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=13.00"

Area (ac)	CN	Description
.400	99	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	80	0.0500	0.1		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
2.5	22	0.1000	0.1		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
10.0	155	0.1700	0.3		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
0.4	145	0.1700	6.6		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.0	12	0.0500	4.5		Shallow Concentrated Flow, Paved Kv= 20.3 fps
22.1	424	Total			

Subcatchment JR: (new node)



Document 6274

Subcatchment K: runon east of OSDF

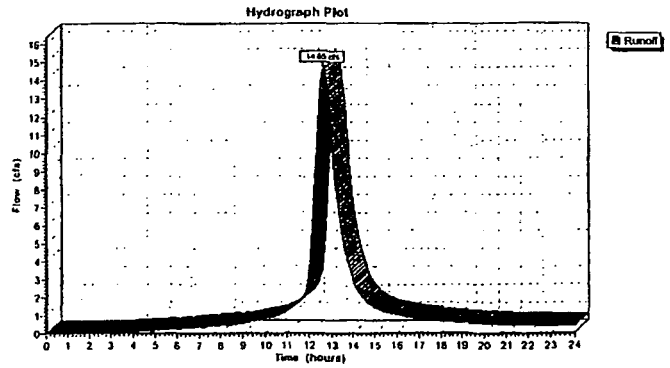
Runoff = 14.65 cfs @ 12.63 hrs, Volume= 2.425 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=13.00"

Area (ac)	CN	Description
2.623	86	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
58.0	300	0.0070	0.1		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
2.1	290	0.0200	2.3		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
2.3	250	0.0045	1.8	72.93	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=2.86' Z= 6.0 & 4.0 '/' n= 0.070
62.4	840	Total			

Subcatchment K: runon east of OSDF



Subcatchment L: runon east of OSDF

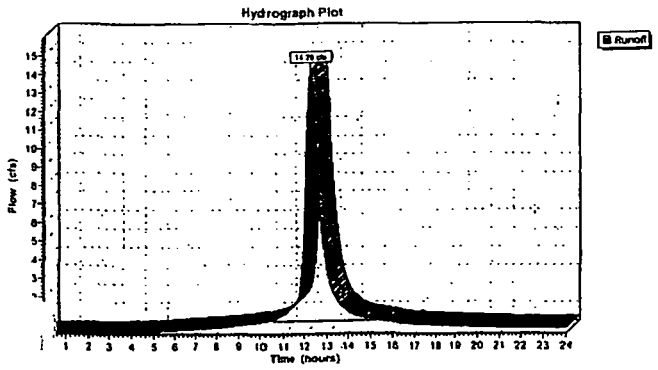
Runoff = 14.28 cfs @ 12.31 hrs, Volume= 1.653 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=13.00"

Area (ac)	CN	Description
1.779	86	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
34.9	300	0.0250	0.1		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
0.9	140	0.0250	2.5		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.9	170	0.0375	3.1		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
0.5	90	0.0105	3.0	148.58	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=3.32' Z= 6.0 & 3.0 '/' n= 0.070
37.2	700	Total			

Subcatchment L: runon east of OSDF



Subcatchment M: runon east of OSDF

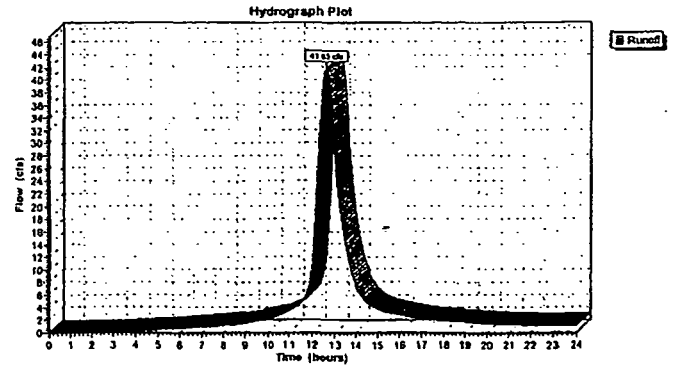
Runoff = 41.83 cfs @ 12.59 hrs, Volume= 6.693 af

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type II 24-hr Rainfall=13.00"

Area (ac)	CN	Description
7.234	86	

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
50.3	300	0.0100	0.1		Sheet Flow, Grass: Dense n= 0.240 P2= 2.60"
3.1	350	0.0139	1.9		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
1.4	180	0.0167	2.1		Shallow Concentrated Flow, Unpaved Kv= 16.1 fps
4.7	360	0.0125	1.3	3.00	Trap/Vee/Rect Channel Flow, Bot.W=0.00' D=0.82' Z= 4.0 & 3.0 '/' n= 0.070
59.5	1,190	Total			

Subcatchment M: runon east of OSDF



Reach 2: runoff channel

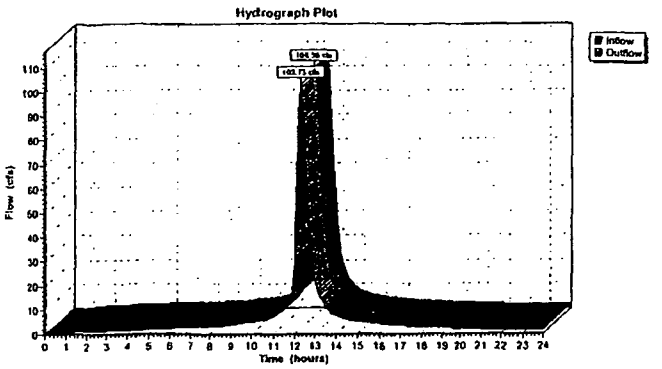
[65] Warning: Inlet elevation not specified

Inflow = 104.36 cfs @ 12.23 hrs, Volume= 11.538 af
Outflow = 102.73 cfs @ 12.32 hrs, Volume= 11.513 af, Atten= 2%, Lag= 5.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.2 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 0.9 fps, Avg. Travel Time= 7.0 min

Peak Depth= 2.94'
Capacity at bank full= 880.57 cfs
0.00' x 6.57' deep channel, n= 0.070 Length= 385.0' Slope= 0.0064 '/'
Side Slope Z-value= 6.0 5.0 '/'

Reach 2: runoff channel



Reach 3: runoff channel

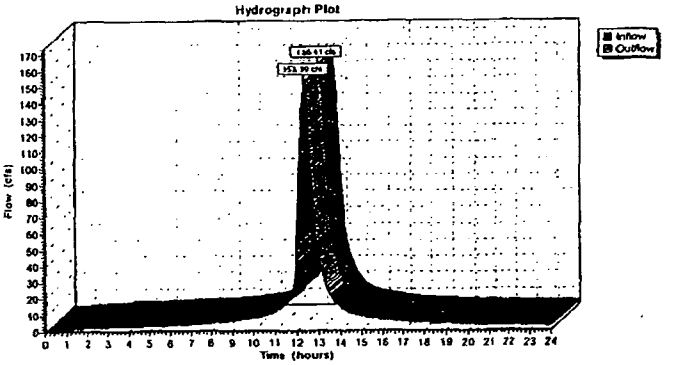
[65] Warning: Inlet elevation not specified

Inflow = 155.41 cfs @ 12.30 hrs, Volume= 19.009 af
Outflow = 153.39 cfs @ 12.37 hrs, Volume= 18.973 af, Atten= 1%, Lag= 4.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.7 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 1.1 fps, Avg. Travel Time= 5.9 min

Peak Depth= 3.58'
Capacity at bank full= 681.67 cfs
0.00' x 6.26' deep channel, n= 0.070 Length= 405.0' Slope= 0.0075 '/'
Side Slope Z-value= 3.0 6.0 '/'

Reach 3: runoff channel



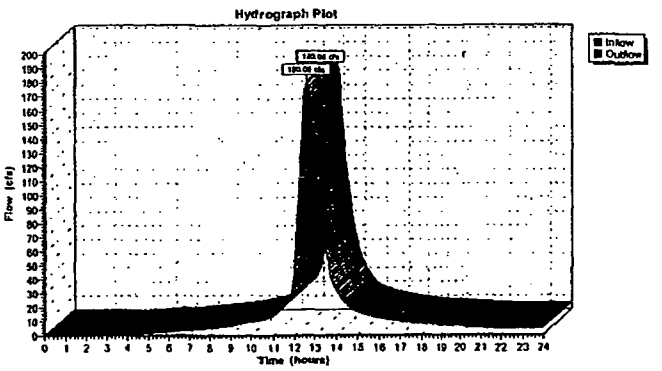
Reach 3R: (new node)

[40] Hint: Not Described (Outflow=Inflow)

Inflow = 180.08 cfs @ 12.58 hrs, Volume= 28.844 af
Outflow = 180.08 cfs @ 12.58 hrs, Volume= 28.844 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Reach 3R: (new node)



Reach 4: runoff channel

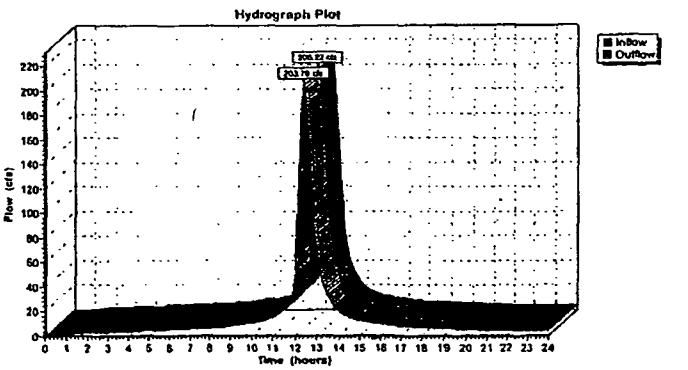
[65] Warning: Inlet elevation not specified

Inflow = 206.22 cfs @ 12.34 hrs, Volume= 25.911 af
Outflow = 203.76 cfs @ 12.42 hrs, Volume= 25.859 af, Atten= 1%, Lag= 4.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.4 fps, Min. Travel Time= 2.7 min
Avg. Velocity = 1.0 fps, Avg. Travel Time= 6.3 min

Peak Depth= 4.12'
Capacity at bank full= 590.36 cfs
0.00' x 6.14' deep channel, n= 0.070 Length= 395.0' Slope= 0.0050 '/'
Side Slope Z-value= 4.0 6.0 '/'

Reach 4: runoff channel



Reach 8: east runon ditch

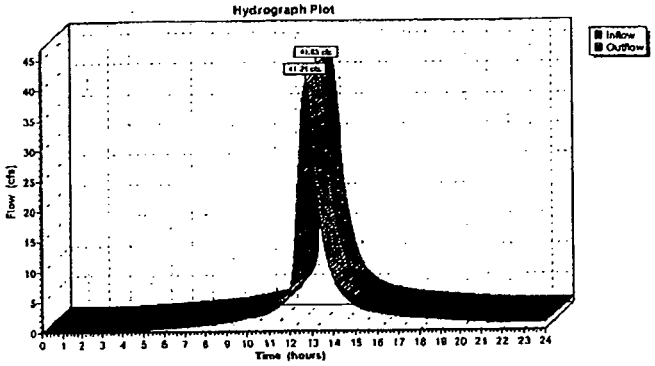
[65] Warning: Inlet elevation not specified

Inflow = 41.83 cfs @ 12.59 hrs, Volume= 6.693 af
Outflow = 41.21 cfs @ 12.74 hrs, Volume= 6.667 af, Atten= 1%, Lag= 8.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.3 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 0.6 fps, Avg. Travel Time= 10.9 min

Peak Depth= 1.01'
Capacity at bank full= 768.96 cfs
0.00' x 3.01' deep channel, n= 0.070 Length= 405.0' Slope= 0.0100 '/'
Side Slope Z-value= 58.0 3.0 '/'

Reach 8: east runon ditch



Reach 8R: (new node)

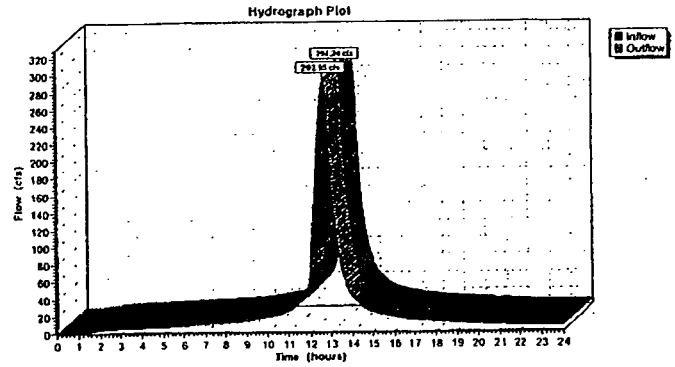
[65] Warning: Inlet elevation not specified

Inflow = 294.24 cfs @ 12.58 hrs, Volume= 45.952 af
Outflow = 292.95 cfs @ 12.62 hrs, Volume= 45.904 af, Atten= 0%, Lag= 2.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.8 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 1.3 fps, Avg. Travel Time= 3.2 min

Peak Depth= 5.16'
Capacity at bank full= 433.14 cfs
0.00' x 5.97' deep channel, n= 0.070 Length= 241.0' Slope= 0.0050 '/'
Side Slope Z-value= 6.0 2.0 '/'

Reach 8R: (new node)



Reach 9: east runon ditch

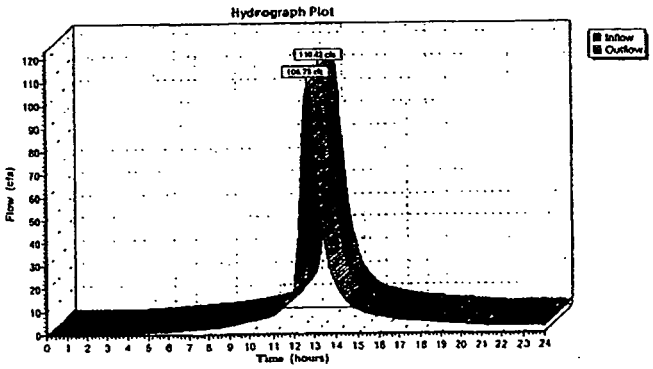
[65] Warning: Inlet elevation not specified

Inflow = 110.42 cfs @ 12.54 hrs, Volume= 17.353 af
Outflow = 108.78 cfs @ 12.68 hrs, Volume= 17.290 af, Atten= 1%, Lag= 8.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 1.7 fps, Min. Travel Time= 4.7 min
Avg. Velocity = 0.8 fps, Avg. Travel Time= 10.2 min

Peak Depth= 1.43'
Capacity at bank full= 5,717.07 cfs
0.00' x 6.31' deep channel, n= 0.070 Length= 475.0' Slope= 0.0100 '/'
Side Slope Z-value= 60.0 3.0 '/'

Reach 9: east runon ditch



Reach 9R: (new node)

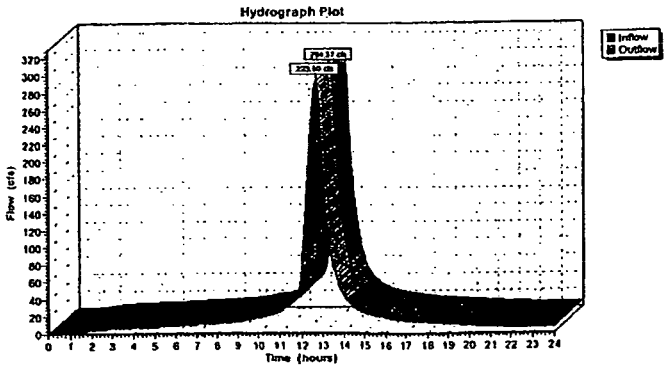
[65] Warning: Inlet elevation not specified

Inflow = 294.37 cfs @ 12.62 hrs, Volume= 46.932 af
Outflow = 293.60 cfs @ 12.64 hrs, Volume= 46.902 af, Atten= 0%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.7 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.2 fps, Avg. Travel Time= 2.0 min

Peak Depth= 4.61'
Capacity at bank full= 1,284.57 cfs
3.00' x 8.24' deep channel, n= 0.070 Length= 144.0' Slope= 0.0050 '/'
Side Slope Z-value= 6.0 3.0 '/'

Reach 9R: (new node)



ATTACHMENT C-2

WEIGHTED CURVE NUMBER CALCULATIONS

SUBCATCHMENT AREA AND HYDROCAD ™ INPUT PARAMETERS FOR THE CALCULATION OF WEIGHTED CN
2000 YEAR STORM DESIGN SCENARIOS

Subcatchment Label	Area (acres)	Percent of Total Area %	HSG	Land Use Description	CN AMC = 2	Weighted CN AMC = 2	Weighted CN (2) AMC = 3
A	2.60	100%	B/C	vegetated final cover	74	(1) 98	99
B	1.64	100%	B/C	vegetated final cover	74	(1) 98	99
C	4.96	100%	B/C	vegetated final cover	74	(1) 98	99
D	4.75	100%	B/C	vegetated final cover	74	(1) 98	99
DDR	0.96	100%	B/C	vegetated final cover	74	(1) 98	99
E	4.95	100%	B/C	vegetated final cover	74	(1) 98	99
F	4.81	100%	B/C	vegetated final cover	74	(1) 98	99
FFR	4.67	100%	B/C	vegetated final cover	74	(1) 98	99
G	4.95	100%	B/C	vegetated final cover	74	(1) 98	99
HR	4.59	100%	B/C	vegetated final cover	74	(1) 98	99
I	0.53	100%	C	runon east of OSDF	79	79	90
IR	0.71	100%	B/C	vegetated final cover	74	(1) 98	99
J	1.24	100%	C	runon east of OSDF	79	79	90
JR	2.40	100%	B/C	vegetated final cover	74	(1) 98	99
K	2.62	65% 35%	B C	runon east of OSDF runon east of OSDF	69 79	73	86
L	1.78	70% 30%	B C	runon east of OSDF runon east of OSDF	69 79	72	86
M	7.23	60% 40%	B C	runon east of OSDF runon east of OSDF	69 79	73	86
N	11.66	75% 25%	B C	runon east of OSDF runon east of OSDF	69 79	72	85
O	10.94	65% 35%	B C	runon east of OSDF runon east of OSDF	69 79	73	86
Q	1.52	50% 50%	B C	runon east of OSDF runon east of OSDF	69 79	74	87

Note (1): The weighted curve number of the final cover system is assumed to be 98, as consistent with the *OSDF Final Design Package*, prepared by GeoSyntec Consultants for the United States Department of Engergy, Fernald Environmental Management Project, in May 1997.
Note (2): The Antecedent Moisture Condition (III) was calculated using the equation CN(III) = 23CN(II) / 10 + 0.13CN(II).

N/A - Not Applicable

ATTACHMENT C-3

TABULATED CHANNEL ANALYSIS RESULTS

2000 YEAR STORM DESIGN SCENARIO - HEAVY VEGETATION
SUMMARY OF CHANNEL ANALYSIS RESULTS

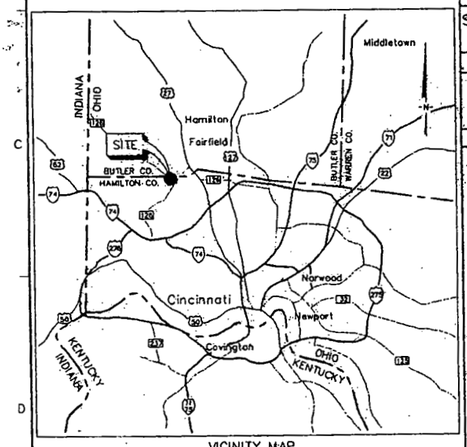
Channel Identification			Channel Characteristics							Hydrologic Calculations		Hydraulic Calculations							
Channel Name[1]	Status	Design Scenario	Section Shape	Minimum Channel Depth (ft)	Longitudinal Slope[2] (%)	Manning n	Bottom Width B (ft)	Side Slope M_1:1	Side Slope M_2:1	HydroCAD Node	HydroCAD Q[3] (cfs)	Area of Flow A (sq ft)	Perimeter P (ft)	Hydraulic Radius, R (ft)	Peak Flow Depth[5] Y (ft)	Estimated Q[5] (cfs)	Channel Freeboard[4] (ft)	Peak Flow Velocity (fps)	Lining Type[6]
subcatchment B	existing	2000 DS	vee	11.90	0.35%	0.070	0	6	4	1	52.4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
reach 1	existing	2000 DS	vee	8.29	0.35%	0.070	0	6	4	2	104.4	58.8	35.01	1.68	3.43	104.72	4.86	1.78	riprap
reach 2	existing	2000 DS	vee	6.57	0.64%	0.070	0	6	5	3	155.4	64.71	38.35	1.69	3.43	156.18	3.14	2.41	riprap
reach 3	new[4]	2000 DS	vee	6.26	0.75%	0.070	0	6	3	4	206.2	71.64	36.89	1.94	3.99	205.62	2.27	2.87	riprap
reach 4	new	2000 DS	vee	6.14	0.50%	0.070	0	6	4	5	236.6	94.61	44.40	2.13	4.35	235.89	1.79	2.49	riprap
reach 5	new	2000 DS	vee	5.32	0.50%	0.070	0	6	3	6	262.6	99.83	43.54	2.29	4.71	261.31	0.61	2.62	riprap
reach 6	new	2000 DS	vee	5.70	0.50%	0.070	0	6	3	7R	279.1	104.98	44.65	2.35	4.83	279.45	0.87	2.66	riprap
reach 7	new	2000 DS	vee	3.10	1.25%	0.070	0	4	3	8	41.8	16.94	16.03	1.06	2.20	41.83	0.90	2.47	grass
reach 7R	new	2000 DS	vee	5.98	0.50%	0.070	0	6	3	8R	294.2	109.31	45.58	2.40	4.93	295.15	1.05	2.70	riprap
reach 8	new	2000 DS	vee	3.01	1.00%	0.070	0	58	3	9	110.4	64.13	88.70	0.72	1.45	109.94	1.56	1.71	grass
reach 8R	new	2000 DS	vee	5.97	0.50%	0.070	0	6	2	9R	294.4	106.92	43.01	2.49	5.17	295.40	0.80	5.17	riprap
reach 9	new	2000 DS	vee	6.31	1.00%	0.070	0	60	3	11	171.7	89.97	106.76	0.84	1.69	170.84	4.62	1.90	grass
reach 9R	new	2000 DS	trapezoidal	8.24	0.50%	0.070	3	6	3	9R+IR	303.2	111.70	46.08	2.42	4.66	303.46	3.58	2.72	riprap
reach 10AR	new	2000 DS	trapezoidal	4.76	0.50%	0.070	9	6	3	10AR	300.4	111.63	46.72	2.39	4.08	300.37	0.68	2.69	riprap
reach 11	new	2000 DS	vee	4.08	1.00%	0.070	0	5.7	13.5	3R	180.1	70.31	53.21	1.32	2.23	180.21	1.85	2.56	grass

2000 DS = 2000 Year Storm Design Scenario

Notes:
1. Channels are named after the corresponding subcatchment or reach.
2. Longitudinal slopes taken from existing topographic information and Construction Drawings.
3. Peak flow rates calculated by HydroCAD for each reach. See attachment C-1.
4. Calculated as the difference between minimum channel depth and peak flow depth.
5. Calculated flow rates using Manning's equation.
6. Maximum permissible velocity for grass lined channels is 5 fps.
   Maximum permissible velocity for riprap lined channels is 12 fps.

Document 6774

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT
ON-SITE DISPOSAL FACILITY - PHASE V
FLUOR FERNALD, INC. PROJECT NUMBER 20105
HAMILTON COUNTY AND BUTLER COUNTY, OHIO



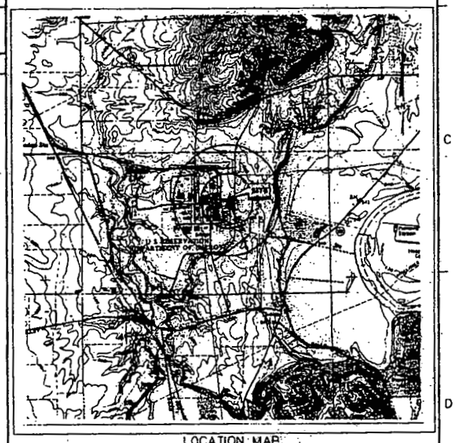
VICINITY MAP

6 3 0 6 12
SCALE IN MILES

CONSTRUCTION DRAWING INDEX

SHEET NO.	REVISION NO.	FEMP DRAWING NO.	TITLE
GENERAL			
X-1	2	90X-6000-X-00360	TITLE SHEET I
X-2	0	90X-6000-X-00361	TITLE SHEET II
X-3	1	90X-6000-X-00362	LEGEND AND SYMBOLS
CIVIL			
G-1	0	90X-6000-G-00363	SITE DEVELOPMENT PLAN I - CELL 6
G-2	1	90X-6000-G-00364	SITE DEVELOPMENT PLAN II - CELL 7
G-2A	1	90X-6000-G-00413	SITE DEVELOPMENT PLAN III - CELL 8
G-3	1	90X-6000-G-00365	SUBGRADE GRADING PLAN I - CELLS 3, 4, AND 5 LINER AND FINAL COVER SYSTEMS
G-4	0	90X-6000-G-00366	SUBGRADE GRADING PLAN II - CELL 6 LINER SYSTEM AND OSDF SEDIMENTATION BASIN NO. 2
G-5	1	90X-6000-G-00367	SUBGRADE GRADING PLAN III - CELL 6 LINER SYSTEM AND OSDF SEDIMENTATION BASIN NO. 2
G-6	1	90X-6000-G-00368	SUBGRADE GRADING PLAN IV - CELL 7 LINER SYSTEM
G-6A	1	90X-6000-G-00414	SUBGRADE GRADING PLAN V - CELL 8 LINER SYSTEM
G-7	1	90X-6000-G-00369	COMPACTED CLAY LINER GRADING PLAN I - CELLS 6 AND 7 LINER SYSTEM
G-7A	1	90X-6000-G-00415	COMPACTED CLAY LINER GRADING PLAN II - CELL 8 LINER SYSTEM
G-8	1	90X-6000-G-00370	CELL OUTLET GRADING PLANS I - CELLS 6, 7, AND 8 LINER SYSTEM
G-9	1	90X-6000-G-00371	CELL OUTLET GRADING PLANS II - CELLS 6, 7, AND 8 LINER SYSTEM
G-10	0	90X-6000-G-00372	FINAL COVER SYSTEM CONTOURING LAYER GRADING PLAN I - CELLS 3, 4, AND 5
G-11	2	90X-6000-G-00373	FINAL COVER SYSTEM CONTOURING LAYER GRADING PLAN II - CELLS 6 AND 7
G-11A	0	90X-6000-G-00427	FINAL COVER SYSTEM CONTOURING LAYER GRADING PLAN III - CELL 8
G-12	0	90X-6000-G-00374	FINAL COVER SYSTEM COMPACTED CLAY CAP GRADING PLAN I - CELLS 3, 4, AND 5
G-13	1	90X-6000-G-00375	FINAL COVER SYSTEM COMPACTED CLAY CAP GRADING PLAN II - CELLS 6 AND 7
G-13A	1	90X-6000-G-00416	FINAL COVER SYSTEM COMPACTED CLAY CAP GRADING PLAN III - CELL 8
G-14	0	90X-6000-G-00376	FINAL COVER SYSTEM GRADING PLAN I - CELLS 3, 4, AND 5
G-15	1	90X-6000-G-00377	FINAL COVER SYSTEM GRADING PLAN II - CELLS 6 AND 7
G-15A	1	90X-6000-G-00417	FINAL COVER SYSTEM GRADING PLAN III - CELL 8
G-16	2	90X-6000-G-00378	FINAL COVER SYSTEM STAGED CLOSURE GRADING PLANS - CELLS 7 AND 8
G-17	0	90X-6000-G-00379	IMPACTED MATERIAL HAUL ROAD GRADING PLAN AND DETAILS I
G-18	2	90X-6000-G-00380	IMPACTED MATERIAL HAUL ROAD GRADING PLAN AND DETAILS II
G-18A	1	90X-6000-G-00418	IMPACTED MATERIAL HAUL ROAD GRADING PLAN AND DETAILS III
G-19	0	90X-6000-G-00381	OSDF NORTH-SOUTH SECTIONS I
G-20	1	90X-6000-G-00382	OSDF NORTH-SOUTH SECTIONS II
G-20A	1	90X-6000-G-00419	OSDF NORTH-SOUTH SECTIONS III

SHEET NO.	REVISION NO.	FEMP DRAWING NO.	TITLE
CIVIL (CONTINUED)			
G-21	0	90X-6000-G-00383	OSDF WEST-EAST SECTIONS I
G-22	1	90X-6000-G-00384	OSDF WEST-EAST SECTIONS II
G-23	1	90X-6000-G-00385	OSDF WEST-EAST SECTIONS III
G-23A	1	90X-6000-G-00420	OSDF WEST-EAST SECTIONS IV
G-24	1	90X-6000-G-00386	CELL PERIMETER DETAILS I
G-25	1	90X-6000-G-00387	CELL PERIMETER DETAILS II
G-26	1	90X-6000-G-00388	CELL PERIMETER DETAILS III
G-27	1	90X-6000-G-00389	CELL PERIMETER DETAILS IV
G-28	1	90X-6000-G-00390	CELL PERIMETER DETAILS V
G-29	1	90X-6000-G-00391	LINER SYSTEM DETAILS I
G-30	2	90X-6000-G-00392	LINER SYSTEM DETAILS II
G-31	1	90X-6000-G-00393	LINER SYSTEM DETAILS III
G-32	1	90X-6000-G-00394	LINER SYSTEM DETAILS IV
G-33	1	90X-6000-G-00395	LINER SYSTEM DETAILS V
G-33A	0	90X-6000-G-00421	LINER SYSTEM DETAILS VI
G-34	1	90X-6000-G-00398	FINAL COVER SYSTEM DETAILS I
G-35	1	90X-6000-G-00397	FINAL COVER SYSTEM DETAILS II
G-36	1	90X-6000-G-00398	SURFACE-WATER MANAGEMENT SYSTEM DETAILS I
G-37	1	90X-6000-G-00399	SURFACE-WATER MANAGEMENT SYSTEM DETAILS II
G-38	1	90X-6000-G-00400	SURFACE-WATER MANAGEMENT SYSTEM DETAILS III
G-39	0	90X-6000-G-00401	SURFACE-WATER MANAGEMENT SYSTEM DETAILS IV
G-40	1	90X-6000-G-00402	SURFACE-WATER MANAGEMENT SYSTEM DETAILS V
G-41	1	90X-6000-G-00403	SURFACE-WATER MANAGEMENT SYSTEM DETAILS VI
G-42	1	90X-6000-G-00404	SURFACE-WATER MANAGEMENT SYSTEM DETAILS VII
G-43	1	90X-6000-G-00405	SURFACE-WATER MANAGEMENT SYSTEM DETAILS VIII
G-43A	0	90X-6000-G-00422	SURFACE-WATER MANAGEMENT SYSTEM DETAILS IX
G-43B	1	90X-6000-G-00423	SURFACE-WATER MANAGEMENT SYSTEM DETAILS X
G-44	1	90X-6000-G-00406	HORIZONTAL MONITORING WELL AND MISCELLANEOUS DETAILS
G-45	1	90X-6000-G-00407	IMPACTED MATERIAL PLACEMENT DETAILS I
G-46	2	90X-6000-G-00408	IMPACTED MATERIAL PLACEMENT DETAILS II
G-47	0	90X-6000-G-00409	CHAIN-LINK FENCE AND GATE DETAILS



LOCATION MAP
U.S.G.S. SHANDON QUADRANGLE, OHIO

2000 1000 0 2000 4000
SCALE IN FEET

REV NO	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW BY	APP. BY
2	03.02.15	CFC REVISION 2 SUBMITTAL TO FF/DOE/EPA	TEZ	VOR	LMC	DKP	JFB
1	04.05.72	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	LMC	VOR	TEZ	DKP	RB
1B	03.17.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	LMC	VOR	TEZ	DKP	RB
1A	03.10.78	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	LMC	VOR	TEZ	DKP	RB
0	02.01.79	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	VOR	LMC	DCP	JFB
B	01.12.77	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	JMD	LMC	DCP	JFB
A	01.10.77	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	TMM	LMC	DCP	JFB

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY - PHASE V

TITLE: TITLE SHEET I

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

STATE OF OHIO
JOHN R. BECCHI
E-58248
REGISTERED
PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS
1255 ROBERTS BOULEVARD NW
KENNESAW, GEORGIA 30144

PROJECT NO.:	20105
CONTRACT NO.:	03T0899
FEMP DRAWING NO.:	90X-6000-X-00360
GEOSYNTEC PROJECT NO.:	003409-09 02
GEOSYNTEC DOCUMENT NO.:	FDA-2501
SHEET NO.:	X-1
REVISION NO.:	2

Attachment to:
F-0424
DOE-0164-05

FLUOR FERNALD, INC.

FLUOR FERNALD, INC.
P.O. BOX 398704
CINCINNATI, OHIO 45239

GEOSYNTEC CONSULTANTS
1255 ROBERTS BLVD, SUITE 200
KENNESAW, GEORGIA 30144-3694

CERTIFIED-FOR-CONSTRUCTION

REFERENCE DRAWING INDEX

SHEET NO.	REVISION NO.	FEMP DRAWING NO.	TITLE
REFERENCE			
FINAL DESIGN PACKAGE			
X-1	0	90X-6000-X-00001	TITLE SHEET
X-2	0	90X-6000-X-00002	LEGENDS AND SYMBOLS
X-7	0	90X-6000-X-00006	GEOTECHNICAL DATA POINT LOCATION PLAN
X-8	0	90X-6000-X-00007	GREAT MIAMI AQUIFER GROUND-WATER CONTOUR MAP
X-9	0	90X-6000-X-00008	PERCHED ZONE POTENTIOMETRIC SURFACE MAP
X-10	0	90X-6000-X-00009	BROWN TILL/GRAY TILL INTERFACE CONTOUR MAP
X-11	0	90X-6000-X-00010	GRAY TILL ISOPACH MAP
X-12	0	90X-6000-X-00011	SURFACE GEOLOGY MAP
X-13	0	90X-6000-X-00012	GEOLOGIC SECTION A-A
X-14	0	90X-6000-X-00013	GEOLOGIC SECTION B-B
X-15	0	90X-6000-X-00014	GEOLOGIC SECTION C-C AND D-D
ON-SITE DISPOSAL FACILITY – PHASE I			
X-1A	2	90X-6000-X-00070	TITLE SHEET
X-2B	0	90X-6000-X-00071	LEGEND AND SYMBOLS
G-2A	0	90X-6000-G-00072	SITE DEVELOPMENT PLAN
G-5A	1	90X-6000-G-00073	SUBGRADE GRADING PLAN I
G-5B	2	90X-6000-G-00074	SUBGRADE GRADING PLAN II
G-5C	0	90X-6000-G-00075	SUBGRADE GRADING PLAN III
G-41A	0	90X-6000-G-00089	SEDIMENTATION BASIN DETAILS
ON-SITE DISPOSAL FACILITY – PHASE II			
X-1B	0	90X-6000-X-00200	TITLE SHEET
X-2C	0	90X-6000-X-00201	LEGENDS AND SYMBOLS
G-2B	0	90X-6000-G-00202	SITE DEVELOPMENT PLAN I – BASE BID
G-5D	0	90X-6000-G-00204	SUBGRADE GRADING PLAN
G-20B	2	90X-6000-G-00212	CELL PERIMETER DETAILS I
G-30B	2	90X-6000-G-00220	STORM-WATER MANAGEMENT SYSTEM DETAILS
ENCHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM			
X-1	0	90X-6000-X-00239	TITLE SHEET
X-2	0	90X-6000-X-00240	LEGEND AND SYMBOLS
G-3	0	90X-6000-G-00281	LTS PIPE PLAN AND PROFILE STATIONS 0+00 TO 5+00
G-4	0	90X-6000-G-00282	LTS PIPE PLAN AND PROFILE STATIONS 5+00 TO 11+00
G-5	0	90X-6000-G-00283	LTS PIPE PLAN AND PROFILE STATIONS 11+00 TO 17+00
G-6	0	90X-6000-G-00284	LTS PIPE PLAN AND PROFILE STATIONS 17+00 TO 23+00
G-7	0	90X-6000-G-00285	LTS PIPE PLAN AND PROFILE STATIONS 23+00 TO 29+00
G-8	0	90X-6000-G-00286	LTS PIPE PLAN AND PROFILE STATIONS 29+00 TO 34+24.34
G-14	0	90X-6000-G-00251	VALVE HOUSE AND CONTROL VALVE HOUSE GENERAL LAYOUTS
G-20	0	90X-6000-G-00292	SURFACE-WATER MANAGEMENT SYSTEM DETAILS
E-1	0	90X-6000-E-00258	OVERHEAD POWER TRANSMISSION SYSTEM PLAN
M-3	0	90X-6000-M-00265	VALVE HOUSE MECHANICAL DETAILS II
ON-SITE DISPOSAL FACILITY – PHASE III			
X-1	1	90X-6000-X-00293	TITLE SHEET I
X-3	1	90X-6000-X-00295	LEGEND AND SYMBOLS
G-1	1	90X-6000-X-00296	SITE DEVELOPMENT PLAN
G-2	1	90X-6000-X-00297	SUBGRADE GRADING PLAN I
G-3	1	90X-6000-X-00298	SUBGRADE GRADING PLAN II
G-7	1	90X-6000-G-00302	FINAL COVER GRADING PLAN
G-11	1	90X-6000-G-00306	IMPACTED MATERIAL HAUL ROAD GRADING PLANS AND DETAILS
G-24	1	90X-6000-G-00319	SURFACE-WATER MANAGEMENT SYSTEM DETAILS II
G-25	1	90X-6000-G-00320	SURFACE-WATER MANAGEMENT SYSTEM DETAILS III
ON-SITE DISPOSAL FACILITY – PHASE IV			
X-1	0	90X-6000-X-00328	TITLE SHEET I
X-3	0	90X-6000-X-00328	LEGEND AND SYMBOLS
G-1	0	90X-6000-X-00329	SITE DEVELOPMENT PLAN I
G-2	0	90X-6000-G-00330	SITE DEVELOPMENT PLAN II
G-3	0	90X-6000-G-00331	SUBGRADE GRADING PLAN – CELL 4 LINER
G-4	0	90X-6000-G-00332	SUBGRADE GRADING PLAN – CELL 5 LINER
G-7	0	90X-6000-G-00335	CELL OUTLET GRADING PLANS II
G-11	0	90X-6000-G-00339	CELL PERIMETER SECTIONS I
G-12	0	90X-6000-G-00340	CELL PERIMETER SECTIONS II
G-17	0	90X-6000-G-00345	SURFACE-WATER MANAGEMENT SYSTEM DETAILS I
G-18	0	90X-6000-G-00346	SURFACE-WATER MANAGEMENT SYSTEM DETAILS II
G-19	0	90X-6000-G-00347	SURFACE-WATER MANAGEMENT SYSTEM DETAILS III
G-20	0	90X-6000-G-00348	SURFACE-WATER MANAGEMENT SYSTEM DETAILS IV

SHEET NO.	REVISION NO.	FEMP DRAWING NO.	TITLE
REFERENCE			
ON-SITE DISPOSAL FACILITY – PHASE IV (CONTINUED)			
G-21	0	90X-6000-G-00349	HORIZONTAL MONITORING WELL DETAILS – CELL 6
G-25	0	90X-6000-G-00353	SUBGRADE GRADING PLAN – CELL 2 CAP
G-26	0	90X-6000-G-00354	CONTOURING LAYER GRADING PLAN – CELL 2
G-27	0	90X-6000-G-00355	COMPACTED CLAY CAP GRADING PLAN – CELL 2
G-28	0	90X-6000-G-00356	FINAL COVER SYSTEM GRADING PLAN – CELL 2
G-30	0	90X-6000-G-00358	FINAL COVER SYSTEM DETAILS
–	0	90X-5500-G-00580	BORROW AREA – SUBAREA 3 EXCAVATION AND (INTERIM) RESTORATION PLAN
INTERIM LEACHATE COLLECTION SYSTEM			
–	1	90X-5500-G-00536	INTERIM LCS COVER SHEET
–	1	90X-5500-G-00537	INTERIM LCS PLAN AND PROFILE, SHEET 1 OF 3
–	1	90X-5500-G-00538	INTERIM LCS PLAN AND PROFILE, SHEET 2 OF 3
–	1	90X-5500-G-00539	INTERIM LCS PLAN AND PROFILE, SHEET 3 OF 3
LEACHATE CONVEYANCE SYSTEM			
–	2	92X-5900-G-00254	PLAN AND PROFILE, SHEET 1 OF 4
–	3	92X-5900-G-00261	PLAN AND PROFILE, SHEET 2 OF 4
–	3	92X-5900-G-00266	PLAN AND PROFILE, SHEET 3 OF 4
–	2	92X-5900-G-00262	PLAN AND PROFILE, SHEET 4 OF 4
EXISTING UTILITIES			
–	1	91X-5900-G-00232	CIVIL MASTER PLAN
–	–	SKG-04391	EXISTING UTILITIES – REFERENCE DRAWINGS – OVERALL PLAN
–	–	SKG-04392	EXISTING UTILITIES – REFERENCE DRAWINGS – SHEET 1 OF 6
–	–	SKG-04393	EXISTING UTILITIES – REFERENCE DRAWINGS – SHEET 2 OF 6
–	–	SKG-04394	EXISTING UTILITIES – REFERENCE DRAWINGS – SHEET 3 OF 6
–	–	SKG-04395	EXISTING UTILITIES – REFERENCE DRAWINGS – SHEET 4 OF 6
–	–	SKG-04396	EXISTING UTILITIES – REFERENCE DRAWINGS – SHEET 5 OF 6
–	–	SKG-04397	EXISTING UTILITIES – REFERENCE DRAWINGS – SHEET 6 OF 6
–	14	22X-5500-P-00659	MASTER GRID OF UNDERGROUND UTILITY PLANS
–	21	22C-5500-P-00661	GRID 2 – UNDERGROUND UTILITIES
–	26	22C-5500-P-00662	GRID 3 – UNDERGROUND UTILITIES
–	21	22C-5500-P-00663	GRID 4 – UNDERGROUND UTILITIES
–	22	22A-5500-P-00664	GRID 5 – UNDERGROUND UTILITIES
–	17	22F-5500-P-00665	GRID 6 – UNDERGROUND UTILITIES
–	20	22H-5500-P-00666	GRID 7 – UNDERGROUND UTILITIES
–	15	22H-5500-P-00667	GRID 8 – UNDERGROUND UTILITIES
–	11	22A-5500-P-00707	GRID 32 – UNDERGROUND UTILITIES
–	3	90X-5500-E-00522	ELECTRICAL POWER FOR OSDF
–	0	90X-5500-E-00542	ELECTRIC FOR OSDF AIR MONITORS
G0015	3	93X-5900-G-00286	CIVIL EXISTING SITE AND UTILITY PLAN – GRID 13
G0021	8	93X-5900-G-00294	CIVIL EXISTING SITE AND UTILITY PLAN – GRID 21
G0029	9	93X-5900-G-00302	CIVIL EXISTING SITE AND UTILITY PLAN – GRID 29
G0030	10	93X-5900-G-00303	CIVIL EXISTING SITE AND UTILITY PLAN – GRID 30
G0037	9	93X-5900-G-00310	CIVIL EXISTING SITE AND UTILITY PLAN – GRID 37
G0038	7	93X-5900-G-00311	CIVIL EXISTING SITE AND UTILITY PLAN – GRID 38
G0045	8	93X-5900-G-00318	CIVIL EXISTING SITE AND UTILITY PLAN – GRID 45
E0018	3	96X-5900-E-00356	13.2 kV ELECTRICAL MASTER PLOT
CONSTRUCTION LAYDOWN AREA			
–	1	90X-5500-G-00543	ON-SITE DISPOSAL FACILITY CONSTRUCTION LAYDOWN AREA ACCESS ROAD PLAN AND PROFILE SHEET 1 OF 2
–	1	90X-5500-G-00544	ON-SITE DISPOSAL FACILITY CONSTRUCTION LAYDOWN AREA ACCESS ROAD PLAN AND PROFILE SHEET 2 OF 2
–	0	90X-5500-G-00545	ON-SITE DISPOSAL FACILITY CONSTRUCTION LAYDOWN AREA ACCESS ROAD CROSS SECTIONS SHEET 1 OF 2
–	0	90X-5500-G-00546	ON-SITE DISPOSAL FACILITY CONSTRUCTION LAYDOWN AREA ACCESS ROAD CROSS SECTIONS SHEET 2 OF 2
–	0	90X-5500-G-00547	ON-SITE DISPOSAL FACILITY CONSTRUCTION LAYDOWN AREA PLAN AND PROFILE
MISCELLANEOUS			
–	7	75A-5500-G-00441	AREA 1 PHASE I SITE PLAN 3 OF 3
–	2	75X-5500-X-00450	AREA 1 PHASE 1 (EAST) DETAIL SHEET 1
–	3	00X-5500-G-01843	FEMP ON-SITE EASEMENTS AND RIGHT-OF-WAYS
–	0	90X-6000-G-00359	TOPOGRAPHY BASED ON 12 JANUARY 2000 FLYOVER

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	VDR	LMC	DOP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	JWQ	LMC	DOP	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	TMW	LMC	DOP	JFB

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
TITLE SHEET II

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

STATE OF OHIO
JOHN F. BEZEK
E-52246
REGISTERED PROFESSIONAL ENGINEER

GeoSyntec Consultants
FOR CHICAGO, DENVER, HOUSTON, ATLANTA, COLUMBUS, SAN DIEGO, USA

PROJECT NO.:	20105
CONTRACT NO.:	95P5095078
FEMP DRAWING NO.:	90X-6000-X-00361
GEOSYNTEC PROJECT NO.:	GD1342-17.6
GEOSYNTEC DOCUMENT NO.:	F01-0507
SHEET NO.:	X-2
REVISION NO.:	0

CERTIFIED-FOR-CONSTRUCTION

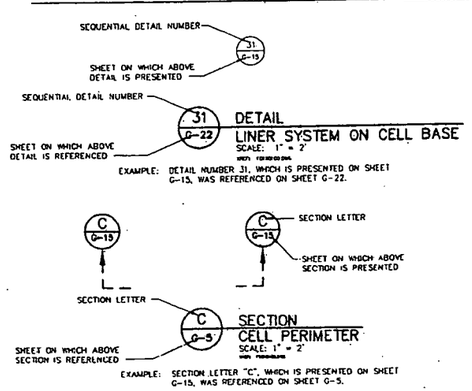
SYMBOLS LEGEND

EXISTING		NEW
	IMPACTED MATERIAL DISPOSAL LIMIT	
	BATTERY LIMIT	
	BORROW AREA LIMIT	
	FCP PROPERTY LINE	
	BUTLER COUNTY/HAMILTON COUNTY LINE	
	ADJACENT LANDOWNER PROPERTY LINE	
	FENCE	
	RAD FENCE	
	NON-POTABLE CONSTRUCTION WATER LINE	
	FENCE GATE	
	RAILROAD TRACK	
	PAVED ROAD, SIDEWALK OR PARKING LOT	
	UNPAVED ROAD, SIDEWALK OR PARKING LOT	
	CENTERLINE OR BASELINE	
	PERIMETER BERM BASELINE	
	SLOPE CREST OR TOE	
LTS	LTS PIPE	
ILTS	ILTS PIPE	
EPLTS	EPLTS PIPE	
E	UTILITY EASEMENT	
GW	24" STORMWATER FORCEMAIN	
UE	UNDERGROUND ELECTRIC	
	WATER TABLE OR PIEZOMETRIC SURFACE	
	DECIDUOUS TREE	
	CONIFEROUS TREE	
	TREE LINE	
	PARKING LOT STRIPING	
	CELL DESIGNATION	6
	TRAILER OR BUILDING	
	DRAINAGE FLOW DIRECTION	
	HEADWALL	
	SIGN	
	POST	
	SLOPE INDICATOR	CREST TOE
	TRANSMISSION TOWER	
	CATCH BASIN	
	MANHOLE	
	POWER POLE	
1050	TYPE 1 MONITORING WELL	
2420	TYPE 2 MONITORING WELL	
2420	TYPE 3 MONITORING WELL	
2000	TYPE 4 MONITORING WELL	
0.3269	TYPE 6 MONITORING WELL	
1740	GEOTECHNICAL BORING	
11425	CONE PENETROMETER TEST SOUNDING	
BM-10	BENCHMARK	
1124.6	LYSIMETER	
1122	MONITORING WELL	
1170.6	PIEZOMETER	
	VALVE HOUSE	
	LEACHATE TRANSMISSION SYSTEM PERMANENT LIFT STATION	
	CONSTRUCTION CONTROL POINT	
	DRAINAGE CHANNEL GRAVITY INLET STRUCTURE	
	CULVERT	
	PERMANENT VEGETATION	
	INTERIM VEGETATION	
	HORIZONTAL MONITORING WELL WITH COVER SLAB	

SYMBOLS LEGEND (CONTINUED)

SYMBOL	COMPONENT
	PRIMARY GEOMEMBRANE LINER
	SECONDARY GEOMEMBRANE LINER
	PRIMARY GEOSYNTHETIC CLAY LINER
	SECONDARY GEOSYNTHETIC CLAY LINER
	GEOTEXTILE FILTER
	GEOTEXTILE CUSHION
	SUPPLEMENTAL GEOTEXTILE CUSHION
	SUBGRADE
	COMPACTED CLAY LINER/PROTECTIVE CLAY LAYER
	LDS DRAINAGE LAYER
	LDS DRAINAGE CORRIDOR
	LCS DRAINAGE LAYER
	LCS DRAINAGE CORRIDOR
	PROTECTIVE LAYER (IMPACTED)
	PROTECTIVE LAYER (NON-IMPACTED GRANULAR)
	PROTECTIVE LAYER (NON-IMPACTED NON-GRANULAR)
	SELECT IMPACTED MATERIAL
	TRENCH BACKFILL
	PIPE EMBEDMENT FILL
	GEOMEMBRANE CAP
	GEOSYNTHETIC CLAY CAP
	COMPACTED CLAY CAP
	COVER DRAINAGE LAYER
	BIOINTRUSION BARRIER
	GRANULAR FILTER
	TOPSOIL
	CONTOURING LAYER
	BERM CREST
	OSDF MONITORING ACCESS
	RIPRAP
	EROSION MAT
	FINAL COVER SYSTEM
	IMPACTED MATERIAL PLACEMENT AREA
	LINER SYSTEM
	ACCESS CORRIDOR, ACCESS ROAD, ACCESS RAMP, MAINTENANCE ACCESS, OR HAUL ROAD
	FINAL COVER SYSTEM TEMPORARY TERMINATION AREA

DETAIL AND SECTION IDENTIFICATION LEGEND



ABBREVIATIONS

ASTM.	AMERICAN SOCIETY FOR TESTING AND MATERIALS
BAMP	BORROW AREA MANAGEMENT AND RESTORATION PLAN
BCY	BULK CUBIC YARDS
℄	BASELINE
BM	BENCH MARK
CFC	CERTIFIED-FOR-CONSTRUCTION
℄	CENTERLINE
CLR	CLEARANCE
CMP	CORRUGATED METAL PIPE
CO.	COUNTY
CPT	CONE PENETROMETER TEST
CQA	CONSTRUCTION QUALITY ASSURANCE
CQC	CONSTRUCTION QUALITY CONTROL
CSA	CONSTRUCTION SITE ACCESS
CVH	CONTROL VALVE HOUSE
D	DEPTH
DECON	DECONTAMINATION
DIA.	DIAMETER
DOE	DEPARTMENT OF ENERGY
DOT	DEPARTMENT OF TRANSPORTATION
E	EASTING
EL	ELEVATION
EPA	ENVIRONMENTAL PROTECTION AGENCY
EPLTS	ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM
FCP	FERNALD CLOSURE PROJECT
FEMP	FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FF	FLUOR FERNALD
GIS	GRAVITY INLET STRUCTURE
HDPE	HIGH DENSITY POLYETHYLENE
H:V	HORIZONTAL TO VERTICAL LENGTH RATIO FOR A SLOPE
ID	INSIDE DIAMETER
ILTS	INTERIM LEACHATE TRANSMISSION SYSTEM
IMP	IMPACTED MATERIAL PLACEMENT
INC.	INCORPORATED
IP	IRON PIN
LCS	LEACHATE COLLECTION SYSTEM
LDS	LEAK DETECTION SYSTEM
LTS	LEACHATE TRANSMISSION SYSTEM
(MAX)	MAXIMUM
(MIN)	MINIMUM
N	NORTHING
NAD	NORTH AMERICAN DATUM
NGVD	NATIONAL GEODETIC VERTICAL DATUM
NO.	NUMBER
NPT	NATIONAL PIPE THREAD
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
ODOT	OHIO DEPARTMENT OF TRANSPORTATION
OMTA	OSDF MATERIAL TRANSFER AREA
OSDF	ON-SITE DISPOSAL FACILITY
PLS	PERMANENT LIFT STATION
RAD	RADIOLOGICAL
RCP	REINFORCED CONCRETE PIPE
REV.	REVISION
RLCS	REDUNDANT LEACHATE COLLECTION SYSTEM
STP	SEWAGE TREATMENT PLANT
SWMEC	SURFACE WATER MANAGEMENT AND EROSION CONTROL
(TYP)	TYPICAL
WAC	WASTE ACCEPTANCE CRITERIA
W.E.	WATER ELEVATION
VH	VALVE HOUSE
6"\10"	6"\10" NOMINAL PIPE SIZE (CARRIER\CONTAINMENT)

CONTOUR LEGEND

EXISTING		NEW
590	EXISTING GROUND ELEVATION (FEET)	
580	SUBGRADE ELEVATION (FEET)	580
575	COMPACTED CLAY LINER ELEVATION (FEET)	575
600	LEACHATE COLLECTION SYSTEM ELEVATION (FEET)	600
585	PROTECTIVE LAYER ELEVATION (FEET)	585
600	CONTOURING LAYER ELEVATION (FEET)	600
610	COMPACTED CLAY CAP ELEVATION (FEET)	610
590	FINISHED GRADE ELEVATION (FEET)	590
	IMPACTED MATERIAL ELEVATION (FEET)	600

GENERAL NOTES

NOTES:

1. TOPOGRAPHY SHOWN ON CONSTRUCTION DRAWINGS IS BASED ON 12 JANUARY 2000 FLYOVER UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO 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 GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY.
5. SURVEY COORDINATES AND DIMENSIONS SHALL BE USED FOR CONSTRUCTION. DRAWINGS SHALL NOT BE SCALED TO OBTAIN LOCATIONS AND DIMENSIONS.
6. BATTERY LIMIT DEFINES LIMIT OF THIS WORK PACKAGE FOR OSDF AND SUPPORT FACILITIES AND LOCATION OF INTERFACES WITH OTHER WORK PACKAGES. PERFORM DUST CONTROL WITHIN BATTERY LIMIT AS SPECIFIED IN FLUOR FERNALD CONSTRUCTION WORK CONTROL TRAVELER PACKAGE DOCUMENTS.
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. IMPACTED MATERIAL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APR. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	LMG	JJA	TEZ	DKP	RB
1B	03.17.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DKP	RB
1A	03.10.78	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DKP	RB
0	02.01.78	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	JWD	LMG	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	JWD	LMG	DCP	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	JWH	LMG	DCP	JFB

SCALE AS SHOWN

OWNER/FACILITY:

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:

FLUOR FERNALD, INC.

PROJECT:

ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:

LEGEND AND SYMBOLS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

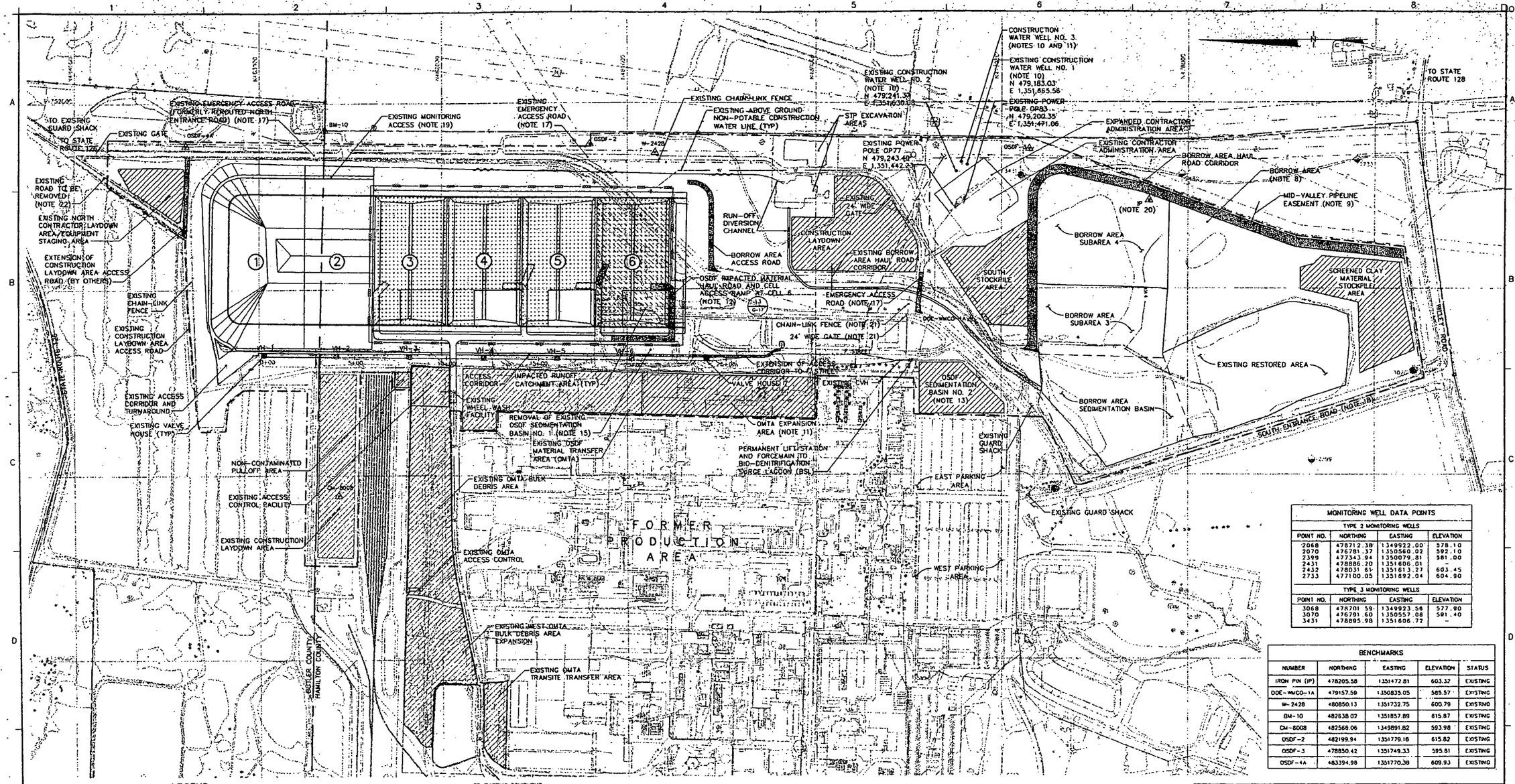
SIGNATURE
DATE

STATE OF OHIO
RUDOLPH BONAPARTE
E-58879
REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS
1000 CLUB HILLS DRIVE, SUITE 1
ATLANTA, GEORGIA 30342 USA

PROJECT NO.:	20106
CONTRACT NO.:	03T0899
TEMP DRAWING NO.:	902-6080-X-00362
GEOSYNTEC PROJECT NO.:	00571-05 04
GEOSYNTEC DOCUMENT NO.:	F03-1503
SHEET NO.:	X-3
REVISION NO.:	1

CERTIFIED-FOR-CONSTRUCTION



MONITORING WELL DATA POINTS			
TYPE 2 MONITORING WELLS			
POINT NO.	NORTHING	EASTING	ELEVATION
2068	478712.38	1349922.00	578.10
3070	476781.37	1350560.02	592.10
2399	477343.94	1350079.81	581.00
2431	478886.20	1351606.01	–
2432	478031.61	1351613.27	603.45
2733	477100.05	1351692.04	604.90
TYPE 3 MONITORING WELLS			
POINT NO.	NORTHING	EASTING	ELEVATION
3068	478701.59	1349923.58	577.00
3070	476791.60	1350557.08	591.40
3431	478895.98	1351606.72	–

BENCHMARKS				
NUMBER	NORTHING	EASTING	ELEVATION	STATUS
IRON PIN (IP)	478205.58	1351472.81	603.32	EXISTING
DOE-WMCO-1A	479157.59	1350835.05	585.57	EXISTING
W-2428	480850.13	1351732.75	600.79	EXISTING
BM-10	482638.02	1351857.89	815.87	EXISTING
CM-8008	482566.06	1349891.82	593.98	EXISTING
OSDF-2	482199.94	1351779.18	615.82	EXISTING
OSDF-3	478850.42	1351749.33	595.61	EXISTING
OSDF-4A	483394.98	1351770.39	609.93	EXISTING

LEGEND

- BUTLER COUNTY/HAMILTON COUNTY LINE
- FEMP PROPERTY LINE
- BATTERY LIMIT
- IMPACTED MATERIAL DISPOSAL LIMIT
- BORROW AREA LIMIT
- FENCE
- RADIOLOGICAL CONTROL LIMIT/FENCE (NOTE 7)
- EXISTING ILTS PIPE
- EXISTING LTS PIPE
- EXISTING EPLTS PIPE
- DRAINAGE FLOW DIRECTION
- OSDF-4A BENCHMARK
- EXISTING MONITORING WELLS
- ON-SITE DISPOSAL FACILITY CELL DESIGNATION
- ACCESS CORRIDOR, ACCESS ROAD, ACCESS RAMP, OR HAUL ROAD
- IMPACTED MATERIAL PLACEMENT AREA CELLS 3, 4, 5, AND 6 (NOTE 8)
- CELL 6 LINER SYSTEM (NOTE 6)

NOTES:

1. PURPOSE OF THIS DRAWING IS TO CONCEPTUALLY ILLUSTRATE SITE DEVELOPMENT FOR OSDF-PHASE V WITH SUPPORT FACILITIES INCLUDING BUT NOT LIMITED TO HAUL ROADS, GUARD SHACKS, EQUIPMENT WASH FACILITY, CONTRACTOR ADMINISTRATION AREA, PARKING AREAS, CONSTRUCTION LAYDOWN AREA, ACCESS CONTROL FACILITY, RADIOLOGICAL CONTROL LIMIT/FENCE, STOCKPILE AREAS, AND SEDIMENTATION BASINS. SIZE AND LOCATION OF SUPPORT FACILITIES MAY VARY FROM THOSE SHOWN.
2. CONTRACTOR SHALL CONTAIN AND CONTROL WATER GENERATED DURING CONSTRUCTION AND FILLING OF OSDF IN ACCORDANCE WITH SPECIFICATION SECTIONS 02270 AND 13010.
3. CONTRACTOR SHALL SUBMIT EARTHWORK WORK PLAN IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
4. EXISTING CONTOURS ARE NOT SHOWN FOR CLARITY. EXISTING CONTOURS ARE SHOWN ON GRADING PLANS. ADDITIONAL EXISTING CONDITIONS ARE SHOWN ON REFERENCE DRAWINGS. EXISTING CONDITIONS SHALL BE VERIFIED IN ACCORDANCE WITH SPECIFICATION SECTION 02100.
5. IMPACTED RUNOFF CATCHMENT AREA IN ACTIVE CELL SHALL REMAIN OPEN UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED IN ADJACENT UPGRADIENT CELL AND IMPACTED RUNOFF CATCHMENT AREA IN DOWNGRADIENT CELL IS CONSTRUCTED AND OPERATIONAL.
6. STATEMENT OF WORK FOR OSDF-PHASE V CONSTRUCTION IS SPECIFIED IN PART 6 OF THE CONTRACT DOCUMENT.
7. RADIOLOGICAL CONTROL LIMIT/FENCE INDICATES LIMIT OF RADIOLOGICAL CONTROL FOR IMPACTED MATERIAL HAULING AND PLACEMENT. RAD FENCE SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
8. BORROW AREA MANAGEMENT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13000.
9. CONTRACTOR SHALL LOCATE MID-VALLEY PIPELINE EASEMENT IN ACCORDANCE WITH SPECIFICATION SECTION 02100. CONTRACTOR SHALL NOT ENTER PIPELINE EASEMENT.
10. CONSTRUCTION WATER SHALL BE OBTAINED FROM EXISTING WELL HOUSES LOCATED WEST OF FORMER PRODUCTION AREA AT LOCATIONS N 480,784.4 AND E 1,348,404.7 AND N 481,456.8 AND E 1,350,478.4 AND CONSTRUCTION WATER WELLS SHOWN ON THIS DRAWING.
11. LOCATION AND DESIGN OF OMTA EXPANSION AREA AND CONSTRUCTION WATER WELL NO. 3 TO BE PROVIDED BY CONSTRUCTION MANAGER.
12. OSDF IMPACTED MATERIAL HAUL ROAD AND CELL ACCESS RAMP AT CELL 6 GRADING PLANS ARE SHOWN ON DRAWING G-17.
13. OSDF SEDIMENTATION BASIN NO. 2 GRADING PLAN IS SHOWN ON DRAWING G-5.
14. REMOVAL LIMITS FOR NORTH ENTRANCE ROAD AND VALVE HOUSE ACCESS ROAD ARE SHOWN ON DRAWING G-4.
15. REMOVAL OF EXISTING OSDF SEDIMENTATION BASIN NO. 1 IS SHOWN ON DRAWING G-4.
16. GEOTECHNICAL DATA POINTS ARE SHOWN ON DRAWINGS G-4 AND G-6.
17. EMERGENCY ACCESS ROAD TO BE USED FOR EMERGENCY RESPONSE VEHICLES AND PICKUP TRUCK VEHICLES. THIS ROAD SHALL BE USED FOR DELIVERY OF CONSTRUCTION MATERIALS AND EQUIPMENT AS APPROVED BY CONSTRUCTION MANAGER.
18. SOUTH ENTRANCE ROAD SHALL NOT BE USED FOR DELIVERY OF CONSTRUCTION MATERIALS.
19. MONITORING ACCESS TO BE USED FOR MAINTENANCE, SEEDING, IRRIGATION, MONITORING, INSPECTION, FEMP OPERATIONS, AND EMERGENCY VEHICLES ONLY.
20. CONTRACTOR SHALL REMOVE EXISTING SURVEY BENCHMARK IP AND ESTABLISH NEW SURVEY BENCHMARK IP-2 AS DIRECTED BY CONSTRUCTION MANAGER.
21. DETAILS FOR FENCE AND GATE INSTALLATION ARE SHOWN ON DRAWING G-47.
22. ROAD PAVEMENT COURSES AND ASSOCIATED IMPACTED MATERIAL FOR EXISTING ROAD SHALL BE REMOVED WITHIN LIMITS SHOWN. REMOVAL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200. CONTRACTOR SHALL PLACE REMOVED MATERIAL IN SOUTH STOCKPILE AREA OR ACTIVE CELL AS APPROVED BY CONSTRUCTION MANAGER.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
0	02.01.19	CFC SUBMITTAL TO FF/DOE/EPA	TEJ	JAA	LMG	DGP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEJ	TMM	LMG	DGP	JFB
A	01.10.17	PRELIMINARY SUBMITTAL TO FF/DOE	TEJ	VDW	LMG	DGP	JFB

200 100 0 200 400
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
SITE DEVELOPMENT PLAN I – CELL 6

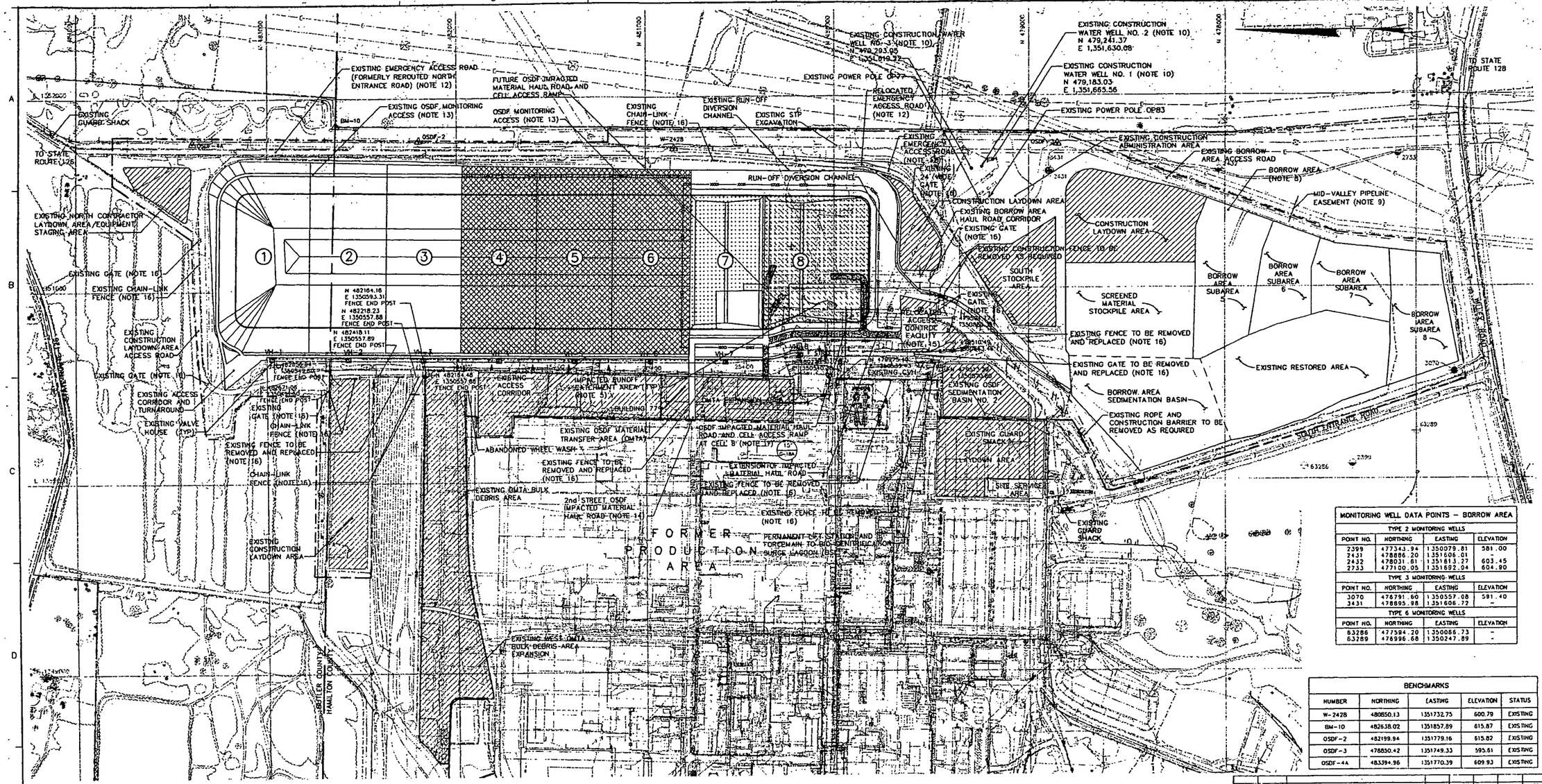
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT VENDOR ON CONSTRUCTION, UNLESS DETAILED.

STATE OF OHIO JOHN E. BEECH E-38349 REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS
1900 LAKE PLACE DRIVE
ATLANTA, GEORGIA 30342 USA

PROJECT NO.:	20105
CONTRACT NO.:	95P5005028
FEMP DRAWING NO.:	903-6000-0-00383
GEOSYNTEC PROJECT NO.:	G01342-33.4
GEOSYNTEC DOCUMENT NO.:	F01-0001
SHEET NO.:	G-1
REVISION NO.:	

CERTIFIED-FOR-CONSTRUCTION



MONITORING WELL DATA POINTS – BORROW AREA			
TYPE 2 MONITORING WELLS			
POINT NO.	NORTHING	EASTING	ELEVATION
2399	477343.94	1350079.81	581.00
2431	478886.20	1351606.01	–
2432	478031.81	1351813.27	603.45
2733	477100.05	1351692.04	604.90
TYPE 3 MONITORING WELLS			
POINT NO.	NORTHING	EASTING	ELEVATION
3070	476791.60	1350557.08	591.40
3431	478895.98	1351606.72	–
TYPE 6 MONITORING WELLS			
POINT NO.	NORTHING	EASTING	ELEVATION
63286	477594.20	1350066.73	–
63289	476996.68	1350247.89	–

BENCHMARKS				
NUMBER	NORTHING	EASTING	ELEVATION	STATUS
W-2428	480850.13	1351732.75	600.79	EXISTING
BM-10	482638.02	1351857.89	615.87	EXISTING
OSDF-2	482199.94	1351779.16	615.82	EXISTING
OSDF-3	478850.42	1351749.33	595.61	EXISTING
OSDF-4A	483394.96	1351770.39	609.93	EXISTING

LEGEND

- BUTLER COUNTY/HAMILTON COUNTY LINE
- FCP PROPERTY LINE
- BATTERY LIMIT
- IMPACTED MATERIAL DISPOSAL LIMIT
- BORROW AREA LIMIT
- RADIOLOGICAL CONTROL LIMIT/FENCE (NOTE 6)
- FENCE
- R.T.S — EXISTING R.T.S PIPE
- L.T.S — EXISTING L.T.S PIPE
- 135-00 — EXISTING EPLTS PIPE
- DRAINAGE FLOW DIRECTION
- OSDF-4A — BENCHMARK
- EXISTING MONITORING WELLS
- 2 — ON-SITE DISPOSAL FACILITY CELL DESIGNATION
- ACCESS CORRIDOR, ACCESS ROAD, ACCESS RAMP, OR HAUL ROAD
- CELLS 4, 5, AND 6 FINAL COVER SYSTEM
- IMPACTED MATERIAL PLACEMENT AREA CELLS 7 AND 8
- CELL 8 LINER SYSTEM

NOTES:

1. PURPOSE OF THIS DRAWING IS TO CONCEPTUALLY ILLUSTRATE SITE DEVELOPMENT FOR OSDF-PHASE V WITH SUPPORT FACILITIES INCLUDING BUT NOT LIMITED TO HAUL ROADS, GUARD SHACKS, EQUIPMENT WASH FACILITY, CONTRACTOR ADMINISTRATION AREA, PARKING AREAS, CONSTRUCTION LAYDOWN AREA, ACCESS CONTROL FACILITY, RADIOLOGICAL CONTROL LIMIT/FENCE, STOCKPILE AREAS, AND SEDIMENTATION BASINS. SIZE AND LOCATION OF SUPPORT FACILITIES MAY VARY FROM THOSE SHOWN.
2. CONTAIN AND CONTROL WATER GENERATED DURING CONSTRUCTION AND FILLING OF OSDF IN ACCORDANCE WITH SPECIFICATION SECTIONS 02270 AND 13010.
3. PREPARE EARTHWORK WORK PLAN IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
4. EXISTING CONTOURS ARE NOT SHOWN FOR CLARITY. EXISTING CONTOURS ARE SHOWN ON GRADING PLANS. ADDITIONAL EXISTING CONDITIONS ARE SHOWN ON REFERENCE DRAWINGS. EXISTING CONDITIONS SHALL BE VERIFIED IN ACCORDANCE WITH SPECIFICATION SECTION 02100.
5. IMPACTED RUNOFF CATCHMENT AREA IN ACTIVE CELL SHALL REMAIN OPEN UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED IN ADJACENT UPGRADIENT CELL AND IMPACTED RUNOFF CATCHMENT AREA IN DOWNGRADIENT CELL IS CONSTRUCTED AND OPERATIONAL.
6. RADIOLOGICAL CONTROL LIMIT/FENCE INDICATES LIMIT OF RADIOLOGICAL CONTROL FOR IMPACTED MATERIAL HAULING AND PLACEMENT. RAD FENCE SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
7. GEOTECHNICAL DATA POINTS ARE SHOWN ON DRAWINGS G-4, G-6, AND G-6A.
8. BORROW AREA MANAGEMENT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13000.
9. LOCATE MID-VALLEY PIPELINE EASEMENT IN ACCORDANCE WITH SPECIFICATION SECTION 02100. DO NOT ENTER PIPELINE EASEMENT.
10. CONSTRUCTION WATER SHALL BE OBTAINED FROM EXISTING WELL HOUSES LOCATED WEST OF FORMER PRODUCTION AREA AT LOCATIONS N 480,384.4 AND E 1,348,403.7 AND N 481,454.8 AND E 1,350,487.4 AND CONSTRUCTION WATER WELLS SHOWN ON THIS DRAWING.
11. OSDF IMPACTED MATERIAL HAUL ROAD AND CELL ACCESS RAMP AT CELL 8 GRADING PLANS ARE SHOWN ON DRAWING G-18A.
12. EMERGENCY ACCESS ROAD TO BE USED FOR EMERGENCY RESPONSE VEHICLES AND PICKUP TRUCK VEHICLES. THIS ROAD SHALL ONLY BE USED FOR DELIVERY OF CONSTRUCTION MATERIALS AND EQUIPMENT AS APPROVED BY CONSTRUCTION MANAGER.
13. OSDF MONITORING ACCESS TO BE USED FOR MAINTENANCE, SEEDING, IRRIGATION, MONITORING, INSPECTION, FEMP OPERATIONS, AND EMERGENCY VEHICLES ONLY.
14. SECOND STREET IMPACTED MATERIAL HAUL ROAD MAY BE ROUTED AROUND BUILDING 77 BASED ON DEMOLITION SCHEDULE. CONSTRUCT SECOND STREET IMPACTED MATERIAL HAUL ROAD TO BE OPERATIONAL BEFORE CONSTRUCTION OF CELL 4 FINAL COVER SYSTEM.
15. CONSTRUCT RELOCATED ACCESS CONTROL FACILITY. FACILITY TO BE OPERATIONAL BEFORE CONSTRUCTION OF CELL 4 FINAL COVER SYSTEM. LOCATION AND DESIGN OF RELOCATED ACCESS CONTROL FACILITY TO BE PROVIDED BY CONSTRUCTION MANAGER.
16. DENOTES FINAL CONFIGURATION OF OSDF FENCE AND GATES. CHAIN-LINK FENCE AND GATES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02831.

CERTIFIED-FOR-CONSTRUCTION

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APV. BY
1	05.03.15	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LWG	DKP	JFB
1C	04.08.18	REVISED PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE/EPA PER DCN	TEZ	JJA	LWG	DKP	RB
1B	04.06.33	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE PER DCN.	TEZ	JJA	LWG	DKP	RB
1A	04.06.16	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE PER DCN	TEZ	JJA	LWG	DKP	RB
0	04.01.22	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LWG	DKP	RB
B	03.12.08	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	JJA	LWG	DKP	RB
A	03.10.28	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	JJA	LWG	DKP	RB

200 100 0 200 400
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

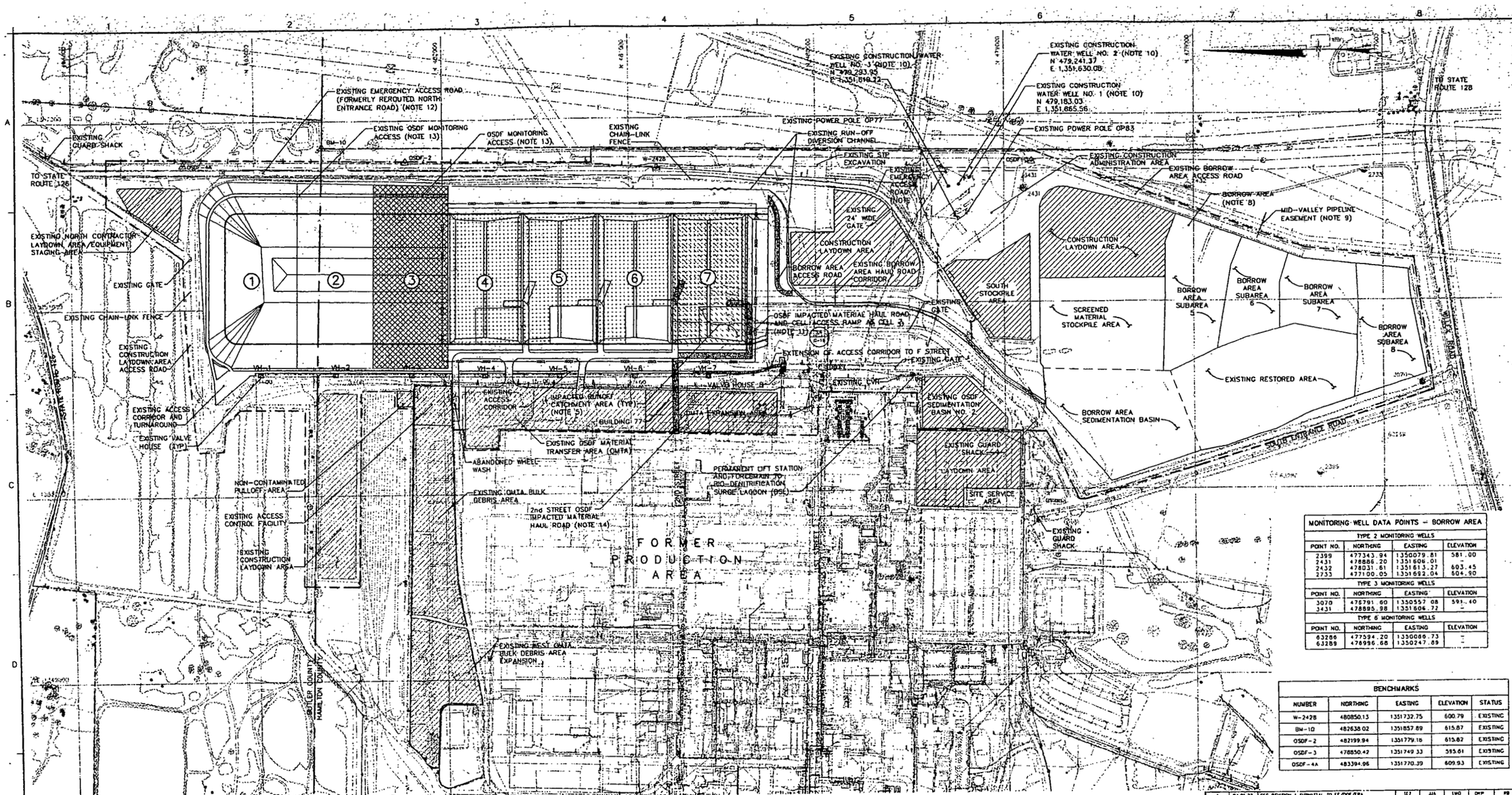
TITLE:
SITE DEVELOPMENT PLAN III – CELL 8

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDER OR CONSTRUCTION, UNLESS SEALED.

STATE OF OHIO — JOHN F. BEECH E-58246 — REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS
1206 PEARL ST. ENGLEWOOD, OH 45322 - USA

PROJECT NO.:	20105
CONTRACT NO.:	03FF0699
FEMP DRAWING NO.:	90X-8000-G-00413
GEOSYNTEC PROJECT NO.:	003309-02.02
GEOSYNTEC DOCUMENT NO.:	FD4-1087
SHEET NO.:	G-2A
REVISION NO.:	1



MONITORING WELL DATA POINTS – BORROW AREA			
TYPE 2 MONITORING WELLS			
POINT NO.	NORTHING	EASTING	ELEVATION
2399	477343.94	1350079.81	581.00
2431	478886.20	1351606.01	–
2432	478031.61	1351613.27	603.45
2733	477100.05	1351692.04	604.90
TYPE 3 MONITORING WELLS			
POINT NO.	NORTHING	EASTING	ELEVATION
3070	476791.60	1350557.08	591.40
3431	478895.98	1351606.72	–
TYPE 6 MONITORING WELLS			
POINT NO.	NORTHING	EASTING	ELEVATION
63286	477594.20	1350066.73	–
63289	478996.68	1350247.69	–

BENCHMARKS				
NUMBER	NORTHING	EASTING	ELEVATION	STATUS
W-2428	480850.13	1351732.75	600.79	EXISTING
BM-10	482638.02	1351857.89	615.87	EXISTING
OSDF-2	482199.94	1351779.18	615.82	EXISTING
OSDF-3	478850.42	1351749.33	595.61	EXISTING
OSDF-4A	483394.96	1351770.39	609.93	EXISTING

LEGEND

- BUTLER COUNTY/HAMILTON COUNTY LINE
- FOP PROPERTY LINE
- BATTERY LIMIT
- IMPACTED MATERIAL DISPOSAL LIMIT
- BORROW AREA LIMIT
- RADIOLOGICAL CONTROL LIMIT/FENCE (NOTE 6)
- FENCE
- EXISTING ILTS PIPE
- EXISTING LTS PIPE
- EXISTING EPLTS PIPE
- DRAINAGE FLOW DIRECTION
- OSDF-4A — BENCHMARK
- EXISTING MONITORING WELLS
- 2 — ON-SITE DISPOSAL FACILITY CELL DESIGNATION
- ACCESS CORRIDOR, ACCESS ROAD, ACCESS RAMP, OR HAUL ROAD
- CELL 3 FINAL COVER SYSTEM
- IMPACTED MATERIAL PLACEMENT AREA CELLS 4, 5, 6, AND 7
- CELL 7 LINER SYSTEM

NOTES:

1. PURPOSE OF THIS DRAWING IS TO CONCEPTUALLY ILLUSTRATE SITE DEVELOPMENT FOR OSDF-PHASE V WITH SUPPORT FACILITIES INCLUDING BUT NOT LIMITED TO HAUL ROADS, GUARD SHACKS, EQUIPMENT WASH FACILITY, CONTRACTOR ADMINISTRATION AREA, PARKING AREAS, CONSTRUCTION LAYDOWN AREA, ACCESS CONTROL FACILITY, RADIOLOGICAL CONTROL LIMIT/FENCE, STOCKPILE AREAS, AND SEDIMENTATION BASINS. SIZE AND LOCATION OF SUPPORT FACILITIES MAY VARY FROM THOSE SHOWN.
2. CONTAIN AND CONTROL WATER GENERATED DURING CONSTRUCTION AND FILLING OF OSDF IN ACCORDANCE WITH SPECIFICATION SECTIONS 02270 AND 13010.
3. PREPARE EARTHWORK WORK PLAN IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
4. EXISTING CONTOURS ARE NOT SHOWN FOR CLARITY. EXISTING CONTOURS ARE SHOWN ON GRADING PLANS. ADDITIONAL EXISTING CONDITIONS ARE SHOWN ON REFERENCE DRAWINGS. EXISTING CONDITIONS SHALL BE VERIFIED IN ACCORDANCE WITH SPECIFICATION SECTION 02100.
5. IMPACTED RUNOFF CATCHMENT AREA IN ACTIVE CELL SHALL REMAIN OPEN UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED IN ADJACENT UPGRADIENT CELL AND IMPACTED RUNOFF CATCHMENT AREA IN DOWNGRADIENT CELL IS CONSTRUCTED AND OPERATIONAL.
6. RADIOLOGICAL CONTROL LIMIT/FENCE INDICATES LIMIT OF RADIOLOGICAL CONTROL FOR IMPACTED MATERIAL HAULING AND PLACEMENT. RAD FENCE SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
7. GEOTECHNICAL DATA POINTS ARE SHOWN ON DRAWINGS G-4, G-6, AND G-8A.
8. BORROW AREA MANAGEMENT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13000.
9. LOCATE MID-VALLEY PIPELINE EASEMENT IN ACCORDANCE WITH SPECIFICATION SECTION 02100. DO NOT ENTER PIPELINE EASEMENT.
10. CONSTRUCTION WATER SHALL BE OBTAINED FROM EXISTING WELL HOUSES LOCATED WEST OF FORMER PRODUCTION AREA AT LOCATIONS N 480,784.4 AND E 1,348,403.7 AND N 481,434.8 AND E 1,350,487.4 AND CONSTRUCTION WATER WELLS SHOWN ON THIS DRAWING.
11. OSDF IMPACTED MATERIAL HAUL ROAD AND CELL ACCESS RAMP AT CELL 7 GRADING PLANS ARE SHOWN ON DRAWING G-18.
12. EMERGENCY ACCESS ROAD TO BE USED FOR EMERGENCY RESPONSE VEHICLES AND PICKUP TRUCK VEHICLES. THIS ROAD SHALL ONLY BE USED FOR DELIVERY OF CONSTRUCTION MATERIALS AND EQUIPMENT AS APPROVED BY CONSTRUCTION MANAGER.
13. OSDF MONITORING ACCESS TO BE USED FOR MAINTENANCE, SEEDING, IRRIGATION, MONITORING, INSPECTION, FEMP OPERATIONS, AND EMERGENCY VEHICLES ONLY.
14. SECOND STREET IMPACTED MATERIAL HAUL ROAD MAY BE ROUTED AROUND BUILDING 77 BASED ON DEMOLITION SCHEDULE. SECOND STREET IMPACTED MATERIAL HAUL ROAD TO BE OPERATIONAL BEFORE CONSTRUCTION OF CELL 4 FINAL COVER SYSTEM.

REV. NO.	DATE	DESCRIPTION	CES BY	DR BY	CHK BY	RVW BY	APP. BY
1	04.01.23	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMG	DKP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TEZ	JJA	LMG	DKP	RB
1A	03.10.28	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	TEZ	JJA	LMG	DKP	RB
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMG	DGP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	HJM	LMG	DGP	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	VGR	LMG	DGP	JFB

200 100 0 200 400
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: SITE DEVELOPMENT PLAN II – CELL 7

THIS DRAWING MAY NOT BE USED FOR PROJECT REVIEW OR CONSTRUCTION, UNLESS SEALED.

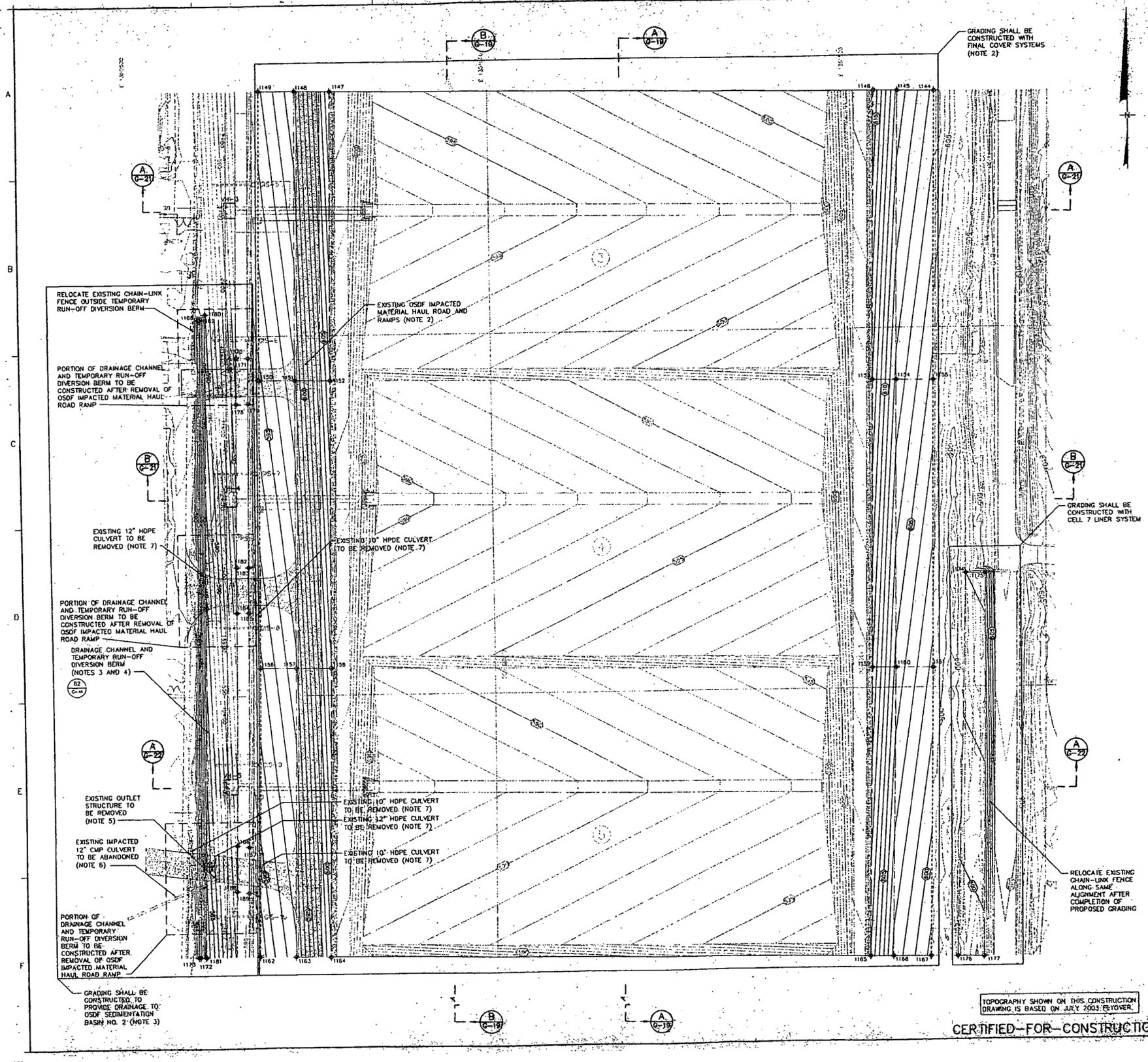
Signature
22 January 04
DATE

STATE OF OHIO — RUDOLPH BONAPARTE E-56679 — REGISTERED PROFESSIONAL ENGINEER — U.S.A.

GEOSYNTEC CONSULTANTS
1000 LAKE OF THE OAKS
ATLANTA, GEORGIA 30339 USA

PROJECT NO.:	20105
CONTRACT NO.:	03J70899
FEMP DRAWING NO.:	90K-6000-G-00364
GEOSYNTEC PROJECT NO.:	003211.06.04
GEOSYNTEC DOCUMENT NO.:	F03-1002
SHEET NO.:	G-2
REVISION NO.:	1

CERTIFIED–FOR–CONSTRUCTION



LEGEND

- EXISTING GROUND ELEVATION (FEET)
- EXISTING SUBGRADE ELEVATION (FEET) (NOTE 1)
- SUBGRADE ELEVATION (FEET) (NOTES 1 AND 2)
- PERIMETER BERM BASELINE
- APPROXIMATE LIMIT OF FINAL COVER SYSTEM CONSTRUCTION
- EXISTING ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM PIPE
- EXISTING INTERIM LEACHATE TRANSMISSION SYSTEM PIPE
- CONSTRUCTION CONTROL POINT
- EXISTING CELL DESIGNATION
- BERM CREST

SUBGRADE CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
1144	482327.33	1351619.11	607.69
1145	482327.94	1351569.03	610.70
1146	482328.33	1351537.40	615.97
1147	482337.57	1350780.79	608.94
1148	482338.17	1350731.85	600.79
1149	482338.78	1350681.76	597.78
1150	481938.68	1350676.87	594.78
1151	481938.12	1350726.86	597.79
1152	481937.56	1350775.90	605.94
1153	481928.37	1351532.52	612.97
1154	481927.99	1351584.14	607.71
1155	481927.37	1351614.23	604.69
1156	481538.84	1350671.98	591.78
1157	481538.23	1350722.07	594.79
1158	481537.64	1350771.01	602.94
1159	481528.38	1351527.63	609.97
1160	481527.99	1351589.25	604.70
1161	481527.38	1351609.34	601.69
1162	481138.36	1350667.09	588.78
1163	481137.73	1350717.17	591.78
1164	481137.11	1350766.11	599.94
1165	481128.32	1351527.74	606.96
1166	481127.93	1351554.38	601.69
1167	481127.31	1351604.45	598.69
1168	482023.13	1350594.14	593.85
1169	482023.11	1350586.14	593.85
1170	481970.11	1350645.49	596.46
1171	481969.91	1350661.99	596.46
1172	481138.40	1350565.32	587.21
1173	481138.40	1350583.32	587.21
1174	481658.14	1351858.04	602.00
1175	481657.83	1351883.43	602.27
1176	481126.86	1351841.57	599.34
1177	481126.40	1351878.14	599.71
1178	481906.47	1350644.71	595.98
1179	481906.68	1350661.22	595.98
1180	482030.89	1350604.23	589.91
1181	481138.40	1350593.32	583.22
1182	481679.09	1350641.93	594.27
1183	481679.09	1350858.44	594.28
1184	481615.87	1350641.16	593.80
1185	481615.87	1350657.68	593.80
1186	481292.71	1350637.21	591.38
1187	481290.65	1350653.69	591.38
1188	481229.40	1350638.44	590.90
1189	481227.33	1350652.91	590.89

NOTES:

1. SUBGRADE ELEVATIONS CORRESPOND TO TOP OF PREPARED SUBGRADE INCLUDING ANY FILL. SUBGRADE AND FILL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
2. RE-ESTABLISH SUBGRADE ELEVATIONS TO FINAL COVER SYSTEM CONSTRUCTION LIMITS SHOWN HEREON AND RELOCATE EXISTING CHAIN-LINK FENCE AFTER REMOVAL OF IMPACTED MATERIAL HAUL ROAD AND RAMP AND PRIOR TO FINAL COVER SYSTEM CONSTRUCTION.
3. CONSTRUCT DRAINAGE CHANNEL AND TEMPORARY RUN-OFF DIVERSION BERM TO PROVIDE POSITIVE DRAINAGE TO OSDF SEDIMENTATION BASIN NO. 2.
4. REMOVE EXISTING INTERIM LEACHATE TRANSMISSION SYSTEM PIPE AND TEMPORARY RUN-OFF DIVERSION BERM AFTER ADJACENT CELL CAPS ARE FULLY VEGETATED. PLACE COMPACTED FILL, AS NECESSARY, TO PROVIDE POSITIVE DRAINAGE TO FORMER PRODUCTION AREA AND AWAY FROM OSDF FACILITY.
5. REMOVE EXISTING OUTLET STRUCTURE AND RE-ESTABLISH DRAINAGE CHANNEL SLOPE AFTER CELL 5 FINAL COVER SYSTEM CONSTRUCTION. MATERIAL SHALL BE STOCKPILED AT LOCATION DESIGNATED BY CONSTRUCTION MANAGER.
6. ABANDON EXISTING IMPACTED CORRUGATED METAL PIPE CULVERT IN PLACE BY FILLING END OF CULVERT WITH GROUT FOR A MINIMUM LENGTH OF 4 FEET.
7. REMOVE EXISTING CULVERT AND STOCKPILE MATERIAL AT LOCATIONS DESIGNATED BY CONSTRUCTION MANAGER.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	LMG	JJA	TEZ	DGP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DGP	RB
1A	–	NOT ISSUED	–	–	–	–	–
0	02.01.25	CFC SUBMITTAL TO FF/DOE/EPA	LMG	JJA	TEZ	DGP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DGP	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	KRG	DAH	KRG	DGP	JFB

SCALE IN FEET: 50 25 0 50 100

OWNER/FACILITY: UNITED STATES DEPARTMENT OF ENERGY FERNALD CLOSURE PROJECT

CLIENT: FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

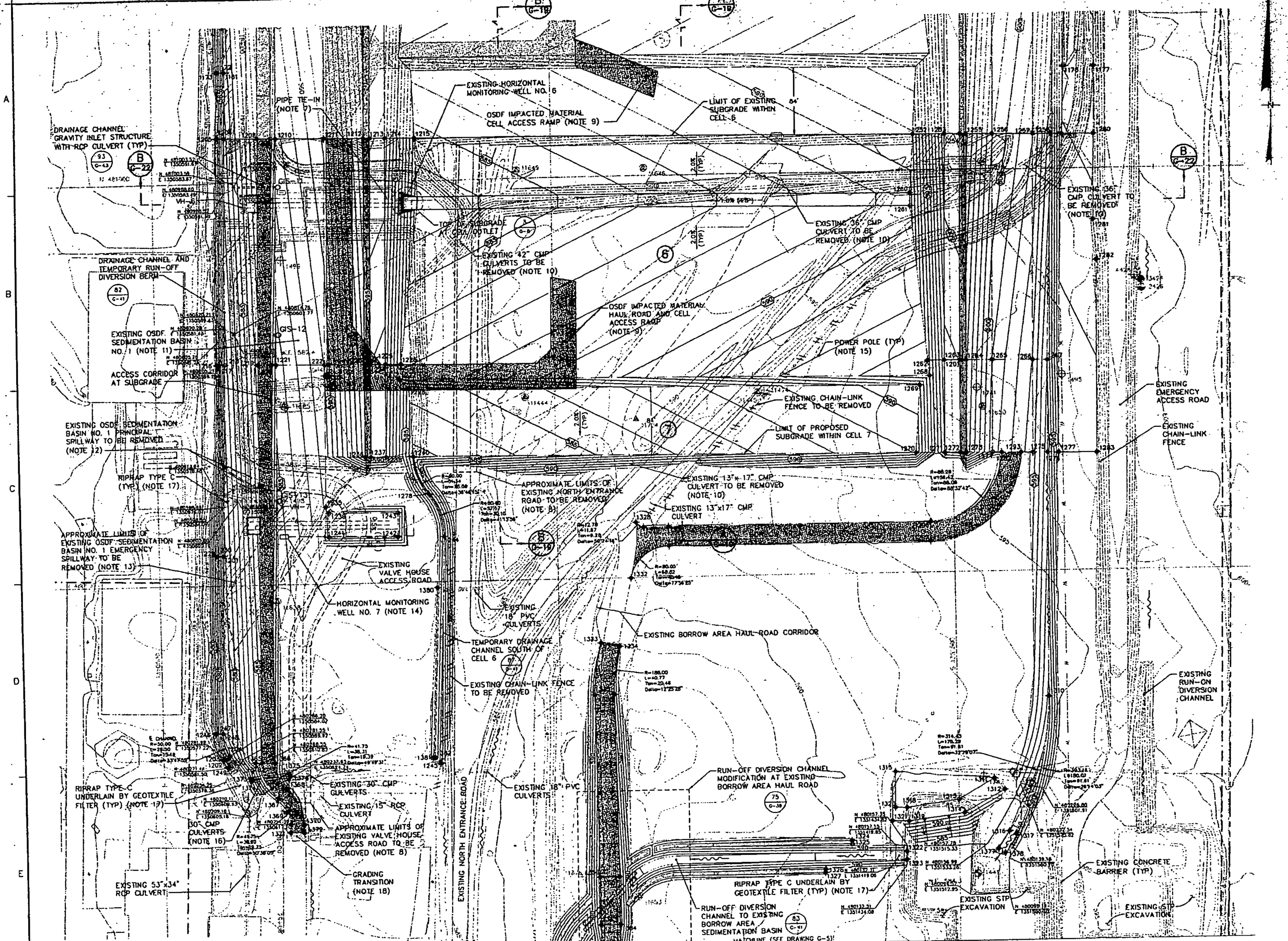
TITLE: SUBGRADE GRADING PLAN I – CELLS 3, 4, AND 5 LINER AND FINAL COVER SYSTEMS

THIS DRAWING MAY NOT BE USED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

STATE OF OHIO — RUDOLPH BONAPARTE E-56879 — REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS

PROJECT NO.:	20105
CONTRACT NO.:	03T06.09
TEMP DRAWING NO.:	SOX-5000-G-00.363
GEOSYNTEC PROJECT NO.:	GO3711-06-04
GEOSYNTEC DOCUMENT NO.:	F03-1003
SHEET NO.:	G-1.3
REVISION NO.:	1



SUBGRADE CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION	POINT NO.	NORTHING	EASTING	ELEVATION
1172	481138.40	1350585.32	587.21	1268	480745.38	1351477.84	593.90
1173	481138.40	1350583.32	587.21	1269	480733.51	1351460.43	590.77
1176	481126.88	1351641.57	599.34	1270	480849.58	1351434.15	589.04
1177	481126.40	1351678.14	599.71	1271	480849.14	1351490.37	598.09
1181	481128.40	1350593.32	583.22	1272	480848.91	1351509.08	598.47
1201	480784.02	1351510.49	599.04	1273	480848.81	1351516.88	603.66
1202	480280.52	1350575.52	580.54	1274	480848.43	1351548.50	598.39
1203	480281.98	1350577.72	580.54	1275	480847.82	1351598.89	605.38
1204	480288.20	1350584.02	578.54	1276	480847.80	1351616.58	597.38
1205	481056.33	1350582.32	586.60	1277	480847.43	1351630.25	596.94
1206	481056.31	1350584.32	586.60	1278	480810.21	1350838.31	582.53
1207	481058.21	1350592.32	582.60	1280	481042.84	1351677.23	599.30
1208	481055.68	1350634.32	586.60	1281	480938.18	1351676.07	598.78
1209	481055.47	1350650.81	589.60	1282	480888.03	1351678.74	598.58
1210	481055.40	1350656.81	587.60	1283	480844.88	1351676.79	597.41
1211	481054.68	1350716.16	591.16	1292	480848.29	1351539.63	597.76
1212	481054.05	1350765.10	599.37	1293	480848.00	1351583.71	588.29
1213	481053.95	1350772.89	594.13	1296	480563.10	1351470.58	594.21
1214	481053.71	1350781.61	593.75	1297	480539.10	1351470.58	594.21
1215	481053.28	1350828.01	584.65	1310	480341.79	1351612.85	590.71
1216	480775.41	1350578.89	584.49	1311	480239.91	1351343.88	593.00
1217	480775.38	1350580.88	584.49	1312	480225.48	1351556.47	592.00
1218	480775.29	1350588.89	580.49	1313	480214.12	1351489.89	593.00
1219	480774.77	1350630.88	587.49	1314	480197.09	1351508.72	592.00
1220	480774.57	1350647.38	587.49	1315	480249.98	1351420.79	593.00
1221	480774.50	1350653.38	588.48	1316	480173.51	1351561.61	588.82
1222	480773.77	1350712.73	589.05	1317	480168.52	1351570.28	588.92
1223	480773.17	1350781.67	597.21	1318	480204.82	1351434.87	593.00
1224	480772.85	1350788.18	591.64	1319	480187.89	1351437.37	592.00
1225	480773.08	1350789.46	592.01	1320	480205.27	1351420.33	593.00
1226	480772.67	1350807.31	588.88	1321	480188.68	1351416.33	592.00
1227	480753.54	1350805.24	587.22	1322	480149.93	1351434.60	588.53
1228	480741.38	1350816.42	584.33	1323	480139.93	1351434.30	588.53
1229	480537.35	1350572.40	582.70	1324	480164.04	1351363.96	591.78
1230	480537.32	1350574.40	582.71	1325	480160.64	1351363.06	591.78
1231	480537.23	1350582.40	578.71	1326	480128.22	1351330.41	591.63
1235	480586.32	1350710.58	588.17	1327	480125.22	1351330.41	591.63
1236	480658.05	1350760.26	594.83	1328	480569.27	1351098.51	590.00
1237	480657.97	1350768.05	591.44	1329	480563.10	1351107.94	590.59
1238	480657.74	1350788.77	591.06	1330	480563.10	1351139.37	590.90
1239	480588.49	1350734.55	589.70	1331	480539.10	1351139.66	590.90
1240	480657.33	1350820.24	582.70	1332	480499.55	1351090.77	590.88
1241	480558.48	1350734.18	589.55	1333	480418.88	1351051.40	590.07
1242	480557.70	1350799.27	589.55	1334	480414.00	1351074.90	590.07
1243	480587.70	1350799.84	589.70	1335	480353.71	1351042.85	590.75
1244	480556.87	1350856.43	587.33	1336	480353.93	1351088.85	590.75
1245	480272.12	1350847.18	581.42	1356	480125.70	1351045.31	593.50
1246	480314.50	1350568.33	581.03	1357	480175.96	1351088.31	593.50
1247	480314.45	1350568.33	581.03	1363	480065.53	1351045.97	593.50
1248	480314.23	1350578.33	577.03	1364	480065.79	1351089.98	593.50
1249	480771.44	1350861.50	580.36	1365	480278.45	1350624.79	585.00
1250	480272.50	1350583.20	580.36	1366	480278.25	1350841.29	585.00
1252	481045.41	1351455.81	590.92	1367	480231.77	1350844.89	583.23
1253	481044.91	1351495.70	600.77	1368	480244.14	1350865.75	583.23
1254	481044.68	1351513.82	601.13	1369	480189.01	1350859.33	581.41
1255	481044.58	1351521.71	608.34	1370	480186.00	1350875.63	581.41
1256	481044.18	1351553.34	601.07	1371	480188.65	1350659.08	580.99
1257	481043.58	1351603.42	598.07	1372	480188.22	1350675.55	580.99
1258	481043.28	1351625.63	594.36	1373	480257.46	1350610.16	578.84
1259	481043.11	1351639.29	588.92	1374	480253.63	1350811.49	578.84
1260	480972.78	1351431.13	581.43	1375	480262.47	1350858.63	579.33
1261	480958.76	1351431.44	581.43	1376	480258.83	1350659.83	578.33
1262	480764.50	1351471.09	593.49	1377	480151.86	1351548.02	588.88
1263	480769.25	1351491.77	598.67	1378	480146.73	1351558.28	588.86
1264	480783.93	1351518.28	604.24	1379	480278.57	1350616.96	583.70
1265	480763.54	1351548.91	598.97	1380	480482.68	1350846.72	584.00
1266	480782.93	1351589.99	595.96	1381	480279.85	1350837.77	584.00
1267	480782.71	1351617.99	592.96	1387	480279.85	1350839.77	584.00

LEGEND

Symbol	Description
600	EXISTING GROUND ELEVATION (FEET)
585	SUBGRADE ELEVATION (FEET) (NOTE 1)
590	FINISHED GRADE ELEVATION (FEET)
	FEMP PROPERTY LINE
	BATTERY LIMIT
	PERIMETER BERM BASELINE
22+00	EXISTING ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM PIPE
	EXISTING INTERIM LEACHATE TRANSMISSION SYSTEM PIPE
	SLOPE TOE OR CREST
	EXISTING HORIZONTAL MONITORING WELL WITH COVER SLAB
3426, 11444, 1441, 1493, 4064, 11704, 2064, 1152	EXISTING GEOTECHNICAL DATA POINTS (NOTE 4)
6	CELL DESIGNATION
1250	CONSTRUCTION CONTROL POINT
	ACCESS CORRIDOR, ACCESS ROAD, ACCESS RAMP, MAINTENANCE ACCESS, OR HAUL ROAD
	BERM CREST
	RIPRAP LIMIT
	GRADING TRANSITION (NOTE 18)
	DRAINAGE FLOW DIRECTION

GEOTECHNICAL DATA POINTS (NOTE 4)

CONE PENETRATION TESTS

POINT NO.	NORTHING	EASTING	ELEVATION
11444	480778.09	1350863.67	
11445	480720.10	1351256.03	
11834	481071.71	1350668.86	
11835	480724.26	1350562.01	
11838	480479.06	1350848.77	
11644	481010.60	1351540.08	
11646	481009.50	1351115.31	
11649	481009.87	1350857.20	
11650	480706.49	1351537.67	
11653	480100.29	1351094.32	

GEOTECHNICAL BORINGS

POINT NO.	NORTHING	EASTING	ELEVATION
1493	480244.41	1351570.98	
1495	480744.42	1351635.97	
1498	480609.41	1350858.98	
1499	480904.41	1350880.97	
1741	480729.42	1351530.97	
1742	480242.41	1351560.98	
11326	480126.49	1351087.07	
11474	480728.81	1351263.60	
11885	480721.77	1350683.00	

PIEZOMETERS

POINT NO.	NORTHING	EASTING	ELEVATION
11704	480697.66	1351101.05	

MONITORING WELLS

POINT NO.	NORTHING	EASTING	ELEVATION
1152	480440.42	1350636.60	

TYPE 1 MONITORING WELLS

POINT NO.	NORTHING	EASTING	ELEVATION
1064	480748.20	1350724.01	
1441	480121.40	1351522.40	

TYPE 2 MONITORING WELLS

POINT NO.	NORTHING	EASTING	ELEVATION
2064	480749.51	1350714.84	
2120	480216.32	1350654.03	
2426	480850.24	1351733.70	

TYPE 3 MONITORING WELLS

POINT NO.	NORTHING	EASTING	ELEVATION
3064	480759.94	1350715.19	
3426	480860.32	1351733.15	

TYPE 4 MONITORING WELLS

POINT NO.	NORTHING	EASTING	ELEVATION
4064	480759.64	1350724.69	
4426	480865.60	1351724.77	

NOTES:

1. CLEARING, GRUBBING, AND STRIPPING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02110. SUBGRADE ELEVATIONS CORRESPOND TO TOP OF PREPARED SUBGRADE, INCLUDING ANY COMPACTED FILL. SUBGRADE SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
2. ACTIVE VERTICAL MONITORING WELLS AND PIEZOMETERS WITHIN CONSTRUCTION AREA WILL BE ABANDONED BY OWNER PRIOR TO CONSTRUCTION IN THAT AREA.
3. CONTRACTOR SHALL LOCATE AND REMOVE EXISTING SUBDRAIN TILE SYSTEM WITHIN CONSTRUCTION AREA IN ACCORDANCE WITH SPECIFICATION SECTION 02200. REFER TO REFERENCE DRAWINGS SKG-04391 THROUGH SKG-04397 FOR LOCATION OF SUBDRAIN TILE SYSTEM.
4. CONTRACTOR SHALL REMOVE GROUT USED TO BACKFILL GEOTECHNICAL DATA POINTS AND MONITORING WELLS LOCATED WITHIN PERIMETER BERM BASELINE TO A MINIMUM DEPTH OF 3 FEET BELOW SUBGRADE ELEVATIONS.
5. CONTRACTOR SHALL DEWATER EXCAVATIONS AND MANAGE COLLECTED WATER IN ACCORDANCE WITH SPECIFICATION SECTION 02200. GROUNDWATER LEVELS IN BROWN AND GRAY TILL LAYERS VARY DURING YEAR AND MAY BE HIGHER THAN THOSE SHOWN ON REFERENCE DRAWINGS. LEVELS MAY APPROACH GROUND SURFACE DURING PERIODS OF HEAVY PRECIPITATION.
6. CONTRACTOR SHALL LOCATE EXISTING UNDERGROUND UTILITIES WITHIN CONSTRUCTION AREA AS SHOWN ON REFERENCE DRAWINGS SKG-04391 THROUGH SKG-04397. CONTRACTOR SHALL REMOVE UNDERGROUND UTILITES IN CONSTRUCTION AREA IN ACCORDANCE WITH SPECIFICATION SECTION 02200 AND AS APPROVED BY CONSTRUCTION MANAGER.
7. LOS, LCS, AND RLCS PIPES SHALL TIE INTO EXISTING PIPES. CONSTRUCTION CONTROL POINTS FOR PIPE TIE-INS ARE SHOWN ON DRAWING G-9.
8. ROAD PAVEMENT COURSES AND ASSOCIATED IMPACTED MATERIAL FOR EXISTING NORTH ENTRANCE ROAD AND EXISTING VALVE HOUSE ACCESS ROAD SHALL BE REMOVED WITHIN LIMITS SHOWN. REMOVAL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200. CONTRACTOR SHALL PLACE REMOVED MATERIAL IN SOUTH STOCKPILE AREA OR ACTIVE CELL AS APPROVED BY CONSTRUCTION MANAGER.
9. OSDF IMPACTED MATERIAL HAUL ROAD AND CELL ACCESS RAMP GRADING PLAN IS SHOWN ON DRAWING G-17.
10. CONTRACTOR SHALL REMOVE EXISTING CULVERTS AND STOCKPILE MATERIAL AT LOCATIONS APPROVED BY CONSTRUCTION MANAGER.
11. CONTRACTOR SHALL REMOVE SEDIMENT FROM EXISTING OSDF SEDIMENTATION BASIN NO. 1 AND EXCAVATE TO COMPETENT SUBGRADE (MINIMUM ELEVATION OF 579 OR LOWER) PRIOR TO BACKFILLING BASIN TO CREST OF EXISTING EMBANKMENT. CONTRACTOR SHALL STOCKPILE EXCAVATED SEDIMENT AT LOCATION APPROVED BY CONSTRUCTION MANAGER. CONTRACTOR SHALL SLOPE COMPACTED FILL FINISHED GRADE WITHIN BASIN TO DRAIN TO WEST AT A MINIMUM SLOPE OF 1 PERCENT.
12. CONTRACTOR SHALL REMOVE EXISTING OSDF SEDIMENTATION BASIN NO. 1 PRIMARY SPILLWAY AND STOCKPILE MATERIAL AT LOCATION APPROVED BY CONSTRUCTION MANGER.
13. CONTRACTOR SHALL REMOVE EXISTING OSDF SEDIMENTATION BASIN NO. 1 EMERGENCY SPILLWAY RIPRAP AND UNDERLYING GEOTEXTILE AND STOCKPILE MATERIAL AT LOCATION APPROVED BY CONSTRUCTION MANAGER.
14. HORIZONTAL MONITORING WELL FOR CELL 7 SHALL BE CONSTRUCTED MINIMUM ONE YEAR PRIOR TO CONSTRUCTION OF CELL 7. HORIZONTAL MONITORING WELL AND MISCELLANEOUS DETAILS ARE SHOWN ON DRAWING G-44.
15. CONTRACTOR SHALL REMOVE POWER POLES LOCATED WITHIN PROPOSED SUBGRADE AND BACKFILL HOLES IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
16. CONTRACTOR SHALL EXTEND EXISTING 30-INCH CMP CULVERTS TO OUTLET INVERTS AS SHOWN. ALUMINIZED CMP CULVERTS AND JOINTS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02721. TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02216.
17. CONTRACTOR SHALL PLACE RIPRAP WITHIN AREA SHOWN. RIPRAP THICKNESS SHALL BE 1.5 FEET. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION 02271. GEOTEXTILE FILTER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02714.
18. CONTRACTOR SHALL TRANSITION PROPOSED ACCESS CORRIDOR ELEVATIONS TO TIE-IN WITH EXISTING GROUND ELEVATIONS WITHIN AREA SHOWN.

CERTIFIED—FOR—CONSTRUCTION

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	LMG	JJA	TEZ	DCP	FB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DCP	FB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DCP	FB

50 25 0 50 100
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

DEPARTMENT OF ENERGY • UNITED STATES OF AMERICA

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
SUBGRADE GRADING PLAN II –
CELL 6 LINER SYSTEM AND
OSDF SEDIMENTATION BASIN NO. 2

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

SIGNATURE
29 Jan 2002
DATE

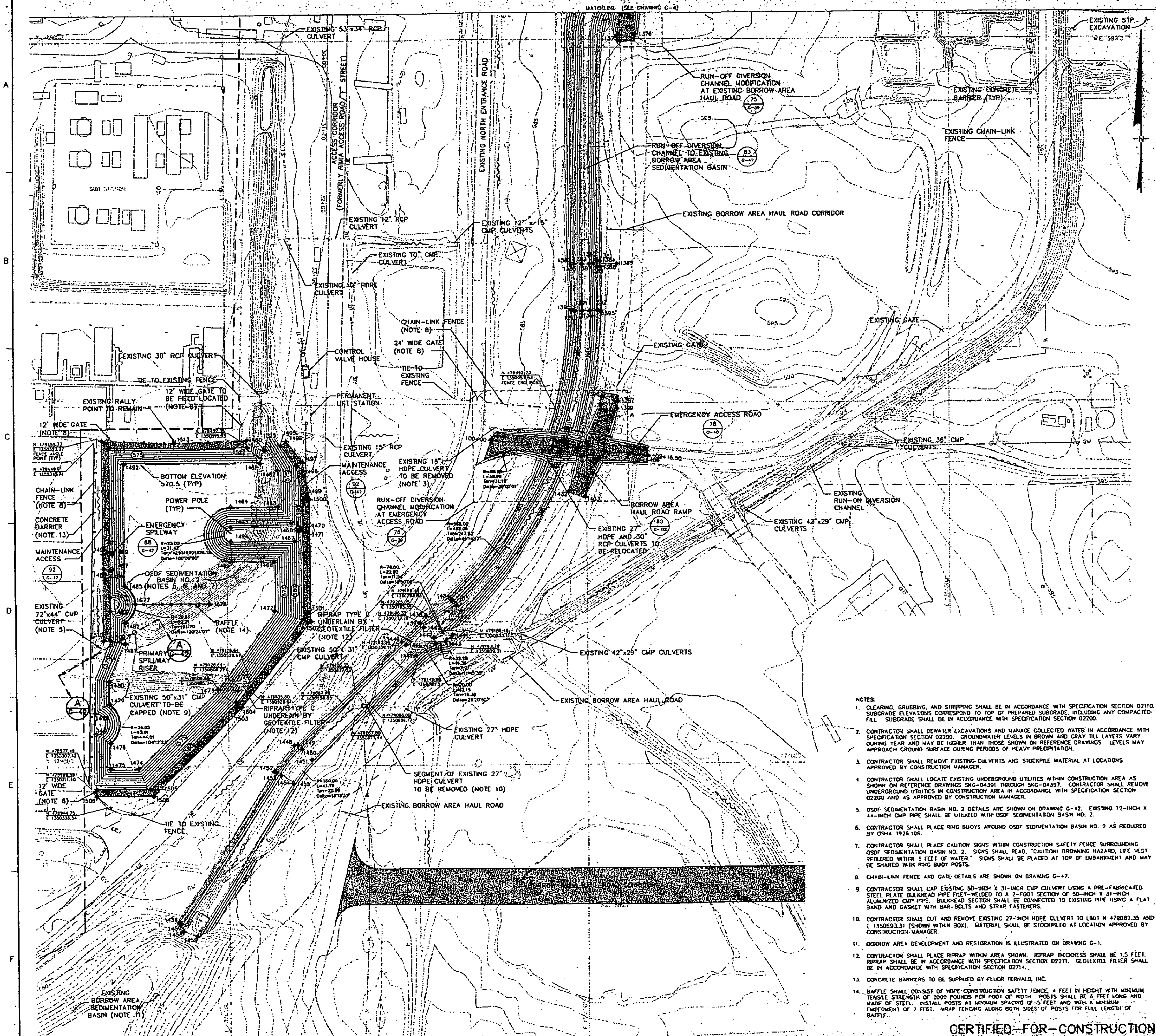
STATE OF OHIO • JOHN F. BETCH • E-58246 • REGISTERED • PROFESSIONAL ENGINEER
SEAL

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE ATLANTA, GEORGIA 30342 USA

PROJECT NO.: 20105
CONTRACT NO.: 95PS005028
FEMP DRAWING NO.: 90X-6000-G-00366
GEOSYNTEC PROJECT NO.: GO1342-17.4
GEOSYNTEC DOCUMENT NO.: F01-0004
SHEET NO.: G-4
REVISION NO.: 0

Document 6774

MATCHLINE (SEE DRAWING C-4)



NOTES:

1. CLEARING, GRUBBING, AND STRIPPING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02110. SUBGRADE ELEVATIONS CORRESPOND TO TOP OF PREPARED SUBGRADE, INCLUDING ANY COMPACTED FILL. SUBGRADE SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
2. CONTRACTOR SHALL DEWATER EXCAVATIONS AND MANAGE COLLECTED WATER IN ACCORDANCE WITH SPECIFICATION SECTION 02200. GROUNDWATER LEVELS IN BROWN AND GRAY TILL LAYERS VARY DURING YEAR AND MAY BE HIGHER THAN THOSE SHOWN ON REFERENCE DRAWINGS. LEVELS MAY APPROACH GROUND SURFACE DURING PERIODS OF HEAVY PRECIPITATION.
3. CONTRACTOR SHALL REMOVE EXISTING CULVERTS AND STOCKPILE MATERIAL AT LOCATIONS APPROVED BY CONSTRUCTION MANAGER.
4. CONTRACTOR SHALL LOCATE EXISTING UNDERGROUND UTILITIES WITHIN CONSTRUCTION AREA AS SHOWN ON REFERENCE DRAWINGS SKG-04391 THROUGH SKG-04397. CONTRACTOR SHALL REMOVE UNDERGROUND UTILITIES IN CONSTRUCTION AREA IN ACCORDANCE WITH SPECIFICATION SECTION 02200 AND AS APPROVED BY CONSTRUCTION MANAGER.
5. OSDF SEDIMENTATION BASIN NO. 2 DETAILS ARE SHOWN ON DRAWING G-42. EXISTING 72-INCH X 44-INCH CMP PIPE SHALL BE UTILIZED WITH OSDF SEDIMENTATION BASIN NO. 2.
6. CONTRACTOR SHALL PLACE RING BUOYS AROUND OSDF SEDIMENTATION BASIN NO. 2 AS REQUIRED BY OSHA 1926.106.
7. CONTRACTOR SHALL PLACE CAUTION SIGNS WITHIN CONSTRUCTION SAFETY FENCE SURROUNDING OSDF SEDIMENTATION BASIN NO. 2. SIGNS SHALL READ, "CAUTION! DROWNING HAZARD, LIFE VEST REQUIRED WITHIN 5 FEET OF WATER." SIGNS SHALL BE PLACED AT TOP OF EMBANKMENT AND MAY BE SHARED WITH RING BUOY POSTS.
8. CHAIN-LINK FENCE AND GATE DETAILS ARE SHOWN ON DRAWING G-47.
9. CONTRACTOR SHALL CAP EXISTING 50-INCH X 31-INCH CMP CULVERT USING A PRE-FABRICATED STEEL PLATE BULKHEAD PIPE FILET-WELDED TO A 2-FOOT SECTION OF 50-INCH X 31-INCH ALUMINIZED CMP PIPE. BULKHEAD SECTION SHALL BE CONNECTED TO EXISTING PIPE USING A FLAT BAND AND GASKET WITH BAR-BOLTS AND STRAP FASTENERS.
10. CONTRACTOR SHALL CUT AND REMOVE EXISTING 27-INCH HDPE CULVERT TO LIMIT N 479082.35 AND E 1350693.31 (SHOWN WITHIN BOX). MATERIAL SHALL BE STOCKPILED AT LOCATION APPROVED BY CONSTRUCTION MANAGER.
11. BORROW AREA DEVELOPMENT AND RESTORATION IS ILLUSTRATED ON DRAWING C-1.
12. CONTRACTOR SHALL PLACE RIPRAP WITHIN AREA SHOWN. RIPRAP THICKNESS SHALL BE 1.5 FEET. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271. GEOTEXTILE FILTER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02714.
13. CONCRETE BARRIERS TO BE SUPPLIED BY FLUOR FERNALD, INC.
14. BAFFLE SHALL CONSIST OF HDPE CONSTRUCTION SAFETY FENCE, 4 FEET IN HEIGHT WITH MINIMUM TENSILE STRENGTH OF 2000 POUNDS PER FOOT OF WIDTH. POSTS SHALL BE 6 FEET LONG AND MADE OF STEEL. INSTALL POSTS AT MINIMUM SPACING OF 5 FEET AND WITH A MINIMUM EMBEDMENT OF 2 FEET. WRAP FENCING ALONG BOTH SIDES OF POSTS FOR FULL LENGTH OF BAFFLE.

CERTIFIED-FOR-CONSTRUCTION

SUBGRADE CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION	POINT NO.	NORTHING	EASTING	ELEVATION
1375	480008.28	1351048.81	590.31	1463	479360.50	1350572.50	570.50
1376	480006.54	1351070.61	590.51	1464	479360.50	1350506.00	570.50
1380	479691.27	1351012.18	588.97	1465	479283.50	1350506.00	570.50
1381	479695.50	1351016.76	588.53	1466	479283.50	1350588.50	570.50
1382	479691.27	1350980.83	588.51	1467	479317.00	1350595.00	580.00
1383	479691.27	1350995.81	584.85	1468	479329.00	1350598.00	581.00
1384	479695.11	1351020.77	588.53	1469	479332.00	1350601.00	580.00
1385	479691.27	1351044.32	588.00	1470	479329.00	1350604.00	581.00
1386	479691.27	1350984.83	588.51	1471	479326.00	1350601.00	582.00
1387	479691.27	1351005.81	584.85	1472	479215.08	1350588.50	570.50
1388	479687.53	1351020.82	588.49	1473	479108.85	1350485.24	570.50
1389	479687.15	1351016.82	588.49	1474	478997.70	1350376.29	570.50
1390	479627.12	1350981.29	588.72	1475	478987.70	1350338.61	570.50
1391	479627.23	1350996.27	584.96	1476	479033.11	1350338.61	570.50
1392	479627.38	1351017.25	588.22	1477	479045.51	1350318.52	577.20
1393	479627.15	1350985.29	588.22	1478	479074.83	1350317.45	577.20
1394	479627.30	1351006.27	584.36	1479	479087.77	1350337.48	570.50
1395	479627.41	1351021.75	588.72	1480	479118.10	1350337.46	570.50
1396	479508.93	1351021.76	586.94	1481	479171.29	1350359.50	570.50
1397	479502.78	1351045.07	587.23	1482	479200.31	1350359.50	570.50
1398	479489.08	1351020.17	587.75	1483	479216.38	1350359.64	577.12
1399	479492.90	1351043.49	587.49	1484	479238.63	1350339.64	577.12
1406	479427.58	1351085.91	587.32	1485	479251.69	1350359.50	570.50
1407	479433.96	1351024.32	589.32	1486	479272.63	1350340.00	577.00
1408	479437.78	1350987.56	589.32	1487	479275.63	1350343.00	576.00
1409	479439.11	1350974.77	590.07	1488	479275.63	1350331.25	576.00
1414	479441.24	1350954.37	590.07	1489	479295.63	1350343.00	576.00
1416	479449.95	1350870.57	585.16	1490	479298.83	1350340.00	577.00
1432	479379.80	1350975.70	586.81	1491	479295.63	1350330.99	578.00
1433	479371.40	1350998.18	587.09	1492	479420.17	1350359.50	570.50
1434	479729.74	1350813.24	585.01	1493	479332.00	1350506.00	580.00
1435	479726.67	1350815.77	585.01	1494	479312.00	1350506.00	580.00
1436	479720.77	1350820.51	582.52	1495	479444.27	1350578.50	-
1437	479713.59	1350827.48	582.52	1496	479450.60	1350584.61	-
1438	479206.43	1350778.20	584.83	1497	479421.42	1350607.39	-
1439	479196.33	1350770.25	584.77	1498	479417.19	1350598.00	-
1440	479190.47	1350774.98	582.28	1499	479360.64	1350607.00	-
1441	479179.99	1350814.95	582.39	1500	479369.55	1350617.00	-
1442	479176.12	1350788.81	582.28	1501	479203.75	1350607.00	-
1443	479171.54	1350805.58	582.35	1502	479200.15	1350617.00	-
1444	479170.60	1350743.77	584.61	1503	479088.27	1350511.41	-
1445	479188.49	1350750.30	582.12	1504	479081.53	1350518.81	-
1446	479168.51	1350791.39	582.28	1505	478988.20	1350382.34	-
1447	479152.15	1350764.23	582.12	1506	478959.20	1350386.48	-
1448	479028.19	1350591.51	583.88	1507	478969.20	1350318.50	-
1449	479028.33	1350597.33	583.69	1508	478959.20	1350318.50	-
1450	479022.95	1350602.56	581.19	1509	479175.17	1350340.00	-
1451	479008.61	1350616.50	581.19	1510	479175.17	1350330.00	-
1452	478983.22	1350563.59	583.49	1511	479457.72	1350330.00	-
1453	478991.07	1350566.97	583.49	1512	479442.72	1350340.00	-
1454	478987.03	1350573.27	581.00	1513	479449.43	1350429.00	-
1455	478976.28	1350580.15	580.99	1521	479432.72	1350530.01	-
1456	478784.18	1350430.30	582.38	1522	479442.72	1350530.01	-
1457	478782.03	1350433.88	582.38	1523	479438.93	1350555.36	570.50
1458	478771.59	1350435.91	579.85	1524	479446.96	1351000.74	588.96
1459	478784.67	1350455.22	579.87	1525	479444.40	1351025.40	588.87
1460	479438.93	1350553.38	570.50	1526	479420.64	1350993.18	588.88
1461	479420.17	1350548.55	570.50	1577	479474.08	1351017.82	588.89
1462	479410.17	1350572.50	570.50	1677	479226.01	1350374.39	570.50
				1678	479226.01	1350474.39	570.50

EMERGENCY ACCESS ROAD HORIZONTAL ALIGNMENT STATION AND CURVE REPORT

Project: 1342-174
Horizontal Alignment Station and Curve Report
Alignment: em-4 Desc:

Desc.	Station	Spiral/Curve Data	Northing	Easting
PI	100+00		479449.95	1350870.57
Length:		218.50 Course: S 84-03-47 E		
PI	102+18.50		479427.58	1351085.91

Tangent Data

Station			Northing	Easting
100+00			479449.95	1350870.57
102+18.50			479427.56	1351085.91
Length:	218.50	Course: S 84-03-47 E		

LEGEND

- 600 — EXISTING GROUND ELEVATION (FEET)
- (580) — SUBGRADE ELEVATION (FEET) (NOTE 1)
- 580 — FINISHED GRADE ELEVATION (FEET)
- BATTERY LIMIT
- BORROW AREA LIMIT
- 32+00 — EXISTING ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM PIPE
- ILTS — EXISTING INTERIM LEACHATE TRANSMISSION SYSTEM PIPE
- LTS — EXISTING LEACHATE TRANSMISSION SYSTEM PIPE
- UE — EXISTING UNDERGROUND ELECTRIC
- SW — EXISTING 24" STORMWATER FORCEMAIN
- SLOPE TOE OR CREST
- DRAINAGE FLOW DIRECTION
- 1444 — CONSTRUCTION CONTROL POINT
- BERM CREST
- ACCESS CORRIDOR, ACCESS ROAD, ACCESS RAMP, MAINTENANCE ACCESS, OR HAUL ROAD
- RIPRAP LIMIT

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	02.10.30	RESPONSE TO OEPA COMMENTS	DCP	JJA	CDC	DKP	JFB
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	LMG	JJA	TEZ	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DCP	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	JJA	LMG	DCP	JFB

50 25 0 50 100
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
SUBGRADE GRADING PLAN III – CELL 6 LINER SYSTEM AND OSDF SEDIMENTATION BASIN NO. 2

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

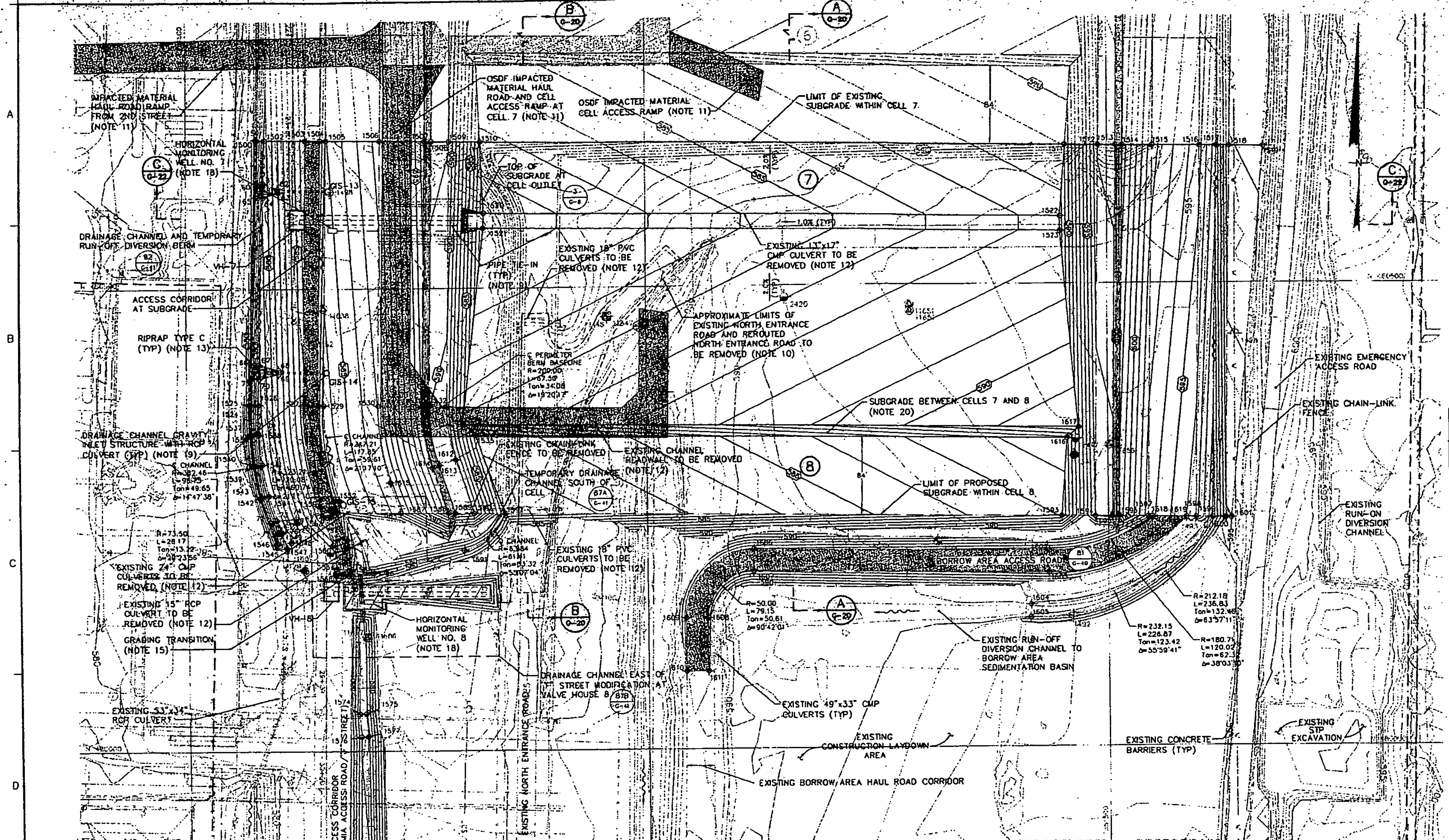
SIGNATURE
29 Jan 2002
DATE

STATE OF OHIO · JOHN F. BEECH · E-58246 · REGISTERED · PROFESSIONAL ENGINEER
SEAL

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE ATLANTA, GEORGIA 30342 USA

PROJECT NO.:	20105
CONTRACT NO.:	95PS005028
FEMP DRAWING NO.:	90X-6000-G-00367
GEOSYNTEC PROJECT NO.:	GO1342-174
GEOSYNTEC DOCUMENT NO.:	F02-1003
SHEET NO.:	C-5
REVISION NO.:	1

Document 6774



SUBGRADE CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION	POINT NO.	NORTHING	EASTING	ELEVATION
1500	480660.47	1350575.75	583.83	1554	480259.22	1350862.88	588.10
1501	480660.41	1350577.75	583.83	1560	480274.11	1350857.11	582.81
1502	480660.19	1350585.75	579.63	1561	480228.32	1350872.77	582.81
1503	480659.65	1350629.47	588.42	1564	480198.38	1350860.93	580.55
1504	480659.45	1350649.97	588.92	1565	480197.88	1350877.43	580.55
1505	480659.38	1350651.97	584.92	1568	480191.35	1350860.72	580.00
1506	480658.86	1350711.32	588.48	1569	480190.85	1350877.21	580.00
1507	480658.06	1350780.26	596.63	1574	480040.64	1350884.78	577.25
1508	480657.97	1350788.05	581.44	1575	480040.87	1350891.76	577.67
1509	480657.74	1350788.77	591.04	1576	480015.59	1350888.30	577.12
1510	480657.33	1350820.24	582.70	1577	480015.80	1350893.57	577.54
1511	480649.38	1351454.15	589.04	1578	479783.48	1350890.97	578.40
1512	480649.14	1351490.37	598.09	1579	479780.82	1350883.89	578.00
1513	480648.91	1351509.08	598.47	1580	479760.74	1350890.89	578.90
1514	480648.81	1351516.88	603.46	1581	479724.00	1350881.98	576.00
1515	480648.43	1351548.50	598.39	1582	479727.21	1350889.12	576.00
1516	480647.82	1351598.59	595.38	1583	479726.22	1350713.42	576.00
1617	480647.60	1351616.39	592.38	1584	479722.72	1350713.28	576.00
1518	480647.43	1351630.25	596.94	1585	479725.20	1350738.38	576.62
1519	480647.14	1351866.00	597.30	1586	479721.57	1350827.48	578.85
1520	480580.40	1350823.73	581.20	1587	480258.38	1350731.94	586.54
1521	480584.41	1350823.23	581.20	1588	480257.74	1350783.79	594.81
1522	480572.77	1351448.41	587.45	1589	480257.84	1350792.00	589.40
1523	480558.78	1351448.55	587.45	1590	480257.40	1350811.61	589.00
1524	480375.63	1350568.00	581.49	1591	480217.65	1350800.70	580.09
1525	480375.59	1350570.00	581.49	1592	480257.00	1350844.75	580.99
1526	480375.43	1350578.00	577.49	1593	480249.61	1351449.26	587.04
1527	480374.78	1350825.99	585.49	1594	480249.17	1351485.48	598.09
1528	480374.58	1350642.49	585.48	1595	480248.94	1351504.20	598.47
1529	480374.50	1350648.49	583.49	1596	480248.84	1351511.99	601.88
1530	480373.78	1350707.84	587.05	1597	480248.46	1351543.61	598.39
1531	480373.18	1350766.78	595.21	1598	480247.85	1351593.70	593.38
1532	480373.11	1350764.57	590.01	1599	480247.83	1351611.70	590.38
1533	480372.95	1350783.29	589.84	1600	480247.48	1351625.36	594.94
1534	480353.57	1350800.35	585.22	1601	480247.39	1351631.39	595.00
1535	480341.38	1350814.47	587.38	1602	480212.35	1351434.89	595.60
1536	480342.84	1350568.57	581.33	1603	480188.55	1351434.60	585.60
1537	480342.95	1350570.51	581.33	1604	480154.29	1351414.79	590.00
1538	480343.41	1350578.50	577.33	1605	480140.48	1351414.20	590.00
1539	480309.82	1350571.84	581.17	1606	480218.45	1351115.88	594.12
1540	480310.10	1350573.82	581.17	1607	480192.45	1351115.58	594.12
1541	480311.24	1350581.74	577.17	1608	480142.45	1351064.97	593.59
1542	480274.81	1350578.48	580.99	1609	480142.45	1351040.97	593.59
1543	480275.34	1350580.41	580.98	1610	480084.57	1351040.97	593.31
1544	480277.48	1350588.13	576.99	1611	480084.52	1351064.87	593.31
1545	480224.67	1350595.48	581.00	1612	480315.22	1350792.39	588.30
1546	480225.26	1350597.36	581.00	1613	480309.78	1350774.64	589.68
1547	480220.24	1350607.50	577.00	1614	480306.82	1350787.25	594.87
1548	480227.12	1350611.81	577.00	1615	480291.18	1350720.87	588.72
1549	480237.92	1350601.52	577.00	1616	480333.54	1351468.54	588.77
1550	480265.69	1350643.09	585.15	1617	480345.41	1351467.98	591.80
1551	480270.88	1350668.76	585.15	1618	480248.41	1351547.37	598.16
1552	480272.21	1350664.64	583.15	1619	480247.97	1351583.45	594.00
1553	480253.95	1350647.05	585.10	1766	480193.53	1350701.76	578.59

RIPRAP LIMITS CONTROL POINTS

POINT NO.	NORTHING	EASTING	POINT NO.	NORTHING	EASTING	POINT NO.	NORTHING	EASTING
60	480613.64	1350576.48	71	480403.58	1350570.76	82	479427.81	1350572.46
61	480613.55	1350584.48	72	480248.58	1350589.47	83	479420.17	1350588.54
62	480608.10	1350800.24	73	480251.01	1350598.60	84	479420.17	1350548.55
63	480603.90	1350800.19	74	480252.59	1350817.44	85	479429.17	1350641.57
64	480598.55	1350584.07	75	480248.33	1350818.88	86	479440.43	1350543.08
65	480598.85	1350576.07	76	480236.75	1350601.23	87	479470.23	1350542.44
66	480418.53	1350571.17	77	480234.37	1350594.27	88	479482.22	1350541.78
67	480418.58	1350879.17	78	479503.18	1350542.00	89	479485.85	1360534.32
68	480413.03	1350800.12	79	479503.74	1350555.65	90	479496.66	1350535.48
69	480408.53	1350600.08	80	479499.14	1350560.07			
70	480403.53	1350578.76	81	479440.43	1350564.95			

LEGEND

Symbol	Description
590	EXISTING GROUND ELEVATION (FEET)
(585)	SUBGRADE ELEVATION (FEET) (NOTE 3)
585	FINISHED GRADE ELEVATION (FEET)
	FCP PROPERTY LINE
	BATTERY LIMIT
	PERIMETER BERM BASELINE
22+00	EXISTING ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM (EPLTS) PIPE
ILTS	EXISTING INTERIM LEACHATE TRANSMISSION SYSTEM (ILTS) PIPE
UE	EXISTING UNDERGROUND ELECTRIC (NOTE 14)
	SLOPE TOE OR CREST
	EXISTING HORIZONTAL MONITORING WELL WITH COVER SLAB
3417, 11651, 11067, 1494, 11703, 11547, 2417, 1152	EXISTING GEOTECHNICAL DATA POINTS (NOTE 6)
(7)	CELL DESIGNATION
1565	CONSTRUCTION CONTROL POINT
	ACCESS CORRIDOR, ACCESS ROAD, ACCESS RAMP, MAINTENANCE ACCESS, OR HAUL ROAD
	BERM CREST
	RIPRAP LIMIT
	DRAINAGE FLOW DIRECTION

GEOTECHNICAL DATA POINTS (NOTE 6)

CONE PENETRATION TESTS

POINT NO.	NORTHING	EASTING	ELEVATION
11446	480467.81	1350936.87	587.98
11638	480478.06	1350848.77	585.27
11847	480124.05	1350693.07	582.74
11651	480471.45	1351285.84	591.88
11651	480478.39	1351285.27	592.02
11656	480326.34	1351501.40	593.46

GEOTECHNICAL BORINGS

POINT NO.	NORTHING	EASTING	ELEVATION
1492	480141.41	1351480.98	0.0
1493	480244.41	1351570.98	-
1494	480444.42	1351635.98	-
1498	480604.41	1350855.98	0.00
1747	480242.41	1351530.98	0.00
11686	480124.05	1350595.40	582.44

MONITORING WELLS

POINT NO.	NORTHING	EASTING	ELEVATION
1152	480440.42	1350838.6	0.00
1160	480212.85	1350835.49	0.00

TYPE 1 MONITORING WELLS

POINT NO.	NORTHING	EASTING	ELEVATION
11067	480223.10	1351313.70	0.00

TYPE 2 MONITORING WELLS

POINT NO.	NORTHING	EASTING	ELEVATION
2120	480216.32	1350654.03	-
2417	480332.90	1351484.84	-
2420	480488.57	1351130.73	-

TYPE 3 MONITORING WELLS

POINT NO.	NORTHING	EASTING	ELEVATION
3120	480198.63	1350626.18	-
3417	480314.51	1351463.44	-

LYSIMETERS

POINT NO.	NORTHING	EASTING	ELEVATION
11547	480468.17	1350857.90	588.20

NOTES:

1. SURFACE-WATER MANAGEMENT AND EROSION CONTROL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
2. CLEARING, GRUBBING, AND STRIPPING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02110.
3. SUBGRADE ELEVATIONS CORRESPOND TO TOP OF PREPARED SUBGRADE, INCLUDING ANY FILL. SUBGRADE AND FILL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
4. ACTIVE VERTICAL MONITORING WELLS AND PIEZOMETERS WITHIN CONSTRUCTION AREA WILL BE ABANDONED BY OTHERS PRIOR TO CONSTRUCTION IN THAT AREA.
5. LOCATE AND REMOVE EXISTING SUBDRAIN TILE SYSTEM WITHIN CONSTRUCTION AREA IN ACCORDANCE WITH SPECIFICATION SECTION 02200. REFER TO REFERENCE DRAWINGS SKG-04391 THROUGH SKG-04397 FOR LOCATION OF SUBDRAIN TILE SYSTEM.
6. REMOVE GROUT USED TO BACKFILL GEOTECHNICAL DATA POINTS AND MONITORING WELLS LOCATED WITHIN PERIMETER BERM BASELINE TO A MINIMUM DEPTH OF 3 FEET BELOW SUBGRADE ELEVATIONS.
7. DEWATER EXCAVATIONS AND MANAGE COLLECTED WATER IN ACCORDANCE WITH SPECIFICATION SECTION 02200. GROUNDWATER LEVELS IN BROWN AND GRAY TILL LAYERS VARY DURING YEAR AND MAY BE HIGHER THAN THOSE SHOWN ON REFERENCE DRAWINGS. LEVELS MAY APPROACH GROUND SURFACE DURING PERIODS OF HEAVY PRECIPITATION.
8. LOCATE EXISTING UNDERGROUND UTILITIES WITHIN CONSTRUCTION AREA AS SHOWN ON REFERENCE DRAWINGS SKG-04391 THROUGH SKG-04397. REMOVE UNDERGROUND UTILITIES IN CONSTRUCTION AREA IN ACCORDANCE WITH SPECIFICATION SECTION 02200 AND AS APPROVED BY CONSTRUCTION MANAGER.
9. LDS, LCS, AND RICS PIPES SHALL TIE INTO EXISTING PIPES. CONSTRUCTION CONTROL POINTS FOR PIPE TIE-INS ARE SHOWN ON DRAWING G-9.
10. PAVEMENT COURSES FOR EXISTING NORTH ENTRANCE ROAD AND REROUTED NORTH ENTRANCE ROAD SHALL BE REMOVED WITHIN LIMITS SHOWN.
11. OSDF IMPACTED MATERIAL HAUL ROAD RAMP AND CELL ACCESS RAMP GRADING PLAN IS SHOWN ON DRAWING G-18
12. REMOVE EXISTING CULVERTS AND HEADWALLS AND STOCKPILE MATERIAL AT LOCATIONS DESIGNATED BY CONSTRUCTION MANAGER.
13. PLACE RIPRAP WITHIN AREA SHOWN. RIPRAP THICKNESS SHALL BE 1.5 FEET. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
14. UNDERGROUND ELECTRIC AT CULVERT CROSSING SHALL BE REMOVED AND RELOCATED PRIOR TO INSTALLATION OF NEW CULVERT.
15. TRANSITION PROPOSED ACCESS CORRIDOR ELEVATIONS TO TIE-IN WITH "F" STREET ELEVATIONS WITHIN AREA SHOWN.
16. REMOVE POWER POLES LOCATED WITHIN PROPOSED SUBGRADE AND FILL HOLES IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
17. SIDESLOPES IN FILL OR EXCAVATION SHALL BE 3 HORIZONTAL TO 1 VERTICAL UNLESS OTHERWISE SHOWN ON DRAWINGS.
18. HORIZONTAL MONITORING WELL AND MISCELLANEOUS DETAILS ARE SHOWN ON DRAWING G-44.
19. DRAINAGE CHANNEL GRAVITY INLET STRUCTURE WITH RCP CULVERT AND RIPRAP OUTLET PROTECTION IS SHOWN ON DRAWING G-43.
20. IF CELLS 7 AND 8 LINER SYSTEMS ARE CONSTRUCTED CONCURRENTLY, CONSTRUCT ALTERNATE INTERCELL DETAILS AS SHOWN ON DRAWING G-31A.

TOPOGRAPHY SHOWN ON THIS CONSTRUCTION DRAWING IS BASED ON JULY 2003 FLYOVER.

CERTIFIED-FOR-CONSTRUCTION

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW. BY	APP BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	LMC	JJA	TEZ	DKP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DKP	RB
1A	03.10.28	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DKP	RB
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	LMG	JJA	TEZ	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DCP	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	JJA	LMG	DCP	JFB

50 25 0 50 100
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
SUBGRADE GRADING PLAN IV – CELL 7 LINER SYSTEM

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

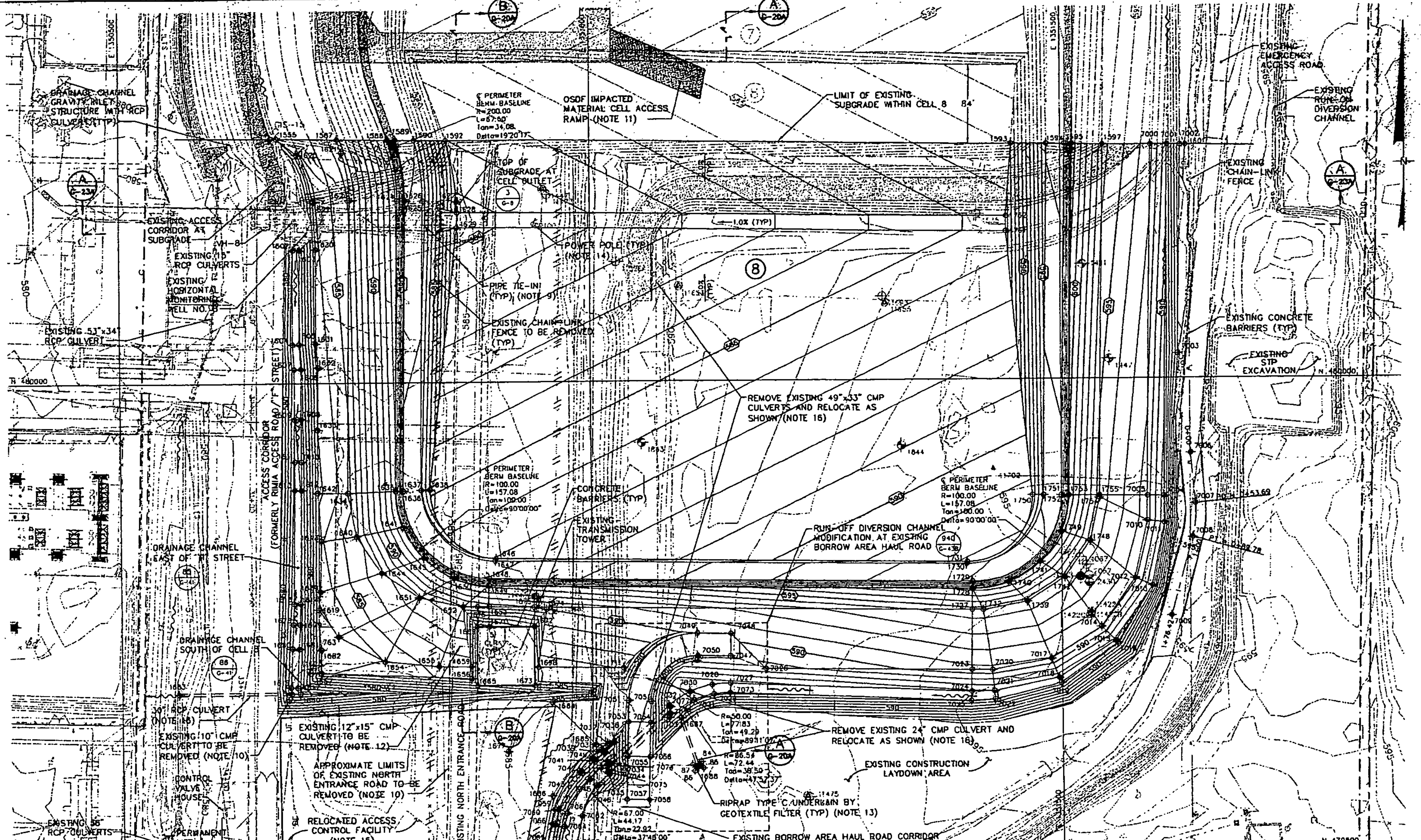
SIGNATURE: Rudolph Bonaparte
DATE: 22 Jan 04

STATE OF OHIO — RUDOLPH BONAPARTE E-56875 — REGISTERED PROFESSIONAL ENGINEER
SEAL

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE, ATLANTA, GEORGIA 30342 USA

PROJECT NO.:	20105
CONTRACT NO.:	03FF0699
FEMP DRAWING NO.:	90X-6000-G-00368
GEOSYNTEC PROJECT NO.:	GO3211-06.04
GEOSYNTEC DOCUMENT NO.:	F03-1C06
SHEET NO.:	G-6
REVISION NO.:	1

Document 6774



SUBGRADE CONSTRUCTION CONTROL POINTS

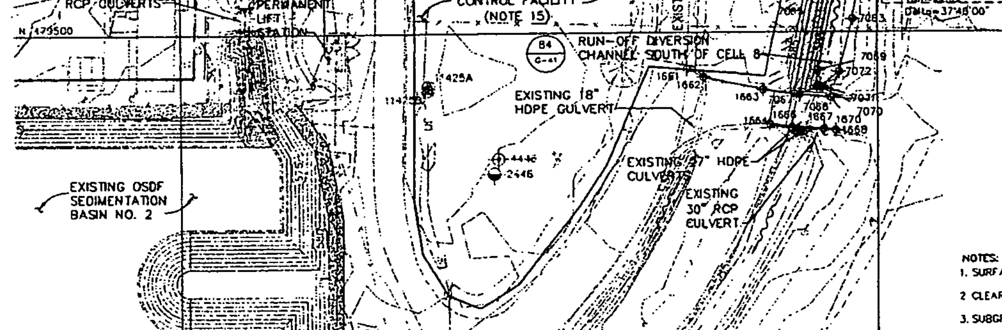
POINT NO.	NORTHING	EASTING	ELEVATION	POINT NO.	NORTHING	EASTING	ELEVATION
1554	480250.22	1350662.68	585.10	1711	479695.39	1351032.24	587.10
1555	480259.15	1350669.04	583.09	1727	479754.98	1351405.95	584.60
1587	480258.38	1350731.94	586.34	1728	479777.30	1351406.72	598.31
1588	480257.74	1350783.78	594.61	1729	479785.09	1351406.31	593.12
1589	480257.64	1350792.00	588.40	1730	479803.88	1351400.35	592.68
1590	480257.40	1350811.61	589.00	1731	479808.26	1351401.12	592.09
1592	480257.00	1350844.75	580.99	1732	479784.84	1351417.57	584.56
1593	480248.81	1351449.26	587.04	1739	479763.43	1351440.59	594.35
1594	480248.17	1351483.48	596.09	1740	479784.48	1351444.86	598.60
1595	480248.94	1351504.20	598.47	1741	479805.24	1351477.28	598.06
1596	480248.84	1351511.99	601.66	1742	479788.07	1351502.83	594.55
1597	480248.48	1351543.61	596.39	1748	479827.57	1351528.32	594.34
1601	480247.39	1351631.39	595.00	1749	479837.90	1351498.34	599.43
1602	480140.89	1350685.47	577.75	1750	479876.53	1351469.39	591.34
1603	480140.63	1350692.47	578.17	1751	479876.39	1351480.02	594.23
1604	480040.62	1350684.62	577.31	1752	479876.16	1351499.84	594.60
1605	480041.02	1350691.62	577.73	1753	479876.07	1351507.43	599.80
1606	480014.74	1350693.36	577.81	1754	479873.37	1351539.03	594.53
1607	480014.32	1350686.38	577.19	1755	479873.66	1351539.08	594.58
1608	479981.78	1350692.84	577.38	1761	480156.79	1351443.66	585.45
1609	479981.67	1350685.94	576.96	1762	480172.80	1351443.52	585.45
1610	479916.61	1350692.94	577.18	1763	479730.36	1350729.76	583.12
1611	479918.64	1350685.94	576.76	7000	480247.85	1351593.70	593.38
1612	479888.43	1350697.87	577.05	7001	480247.63	1351611.70	590.38
1613	479888.53	1350685.67	576.63	7002	480247.46	1351625.36	594.94
1614	479785.90	1350690.65	576.52	7003	480025.88	1351822.65	593.83
1615	479786.07	1350683.65	576.10	7004	479874.85	1351607.14	588.52
1616	479678.30	1350679.81	576.00	7005	479875.07	1351589.14	591.52
1617	479678.05	1350686.80	576.00	7006	479920.32	1351635.95	595.50
1618	479660.50	1350680.53	576.00	7007	479888.88	1351640.93	595.26
1619	479759.37	1350709.46	582.84	7008	479831.10	1351637.80	595.06
1620	480247.24	1350689.59	583.82	7009	479747.55	1351614.86	594.50
1621	480244.11	1350736.75	586.47	7010	479848.60	1351588.82	591.50
1622	480191.44	1350708.39	583.62	7011	479846.48	1351607.51	588.38
1623	480193.66	1350744.77	586.13	7012	479787.53	1351578.88	591.32
1624	480193.08	1350783.71	594.28	7013	479779.63	1351594.32	588.04
1625	480192.99	1350801.50	589.09	7014	479736.06	1351540.57	591.13
1626	480192.81	1350820.22	588.71	7015	479720.97	1351555.29	587.69
1627	480191.66	1350855.83	579.81	7016	479710.85	1351537.42	587.09
1628	480179.97	1350856.36	579.58	7017	479702.01	1351486.24	590.95
1629	480163.98	1350855.88	579.58	7018	479681.48	1351496.46	587.33
1630	480141.32	1350709.29	583.78	7019	479675.91	1351498.78	587.33
1631	480041.65	1350708.68	583.31	7020	479690.57	1351426.88	590.78
1632	480018.59	1350710.96	583.34	7021	479667.87	1351428.83	588.98
1633	479950.45	1350709.85	583.00	7022	479658.95	1351429.78	588.98
1634	479883.17	1350740.97	584.57	7023	479690.83	1351405.16	590.75
1635	479884.83	1350789.94	592.74	7024	479667.55	1351404.88	588.86
1636	479884.74	1350797.74	587.55	7025	479657.56	1351404.47	586.86
1637	479885.76	1350816.47	587.18	7026	479693.53	1351184.82	588.39
1638	479888.09	1350825.71	584.87	7027	479678.09	1351147.08	585.57
1639	479778.61	1350711.22	583.36	7028	479678.80	1351127.15	585.48
1640	479837.09	1350749.55	585.69	7029	479668.94	1351128.84	585.48
1641	479846.48	1350797.10	592.86	7030	479669.41	1351103.35	585.38
1642	479883.31	1350709.51	582.09	7031	479680.32	1351107.55	585.38
1643	479837.31	1350713.01	583.80	7032	479654.91	1351080.98	585.24
1644	479797.84	1350775.08	586.75	7033	479641.87	1351081.39	585.20
1645	479813.78	1350818.39	592.99	7034	479595.00	1351014.83	584.83
1646	479812.80	1350896.18	587.03	7035	479582.23	1351015.63	584.79
1647	479810.05	1350895.23	587.72	7036	479615.65	1351021.97	588.42
1648	479791.41	1350888.81	588.03	7037	479614.48	1351014.72	588.39
1649	479783.62	1350888.71	593.23	7038	479608.11	1351007.70	588.35
1650	479791.72	1350850.57	593.11	7039	479605.15	1351010.39	588.35
1651	479771.38	1350813.69	587.80	7040	479599.33	1350998.02	588.28
1652	479781.88	1350839.50	588.86	7041	479598.39	1351000.74	588.28
1653	479781.31	1350888.44	589.51	7042	479585.88	1350984.87	588.11
1654	479703.43	1350777.70	583.98	7043	479583.21	1350987.87	588.11
1655	479697.82	1350833.78	585.12	7044	479588.69	1351007.88	584.78
1656	479684.56	1350868.87	585.37	7045	479576.28	1350998.75	584.61
1657	479691.58	1350711.20	583.88	7046	479570.33	1351003.08	584.71
1658	479669.50	1350998.07	583.50	7047	479707.40	1351147.25	590.47
1659	479697.39	1350888.29	585.48	7048	479731.48	1351147.55	590.47
1660	479689.50	1350689.57	576.00	7049	479731.92	1351111.73	590.87
1661	479473.61	1350860.10	584.84	7050	479707.92	1351112.04	590.87
1662	479467.85	1350872.59	585.00	7051	479680.22	1351037.47	591.75
1663	479458.71	1350916.63	585.38	7052	479659.24	1351061.45	591.75
1664	479433.95	1350921.85	586.00	7053	479637.37	1351036.86	592.00
1665	479678.93	1350875.18	583.19	7054	479638.74	1351060.85	592.00
1666	479431.73	1350938.41	587.29	7055	479600.60	1351035.09	592.00
1667	479430.47	1350981.71	587.45	7056	479589.97	1351059.08	592.00
1668	479429.48	1350970.07	587.38	7057	479654.75	1351034.88	590.50
1669	479739.93	1350873.18	583.19	7058	479554.11	1351058.67	590.30
1670	479452.87	1350968.83	587.41	7059	479544.58	1350958.64	587.40
1671	479739.93	1350888.64	583.65	7060	479543.75	1350967.55	587.40
1672	479738.93	1350938.16	585.38	7061	479540.35	1350971.03	584.20
1673	479678.93	1350918.16	584.66	7062	479537.49	1350987.19	584.55
1674	479758.35	1350951.49	590.00	7063	479509.37	1350982.31	584.28
1675	479760.70	1350938.37	590.00	7064	479528.11	1350968.59	584.15
1676	479761.47	1350875.28	589.21	7065	479528.09	1350959.21	587.35
1677	479606.49	1350907.94	585.00	7066	479528.92	1350955.29	587.35
1678	479743.73	1350682.91	578.00	7067	479455.88	1350940.01	587.13
1679	479743.45	1350689.91	578.42	7068	479455.08	1350943.97	587.13
1680	479717.80	1350681.72	578.00	7069	479472.81	1350957.44	583.99
1681	479717.48	1350688.71	578.00	7070	479461.49	1350958.93	583.98
1682	479718.44	1350711.76	583.52	7071	479481.04	1350959.17	583.67
1683	479868.50	1350561.28	575.75	7072	479471.50	1350972.54	584.05
1684	479859.03	1350957.36	586.00	7073	479668.10	1351146.87	585.37
1685	479813.34	1351002.98	586.00	7074	479591.00	1351013.81	584.82
1686	479558.73	1350958.45	585.00	7075	479584.05	1351014.24	584.80
1687	479841.33	1351093.97	588.00	7076	479648.02	1351082.59	585.21
1688	479589.55	1351111.58	590.00	7077	479653.17	1351087.36	585.73
1698	479698.49	1350942.19	586.22				

RELOCATED ACCESS ROAD HORIZONTAL ALIGNMENT STATION AND CURVE REPORT

Desc.	Station	Spiral/Curve Data	Northing	Easting
PI	0+00		479920.32	1351635.95
		Length: 71.93 Course:	S 05-19-25 E	
PI	0+71.93		479848.89	1351642.63
		Length: 104.88 Course:	S 15-21-10 W	
		Delta: 20-40-35		
		Tangent Data		
	0+00		479920.32	1351635.95
	0+53.69		479868.88	1351640.93
		Length: 53.69 Course:	S 05-19-25 E	
		Circular Curve Data		
PC	0+53.69		479868.88	1351640.93
RP			479857.58	1351541.37
PT	0+89.78		479831.10	1351637.80
		Delta: 20-41 Type:	RIGHT	
		Radius: 100.00 DOC:	57-18	
		Length: 36.09 Tangent:	18.24	
		Mid-Ord: 1.62 External:	1.65	
		Chord: 35.89 Course:	S 05-00-52 W	
		Es: 1.65		
PI	1+76.42		479747.55	1351614.86
		Tangent Data		
	0+89.78		479831.10	1351637.80
	1+76.42		479747.55	1351614.86
		Length: 86.64 Course:	S 15-21-10 W	

RIPRAP LIMITS CONTROL POINTS

POINT NO.	NORTHING	EASTING	POINT NO.	NORTHING	EASTING
84	479594.48	1351115.18	86	479584.83	1351107.98
85	479587.85	1351117.44	87	479591.25	1351105.72



GEOTECHNICAL DATA POINTS (NOTE 6)

CONE PENETRATION TESTS

POINT NO.	NORTHING	EASTING	ELEVATION
11422A	479752.08	1351530.33	592.58
11422B	479748.99	1351529.51	592.68
11422C	479747.38	1351529.1	592.59
11425A	479462.13	1350878.45	579.88
11425B	479459.09	1350877.94	580.08
11447	480204.13	1350950.15	585.44
11448	479771.42	1350939.75	585.14
11450	479557.13	1351228.35	591.71
11623	479893.33	1350700.61	582.38
11653	480100.29	1351094.32	588.47
11655	480081.79	1351315.18	592.02
11659	479704.31	1351111.23	587.72

GEOTECHNICAL BORINGS

POINT NO.	NORTHING	EASTING	ELEVATION
1535	480175.27	1351412.81	0
4987	479809.97	1351518.22	0
11376	480128.49	1351027.07	0
11472	479788.43	1350942.89	584.65
11473	480197.91	1350955.16	585.81
11475	479556.06	1351230.77	591.84
11693	480088.52	1351312.37	592.02

PIEZOMETERS

POINT NO.	NORTHING	EASTING	ELEVATION
11701	479513.45	1351115.51	588.36
11702	479904.61	1351428.82	594.56
11703	479893.07	1350760.18	584.12

TYPE 1 MONITORING WELLS

POINT NO.	NORTHING	EASTING	ELEVATION
1441	480121.40	1351522.40	0.00
1447	480020.34	1351550.16	0.00
1843	479935.00	1351053.37	0.00
1844	479930.33	1351331.92	0.00

TYPE 2 MONITORING WELLS

POINT NO.	NORTHING	EASTING	ELEVATION
2067	479790.41	1351527.98	-
2430	479783.18	1351528.30	-
2446	479399.20	1350724.34	-

TYPE 3 MONITORING WELLS

POINT NO.	NORTHING	EASTING	ELEVATION
3067	479789.54	1351519.16	-

TYPE 4 MONITORING WELLS

POINT NO.	NORTHING	EASTING	ELEVATION
4067	479802.02	1351525.38	0.00
4448	479409.92	1350727.47	0.00

LYSIMETERS

POINT NO.	NORTHING	EASTING	ELEVATION
11487	479770.39	1350940.70	585.00
11548	479757.95	1350958.3	585.70

NOTES:

1. SURFACE-WATER MANAGEMENT AND EROSION CONTROL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
2. CLEARING, GRUBBING, AND STRIPPING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02110.
3. SUBGRADE ELEVATIONS CORRESPOND TO TOP OF PREPARED SUBGRADE, INCLUDING ANY FILL. SUBGRADE AND FILL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
4. ACTIVE VERTICAL MONITORING WELLS AND PIEZOMETERS WITHIN CONSTRUCTION AREA WILL BE ABANDONED BY OTHERS PRIOR TO CONSTRUCTION IN THAT AREA.
5. LOCATE AND REMOVE EXISTING SUBDRAIN TILE SYSTEM WITHIN CONSTRUCTION AREA IN ACCORDANCE WITH SPECIFICATION SECTION 02200. REFER TO REFERENCE DRAWINGS SKG-04391 THROUGH SKG-04397 FOR LOCATION OF SUBDRAIN TILE SYSTEM.
6. REMOVE GROUT USED TO BACKFILL GEOTECHNICAL DATA POINTS AND MONITORING WELLS LOCATED WITHIN PERIMETER BERM BASELINE TO A MINIMUM DEPTH OF 3 FEET BELOW SUBGRADE ELEVATIONS.
7. DEWATER EXCAVATIONS AND MANAGE COLLECTED WATER IN ACCORDANCE WITH SPECIFICATION SECTION 02200. GROUNDWATER LEVELS IN BROWN AND GRAY TILL LAYERS VARY DURING YEAR AND MAY BE HIGHER THAN THOSE SHOWN ON REFERENCE DRAWINGS. LEVELS MAY APPROACH GROUND SURFACE DURING PERIODS OF HEAVY PRECIPITATION.
8. LOCATE EXISTING UNDERGROUND UTILITIES WITHIN CONSTRUCTION AREA AS SHOWN ON REFERENCE DRAWINGS SKG-04391 THROUGH SKG-04397. REMOVE UNDERGROUND UTILITIES IN CONSTRUCTION AREA IN ACCORDANCE WITH SPECIFICATION SECTION 02200 AND AS APPROVED BY CONSTRUCTION MANAGER.
9. LDS, LCS, AND RLCS PIPES SHALL TIE INTO EXISTING PIPES. CONSTRUCTION CONTROL POINTS FOR PIPE TIE-INS ARE SHOWN ON DRAWING G-9.
10. PAVEMENT COURSES AND ASSOCIATED IMPACTED MATERIAL FOR EXISTING NORTH ENTRANCE ROAD AND REROUTED NORTH ENTRANCE ROAD SHALL BE REMOVED WITHIN LIMITS SHOWN. REMOVAL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200. PLACE REMOVED MATERIAL IN ACTIVE CELL AS APPROVED BY CONSTRUCTION MANAGER.
11. OSDF IMPACTED MATERIAL HAUL ROAD RAMP AND CELL ACCESS RAMP GRADING PLAN IS SHOWN ON DRAWING G-18A.
12. REMOVE EXISTING CULVERTS AND STOCKPILE MATERIAL AT LOCATIONS DESIGNATED BY CONSTRUCTION MANAGER.
13. PLACE RIPRAP WITHIN AREA SHOWN. RIPRAP THICKNESS SHALL BE 1.5 FEET. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271. GEOTEXTILE FILTER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02714.
14. REMOVE POWER POLES LOCATED WITHIN PROPOSED SUBGRADE AND BACKFILL HOLES IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
15. RELOCATED ACCESS CONTROL FACILITY SHALL BE OPERATIONAL BEFORE CONSTRUCTION OF CELL 4 FINAL COVER SYSTEM. LOCATION AND DESIGN OF RELOCATED ACCESS CONTROL FACILITY TO BE PROVIDED BY FLUOR FERNALD.
16. ALUMINIZED CMP AND RCP CULVERTS AND JOINTS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02721. CONTROL POINTS SHOWN AT ENDS OF CULVERT CORRESPONDS TO INVERT ELEVATIONS. TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
17. SIDESLOPES IN FILL OR EXCAVATION SHALL BE 3 HORIZONTAL TO 1 VERTICAL UNLESS OTHERWISE SHOWN ON DRAWINGS.

TOPOGRAPHY SHOWN ON THIS CONSTRUCTION DRAWING IS BASED ON JULY 2003 FLYOVER.

LEGEND

Symbol	Description
590	EXISTING GROUND ELEVATION (FEET)
(595)	SUBGRADE ELEVATION (FEET) (NOTE 3)
585	FINISHED GRADE ELEVATION (FEET)
	FCP PROPERTY LINE
	BATTERY LIMIT
	PERIMETER BERM BASELINE
22+00	EXISTING ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM (EPLTS) PIPE
ILTS	EXISTING INTERIM LEACHATE TRANSMISSION SYSTEM (ILTS) PIPE
	SLOPE TOE OR CREST
	EXISTING HORIZONTAL MONITORING WELL WITH COVER SLAB
3067, 11447, 1441, 11472, 11703, 11487, 2430, 4446	EXISTING GEOTECHNICAL DATA POINTS (NOTE 6)
(7)	CELL DESIGNATION
1763	CONSTRUCTION CONTROL POINT
	ACCESS CORRIDOR, ACCESS ROAD, ACCESS RAMP, MAINTENANCE ACCESS, OR HAUL ROAD
	BERM CREST
	RIPRAP LIMIT
	DRAINAGE FLOW DIRECTION

CERTIFIED-FOR-CONSTRUCTION

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	05.07.15	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMG	DKP	JFB
1C	-	NOT ISSUED	-	-	-	-	-
1B	04.05.21	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE/EPA PER DCN	TEZ	JJA	LMG	DKP	RB
1A	04.05.14	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE PER DCN	TEZ	JJA	LMG	DKP	RB
0	04.01.22	CFC SUBMITTAL TO FF/DOE/EPA	LMG	JJA	TEZ	DKP	RB
B	03.12.08	PRE-FINAL SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DKP	RB
A	03.10.28	PRELIMINARY SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DKP	RB

50 25 0 50 100

SCALE IN FEET

OWNER/FACILITY:

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:

FLUOR FERNALD, INC.

PROJECT:

ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:

SUBGRADE GRADING PLAN V – CELL 8 LINER SYSTEM

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

SIGNATURE

15 Feb 2005

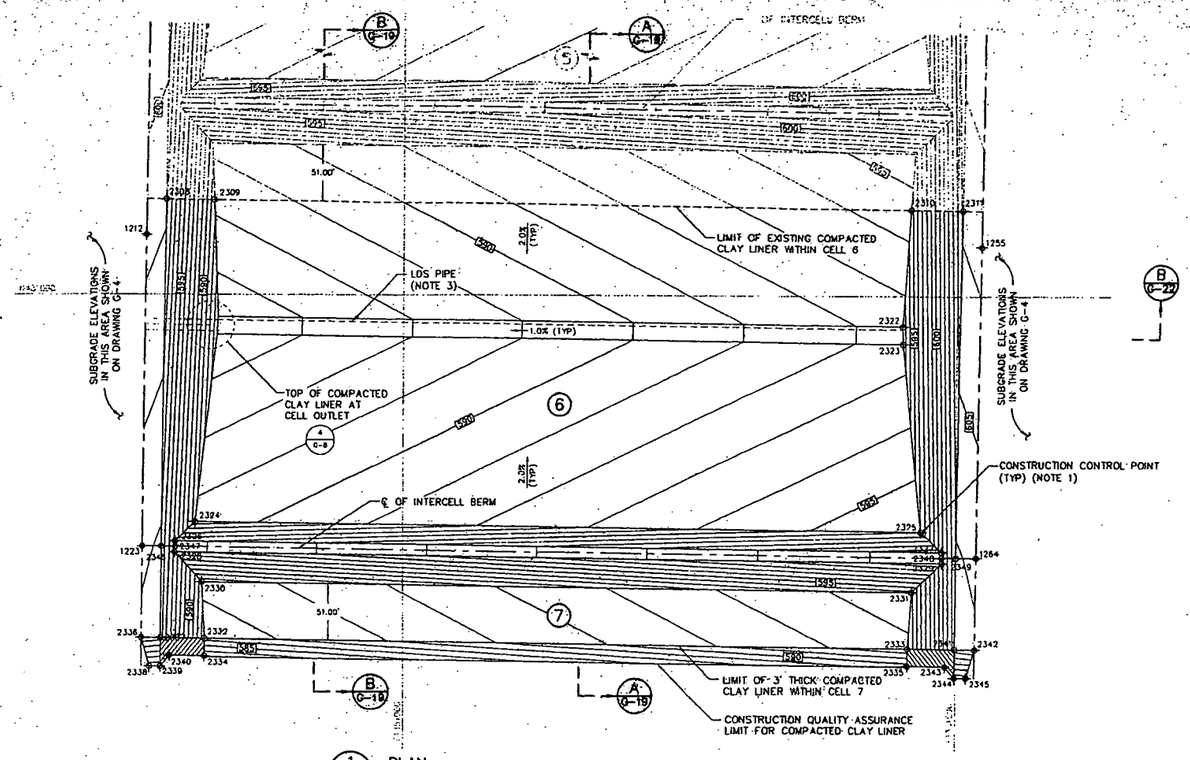
DATE

STATE OF OHIO — JOHN F. BETCH — E-58246 — REGISTERED PROFESSIONAL ENGINEER

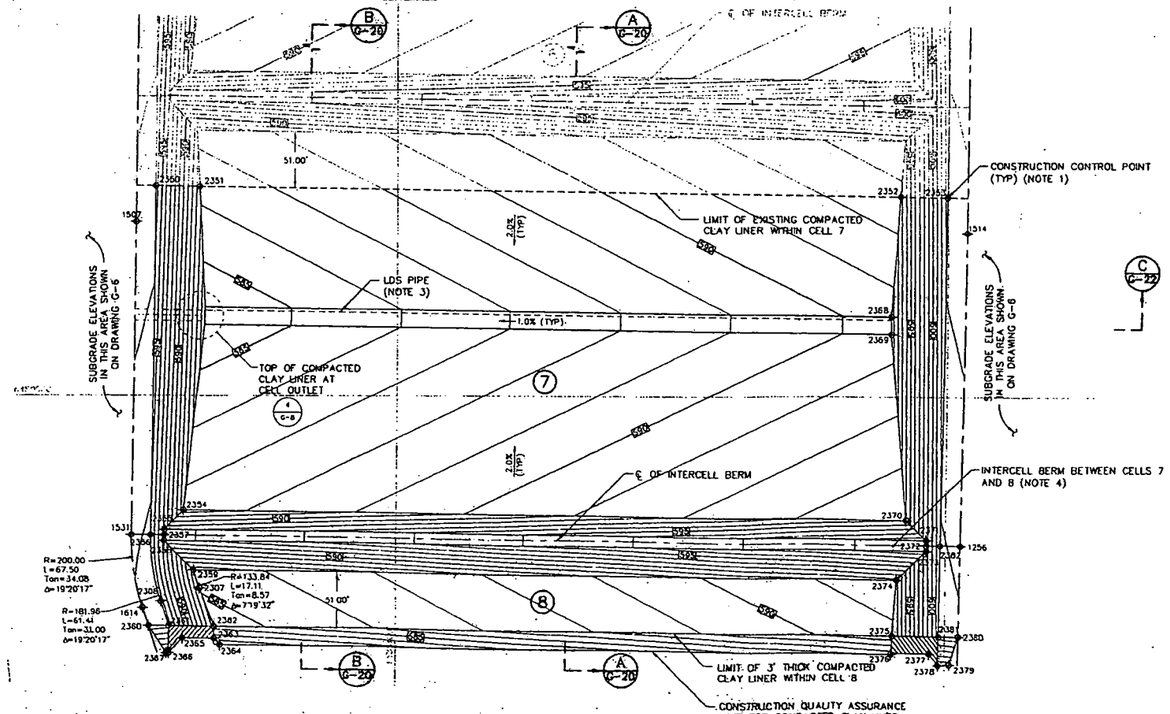
SEAL

GEOSYNTEC CONSULTANTS
1255 ROBERTS BOULEVARD NW, KENNESAW, GEORGIA 30144 USA

PROJECT NO.: 20105
CONTRACT NO.: 03FF0589
FEMP DRAWING NO.: 98X-6000-G-00414
GEOSYNTEC PROJECT NO.: GO3309-02:02
GEOSYNTEC DOCUMENT NO.: F04-1013
SHEET NO.: G-6A
REVISION NO.: 1



1 PLAN
COMPACTED CLAY LINER – CELL 6
SCALE: 1" = 50'



2 PLAN
COMPACTED CLAY LINER – CELL 7
SCALE: 1" = 50'

LEGEND

- EXISTING COMPACTED CLAY LINER ELEVATION (FEET) (NOTE 2)
- COMPACTED CLAY LINER ELEVATION (FEET) (NOTE 2)
- PERIMETER BERM BASELINE/LIMIT OF COMPACTED CLAY LINER
- CONSTRUCTION CONTROL POINT
- CELL DESIGNATION

COMPACTED CLAY LINER CONSTRUCTION CONTROL POINTS

CELL 6				CELL 7			
POINT NO.	NORTHING	EASTING	ELEVATION	POINT NO.	NORTHING	EASTING	ELEVATION
2308	481086.06	1350783.53	599.70	2306	480312.58	1350784.35	594.51
2309	481085.53	1350837.20	588.28	2307	480324.64	1350820.09	585.08
2310	481077.82	1351457.51	594.58	2350	480890.44	1350778.70	596.44
2311	481077.25	1351504.07	606.22	2351	480689.94	1350819.11	588.33
2322	480972.74	1351450.75	592.42	2352	480682.16	1351456.21	592.71
2323	480956.79	1351451.05	592.43	2353	480081.63	1351499.23	603.48
2324	480785.41	1350810.36	589.43	2354	480395.44	1350805.25	587.43
2325	480787.38	1351488.37	594.01	2355	480377.83	1350787.56	591.71
2326	480777.80	1350792.49	593.71	2356	480372.98	1350774.82	594.85
2327	480769.31	1351487.27	600.66	2357	480372.83	1350787.39	591.71
2328	480767.80	1350792.12	593.70	2358	480367.83	1350787.24	591.70
2329	480759.30	1351487.43	600.66	2359	480340.97	1350815.01	585.36
2330	480740.98	1350816.79	587.32	2360	480990.48	1350772.75	594.79
2331	480733.11	1351480.02	593.78	2361	480990.25	1350791.88	594.39
2332	480689.94	1350819.11	588.33	2362	480969.74	1350833.42	584.53
2333	480682.96	1351456.21	592.71	2363	480978.62	1350833.28	582.30
2334	480674.09	1350818.91	583.16	2364	480973.00	1350838.85	581.25
2335	480666.30	1351456.01	589.53	2365	480978.97	1350804.62	589.11
2336	480690.66	1350780.66	596.80	2366	480965.30	1350791.58	589.40
2337	480690.44	1350778.70	599.44	2367	480965.31	1350789.47	589.44
2338	480664.72	1350768.13	591.47	2368	480572.74	1351448.02	590.45
2339	480664.59	1350778.38	591.27	2369	480536.80	1351448.16	590.45
2340	480674.48	1350786.97	591.15	2370	480357.39	1351463.72	594.01
2341	480681.63	1351499.23	603.46	2371	480389.34	1351482.44	598.66
2342	480681.41	1351517.28	603.82	2372	480364.33	1351482.48	598.66
2343	480665.88	1351490.57	588.17	2373	480359.33	1351482.52	598.66
2344	480655.79	1351498.82	598.28	2374	480333.14	1351455.13	591.76
2345	480655.68	1351509.17	598.50	2375	480282.19	1351451.32	590.71
2346	480772.95	1350779.71	596.85	2376	480265.53	1351450.45	587.38
2347	480772.80	1350792.30	593.70	2377	480265.91	1351485.68	596.17
2348	480764.30	1351487.34	600.66	2378	480255.10	1351494.02	596.15
2349	480764.15	1351500.24	603.88	2379	480255.69	1351504.28	596.50
				2380	480281.44	1351512.39	601.82
				2381	480281.66	1351494.35	601.46
				2382	480364.18	1351495.35	601.88

SUBGRADE CONSTRUCTION CONTROL POINTS

CELL 6				CELL 7			
POINT NO.	NORTHING	EASTING	ELEVATION	POINT NO.	NORTHING	EASTING	ELEVATION
1212	481054.05	1350755.10	599.32	1256	480363.98	1351513.40	602.24
1223	480773.17	1350761.67	597.21	1507	480858.06	1350760.26	596.63
1255	481044.58	1351521.71	606.34	1514	480848.81	1351516.88	603.66
1264	480763.93	1351518.28	604.24	1531	480373.18	1350756.78	595.21
				1614	480306.82	1350767.25	594.87

NOTES:

1. THIS DRAWING SHOWS GRADING AND CONSTRUCTION CONTROL POINTS FOR COMPACTED CLAY LINER FOR CELLS 6 AND 7 AND LINER SYSTEM TEMPORARY TERMINATIONS WITHIN CELLS 7 AND 8.
2. COMPACTED CLAY LINER ELEVATIONS CORRESPOND TO TOP OF COMPACTED CLAY LINER.
3. LDS PIPE CONSTRUCTION CONTROL POINTS ARE SHOWN ON DRAWINGS G-8 AND G-9.
4. IF CELLS 7 AND 8 LINER SYSTEMS ARE CONSTRUCTED CONCURRENTLY, CONSTRUCT ALTERNATE INTERCELL BERM DETAILS AS SHOWN ON DRAWING G-33A.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	LMC	JJA	TEZ	DKP	RB
1B	03.17.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	LMC	JJA	TEZ	DKP	RB
1A	03.10.08	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	LMC	JJA	TEZ	DKP	RB
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	JWO	LMC	DGP	JFB
B	01.12.12	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	JWO	LMC	DGP	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	JWO	LMC	DGP	JFB

50 25 0 50 100
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
COMPACTED CLAY LINER GRADING PLAN I – CELLS 6 AND 7 LINER SYSTEM

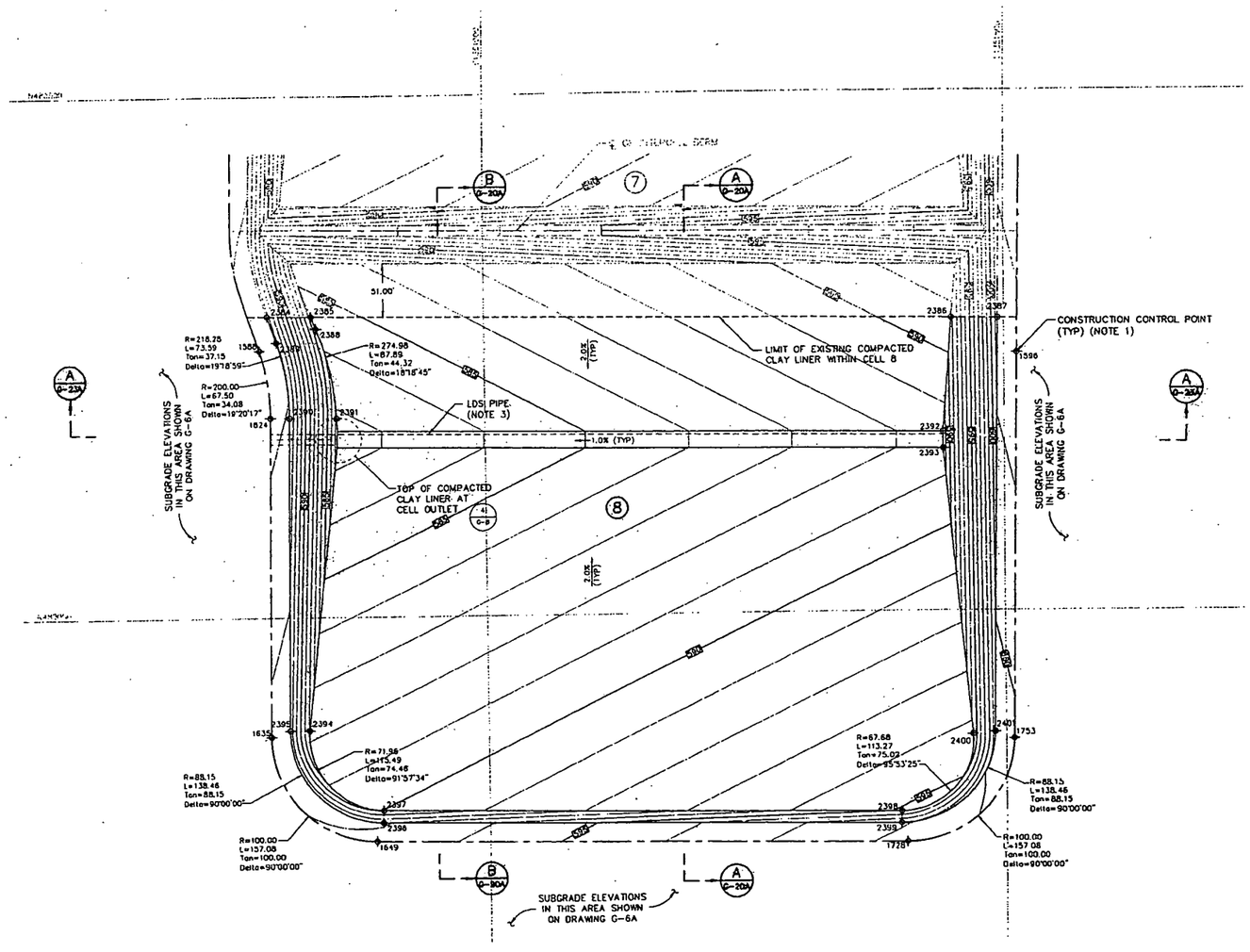
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDER OR CONSTRUCTION, UNLESS SEALED.

STATE OF OHIO — RUDOLPH BONAPARTE — E-56479 — REGISTERED PROFESSIONAL ENGINEER

GeoSyntec Consultants — 1100 LAKESIDE AVENUE, ATLANTA, GEORGIA 30342 USA

PROJECT NO.:	20105
CONTRACT NO.:	03F0899
FEMP DRAWING NO.:	90X-6000-G-00369
GEOSYNTEC PROJECT NO.:	03211-06.04
GEOSYNTEC DOCUMENT NO.:	F03-1206
SHEET NO.:	G-7

CERTIFIED-FOR-CONSTRUCTION



2A PLAN
COMPACTED CLAY LINER – CELL 8
SCALE: 1" = 50'

LEGEND

(2.39)	EXISTING COMPACTED CLAY LINER ELEVATION (FEET) (NOTE 2)
580	COMPACTED CLAY LINER ELEVATION (FEET) (NOTE 2)
	PERIMETER BERM BASELINE/LIMIT OF COMPACTED CLAY LINER
2308	CONSTRUCTION CONTROL POINT
8	CELL DESIGNATION

COMPACTED CLAY LINER CONSTRUCTION CONTROL POINTS

CELL 8

POINT NO.	NORTHING	EASTING	ELEVATION
2384	480290.23	1350791.88	594.39
2385	480269.74	1350833.42	584.53
2386	480202.19	1351431.32	590.71
2387	480281.66	1351494.35	601.46
2388	480277.89	1350837.94	584.34
2389	480265.19	1350800.33	594.26
2390	480192.84	1350811.75	593.92
2391	480192.30	1350856.16	582.82
2392	480172.77	1351443.14	588.45
2393	480156.83	1351443.27	588.45
2394	479890.58	1350826.55	587.79
2395	479890.81	1350808.06	592.41
2396	479801.59	1350895.11	592.93
2397	479813.22	1350895.29	590.02
2398	479806.67	1351400.41	595.08
2399	479795.41	1351400.23	597.89
2400	479880.46	1351488.85	594.26
2401	479882.48	1351489.47	599.47

SUBGRADE CONSTRUCTION CONTROL POINTS

CELL 8

POINT NO.	NORTHING	EASTING	ELEVATION
1588	480257.74	1350783.79	594.61
1596	480248.84	1351511.99	601.66
1624	480193.08	1350793.71	594.28
1635	479884.83	1350789.94	592.74
1649	479783.62	1350888.71	593.23
1728	479777.30	1351406.22	598.31
1753	479876.07	1351507.43	599.80

NOTES:

1. THIS DRAWING SHOWS GRADING AND CONSTRUCTION CONTROL POINTS FOR COMPACTED CLAY LINER FOR CELL 8.
2. COMPACTED CLAY LINER ELEVATIONS CORRESPOND TO TOP OF COMPACTED CLAY LINER.
3. LDS PIPE CONSTRUCTION CONTROL POINTS ARE SHOWN ON DRAWINGS G-8 AND G-9.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	05.02.15	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TCZ	JJA	LMC	DKP	JFB
1C	-	NOT ISSUED	-	-	-	-	-
1B	-	NOT ISSUED	-	-	-	-	-
1A	04.05.28	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE/EPA PER DOE	LMC	JJA	TCZ	DKP	RB
0	04.09.22	CFC SUBMITTAL TO FF/DOE/EPA	LMC	JJA	TCZ	DKP	RB
B	03.12.03	PRE-FINAL SUBMITTAL TO FF/DOE	LMC	JJA	TCZ	DKP	RB
A	03.10.28	PRELIMINARY SUBMITTAL TO FF/DOE	LMC	JJA	TCZ	DKP	RB

40 25 0 50 100
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
COMPACTED CLAY LINER GRADING PLAN II – CELL 8 LINER SYSTEM

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT SCHEDULE OR CONSTRUCTION, UNLESS SEALED

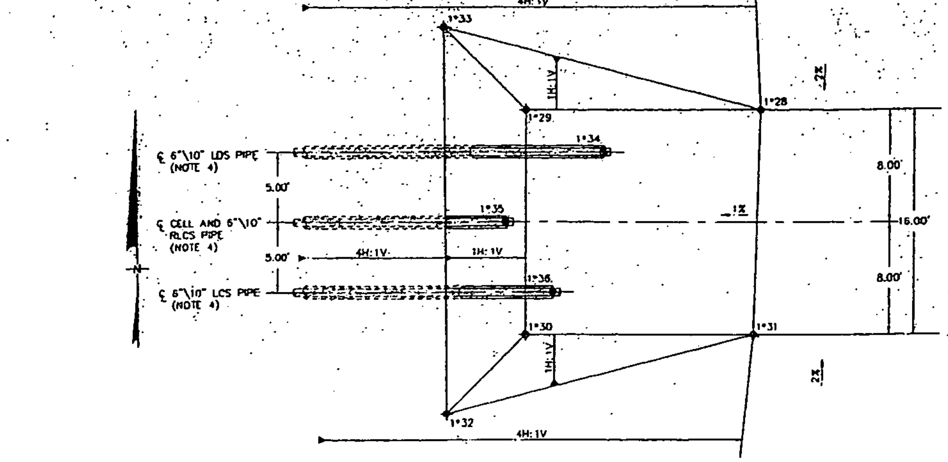
STATE OF OHIO JOHN E. BEECH E-58246 REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS

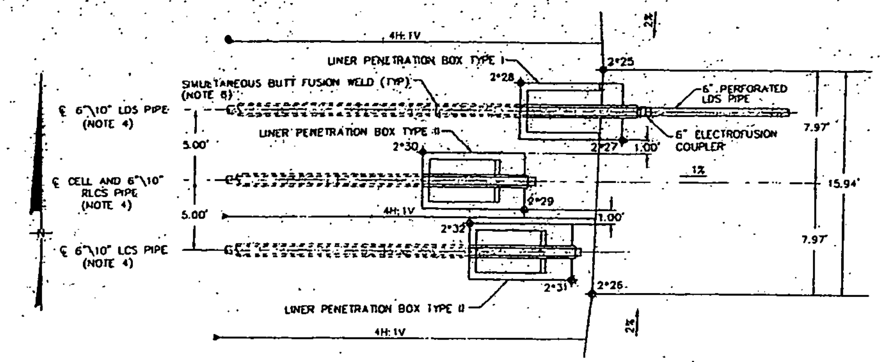
PROJECT NO.:	20105
CONTRACT NO.:	03F10696
FEMP DRAWING NO.:	901-6000-C-00416
GEOSYNTEC PROJECT NO.:	GC03395-07.02
GEOSYNTEC DOCUMENT NO.:	FDA-1186
SHEET NO.:	G-7A

CERTIFIED FOR CONSTRUCTION

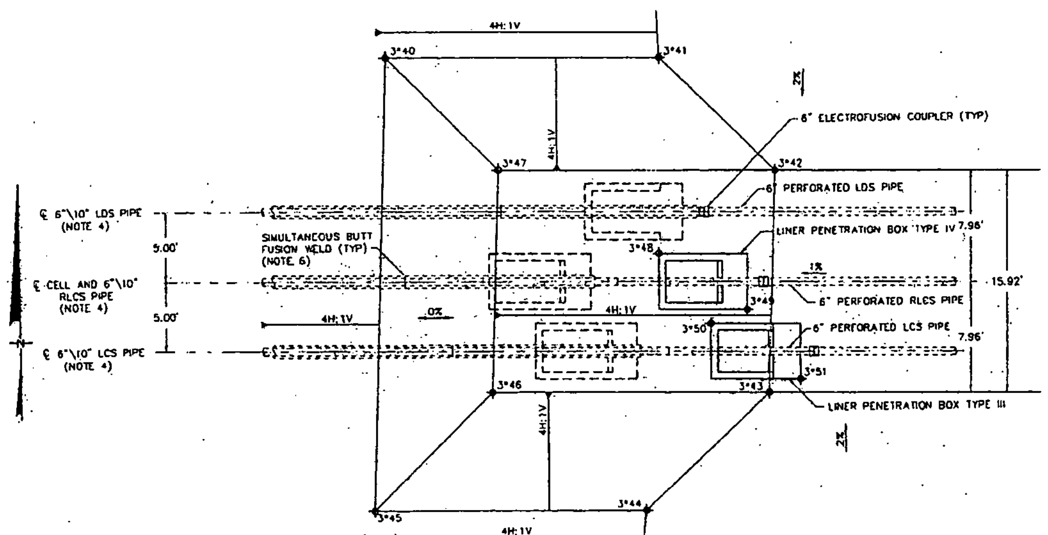
Document 6774



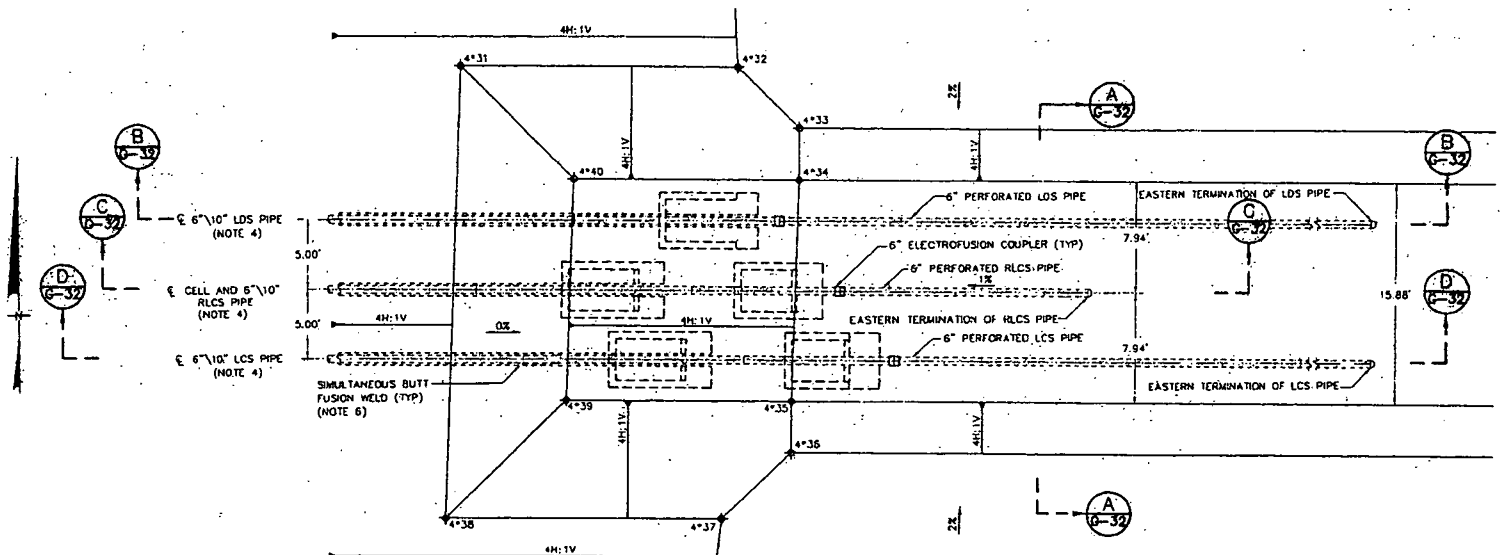
3 / G-4 PLAN
TOP OF SUBGRADE AT CELL OUTLET
SCALE: 1" = 5'



4 / G-7 PLAN
TOP OF COMPACTED CLAY LINER AT CELL OUTLET
SCALE: 1" = 5'



5 PLAN
TOP OF LDS DRAINAGE LAYER AT CELL OUTLET
SCALE: 1" = 5'



6 PLAN
TOP OF LCS DRAINAGE LAYER AT CELL OUTLET
SCALE: 1" = 5'

CELL 6 CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
TOP OF SUBGRADE AT CELL OUTLET			
1628	480980.35	1350830.62	583.22
1629	480980.55	1350813.89	583.06
1630	480984.55	1350813.69	583.06
1631	480964.35	1350829.96	583.22
1632	480958.98	1350808.04	588.84
1633	480986.54	1350808.10	588.92
1634	480977.48	1350819.33	586.11
1635	480972.57	1350812.17	588.04
1636	480967.53	1350815.60	587.08
TOP OF COMPACTED CLAY LINER AT CELL OUTLET			
2625	480980.31	1350830.97	586.23
2626	480984.38	1350830.32	586.22
2627	480975.32	1350832.30	586.20
2628	480979.41	1350825.35	587.54
2629	480970.41	1350825.41	587.65
2630	480974.50	1350818.20	589.47
2631	480965.36	1350828.83	586.69
2632	480969.45	1350821.62	588.51
TOP OF LDS DRAINAGE LAYER AT CELL OUTLET			
3640	480988.55	1350811.28	592.27
3641	480988.31	1350830.82	587.38
3642	480980.20	1350839.04	587.31
3643	480964.29	1350838.39	587.30
3644	480955.90	1350829.46	587.38
3645	480956.14	1350809.95	592.26
3646	480984.53	1350818.55	592.26
3647	480980.45	1350819.20	592.27
3648	480974.35	1350830.39	589.53
3649	480970.27	1350838.63	587.98
3650	480969.30	1350834.13	588.47
3651	480965.22	1350840.58	587.29
TOP OF LCS DRAINAGE LAYER AT CELL OUTLET			
4631	480988.53	1350811.39	593.27
4632	480988.29	1350830.92	588.39
4633	480983.93	1350835.34	588.34
4634	480980.23	1350835.29	589.27
4635	480964.36	1350834.64	589.27
4636	480960.65	1350834.39	588.34
4637	480955.92	1350829.55	588.39
4638	480956.15	1350810.06	593.26
4639	480964.35	1350818.65	593.26
4640	480980.43	1350819.38	593.27

CELL 7 CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
TOP OF SUBGRADE AT CELL OUTLET			
1728	480580.40	1350823.73	581.20
1729	480580.60	1350807.08	581.04
1730	480564.61	1350808.88	581.04
1731	480564.41	1350823.23	581.20
1732	480558.99	1350801.19	586.67
1733	480586.55	1350801.34	588.85
1734	480577.54	1350812.50	584.11
1735	480572.62	1350805.57	586.04
1736	480567.58	1350808.87	585.08
TOP OF COMPACTED CLAY LINER AT CELL OUTLET			
2725	480580.37	1350824.09	584.21
2726	480564.43	1350823.59	584.20
2727	480575.38	1350825.47	584.20
2728	480579.46	1350818.52	585.54
2729	480570.46	1350818.81	585.65
2730	480574.55	1350811.60	587.47
2731	480565.42	1350822.10	584.69
2732	480569.51	1350814.89	586.51
TOP OF LDS DRAINAGE LAYER AT CELL OUTLET			
3740	480588.76	1350804.30	590.25
3741	480588.52	1350823.83	585.37
3742	480580.26	1350832.21	585.29
3743	480564.34	1350831.56	585.28
3744	480556.12	1350822.80	585.36
3745	480558.36	1350803.29	590.24
3746	480564.59	1350811.72	590.24
3747	480580.50	1350812.37	590.25
3748	480574.40	1350823.79	587.53
3749	480570.32	1350830.03	585.98
3750	480569.38	1350827.41	586.47
3751	480565.28	1350833.86	585.29
TOP OF LCS DRAINAGE LAYER AT CELL OUTLET			
4731	480588.74	1350804.42	591.25
4732	480588.50	1350823.95	586.37
4733	480583.99	1350828.53	586.32
4734	480580.28	1350828.48	587.25
4735	480584.41	1350827.83	587.25
4736	480580.71	1350827.79	586.32
4737	480556.14	1350822.92	586.38
4738	480556.37	1350803.42	591.24
4739	480584.61	1350811.84	591.24
4740	480580.48	1350812.49	591.25

CELL 8 CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
TOP OF SUBGRADE AT CELL OUTLET			
1828	480179.97	1350856.38	579.56
1829	480180.17	1350839.71	579.41
1830	480164.18	1350839.51	579.41
1831	480163.98	1350855.86	579.56
1832	480158.56	1350833.82	585.04
1833	480186.12	1350833.97	585.22
1834	480177.11	1350845.13	582.49
1835	480172.19	1350838.20	584.42
1836	480167.15	1350841.50	583.46
TOP OF COMPACTED CLAY LINER AT CELL OUTLET			
2825	480179.94	1350856.72	582.58
2826	480164.00	1350856.22	582.58
2827	480174.95	1350858.10	582.68
2828	480179.03	1350851.15	583.92
2829	480170.03	1350851.44	584.03
2830	480174.12	1350844.23	585.85
2831	480164.99	1350854.73	583.07
2832	480169.08	1350847.52	584.89
TOP OF LDS DRAINAGE LAYER AT CELL OUTLET			
3840	480188.33	1350836.93	588.63
3841	480188.09	1350856.46	583.74
3842	480179.83	1350864.84	583.66
3843	480163.91	1350864.19	583.66
3844	480155.69	1350855.43	583.74
3845	480155.93	1350835.92	588.62
3846	480184.16	1350844.35	588.62
3847	480180.07	1350845.00	588.62
3848	480173.97	1350856.42	585.91
3849	480169.89	1350862.66	584.36
3850	480168.92	1350860.04	584.85
3851	480164.85	1350866.49	583.67
TOP OF LCS DRAINAGE LAYER AT CELL OUTLET			
4831	480188.31	1350837.06	589.63
4832	480188.07	1350856.58	584.74
4833	480183.56	1350861.18	584.70
4834	480179.85	1350861.11	585.63
4835	480163.98	1350860.46	585.62
4836	480160.27	1350860.42	584.69
4837	480155.70	1350855.55	584.74
4838	480155.94	1350836.05	589.62
4839	480164.17	1350844.47	589.62
4840	480180.05	1350845.12	589.62

LEGEND

1*28 ✦ CONSTRUCTION CONTROL POINT (SEE NOTE 5)

NOTES:

1. LDS, LCS, AND RLCS PIPES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02605.
2. FOR LINER PENETRATION BOX DETAILS, SEE DRAWING G-33.
3. TRENCH FOR LDS, LCS, AND RLCS PIPES IS NOT SHOWN ON THIS DRAWING FOR CLARITY. TRENCHING AND BACKFILLING FOR LDS, LCS, AND RLCS PIPES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTIONS 02215 AND 02225.
4. LDS, LCS, AND RLCS PIPES SHALL TIE INTO EXISTING PIPES. TIE-IN LOCATIONS ARE SHOWN IN CONSTRUCTION CONTROL POINT TABLE PRESENTED ON DRAWING G-9.
5. THE "*" SYMBOL REPRESENTS THE CELL IN WHICH THE APPROPRIATE CELL OUTLET CONTROL POINTS ARE LOCATED.
6. SIMULTANEOUS BUTT FUSION WELDS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13005.

CERTIFIED FOR CONSTRUCTION

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	LMC	JJA	TEZ	DKP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	LMC	JJA	TEZ	DKP	RB
1A	-	NOT ISSUED	-	-	-	-	-
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	PBC	LMC	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	TMM	LMC	DCP	JFB
A	-	NOT ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY: UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT: **FLUOR FERNALD, INC.**

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: CELL OUTLET GRADING PLANS I – CELLS 6, 7, AND 8 LINER SYSTEM

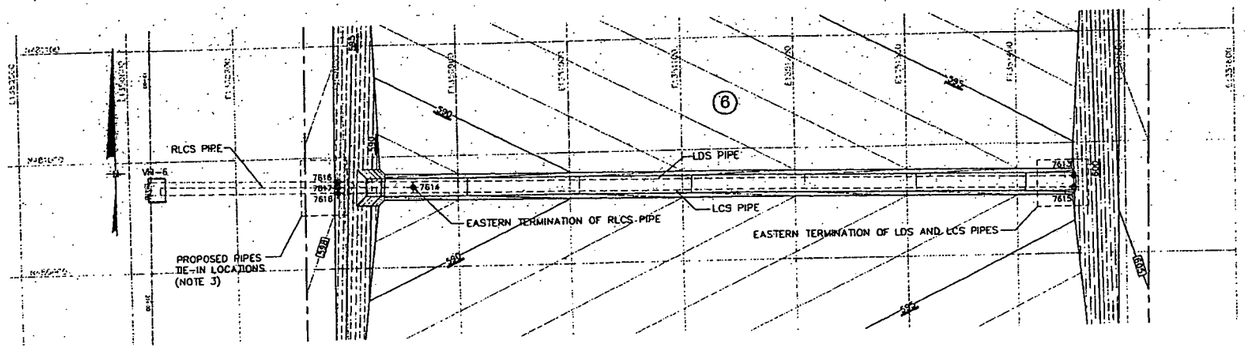
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED

SIGNATURE: 22 January 04

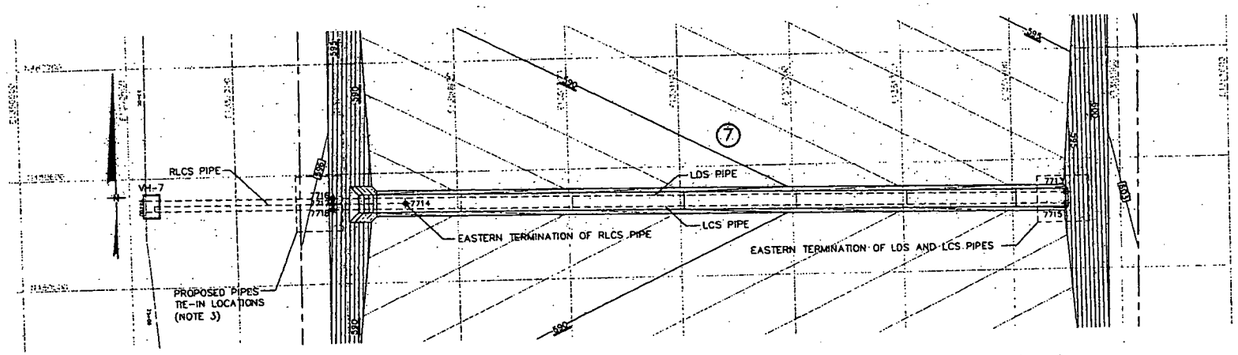
STATE OF OHIO — RUDOLPH BONAPARTE E-54670 — REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS, ATLANTA, GEORGIA

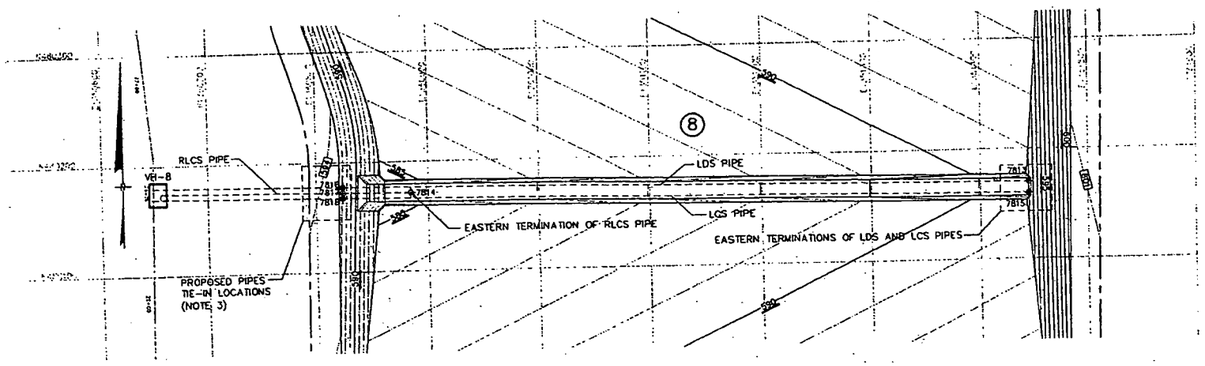
PROJECT NO.:	20100
CONTRACT NO.:	03FF0698
FEMP DRAWING NO.:	90X-6000-C-00370
GEOSYNTEC PROJECT NO.:	GO3211-06.04
GEOSYNTEC DOCUMENT NO.:	F03-3009
SHEET NO.:	G-8



7 PLAN
CONSTRUCTION CONTROL POINT LOCATIONS FOR CELL 6 LDS, LCS, AND RLCS PIPES
SCALE: 1" = 50'



8 PLAN
CONSTRUCTION CONTROL POINT LOCATIONS FOR CELL 7 LDS, LCS, AND RLCS PIPES
SCALE: 1" = 50'



8A PLAN
CONSTRUCTION CONTROL POINT LOCATIONS FOR CELL 8 LDS, LCS, AND RLCS PIPES
SCALE: 1" = 50'

EXISTING LDS, LCS, AND RLCS PIPES TIE-IN LOCATIONS (NOTE 3)

CELL 6			
POINT NO.	NORTHING	EASTING	ELEVATION
7616	480976.00	1350794.41	585.83
7617	480972.57	1350794.28	587.84
7618	480967.81	1350794.15	586.75

CELL 7			
POINT NO.	NORTHING	EASTING	ELEVATION
7716	480577.87	1350788.52	583.83
7717	480572.82	1350788.38	583.84
7718	480567.82	1350788.28	584.73

CELL 8			
POINT NO.	NORTHING	EASTING	ELEVATION
7818	480177.37	1350823.75	582.08
7817	480172.37	1350823.63	584.08
7818	480167.37	1350823.50	583.08

LDS, LCS, AND RLCS PIPES EASTERN TERMINATIONS

CELL 6			
POINT NO.	NORTHING	EASTING	ELEVATION
7613	480968.74	1351452.71	592.44
7614	480971.89	1350800.05	588.47
7615	480959.74	1351452.84	593.45

CELL 7			
POINT NO.	NORTHING	EASTING	ELEVATION
7713	480569.73	1351450.02	590.44
7714	480572.04	1350853.23	588.47
7715	480559.75	1351449.95	591.45

CELL 8			
POINT NO.	NORTHING	EASTING	ELEVATION
77813	480169.77	1351445.15	588.47
7814	480171.83	1350884.30	584.96
7815	480159.77	1351445.03	590.47

LEGEND

605	COMPACTED CLAY LINER ELEVATION (FEET)
600	LEACHATE COLLECTION SYSTEM ELEVATION (FEET)
	PERIMETER BERM BASELINE
21-24"	EXISTING EPLTS PIPE
7618	CONSTRUCTION CONTROL POINT
6	CELL DESIGNATION

NOTES:

1. LDS, LCS, AND RLCS PIPES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02605.
2. TRENCH FOR LDS, LCS, AND RLCS PIPES IS NOT SHOWN ON THIS DRAWING FOR CLARITY. TRENCHING AND BACKFILLING FOR LDS, LCS, AND RLCS PIPES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTIONS 02215 AND 02225.
3. LDS, LCS, AND RLCS PIPES FOR CELLS 6, 7, AND 8 SHALL TIE INTO EXISTING PIPES. TIE-IN LOCATIONS FOR CELLS 6, 7, AND 8 ARE SHOWN IN CONSTRUCTION CONTROL POINT TABLE PRESENTED ON THIS DRAWING. TIE-IN CONSTRUCTION CONTROL POINTS REPRESENT OUTSIDE BOTTOM OF 10-INCH PIPE. REMOVE END CAPS OR OTHER TEMPORARY PROTECTION INSTALLED ON EXISTING PIPES PRIOR TO TIE-INS. AS-BUILT TIE-IN LOCATIONS MAY VARY SLIGHTLY FROM CONSTRUCTION CONTROL POINTS GIVEN ON THIS DRAWING.

REV. NO	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	LMG	JJA	TEZ	DKP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DKP	RB
1A	-	NOT ISSUED	—	—	—	-	-
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	JMO	LMG	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	TMM	LMG	DCP	JFB
A	-	NOT ISSUED	—	—	—	-	-

50 25 0 50 100
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
CELL OUTLET GRADING PLANS II –
CELLS 6, 7, AND 8 LINER SYSTEM

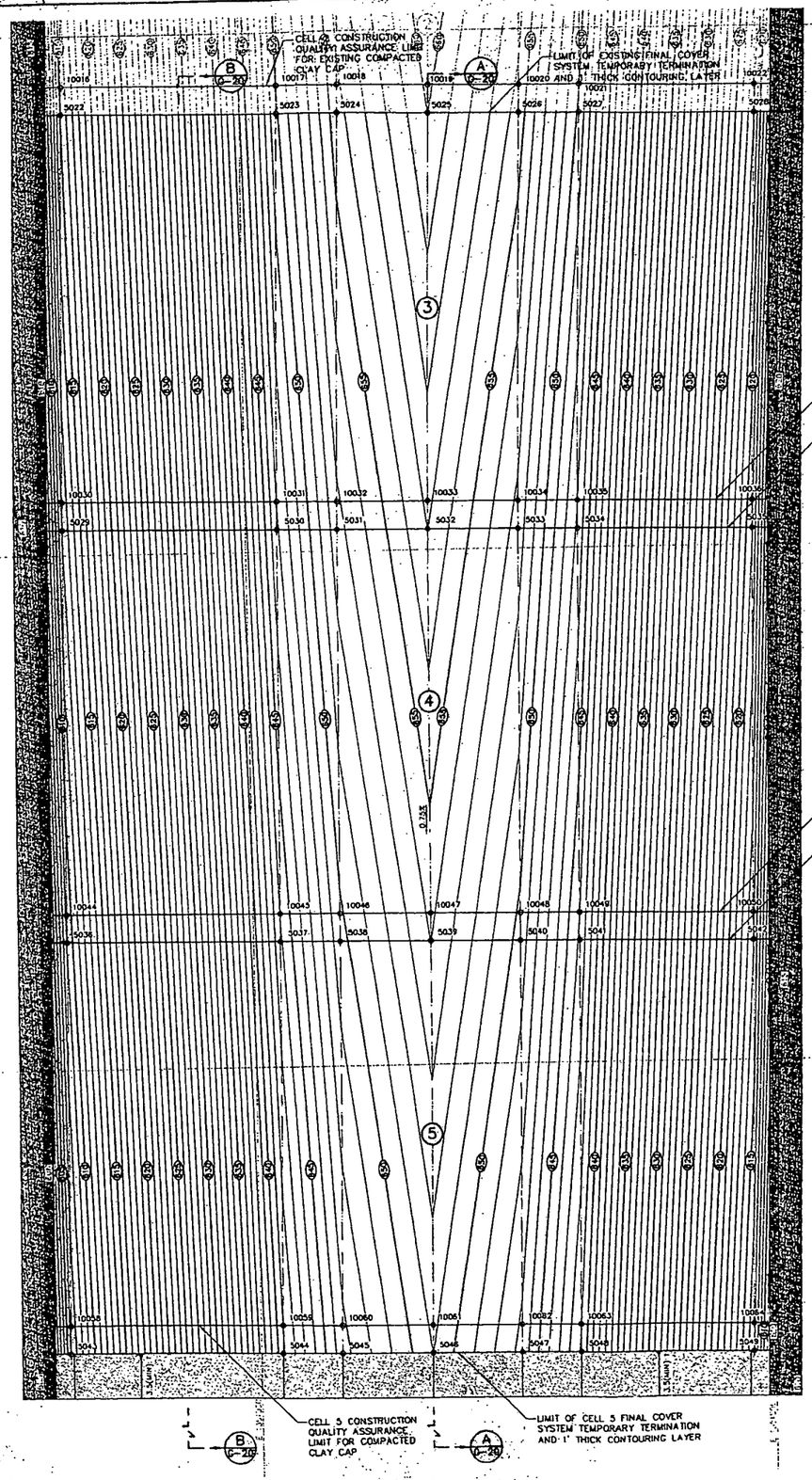
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

STATE OF OHIO
RUSSELL RONALD MARTE
E-56879
REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS
1000 HOLCOMB WOODS PKWY
ROSWELL, GEORGIA 30076

PROJECT NO.:	20105
CONTRACT NO.:	0J370899
FFMP DRAWING NO.:	90X-5000-C-00371
GEOSYNTEC PROJECT NO.:	503711.28.04
GEOSYNTEC DOCUMENT NO.:	F04-1010
SHEET NO.:	G-19
REVISION NO.:	

CERTIFIED-FOR-CONSTRUCTION



LEGEND

- EXISTING CONTOURING LAYER ELEVATION (FEET)
- EXISTING PROTECTIVE CLAY LAYER ELEVATION (FEET)
- CONTOURING LAYER ELEVATION (FEET) (NOTE 2)
- PERIMETER BERM BASELINE
- CONSTRUCTION CONTROL POINT
- CELL DESIGNATION
- DRAINAGE FLOW DIRECTION (NOTE 4)
- CONTOURING LAYER AND IMPACTED MATERIAL INTERIM GRADE (NOTE 3)
- EXISTING PROTECTIVE CLAY LAYER GRADES

CONTOURING LAYER CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
5022	482424.24	1350826.92	615.09
5023	482421.69	1351035.45	649.84
5024	482420.98	1351093.28	655.62
5025	482419.91	1351181.24	660.02
5026	482418.83	1351269.20	655.62
5027	482418.13	1351327.03	649.84
5028	482416.09	1351493.38	622.11
5029	482024.27	1350822.03	612.08
5030	482021.72	1351030.56	646.84
5031	482021.01	1351088.39	652.62
5032	482019.94	1351176.35	657.02
5033	482018.86	1351264.31	652.62
5034	482018.16	1351322.14	646.84
5035	482016.12	1351488.51	619.11
5036	481624.30	1350817.15	609.08
5037	481621.75	1351025.67	643.84
5038	481621.04	1351083.50	649.62
5039	481619.97	1351171.46	654.02
5040	481618.89	1351259.43	649.62
5041	481618.19	1351317.25	643.84
5042	481616.15	1351483.82	616.11
5043	481224.33	1350812.28	606.08
5044	481221.78	1351020.79	640.84
5045	481221.07	1351078.61	646.62
5046	481220.00	1351166.57	651.02
5047	481218.92	1351254.54	646.62
5048	481218.22	1351312.36	640.84
5049	481216.18	1351478.73	613.11

CQA LIMIT FOR COMPACTED CLAY CAP CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
10016	482451.24	1350827.27	615.29
10017	482448.69	1351035.77	650.04
10018	482447.98	1351093.60	655.82
10019	482446.91	1351181.57	660.22
10020	482445.83	1351269.54	655.83
10021	482445.13	1351327.37	650.04
10022	482443.09	1351493.71	622.32
10030	482051.27	1350822.36	612.28
10031	482048.72	1351030.89	647.04
10032	482048.01	1351088.77	652.82
10033	482046.94	1351176.88	657.22
10034	482045.86	1351264.84	652.82
10035	482045.16	1351322.67	647.04
10036	482043.12	1351488.84	619.31
10044	481651.30	1350817.48	609.28
10045	481648.75	1351026.00	644.04
10046	481648.04	1351083.83	649.82
10047	481646.97	1351171.79	654.22
10048	481645.89	1351259.76	649.82
10049	481645.19	1351317.58	644.04
10050	481643.15	1351483.95	616.31
10058	481251.33	1350812.59	606.28
10059	481248.78	1351021.12	641.04
10060	481248.07	1351078.94	646.82
10061	481247.00	1351166.90	651.22
10062	481245.92	1351254.87	646.82
10063	481245.22	1351312.69	641.04
10064	481243.18	1351479.06	613.31

NOTES:

1. THIS DRAWING PRESENTS CONSTRUCTION CONTROL POINTS FOR CONTOURING LAYER, LIMIT OF FINAL COVER SYSTEM TEMPORARY TERMINATION, AND CQA LIMIT FOR COMPACTED CLAY CAP FOR CELLS 3, 4, AND 5.
2. CONTOURING LAYER AND PROTECTIVE CLAY LAYER ELEVATIONS CORRESPOND TO TOP OF CONTOURING LAYER AND TOP OF PROTECTIVE CLAY LAYER, RESPECTIVELY.
3. CONSTRUCT INTERIM GRADES TO MEET EXISTING IMPACTED MATERIAL GRADES.
4. RUNOFF FROM NON-IMPACTED CONTOURING LAYER SHALL BE DIVERTED TO DOWNGRADIENT IMPACTED RUNOFF CATCHMENT AREA UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED. DRAINAGE FLOW DIRECTION INDICATES LOCATION OF TEMPORARY DRAINAGE CHANNEL THAT SHALL BE USED TO DIVERT RUNOFF FROM CONTOURING LAYER TO IMPACTED RUNOFF CATCHMENT AREA. CONTRACTOR SHALL CONTAIN AND CONTROL WATER GENERATED DURING CONSTRUCTION AND FILLING OF OSDF IN ACCORDANCE WITH THE CONSTRUCTION DRAWINGS AND SPECIFICATION SECTION 02270.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWO	KRD	DGP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DGP	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DGP	JFB

SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY - PHASE V

TITLE: FINAL COVER SYSTEM CONTOURING LAYER GRADING PLAN I - CELLS 3, 4, AND 5

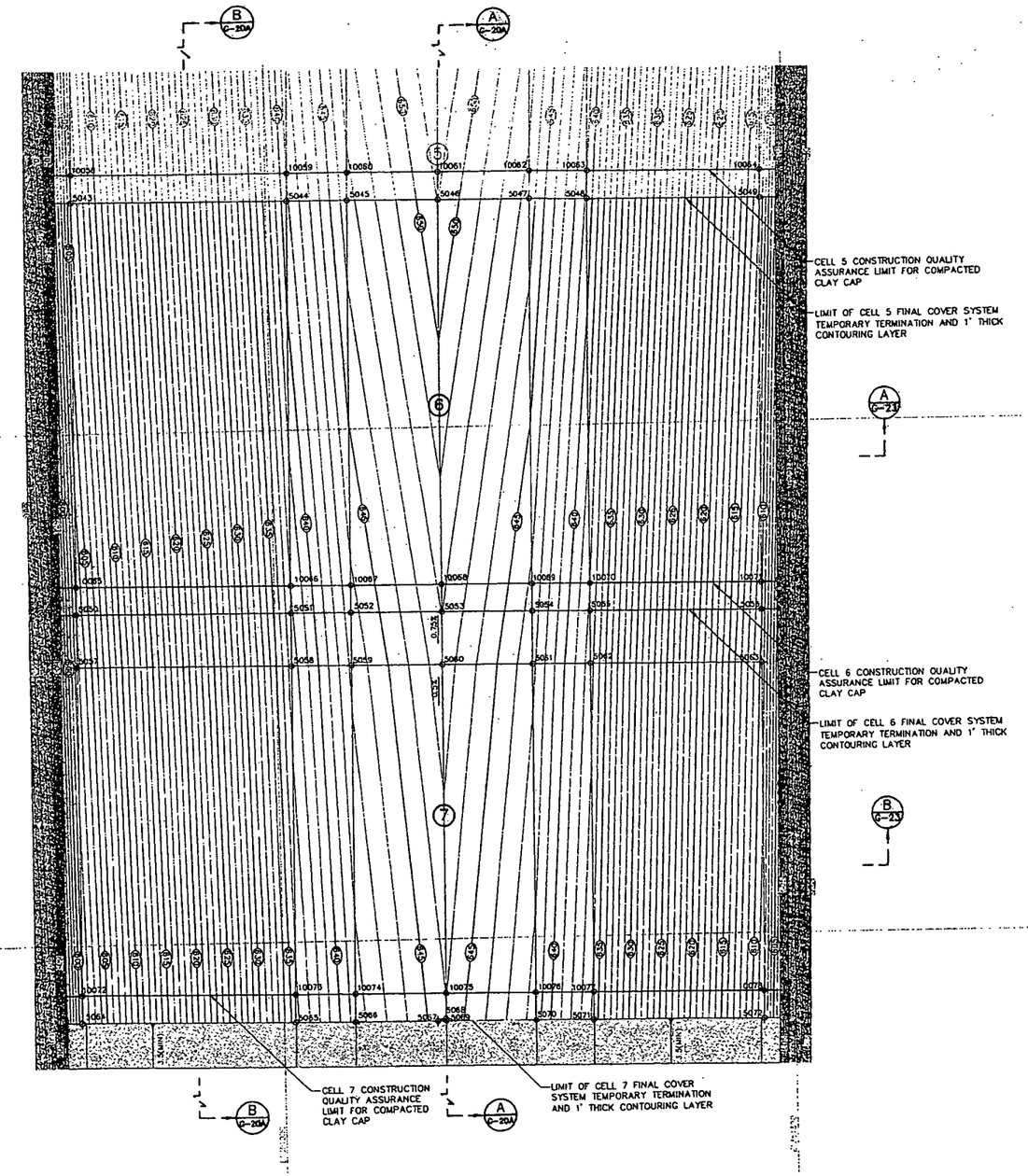
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

STATE OF OHIO — JOHN W. BETCH — E-34248 — REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS

PROJECT NO.: 20190
CONTRACT NO.: 95P5005028
FEMP DRAWING NO.: 5D1-6000-C-00372
GEOSYNTEC PROJECT NO.: C01342-17.4
GEOSYNTEC DOCUMENT NO.: C01-0031
SHEET NO.: G-10
REVISION NO.:

CERTIFIED-FOR-CONSTRUCTION



LEGEND

- EXISTING CONTOURING LAYER ELEVATION (FEET)
- EXISTING PROTECTIVE CLAY LAYER ELEVATION (FEET)
- CONTOURING LAYER ELEVATION (FEET) (NOTE 2)
- PERIMETER BERM BASELINE
- CONSTRUCTION CONTROL POINT
- CELL DESIGNATION
- DRAINAGE FLOW DIRECTION (NOTE 3)
- CONTOURING LAYER AND IMPACTED MATERIAL INTERIM GRADE (NOTE 4)
- EXISTING PROTECTIVE CLAY LAYER GRADES

CONTOURING LAYER CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
5043	481224.33	1350812.26	606.08
5044	481221.78	1351020.79	640.84
5045	481221.07	1351078.61	646.62
5046	481220.00	1351166.57	651.02
5047	481218.92	1351254.54	646.62
5048	481218.22	1351312.36	640.84
5049	481216.18	1351478.73	613.11
5050	480824.36	1350807.38	603.09
5051	480821.81	1351015.90	637.84
5052	480821.10	1351073.72	643.62
5053	480820.03	1351161.69	648.02
5054	480818.95	1351249.65	643.62
5055	480818.25	1351307.47	637.84
5056	480816.21	1351473.83	610.11
5057	480772.62	1350806.75	602.70
5058	480770.07	1351015.26	637.45
5059	480769.37	1351073.09	643.23
5060	480768.29	1351161.05	647.63
5061	480767.22	1351249.02	643.23
5062	480766.51	1351306.84	637.45
5063	480764.48	1351473.20	609.72
5064	480424.39	1350807.49	600.96
5065	480421.84	1351011.01	635.71
5066	480421.13	1351068.83	641.49
5067	480420.16	1351148.68	645.49
5068	480422.29	1351156.82	645.90
5069	480420.05	1351157.18	645.87
5070	480418.98	1351244.76	641.49
5071	480418.28	1351302.58	635.71
5072	480416.24	1351468.94	607.98

COA LIMIT FOR COMPACTED CLAY CAP CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
10058	481251.33	1350812.58	606.28
10059	481248.78	1351021.12	641.04
10060	481248.07	1351078.94	646.82
10061	481247.00	1351166.90	651.22
10062	481245.92	1351254.87	646.82
10063	481245.22	1351312.69	641.04
10064	481243.18	1351479.06	613.31
10065	480851.36	1350807.71	603.29
10066	480848.81	1351016.23	638.04
10067	480848.10	1351074.05	643.83
10068	480847.03	1351162.02	648.22
10069	480845.95	1351249.98	643.83
10070	480845.25	1351307.80	638.04
10071	480843.21	1351474.16	610.31
10072	480451.39	1350807.87	601.09
10073	480448.84	1351011.34	635.85
10074	480448.13	1351069.16	641.63
10075	480447.06	1351157.13	646.03
10076	480445.98	1351245.09	641.63
10077	480445.27	1351302.92	635.85
10078	480443.24	1351469.27	608.12

NOTES:

1. THIS DRAWING PRESENTS CONSTRUCTION CONTROL POINTS FOR CONTOURING LAYER, LIMIT OF FINAL COVER SYSTEM TEMPORARY TERMINATION, AND COA LIMIT FOR COMPACTED CLAY CAP FOR CELLS 6 AND 7.
2. PROTECTIVE CLAY LAYER AND CONTOURING LAYER ELEVATIONS CORRESPOND TO TOP OF PROTECTIVE CLAY LAYER AND CONTOURING LAYER, RESPECTIVELY. PROTECTIVE CLAY LAYER WILL BE CONSTRUCTED AS PART OF CELLS 6 AND 7 LINER SYSTEM CONSTRUCTION.
3. RUNOFF FROM NON-IMPACTED CONTOURING LAYER SHALL BE DIVERTED TO DOWNGRADIENT IMPACTED RUNOFF CATCHMENT AREA UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED. DRAINAGE FLOW DIRECTION INDICATES LOCATION OF TEMPORARY DRAINAGE CHANNEL THAT SHALL BE USED TO DIVERT RUNOFF FROM CONTOURING LAYER TO IMPACTED RUNOFF CATCHMENT AREA. CONTAIN AND CONTROL WATER GENERATED DURING CONSTRUCTION AND FILLING OF OSDF IN ACCORDANCE WITH THE CONSTRUCTION DRAWINGS AND SPECIFICATION SECTION 02270.
4. CONSTRUCT INTERIM GRADES TO MEET EXISTING IMPACTED MATERIAL GRADES.
5. FINAL COVER SYSTEM FOR CELLS 7 AND 8 MAY BE CONSTRUCTED CONCURRENTLY WITHOUT CONSTRUCTION OF THE FINAL COVER SYSTEM TEMPORARY TERMINATION. CELLS 7 AND 8 FINAL COVER SYSTEM STAGED CLOSURE SEQUENCE IS SHOWN ON DRAWING G-18.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVWL BY	APR. BY
2	05.03.16	CFC REVISION 2 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	KRD	DCP	JFB
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	KRD	DCP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TEZ	JJA	KRD	DCP	RB
1A	03.10.28	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	TEZ	JJA	KRD	DCP	RB
0	07.01.24	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWO	KRD	DCP	JFB
B	01.13.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DCP	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DCP	JFB

SCALE IN FEET: 50 25 0 50 100

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: FINAL COVER SYSTEM CONTOURING LAYER GRADING PLAN II – CELLS 6 AND 7

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

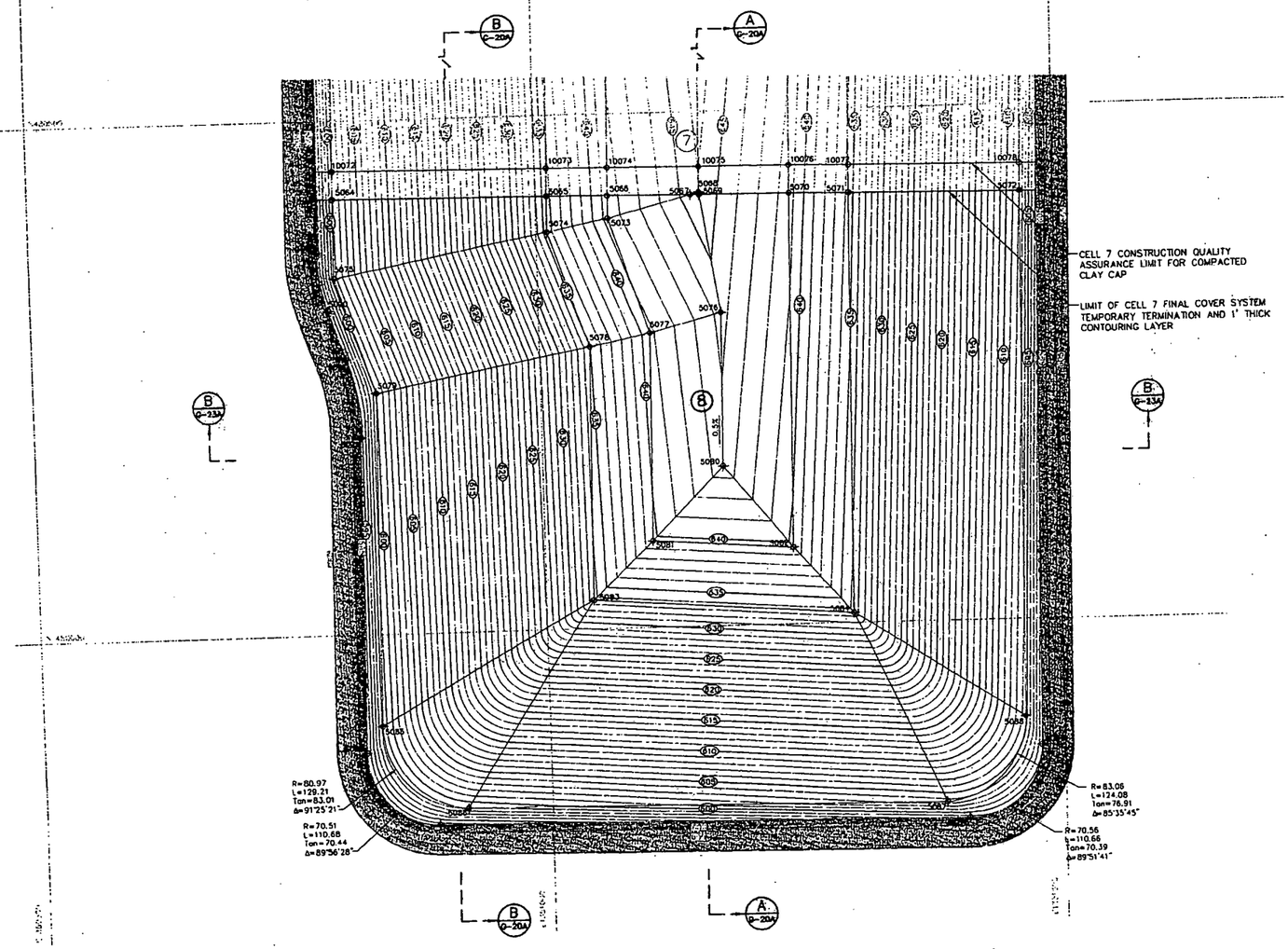
SIGNATURE
15 SEP 2006
DATE

STATE OF OHIO — JOHN T. WEECH — E-38246 — REGISTERED PROFESSIONAL ENGINEER
SEAL

GeoSyntec Consultants
1300 NORTHWEST BOULEVARD PH: KENNESAW, GEORGIA 30144

PROJECT NO.:	20105
CONTRACT NO.:	03F0699
FFMP DRAWING NO.:	90X-6000-C-00373
GEOSYNTEC PROJECT NO.:	GO3309-02.02
GEOSYNTEC DOCUMENT NO.:	FGA-2012
SHEET NO.:	G-11
REVISION NO.:	2

CERTIFIED-FOR-CONSTRUCTION



LEGEND

- 630 — EXISTING CONTOURING LAYER ELEVATION (FEET)
- 610 — EXISTING PROTECTIVE CLAY LAYER ELEVATION (FEET)
- 634 — CONTOURING LAYER ELEVATION (FEET) (NOTE 2)
- PERIMETER BERM BASELINE
- 5080 — CONSTRUCTION CONTROL POINT
- 8 — CELL DESIGNATION
- DRAINAGE FLOW DIRECTION (NOTE 3)
- EXISTING PROTECTIVE CLAY LAYER GRADES

CONTOURING LAYER CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
5064	480424.39	1350802.49	600.96
5065	480421.84	1351011.01	635.71
5066	480421.13	1351088.83	641.49
5067	480420.16	1351148.68	645.49
5068	480422.29	1351156.82	645.80
5069	480420.05	1351157.18	645.87
5070	480418.98	1351244.76	641.49
5071	480418.28	1351302.59	635.71
5072	480416.24	1351468.94	607.98
5073	480399.17	1351068.57	641.38
5074	480387.02	1351010.58	635.54
5075	480347.58	1350801.56	600.57
5076	480305.38	1351175.28	644.33
5077	480287.31	1351106.29	640.79
5078	480275.16	1351048.31	634.95
5079	480235.72	1350839.32	599.98
5080	480155.73	1351173.45	643.58
5081	480084.45	1351103.81	639.78
5082	480074.73	1351240.55	639.77
5083	480027.73	1351045.29	633.71
5084	480009.50	1351297.59	633.67
5085	479910.24	1350835.34	598.38
5086	479828.38	1350917.41	598.99
5087	479822.65	1351385.00	603.59
5088	479804.52	1351462.69	605.42
5089	480372.82	1350786.30	595.51
5090	480316.25	1350795.23	595.17
5091	480268.86	1350811.21	594.92
5092	480192.70	1350823.23	594.58
5093	479884.47	1350819.47	593.04
5094	479813.14	1350869.07	593.53
5095	479806.82	1351406.58	598.61
5096	479876.43	1351477.91	600.10

COA LIMIT FOR COMPACTED CLAY CAP CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
10072	480451.39	1350802.82	601.09
10073	480448.84	1351011.34	635.65
10074	480448.13	1351059.16	641.63
10075	480447.06	1351157.13	646.03
10076	480445.98	1351245.09	641.63
10077	480445.27	1351302.92	635.85
10078	480443.24	1351469.27	608.12

NOTES:

1. THIS DRAWING PRESENTS CONSTRUCTION CONTROL POINTS FOR CONTOURING LAYER, LIMIT OF FINAL COVER SYSTEM TEMPORARY TERMINATION, AND COA LIMIT FOR COMPACTED CLAY CAP FOR CELL 8.
2. PROTECTIVE CLAY LAYER AND CONTOURING LAYER ELEVATIONS CORRESPOND TO TOP OF PROTECTIVE CLAY LAYER AND CONTOURING LAYER, RESPECTIVELY. PROTECTIVE CLAY LAYER WILL BE CONSTRUCTED AS PART OF CELL 8 LINER SYSTEM CONSTRUCTION.
3. RUNOFF FROM NON-IMPACTED CONTOURING LAYER SHALL BE DIVERTED TO DOWNGRADIENT IMPACTED RUNOFF CATCHMENT AREA UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED. DRAINAGE FLOW DIRECTION INDICATES LOCATION OF TEMPORARY DRAINAGE CHANNEL THAT SHALL BE USED TO DIVERT RUNOFF FROM CONTOURING LAYER TO IMPACTED RUNOFF CATCHMENT AREA. CONTAIN AND CONTROL WATER GENERATED DURING CONSTRUCTION AND FILLING OF OSDF IN ACCORDANCE WITH THE CONSTRUCTION DRAWINGS AND SPECIFICATION SECTION 02270. CELL 8 IMPACTED RUNOFF CATCHMENT AREA DURING STAGED CLOSURE SHOWN ON DRAWING G-16.
4. FINAL COVER SYSTEM FOR CELLS 7 AND 8 MAY BE CONSTRUCTED CONCURRENTLY WITHOUT CONSTRUCTION OF THE FINAL COVER SYSTEM TEMPORARY TERMINATION. CELLS 7 AND 8 FINAL COVER SYSTEM STAGED CLOSURE SEQUENCE IS SHOWN ON DRAWING G-16.

REV. NO	DATE	DESCRIPTION	DES. BY	DR BY	CHK. BY	RVW. BY	APR. BY
0	03.02.13	CFC SUBMITTAL TO FF/CDE/EPA	TEZ	JAA	LMG	DKP	JB

50 25 0 50 100
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: FINAL COVER SYSTEM CONTOURING LAYER GRADING PLAN III – CELL 8

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED

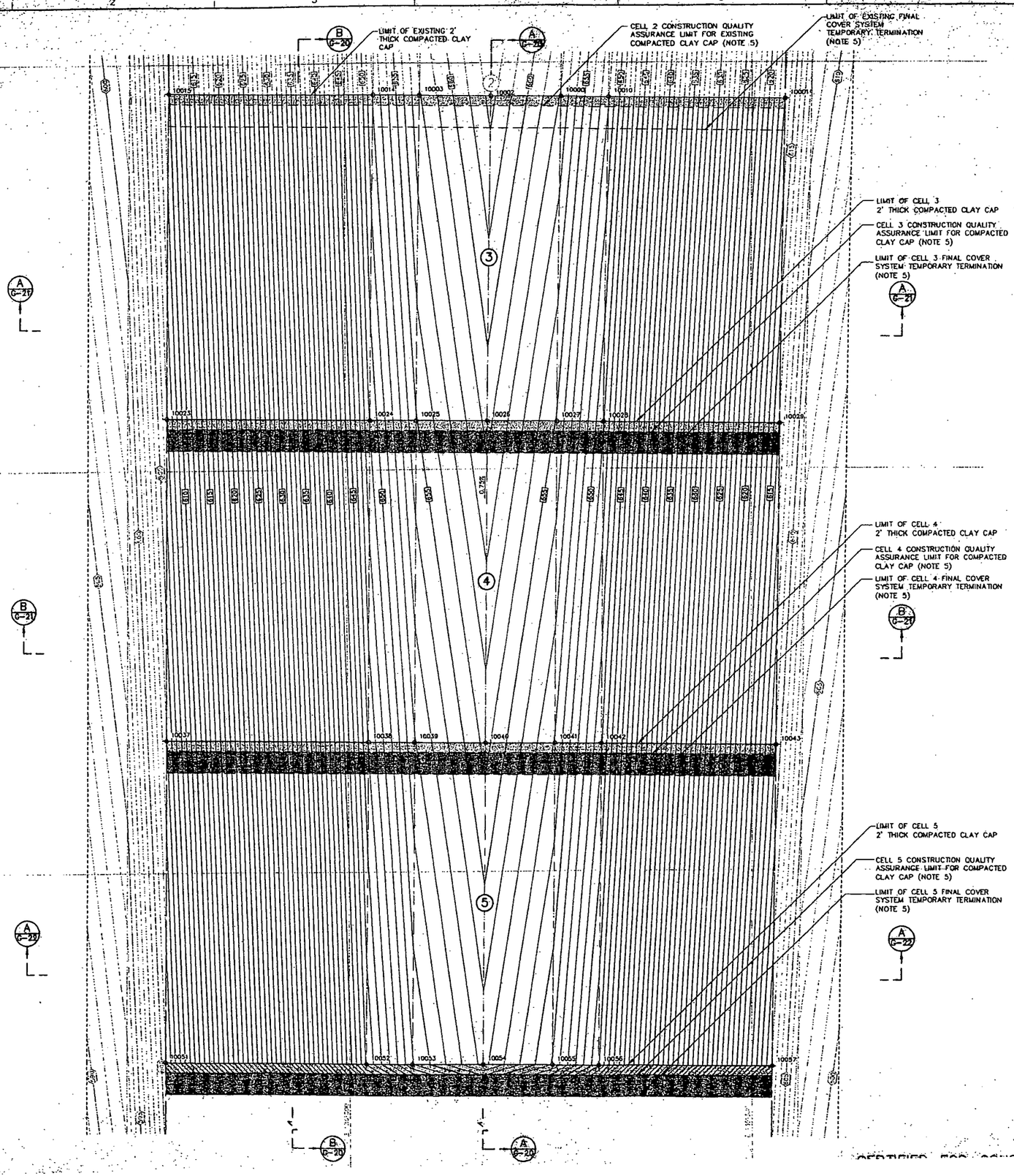
STATE OF OHIO — JOHN BEECH — E-56248 — REGISTERED PROFESSIONAL ENGINEER

15 Feb 2013

GeoSyntec Consultants

PROJECT NO:	20100
CONTRACT NO:	03FF0889
TEMP. DRAWING NO:	90X-6000-C-00427
GEOSYNTEC PROJECT NO:	03309-10.02
GEOSYNTEC DOCUMENT NO:	E045-0214
SHEET NO:	G-18A
REVISION NO:	0

CERTIFIED-FOR-CONSTRUCTION



LEGEND

- EXISTING SUBGRADE LAYER ELEVATION (FEET)
- EXISTING COMPACTED CLAY CAP ELEVATION (FEET)
- COMPACTED CLAY CAP ELEVATION (FEET) (NOTE 2)
- PERIMETER BERM BASELINE
- APPROXIMATE LIMIT OF FINAL COVER SYSTEM CONSTRUCTION
- CONSTRUCTION CONTROL POINT
- CELL DESIGNATION
- PORTION OF FINAL COVER SYSTEM TEMPORARY TERMINATION AREA (NOTE 3)
- COMPACTED CLAY CAP TRANSITION AREA (NOTE 4)

COMPACTED CLAY CAP CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
10000	482458.38	1351269.84	657.91
10001	482455.00	1351538.95	616.32
10002	482459.46	1351181.72	662.32
10003	482460.53	1351093.61	657.91
10010	482457.67	1351327.78	652.12
10014	482461.24	1351035.65	657.12
10015	482464.34	1350782.33	608.89
10023	482064.37	1350777.45	606.89
10024	482061.27	1351030.76	649.12
10025	482060.56	1351088.72	654.91
10026	482059.49	1351176.83	659.32
10027	482058.41	1351264.95	654.91
10028	482057.70	1351322.90	649.12
10029	482055.12	1351534.07	613.92
10037	481664.40	1350772.56	603.89
10038	481661.30	1351025.87	646.12
10039	481660.59	1351083.83	651.91
10040	481659.52	1351171.95	656.32
10041	481658.44	1351260.08	651.91
10042	481657.73	1351318.01	646.12
10043	481655.15	1351529.18	610.92
10051	481264.43	1350767.67	600.89
10052	481261.33	1351020.99	643.12
10053	481260.62	1351078.94	648.81
10054	481259.55	1351167.06	653.32
10055	481258.47	1351255.17	648.91
10056	481257.76	1351313.13	643.12
10057	481255.18	1351524.29	607.92

NOTES:

1. THIS DRAWING PRESENTS CONSTRUCTION CONTROL POINTS FOR COMPACTED CLAY CAP FOR CELLS 3, 4, AND 5.
2. COMPACTED CLAY CAP AND SUBGRADE LAYER ELEVATIONS CORRESPOND TO TOP OF COMPACTED CLAY CAP AND SUBGRADE LAYER, RESPECTIVELY.
3. SHADED AREA REPRESENTS A PORTION OF TEMPORARY TERMINATION OF FINAL COVER SYSTEM. TEMPORARY TERMINATION SHALL BE CONSTRUCTED ACCORDING TO DETAIL SHOWN ON DRAWING G-34.
4. CONSTRUCT TRANSITION FROM EXISTING FULL DEPTH SECTION OF COMPACTED CLAY CAP TO ADJACENT SECTION OF COMPACTED CLAY CAP IN ACCORDANCE WITH SPECIFICATION SECTION 02225.
5. CONSTRUCTION CONTROL POINTS FOR LIMIT OF FINAL COVER SYSTEM TEMPORARY TERMINATION AND CONSTRUCTION QUALITY ASSURANCE LIMIT FOR COMPACTED CLAY CAP FOR CELLS 2, 3, 4, AND 5 ARE PROVIDED ON DRAWING G-10.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWO	KRD	DGP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DGP	JFD
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	KRD	TWM	KRD	DGP	JFB

SCALE IN FEET: 50 25 0 50 100

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

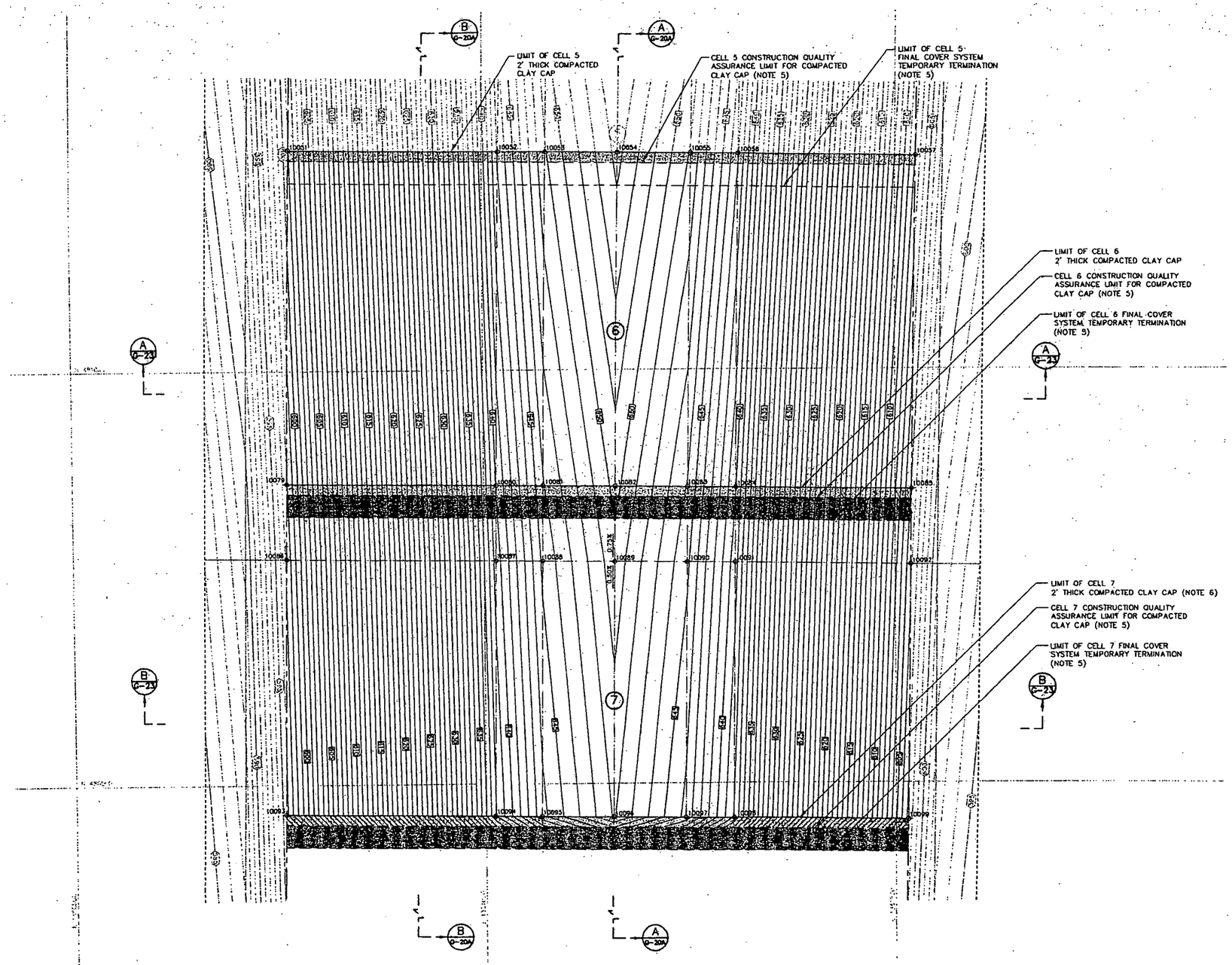
TITLE:
FINAL COVER SYSTEM COMPACTED CLAY CAP
GRADING PLAN I – CELLS 3, 4, AND 5

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDER OR CONSTRUCTION UNLESS SEALED.

STATE OF OHIO — JOHN BELCH E-54246 — REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS

PROJECT NO.:	20105
CONTRACT NO.:	96PS005028
FENF DRAWING NO.:	910-600D-G-00374
GEOSYNTEC PROJECT NO.:	GG1342-10.4
GEOSYNTEC DOCUMENT NO.:	7011-0012
SHEET NO.:	



LEGEND

- EXISTING SUBGRADE LAYER ELEVATION (FEET)
- EXISTING COMPACTED CLAY CAP ELEVATION (FEET)
- COMPACTED CLAY CAP ELEVATION (FEET) (NOTE 2)
- PERIMETER BERM BASELINE
- APPROXIMATE LIMIT OF FINAL COVER SYSTEM CONSTRUCTION
- 10051 CONSTRUCTION CONTROL POINT
- 6 CELL DESIGNATION
- PORTION OF FINAL COVER SYSTEM TEMPORARY TERMINATION AREA (NOTE 3)
- COMPACTED CLAY CAP TRANSITION AREA (NOTE 4)

COMPACTED CLAY CAP CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
10051	481264.43	1350767.67	600.89
10052	481261.33	1351020.99	643.12
10053	481260.62	1351078.94	648.91
10054	481259.55	1351167.06	653.32
10055	481258.47	1351255.17	648.91
10056	481257.76	1351313.13	643.12
10057	481255.18	1351524.29	607.92
10079	480864.46	1350762.78	597.89
10080	480861.36	1351016.10	640.12
10081	480860.65	1351074.06	645.91
10082	480859.58	1351162.17	650.32
10083	480858.50	1351250.28	645.91
10084	480857.79	1351308.24	640.12
10085	480855.21	1351519.40	604.92
10086	480773.17	1350761.67	597.21
10087	480770.08	1351014.98	639.43
10088	480769.37	1351072.94	645.23
10089	480768.29	1351161.05	649.63
10090	480767.22	1351249.17	645.23
10091	480766.51	1351307.12	639.43
10092	480763.93	1351518.28	604.24
10093	480484.49	1350757.89	595.67
10094	480481.39	1351011.21	637.89
10095	480480.68	1351069.17	643.69
10096	480479.61	1351157.28	648.09
10097	480478.53	1351245.39	643.69
10098	480477.82	1351303.35	637.89
10099	480475.24	1351514.51	602.69

NOTES:

1. THIS DRAWING PRESENTS CONSTRUCTION CONTROL POINTS FOR COMPACTED CLAY CAP FOR CELLS 6 AND 7.
2. COMPACTED CLAY CAP AND SUBGRADE LAYER ELEVATIONS CORRESPOND TO TOP OF COMPACTED CLAY CAP AND SUBGRADE LAYER, RESPECTIVELY.
3. SHADED AREA REPRESENTS A PORTION OF TEMPORARY TERMINATION OF FINAL COVER SYSTEM TO BE CONSTRUCTED ACCORDING TO DETAIL SHOWN ON DRAWING C-34.
4. CONSTRUCT TRANSITION FROM EXISTING FULL DEPTH SECTION OF COMPACTED CLAY CAP TO ADJACENT SECTION OF COMPACTED CLAY CAP IN ACCORDANCE WITH SPECIFICATION SECTION 02225.
5. CONSTRUCTION CONTROL POINTS FOR LIMIT OF FINAL COVER SYSTEM TEMPORARY TERMINATION AND CONSTRUCTION QUALITY ASSURANCE LIMIT FOR COMPACTED CLAY CAP FOR CELLS 5, 6, AND 7 ARE PROVIDED ON DRAWING C-11.
6. FINAL COVER SYSTEM FOR CELLS 7 AND 8 MAY BE CONSTRUCTED CONCURRENTLY WITHOUT CONSTRUCTION OF THE FINAL COVER SYSTEM TEMPORARY TERMINATION. CELL 8 FINAL COVER SYSTEM STAGED CLOSURE SEQUENCE IS SHOWN ON DRAWING C-16.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.27	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TCZ	JJA	KRD	DCP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TCZ	JJA	KRD	DCP	RB
1A	03.10.28	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	TCZ	JJA	KRD	DCP	RB
0	02.01.19	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWO	KRD	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DCP	JFB
A	01.10.27	PRELIMINARY SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DCP	JFB

50 25 0 50 100
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
FINAL COVER SYSTEM COMPACTED CLAY CAP
GRADING PLAN II – CELLS 6 AND 7

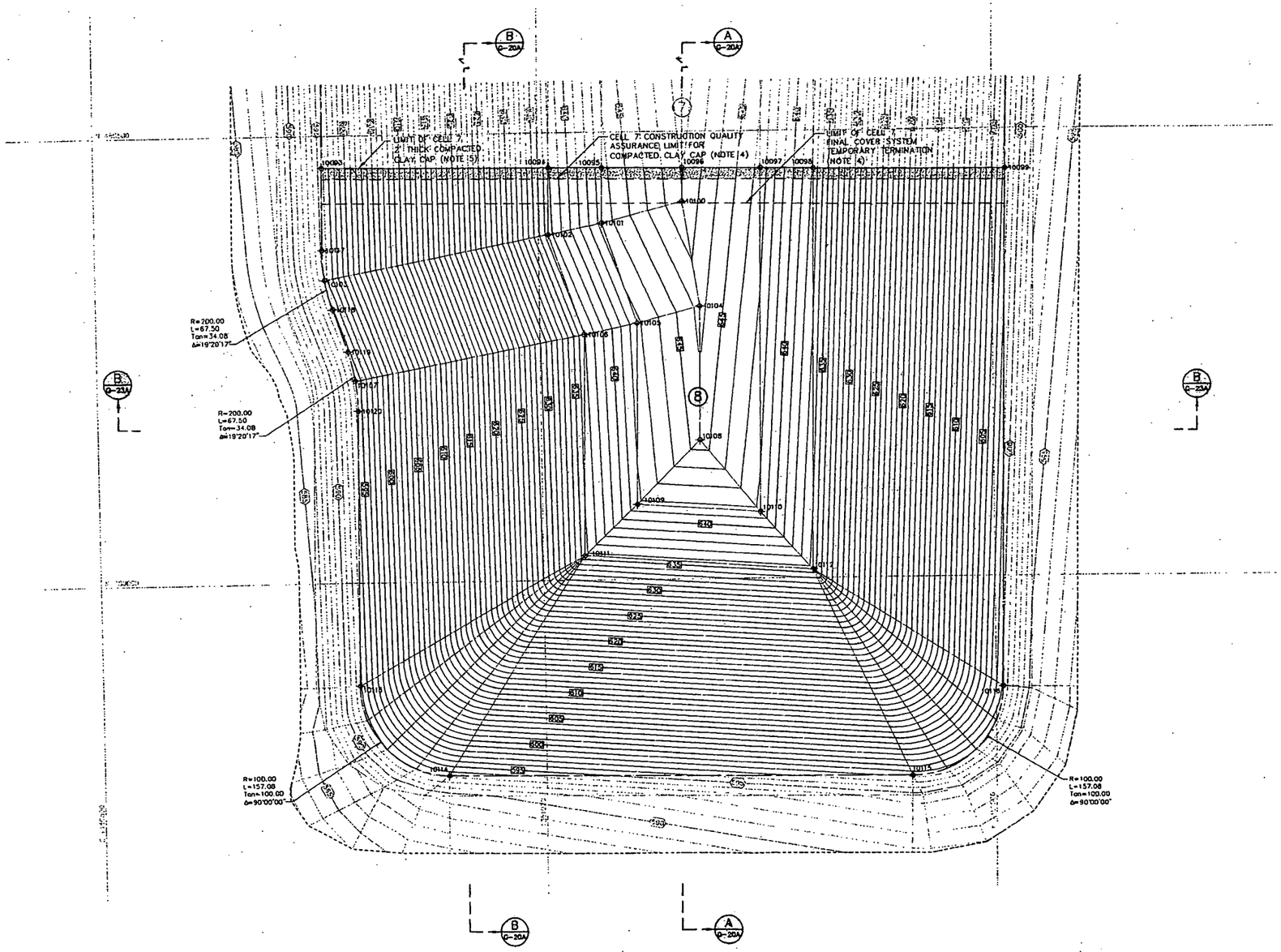
THIS DRAWING MAY NOT BE USED FOR PROJECT BIDDER OR CONSTRUCTION, UNLESS SEALED.

STATE OF OHIO
RUDOLPH BONAPARTE
E-58879
REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS

PROJECT NO.: 20105
CONTRACT NO.: 03FT0899
TEMP DRAWING NO.: 20X-6000-C-00375
GEOSYNTEC PROJECT NO.: 003211-06/04
GEOSYNTEC DOCUMENT NO.: 703-1015
SHEET NO.: 11-37

CERTIFIED FOR CONSTRUCTION



LEGEND

- EXISTING SUBGRADE LAYER ELEVATION (FEET)
- EXISTING COMPACTED CLAY CAP ELEVATION (FEET)
- COMPACTED CLAY CAP ELEVATION (FEET) (NOTE 2)
- PERIMETER BERM BASELINE
- APPROXIMATE LIMIT OF FINAL COVER SYSTEM CONSTRUCTION
- 10093 CONSTRUCTION CONTROL POINT
- 8 CELL DESIGNATION
- COMPACTED CLAY CAP TRANSITION AREA (NOTE 3)

COMPACTED CLAY CAP CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
10093	480464.49	1350757.89	595.67
10094	480461.39	1351011.21	637.89
10095	480460.68	1351069.17	643.69
10096	480459.61	1351157.28	648.09
10097	480458.53	1351245.39	643.08
10098	480457.82	1351303.35	637.89
10099	480455.24	1351514.51	602.69
10100	480492.30	1351156.82	647.90
10101	480399.14	1351068.42	643.38
10102	480386.97	1351010.30	637.52
10103	480339.58	1350759.21	595.52
10104	480305.39	1351175.28	646.33
10105	480287.28	1351106.14	642.79
10106	480275.11	1351048.03	638.93
10107	480228.65	1350791.28	594.45
10108	480155.74	1351173.45	645.58
10109	480084.31	1351103.66	641.77
10110	480074.57	1351240.70	641.77
10111	480027.46	1351045.00	635.69
10112	480009.18	1351287.87	635.85
10113	479984.83	1350889.94	592.74
10114	479983.62	1350888.71	593.23
10115	479977.30	1351406.22	588.31
10116	479876.07	1351507.43	589.80
10117	480373.18	1350756.78	595.21
10118	480306.82	1350767.25	594.67
10119	480259.42	1350783.24	594.62
10120	480193.06	1350793.71	594.28

NOTES:

1. THIS DRAWING PRESENTS CONSTRUCTION CONTROL POINTS FOR COMPACTED CLAY CAP FOR CELL 8.
2. COMPACTED CLAY CAP AND SUBGRADE LAYER ELEVATIONS CORRESPOND TO TOP OF COMPACTED CLAY CAP AND SUBGRADE LAYER, RESPECTIVELY.
3. CONSTRUCT TRANSITION FROM EXISTING FULL DEPTH SECTION OF COMPACTED CLAY CAP TO ADJACENT SECTION OF COMPACTED CLAY CAP IN ACCORDANCE WITH SPECIFICATION SECTION 02223.
4. CONSTRUCTION CONTROL POINTS FOR LIMIT OF FINAL COVER SYSTEM TEMPORARY TERMINATION AND CONSTRUCTION QUALITY ASSURANCE LIMIT FOR COMPACTED CLAY CAP FOR CELLS 7 AND 8 ARE PROVIDED ON DRAWINGS G-11 AND G-11A.
5. FINAL COVER SYSTEM FOR CELLS 7 AND 8 MAY BE CONSTRUCTED CONCURRENTLY WITHOUT CONSTRUCTION OF THE FINAL COVER SYSTEM TEMPORARY TERMINATION. CELL 8 FINAL COVER SYSTEM STAGED CLOSURE SEQUENCE IS SHOWN ON DRAWING G-16.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	05.02.15	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMC	DKP	JFB
1C	-	NOT ISSUED	-	-	-	-	-
1B	-	NOT ISSUED	-	-	-	-	-
1A	-	NOT ISSUED	-	-	-	-	-
0	04.01.22	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	KRD	DKP	RB
B	03.12.08	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	JJA	KRD	DKP	RB
A	03.10.26	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	JJA	KRD	DKP	RB

50 25 0 50 100
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: FINAL COVER SYSTEM COMPACTED CLAY CAP GRADING PLAN III – CELL 8

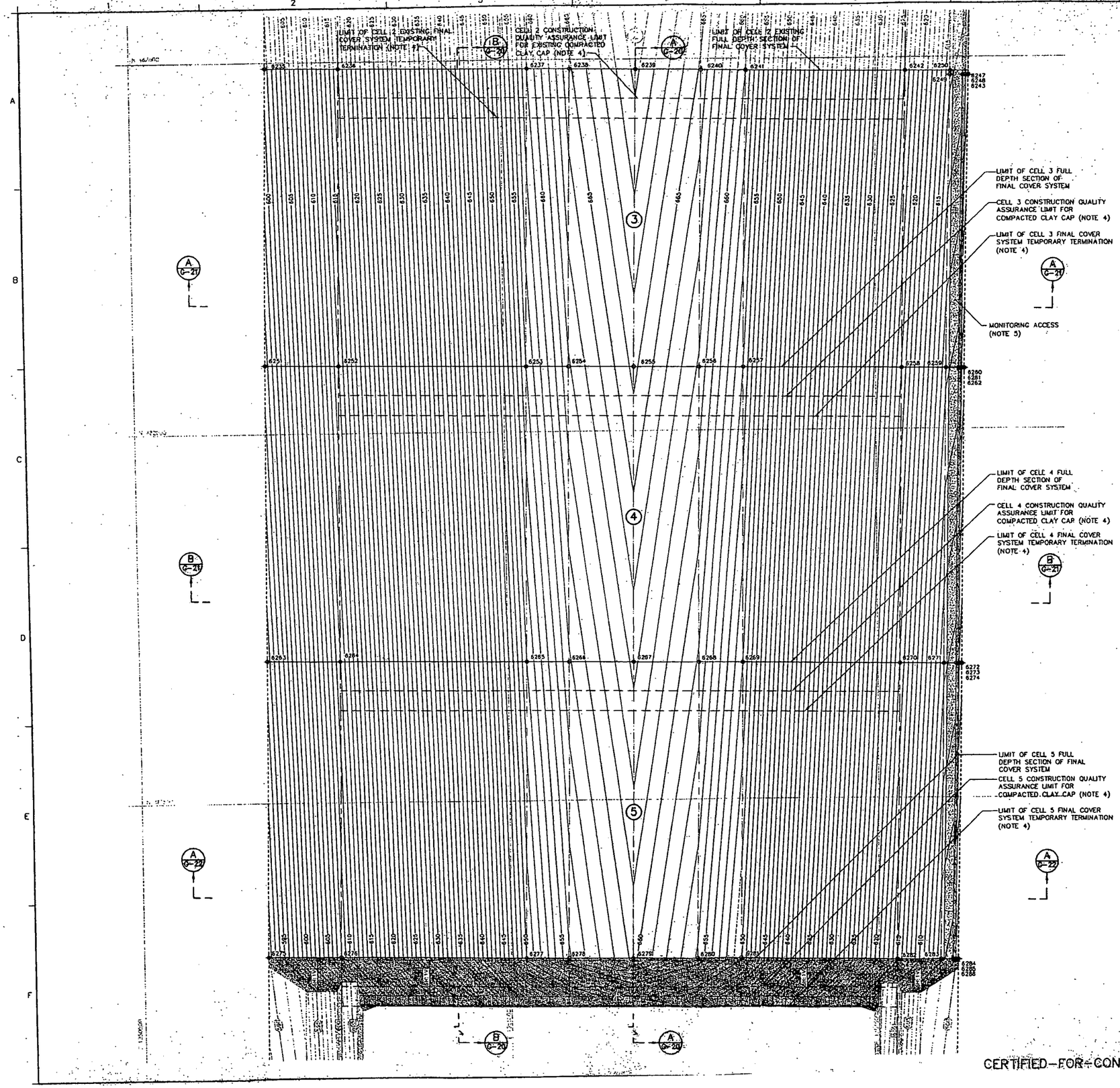
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

STATE OF OHIO — JOHN F. BEECH — E-58248 — REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS, 1255 ROBERTS BOULEVARD NW, KENNESAW, GEORGIA 30144-3683

PROJECT NO.: 20105
CONTRACT NO.: 03FF0599
FEMP DRAWING NO.: 98X-6000-G-00416
GEOSYNTEC PROJECT NO.: GS3009-02.02
GEOSYNTEC DOCUMENT NO.: F04-1059
SHEET NO.: G-11A
REVISION NO.:

CERTIFIED-FOR-CONSTRUCTION



LEGEND

- EXISTING FINISHED GRADE ELEVATION (FEET)
- EXISTING SUBGRADE LAYER ELEVATION (FEET)
- EXISTING PROTECTIVE CLAY LAYER ELEVATION (FEET)
- FINISHED GRADE ELEVATION (FEET) (NOTE 2)
- PERIMETER BERM BASELINE
- APPROXIMATE LIMIT OF FINAL COVER SYSTEM CONSTRUCTION
- CONSTRUCTION CONTROL POINT
- CELL DESIGNATION
- FINAL COVER SYSTEM TEMPORARY TERMINATION AREA (NOTE 3)
- MONITORING ACCESS (NOTE 5)

FINAL COVER SYSTEM CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
6235	482492.22	1350683.64	600.43
6236	482491.01	1350782.66	616.94
6237	482487.92	1351035.10	659.01
6238	482487.21	1351093.43	664.85
6239	482486.12	1351182.05	669.28
6240	482485.04	1351270.67	664.85
6241	482484.33	1351329.00	659.01
6242	482481.76	1351539.28	623.96
6243	482475.28	1351620.92	610.30
6247	482475.37	1351613.68	613.54
6248	482475.32	1351617.68	610.87
6249	482475.34	1351597.69	614.18
6250	482481.04	1351597.76	614.22
6251	482092.23	1350678.75	597.43
6252	482091.03	1350777.77	613.94
6253	482087.95	1351030.21	656.01
6254	482087.24	1351088.54	661.85
6255	482086.15	1351177.16	666.28
6256	482085.07	1351265.78	661.85
6257	482084.36	1351324.11	656.01
6258	482081.79	1351534.39	620.96
6259	482081.07	1351592.88	611.22
6260	482080.88	1351608.88	610.58
6261	482080.83	1351612.88	607.81
6262	482080.78	1351616.10	607.34
6263	481692.78	1350873.88	594.43
6264	481691.07	1350972.88	610.94
6265	481687.98	1351025.32	653.01
6266	481687.27	1351083.65	658.85
6267	481686.18	1351172.27	663.28
6268	481685.10	1351260.89	658.85
6269	481684.39	1351319.22	653.01
6270	481681.82	1351529.50	617.96
6271	481681.10	1351587.99	608.22
6272	481680.91	1351603.97	607.58
6273	481680.86	1351607.97	604.91
6274	481680.82	1351611.21	604.34
6275	481292.31	1350668.97	591.43
6276	481291.09	1350768.00	607.94
6277	481288.01	1351020.43	650.01
6278	481287.30	1351078.76	655.85
6279	481286.21	1351167.38	660.28
6280	481285.13	1351256.00	655.85
6281	481284.42	1351314.34	650.01
6282	481281.85	1351524.62	614.96
6283	481281.13	1351583.10	605.22
6284	481280.94	1351599.08	604.58
6285	481280.89	1351603.08	601.91
6286	481280.85	1351608.33	601.34

NOTES:

1. THIS DRAWING PRESENTS CONSTRUCTION CONTROL POINTS FOR FINAL COVER SYSTEM FOR CELLS 3, 4, AND 5.
2. FINISHED GRADE ELEVATIONS EXCLUDING MONITORING ACCESS CORRESPOND TO TOP OF FINAL COVER SYSTEM TOPSOIL LAYER.
3. SHADED AREA REPRESENTS EXTENT OF TEMPORARY TERMINATION OF FINAL COVER SYSTEM. TEMPORARY TERMINATION SHALL BE CONSTRUCTED ACCORDING TO DETAIL SHOWN ON DRAWING G-34.
4. CONSTRUCTION CONTROL POINTS FOR LIMIT OF FINAL COVER SYSTEM TEMPORARY TERMINATION AND CONSTRUCTION QUALITY ASSURANCE LIMIT FOR COMPACTED CLAY CAP ARE PROVIDED ON DRAWING G-10.
5. MONITORING ACCESS DETAILS ARE SHOWN ON DRAWING G-37.

REV NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK. BY	RVW. BY	APP. BY
0	02.01.19	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JMD	KRD	DCP	JB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JMD	KRD	DCP	JB
A	01.10.17	PRELIMINARY SUBMITTAL TO FF/DOE	KRD	JMD	KRD	DCP	JB

SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: FINAL COVER SYSTEM GRADING PLAN I – CELLS 3, 4, AND 5

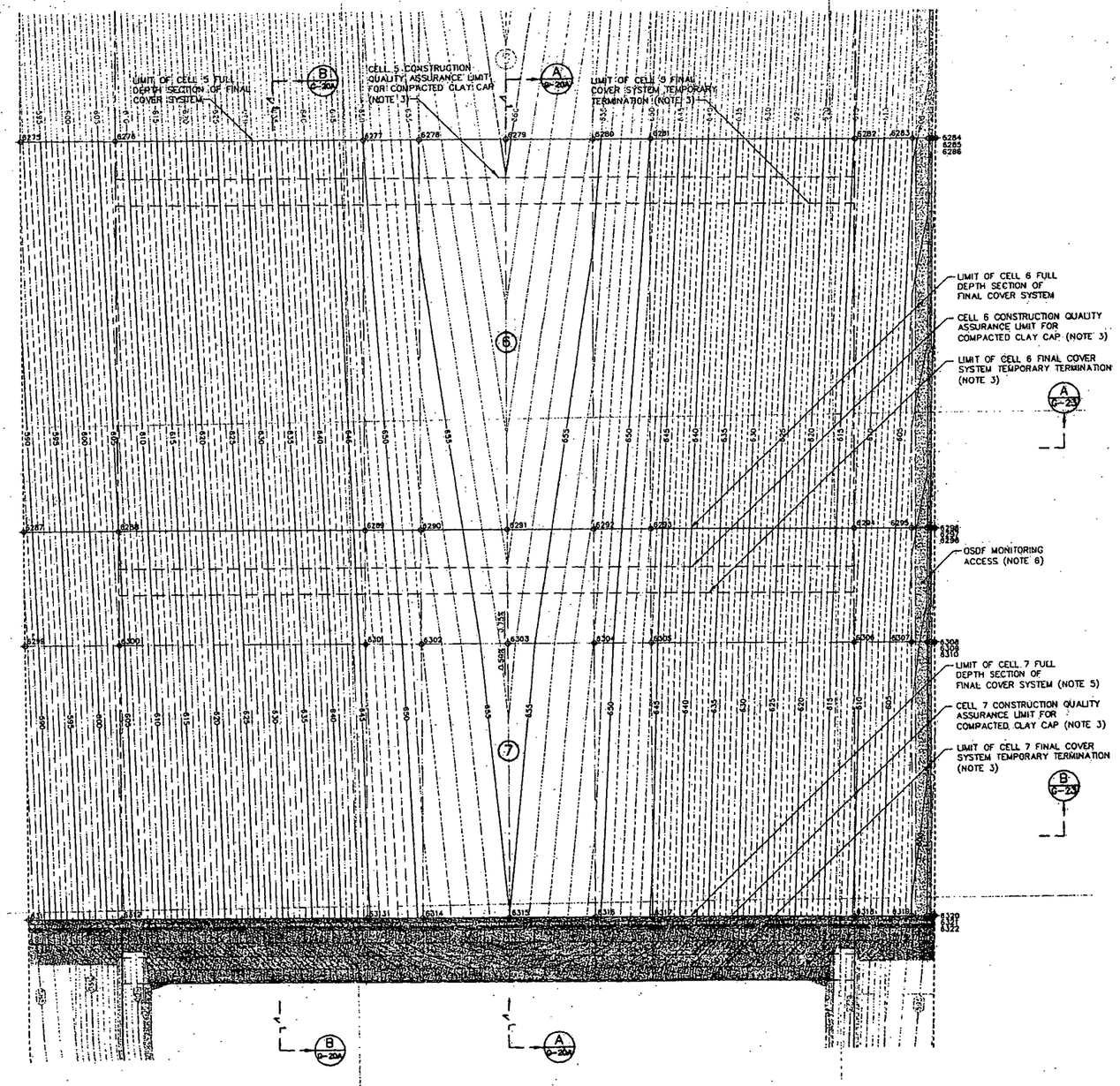
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT WORK OR CONSTRUCTION, UNLESS SIGNED.

STATE OF OHIO — JOHN F. BECKER E-58246 — REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS

PROJECT NO.: 29T05
CONTRACT NO.: 95P5000028
FEMP DRAWING NO.: 903-5000-D-00378
GEOSYNTEC PROJECT NO.: 6018427.17.9
GEOSYNTEC DOCUMENT NO.: FDF-0802
SHEET NO.: G-14
REVISION NO.:

CERTIFIED–FOR–CONSTRUCTION



LEGEND

- 645 — EXISTING FINISHED GRADE ELEVATION (FEET)
- 592 — EXISTING SUBGRADE LAYER ELEVATION (FEET)
- 594 — EXISTING PROTECTIVE CLAY LAYER ELEVATION (FEET)
- 645 — FINISHED GRADE ELEVATION (FEET) (NOTE 2)
- PERIMETER BLKM BASELINE
- APPROXIMATE LIMIT OF FINAL COVER SYSTEM CONSTRUCTION
- 6299 — CONSTRUCTION CONTROL POINT
- 6 — CELL DESIGNATION
- FINAL COVER SYSTEM TEMPORARY TERMINATION AREA (NOTE 4)
- MONITORING ACCESS (NOTE 6)

FINAL COVER SYSTEM CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
6275	481297.31	1350668.97	591.43
6276	481291.09	1350768.00	607.94
6277	481288.01	1351020.43	650.01
6278	481287.30	1351078.76	655.85
6279	481288.21	1351167.38	660.28
6280	481285.13	1351256.00	655.85
6281	481284.42	1351314.34	650.01
6282	481281.85	1351524.61	614.96
6283	481281.13	1351583.10	605.22
6284	481280.94	1351598.08	604.58
6285	481280.89	1351603.08	601.91
6286	481280.85	1351606.30	601.34
6287	480892.34	1350664.08	588.43
6288	480891.13	1350763.11	604.94
6289	480888.04	1351013.54	647.01
6290	480887.33	1351073.67	652.85
6291	480886.24	1351162.50	657.28
6292	480885.16	1351251.12	652.85
6293	480884.45	1351309.45	647.01
6294	480881.88	1351519.73	611.96
6295	480881.16	1351578.21	602.22
6296	480880.97	1351594.19	601.58
6297	480880.92	1351598.19	598.91
6298	480880.88	1351601.44	598.35
6299	480774.38	1350662.64	587.49
6300	480773.17	1350761.67	604.05
6301	480770.09	1351014.10	646.32
6302	480769.38	1351072.43	651.86
6303	480768.29	1351161.05	656.44
6304	480767.21	1351249.67	651.98
6305	480766.50	1351308.01	646.13
6306	480763.93	1351518.28	611.08
6307	480763.21	1351576.77	601.33
6308	480763.02	1351592.75	600.69
6309	480762.97	1351596.75	598.03
6310	480762.93	1351600.00	597.48
6311	480492.37	1350659.19	586.14
6312	480491.15	1350758.22	602.64
6313	480488.07	1351010.65	644.72
6314	480487.36	1351068.99	650.55
6315	480486.27	1351157.61	654.98
6316	480485.19	1351246.23	650.55
6317	480484.48	1351304.56	644.72
6318	480481.91	1351514.84	609.67
6319	480481.19	1351573.32	599.92
6320	480481.00	1351589.30	599.28
6321	480480.95	1351593.30	596.62
6322	480480.91	1351596.55	596.05

NOTES:

1. THIS DRAWING PRESENTS CONSTRUCTION CONTROL POINTS FOR FINAL COVER SYSTEM FOR CELLS 6 AND 7.
2. FINISHED GRADE ELEVATIONS EXCLUDING MONITORING ACCESS CORRESPOND TO TOP OF FINAL COVER SYSTEM TOPSOIL LAYER.
3. CONSTRUCTION CONTROL POINTS FOR LIMIT OF FINAL COVER SYSTEM TEMPORARY TERMINATION AND CONSTRUCTION QUALITY ASSURANCE LIMIT FOR COMPACTED CLAY CAP ARE PROVIDED ON DRAWING G-11.
4. SHADED AREA REPRESENTS EXTENT OF TEMPORARY TERMINATION OF FINAL COVER SYSTEM. TEMPORARY TERMINATION SHALL BE CONSTRUCTED ACCORDING TO DETAIL SHOWN ON DRAWING G-34.
5. FINAL COVER SYSTEM FOR CELLS 7 AND 8 MAY BE CONSTRUCTED CONCURRENTLY WITHOUT CONSTRUCTION OF THE FINAL COVER SYSTEM TEMPORARY TERMINATION. CELL 8 FINAL COVER SYSTEM STAGED CLOSURE SEQUENCE IS SHOWN ON DRAWING G-16.
6. OSDF MONITORING ACCESS DETAILS ARE SHOWN ON DRAWINGS G-37 AND G-38.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	KRD	DKP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TEZ	JJA	KRD	DKP	RB
1A	03.10.28	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	TEZ	JJA	KRD	DKP	RB
0	03.02.25	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWO	KRD	DCP	JFD
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DCP	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DCP	JFB

SCALE IN FEET: 50 25 0 50 100

OWNER/FACILITY: UNITED STATES DEPARTMENT OF ENERGY FERNALD CLOSURE PROJECT

CLIENT: **FLUOR FERNALD, INC.**

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: FINAL COVER SYSTEM GRADING PLAN II – CELLS 6 AND 7

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDING OR CONSTRUCTION UNLESS SEALED.

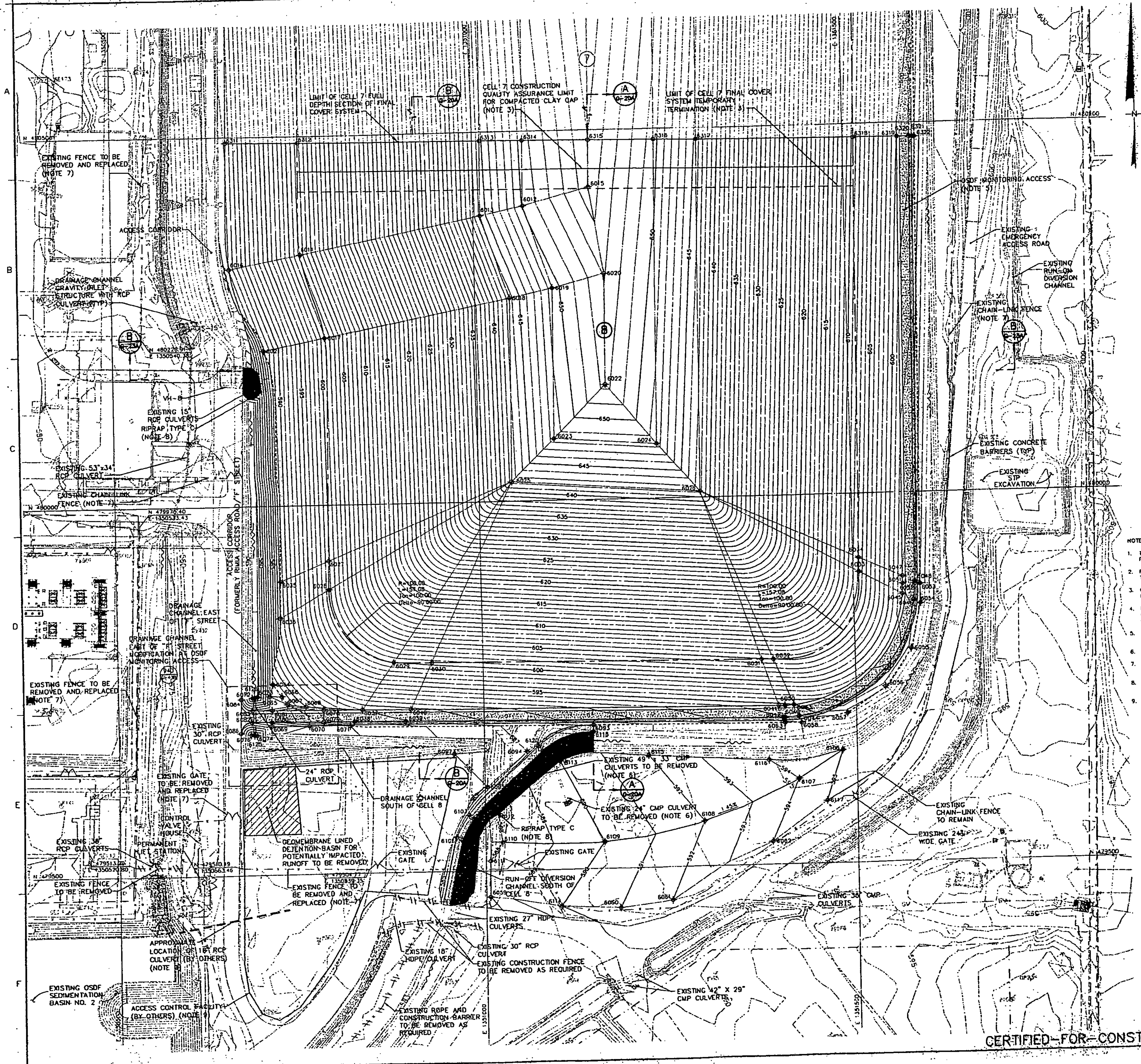
STATE OF OHIO — RUDOLPH BONAPARTE — E-56479 — REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS

PROJECT NO.:	20105
CONTRACT NO.:	03F0699
ZEMP DRAWING NO.:	9010-5000-G-00377
GEOSYNTEC PROJECT NO.:	CO3711-08.04
GEOSYNTEC DOCUMENT NO.:	FO3-1019
SHEET NO.:	G-19
REVISION NO.:	1

CERTIFIED-FOR-CONSTRUCTION

Document 6774



LEGEND

- EXISTING FINISHED GRADE ELEVATION (FEET)
- FINISHED GRADE ELEVATION (FEET) (NOTE 2)
- PERIMETER BERM BASELINE
- APPROXIMATE LIMIT OF FINAL COVER SYSTEM CONSTRUCTION
- FCP PROPERTY LINE
- PERIMETER BERM BASELINE
- BORROW AREA LIMIT
- 6299 CONSTRUCTION CONTROL POINT
- (8) CELL DESIGNATION
- OSDF MONITORING ACCESS (NOTE 5)
- RIPRAP LIMIT
- BERM CREST
- DRAINAGE FLOW DIRECTION
- FENCE

FINAL COVER SYSTEM CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION	POINT NO.	NORTHING	EASTING	ELEVATION
6012	480399.06	1351067.91	650.11	6067	479730.38	1350729.76	583.12
6013	480386.80	1351009.42	644.21	6068	479727.08	1350754.63	585.00
6014	480339.58	1350759.21	602.36	6069	479701.08	1350708.23	583.69
6015	480422.35	1351156.83	654.66	6070	479700.48	1350759.55	584.00
6016	480321.21	1350861.86	588.07	6071	479689.87	1350815.79	585.00
6017	480226.65	1350791.78	600.82	6072	479740.04	1350682.74	577.50
6018	480274.94	1351047.15	643.82	6073	479741.12	1350689.86	577.50
6019	480287.19	1351105.63	649.52	6074	479689.05	1350688.85	577.50
6020	480305.44	1351175.28	653.09	6076	479690.04	1350680.44	577.50
6021	480210.69	1350706.64	586.66	6078	479721.72	1350779.16	588.50
6022	480155.71	1351173.45	652.34	6079	479705.72	1350778.97	587.86
6023	480083.73	1351103.15	648.50	6080	479706.38	1350708.44	584.34
6024	480073.96	1351241.20	648.50	6081	479722.57	1350709.07	584.67
6025	480028.49	1351044.11	642.38	6082	479708.81	1350861.77	583.00
6026	480008.17	1351298.74	642.34	6083	479722.90	1350682.61	583.22
6027	479923.80	1350790.42	598.70	6084	479738.33	1350667.64	582.50
6028	479884.79	1350789.94	599.56	6086	479692.34	1350668.53	582.15
6029	479784.51	1350878.58	600.01	6093	479693.98	1351147.88	588.23
6030	479783.13	1350928.57	600.49	6094	479660.00	1351057.44	587.00
6031	479777.68	1351376.03	604.86	6095	479613.34	1351002.98	586.00
6032	479777.47	1351391.81	605.02	6096	479558.73	1350938.45	585.00
6033	479893.26	1351507.64	606.73	6097	479659.03	1350957.36	586.00
6034	479912.37	1351507.88	606.82	6102	479670.85	1350983.56	588.00
6035	479896.84	1350723.58	588.56	6103	479575.97	1350976.77	588.00
6036	479847.16	1350722.15	588.21	6104	479542.42	1350966.87	587.40
6037	479721.06	1350832.85	589.02	6105	479546.47	1350959.34	587.42
6038	479706.20	1350871.66	588.77	6106	479652.05	1351480.69	595.00
6039	479704.35	1350891.17	588.95	6107	479615.05	1351422.50	594.00
6040	479720.25	1350888.72	589.66	6108	479560.97	1351295.94	592.00
6041	479714.18	1351397.33	594.54	6109	479536.09	1351180.60	590.00
6042	479888.09	1351402.71	593.85	6110	479538.38	1351022.82	588.00
6043	479714.76	1351417.12	594.94	6111	479513.41	1351008.11	588.00
6044	479899.33	1351423.34	594.42	6112	479577.25	1351017.81	588.00
6045	479861.65	1351565.09	597.21	6113	479646.17	1351101.83	590.00
6046	479883.33	1351580.23	598.71	6114	479450.31	1351101.98	590.00
6047	479885.65	1351566.05	596.84	6115	479651.40	1351220.97	592.00
6048	479878.37	1351581.94	596.27	6116	479641.19	1351383.58	594.00
6049	479898.06	1351408.23	593.88	6117	479584.53	1351459.17	595.00
6050	479714.08	1351405.43	594.82	6118	479684.91	1351147.38	588.21
6061	479875.69	1351565.92	596.89	6119	479660.55	1351078.29	588.75
6052	479875.49	1351581.90	596.25	6120	479666.89	1351072.63	588.75
6053	479875.07	1351589.14	593.02	6125	479689.31	1350685.35	577.50
6054	479848.60	1351588.82	592.89	6126	479740.77	1350685.93	577.50
6055	479787.81	1351575.22	593.47	6311	480492.37	1350659.19	586.14
6056	479737.04	1351539.61	593.43	6312	480481.15	1350758.22	602.84
6057	479702.17	1351488.20	592.48	6313	480488.07	1351010.85	644.72
6058	479690.57	1351476.88	590.96	6314	480487.36	1351088.99	650.55
6059	479484.78	1351005.62	588.00	6315	480486.27	1351157.61	654.98
6060	479446.49	1351180.75	591.00	6316	480485.19	1351246.23	650.85
6061	479454.81	1351251.04	592.00	6317	480484.48	1351304.56	644.72
6062	479530.82	1351387.35	594.00	6318	480481.91	1351514.84	609.67
6063	479690.83	1351405.15	590.75	6319	480481.19	1351573.32	599.92
6064	479757.89	1350710.43	582.86	6320	480481.00	1351589.30	599.28
6065	479741.61	1350706.38	583.00	6321	480480.95	1351593.30	598.82
6066	479741.13	1350722.73	583.00	6322	480480.91	1351596.55	598.06

NOTES:

1. THIS DRAWING SHOWS CONSTRUCTION CONTROL POINTS FOR FINAL COVER SYSTEM FOR CELL 8, FINAL SURFACE-WATER FEATURES, AND FINAL FENCE CONFIGURATION.
2. FINISHED GRADE ELEVATIONS EXCLUDING OSDF MONITORING ACCESS CORRESPOND TO TOP OF FINAL COVER SYSTEM TOPSOIL LAYER. FINAL COVER SYSTEM SHALL BE MAINTAINED UNTIL VEGETATION IS FULLY ESTABLISHED.
3. CONSTRUCTION CONTROL POINTS FOR LIMIT OF FINAL COVER SYSTEM TEMPORARY TERMINATION AND CONSTRUCTION QUALITY ASSURANCE LIMIT FOR COMPACTED CLAY CAP FOR CELL 8 ARE PROVIDED ON DRAWINGS G-11 AND G-11A.
4. FINAL COVER SYSTEM FOR CELLS 7 AND 8 MAY BE CONSTRUCTED CONCURRENTLY WITHOUT CONSTRUCTION OF THE FINAL COVER SYSTEM TEMPORARY TERMINATION. CELL 8 FINAL COVER SYSTEM STAGED CLOSURE SEQUENCE IS SHOWN ON DRAWING G-16.
5. OSDF MONITORING ACCESS DETAILS ARE SHOWN ON DRAWINGS G-37, G-38, AND G-43B. TRANSITION PROPOSED OSDF MONITORING ACCESS ELEVATIONS TO TIE-IN WITH EXISTING ACCESS CORRIDOR AT TIE-IN LOCATION SHOWN.
6. REMOVE EXISTING CULVERTS AND STOCKPILE MATERIAL AT LOCATIONS DESIGNATED BY CONSTRUCTION MANAGER.
7. DENOTES FINAL CONFIGURATION OF OSDF FENCE AND GATES. CHAIN-LINK FENCE AND GATES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02831.
8. PLACE RIPRAP WITHIN AREA SHOWN. RIPRAP THICKNESSS SHALL BE 1.5 FEET. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
9. ACCESS CONTROL FACILITY FINAL GRADES AND LOCATION OF 18 INCH RCP CULVERT SHALL BE IN ACCORDANCE WITH PLAN DRAWING 90X-5500-G-00730 TO BE PROVIDED BY FLUOR FERNALD.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP.-BY
1	05.02.15	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMG	DKP	FB
1C	–	NOT ISSUED	–	–	–	–	–
1B	04.06.23	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE/EPA PER DCN	TEZ	JJA	LMG	DKP	RB
1A	04.08.16	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE PER DCN	TEZ	JJA	LMG	DKP	RB
0	04.01.22	CFC SUBMITTAL TO FF/DOE/EPA	LMG	JJA	TEZ	DKP	RB
B	03.12.08	PRE-FINAL SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DKP	RB
A	03.10.28	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	JJA	KRD	DKP	RB

50 25 0 50 100
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: FINAL COVER SYSTEM GRADING PLAN III – CELL 8

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

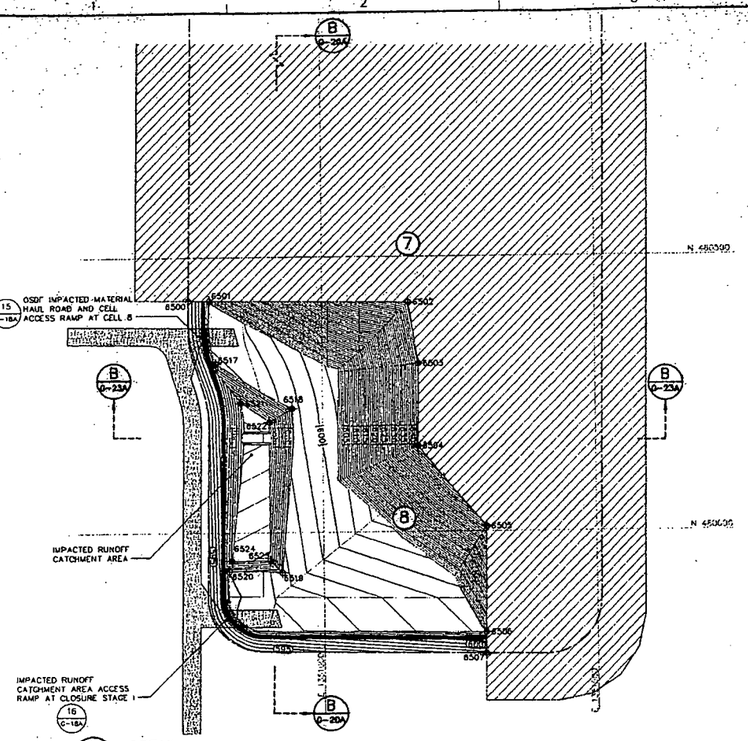
STATE OF OHIO – JOHN F. BEECH – E-58246 – REGISTERED PROFESSIONAL ENGINEER

SIGNATURE: 15 Feb 2005

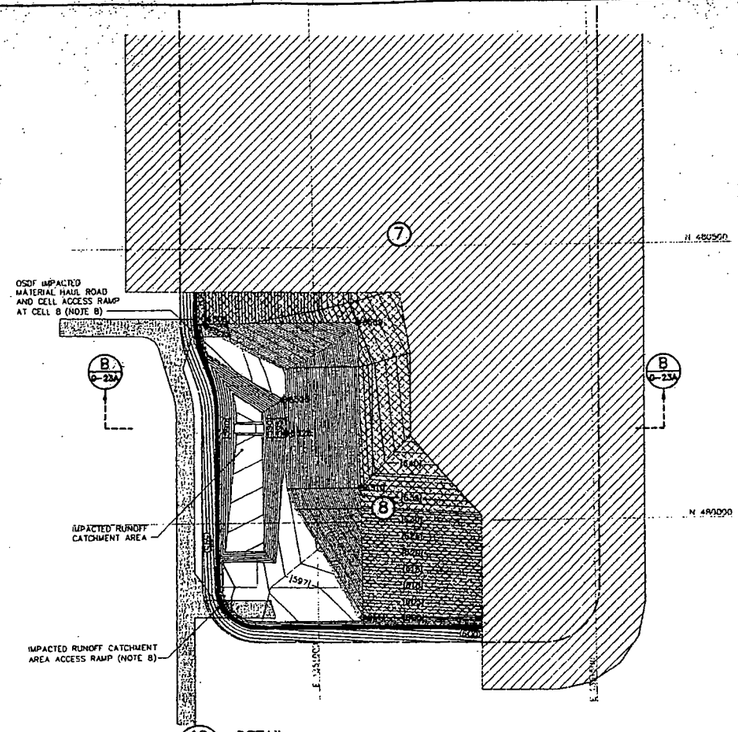
GEOSYNTEC CONSULTANTS
1255 ROBERTS BOULEVARD NW, KENNESAW, GEORGIA 30144 USA

PROJECT NO.: 20185
CONTRACT NO.: 03FF0699
FEMP DRAWING NO.: 90X-6000-G-00417
GEOSYNTEC PROJECT NO.: GQ3309-02.02
GEOSYNTEC DOCUMENT NO.: FLH-1858
SHEET NO.: G-15A
REVISION NO.: 1

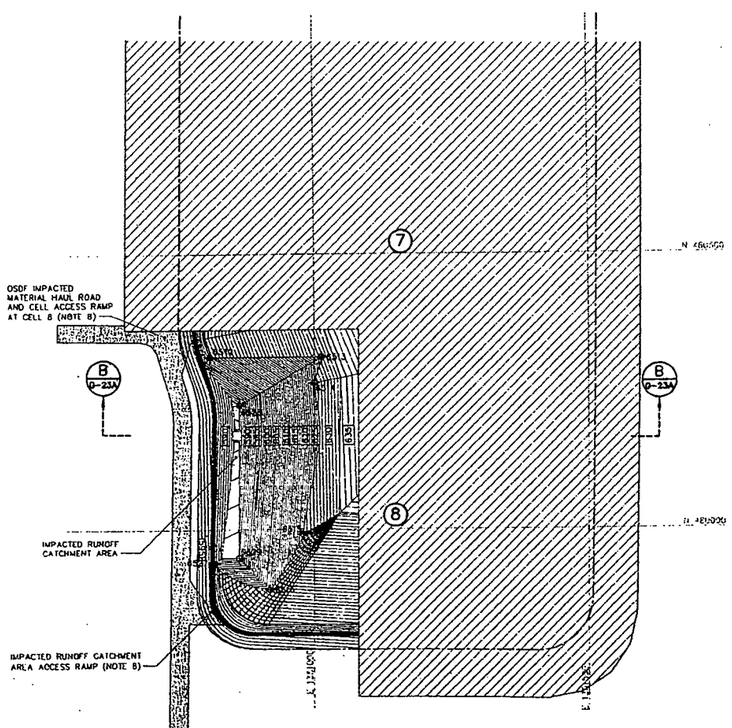
CERTIFIED-FOR-CONSTRUCTION



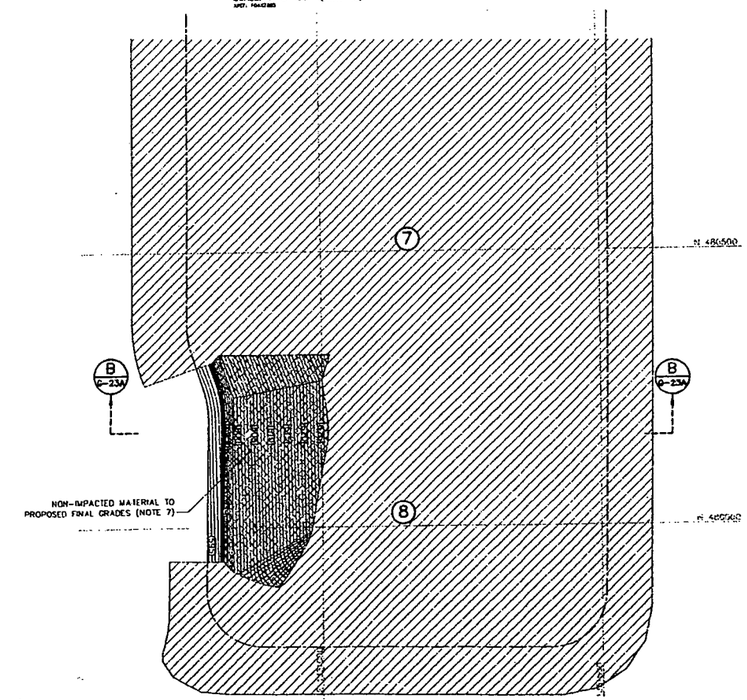
9 DETAIL
STAGE I – IMPACTED MATERIAL PLACEMENT/PARTIAL CLOSURE IN-PROGRESS
SCALE: 1" = 100' (NOTE 9)



10 DETAIL
STAGE II – IMPACTED MATERIAL PLACEMENT/PARTIAL CLOSURE IN-PROGRESS
SCALE: 1" = 100' (NOTE 10)



11 DETAIL
STAGE III – LIMITS OF FINAL IMPACTED MATERIAL PLACEMENT
(NOTE 6)
SCALE: 1" = 100' (NOTE 11)



12 DETAIL
STAGE IV – NON IMPACTED MATERIAL BUILDOUT TO FINAL GRADES
SCALE: 1" = 100'

LEGEND

- (820) PROTECTIVE LAYER ELEVATION (FEET)
- (800) IMPACTED MATERIAL ELEVATION (FEET) (NOTE 2)
- PERIMETER BERM BASELINE
- APPROXIMATE LIMIT OF FINAL COVER SYSTEM CONSTRUCTION
- 6500 CONSTRUCTION CONTROL POINT
- (7) CELL DESIGNATION
- NON-IMPACTED RUNOFF AREA (NOTE 4)
- IMPACTED RUNOFF AREA (NOTE 5)
- OSDF IMPACTED MATERIAL HAUL ROAD AND ACCESS RAMP

FINAL COVER SYSTEM STAGED CLOSURE CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
6500	480421.44	1350757.37	–
6501	480420.68	1350795.30	–
6502	480416.55	1351157.73	–
6503	480305.38	1351175.28	–
6504	480155.73	1351173.45	–
6505	480009.50	1351297.59	–
6506	479816.59	1351295.23	–
6507	479778.86	1351284.77	–
6508	480362.72	1350801.98	–
6509	480362.72	1351080.86	–
6510	480062.20	1351080.86	–
6511	479826.38	1351080.86	–
6512	480313.51	1350812.83	–
6513	480312.97	1351013.55	–
6514	480265.98	1350898.88	–
6515	479981.23	1350880.06	–
6516	479890.53	1350920.74	–
6517	480306.65	1350807.34	596.86
6518	480224.73	1350944.02	598.61
6519	479927.45	1350923.80	598.65
6520	479929.99	1350828.43	593.02
6521	480235.28	1350850.98	586.61
6522	480200.62	1350903.19	585.46
6523	479948.87	1350903.19	590.33
6524	479948.87	1350833.26	589.67
6525	480224.73	1350944.02	598.61
6526	480163.34	1350946.52	598.42
6527	479938.18	1350821.18	592.61
6528	480226.01	1350854.94	586.58
6529	479948.87	1350854.98	589.97

NOTES:

1. THIS DRAWING SHOWS STAGED CLOSURE SEQUENCE FOR FILLING OF CELL 8.
2. IMPACTED MATERIAL ELEVATIONS, EXCLUDING IMPACTED RUNOFF CATCHMENT AREA, REPRESENT TOP OF SELECT IMPACTED MATERIAL.
3. RUNOFF SHALL BE DIVERTED TO IMPACTED RUNOFF CATCHMENT AREA UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED. CONTRACTOR SHALL CONTAIN AND CONTROL WATER GENERATED DURING CLOSURE OF CELL 8 IN ACCORDANCE WITH SPECIFICATION SECTIONS 13010 AND 02270.
4. REPRESENTS AREA WHERE A MINIMUM OF 2 LIFTS OF COMPACTED CLAY CAP IS PLACED AND RUNOFF IS DIVERTED TO OSDF SURFACE-WATER MANAGEMENT SYSTEM.
5. REPRESENTS AREA DISCHARGING IMPACTED RUNOFF TO CELL 8 IMPACTED RUNOFF CATCHMENT AREA.
6. STAGE III REPRESENTS GRADES THAT PROVIDE FOR DISPOSAL OF ESTIMATED QUANTITIES OF IMPACTED MATERIAL. IMPACTED RUNOFF CATCHMENT AREA SHALL REMAIN OPEN UNTIL SUCH TIME THAT RUNOFF MAY BE CONSIDERED NON-IMPACTED.
7. STAGE IV GRADES TO BE ACHIEVED BY FILLING FROM STAGE III WITH NON-IMPACTED MATERIAL. NON-IMPACTED MATERIAL CAPACITY IS APPROXIMATELY 19,000 CUBIC YARDS.
8. ACTUAL LOCATION OF OSDF IMPACTED MATERIAL HAUL ROADS AND CELL ACCESS RAMPS WILL BE DETERMINED AT THE TIME OF STAGED CLOSURE.
9. STAGE I REPRESENTS REMAINING IMPACTED MATERIAL CAPACITY OF APPROXIMATELY 113,000 CUBIC YARDS. STAGE I AREA CONTRIBUTING TO IMPACTED RUNOFF IS APPROXIMATELY 5.9 ACRES. STAGE I ESTIMATED VOLUME OF IMPACTED RUNOFF FOR 25-YEAR/24-HOUR STORM IS APPROXIMATELY 77,000 CUBIC FEET.
10. STAGE II REPRESENTS REMAINING IMPACTED MATERIAL CAPACITY OF APPROXIMATELY 38,000 CUBIC YARDS. STAGE II AREA CONTRIBUTING TO IMPACTED RUNOFF IS APPROXIMATELY 3.4 ACRES. STAGE II ESTIMATED VOLUME OF IMPACTED RUNOFF FOR 25-YEAR/24-HOUR STORM IS APPROXIMATELY 46,000 CUBIC FEET.
11. STAGE III REPRESENTS THE FINAL IMPACTED MATERIAL CONFIGURATIONS WITH NO REMAINING CAPACITY FOR IMPACTED MATERIAL. STAGE III AREA CONTRIBUTING TO IMPACTED RUNOFF IS APPROXIMATELY 1.7 ACRES. STAGE III ESTIMATED VOLUME OF IMPACTED RUNOFF FOR 25-YEAR/24-HOUR STORM IS APPROXIMATELY 23,000 CUBIC FEET.
12. STAGE IV ELEVATIONS REPRESENT TOP OF NON-IMPACTED MATERIAL WHICH IS ALSO THE FOUNDATION FOR FINAL COVER SYSTEM CONTOURING LAYER.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
2	05.02.15	CFC REVISION 2 SUBMITTAL TO FF/DOE/EPA	KRD	JWO	KRD	DKP	JTB
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	KRD	JWO	KRD	DKP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DKP	RB
1A	03.10.28	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DKP	RB
0	02.09.29	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWO	KRD	DCP	JTB
B	01.12.13	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DCP	JTB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DCP	JTB

100 50 0 100 200
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
FINAL COVER SYSTEM STAGED CLOSURE
GRADING PLANS – CELLS 7 AND 8

THIS DRAWING MAY NOT BE VERIFIED FOR PROJECT BENEFIT OR CONSTRUCTION, UNLESS SEALED.

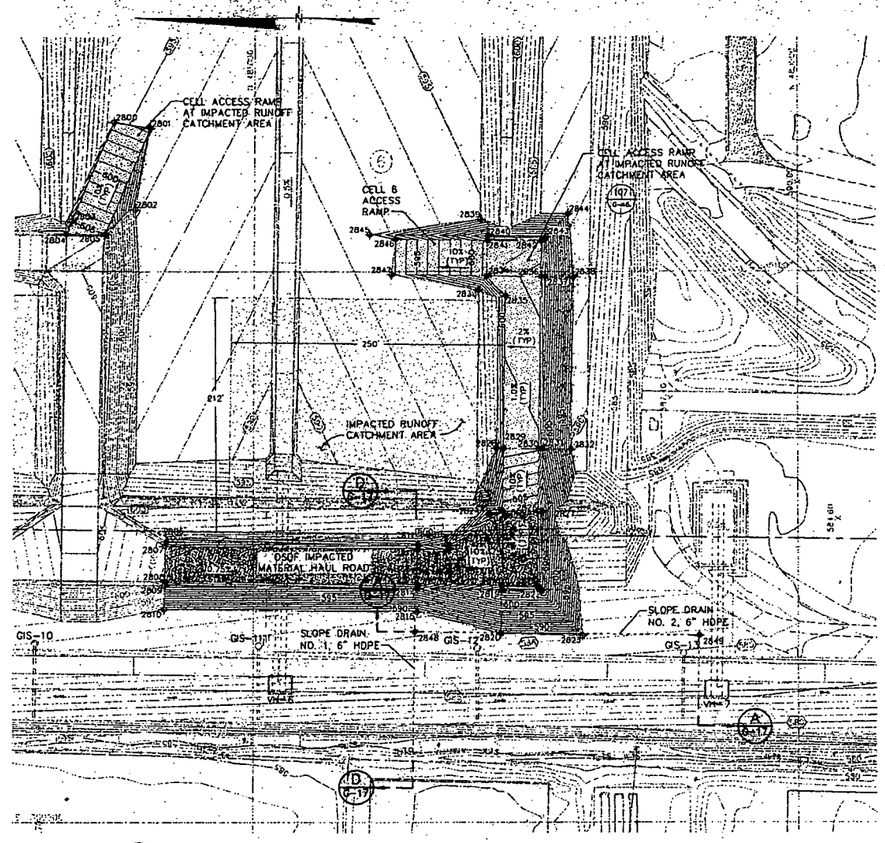
SIGNATURE
15 Feb 2005
DATE

STATE OF OHIO
JOHN E. BEDEN
E-56246
REGISTERED PROFESSIONAL ENGINEER

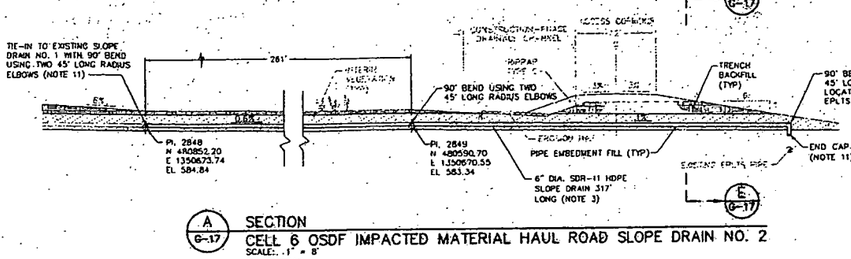
GEOSYNTEC CONSULTANTS
1055 ROBERTS BOULEVARD NW
KENNESAW, GEORGIA 30144 USA

PROJECT NO.:	20105
CONTRACT NO.:	03/T0039
TEMP DRAWING NO.:	90X-6000-G-00378
GEOSYNTEC PROJECT NO.:	GG3099-02-02
GEOSYNTEC DOCUMENT NO.:	TQ4-2018
SHEET NO.:	G-18
REVISION NO.:	2

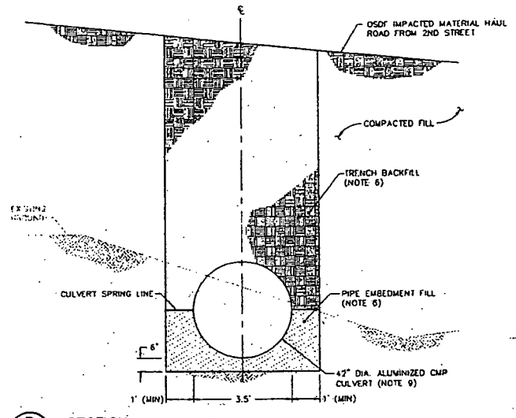
CERTIFIED-FOR-CONSTRUCTION



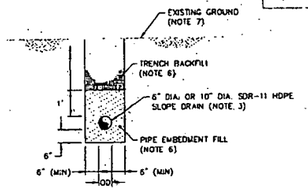
13 / G-1 PLAN
OSDF IMPACTED MATERIAL HAUL ROAD AND CELL ACCESS RAMP AT CELL 6
SCALE: 1" = 50'



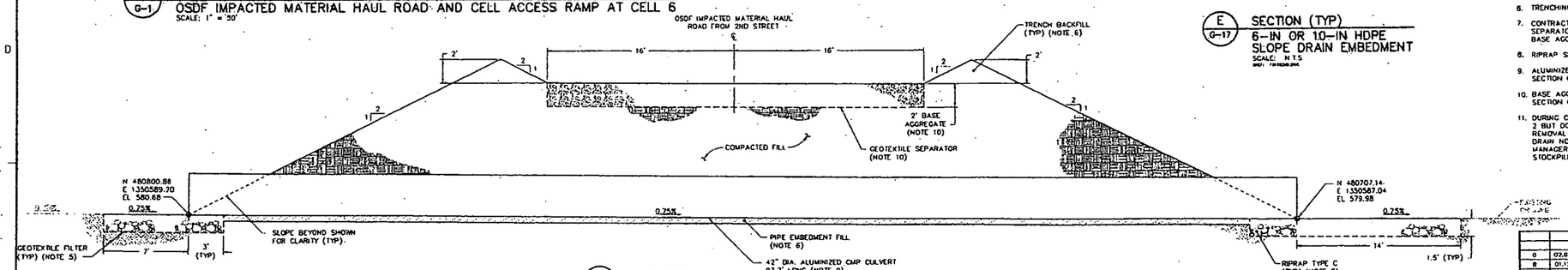
A / G-17 SECTION
CELL 6 OSDF IMPACTED MATERIAL HAUL ROAD SLOPE DRAIN NO. 2
SCALE: 1" = 5'



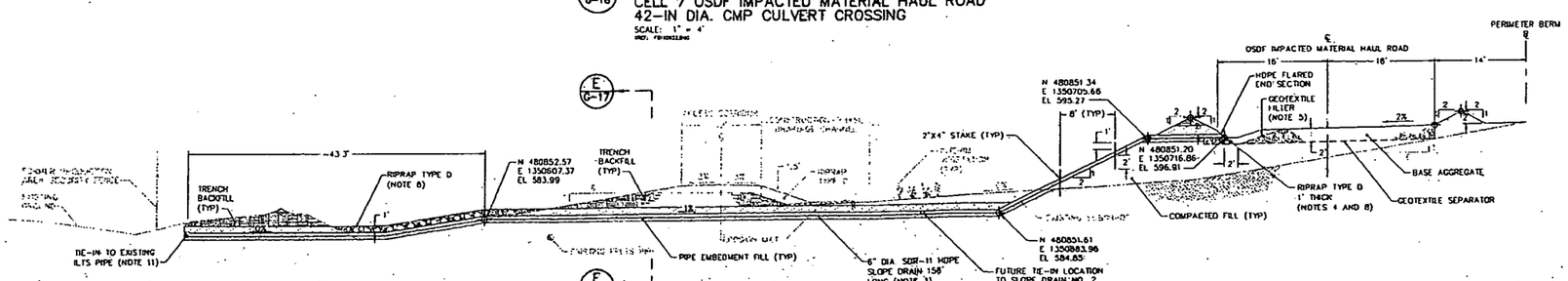
B / G-18 SECTION
CELL 7 OSDF IMPACTED MATERIAL HAUL ROAD 42-IN DIA. CMP CULVERT EMBEDMENT
SCALE: 1" = 2'



E / G-17 SECTION (TYP)
6-IN OR 10-IN HDPE SLOPE DRAIN EMBEDMENT
SCALE: N.T.S.



C / G-18 SECTION
CELL 7 OSDF IMPACTED MATERIAL HAUL ROAD 42-IN DIA. CMP CULVERT CROSSING
SCALE: 1" = 4'



D / G-17 SECTION
CELL 6 OSDF IMPACTED MATERIAL HAUL ROAD SLOPE DRAIN NO. 1
SCALE: 1" = 8'

LEGEND

- 610 — EXISTING GROUND ELEVATION (FEET)
- 600 — FINISHED GRADE ELEVATION (FEET)
- 595 — EXISTING SUBGRADE ELEVATION (FEET)
- 593 — EXISTING COMPACTED CLAY LINER/PROTECTIVE CLAY LAYER ELEVATION (FEET)
- 589 — EXISTING PROTECTIVE LAYER ELEVATION (FEET) (NOTE 2)
- PERIMETER BERM BASELINE
- EPLTS — EXISTING EPLTS PIPE
- ILTS — EXISTING ILTS PIPE
- 2800 — CONSTRUCTION CONTROL POINT
- OSDF IMPACTED MATERIAL HAUL ROAD (NOTE 1)
- CELL ACCESS RAMP
- 6 — EXISTING CELL DESIGNATION

OSDF IMPACTED MATERIAL HAUL ROAD AND CELL ACCESS RAMP CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION	POINT NO.	NORTHING	EASTING	ELEVATION
2800	481126.90	1351135.67	595.31	2826	480740.28	1350783.01	605.86
2801	481096.64	1351129.98	594.61	2827	480738.28	1350782.96	607.86
2802	481109.85	1351056.35	594.10	2828	480777.59	1350840.19	597.18
2803	481165.59	1351045.90	605.00	2829	480771.58	1350840.12	600.18
2804	481170.37	1351034.21	605.00	2830	480739.59	1350839.73	600.82
2805	481136.97	1351033.79	605.00	2831	480735.59	1350839.68	602.82
2806	481080.54	1350755.67	601.35	2832	480709.79	1350839.36	589.93
2807	481081.70	1350751.88	599.25	2833	480784.78	1350983.47	594.15
2808	481082.09	1350719.69	598.61	2834	480786.89	1350998.37	601.40
2809	481082.14	1350715.69	600.61	2835	480769.89	1350978.38	601.57
2810	481082.40	1350694.41	589.97	2836	480737.68	1350995.72	603.38
2811	480849.21	1350752.84	599.50	2837	480733.88	1350995.67	604.38
2812	480849.26	1350748.84	597.50	2838	480707.89	1350995.35	591.49
2813	480849.65	1350716.85	596.86	2839	480792.96	1351047.90	594.78
2814	480849.70	1350712.85	598.86	2840	480786.49	1351032.32	603.40
2815	480849.96	1350691.73	588.31	2841	480786.50	1351028.32	601.40
2816	480822.57	1350752.52	602.16	2842	480737.29	1351027.71	601.40
2817	480821.31	1350748.50	600.29	2843	480733.24	1351031.67	603.28
2818	480773.10	1350715.91	604.51	2844	480713.23	1351052.74	592.18
2819	480773.13	1350711.91	606.51	2845	480894.29	1351033.63	592.82
2820	480773.84	1350672.13	586.61	2846	480870.50	1351029.34	593.00
2821	480741.10	1350715.52	604.51	2847	480874.23	1350997.39	592.67
2822	480737.15	1350711.47	606.43				
2823	480698.80	1350670.36	588.19				
2824	480783.46	1350780.35	606.85				
2825	480772.28	1350763.40	605.86				

NOTES:

1. CONTOURS WITHIN SHADED REGION ON OSDF IMPACTED MATERIAL HAUL ROAD AND CELL ACCESS RAMP REPRESENT TOP OF BASE AGGREGATE. BASE AGGREGATE FOR CELL ACCESS RAMP SHALL BE 6 INCHES THICK AND UNDERLAIN BY GEOTEXTILE SEPARATOR. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
2. FOR PROTECTIVE LAYER, SEE NOTE 3 ON SHEET G-19.
3. HDPE SLOPE DRAIN SHALL BE SDR-11 AND IN ACCORDANCE WITH SPECIFICATION SECTION 02605.
4. RIPRAP APRON SHALL BE CONSTRUCTED AT INLET OF 6-INCH HDPE SLOPE DRAIN. RIPRAP APRON SHALL BE 4 FEET WIDE AND CENTERED ON 6-INCH HDPE SLOPE DRAIN.
5. GEOTEXTILE FILTER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02714.
6. TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
7. CONTRACTOR SHALL RE-ESTABLISH EXISTING GRADES, RIPRAP, VEGETATION, GEOTEXTILE SEPARATOR AND BASE AGGREGATE WITHIN AREA OF SLOPE DRAIN TRENCH EXCAVATION. BASE AGGREGATE THICKNESS SHALL BE 1 FOOT.
8. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
9. ALUMINIZED CMP CULVERTS AND JOINTS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02721.
10. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
11. DURING CONSTRUCTION OF OSDF IMPACTED HAUL ROAD AT CELL 6, INSTALL SLOPE DRAIN NO. 2 BUT DO NOT CONNECT TO SLOPE DRAIN NO. 1 OR EPLTS PIPE. PRIOR TO CUTTING OR REMOVAL OF EXISTING ILTS PIPE SOUTH OF CELL 6, TIE-IN SLOPE DRAIN NO. 2 TO SLOPE DRAIN NO. 1 AND TO EXISTING EPLTS PIPE USING DETAILS TO BE PROVIDED BY CONSTRUCTION MANAGER. REMOVE SLOPE DRAIN NO. 1 SEGMENT LOCATED WEST OF TIE-IN LOCATION AND STOCKPILE MATERIAL AT LOCATIONS APPROVED BY CONSTRUCTION MANAGER.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
0	02.01.29	CYC SUBMITTAL TO FF/DOE/EPA	DCP	JAS	KRD	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	DCP	JAB	DCP	DCP	JFB
A	-	NOT ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: IMPACTED MATERIAL HAUL ROAD GRADING PLAN AND DETAILS I

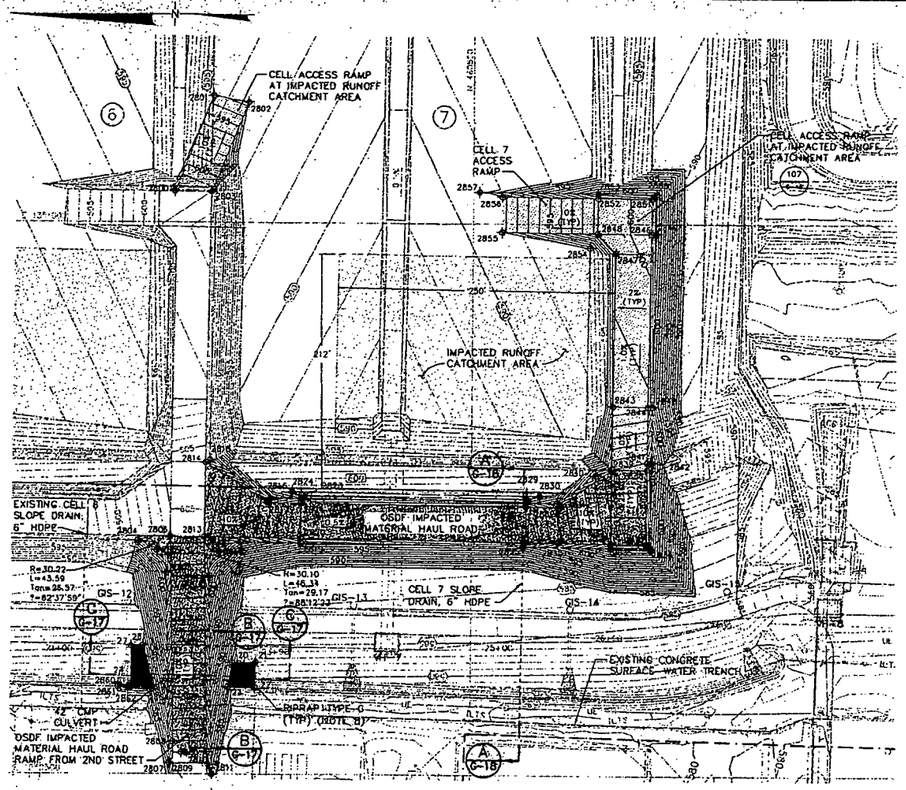
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT STATUS OR CONSTRUCTION UNLESS SEALED.

STATE OF OHIO — JOHN T. BEECH — E-58248 — REGISTERED PROFESSIONAL ENGINEER

GeoSyntec Consultants

PROJECT NO.:	20195
CONTRACT NO.:	95P5005028
FEMP DRAWING NO.:	90X-6000-C-00329
GEOSYNTEC PROJECT NO.:	CO1842-17.4
GEOSYNTEC DOCUMENT NO.:	FDI-0003
SHEET NO.:	G-17
REVISION NO.:	0

CERTIFIED-FOR-CONSTRUCTION



14 / G-2 PLAN
OSDF IMPACTED MATERIAL HAUL ROAD AND CELL ACCESS RAMP AT CELL 7
SCALE: 1" = 50'

OSDF IMPACTED MATERIAL HAUL ROAD AND ACCESS RAMP CONSTRUCTION CONTROL POINTS

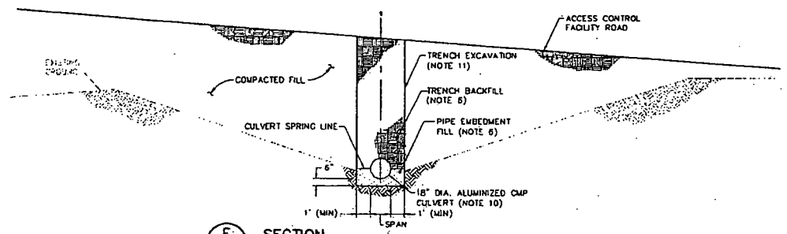
POINT NO.	NORTHING	EASTING	ELEVATION	POINT NO.	NORTHING	EASTING	ELEVATION
2800	480771.73	1351075.14	601.40	2833	480491.67	1350711.82	597.65
2801	480736.15	1351115.04	593.27	2834	480372.13	1350711.02	602.51
2802	480703.89	1351109.40	592.58	2835	480373.18	1350707.02	604.51
2803	480737.29	1351027.71	601.40	2836	480337.18	1350708.58	604.51
2804	480803.48	1350712.28	603.49	2837	480341.13	1350710.63	602.51
2805	480775.38	1350882.98	603.33	2838	480340.31	1350778.12	603.86
2806	480773.11	1350715.91	604.51	2839	480372.31	1350778.51	603.86
2807	480772.56	1350510.25	586.06	2840	480387.18	1350772.83	604.40
2808	480768.99	1350529.79	586.00	2841	480340.23	1350784.52	603.86
2809	480761.09	1350519.96	585.00	2842	480336.23	1350784.47	605.86
2810	480736.78	1350520.50	585.00	2843	480371.61	1350835.23	598.18
2811	480732.32	1350500.09	584.95	2844	480339.62	1350834.84	598.82
2812	480736.32	1350880.43	602.98	2845	480335.62	1350834.78	600.82
2813	480741.10	1350715.52	604.51	2846	480337.71	1350990.83	600.38
2814	480740.28	1350783.01	605.86	2847	480369.92	1350973.49	599.57
2815	480738.25	1350785.22	607.64	2848	480386.92	1350991.43	599.40
2816	480680.57	1350760.78	601.14	2849	480333.71	1350990.78	602.38
2817	480681.73	1350746.80	599.25	2850	480333.27	1351026.78	602.38
2818	480707.79	1350711.11	603.17	2851	480337.32	1351022.83	600.38
2819	480652.87	1350710.44	597.68	2852	480386.53	1351023.43	599.40
2820	480652.82	1350714.44	595.69	2853	480386.48	1351027.43	601.40
2821	480652.70	1350746.44	596.33	2854	480393.78	1350978.33	592.14
2822	480652.65	1350750.44	598.34	2855	480474.26	1350992.50	590.67
2823	480652.47	1350753.63	598.74	2856	480473.87	1351024.50	590.67
2824	480861.04	1350758.45	596.73	2857	480494.44	1351028.75	590.60
2825	480453.39	1350708.00	596.69	2858	480727.74	1350702.10	606.51
2826	480451.38	1350711.98	594.68	2859	480785.34	1350703.70	606.51
2827	480450.97	1350743.98	595.32	2860	480820.27	1350581.43	584.83
2828	480450.93	1350747.98	597.32	2861	480820.43	1350579.44	584.84
2829	480450.89	1350751.16	595.73	2862	480811.27	1350578.16	585.34
2830	480438.75	1350753.73	595.61	2863	480811.11	1350580.16	585.34
2831	480422.60	1350747.83	600.29	2864	480789.02	1350577.56	585.34
2832	480421.34	1350743.61	598.29	2865	480789.47	1350579.57	585.34

RIPRAP LIMITS CONTROL POINTS

POINT NO.	NORTHING	EASTING	POINT NO.	NORTHING	EASTING
20	480714.33	1350401.78	24	480808.05	1350581.33
21	480691.76	1350402.13	25	480785.95	1350581.08
22	480693.31	1350578.65	26	480787.33	1350612.05
23	480718.49	1350578.39	27	480808.67	1350615.93

LEGEND

590	EXISTING GROUND ELEVATION (FEET)
595	FINISHED GRADE ELEVATION (FEET)
595	EXISTING SUBGRADE ELEVATION (FEET)
590	EXISTING COMPACTED CLAY LINER/PROTECTIVE CLAY LAYER ELEVATION (FEET)
595	EXISTING PROTECTIVE LAYER ELEVATION (FEET) (NOTE 2)
	PERIMETER BERM BASELINE
	EXISTING EPLTS PIPE
12+00	EXISTING ILTS PIPE
2800	CONSTRUCTION CONTROL POINT
	OSDF IMPACTED MATERIAL HAUL ROAD (NOTE 1)
	CELL ACCESS RAMP (NOTE 1)
7	EXISTING CELL DESIGNATION

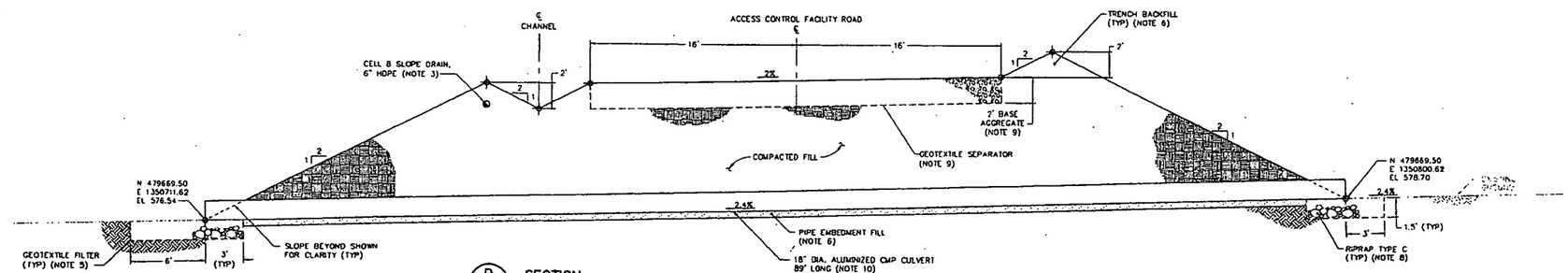


E / G-18A SECTION
ACCESS CONTROL FACILITY ROAD 18-IN DIA. CMP CULVERT EMBEDMENT
SCALE: 1" = 4'

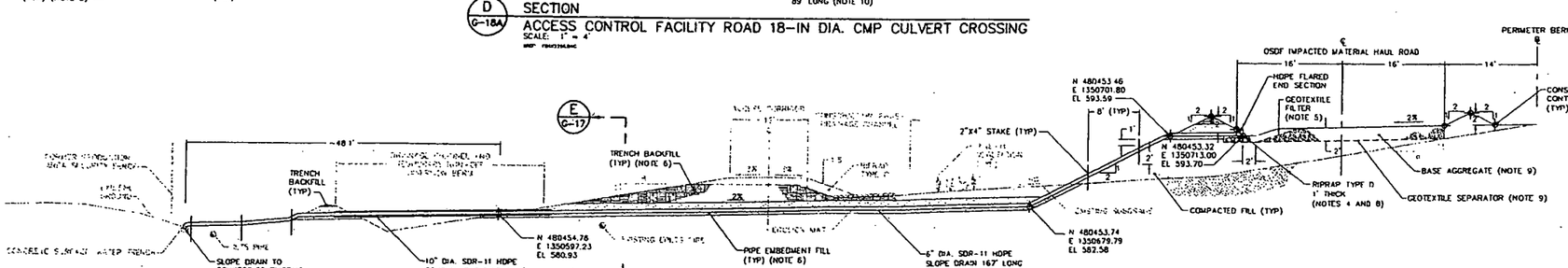
NOTES:

1. CONTOURS WITHIN SHADED REGION ON OSDF IMPACTED MATERIAL HAUL ROAD AND CELL ACCESS RAMP REPRESENT TOP OF BASE AGGREGATE. BASE AGGREGATE FOR CELL ACCESS RAMP SHALL BE 1-FOOT THICK AND UNDERLAIN BY GEOTEXTILE SEPARATOR. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
2. FOR PROTECTIVE LAYER, SEE NOTE 3 ON SHEET G-19.
3. HDPE SLOPE DRAIN AND CONTAINMENT PIPE SHALL BE SDR-11 AND IN ACCORDANCE WITH SPECIFICATION SECTION 02605.
4. RIPRAP APRON SHALL BE CONSTRUCTED AT INLET OF 6-INCH HDPE SLOPE DRAIN. RIPRAP APRON SHALL BE 4 FEET WIDE AND CENTERED ON 6-INCH HDPE SLOPE DRAIN.
5. GEOTEXTILE FILTER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02714.
6. TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
7. CONTRACTOR SHALL RE-ESTABLISH EXISTING GRADES, RIPRAP, VEGETATION, GEOTEXTILE SEPARATOR AND BASE AGGREGATE WITHIN AREA OF SLOPE DRAIN TRENCH EXCAVATION. BASE AGGREGATE THICKNESS SHALL BE 1 FOOT.
8. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
9. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
10. ALUMINIZED CMP CULVERT AND JOINTS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02721.
11. TRENCH EXCAVATION IS SHOWN VERTICAL AS DESIGNED. SHORING AND/OR STABLE TRENCH SIDESLOPES SHALL BE MAINTAINED FOR SAFETY AND TO PROTECT ADJACENT UTILITIES AND STRUCTURES IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
12. PROTECT SLOPE DRAIN ACROSS DRAINAGE CHANNEL AND TEMPORARY DIVERSION BERM USING 10-INCH CONTAINMENT PIPE. FILL ENDS OF CONTAINMENT PIPE WITH GROUT FOR A MINIMUM OF 2 FEET.

50 25 0 50 100
SCALE IN FEET



D / G-18A SECTION
ACCESS CONTROL FACILITY ROAD 18-IN DIA. CMP CULVERT CROSSING
SCALE: 1" = 4'



A / G-18 SECTION
CELL 7 OSDF IMPACTED MATERIAL HAUL ROAD SLOPE DRAIN
SCALE: 1" = 8'

REV. NO	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
2	05.02.15	CFC REVISION 2 SUBMITTAL TO FT/DOE/EPA	TEZ	JJA	LMG	DKP	JFB
1	04.01.27	CFC REVISION 1 SUBMITTAL TO FT/DOE/EPA	LMG	JAA	TEZ	DKP	RB
1B	03.11.08	PRE-FINAL REVISION 1 SUBMITTAL TO FT/DOE	LMG	JJA	FFZ	DKP	RB
1A	-	NOT ISSUED	-	-	-	-	-
0	02.01.29	CFC SUBMITTAL TO FT/DOE/EPA	DCP	JAS	KRD	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FT/DOE	DCP	JAB	KRD	DCP	JFB
A	-	NOT ISSUED	-	-	-	-	-

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
IMPACTED MATERIAL HAUL ROAD
GRADING PLAN AND DETAILS II

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED

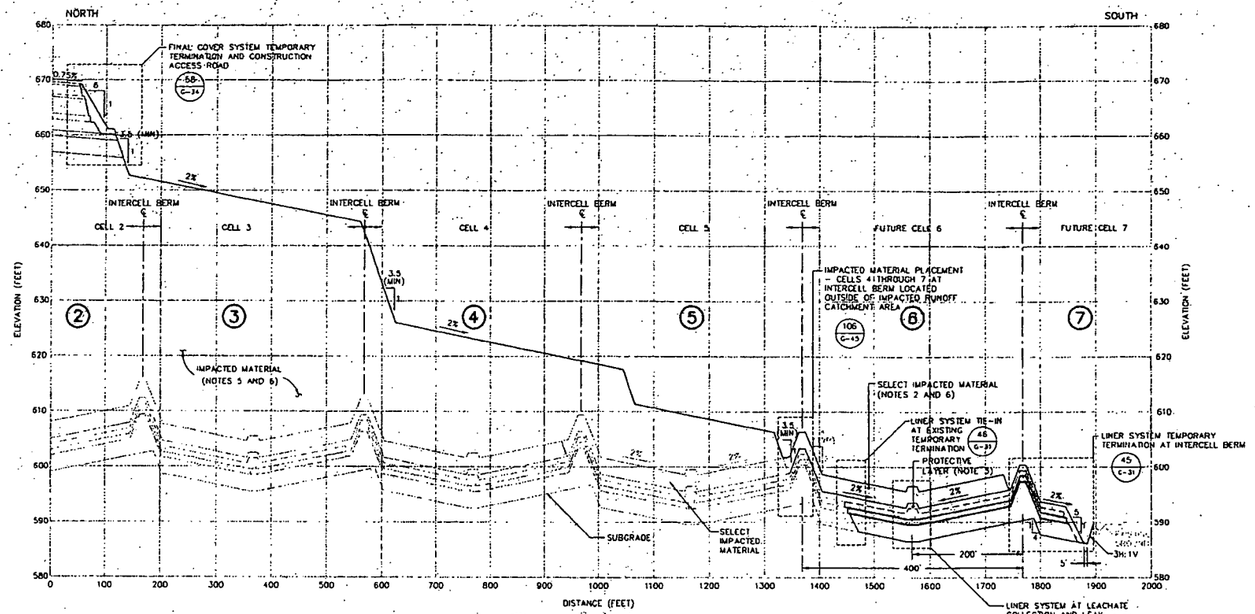
STATE OF OHIO — JOHN R. REECH — E-58248 — REGISTERED PROFESSIONAL ENGINEER

GEO SYSTEMS CONSULTANTS

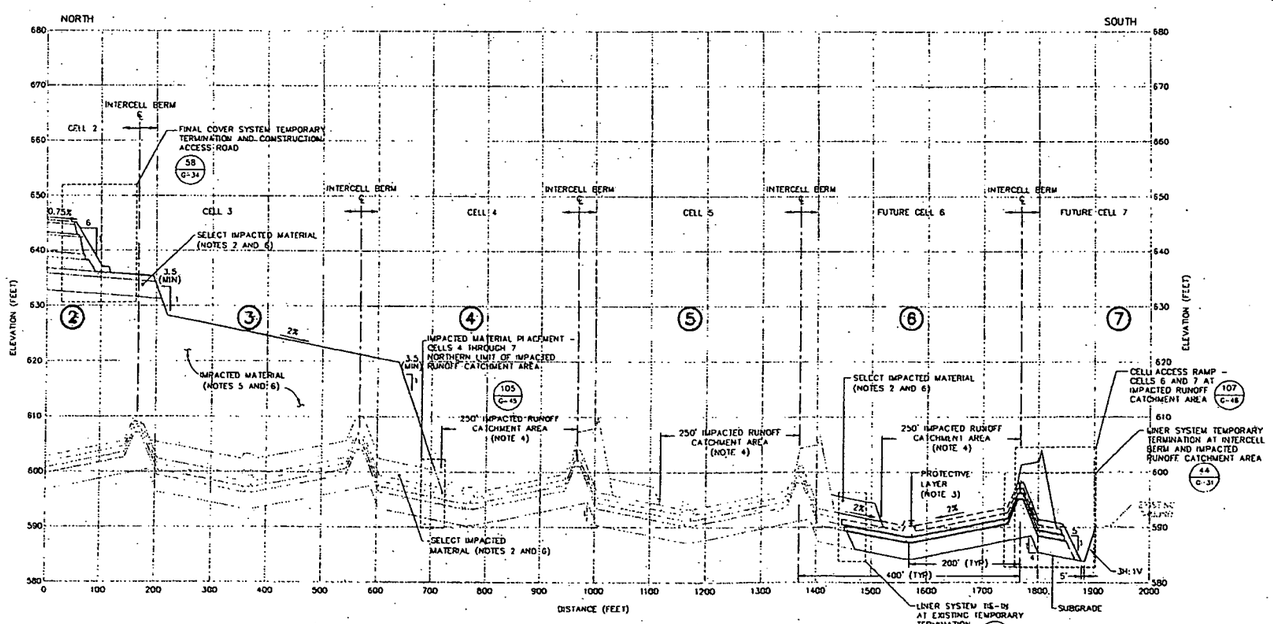
15 OCT 2004
DATE

PROJECT NO.:	20105
CONTRACT NO.:	03T0899
ISWP DRAWING NO.:	2 - 901-6000-C-00380
GEOSYNTEC PROJECT NO.:	003309-07 02
GEOSYNTEC DOCUMENT NO.:	E04-2034
SHEET NO.:	G-18
REVISION NO.:	2

CERTIFIED-FOR-CONSTRUCTION



A 6-3 SECTION
NORTH-SOUTH CELL 6
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'



B 6-3 SECTION
NORTH-SOUTH CELL 6 AT IMPACTED RUNOFF CATCHMENT AREA
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'

NOTES:

1. SECTIONS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. A MINIMUM THICKNESS OF 3 FEET OF SELECT IMPACTED MATERIAL SHALL BE PLACED ABOVE PROTECTIVE LAYER AND BELOW CONTOURING LAYER. THICKNESS OF SELECT IMPACTED MATERIAL OVERLYING PROTECTIVE LAYER MAY BE REDUCED TO 2 FEET IF FIRST LIFT OF IMPACTED MATERIAL TO BE PLACED OVER SELECT IMPACTED MATERIAL IS CATEGORY 1 IMPACTED MATERIAL.
3. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED GRANULAR MATERIAL IN IMPACTED RUNOFF CATCHMENT AREA AND IMPACTED MATERIAL IN REMAINING ACTIVE CELL AREAS EXCLUDING CELL AREA AT INTERCELL BERM TEMPORARY LINER SYSTEM TERMINATION. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED NON-GRANULAR MATERIAL IN ACTIVE AND FUTURE CELL AREAS OF TEMPORARY LINER SYSTEM TERMINATION. NON-IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02240. IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
4. IMPACTED RUNOFF CATCHMENT AREA IN ACTIVE CELL SHALL REMAIN OPEN UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED IN ADJACENT UPGRADIENT CELL AND IMPACTED RUNOFF CATCHMENT AREA IN FUTURE CELL IS CONSTRUCTED AND OPERATIONAL.
5. IMPACTED MATERIAL INTERIM SLOPES SHALL BE NO STEEPER THAN 3.5H:1V. INTERIM SLOPE CONFIGURATION SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY AND MAY VARY BASED ON SEQUENCE AND SCHEDULE FOR REMOVAL OF IMPACTED MATERIAL FROM OPERABLE UNITS. EXISTING IMPACTED MATERIAL GRADES SHOWN ARE APPROXIMATE.
6. IMPACTED MATERIAL PLACEMENT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWO	KRD	DCP	JFB
B	01.12.12	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DCP	JFB
A	-	NOT ISSUED	-	-	-	-	-

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY - PHASE V

TITLE:
OSDF NORTH-SOUTH SECTIONS I

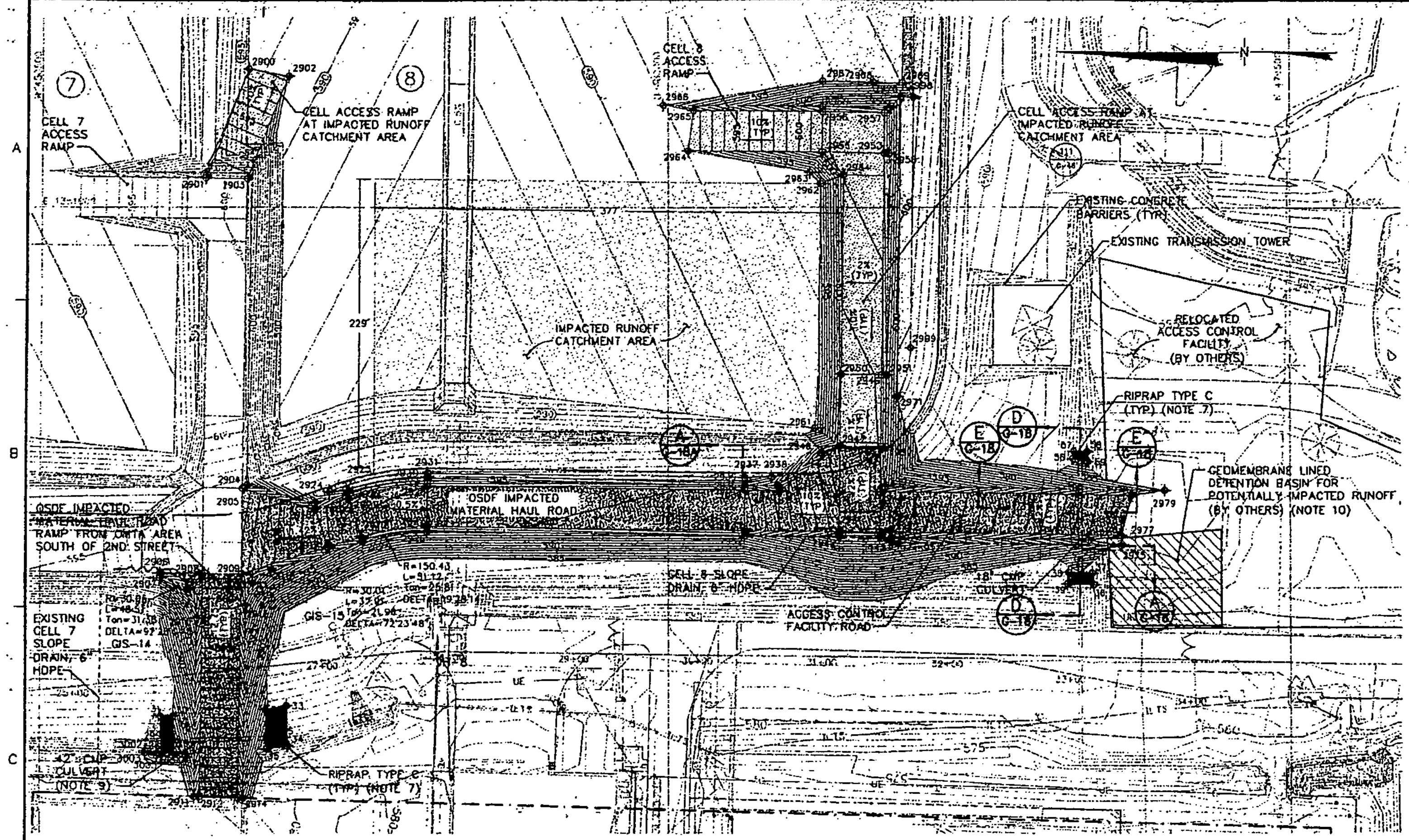
THIS DRAWING MAY NOT BE ISSUED FOR PRODUCT TENDER OR CONSTRUCTION, UNLESS SEALED

STATE OF OHIO — JOHN BLECH E-58248 — PROFESSIONAL ENGINEER

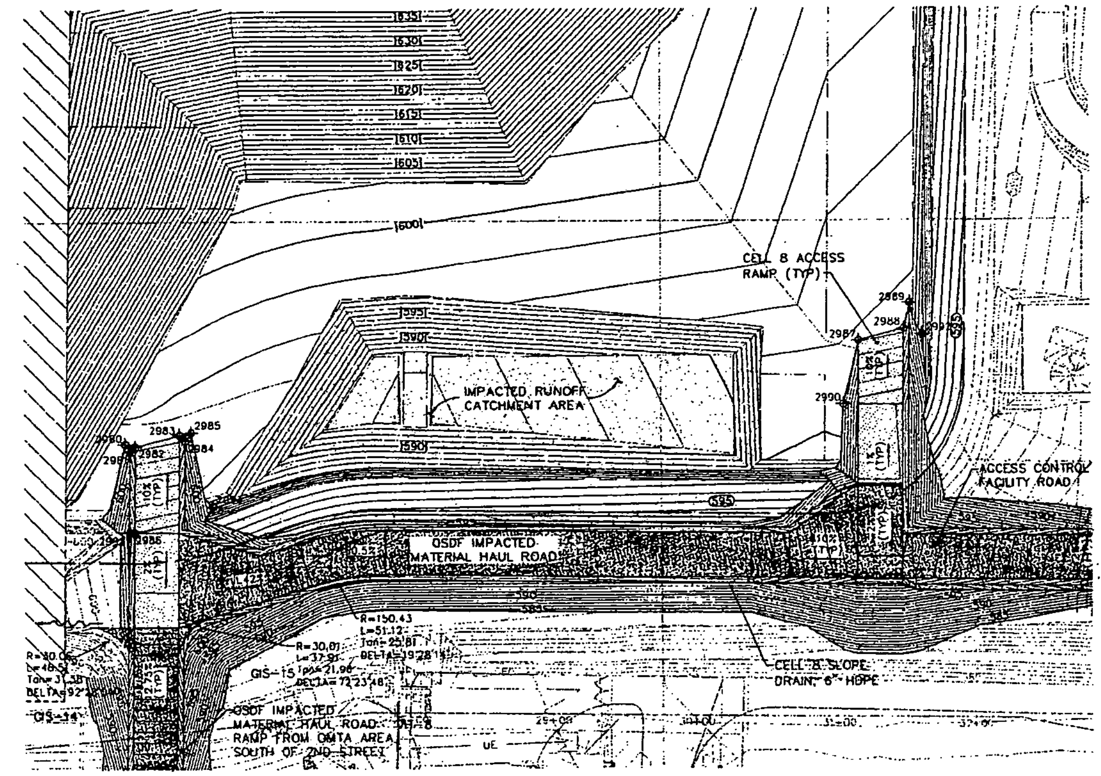
GEOSYNTEC CONSULTANTS

PROJECT NO.:	20105
CONTRACT NO.:	95PS005078
FERNALD DRAWING NO.:	90X-6000-G-003381
GEOSYNTEC PROJECT NO.:	CO-347-17.4
GEOSYNTEC DOCUMENT NO.:	F01-0021
SHEET NO.:	G-19
REVISION NO.:	0

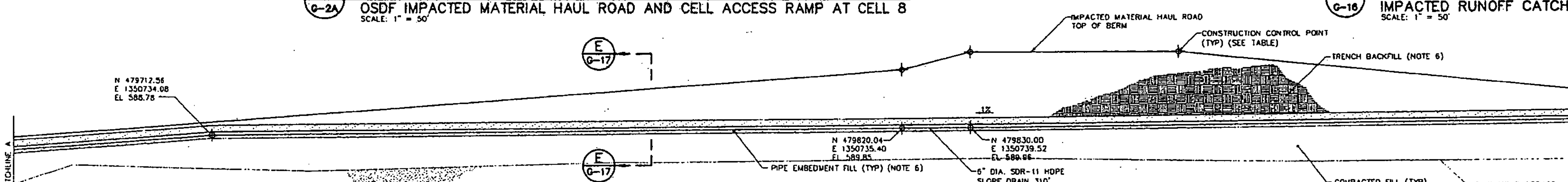
CERTIFIED-FOR-CONSTRUCTION

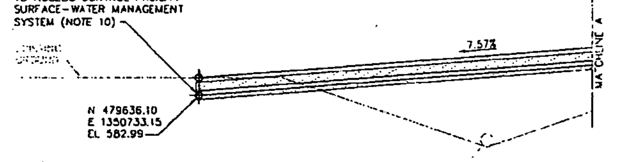


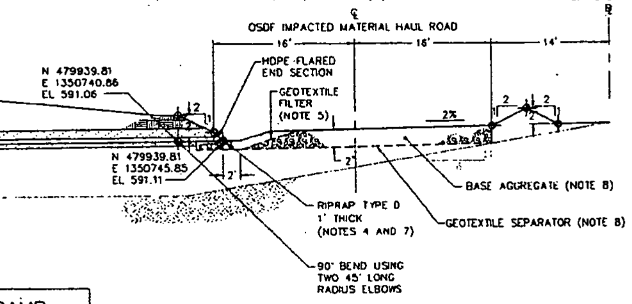
15 PLAN (G-2A)
OSDF IMPACTED MATERIAL HAUL ROAD AND CELL ACCESS RAMP AT CELL 8
SCALE: 1" = 50'



16 PLAN (G-16)
IMPACTED RUNOFF CATCHMENT AREA ACCESS RAMP AT CLOSURE STAGE I
SCALE: 1" = 50'







A SECTION (G-18A)
CELL 8 OSDF IMPACTED MATERIAL HAUL ROAD SLOPE DRAIN
SCALE: 1" = 8'

LEGEND

Symbol	Description
600 (dashed)	EXISTING GROUND ELEVATION (FEET)
600	FINISHED GRADE ELEVATION (FEET)
[600]	IMPACTED MATERIAL ELEVATION (FEET)
(585)	EXISTING SUBGRADE ELEVATION (FEET)
(575)	EXISTING COMPACTED CLAY LINER/PROTECTIVE CLAY LAYER ELEVATION (FEET)
(590)	EXISTING PROTECTIVE LAYER ELEVATION (FEET) (NOTE 2)
	PERIMETER BERM BASELINE
17+00	EXISTING EPLTS PIPE
ILTS	EXISTING ILTS PIPE
2900	CONSTRUCTION CONTROL POINT
	OSDF IMPACTED MATERIAL HAUL ROAD (NOTE 1)
	CELL ACCESS RAMP (NOTE 1)
(8)	EXISTING CELL DESIGNATION

RIPRAP LIMITS CONTROL POINTS

POINT NO.	NORTHING	EASTING	POINT NO.	NORTHING	EASTING	POINT NO.	NORTHING	EASTING
28	480405.40	1350570.81	33	480303.90	1350608.54	38	479679.34	1350711.84
29	480385.39	1350670.54	34	480307.80	1350574.95	39	479680.20	1350707.85
30	480398.11	1350598.62	35	480319.92	1350572.35	58	479675.52	1350801.60
31	480408.20	1350598.48	36	479658.70	1350702.38	57	479674.83	1350807.57
32	480320.81	1350603.45	37	479659.67	1350711.40	58	479663.74	1350802.33
						50	479663.18	1350799.63

NOTES:

1. CONTOURS WITHIN SHADED REGION ON OSDF IMPACTED MATERIAL HAUL ROAD AND CELL ACCESS RAMP REPRESENT TOP OF BASE AGGREGATE. BASE AGGREGATE FOR CELL ACCESS RAMP SHALL BE 1-FOOT THICK AND UNDERLAIN BY GEOTEXTILE SEPARATOR. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
2. FOR PROTECTIVE LAYER, SEE NOTE 3 ON SHEET G-19.
3. HDPE SLOPE DRAIN SHALL BE SDR-11 AND IN ACCORDANCE WITH SPECIFICATION SECTION 02605.
4. RIPRAP APRON SHALL BE CONSTRUCTED AT INLET OF 6-INCH HDPE SLOPE DRAIN. RIPRAP APRON SHALL BE 4 FEET WIDE AND CENTERED ON 6-INCH HDPE SLOPE DRAIN.
5. GEOTEXTILE FILTER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02714.
6. TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
7. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
8. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
9. ALUMINIZED CMP CULVERT AND JOINTS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02721. CONTROL POINTS SHOWN AT ENDS OF CULVERT CORRESPOND TO INVERT ELEVATIONS. TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02215. DETAILS FOR PIPE EMBEDMENT AND CULVERT CROSSING AT 42" CMP CULVERT ARE SIMILAR TO SECTIONS B AND C SHOWN ON DRAWING G-17.
10. GEOMEMBRANE LINED DETENTION BASIN FOR POTENTIALLY IMPACTED RUNOFF SHALL BE IN ACCORDANCE WITH PLAN DRAWING 90X-5500-G-00730 TO BE PROVIDED BY FLUOR FERNALD.

OSDF IMPACTED MATERIAL HAUL ROAD AND ACCESS RAMP CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION	POINT NO.	NORTHING	EASTING	ELEVATION
2900	480336.18	1351110.15	591.27	2954	479858.50	1351025.59	602.04
2901	480371.76	1351023.25	599.70	2955	479875.50	1351043.52	601.87
2902	480303.92	1351104.51	590.58	2956	479875.11	1351075.52	601.87
2903	480337.32	1351022.83	600.38	2957	479825.90	1351074.92	602 86
2904	480336.27	1350781.16	605 50	2958	479822.29	1351042.87	604.86
2905	480340.31	1350778.12	603.86	2959	479821.85	1351078.87	604.86
2906	480407.13	1350711.44	599.11	2960	479875.06	1351079.52	603 87
2907	480407.18	1350707.44	601.11	2961	479880 78	1350825.76	590.97
2908	480373.13	1350711.02	602.51	2962	479876.66	1351018.41	597.93
2909	480341.13	1350710.63	602.51	2963	479885 78	1351027.51	592.85
2910	480377.56	1350675.70	600.00	2964	479983.88	1351044.85	591.03
2911	480379.29	1350534.42	582.00	2965	479979.49	1351076.80	591.43
2912	480375.29	1350534.37	580 00	2966	480003.94	1351081.10	590.98
2913	480343.30	1350533.50	580.00	2967	479874.81	1351099.74	593.76
2914	480339.30	1350533.45	582.00	2968	479834.45	1351099.13	594.57
2915	480337.44	1350685.70	601.34	2969	479811.64	1351098.78	595.03
2916	480316.16	1350714.04	602.33	2970	479813.08	1351087 74	600.53
2917	480271.75	1350731.70	596.16	2971	479815.80	1350850.52	598.67
2918	480281.86	1350762.06	596.80	2972	479819.95	1350743.40	598.93
2919	480281.92	1350766.22	598.70	2973	479820 00	1350739 40	596.93
2920	480244.95	1350739.83	593.71	2974	479820.04	1350735.40	598.93
2921	480255.07	1350770.19	594.35	2975	479636.17	1350733.15	585.00
2922	480256.23	1350774.02	596.35	2976	479662.53	1350737.47	585 00
2923	480257.16	1350777.07	594.75	2977	479636.07	1350741.15	585.00
2924	480270.59	1350775.41	594 76	2978	479627.23	1350773.04	585 00
2925	480243.79	1350736.01	595.71	2979	479600.77	1350776.72	585.00
2926	480193.54	1350743.96	595.37	2980	480379.04	1350841.35	597.76
2927	480193.50	1350747.96	593.37	2981	480375.61	1350835.74	600 14
2928	480193.19	1350779.96	594 01	2982	480371.56	1350839 67	597.70
2929	480193.14	1350783.96	596.01	2983	480339.46	1350848.00	597 46
2930	480193.12	1350787.15	594.42	2984	480335.51	1350843.75	599 93
2931	480193.09	1350789.86	594.36	2985	480331.47	1350849.64	597.39
2932	479937.90	1350740.84	594.09	2986	480372.31	1350778.51	603.86
2933	479937.85	1350744.84	592.09	2987	479859.87	1350913.78	595.90
2934	479937.46	1350776.83	592.73	2988	479827.76	1350922.13	595.66
2935	479937.41	1350780.83	594.73	2989	479823.54	1350940.66	595.81
2936	479937.37	1350784.02	593.14	2990	479870.96	1350888.28	595.22
2937	479937.34	1350786.74	593.08	2992	479813.85	1350917.72	593.10
2938	479916.02	1350787.41	593.44	2993	480315.74	1350796.51	594.46
2939	479911 35	1350780.52	597.59	2994	480376.31	1350778.56	605.88
2940	479910.09	1350776.50	595.47	2995	480317.16	1350580.97	577.23
2941	479861.94	1350743.91	599.68	2996	480398.62	1350578.63	577.67
2942	479861.99	1350739.91	601.68	2997	479825.51	1350779.47	602.44
2943	479830.00	1350739.52	601.68	2998	479802.74	1351087.57	600.77
2944	479829.95	1350743.52	599.68	2999	479805.17	1350889.09	598.82
2945	479829.56	1350775.52	600.32	3000	480331.43	1350703.34	604.51
2946	479829.12	1350811.01	601.03	3001	480386.07	1350698.39	604.51
2947	479861.12	1350811.40	601.03	3002	480418.53	1350571.17	581.81
2948	479875.75	1350805.88	601.63	3003	480418.76	1350569.17	581.81
2949	479828.43	1350867.73	601.11	3004	480409.03	1350569.25	587.57
2950	479860.43	1350868.12	600.47	3005	480409.27	1350567.26	582.57
2951	479824.43	1350867.68	603.11	3006	480386.35	1350568.29	582 57
2952	479825.12	1350810.96	603.03	3007	480385.86	1350566.27	582.57
2953	479826.29	1351042.92	602.86				

CERTIFIED-FOR-CONSTRUCTION

REV. NO.	DATE	DESCRIPTION	DES BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	05.02.15	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	LMG	JJA	TEZ	DKP	JFB
1C	-	NOT ISSUED	-	-	-	-	-
1B	04.08.18	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE PER DCN	LMG	JJA	TEZ	DKP	RB
1A	04.07.08	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE PER DCN	LMG	JJA	TEZ	DKP	RB
0	04.01.22	CFC SUBMITTAL TO FF/DOE/EPA	LMG	JJA	TEZ	DKP	RB
B	03.12.08	PRE-FINAL SUBMITTAL TO FF/DOE	LMG	JJA	TEZ	DKP	RB
A	-	NOT ISSUED	-	-	-	-	-

50 25 0 50 100
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
IMPACTED MATERIAL HAUL ROAD GRADING PLAN AND DETAILS III

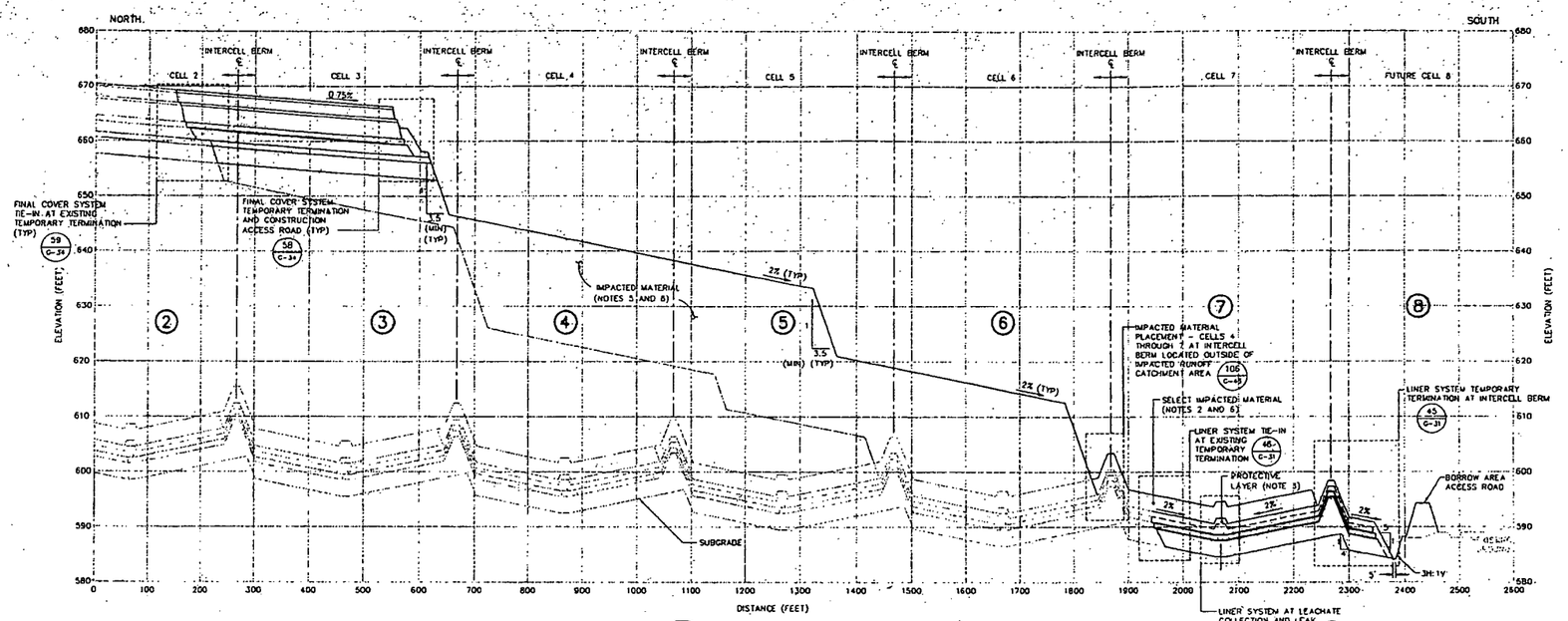
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED

SIGNATURE
15 Feb 2005
DATE

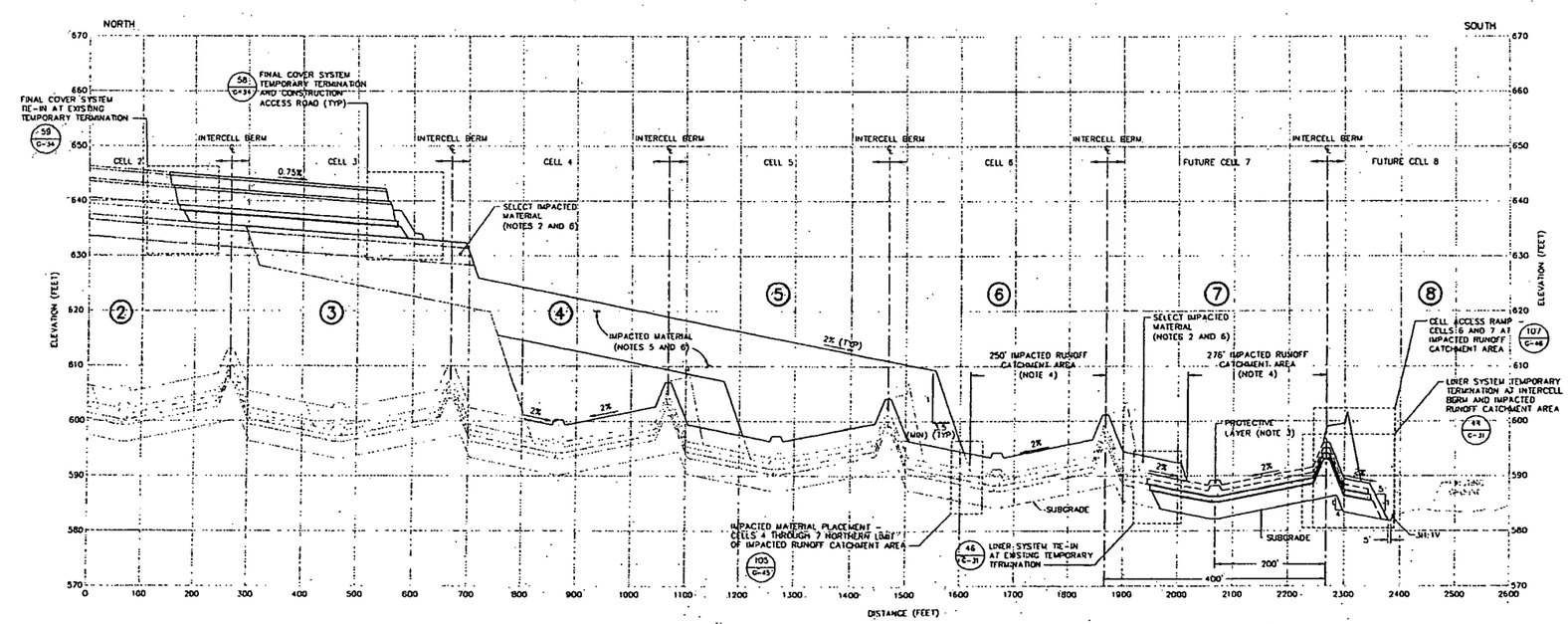
STATE OF OHIO
JOHN F. BEECH
E-58248
REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS

PROJECT NO.: 20105
CONTRACT NO.: 03FF0658
FEMP DRAWING NO.: 90X-6000-G-00418
GEOSYNTEC PROJECT NO.: GD3309-07.02
GEOSYNTEC DOCUMENT NO.: F04-10H
SHEET NO.: G-18A
REVISION NO.: 1



A / G-6 SECTION
NORTH-SOUTH CELL 7
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'



B / G-6 SECTION
NORTH-SOUTH CELL 7 AT IMPACTED RUNOFF CATCHMENT AREA
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'

NOTES:

1. SECTIONS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. A MINIMUM THICKNESS OF 3 FEET OF SELECT IMPACTED MATERIAL SHALL BE PLACED ABOVE PROTECTIVE LAYER AND BELOW CONTOURING LAYER. THICKNESS OF SELECT IMPACTED MATERIAL OVERLYING PROTECTIVE LAYER MAY BE REDUCED TO 2 FEET IF FIRST LIFT OF IMPACTED MATERIAL TO BE PLACED OVER SELECT IMPACTED MATERIAL IS CATEGORY 1 IMPACTED MATERIAL.
3. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED GRANULAR MATERIAL IN IMPACTED RUNOFF CATCHMENT AREA AND IMPACTED MATERIAL IN REMAINING ACTIVE CELL AREAS EXCLUDING CELL AREA AT INTERCELL BERM TEMPORARY LINER SYSTEM TERMINATION. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED NON-GRANULAR MATERIAL IN ACTIVE AND FUTURE CELL AREAS OF TEMPORARY LINER SYSTEM TERMINATION. NON-IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02240. IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
4. IMPACTED RUNOFF CATCHMENT AREA IN ACTIVE CELL SHALL REMAIN OPEN UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED IN ADJACENT UPGRADIENT CELL AND IMPACTED RUNOFF CATCHMENT AREA IN FUTURE CELL IS CONSTRUCTED AND OPERATIONAL.
5. IMPACTED MATERIAL INTERIM SLOPES SHALL BE NO STEEPER THAN 3.5H:1V. INTERIM SLOPE CONFIGURATION SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY AND MAY VARY BASED ON SEQUENCE AND SCHEDULE FOR REMOVAL OF IMPACTED MATERIAL FROM OPERABLE UNITS. EXISTING IMPACTED MATERIAL GRADES SHOWN ARE APPROXIMATE.
6. IMPACTED MATERIAL PLACEMENT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.

REV. NO.	DATE	DESCRIPTION	DES. BY	DN BY	CHK. BY	RVR. BY	APP. BY
1	04 01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	KRD	JAS	KRD	BKP	RB
1B	03.17.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	KRD	JAS	KRD	DKP	RB
1A	–	NOT ISSUED	–	–	–	–	–
0	02 01.29	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JMD	KRD	DCP	JFB
B	01 12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JMD	KRD	DCP	JFB
A	–	NOT ISSUED	–	–	–	–	–

100 50 0 100 200 HORIZONTAL SCALE IN FEET
10 5 0 10 20 VERTICAL SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY - PHASE V

DRAWING:
OSDF NORTH-SOUTH SECTIONS II

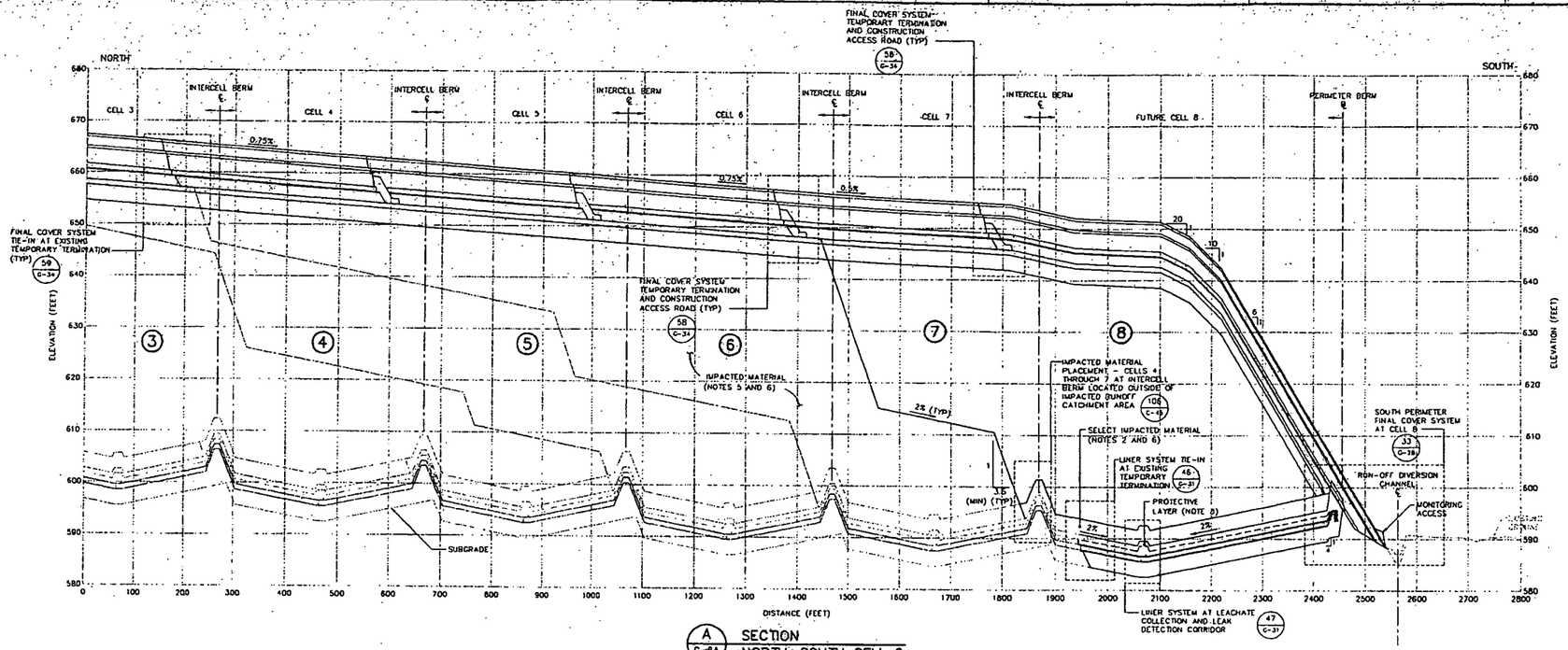
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED

STATE OF OHIO
RUDOLPH BONAPARTE
E-56678
REGISTERED PROFESSIONAL ENGINEER

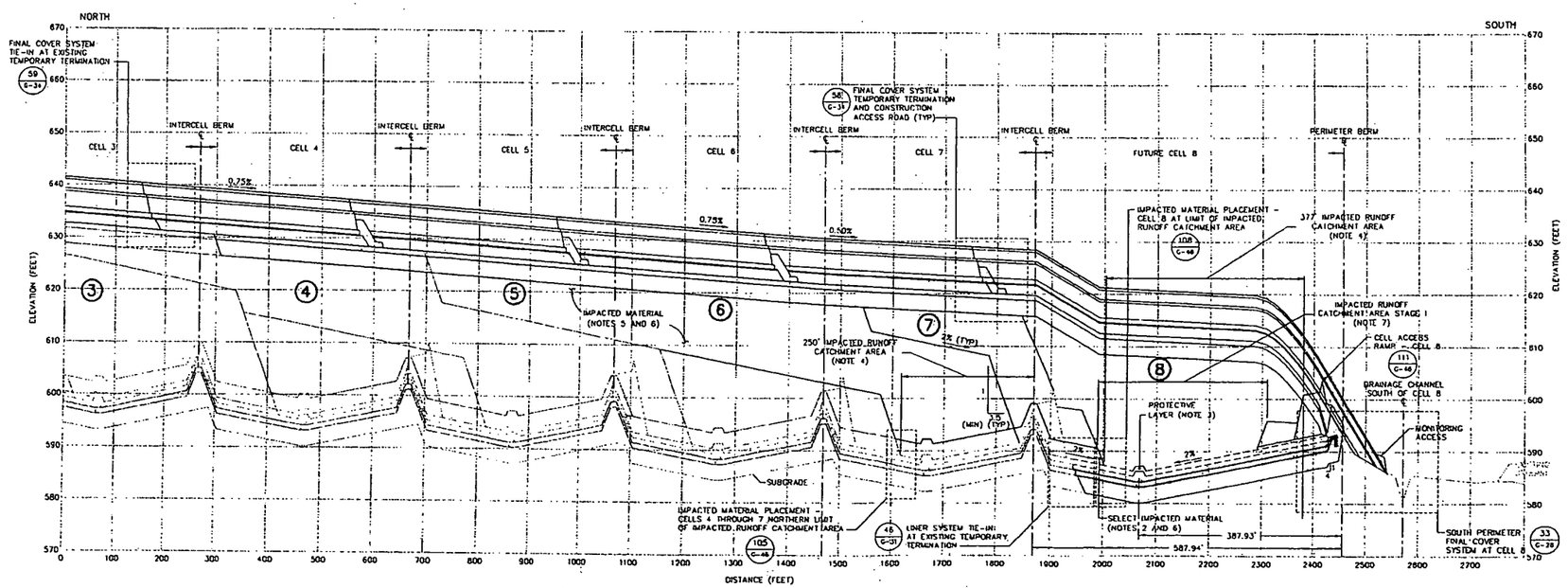
GeoSyntec Consultants
1100 LAKE HIGH DRIVE
ATLANTA, GEORGIA 30318 USA

PROJECT NO.: 20105
CONTRACT NO.: 0377-0539
FFWP DRAWING NO.: 90X-RDRD-G-00382
GEOSYNTEC PROJECT NO.: GS3721-09.04
GEOSYNTEC DOCUMENT NO.: F037-1072
SHEET NO.: G-20
REVISION NO.: 1

CERTIFIED-FOR-CONSTRUCTION



A G-6A SECTION
NORTH-SOUTH CELL 8
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'



8 G-6A SECTION
NORTH-SOUTH CELL 8 AT IMPACTED RUNOFF CATCHMENT AREA
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 10'

NOTES:

1. SECTIONS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. A MINIMUM THICKNESS OF 3 FEET OF SELECT IMPACTED MATERIAL SHALL BE PLACED ABOVE PROTECTIVE LAYER AND BELOW CONTOURING LAYER. THICKNESS OF SELECT IMPACTED MATERIAL OVERLYING PROTECTIVE LAYER MAY BE REDUCED TO 2 FEET IF FIRST LIFT OF IMPACTED MATERIAL TO BE PLACED OVER SELECT IMPACTED MATERIAL IS CATEGORY 1 IMPACTED MATERIAL.
3. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED GRANULAR MATERIAL IN IMPACTED RUNOFF CATCHMENT AREA AND IMPACTED MATERIAL IN REMAINING ACTIVE CELL AREAS EXCLUDING CELL AREA AT INTERCELL BERM TEMPORARY LINER SYSTEM TERMINATION. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED NON-GRANULAR MATERIAL IN ACTIVE AND FUTURE CELL AREAS OF TEMPORARY LINER SYSTEM TERMINATION. NON-IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02240. IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
4. IMPACTED RUNOFF CATCHMENT AREA IN ACTIVE CELL SHALL REMAIN OPEN UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED IN ADJACENT UPGRADIENT CELL AND IMPACTED RUNOFF CATCHMENT AREA IN FUTURE CELL IS CONSTRUCTED AND OPERATIONAL.
5. IMPACTED MATERIAL INTERIM SLOPES SHALL BE NO STEEPER THAN 3.5H:1V. INTERIM SLOPE CONFIGURATION SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY AND MAY VARY BASED ON SEQUENCE AND SCHEDULE FOR REMOVAL OF IMPACTED MATERIAL FROM OPERABLE UNITS. EXISTING IMPACTED MATERIAL GRADES SHOWN ARE APPROXIMATE.
6. IMPACTED MATERIAL PLACEMENT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
7. DEVELOP AND MAINTAIN CELL 8 IMPACTED RUNOFF CATCHMENT AREA AS SHOWN ON DRAWINGS G-16 AND G-46 AND IN ACCORDANCE WITH SPECIFICATION SECTIONS 13010 AND 02270.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	05.02.15	CFC REVISION 1 SUBMITTAL TO FT/DOE/EPA	TEZ	JJA	LMC	DKP	JFB
1C	-	NOT ISSUED	-	-	-	-	-
1B	-	NOT ISSUED	-	-	-	-	-
1A	04.07.08	PRELIMINARY REVISION 1 SUBMITTAL TO FT/DOE/EPA PER LON	TEZ	JJA	LMC	DKP	RB
0	04.01.22	CFC SUBMITTAL TO FT/DOE/EPA	KRD	JAS	KRD	DKP	RB
B	03.12.08	PRE-FINAL SUBMITTAL TO FT/DOE	KRD	JAS	KRD	DKP	RB
A	-	NOT ISSUED	-	-	-	-	-

100 50 0 100 200 HORIZONTAL SCALE IN FEET

10 5 0 10 20 VERTICAL SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY - PHASE V

TITLE:
OSDF NORTH-SOUTH SECTIONS III

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDER OR CONSTRUCTION, UNLESS SEALED

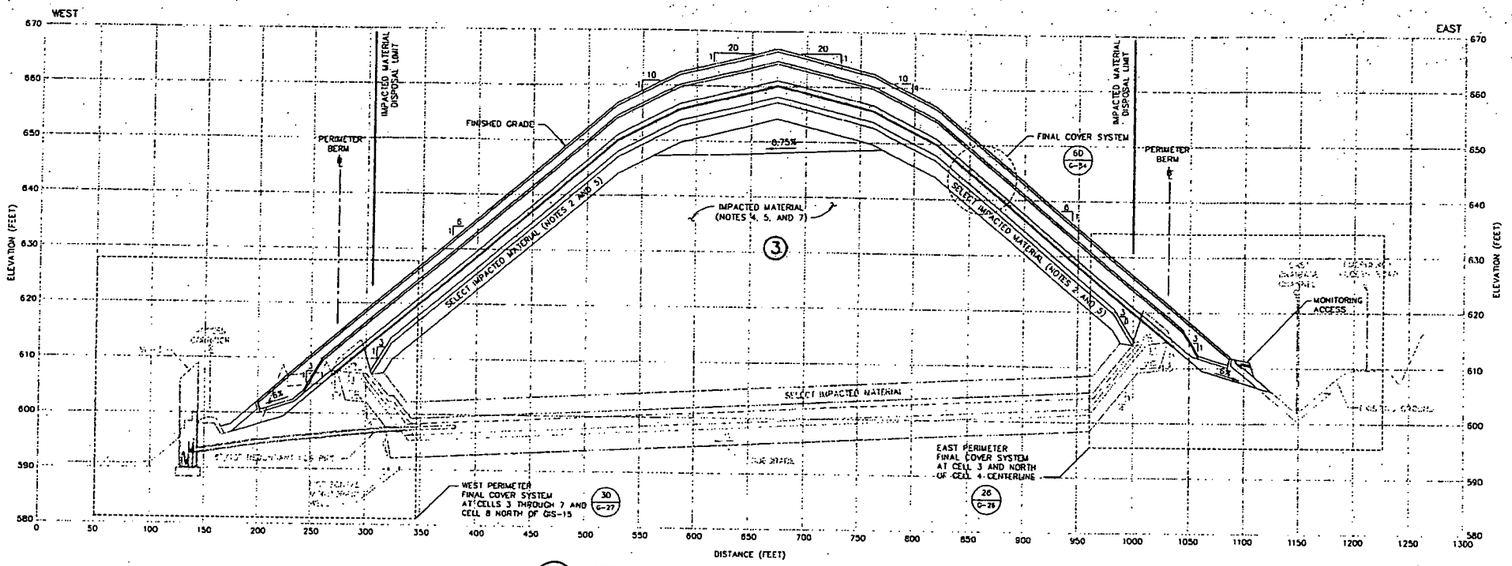
15 Jul 2014

STATE OF OHIO JOHN A. BEECH E-58248 REGISTERED PROFESSIONAL ENGINEER

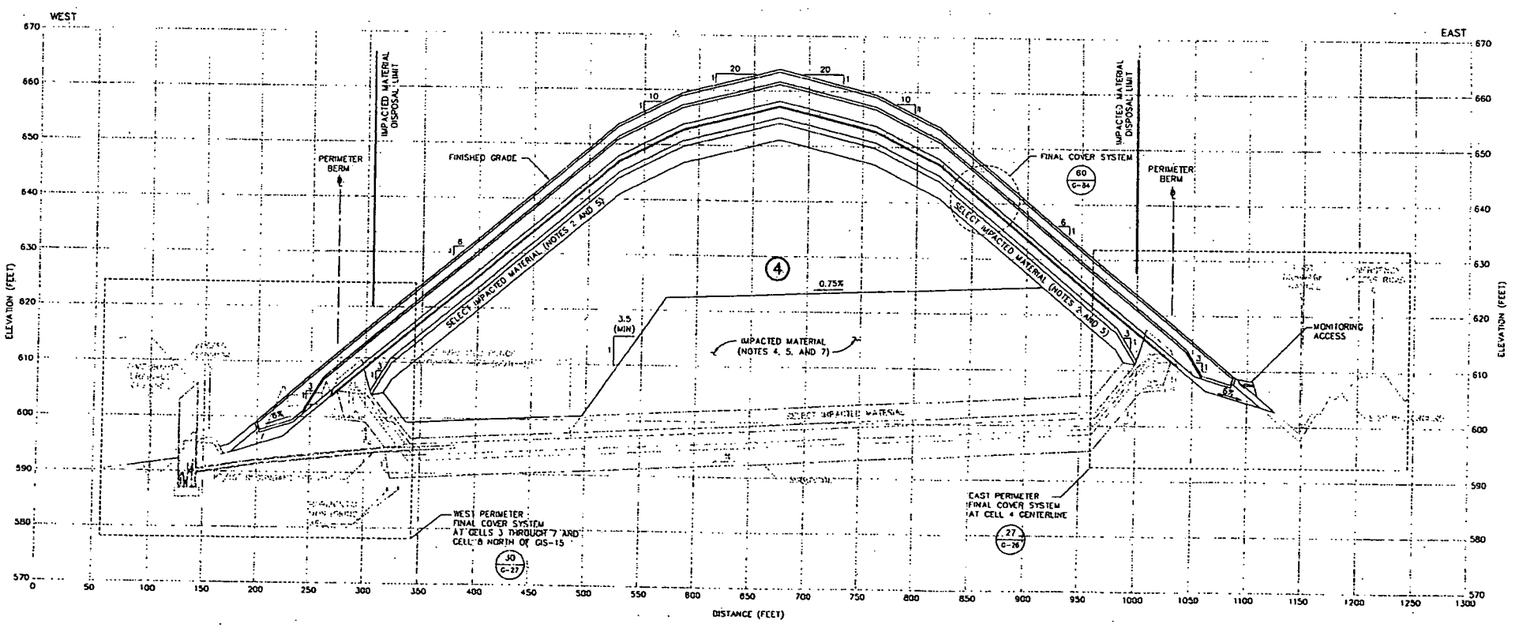
GEOSYNTEC CONSULTANTS

PROJECT NO.:	2010.05
CONTRACT NO.:	0317.0899
TEMP DRAWING NO.:	SOX-8000-E-00419
GEOSYNTEC PROJECT NO.:	GCJ309-02.07
GEOSYNTEC DOCUMENT NO.:	FD4-1042
SHEET NO.:	G-20A
REVISION NO.:	1

CERTIFIED-FOR-CONSTRUCTION



A G-3 SECTION
WEST–EAST CELL 3 AT IMPACTED RUNOFF CATCHMENT AREA
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'



B G-3 SECTION
WEST–EAST CELL 4 AT IMPACTED RUNOFF CATCHMENT AREA
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'

NOTES:

1. SECTIONS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. A MINIMUM THICKNESS OF 3 FEET OF SELECT IMPACTED MATERIAL SHALL BE PLACED ABOVE PROTECTIVE LAYER AND BELOW CONTOURING LAYER. THICKNESS OF SELECT IMPACTED MATERIAL OVERLYING PROTECTIVE LAYER MAY BE REDUCED TO 2 FEET IF FIRST LIFT OF IMPACTED MATERIAL TO BE PLACED OVER SELECT IMPACTED MATERIAL IS CATEGORY 1 IMPACTED MATERIAL.
3. IMPACTED RUNOFF CATCHMENT AREA IN ACTIVE CELL SHALL REMAIN OPEN UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED IN ADJACENT UPGRADIENT CELL AND IMPACTED RUNOFF CATCHMENT AREA IN DOWNGRADIENT CELL IS CONSTRUCTED AND OPERATIONAL.
4. IMPACTED MATERIAL INTERIM SLOPES SHALL BE NO STEEPER THAN 3.5H:1V. INTERIM SLOPE CONFIGURATION SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY AND MAY VARY BASED ON SEQUENCE AND SCHEDULE FOR REMOVAL OF IMPACTED MATERIAL FROM OPERABLE UNITS.
5. IMPACTED MATERIAL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
6. LDS, LCS, AND RLCS PIPES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02605 AND TERMINATE AT THE UPGRADIENT END WITH A 6-INCH MOLDED END CAP.
7. EXISTING IMPACTED MATERIAL GRADES SHOWN ARE APPROXIMATE.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW BY	APP. BY
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWO	KRD	DOP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DOP	JFB
A	-	NOT ISSUED	-	-	-	-	-

50 25 0 50 100 HORIZONTAL SCALE IN FEET
10 5 0 10 20 VERTICAL SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
OSDF WEST–EAST SECTIONS I

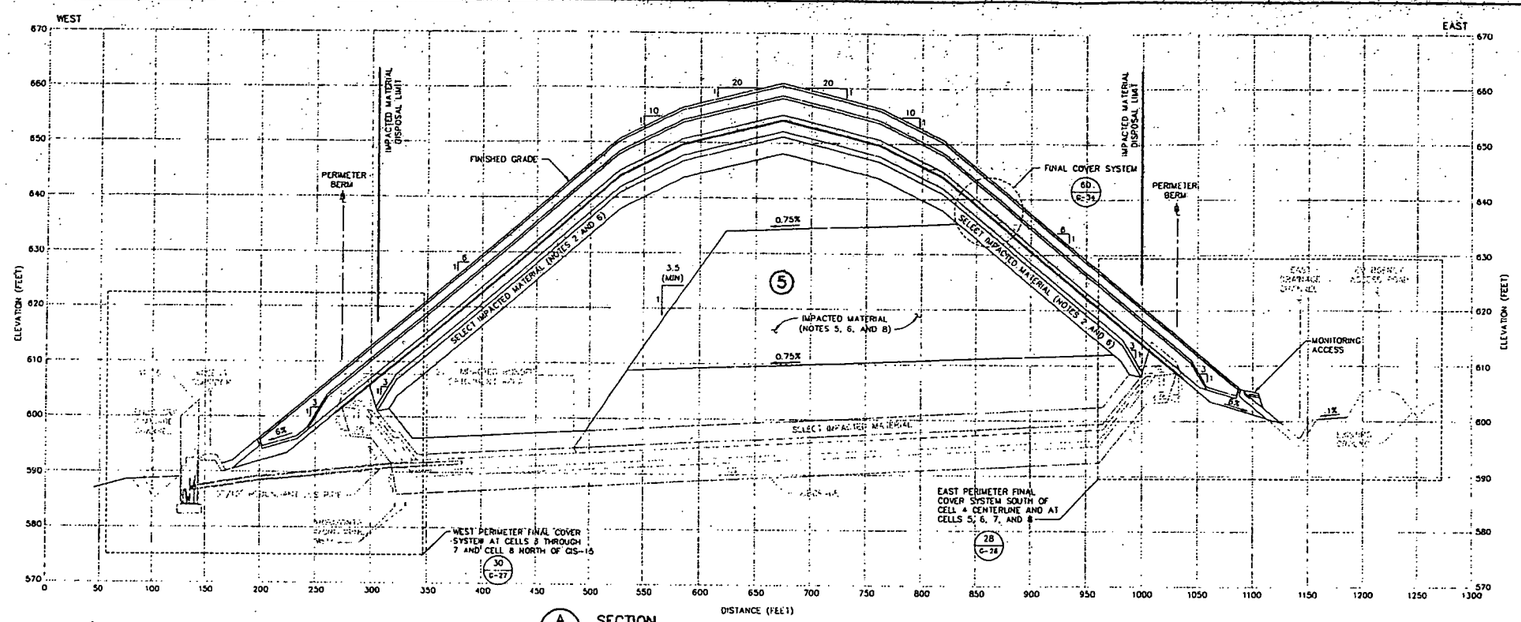
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TUNDER OR CONSTRUCTION, UNLESS SEALED.

STATE OF OHIO JOHN W. BEECH E-52246 REGISTERED PROFESSIONAL ENGINEER

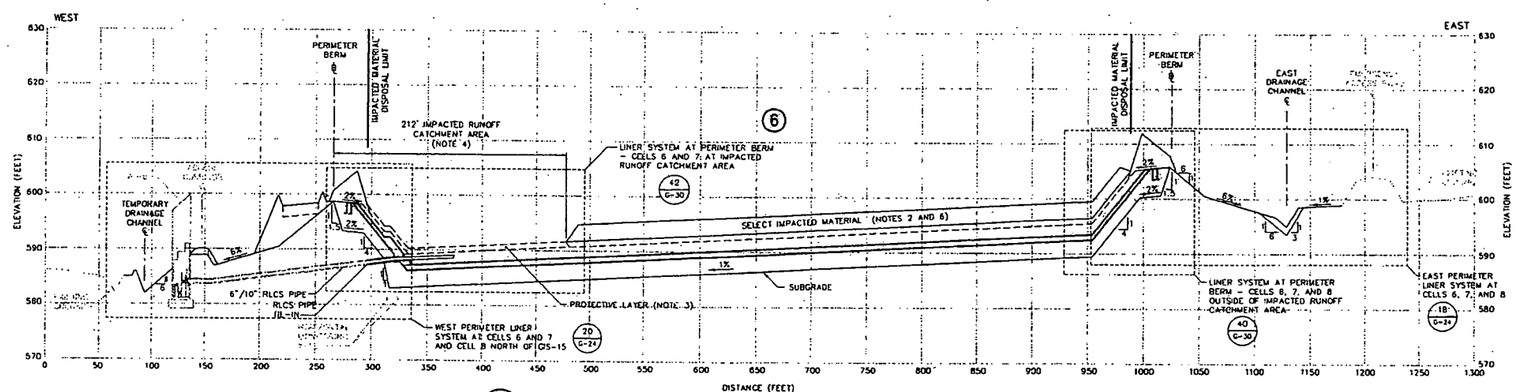
GEO SYNTHETICS CONSULTANTS

PROJECT NO.:	70100
CONTRACT NO.:	95P5003026
TEMP DRAWING NO.:	90X-5000-G-00383
GEOSYNTEC PROJECT NO.:	GD1347-17.4
GEOSYNTEC DOCUMENT NO.:	F01-0033
SHEET NO.:	G-21
REVISION NO.:	0

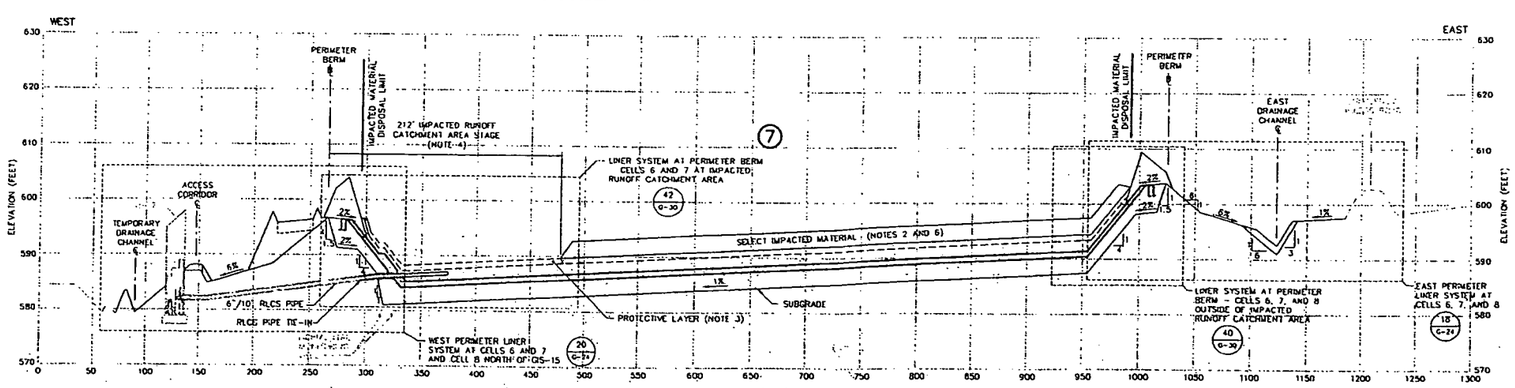
CERTIFIED-FOR-CONSTRUCTION



A / G-3 SECTION
WEST–EAST CELL 5 AT IMPACTED RUNOFF CATCHMENT AREA
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'



B / G-4 SECTION
WEST–EAST CELL 6 AT IMPACTED RUNOFF CATCHMENT AREA
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'



C / G-6 SECTION
WEST–EAST CELL 7 AT IMPACTED RUNOFF CATCHMENT AREA
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'

NOTES:

1. SECTIONS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. A MINIMUM THICKNESS OF 3 FEET OF SELECT IMPACTED MATERIAL SHALL BE PLACED ABOVE PROTECTIVE LAYER AND BELOW CONTOURING LAYER. THICKNESS OF SELECT IMPACTED MATERIAL OVERLYING PROTECTIVE LAYER MAY BE REDUCED TO 2 FEET IF FIRST LIFT OF IMPACTED MATERIAL TO BE PLACED OVER SELECT IMPACTED MATERIAL IS CATEGORY 1 IMPACTED MATERIAL.
3. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED GRANULAR MATERIAL IN IMPACTED RUNOFF CATCHMENT AREA AND IMPACTED MATERIAL IN REMAINING ACTIVE CELL AREAS EXCLUDING CELL AREA AT INTERCELL BERM TEMPORARY LINER SYSTEM TERMINATION. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED NON-GRANULAR MATERIAL IN ACTIVE AND FUTURE CELL AREAS OF TEMPORARY LINER SYSTEM TERMINATION. NON-IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02240. IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
4. IMPACTED RUNOFF CATCHMENT AREA IN ACTIVE CELL SHALL REMAIN OPEN UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED IN ADJACENT UPGRADIENT CELL AND IMPACTED RUNOFF CATCHMENT AREA IN DOWNGRADIENT CELL IS CONSTRUCTED AND OPERATIONAL.
5. IMPACTED MATERIAL INTERIM SLOPES SHALL BE NO STEEPER THAN 3.5H:1V. INTERIM SLOPE CONFIGURATION SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY AND MAY VARY BASED ON SEQUENCE AND SCHEDULE FOR REMOVAL OF IMPACTED MATERIAL FROM OPERABLE UNITS.
6. IMPACTED MATERIAL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
7. LDS, LCS, AND RLCS PIPES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02505 AND TERMINATE AT THE UPGRADIENT END WITH A 6-INCH MOLDED END CAP.
8. EXISTING IMPACTED MATERIAL GRADES SHOWN ARE APPROXIMATE.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	KRD	JAS	KRD	DKP	RB
1B	03.12.09	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	KRD	JAS	KRD	DKP	RB
1A	–	NOT ISSUED	–	–	–	–	–
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JMO	KRD	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JMO	KRD	DCP	JFB
A	–	NOT ISSUED	–	–	–	–	–

50 25 0 50 100 HORIZONTAL SCALE IN FEET

10 5 0 10 20 VERTICAL SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
OSDF WEST–EAST SECTIONS II

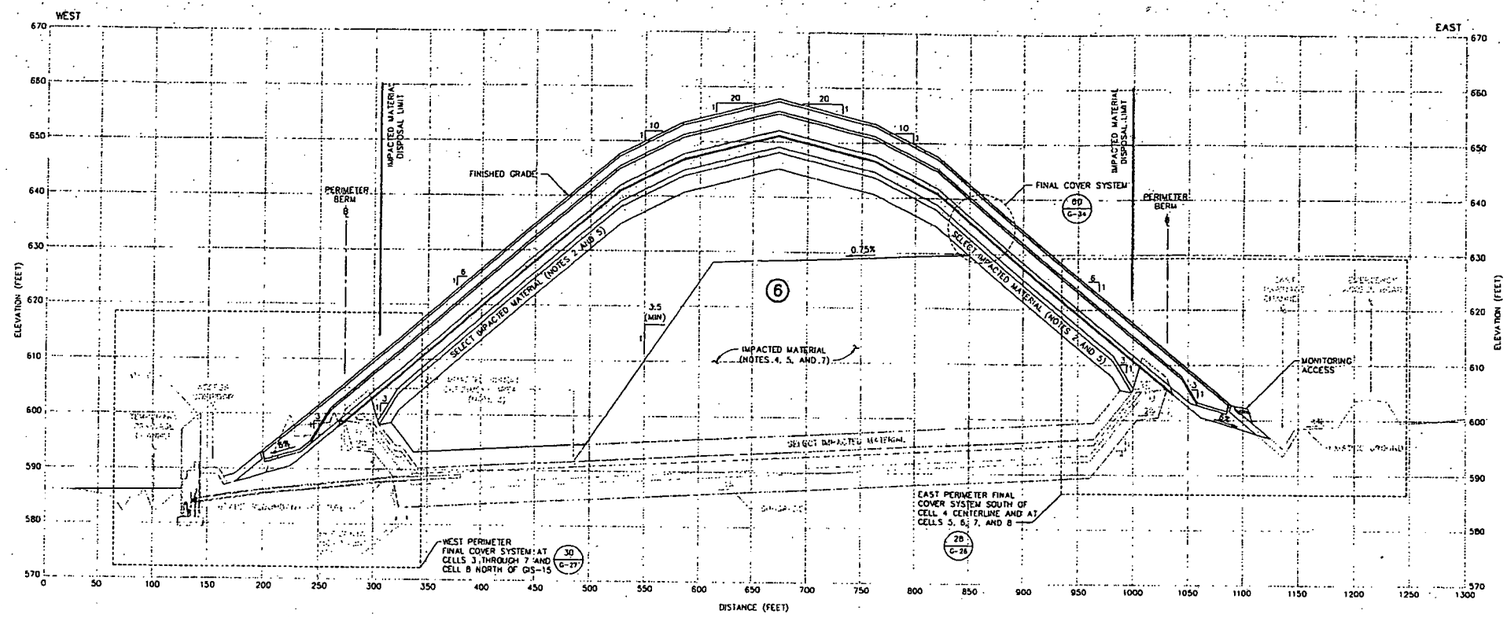
THIS DRAWING MAY NOT BE USED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED

STATE OF OHIO — RUDOLPH BONAPARTE E-58679 — REGISTERED PROFESSIONAL ENGINEER

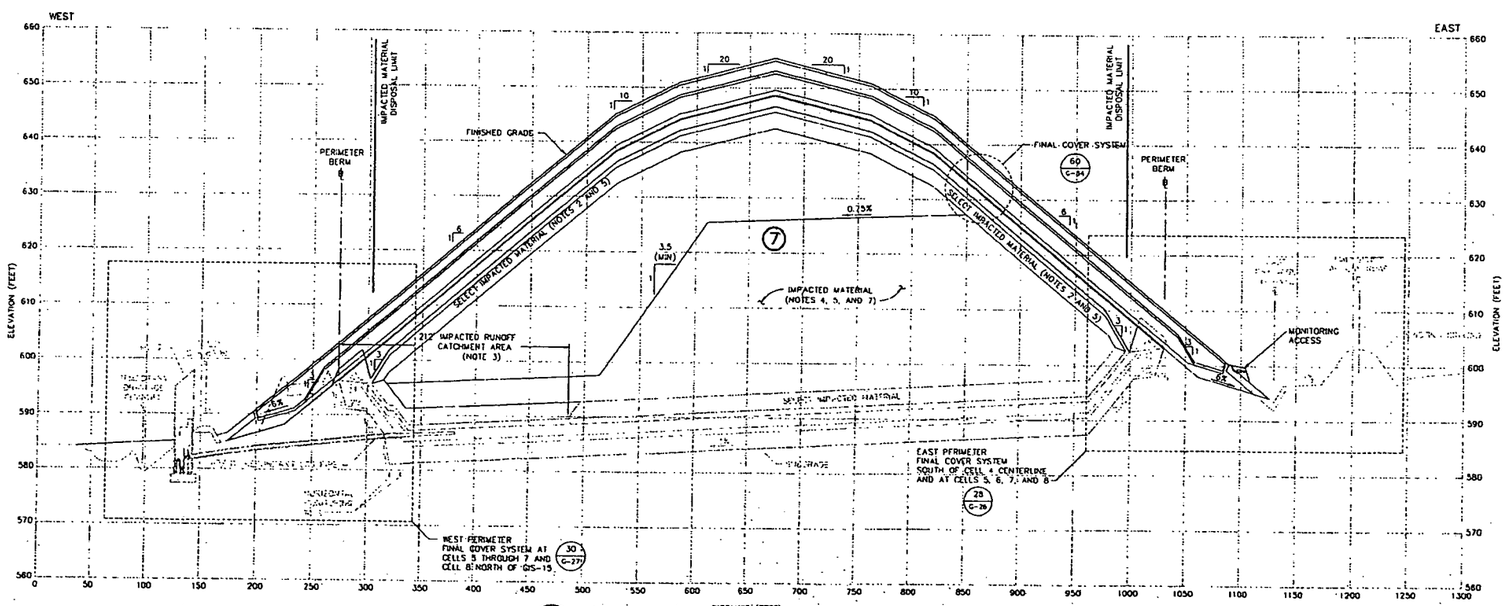
GEOSYNTEC CONSULTANTS

PROJECT NO.:	20106
CONTRACT NO.:	03FD599
FFMP DRAWING NO.:	90X-6000-C-00384
GEOSYNTEC PROJECT NO.:	GC3211-05.04
GEOSYNTEC DOCUMENT NO.:	F03-1024
SHEET NO.:	G-22
REVISION NO.:	1

CERTIFIED-FOR-CONSTRUCTION



A G-11 SECTION
WEST-EAST CELL 6 AT IMPACTED RUNOFF CATCHMENT AREA
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'



B G-11 SECTION
WEST-EAST CELL 7 AT IMPACTED RUNOFF CATCHMENT AREA
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'

NOTES:

1. SECTIONS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. A MINIMUM THICKNESS OF 3 FEET OF SELECT IMPACTED MATERIAL SHALL BE PLACED ABOVE PROTECTIVE LAYER AND BELOW CONTOURING LAYER. THICKNESS OF SELECT IMPACTED MATERIAL OVERLYING PROTECTIVE LAYER MAY BE REDUCED TO 2 FEET IF FIRST LIFT OF IMPACTED MATERIAL TO BE PLACED OVER SELECT IMPACTED MATERIAL IS CATEGORY 1 IMPACTED MATERIAL.
3. IMPACTED RUNOFF CATCHMENT AREA IN ACTIVE CELL SHALL REMAIN OPEN UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED IN ADJACENT UPGRADIENT CELL AND IMPACTED RUNOFF CATCHMENT AREA IN FUTURE CELL IS CONSTRUCTED AND OPERATIONAL.
4. IMPACTED MATERIAL INTERIM SLOPES SHALL BE NO STEEPER THAN 3.5H:1V. INTERIM SLOPE CONFIGURATION SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY AND MAY VARY BASED ON SEQUENCE AND SCHEDULE FOR REMOVAL OF IMPACTED MATERIAL FROM OPERABLE UNITS.
5. IMPACTED MATERIAL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
6. LDS, LCS, AND RLCS PIPES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02605 AND TERMINATE AT THE UPGRADIENT END WITH A 6-INCH DIA MOLDED END CAP.
7. EXISTING IMPACTED MATERIAL GRADES SHOWN ARE APPROXIMATE.

REV NO	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	KRD	JAS	KRD	DKP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	KRD	JAS	KRD	DKP	RB
1A	-	NOT ISSUED	-	-	-	-	-
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWD	KRD	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWD	KRD	DCP	JFB
A	-	NOT ISSUED	-	-	-	-	-

50 25 0 50 100 HORIZONTAL SCALE IN FEET
10 5 0 10 20 VERTICAL SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
OSDF WEST-EAST SECTIONS III

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED

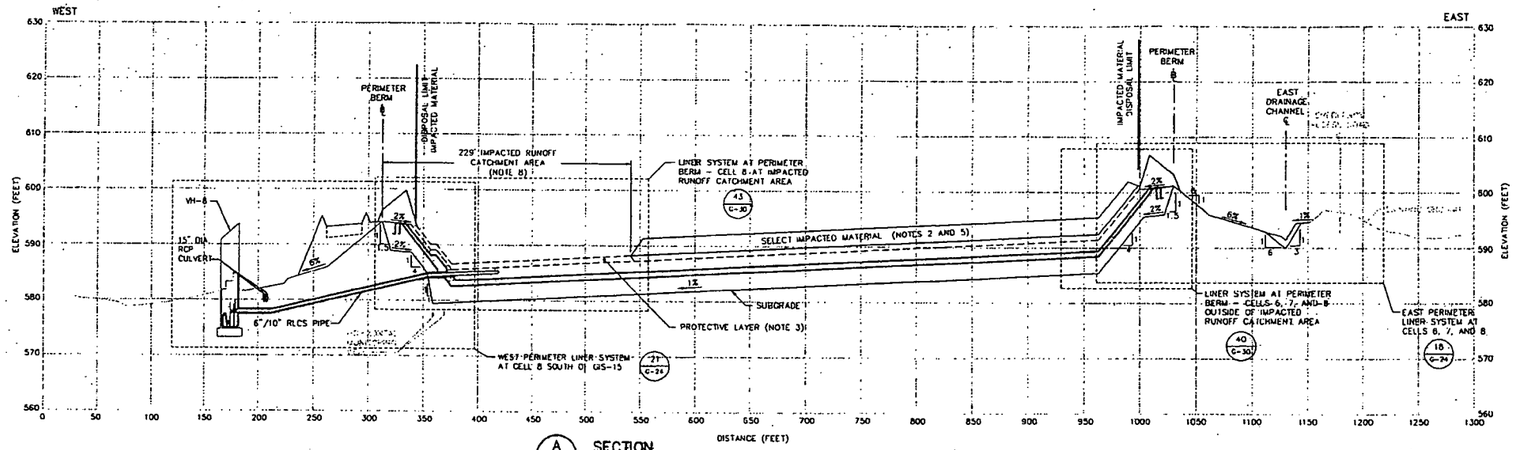
Rudolph Bonaparte
SIGNATURE
22 January 04
DATE

STATE OF OHIO
RUDOLPH BONAPARTE
E-54679
REGISTERED PROFESSIONAL ENGINEER

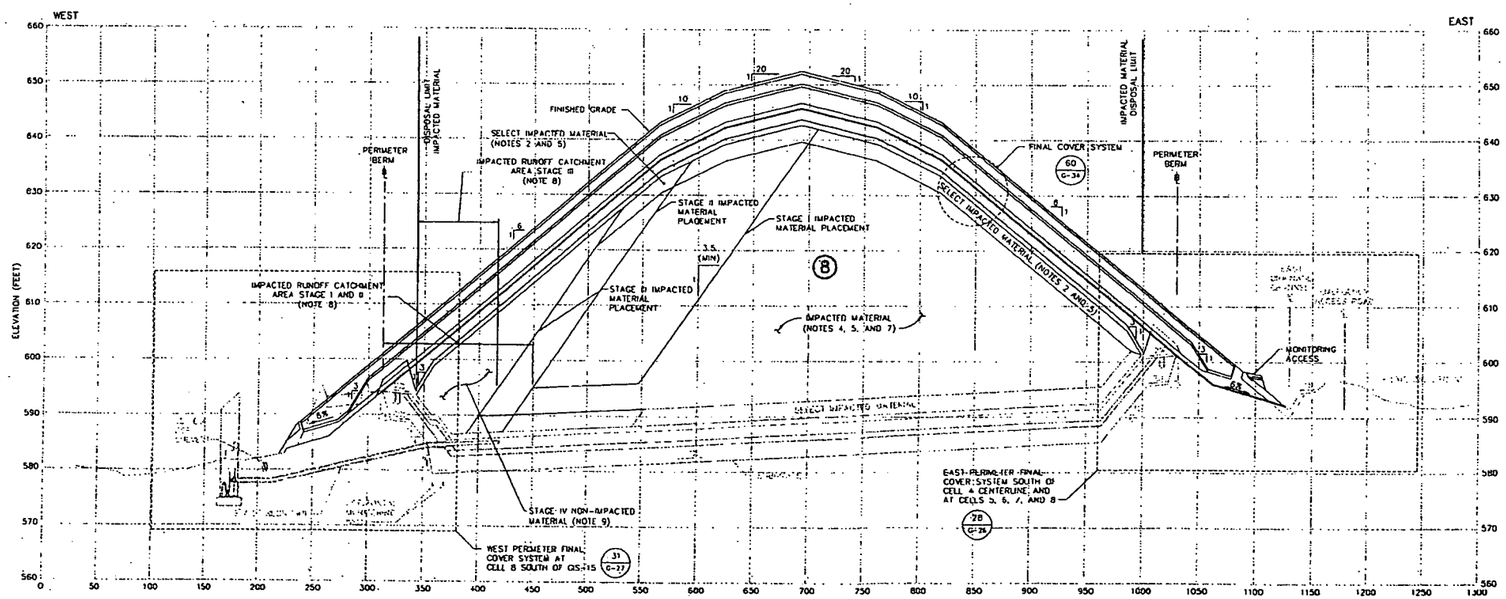
GEOSYNTEC CONSULTANTS
1900 CAMPUS COMMON DRIVE
RESTON, VIRGINIA 20191

PROJECT NO.: 20105
CONTRACT NO.: 03F06599
FEMP DRAWING NO.: 90X-6000-G-00385
GEOSYNTEC PROJECT NO.: GO3231-06.04
GEOSYNTEC DOCUMENT NO.: FRM-1025
SHEET NO.: G-6.03
REVISION NO.: 1

CERTIFIED-FOR-CONSTRUCTION



A G-6A SECTION
WEST-EAST CELL 8 AT IMPACTED RUNOFF CATCHMENT AREA
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'



B G-15A SECTION
WEST-EAST CELL 8 AT IMPACTED RUNOFF CATCHMENT AREA
HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 10'

NOTES:

1. SECTIONS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. A MINIMUM THICKNESS OF 3 FEET OF SELECT IMPACTED MATERIAL SHALL BE PLACED ABOVE PROTECTIVE LAYER AND BELOW CONTOURING LAYER. THICKNESS OF SELECT IMPACTED MATERIAL OVERLYING PROTECTIVE LAYER MAY BE REDUCED TO 2 FEET IF FIRST LIFT OF IMPACTED MATERIAL TO BE PLACED OVER SELECT IMPACTED MATERIAL IS CATEGORY 1 IMPACTED MATERIAL.
3. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED GRANULAR MATERIAL IN IMPACTED RUNOFF CATCHMENT AREA AND IMPACTED MATERIAL IN REMAINING ACTIVE CELL AREAS EXCLUDING CELL AREA AT INTERCELL BERM TEMPORARY LINER SYSTEM TERMINATION. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED NON-GRANULAR MATERIAL IN ACTIVE AND FUTURE CELL AREAS OF TEMPORARY LINER SYSTEM TERMINATION. NON-IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02240. IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
4. IMPACTED MATERIAL INTERIM SLOPES SHALL BE NO STEEPER THAN 3.5H:1V. INTERIM SLOPE CONFIGURATION SHOWN IS FOR ILLUSTRATIVE PURPOSES ONLY AND MAY VARY BASED ON SEQUENCE AND SCHEDULE FOR REMOVAL OF IMPACTED MATERIAL FROM OPERABLE UNITS.
5. IMPACTED MATERIAL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
6. LDS, LCS, AND RLCS PIPES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02605 AND TERMINATE AT THE UPGRADIENT END WITH A 6-INCH DIA MOLDED END CAP.
7. EXISTING IMPACTED MATERIAL GRADES SHOWN ARE APPROXIMATE.
8. DEVELOP AND MAINTAIN CELL 8 IMPACTED RUNOFF CATCHMENT AREA AS SHOWN ON DRAWINGS G-16 AND G-46 AND IN ACCORDANCE WITH SPECIFICATION SECTIONS 13010 AND 02270.
9. STAGE IV GRADES TO BE ACHIEVED BY FILLING FROM STAGE III WITH NON-IMPACTED MATERIAL. NON IMPACTED MATERIAL CAPACITY IS APPROXIMATELY 19,000 CUBIC YARDS.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK BY	RVW BY	APP BY
1	05.02.15	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMG	DKP	JFB
1C	-	NOT ISSUED	-	-	-	-	-
1B	-	NOT ISSUED	-	-	-	-	-
1A	-	NOT ISSUED	-	-	-	-	-
0	04.01.22	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JMO	KRD	DKP	RB
B	03.12.08	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JMO	KRD	DKP	RB
A	-	NOT ISSUED	-	-	-	-	-

50 25 0 50 100 HORIZONTAL SCALE IN FEET

10 5 0 10 20 VERTICAL SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
OSDF WEST-EAST SECTIONS IV

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDER OR CONSTRUCTION, UNLESS SEALED.

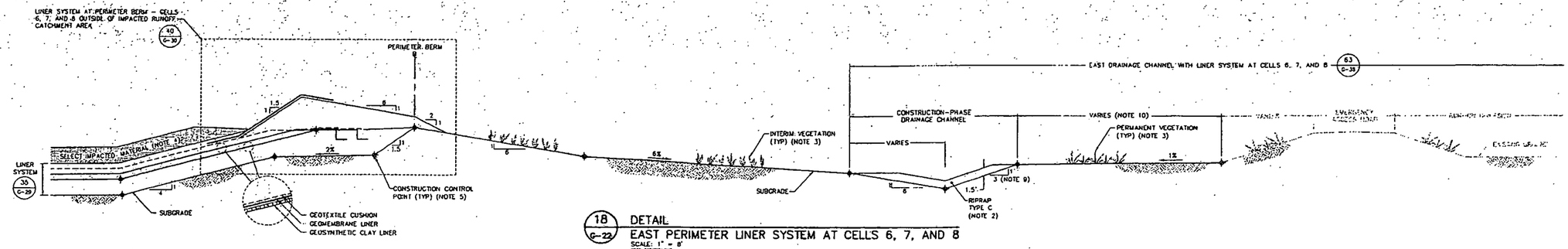
15 MAY 2007

STATE OF OHIO — JOHN M. BEECH — E-38246 — REGISTERED PROFESSIONAL ENGINEER

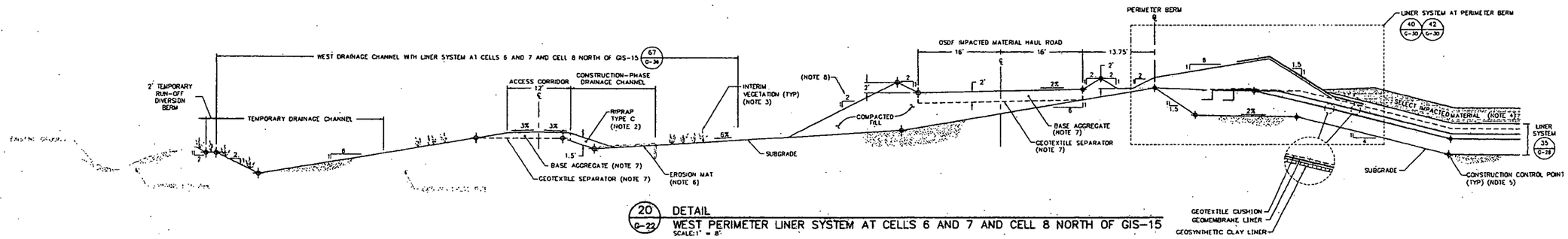
GeoSyntec Consultants

PROJECT NO.	20105
CONTRACT NO.	03T0699
FLUOR DRAWING NO.	90X-5000-G-00420
GEOSYNTEC PROJECT NO.	GO3300-02.02
GEOSYNTEC DOCUMENT NO.	T04-1063
SHEET NO.	G-23A
REVISION NO.	1

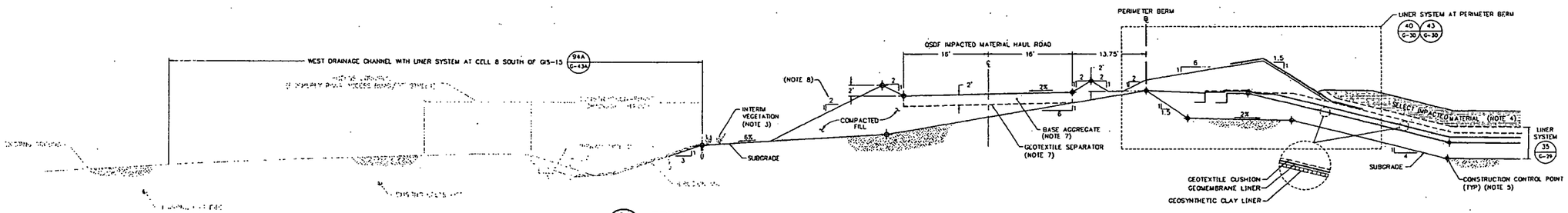
CERTIFIED-FOR-CONSTRUCTION



18 G-22 DETAIL
EAST PERIMETER LINER SYSTEM AT CELLS 6, 7, AND 8
SCALE: 1" = 8'



20 G-22 DETAIL
WEST PERIMETER LINER SYSTEM AT CELLS 6 AND 7 AND CELL 8 NORTH OF GIS-15
SCALE: 1" = 8'



21 G-23A DETAIL
WEST PERIMETER LINER SYSTEM AT CELL 8 SOUTH OF GIS-15
SCALE: 1" = 8'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
3. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
4. A MINIMUM THICKNESS OF 3 FEET OF SELECT IMPACTED MATERIAL SHALL BE PLACED ABOVE THE PROTECTIVE LAYER AND BELOW THE CONTOURING LAYER. THICKNESS OF SELECT IMPACTED MATERIAL MAY BE REDUCED TO 2 FEET IF THE FIRST LIFT OF IMPACTED MATERIAL TO BE PLACED OVER SELECT IMPACTED MATERIAL IS CATEGORY 1 IMPACTED MATERIAL. IMPACTED MATERIAL SHALL BE IN ACCORDANCE WITH SECTION 13010.
5. CONSTRUCTION CONTROL POINTS FOR SUBGRADE, COMPACTED CLAY LINER, AND OSDF IMPACTED MATERIAL HAUL ROAD ARE PROVIDED ON DRAWINGS G-4, G-6, G-6A, G-7, G-7A, G-17, G-18, G-18A.
6. EROSION MAT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
7. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
8. CRUSTING AGENT SHALL BE APPLIED TO OSDF IMPACTED HAUL ROAD EMBANKMENT SIDE SLOPE AS REQUIRED TO MINIMIZE EROSION AND BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
9. EASTERN SLOPE OF CONSTRUCTION-PHASE DRAINAGE CHANNEL AT SOUTHEAST CORNER OF CELL 8 VARIES FROM 3H:1V TO 2H:1V AS SHOWN ON DRAWING G-8A.
10. WIDTH OF 1% SLOPE EAST OF CONSTRUCTION-PHASE DRAINAGE CHANNEL VARIES FROM 0 FEET ALONG SOUTHEAST CORNER OF CELL 8 TO FULL WIDTH EAST OF CELL 6.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW BY	APP BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMC	DHP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TEZ	JJA	LMC	DHP	RB
1A	-	NOT ISSUED	-	-	-	-	-
0	03.01.29	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	JAS	LMC	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	PBG	LMC	DCP	JFB
A	-	NOT ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: CELL PERIMETER DETAILS I

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

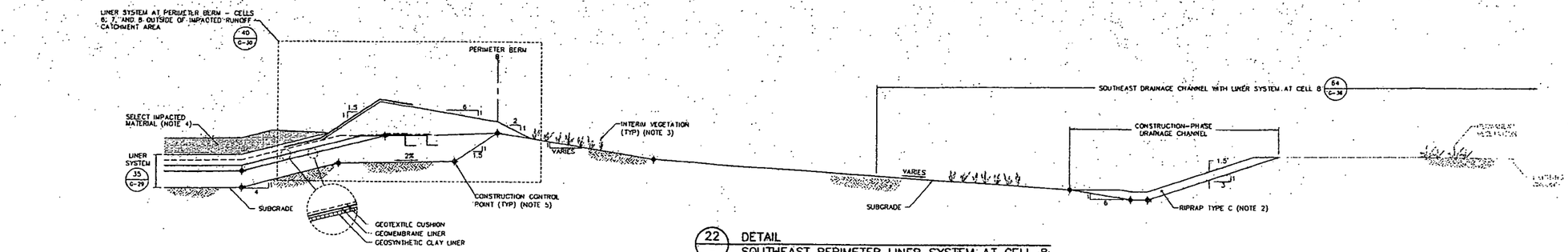
Rudolph Bonifarte
22 Jan 2009
DATE

STATE OF OHIO
RUDOLPH BONIFARTE
E-56678
REGISTERED
PROFESSIONAL ENGINEER

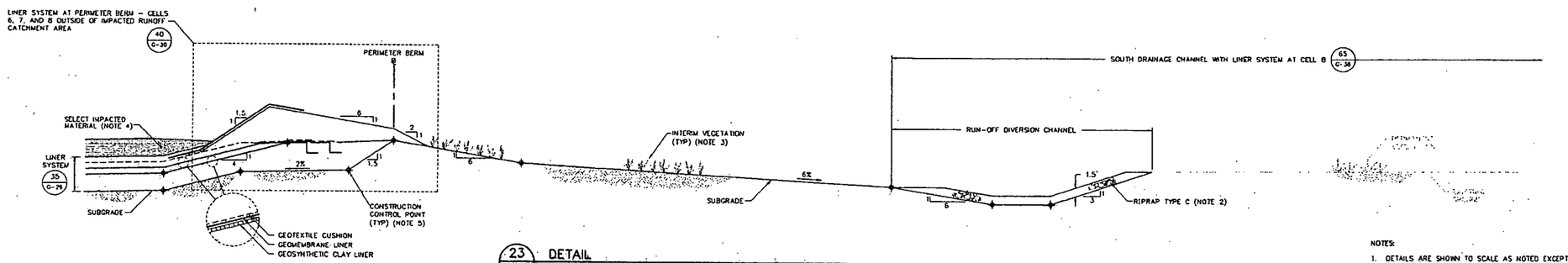
GeoSystems Consultants
1400 Lake Hearn Drive
Atlanta, Georgia 30319 USA

PROJECT NO.:	20105
CONTRACT NO.:	03F06699
TEMP DRAWING NO.:	90X-6000-C-00386
GEOSYNTEC PROJECT NO.:	603211-06.04
GEOSYNTEC DRAWING NO.:	703-1026
SHEET NO.:	G-26
REVISION NO.:	1

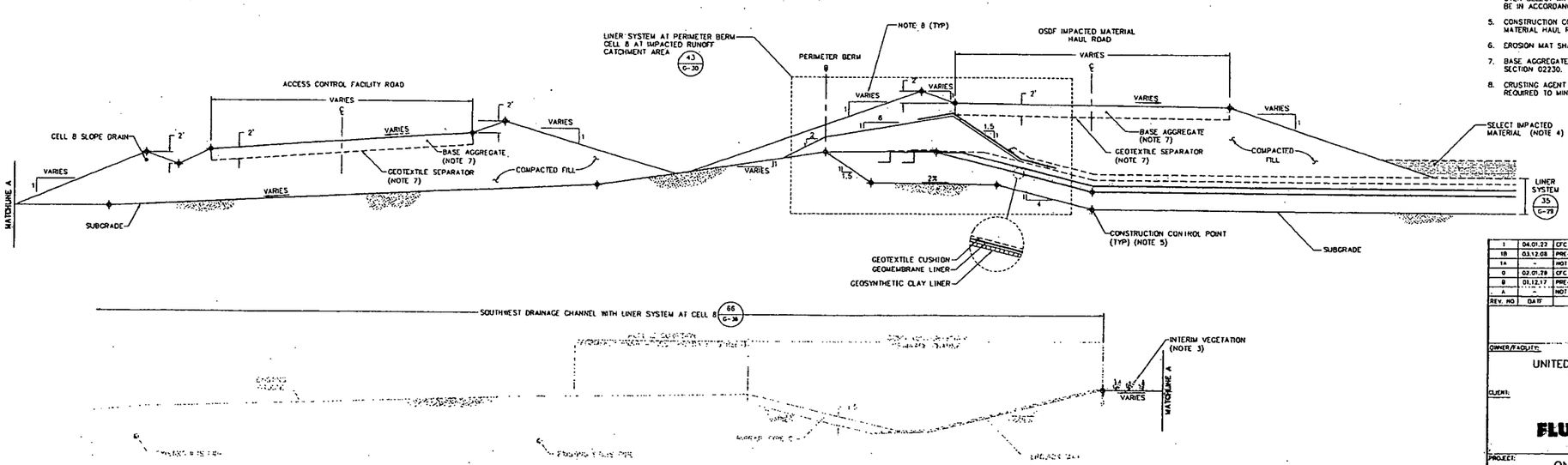
CERTIFIED-FOR-CONSTRUCTION



22 DETAIL
SOUTHEAST PERIMETER LINER SYSTEM AT CELL 8
SCALE: 1" = 8'



23 DETAIL
SOUTH PERIMETER LINER SYSTEM AT CELL 8
SCALE: 1" = 8'



25 DETAIL
SOUTHWEST PERIMETER LINER SYSTEM AT CELL 8
SCALE: 1" = 8'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
3. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
4. A MINIMUM THICKNESS OF 3 FEET OF SELECT IMPACTED MATERIAL SHALL BE PLACED ABOVE THE PROTECTIVE LAYER AND BELOW THE CONTOURING LAYER. THICKNESS OF SELECT IMPACTED MATERIAL MAY BE REDUCED TO 2 FEET IF THE FIRST LIFT OF IMPACTED MATERIAL TO BE PLACED OVER SELECT IMPACTED MATERIAL IS CATEGORY 1 IMPACTED MATERIAL. IMPACTED MATERIAL SHALL BE IN ACCORDANCE WITH SECTION 13010.
5. CONSTRUCTION CONTROL POINTS FOR SUBGRADE, COMPACTED CLAY LINER, AND OSDF IMPACTED MATERIAL HAUL ROAD ARE PROVIDED ON DRAWINGS G-6A, G-7A, AND G-18A.
6. EROSION MAT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
7. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
8. CRUSTING AGENT SHALL BE APPLIED TO OSDF IMPACTED HAUL ROAD EMBANKMENT SIDESLOPES AS REQUIRED TO MINIMIZE EROSION AND BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.

REV. NO	DATE	DESCRIPTION	DES. BY	DR BY	CHK. BY	RVW BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMC	DKP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TEZ	JJA	LMC	DKP	RB
1A	-	NOT ISSUED	-	-	-	-	-
0	02.01.28	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	JAS	LMC	DGP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	PBG	LMC	DGP	JFB
A	-	NOT ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY - PHASE V

TITLE:
CELL PERIMETER DETAILS II

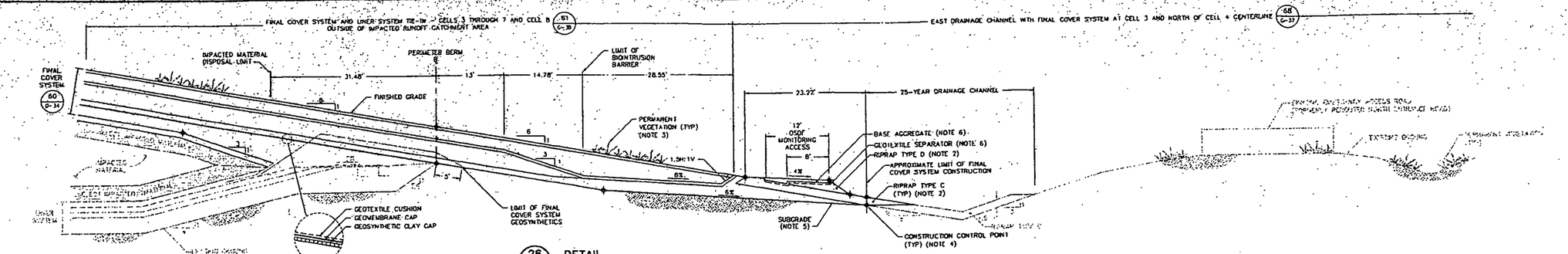
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

STATE OF OHIO
RUDOLPH BONAVENTURE
E-54879
PROFESSIONAL ENGINEER

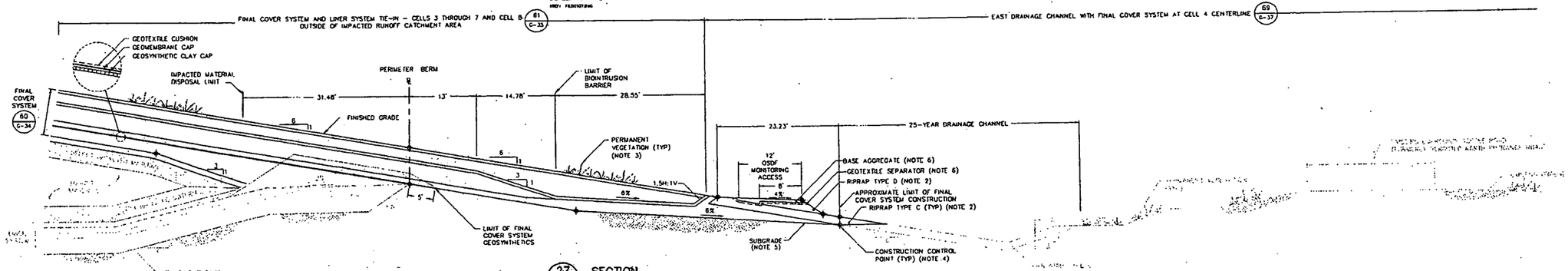
GEO SYNTEC CONSULTANTS

PROJECT NO.: 20105.
CONTRACT NO.: 03F06-99
TEMP DRAWING NO.: 90X-8000-G-00387
GEOSYNTEC PROJECT NO.: GS3211-06-04
GEOSYNTEC DOCUMENT NO.: F03-1027
SHEET NO.: G-25
REVISION NO.: 1

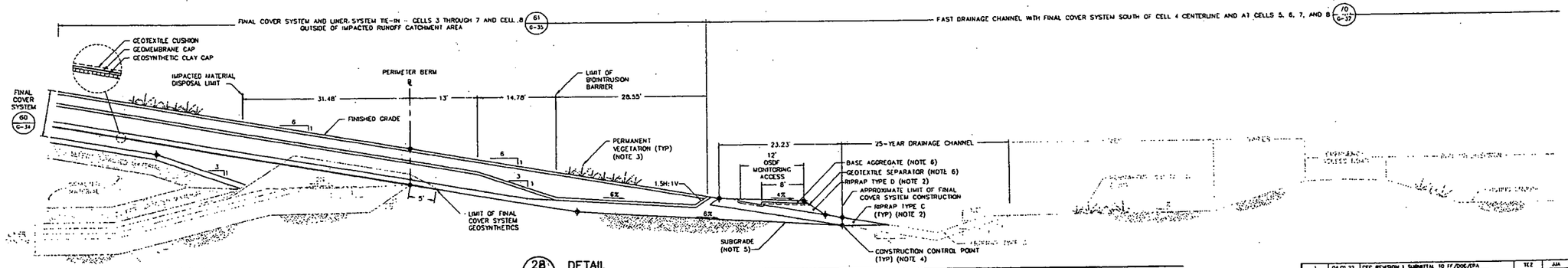
CERTIFIED FOR CONSTRUCTION



26 G-21 DETAIL
EAST PERIMETER FINAL COVER SYSTEM AT CELL 3 AND NORTH OF CELL 4 CENTERLINE
SCALE: 1" = 8'



27 G-21 SECTION
EAST PERIMETER FINAL COVER SYSTEM AT CELL 4 CENTERLINE
SCALE: 1" = 8'



28 G-22 DETAIL
EAST PERIMETER FINAL COVER SYSTEM SOUTH OF CELL 4 CENTERLINE AND AT CELLS 5, 6, 7, AND 8
SCALE: 1" = 8'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
3. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 07930.
4. CONSTRUCTION CONTROL POINTS FOR CONTOURING LAYER, COMPACTED CLAY CAP, AND FINAL COVER SYSTEM ARE PROVIDED ON DRAWINGS G-10 THROUGH G-15A.
5. RE-ESTABLISH SUBGRADE ELEVATIONS OUTSIDE PERIMETER BERM BASELINE PRIOR TO FINAL COVER SYSTEM CONSTRUCTION. CONSTRUCTION CONTROL POINTS FOR SUBGRADE ARE PROVIDED ON DRAWINGS G-3, G-4, G-6, AND G-6A.
6. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.

CERTIFIED-FOR-CONSTRUCTION

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMC	DKP	RB
1B	03.17.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TEZ	JJA	LMC	DKP	RB
1A	–	NOT ISSUED	–	–	–	–	–
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	JWO	LMC	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	PBC	LMC	DCP	JFB
A	–	NOT ISSUED	–	–	–	–	–

[redacted]

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

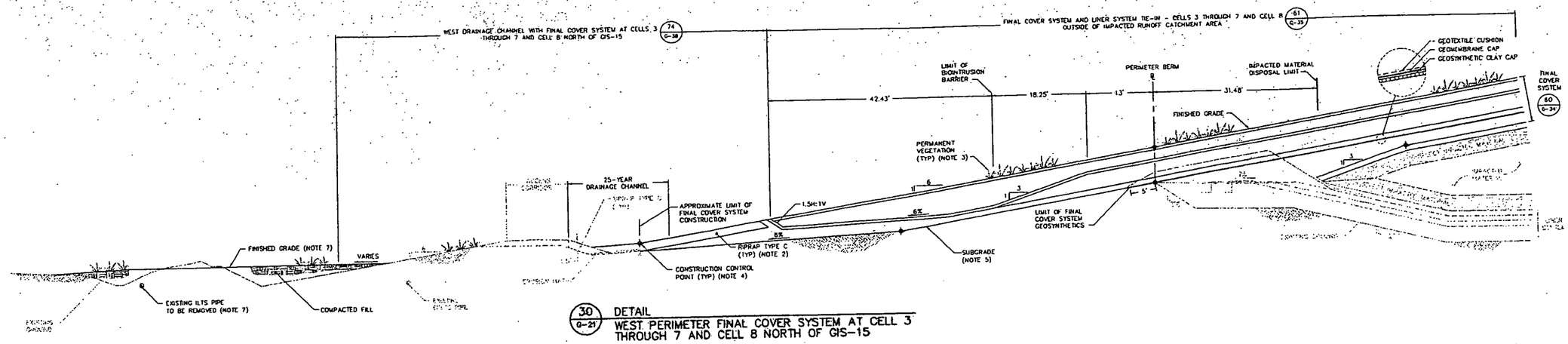
TITLE:
CELL PERIMETER DETAILS III

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDED OR CONSTRUCTION, UNLESS SEALED.

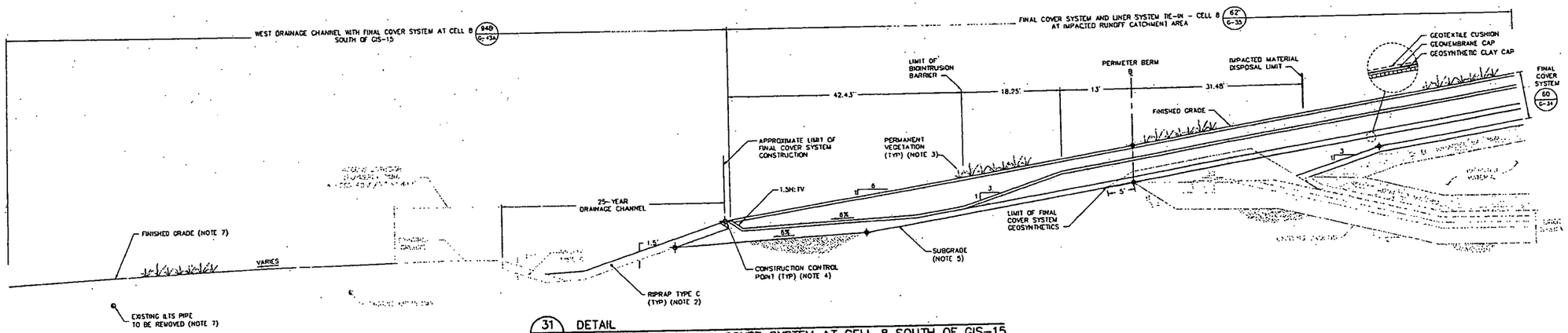
RUDOLPH BONAVENTE C-58576 REGISTERED PROFESSIONAL ENGINEER STATE OF OHIO

GEOSYNTEC CONSULTANTS

PROJECT NO.: 20106
CONTRACT NO.: 03F06199
FLUOR DANIEL WVNC NO.: 901-8093-C-00388
GEOSYNTEC PROJECT NO.: GG3211-06.04
GEOSYNTEC DOCUMENT NO.: FD-1108
SHEET NO.: G-26
REVISION NO.: 1



30 G-21 DETAIL
WEST PERIMETER FINAL COVER SYSTEM AT CELL 3 THROUGH 7 AND CELL 8 NORTH OF GIS-15
SCALE: 1" = 8'



31 G-23 DETAIL
WEST PERIMETER FINAL COVER SYSTEM AT CELL 8 SOUTH OF GIS-15
SCALE: 1" = 8'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
3. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
4. CONSTRUCTION CONTROL POINTS FOR CONTOURING LAYER, COMPACTED CLAY CAP, AND FINAL COVER SYSTEM ARE PROVIDED ON DRAWINGS G-10 THROUGH G-13A.
5. RE-ESTABLISH SUBGRADE ELEVATIONS OUTSIDE PERIMETER BERM BASELINE PRIOR TO FINAL COVER SYSTEM CONSTRUCTION. CONSTRUCTION CONTROL POINTS FOR SUBGRADE ARE PROVIDED ON DRAWINGS G-3, G-4, G-6, AND G-6A.
6. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
7. REMOVE EXISTING INTERIM LEACHATE TRANSMISSION SYSTEM PIPE AND TEMPORARY RUN-OFF DIVERSION BERM AFTER ADJACENT CELL CAPS ARE FULLY VEGETATED. PLACE COMPACTED FILL AS NECESSARY, TO PROVIDE POSITIVE DRAINAGE TO FORMER PRODUCTION AREA AND AWAY FROM OSDF FACILITY.

CERTIFIED-FOR-CONSTRUCTION

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMC	DKP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TEZ	JJA	LMC	DKP	RB
1A	-	NOT ISSUED	-	-	-	-	-
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	JAS	LMC	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	PBC	LMC	DCP	JFB
A	-	NOT ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY - PHASE V

TITLE: CELL PERIMETER DETAILS IV

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDING OR CONSTRUCTION, UNLESS SEALED.

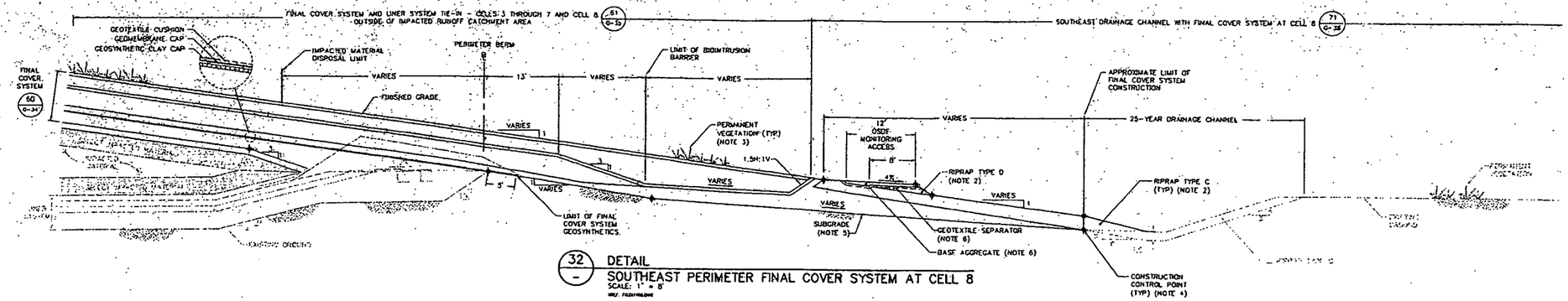
RUDOLPH BONAVENTURE E-56429 REGISTERED PROFESSIONAL ENGINEER STATE OF OHIO

SIGNATURE
22 Jan 09
DATE

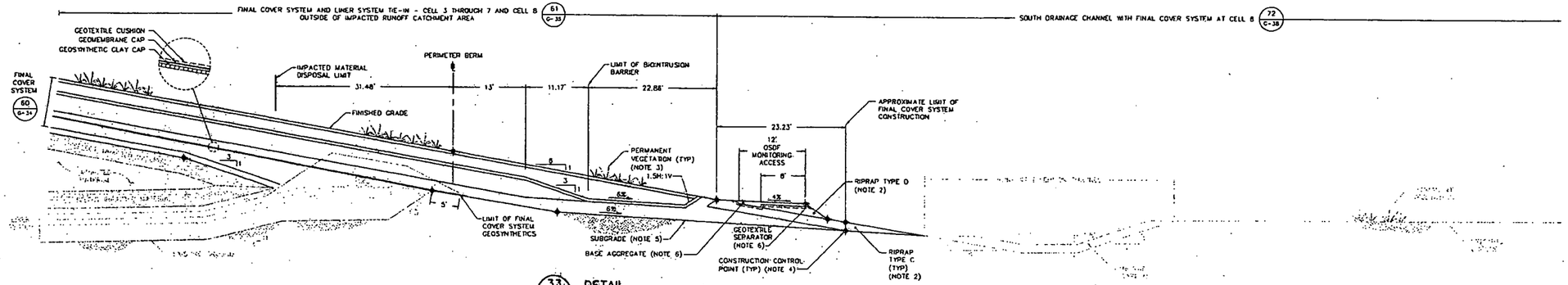
GEO SYNTHETIC CONSULTANTS
1988 CENTENNIAL BLVD
ATLANTA, GEORGIA 30329 USA

SEAL

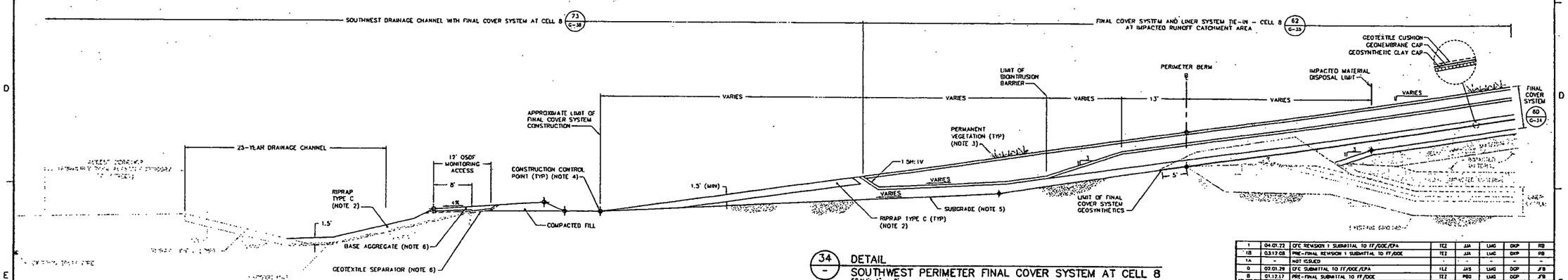
PROJECT NO.:	20105
CONTRACT NO.:	03F0699
TEMP DRAWING NO.:	903-8050-C-00389
GEOSYNTEC PROJECT NO.:	GC3217-06-04
GEOSYNTEC DOCUMENT NO.:	FCS-1028
SHEET NO.:	G-22
REVISION NO.:	1



32 / - DETAIL
SOUTHEAST PERIMETER FINAL COVER SYSTEM AT CELL 8
SCALE: 1" = 8'



33 / G-20A DETAIL
SOUTH PERIMETER FINAL COVER SYSTEM AT CELL 8
SCALE: 1" = 8'



34 / - DETAIL
SOUTHWEST PERIMETER FINAL COVER SYSTEM AT CELL 8
SCALE: 1" = 8'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
3. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
4. CONSTRUCTION CONTROL POINTS FOR CONTOURING LAYER, COMPACTED CLAY CAP, AND FINAL COVER SYSTEM ARE PROVIDED ON DRAWINGS G-11, G-13A, AND G-15A.
5. RE-ESTABLISH SUBGRADE ELEVATIONS OUTSIDE PERIMETER BERM BASELINE PRIOR TO FINAL COVER SYSTEM CONSTRUCTION. CONSTRUCTION CONTROL POINTS FOR SUBGRADE ARE PROVIDED ON DRAWING G-6A.
6. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.

CERTIFIED-FOR-CONSTRUCTION

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMC	DKP	RB
1B	03.17.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TEZ	JJA	LMC	DKP	RB
1A	-	NOT ISSUED	-	-	-	-	-
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	ILZ	JAS	LMC	DGP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	PBG	LMC	DGP	JFB
A	-	NOT ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY - PHASE V

TITLE:
CELL PERIMETER DETAILS V

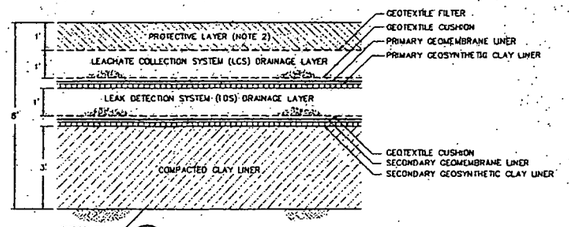
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDER OR CONSTRUCTION UNLESS SEALED.

Rudolph Bonaparte
SIGNATURE
Jul. 7, 2004
DATE

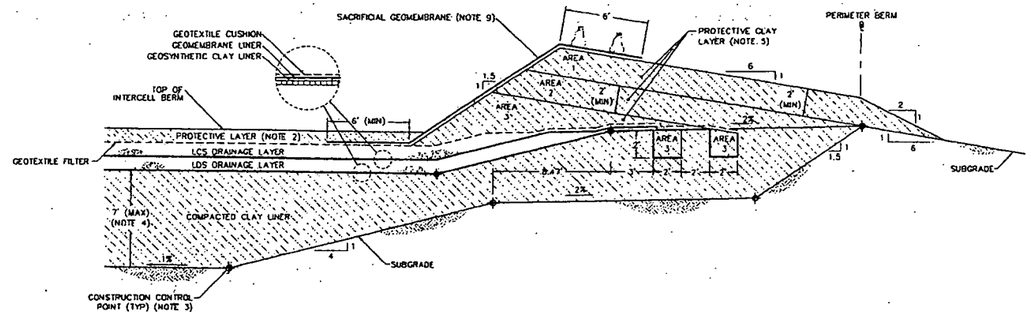
STATE OF OHIO
RUDOLPH BONAPARTE
E-50878
REGISTERED
PROFESSIONAL ENGINEER

GeoSyntec Consultants
900 LAKESIDE AVE. DRIVE
ATLANTA, GEORGIA 30317-1641

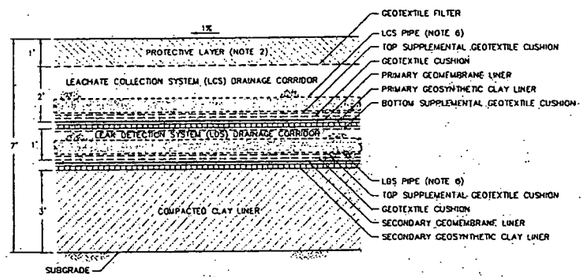
PROJECT NO.:	20105
CONTRACT NO.:	03FF0699
TEMP DRAWING NO.:	901-5000-G-00390
GEOSYNTEC PROJECT NO.:	003201-05 (F)
GEOSYNTEC DOCUMENT NO.:	FD4-1030
SHEET NO.:	G-28
REVISION NO.:	-



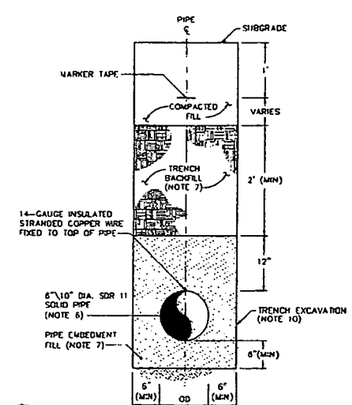
35 / G-24 DETAIL
LINER SYSTEM
SCALE: 1" = 2'



36 / – DETAIL
LINER SYSTEM AT INTERCELL BERM AND PERIMETER BERM INTERSECTION
SCALE: 1" = 4'



37 / – DETAIL
LINER SYSTEM WITH LCS AND LDS PIPES
SCALE: 1" = 2'



39 / G-32 DETAIL
LDS, LCS, OR RLCS PIPE EMBEDMENT
SCALE: 1" =

LINER SYSTEM COMPONENT SUMMARY

GEOSYNTHETICS (NOTE 8)		
SYMBOL	COMPONENT	SPECIFICATION SECTION
	PRIMARY GEOMEMBRANE LINER	02770
	SECONDARY GEOMEMBRANE LINER	02770
	PRIMARY GEOSYNTHETIC CLAY LINER	02772
	SECONDARY GEOSYNTHETIC CLAY LINER	02772
	GEOTEXTILE FILTER	02714
	GEOTEXTILE CUSHION	02714
	SUPPLEMENTAL GEOTEXTILE CUSHION	02714

SOILS		
SYMBOL	COMPONENT	SPECIFICATION SECTION
	SUBGRADE	02200
	COMPACTED CLAY LINER/ PROTECTIVE CLAY LAYER	02225
	LDS DRAINAGE LAYER	02710
	LDS DRAINAGE CORRIDOR	02710
	LCS DRAINAGE LAYER	02710
	LCS DRAINAGE CORRIDOR	02710
	PROTECTIVE LAYER (IMPACTED)	13010
	PROTECTIVE LAYER (NON-IMPACTED GRANULAR)	02240
	PROTECTIVE LAYER (NON-IMPACTED NON-GRANULAR)	02240

NOTES:

1. DETAILS ARE SHOW TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCE SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED GRANULAR MATERIAL IN IMPACTED RUNOFF CATCHMENT AREA AND IMPACTED MATERIAL IN REMAINING ACTIVE CELL AREAS, EXCLUDING CELL AREA AT INTERCELL BERM TEMPORARY LINER SYSTEM TERMINATION. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED NON-GRANULAR MATERIAL IN ACTIVE AND FUTURE CELL AREAS OF TEMPORARY LINER SYSTEM TERMINATION. NON-IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02240. IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
3. CONSTRUCTION CONTROL POINTS FOR SUBGRADE AND COMPACTED CLAY LINER ARE PROVIDED ON DRAWINGS G-4, G-6, G-6A, G-7, AND G-7A.
4. THICKNESS OF COMPACTED CLAY LINER ALONG CENTERLINE OF INTERCELL BERM VARIES FROM A MINIMUM OF 3 FEET TO A MAXIMUM OF 7 FEET.
5. PROTECTIVE CLAY LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02225. EQUIPMENT USED ABOVE GEOMEMBRANE LINER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02770.
6. LDS, LCS, AND RLCS PIPES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02605.
7. TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
8. GEOSYNTHETICS FOR LINER SYSTEM WILL BE SUPPLIED BY FLOUR FERNALD, INC. AS SPECIFIED IN CONSTRUCTION WORK CONTROL TRAVELER PACKAGE DOCUMENTS.
9. SACRIFICIAL GEOMEMBRANE SHALL CONSIST OF HIGH DENSITY POLYETHYLENE APPROVED BY CONSTRUCTION MANAGER AND PROVIDED BY FLOUR FERNALD, INC. SECURE IN PLACE SACRIFICIAL GEOMEMBRANE WITH SANDBAGS TO PREVENT DAMAGE BY WIND.
10. TRENCH EXCAVATION SHOWN VERTICAL AS DESIGNED. SHORING AND/OR STABLE TRENCH SIDE SLOPES SHALL BE MAINTAINED FOR SAFETY AND TO PROTECT ADJACENT UTILITIES AND STRUCTURES IN ACCORDANCE WITH SPECIFICATION SECTION 02215.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	SVW BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TE2	JAA	LWG	DKP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TE2	JAA	LWG	DKP	RB
1A	-	NOT ISSUED	-	-	-	-	-
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWO	LVG	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TE2	JWO	LWG	DCP	JFB
A	-	NOT ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
LINER SYSTEM DETAILS I

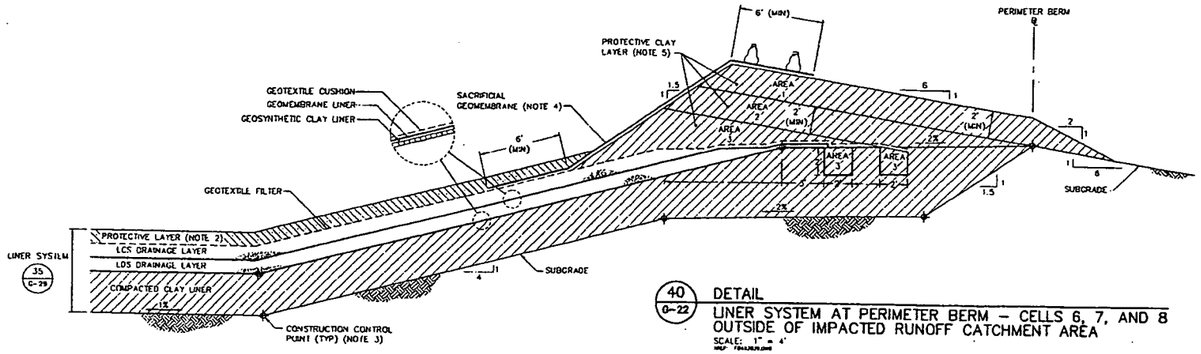
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

STATE OF OHIO — RUDOLPH BONAPARTE — E-56678 — REGISTERED PROFESSIONAL ENGINEER

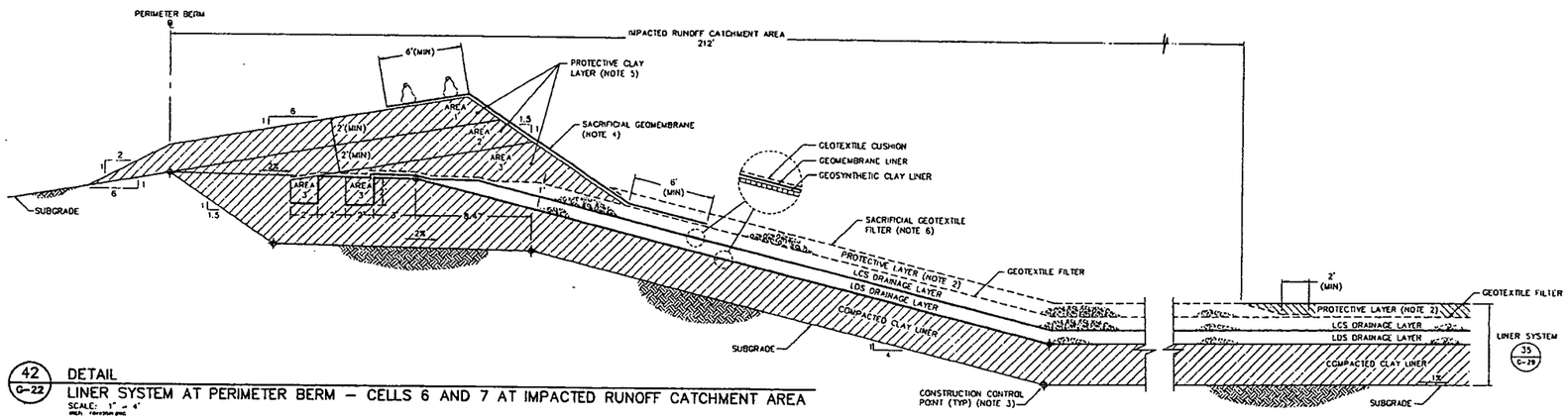
GEOSYNTEC CONSULTANTS
1900 CLEAT AVENUE, SUITE 1000
LAFAYETTE, CALIFORNIA 94549 USA

PROJECT NO:	20105
CONTRACT NO:	03J10890
TEMP DRAWING NO:	902-5000-G-00391
GEOSYNTEC PROJECT NO:	GO3211-09.04
GEOSYNTEC DOCUMENT NO:	F03-1031
SHEET NO:	G-39
REVISION NO:	-

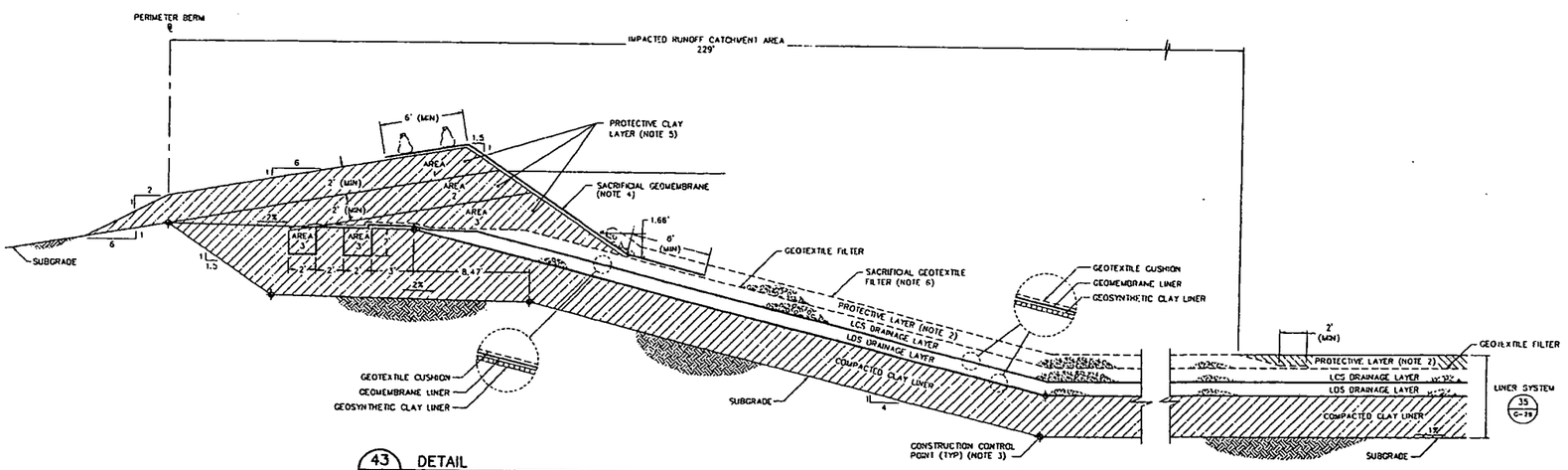
CERTIFIED–FOR–CONSTRUCTION



40 / G-22 DETAIL
LINER SYSTEM AT PERIMETER BERM – CELLS 6, 7, AND 8 OUTSIDE OF IMPACTED RUNOFF CATCHMENT AREA
SCALE: 1" = 4'



42 / G-22 DETAIL
LINER SYSTEM AT PERIMETER BERM – CELLS 6 AND 7 AT IMPACTED RUNOFF CATCHMENT AREA
SCALE: 1" = 4'



43 / G-23A DETAIL
LINER SYSTEM AT PERIMETER BERM – CELL 8 AT IMPACTED RUNOFF CATCHMENT AREA
SCALE: 1" = 4'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED GRANULAR MATERIAL IN IMPACTED RUNOFF CATCHMENT AREA AND IMPACTED MATERIAL IN REMAINING ACTIVE CELL AREAS EXCLUDING CELL AREA AT INTERCELL BERM TEMPORARY LINER SYSTEM TERMINATION. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED NON-GRANULAR MATERIAL IN ACTIVE AND FUTURE CELL AREAS OF TEMPORARY LINER SYSTEM TERMINATION. NON-IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02240. IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
3. CONSTRUCTION CONTROL POINTS FOR SUBGRADE AND COMPACTED CLAY LINER ARE PROVIDED ON DRAWINGS G-4, G-6, G-6A, G-7, G-7A.
4. SACRIFICIAL GEOMEMBRANE SHALL CONSIST OF HIGH DENSITY POLYETHYLENE, AS APPROVED BY CONSTRUCTION MANAGER AND PROVIDED BY FLUOR FERNALD, INC. SECURE IN-PLACE SACRIFICIAL GEOMEMBRANE WITH SANDBAGS TO PREVENT DAMAGE FROM WIND.
5. PROTECTIVE CLAY LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02225. EQUIPMENT USED ABOVE GEOMEMBRANE LINER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02770.
6. SACRIFICIAL GEOTEXTILE FILTER SHALL BE INSTALLED OVER GRANULAR PROTECTIVE LAYER WITHIN IMPACTED RUNOFF CATCHMENT AREA.

REV. NO.	DATE	DESCRIPTION	DFT. BY	DP. BY	CHK. BY	RVW. BY	APR. BY
2	05.02.15	CFC REVISION 2 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMC	DKP	JFB
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMC	DKP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TEZ	JJA	LMC	DKP	RB
1A	–	NOT ISSUED					–
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWO	KRD	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DCP	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	JWO	LMC	DCP	JFB

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
LINER SYSTEM DETAILS II

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDER OR CONSTRUCTION, UNLESS SEALED.

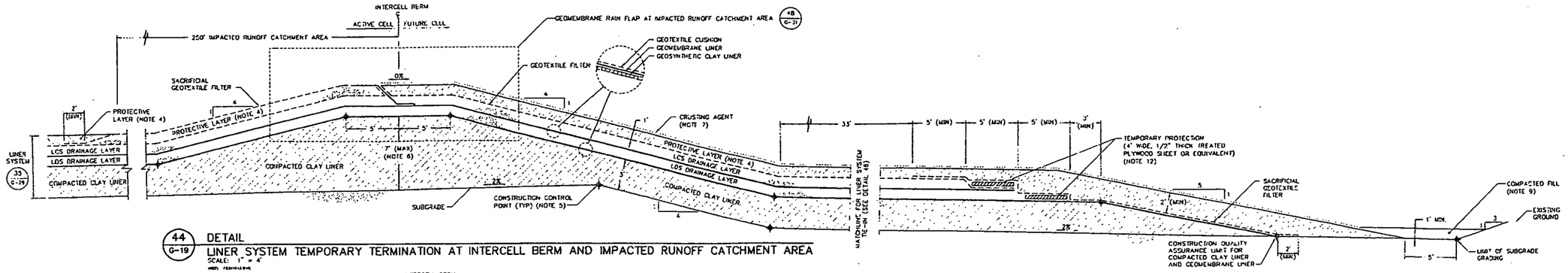
SIGNATURE
DATE: 15/21/2005

STATE OF OHIO
JOHN J. DECOW
E-58246
REGISTERED PROFESSIONAL ENGINEER
SEAL

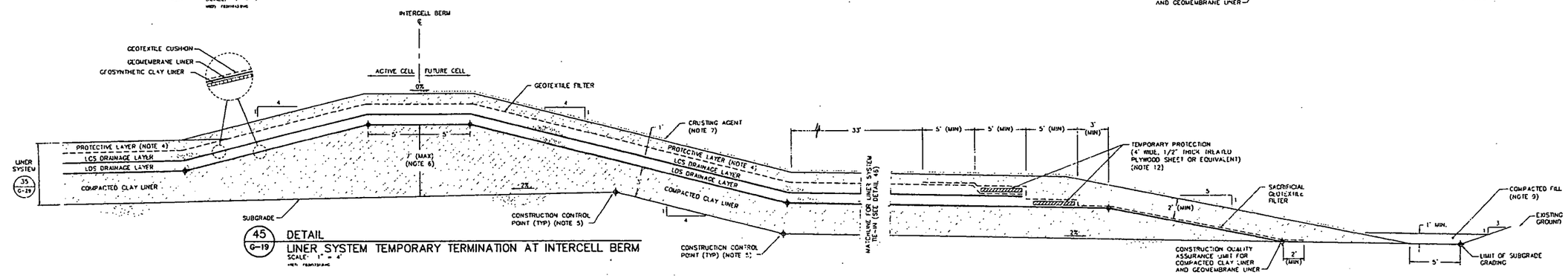
GEOSYNTEC CONSULTANTS
1253 HOBART ROAD, HILLIARD OH 43026 USA

PROJECT NO.:	20103
CONTRACT NO.:	03F10699
FLWP DRAWING NO.:	90X-6000-G-00392
GEOSYNTEC PROJECT NO.:	GO1309-02.07
GEOSYNTEC DOCUMENT NO.:	FC4-2038
SHEET NO.:	G-30
REVISION NO.:	2

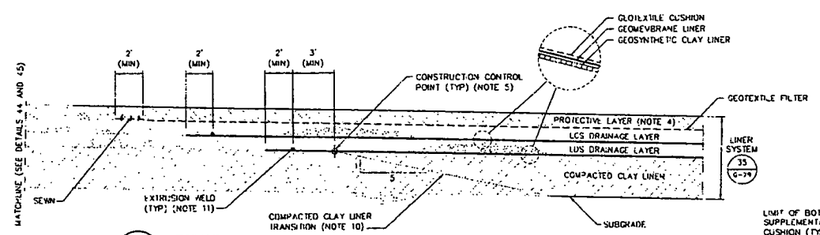
CERTIFIED–FOR–CONSTRUCTION



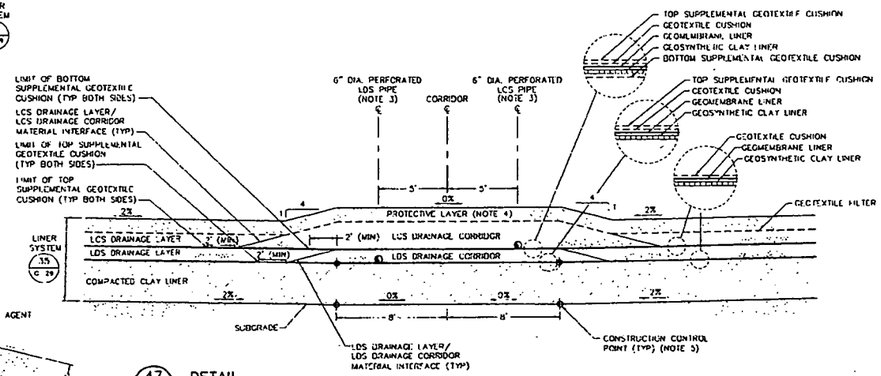
44 G-19 DETAIL
LINER SYSTEM TEMPORARY TERMINATION AT INTERCELL BERM AND IMPACTED RUNOFF CATCHMENT AREA
SCALE: 1" = 4'



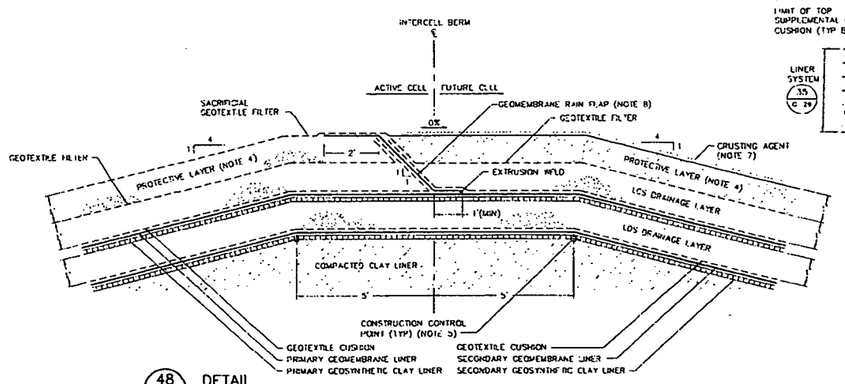
45 G-19 DETAIL
LINER SYSTEM TEMPORARY TERMINATION AT INTERCELL BERM
SCALE: 1" = 4'



46 G-19 DETAIL
LINER SYSTEM TIE-IN AT EXISTING TEMPORARY TERMINATION
SCALE: 1" = 4'



47 G-19 DETAIL
LINER SYSTEM AT LEACHATE COLLECTION AND LEAK DETECTION CORRIDOR
SCALE: 1" = 4'



48 G-31 DETAIL
GEOMEMBRANE RAIN FLAP AT IMPACTED RUNOFF CATCHMENT AREA
SCALE: 1" = 2'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. MATERIAL IN DRAINAGE LAYERS AND DRAINAGE CORRIDORS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02710.
3. LDS AND LCS PIPES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02605.
4. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED GRANULAR MATERIAL IN IMPACTED RUNOFF CATCHMENT AREA AND IMPACTED MATERIAL IN REMAINING ACTIVE CELL AREAS EXCLUDING ACTIVE CELL AREA AT INTERCELL BERM TEMPORARY LINER SYSTEM TERMINATION. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED NON-GRANULAR MATERIAL IN ACTIVE AND FUTURE CELL AREAS OF TEMPORARY LINER SYSTEM TERMINATION. NON-IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02240. IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
5. CONSTRUCTION CONTROL POINTS FOR SUBGRADE AND COMPACTED CLAY LINER ARE PROVIDED ON DRAWINGS G-4, G-6, G-6A, G-7, AND G-7A.
6. THICKNESS OF COMPACTED CLAY LINER ALONG CENTERLINE OF INTERCELL BERM VARIES FROM A MINIMUM OF 3 FEET TO A MAXIMUM OF 7 FEET.
7. CRUSTING AGENT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270
8. RAIN FLAP SHALL BE CONTINUOUSLY EXTRUSION WELDED TO PRIMARY GEOMEMBRANE LINER ALONG INTERCELL BERM. FLAP SHALL RE-TIE TO GEOMEMBRANE AT CREST OF PERIMETER BERM AND EXTEND 212 FEET EAST FROM WEST PERIMETER BERM BASELINE.
9. PLACE COMPACTED FILL TO PROVIDE POSITIVE DRAINAGE TO TEMPORARY DRAINAGE CHANNEL.
10. TRANSITION FROM EXISTING FULL-DEPTH SECTION OF COMPACTED CLAY LINER TO ADJACENT SECTION OF COMPACTED CLAY LINER SECTION SHALL BE CONSTRUCTED IN ACCORDANCE WITH SPECIFICATION SECTION 02225.
11. REMOVE DAMAGED PORTION OF EXISTING GEOMEMBRANE LINER BY CUTTING PRIOR TO INSTALLATION OF NEW GEOMEMBRANE LINER.
12. EXTEND SECONDARY GEOMEMBRANE LINER ONLY BEYOND TEMPORARY PROTECTION. GEOSYNTHETIC CLAY LINER AND GEOTEXTILE CUSHION COMPONENTS DO NOT CONTINUE PAST THE TEMPORARY PROTECTION.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	VDR	LMC	DCP	JSD
1B	03.12.06	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TEZ	VDR	LMC	DCP	RB
1A	-	NOT ISSUED	-	-	-	-	-
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	VDR	LMC	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	JMD	LMC	DCP	JFB
A	06.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	JMD	LMC	DCP	JFB

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
LINER SYSTEM DETAILS III

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDER OR CONSTRUCTION, UNLESS SEALED

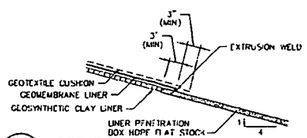
Rudolph Bonaparte
SIGNATURE
22 January 04
DATE

STATE OF OHIO
RUDOLPH BONAPARTE
E-58879
REGISTERED PROFESSIONAL ENGINEER

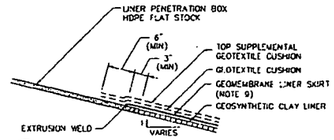
GEOSYNTEC CONSULTANTS
1000 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

PROJECT NO.:	20105
CONTRACT NO.:	03F0699
TEMP DRAWING NO.:	00X-5000-G-00303
GEOSYNTEC PROJECT NO.:	GS3211-05.04
GEOSYNTEC DOCUMENT NO.:	703-1032
SHEET NO.:	G-31
REVISION NO.:	1

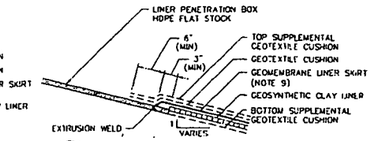
CERTIFIED–FOR–CONSTRUCTION



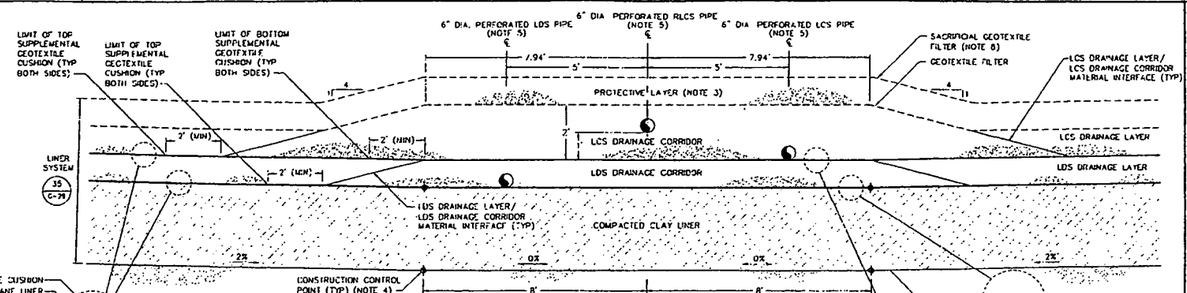
49 G-32 DETAIL
LINER SYSTEM GEOSYNTHETICS TERMINATION TYPE I AT LINER PENETRATION
SCALE: 1" = 1'



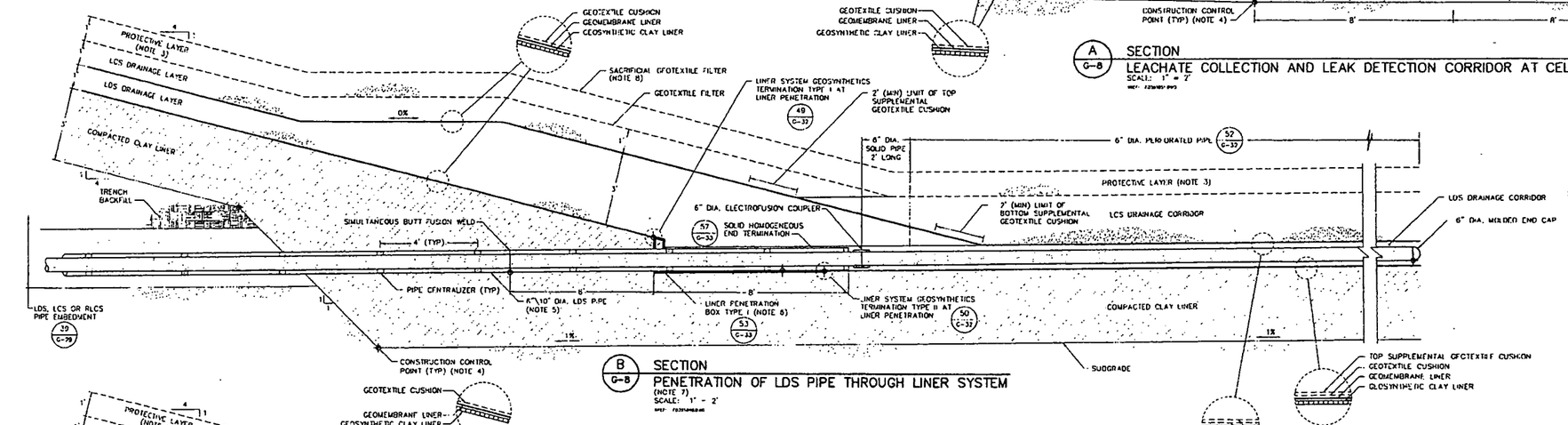
50 G-32 DETAIL
LINER SYSTEM GEOSYNTHETICS TERMINATION TYPE II AT LINER PENETRATION
SCALE: 1" = 1'



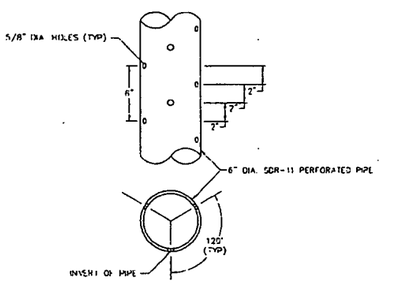
51 G-32 DETAIL
LINER SYSTEM GEOSYNTHETICS TERMINATION TYPE III AT LINER PENETRATION
SCALE: 1" = 1'



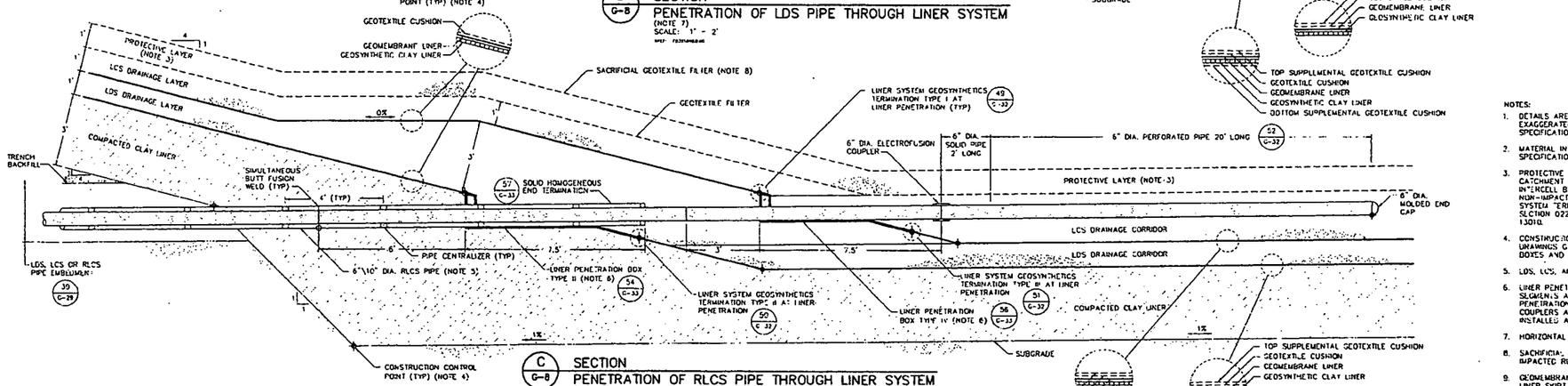
A G-8 SECTION
LEACHATE COLLECTION AND LEAK DETECTION CORRIDOR AT CELL OUTLET
SCALE: 1" = 2'



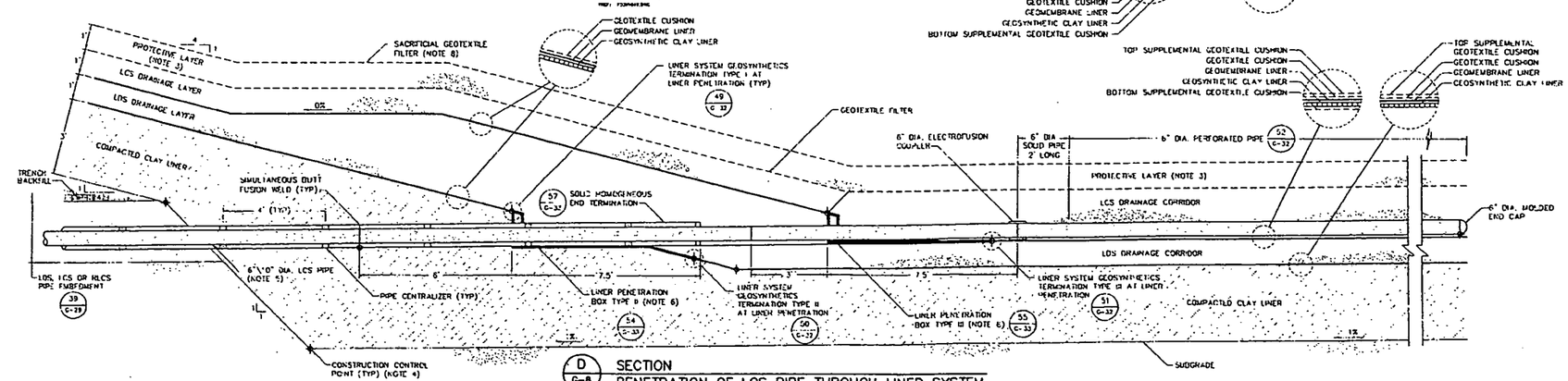
B G-8 SECTION
PENETRATION OF LDS PIPE THROUGH LINER SYSTEM
(NOTE 7)
SCALE: 1" = 2'



52 G-32 DETAIL
6-INCH PERFORATED PIPE
SCALE: 1" = 6"



C G-8 SECTION
PENETRATION OF RLCS PIPE THROUGH LINER SYSTEM
(NOTE 7)
SCALE: 1" = 2'



D G-8 SECTION
PENETRATION OF LCS PIPE THROUGH LINER SYSTEM
(NOTE 7)
SCALE: 1" = 2'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. MATERIAL IN DRAINAGE LAYERS AND DRAINAGE CORRIDORS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02710.
3. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED GRANULAR MATERIAL IN IMPACTED RUNOFF CATCHMENT AREA AND IMPACTED MATERIAL IN REMAINING CELL AREAS EXCLUDING CELL AREA AT INTERCELL BERM TEMPORARY LINER SYSTEM TERMINATION. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED NON-GRANULAR MATERIAL IN ACTIVE AND FUTURE CELL AREAS OF TEMPORARY LINER SYSTEM TERMINATION. NON-IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02240. IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
4. CONSTRUCTION CONTROL POINTS FOR SUBGRADE AND COMPACTED CLAY LINER ARE PROVIDED ON DRAWINGS G-4, G-5, G-6A, G-7, AND G-7A. CONSTRUCTION CONTROL POINTS FOR LINER PENETRATION BOXES AND LDS, LCS, AND RLCS PIPES ARE PROVIDED ON DRAWINGS G-8 AND G-9.
5. LDS, LCS, AND RLCS PIPES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02605.
6. LINER PENETRATION BOXES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13005. 6-INCH PIPE SEGMENTS AND SOLID HOMOGENEOUS END TERMINATIONS SHALL BE FACTORY WELDED TO LINER PENETRATION BOXES AND EXTEND BETWEEN SIMULTANEOUS BUTT FUSION WELDS AND ELECTROFUSION COUPLERS AS SHOWN. SOLID HOMOGENEOUS END TERMINATIONS AND PIPE CENTRALIZERS SHALL BE INSTALLED AS SHOWN AND IN ACCORDANCE WITH SPECIFICATION SECTION 02605.
7. HORIZONTAL MONITORING WELL IS NOT SHOWN IN THIS SECTION FOR CLARITY.
8. SACRIFICIAL GEOTEXTILE FILTER SHALL BE INSTALLED OVER GRANULAR PROTECTIVE LAYER WITHIN IMPACTED RUNOFF CATCHMENT AREA.
9. GEOMEMBRANE LINER SKIRT SHALL BE FACTORY WELDED TO LINER PENETRATION BOX. GEOMEMBRANE LINER SKIRT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02770 AND WILL BE PROVIDED BY FLUOR FERNALD, INC. GEOMEMBRANE LINER SKIRT SHALL BE A MINIMUM 7 FEET WIDE BY 7 FEET LONG.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	VDR	LMG	DKP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TEZ	VDR	LMG	DKP	RB
1A	–	NOT ISSUED	–	–	–	–	–
0	02.09.99	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	JWO	LMG	DKP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	JWO	LMG	DKP	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	JWO	LMG	DKP	JFB

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
LINER SYSTEM DETAILS IV

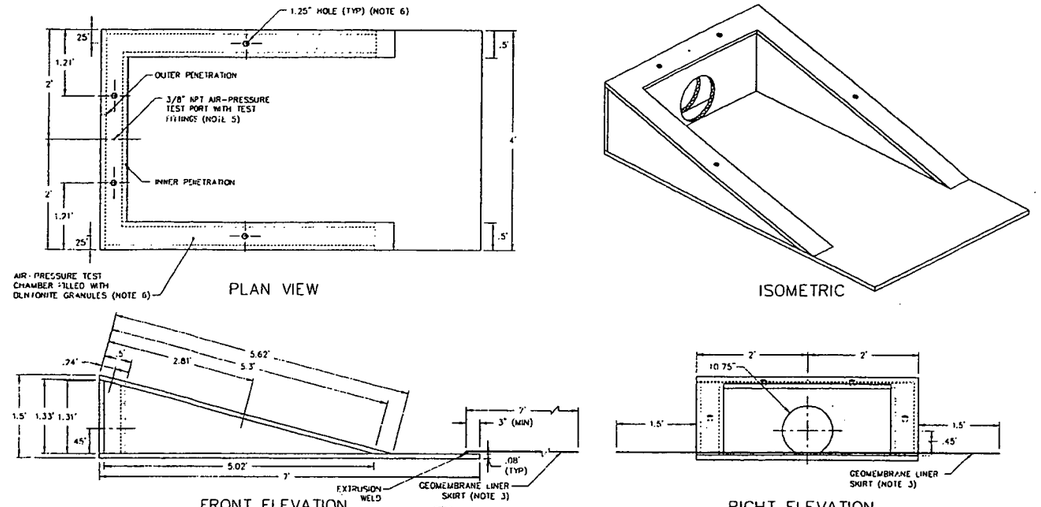
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

STATE OF OHIO — RUDOLPH BONAPARTE — E-56879 — REGISTERED PROFESSIONAL ENGINEER

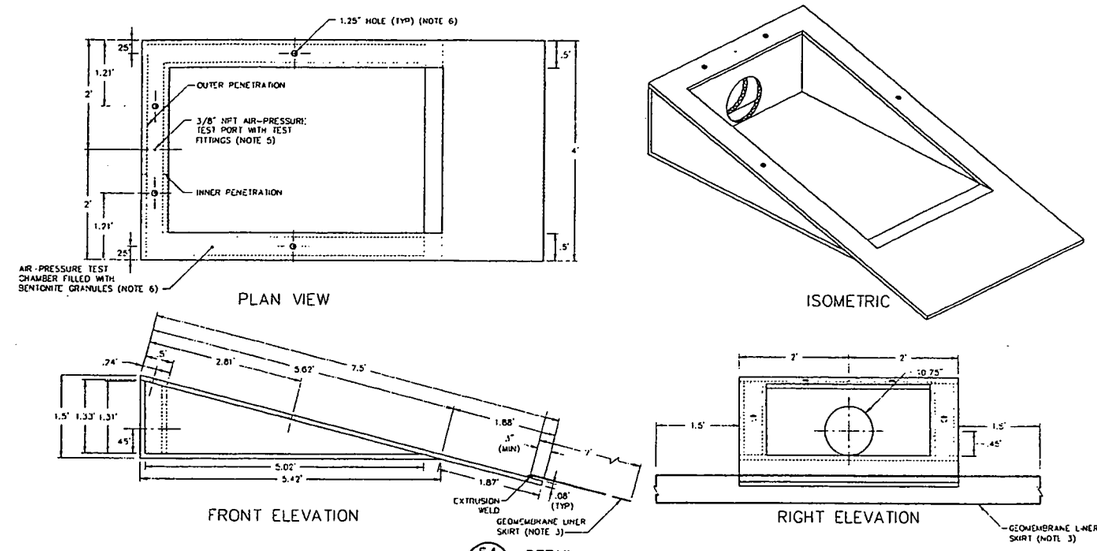
GEOSYNTEC CONSULTANTS

PROJECT NO:	20105
CONTRACT NO:	DJFF0695
FCMP DRAWING NO:	02X-0000-G-00394
GEOSYNTEC PROJECT NO:	GD3211-06.04
GEOSYNTEC DOCUMENT NO:	F03-1033
SHEET NO:	G-32
REVISION NO:	1

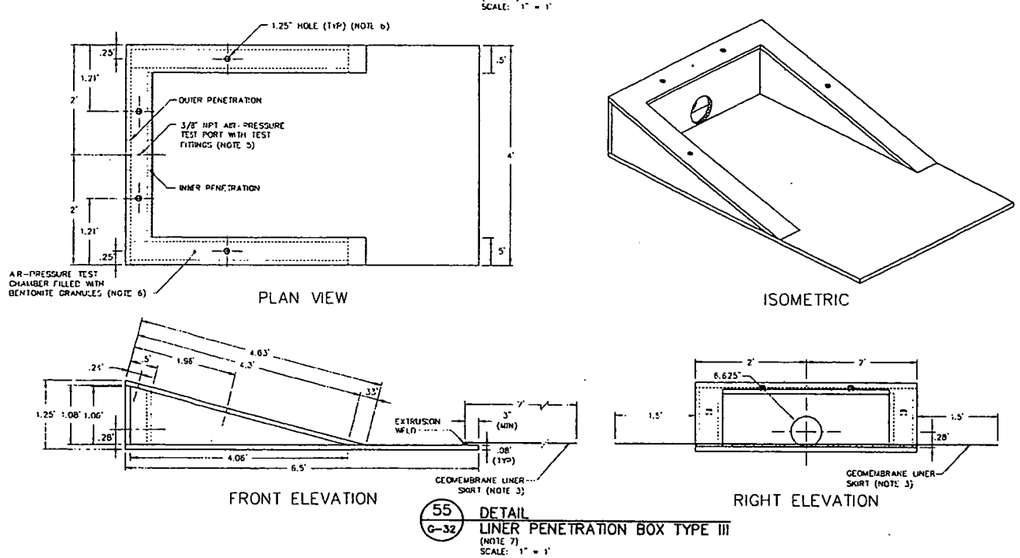
CERTIFIED-FOR-CONSTRUCTION



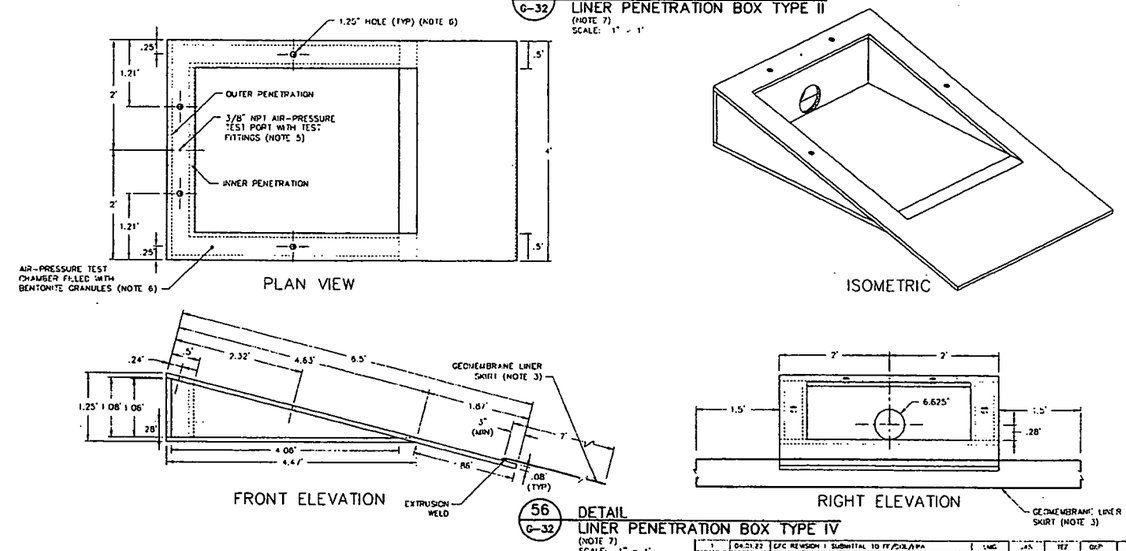
53 G-32 DETAIL
LINER PENETRATION BOX TYPE I
(NOTE 7)
SCALE: 1" = 1'



54 G-32 DETAIL
LINER PENETRATION BOX TYPE II
(NOTE 7)
SCALE: 1" = 1'



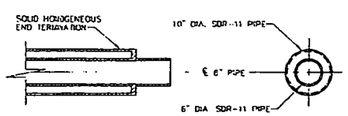
55 G-32 DETAIL
LINER PENETRATION BOX TYPE III
(NOTE 7)
SCALE: 1" = 1'



56 G-32 DETAIL
LINER PENETRATION BOX TYPE IV
(NOTE 7)
SCALE: 1" = 1'

NOTES:

1. LINER PENETRATION BOXES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13005.
2. 6-INCH PIPE SEGMENTS AND SOLID HOMOGENEOUS END TERMINATIONS SHALL BE FACTORY WELDED TO LINER PENETRATION BOXES WITH LENGTHS SHOWN ON DRAWING G-32. PIPES ARE NOT SHOWN ON THIS DRAWING FOR CLARITY. SOLID HOMOGENEOUS END TERMINATIONS AND PIPE CENTRALIZERS SHALL BE INSTALLED AS SHOWN ON DRAWING G-32 AND IN ACCORDANCE WITH SPECIFICATION SECTION 02605.
3. GEOMEMBRANE LINER SKIRT SHALL BE FACTORY WELDED TO LINER PENETRATION BOX. GEOMEMBRANE LINER SKIRT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02770 AND WILL BE PROVIDED BY FLUOR FERNALD, INC. GEOMEMBRANE LINER SKIRT SHALL BE A MINIMUM 7 FEET WIDE BY 7 FEET LONG. THE EXTRUSION WELDS SHALL BE TESTED PRIOR TO DELIVERY.
4. LINER PENETRATION BOXES SHALL BE CONSTRUCTED USING 1-INCH THICK HDPE FLAT STOCK.
5. LINER PENETRATION BOXES AND ATTACHED CONTAINMENT PIPING SHALL BE AIR-PRESSURE TESTED IN FIELD AFTER INSTALLATION.
6. AIR-PRESSURE TEST CHAMBER SHALL BE BACKFILLED WITH BENTONITE GRANULES USING 1.25-INCH HOLES AFTER AIR-PRESSURE TESTING IS COMPLETED. EACH HOLE SHALL BE SEALED WITH HDPE EXTRUDATE AFTER BENTONITE FILLING IS COMPLETED.
7. GEOMEMBRANE LINER SKIRT IS NOT SHOWN ON PLAN AND ISOMETRIC VIEWS FOR CLARITY.



57 G-32 DETAIL
SOLID HOMOGENEOUS END TERMINATION
SCALE: 1" = 1'

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.21.03	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	LMC	JAS	TEZ	DCP	RB
1B	-	NOT ISSUED	-	-	-	-	-
1A	-	NOT ISSUED	-	-	-	-	-
0	02.01.00	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	JMD	LMC	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	JMD	LMC	DCP	JFB
A	09.10.02	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	JMD	LMC	DCP	JFB

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: LINER SYSTEM DETAILS V

THIS DRAWING MAY NOT BE USED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED

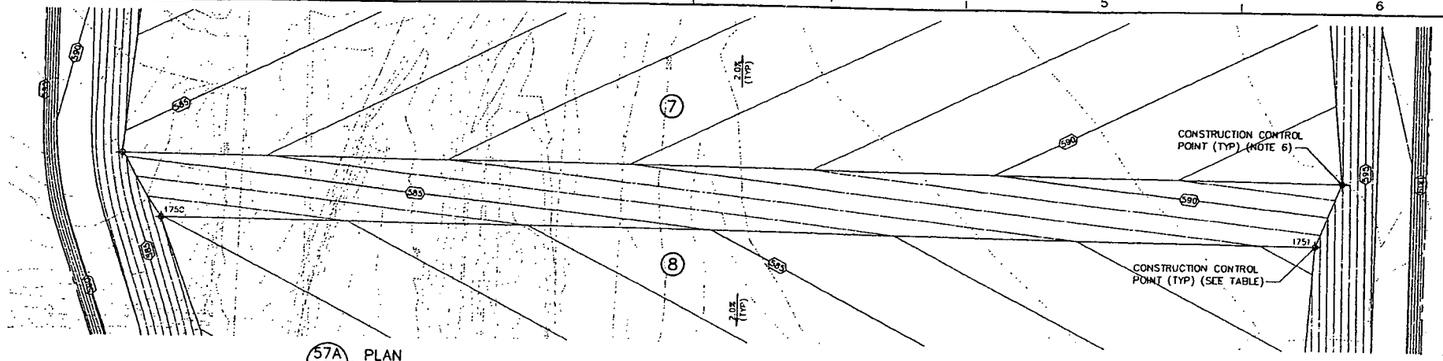
Rudolph Bonaparte
22 Jan 2004

STATE OF OHIO
RUDOLPH BONAPARTE
E-56678
REGISTERED PROFESSIONAL ENGINEER

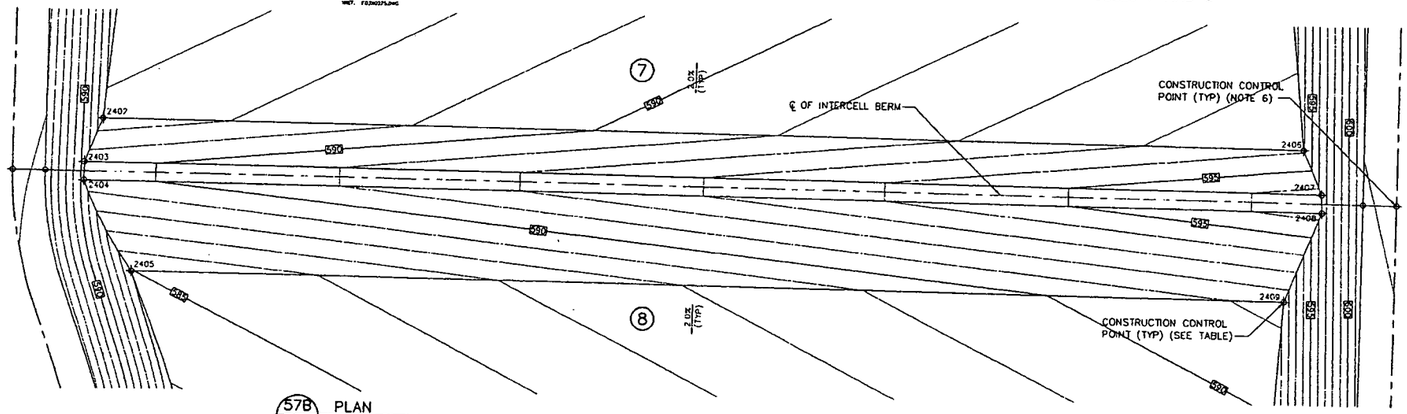
GEOSYNTEC CONSULTANTS
1105 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

PROJECT NO.: 20105
CONTRACT NO.: 0.VFD699
FLUOR DRAWING NO.: 00X-E000-C-00395
GEOSYNTEC PROJECT NO.: GC3211.05.04
GEOSYNTEC DOCUMENT NO.: F03-1034
SHEET NO.: C-33
REVISION NO.: 1

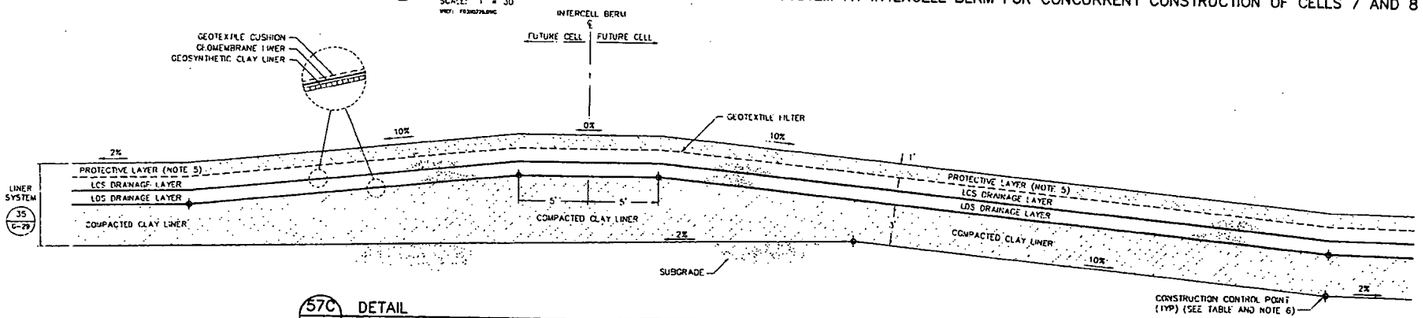
CERTIFIED-FOR-CONSTRUCTION



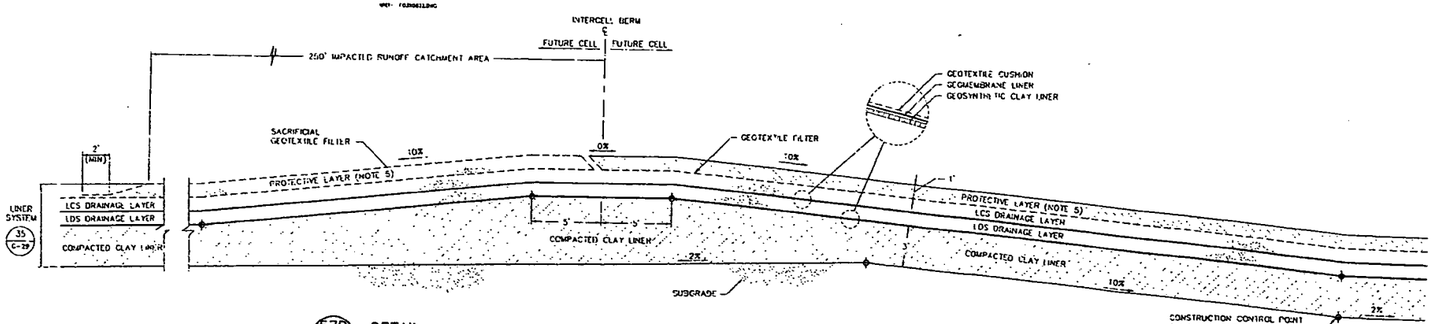
57A PLAN
SUBGRADE–ALTERNATE LINER SYSTEM AT INTERCELL BERM FOR CONCURRENT CONSTRUCTION OF CELLS 7 AND 8
SCALE: 1" = 30'



57B PLAN
COMPACTED CLAY LINER–ALTERNATE LINER SYSTEM AT INTERCELL BERM FOR CONCURRENT CONSTRUCTION OF CELLS 7 AND 8
SCALE: 1" = 30'



57C DETAIL
ALTERNATE LINER SYSTEM AT INTERCELL BERM FOR CONCURRENT CONSTRUCTION OF CELLS 7 AND 8
SCALE: 1" = 4'



57D DETAIL
ALTERNATE LINER SYSTEM AT INTERCELL BERM AND IMPACTED RUNOFF CATCHMENT AREA FOR CONCURRENT CONSTRUCTION OF CELLS 7 AND 8
SCALE: 1" = 4'

LEGEND

- EXISTING GROUND ELEVATION (FEET)
- SUBGRADE ELEVATION (FEET) (NOTE 1)
- COMPACTED CLAY LINER ELEVATION (FEET) (NOTE 2)
- PERIMETER BERM BASELINE/LIMIT OF COMPACTED CLAY LINER
- 1750 — CONSTRUCTION CONTROL POINT
- 7 — CELL DESIGNATION

SUBGRADE CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
1750	480316.75	1350821.95	581.98
1751	480311.03	1351453.86	588.30

COMPACTED CLAY LINER CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
2402	480401.56	1350805.81	587.31
2403	480377.73	1350795.95	589.61
2404	480367.73	1350795.74	589.61
2405	480318.43	1350822.45	589.98
2406	480283.52	1351453.15	592.86
2407	480389.45	1351473.16	594.38
2408	480355.44	1351473.42	594.38
2409	480316.93	1351453.45	591.29

NOTES:

1. CLEARING, GRUBBING, AND STRIPPING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02110. SUBGRADE ELEVATIONS CORRESPOND TO TOP OF PREPARED SUBGRADE, INCLUDING ANY COMPACTED FILL. SUBGRADE SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
2. COMPACTED CLAY LINER ELEVATIONS CORRESPOND TO TOP OF COMPACTED CLAY LINER.
3. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
4. MATERIAL IN DRAINAGE LAYERS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02710.
5. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED GRANULAR MATERIAL IN IMPACTED RUNOFF CATCHMENT AREA AND IMPACTED MATERIAL IN REMAINING ACTIVE CELL AREAS EXCLUDING CELL AREA AT INTERCELL BERM TEMPORARY LINER SYSTEM TERMINATION. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED NON-GRANULAR MATERIAL IN ACTIVE AND FUTURE CELL AREAS OF TEMPORARY LINER SYSTEM TERMINATION. NON-IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02240. IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
6. CONSTRUCTION CONTROL POINTS FOR SUBGRADE AND COMPACTED CLAY LINER ARE PROVIDED ON DRAWINGS G-6, G-6A, G-7, AND G-7A.

REV. NO.	DATE	DESCRIPTION	DES. BY	PR. BY	CHK. BY	PRM. BY	UPD. BY
0	04.01.02	DFC SUBMITTAL TO FF/DOE/EPA	LMG	JJA	TFZ	DKP	RR
A	03.12.08	PRE-FINAL SUBMITTAL TO FF/DOE	LMG	JJA	TFZ	DKP	RGI
A	03.10.08	PRELIMINARY SUBMITTAL TO FF/DOE	LMG	JJA	TFZ	DKP	RB

30 15 0 30 60
SCALE IN FEET

OWNER/ACQUIR:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

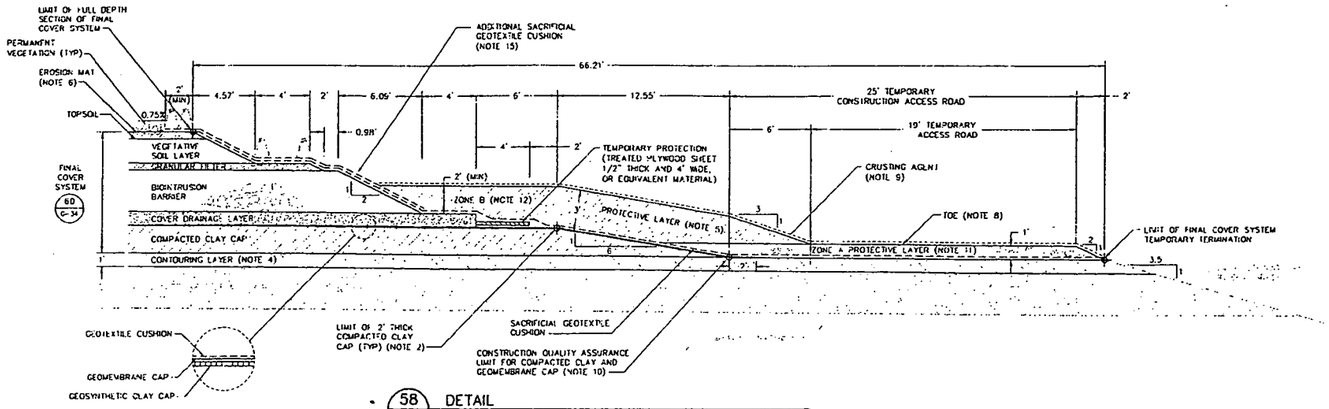
TITLE: LINER SYSTEM DETAILS VI

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

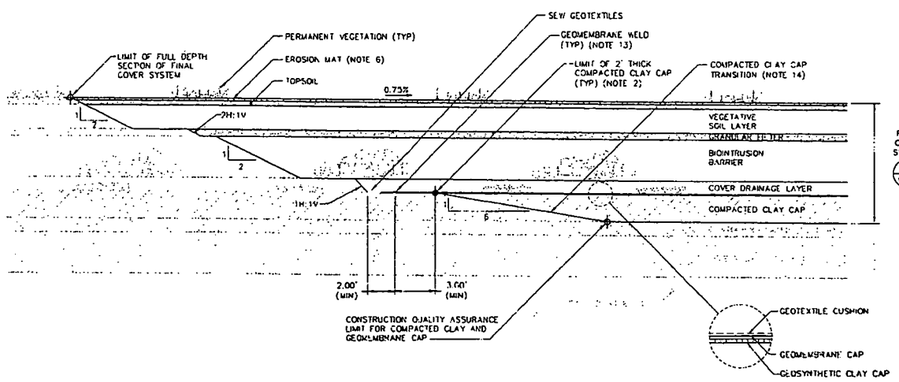
STATE OF OHIO — RUDOLPH BONAPARTE E-54879 — PROFESSIONAL REGISTERED ENGINEER

GEOSYNTEC CONSULTANTS

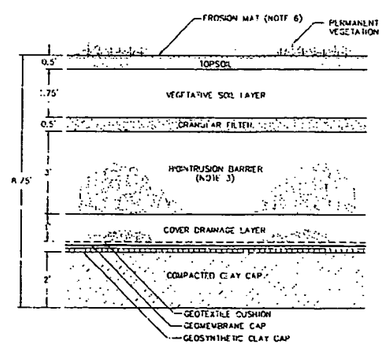
PROJECT NO.:	20105
CONTRACT NO.:	03F0599
FFU# DRAWING NO.:	90X-6060-C-00421
GEOSYNTEC PROJECT NO.:	GO3211-06.04
GEOSYNTEC DOCUMENT NO.:	GO3-0016



58 G-19 DETAIL
FINAL COVER SYSTEM TEMPORARY TERMINATION AND CONSTRUCTION ACCESS ROAD
SCALE: 1" = 4'



59 G-20 DETAIL
FINAL COVER SYSTEM TIE-IN AT EXISTING TEMPORARY TERMINATION
SCALE: 1" = 4'



60 G-21 DETAIL
FINAL COVER SYSTEM
SCALE: 1" = 2'

FINAL COVER SYSTEM COMPONENT SUMMARY

SYMBOL	COMPONENT	SPECIFICATION SECTION
GEOSYNTHETICS (NOTE 7)		
	GEOMEMBRANE CAP	02770
	GEOSYNTHETIC CLAY CAP	02772
	GEOTEXTILE CUSHION	02714
SOILS		
	COMPACTED CLAY CAP	02225
	COVER DRAINAGE LAYER	02710
	BIOINTRUSION BARRIER	02280
	GRANULAR FILTER	02717
	VEGETATIVE SOIL LAYER	02250
	TOPSOIL	02920
	PROTECTIVE LAYER (NON-IMPACTED NON-GRANULAR)	02240
	CONTOURING LAYER (NON-IMPACTED)	02240
VEGETATION		
	PERMANENT VEGETATION	02930

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. CONSTRUCTION CONTROL POINTS FOR CONTOURING LAYER, COMPACTED CLAY CAP, AND FINAL COVER SYSTEM ARE PROVIDED ON DRAWINGS G-10 THROUGH G-15, G-13A, AND G-15A.
3. CHOKE STONE LAYER SHALL BE PLACED INTO TOP OF BIOINTRUSION BARRIER IN ACCORDANCE WITH SPECIFICATION SECTION 02280.
4. CONTOURING LAYER SHALL CONSIST OF NON-IMPACTED MATERIAL IN ACCORDANCE WITH SPECIFICATION SECTION 02240. RUNOFF FROM NON-IMPACTED CONTOURING LAYER SHALL BE DIVERTED TO IMPACTED RUNOFF CATCHMENT AREA UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED. CONTRACTOR SHALL CONTAIN AND CONTROL WATER GENERATED DURING CONSTRUCTION AND FILLING OF OSDF IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
5. ZONE B PROTECTIVE LAYER IN FINAL COVER SYSTEM TEMPORARY TERMINATION SHALL BE NON-IMPACTED MATERIAL. NON-IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02240.
6. EROSION MAT SHALL BE PROVIDED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION SECTION 02270. EROSION MAT WITH A 100% COIR YARN CONTENT SHALL BE USED AT TWO LOCATIONS, TO LIMITS INDICATED ON DETAIL 61, DRAWING G-35, AND AT THE 10H:1V TO 6H:1V FINAL COVER SYSTEM SLOPE TRANSITION. TWO 6-FOOT WIDTHS OF COIR EROSION MAT SHALL BE USED AT EACH LOCATION WITH A 1.5 FOOT OVERLAP ON EACH SIDE OF THE 10H:1V TO 6H:1V TRANSITION.
7. GEOSYNTHETICS FOR THE COVER SYSTEM WILL BE SUPPLIED BY FLUOR FERNALD, INC. AS SPECIFIED IN CONSTRUCTION WORK CONTROL TRAVELER PACKAGE DOCUMENTS.
8. INSTALL SILT FENCE 10 FEET (MEASURED HORIZONTALLY) UPSLOPE FROM TOE OF 6H:1V SLOPE AT FINAL COVER SYSTEM TEMPORARY TERMINATION. SILT FENCE SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
9. CRUSTING AGENT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
10. EXTEND GEOMEMBRANE CAP ONLY BEYOND TEMPORARY PROTECTION. GCL AND GEOTEXTILE CUSHION COMPONENTS DO NOT CONTINUE PAST THE TEMPORARY PROTECTION.
11. ZONE A PROTECTIVE LAYER SHALL CONSIST OF BASE AGGREGATE IN ACCORDANCE WITH SPECIFICATION SECTION 02230 AND SHALL BE PLACED AFTER INSTALLATION OF COMPACTED CLAY CAP.
12. ZONE B PROTECTIVE LAYER SOIL SHALL BE PLACED AFTER COMPLETION OF UNDERLYING COMPONENTS OF FINAL COVER SYSTEM.
13. REMOVE DAMAGED PORTION OF EXISTING GEOMEMBRANE CAP BY CUTTING PRIOR TO INSTALLATION OF NEW GEOMEMBRANE CAP.
14. TRANSITION FROM EXISTING 2 FOOT THICK COMPACTED CLAY CAP TO ADJACENT SECTION OF COMPACTED CLAY CAP SHALL BE CONSTRUCTED IN ACCORDANCE WITH SPECIFICATION SECTION 02225.
15. EXPOSED PORTION OF SACRIFICIAL GEOTEXTILE CUSHION SHALL BE SECURED IN PLACE WITH SAND BAGS.

REV NO	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	MGR BY	APP BY
1	04.01.22	CTC REVISION 1 SUBMITTAL TO FF/DOE/EPA	KRD	VGR	TEF	DKP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	KRD	VGR	TEF	DKP	RB
1A	03.10.08	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	KRD	VGR	TEF	DKP	RB
0	02.01.29	CTC SUBMITTAL TO FF/DOE/EPA	KRD	JWD	KRD	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWD	KRD	DCP	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	KRD	JWD	KRD	DCP	JFB

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
FINAL COVER SYSTEM DETAILS I

THIS DRAWING MAY NOT BE USED FOR PROJECT BIDDER OR CONSTRUCTION, UNLESS SEALED

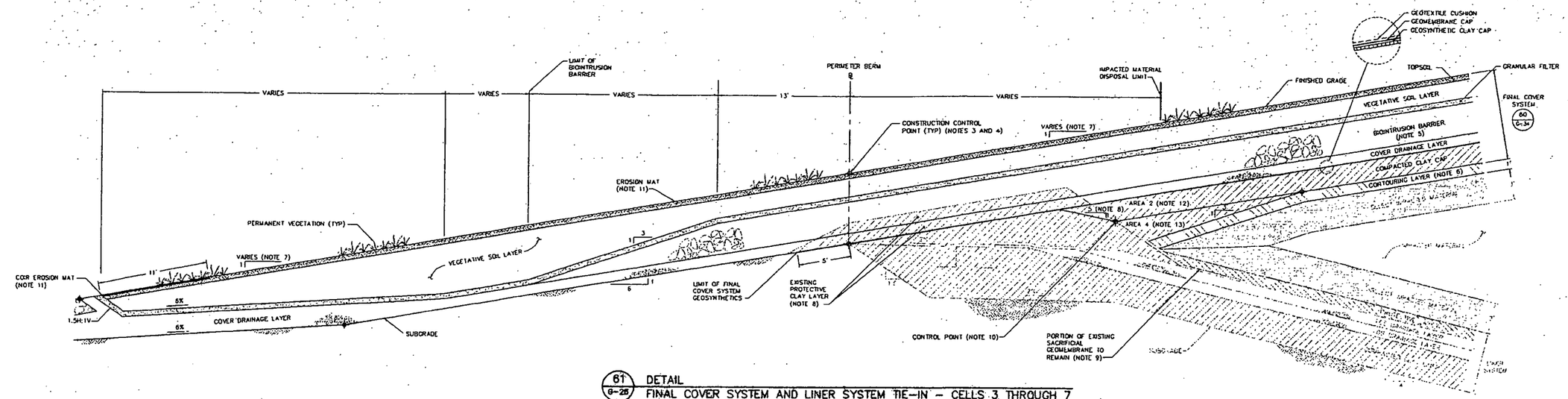
Rudolph Bonaparte
SIGNATURE
22 January 09

STATE OF OHIO
RUDOLPH BONAPARTE
E-58879
REGISTERED PROFESSIONAL ENGINEER

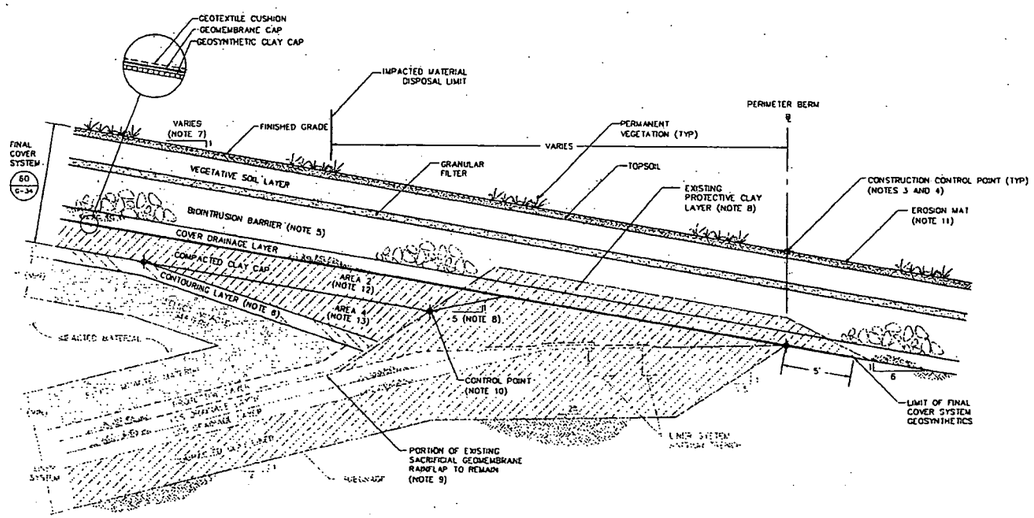
GEOSYNTEC CONSULTANTS
1100 LAKE HOLLOW DRIVE
ATLANTA, GEORGIA 30342 USA

PROJECT NO. 20105
CONTRACT NO. 03FC0099
TEMP DRAWING NO: 93X-6000-G-03398
GEOSYNTEC PROJECT NO. GO3211-08.04
GEOSYNTEC DOCUMENT NO: F03-1035
SHEET NO. G-34
REVISION NO.

CERTIFIED-FOR-CONSTRUCTION



61 / 6-25 DETAIL
FINAL COVER SYSTEM AND LINER SYSTEM TIE-IN – CELLS 3 THROUGH 7 AND CELL 8 OUTSIDE OF IMPACTED RUNOFF CATCHMENT AREA
SCALE: 1" = 4'



62 / G-27 DETAIL
FINAL COVER SYSTEM AND LINER SYSTEM TIE-IN – CELL 8 AT IMPACTED RUNOFF CATCHMENT AREA
SCALE: 1" = 4'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
3. CONSTRUCTION CONTROL POINTS FOR CONTOURING LAYER, COMPACTED CLAY CAP, AND FINAL COVER SYSTEM ARE PROVIDED ON DRAWINGS G-10 THROUGH G-15, G-13A, AND G-15A.
4. REESTABLISH SUBGRADE ELEVATIONS OUTSIDE PERIMETER BERM BASELINE PRIOR TO COMPLETION OF COMPACTED CLAY CAP. CONSTRUCTION CONTROL POINTS FOR SUBGRADE ARE PROVIDED ON DRAWINGS G-3, G-4, G-6, AND G-6A.
5. CHOKE STONE LAYER SHALL BE PLACED INTO TOP OF BIOINTRUSION BARRIER IN ACCORDANCE WITH SPECIFICATION SECTION 02280.
6. CONTOURING LAYER SHALL CONSIST OF NON-IMPACTED MATERIAL IN ACCORDANCE WITH SPECIFICATION SECTION 02240. RUNOFF FROM NON-IMPACTED CONTOURING LAYER SHALL BE DIVERTED TO IMPACTED RUNOFF CATCHMENT AREA UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED. WATER GENERATED DURING CONSTRUCTION AND FILLING OF OSDF SHALL BE CONTAINED AND CONTROLLED IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
7. SLOPE OF LOWER PORTION OF FINAL COVER SYSTEM IS 6H:1V FOR EAST, WEST, AND SOUTH PERIMETERS OF OSDF.
8. EXISTING PROTECTIVE CLAY LAYER PLACED ABOVE FINAL COVER SYSTEM GRADES SHALL BE CUT BACK JUST PRIOR TO COMPLETION OF COMPACTED CLAY CAP. TRANSITION FROM PROTECTIVE CLAY LAYER TO COMPACTED CLAY CAP SHALL BE CUT BACK AT A 5H:1V SLOPE OR FLATTER IN ACCORDANCE WITH SPECIFICATION SECTION 02225.
9. EXPOSED PORTION OF EXISTING SACRIFICAL GEOMEMBRANE SHALL BE REMOVED BY CUTTING PRIOR TO CONSTRUCTION OF COMPACTED CLAY CAP IN TEMPORARY DRAINAGE CHANNEL.
10. CONTROL POINT WILL BE PROVIDED IN ACCORDANCE WITH SPECIFICATION SECTION 02100.
11. EROSION MAT SHALL BE PROVIDED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION SECTION 02270. EROSION MAT WITH A 100% COIR YARN CONTENT SHALL BE USED AT TWO LOCATIONS, TO LIMITS INDICATED ON DETAIL 61, DRAWING G-35, AND AT THE 10H:1V TO 6H:1V FINAL COVER SYSTEM SLOPE TRANSITION. TWO 6-FOOT WIDTHS OF COIR EROSION MAT SHALL BE USED AT EACH LOCATION WITH A 1.5' OVERLAP ON EACH SIDE OF THE 10H:1V TO 6H:1V TRANSITION.
12. AREA 2 OF COMPACTED CLAY CAP SHALL BE CONSTRUCTED IN ACCORDANCE WITH SPECIFICATION SECTION 02225.
13. AREA 4 MAY BE CONSTRUCTED OF COMPACTED CLAY CAP OR NON-IMPACTED CONTOURING LAYER MATERIALS AS APPROVED BY THE CONSTRUCTION MANAGER. COMPACTED CLAY CAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02225. NON-IMPACTED CONTOURING LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02240.

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	KRD	VOR	KRD	DKP	RB
1B	03.12.06	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	KRD	VOR	KRD	DKP	RB
1A	03.10.20	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	KRD	VOR	KRD	DKP	RB
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWO	KRD	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DCP	JFB
A	–	NOT ISSUED	–	–	–	–	–

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
FINAL COVER SYSTEM DETAILS II

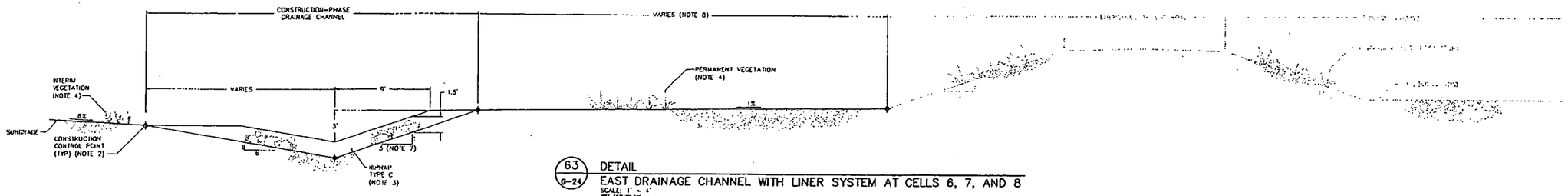
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDER OR CONSTRUCTION, UNLESS SEALED.

STATE OF OHIO
RUDOLPH BONAVENTE
E-56670
REGISTERED
PROFESSIONAL ENGINEER

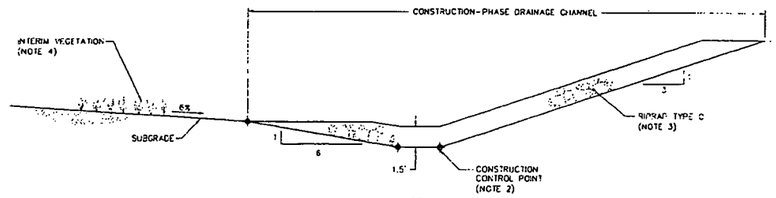
GEOSYNTEC CONSULTANTS

PROJECT NO.: 20105
CONTRACT NO.: 0FF0899
TEMP DRAWING NO.: 90X-6000-G-00397
GEOSYNTEC PROJECT NO.: 00211-05.04
GEOSYNTEC DOCUMENT NO.: F03-1051
SHEET NO.: G-35

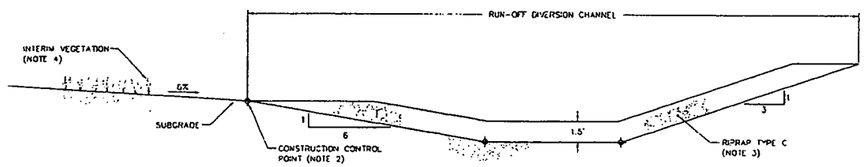
CERTIFIED-FOR-CONSTRUCTION



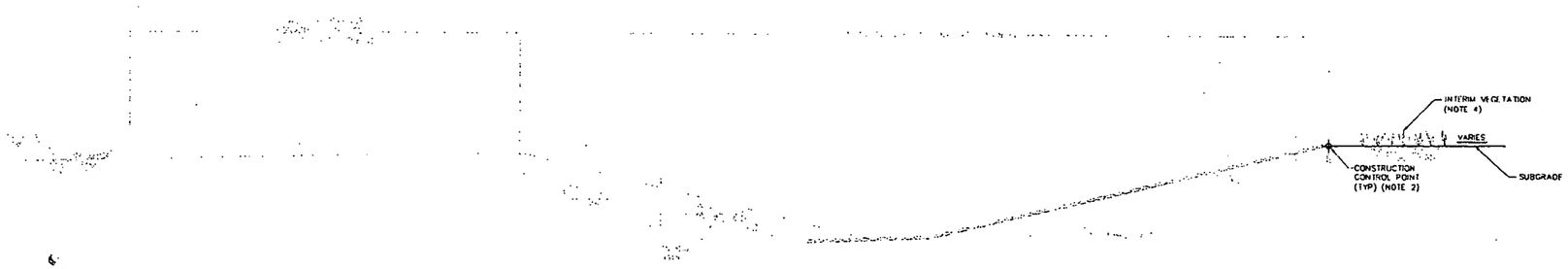
63 / G-24 DETAIL
EAST DRAINAGE CHANNEL WITH LINER SYSTEM AT CELLS 6, 7, AND 8
SCALE: 1" = 4'



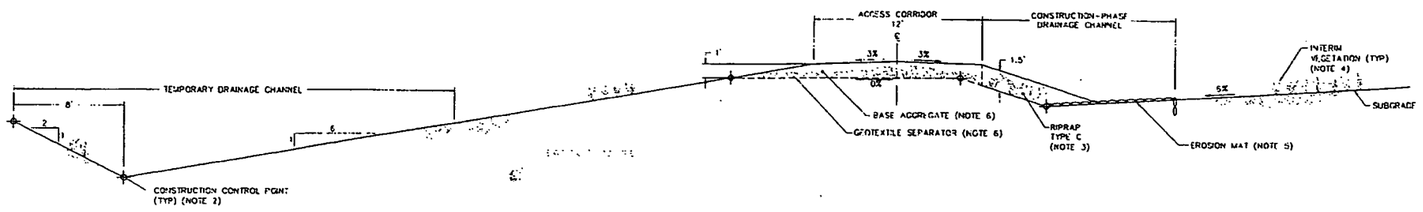
64 / G-25 DETAIL
SOUTHEAST DRAINAGE CHANNEL WITH LINER SYSTEM AT CELL 8
SCALE: 1" = 4'



65 / G-25 DETAIL
SOUTH DRAINAGE CHANNEL WITH LINER SYSTEM AT CELL 8
SCALE: 1" = 4'



66 / G-25 DETAIL
SOUTHWEST DRAINAGE CHANNEL WITH LINER SYSTEM AT CELL 8
SCALE: 1" = 4'



67 / G-24 DETAIL
WEST DRAINAGE CHANNEL WITH LINER SYSTEM AT CELLS 6 AND 7 AND CELL 8 NORTH OF GIS-15
SCALE: 1" = 4'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR THE GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN THE SPECIFICATIONS.
2. CONSTRUCTION CONTROL POINTS FOR SUBGRADE ARE PROVIDED ON DRAWINGS G-4, G-6, AND G-6A.
3. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
4. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
5. EROSION MAT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
6. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
7. EASTERN SLOPE OF CONSTRUCTION-PHASE DRAINAGE CHANNEL SHALL VARY AT SOUTHEAST CORNER OF CELL 8 BETWEEN 3H:1V TO 2H:1V AS SHOWN ON DRAWING G-6A.
8. WIDTH OF 1% SLOPE EAST OF CONSTRUCTION-PHASE DRAINAGE CHANNEL VARIES FROM 0.FFF1 ALONG SOUTHEAST CORNER OF CELL 8 TO FULL WIDTH EAST OF CH. 6.

REV NO	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW BY	APP. BY
1	04.01.29	OFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JAA	LMC	DHP	RBJ
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TEZ	JAA	LMC	DHP	RBJ
1A	-	NOT ISSUED	-	-	-	-	-
C	02.01.29	OFC SUBMITTAL TO FF/DOE/EPA	TEZ	JAS	LMC	DOP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	AND	LMC	DOP	JFB
A	-	NOT ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
SURFACE-WATER MANAGEMENT SYSTEM DETAILS I

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDING OR CONSTRUCTION UNLESS SEALED.

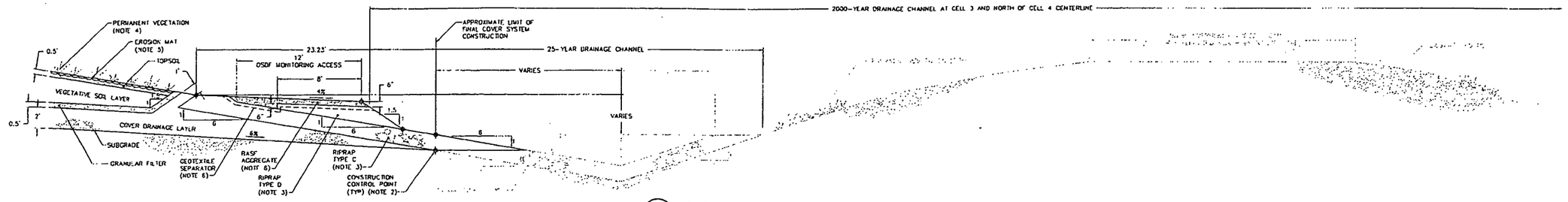
Rudolph Bonaparte
Signature
22 January 07

STATE OF OHIO
RUDOLPH BONAPARTE
E-56879
REGISTERED PROFESSIONAL ENGINEER

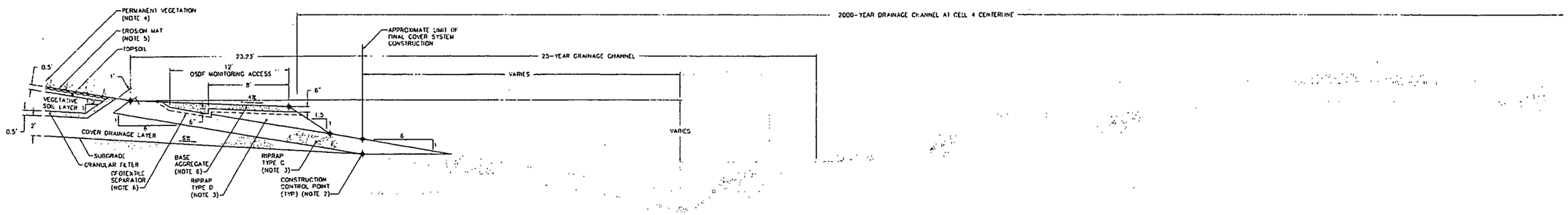
GeoSyntec Consultants
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

PROJECT NO.:	70105
CONTRACT NO.:	03FF0699
FEMP DRAWING NO.:	9GX-6000-(-0039A
GEOSYNTEC PROJECT NO.:	GO3211-06-04
GEOSYNTEC DOCUMENT NO.:	F03-103/
SHEET NO.:	G-36

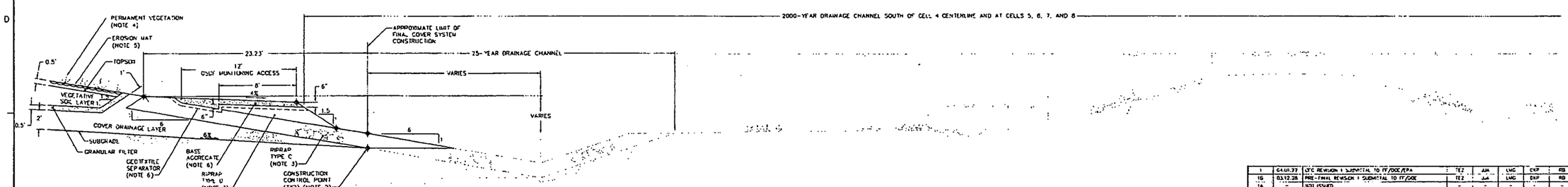
CERTIFIED-FOR-CONSTRUCTION



68 G-26 DETAIL
EAST DRAINAGE CHANNEL WITH FINAL COVER SYSTEM AT CELL 3 AND NORTH OF CELL 4 CENTERLINE
SCALE: 1" = 4'



69 G-26 DETAIL
EAST DRAINAGE CHANNEL WITH FINAL COVER SYSTEM AT CELL 4 CENTERLINE
SCALE: 1" = 4'



70 G-28 DETAIL
EAST DRAINAGE CHANNEL WITH FINAL COVER SYSTEM SOUTH OF CELL 4 CENTERLINE AND AT CELLS 5, 6, 7, AND 8
SCALE 1" = 4'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR THE GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN THE SPECIFICATIONS.
2. CONSTRUCTION CONTROL POINTS FOR SUBGRADE AND FINAL COVER SYSTEM ARE PROVIDED ON DRAWINGS G-3, G-4, G-6, G-6A, G-14, G-15, AND G-15A.
3. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
4. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
5. EROSION MAT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
6. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APV. BY
1	04.01.27	CFC REVISION 1 SUBMITTAL TO IT/DOE/EPA	TEZ	JJA	LMC	DKP	RB
1B	03.12.26	PRE-FINAL REVISION 1 SUBMITTAL TO IT/DOE	TEZ	JJA	LMC	DKP	RB
1A	–	NOT ISSUED	–	–	–	–	–
0	07.01.29	CFC SUBMITTAL TO IT/DOE/EPA	TEZ	JWD	LMC	DOP	JJB
B	01.12.17	PRE-FINAL SUBMITTAL TO IT/DOE	TEZ	JWD	LMC	DOP	JJB
A	–	NOT ISSUED	–	–	–	–	–

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: SURFACE-WATER MANAGEMENT SYSTEM DETAILS II

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDING OR CONSTRUCTION UNLESS SEALED.

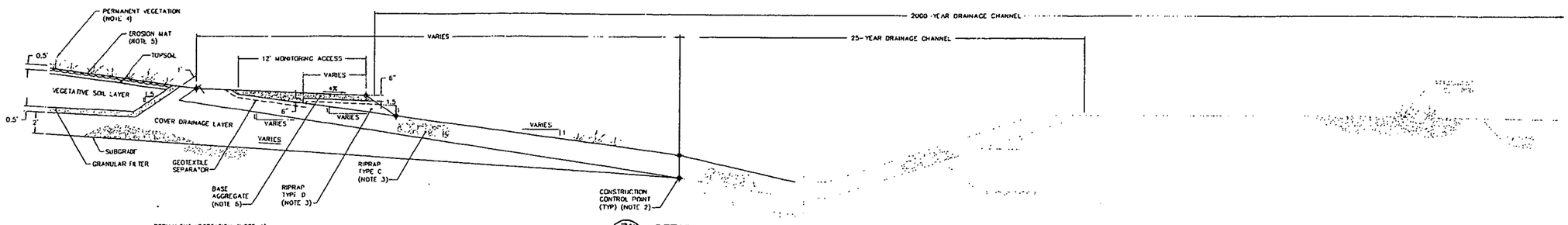
Rudolph Bonaparte
SIGNATURE
22 January 04

STATE OF OHIO
RUDOLPH BONAPARTE
E-56679
REGISTERED PROFESSIONAL ENGINEER

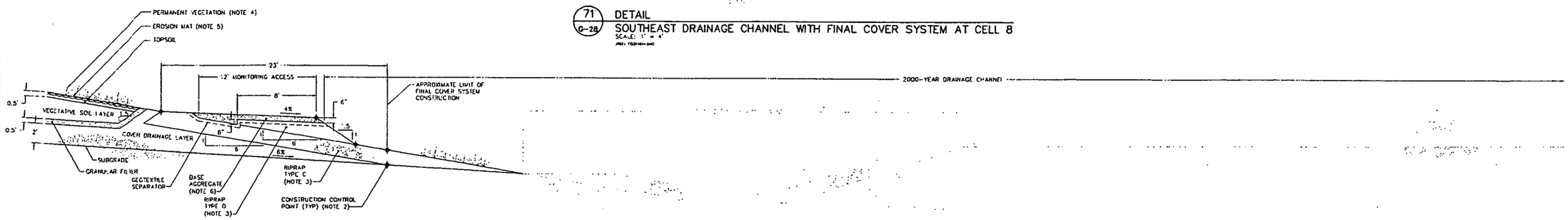
GEO SYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

PROJECT NO.: 2905
CONTRACT NO.: 03FF0699
ISSUE DRAWING NO.: 904-6000-G-00388
GEOSYNTEC PROJECT NO.: GC3711-GG.04
GEOSYNTEC DOCUMENT NO.: F03-1038
SHEET NO.: G-37

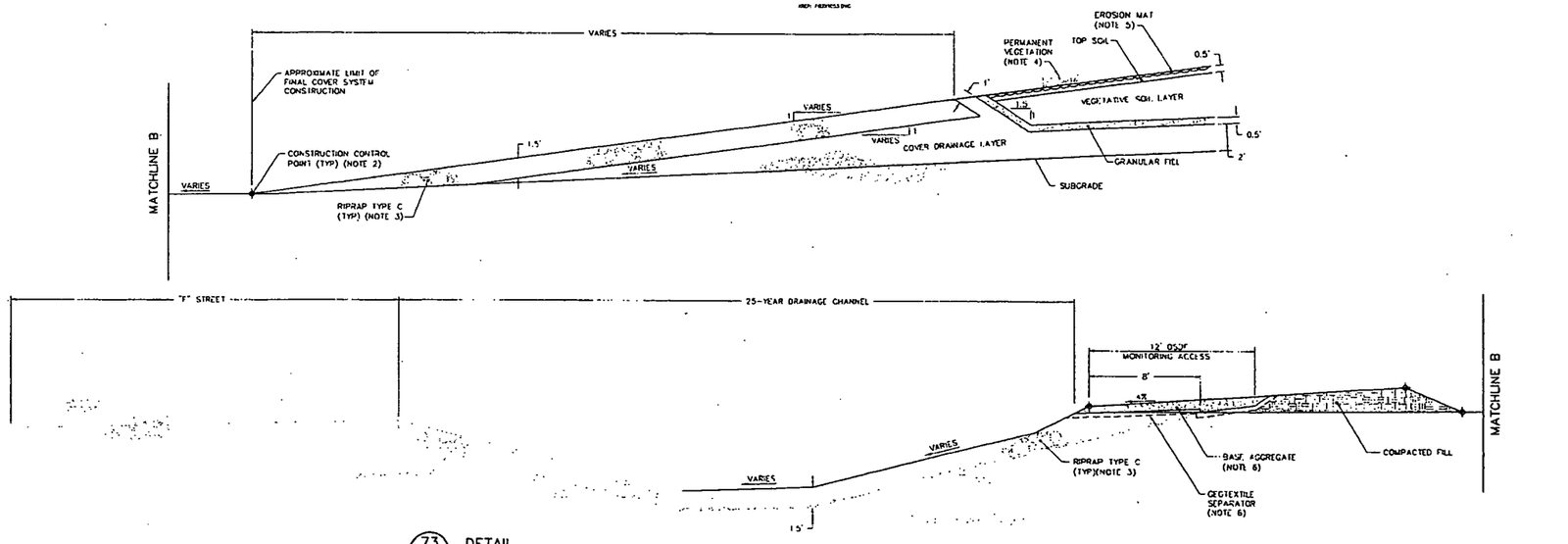
CERTIFIED-FOR-CONSTRUCTION



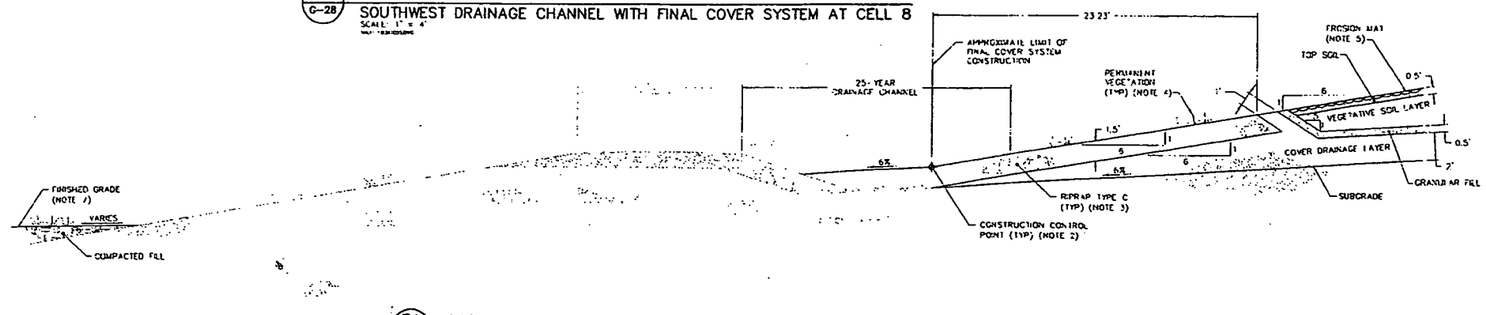
71 / G-28 DETAIL
SOUTHEAST DRAINAGE CHANNEL WITH FINAL COVER SYSTEM AT CELL 8
SCALE: 1" = 4'



72 / G-28 DETAIL
SOUTH DRAINAGE CHANNEL WITH FINAL COVER SYSTEM AT CELL 8
SCALE: 1" = 4'



73 / G-28 DETAIL
SOUTHWEST DRAINAGE CHANNEL WITH FINAL COVER SYSTEM AT CELL 8
SCALE: 1" = 4'



74 / G-27 DETAIL
WEST DRAINAGE CHANNEL WITH FINAL COVER SYSTEM AT CELLS 3 THROUGH 7 AND CELL 8 NORTH OF GIS-15
SCALE: 1" = 4'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR THE GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN THE SPECIFICATIONS.
2. CONSTRUCTION CONTROL POINTS FOR SUBGRADE AND FINAL COVER SYSTEM ARE PROVIDED ON DRAWINGS G-3, G-4, G-6, G-6A, G-14, G-15, AND G-15A.
3. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271
4. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
5. EROSION MAT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
6. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
7. PLACE COMPACTED FILL, AS NECESSARY, TO PROVIDE POSITIVE DRAINAGE TO FORMER PRODUCTION AREA AND AWAY FROM OSDF FACILITY.

REV NO	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	DVR. BY	APP. BY
1	04 01 22	D/C REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMC	DCP	RBI
1B	03 17 22	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TEZ	JJA	LMC	DCP	RBI
1A	-	NOT ISSUED	-	-	-	-	-
C	02 01 29	D/C SUBMITTAL TO FF/DOE/EPA	TEZ	JRD	LMC	DCP	JFB
B	01 12 17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	JRD	LMC	DCP	JFB
A	-	NOT ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

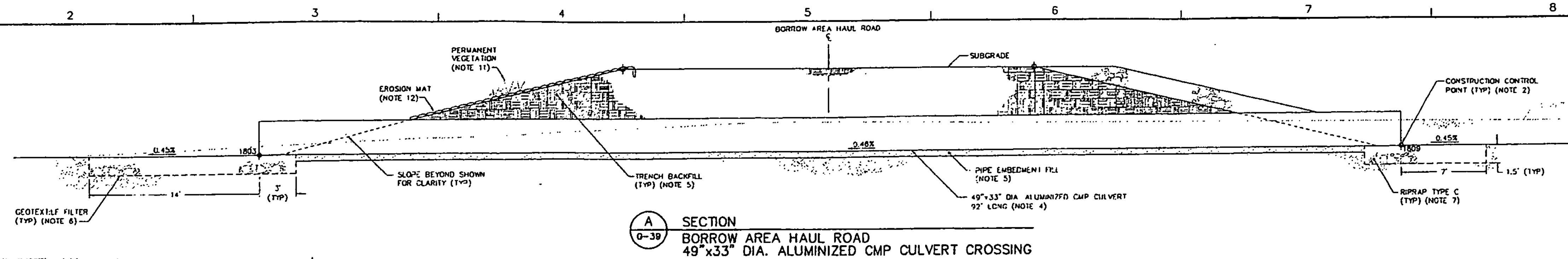
TITLE: SURFACE-WATER MANAGEMENT SYSTEM DETAILS III

THIS DRAWING MAY NOT BE USED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED

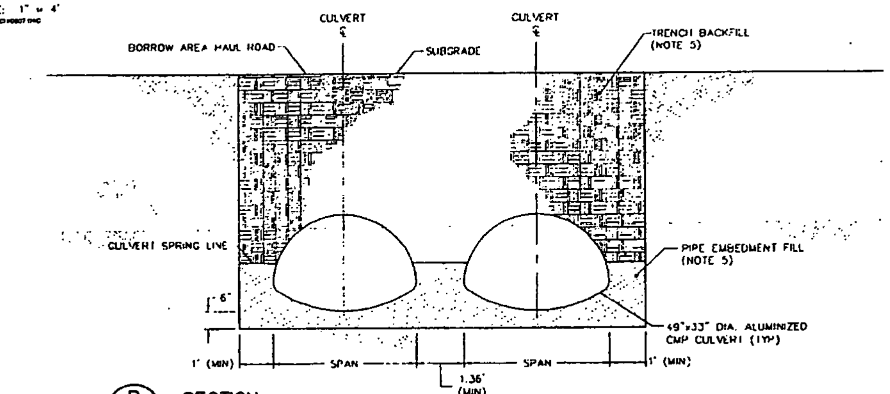
STATE OF OHIO — RUDOLPH BONAPARTE — E-56079 — REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS

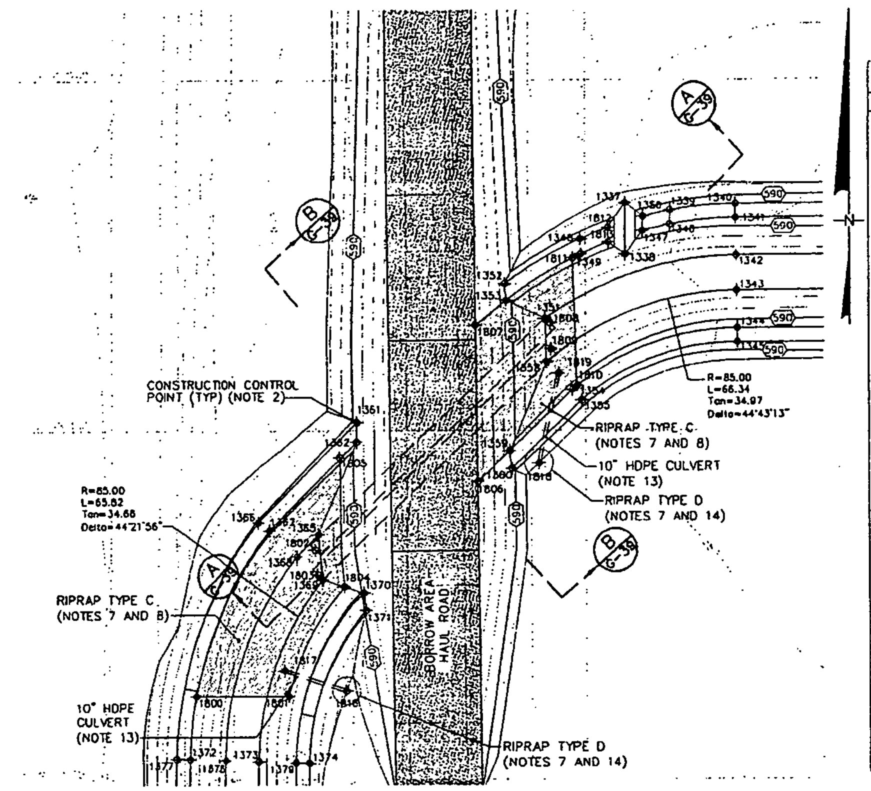
PROJECT NO.:	20105
CONTRACT NO.:	0JFF0659
TEMP DRAWING NO.:	903-5G00-G-UE400
GEOSYNTEC PROJECT NO.:	GD3711-05.04
GEOSYNTEC DOCUMENT NO.:	FC3-1039
SHEET NO.:	



A SECTION (G-39)
BORROW AREA HAUL ROAD
49"x33" DIA. ALUMINIZED CMP CULVERT CROSSING
SCALE: 1" = 4'



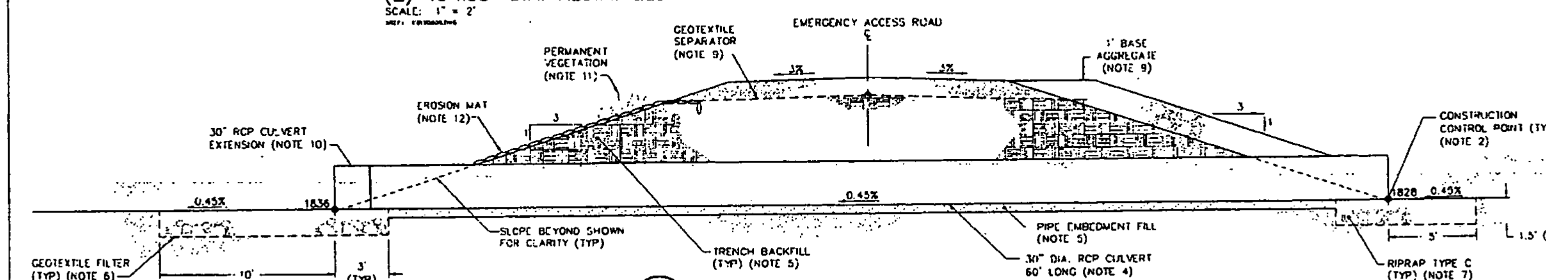
B SECTION (G-39)
BORROW AREA HAUL ROAD
(2) 49"x33" DIA. ALUMINIZED CMP CULVERT EMBEDMENT
SCALE: 1" = 2'



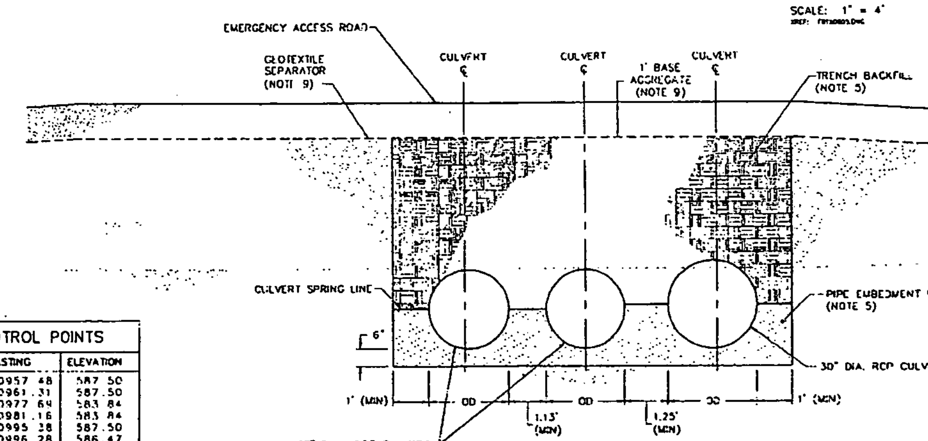
75 PLAN (G-4)
RUN-OFF DIVERSION CHANNEL MODIFICATION
AT EXISTING BORROW AREA HAUL ROAD
SCALE: 1" = 20'

CONSTRUCTION CONTROL POINTS

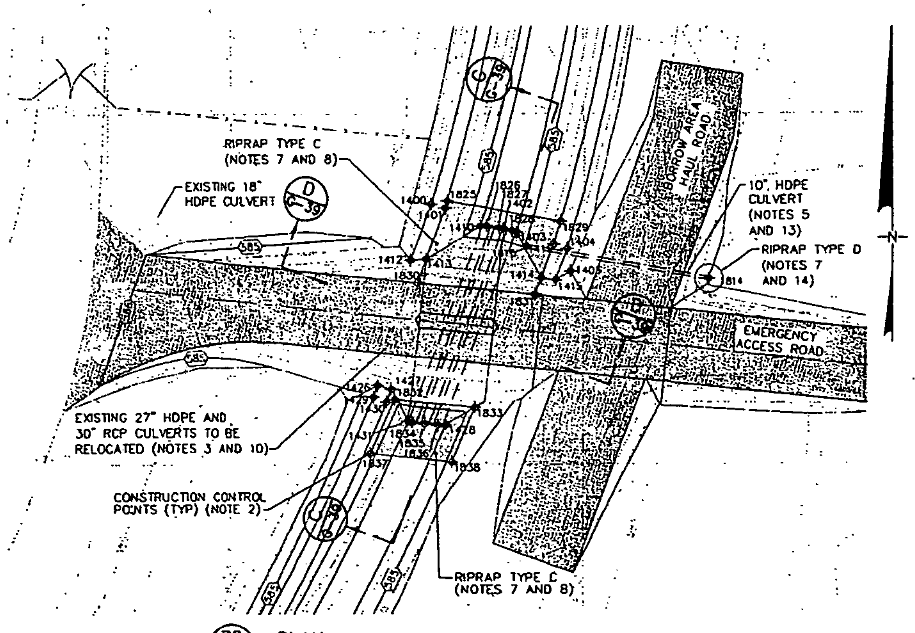
POINT NO.	NORTHING	EASTING	ELEVATION
1337	480164.93	1351111.56	589.00
1338	480150.26	1351111.56	589.00
1339	480162.89	1351124.77	590.72
1340	480164.64	1351143.86	590.79
1341	480160.64	1351143.92	590.79
1342	480149.93	1351144.06	587.22
1343	480139.93	1351144.20	587.22
1344	480129.22	1351144.35	590.79
1345	480125.22	1351144.40	590.79
1346	480158.79	1351124.62	590.72
1347	480156.95	1351116.54	590.66
1348	480154.72	1351098.60	590.67
1349	480150.39	1351098.71	590.61
1350	480161.12	1351116.08	590.69
1351	480132.01	1351088.63	586.97
1352	480141.96	1351077.37	590.53
1353	480137.19	1351077.77	590.52
1354	480111.70	1351096.26	590.50
1355	480108.74	1351098.96	590.51
1358	480119.64	1351089.05	586.93
1359	480094.27	1351078.66	590.50
1360	480089.29	1351079.32	590.38
1361	480102.40	1351036.20	590.38
1362	480096.82	1351036.16	590.36
1365	480070.40	1351025.12	586.58
1366	480073.87	1351007.39	590.20
1367	480071.59	1351010.69	590.20
1368	480064.15	1351018.82	586.54
1369	480057.52	1351028.33	586.53
1370	480053.06	1351038.04	590.21
1371	480048.65	1351038.66	590.19
1372	480005.83	1350986.33	589.92
1373	480005.20	1351007.30	586.26
1374	480004.75	1351022.28	589.92
1377	480005.95	1350982.33	589.92
1378	480005.50	1350997.31	586.26
1379	480004.87	1351018.28	589.92
1800	480023.97	1350988.26	-
1801	480023.97	1351010.31	-
1802	480065.97	1351024.24	586.55
1803	480058.98	1351024.90	586.53
1804	480055.50	1351032.55	-
1805	480092.48	1351031.19	-
1806	480085.45	1351069.75	-
1807	480130.11	1351069.27	-
1808	480130.75	1351090.06	586.97
1809	480123.35	1351090.31	586.95
1810	480112.88	1351097.68	-
1811	480149.23	1351096.43	-
1812	480157.96	1351106.51	590.65
1813	480153.74	1351106.65	590.64
1816	480025.56	1351032.95	587.78
1817	480031.33	1351015.09	587.40
1818	480090.80	1351086.83	589.00
1819	480116.41	1351092.45	588.48



C SECTION (G-39)
EMERGENCY ACCESS ROAD
30" DIA. RCP CULVERT CROSSING
SCALE: 1" = 4'



D SECTION (G-39)
EMERGENCY ACCESS ROAD
(2) 27" DIA. HDPE & 30" DIA. RCP CULVERT EMBEDMENT
SCALE: 1" = 2'



76 PLAN (G-5)
RUN-OFF DIVERSION CHANNEL MODIFICATION
AT EMERGENCY ACCESS ROAD
SCALE: 1" = 20'

CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION
1400	479474.21	1350957.48	587.50
1401	479473.06	1350961.31	587.50
1402	479467.23	1350977.69	583.84
1403	479466.21	1350981.16	583.84
1404	479461.50	1350995.38	587.50
1405	479455.06	1350996.28	586.47
1410	479467.89	1350971.14	583.83
1411	479462.76	1350991.58	587.50
1412	479458.33	1350951.81	587.43
1413	479458.59	1350956.15	587.44
1414	479453.17	1350988.14	587.45
1415	479452.58	1350992.20	587.46
1426	479422.56	1350942.77	585.10
1427	479421.46	1350946.62	586.10
1428	479411.28	1350961.56	583.58
1429	479419.27	1350941.57	586.08
1430	479417.78	1350945.31	586.08
1431	479412.35	1350951.17	583.57
1814	479452.89	1351036.29	586.14
1815	479462.21	1350983.95	585.08
1825	479475.13	1350961.92	-
1826	479467.98	1350972.90	583.84
1827	479467.44	1350976.27	583.84
1828	479466.67	1350979.87	583.84
1829	479469.20	1350993.49	-
1830	479451.86	1350953.75	-
1831	479448.45	1350986.48	-
1832	479418.57	1350947.57	-
1833	479416.26	1350969.76	-
1834	479411.95	1350952.37	583.57
1835	479411.59	1350955.83	583.57
1836	479411.18	1350959.54	583.57
1837	479403.14	1350940.7?	-
1838	479400.71	1350963.40	-

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. CONSTRUCTION CONTROL POINTS FOR SUBGRADE, CULVERT INVERTS, AND RIPRAP LIMITS ARE PROVIDED IN THE TABLES PROVIDED ON THIS DRAWING AND ON DRAWINGS G-4 AND G-5.
3. CONTRACTOR SHALL REMOVE EXISTING CULVERTS AND STOCKPILE MATERIAL AT LOCATIONS APPROVED BY CONSTRUCTION MANAGER.
4. ALUMINIZED CMP CULVERTS AND JOINTS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02721.
5. TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
6. GEOTEXTILE FILTER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02714.
7. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
8. CONTRACTOR SHALL PLACE RIPRAP TYPE C WITHIN AREA SHOWN.
9. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
10. EXISTING CULVERTS SHALL BE EXTENDED AS NECESSARY TO MEET REQUIRED LENGTHS.
11. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
12. EROSION MAT SHALL BE INSTALLED ON SLOPE LENGTHS OF 6' OR GREATER AND IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
13. HDPE CULVERTS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02605.
14. CONTRACTOR SHALL PLACE RIPRAP TO A DISTANCE OF 4 FEET FROM INLET OF 10-INCH HDPE CULVERT. RIPRAP THICKNESS SHALL BE 1 FOOT AND UNDERLAIN BY A GEOTEXTILE FILTER.

CERTIFIED-FOR-CONSTRUCTION

REV. NO.	DATE	DESCRIPTION	DES. BY	CH. BY	CHK. BY	RVW BY	APP BY
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LNG	DGP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	JJA	LNG	DGP	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	TEZ	JJA	LNG	DGP	JFB

20 10 0 20 40
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
SURFACE-WATER MANAGEMENT SYSTEM DETAILS IV

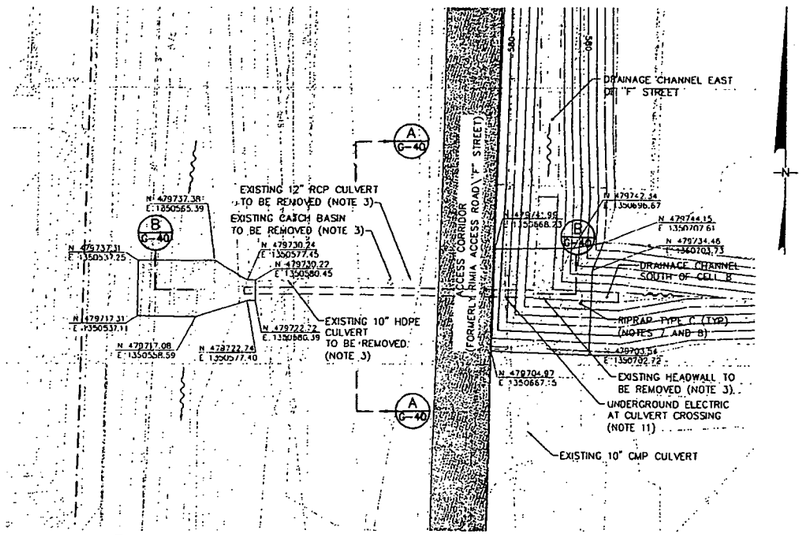
THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

STATE OF OHIO — JOHN F. BEECH — E-56248 — REGISTERED PROFESSIONAL ENGINEER

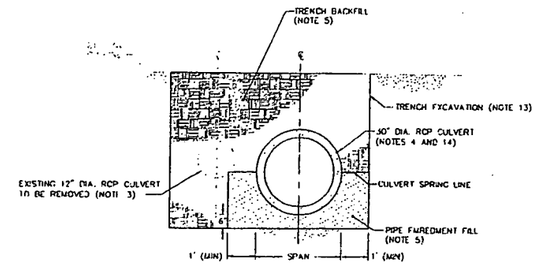
SIGNATURE
29 Jan 2002

GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

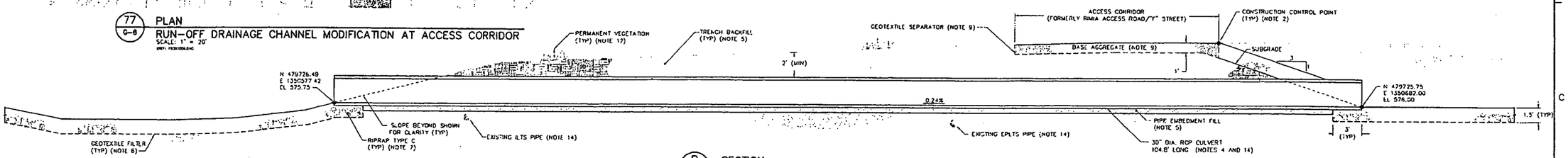
PROJECT NO.: 20105
CONTRACT NO.: 95PS005028
FEMP DRAWING NO.: 90X-5000-G-00401
GEOSYNTEC PROJECT NO.: GC1342-17.4
GEOSYNTEC DOCUMENT NO.: 101-0711
SHEET NO.: G-39
REVISION NO.: -



77 / G-6 PLAN
RUN-OFF DRAINAGE CHANNEL MODIFICATION AT ACCESS CORRIDOR
SCALE: 1" = 20'



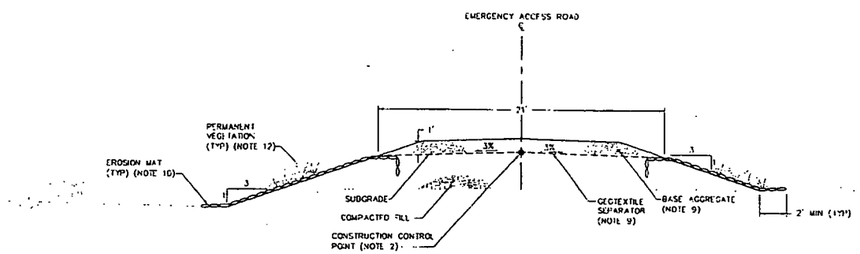
A / G-40 SECTION
RUN-OFF DRAINAGE CHANNEL MODIFICATION
30-IN DIA. RCP CULVERT EMBEDMENT
SCALE: 1" = 2'



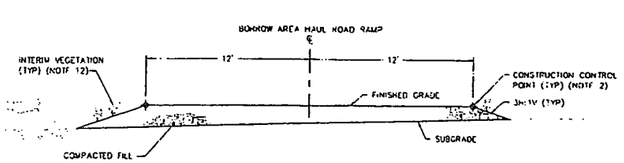
B / G-40 SECTION
RUN-OFF DRAINAGE CHANNEL MODIFICATION
30-IN DIA. RCP CULVERT CROSSING
SCALE: 1" = 4'

NOTES:

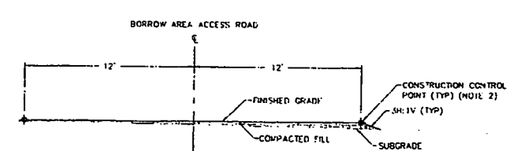
1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. CONSTRUCTION CONTROL POINTS FOR SUBGRADE ARE PROVIDED ON DRAWINGS G-4, G-5, G-6, AND G-6A.
3. REMOVE EXISTING CULVERTS, CATCH BASIN, AND HEADWALL AND STOCKPILE MATERIAL AT LOCATIONS DESIGNATED BY CONSTRUCTION MANAGER.
4. RCP CULVERTS AND JOINTS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02721.
5. TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
6. GEOTEXTILE FILTER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02714.
7. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271
8. PLACE RIPRAP TYPE C WITHIN AREA SHOWN.
9. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
10. EROSION MAT SHALL BE INSTALLED ON SLOPE LENGTHS OF 6 FEET OR GREATER AND IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
11. UNDERGROUND ELECTRIC AT CULVERT CROSSING SHALL BE REMOVED AND RELOCATED PRIOR TO INSTALLATION OF NEW CULVERT.
12. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
13. TRENCH EXCAVATION IS SHOWN VERTICAL AS DESIGNED. SHORING AND/OR STABLE TRENCH SIDESLOPES SHALL BE MAINTAINED FOR SAFETY AND TO PROTECT ADJACENT UTILITIES AND STRUCTURES IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
14. USE EXTREME CAUTION WHEN INSTALLING RCP CULVERTS NEAR LEACHATE PIPES. PIPE EMBEDMENT AND BACKFILL SHALL BE INSTALLED TO PROVIDE NECESSARY SUPPORT FOR CULVERTS TO AVOID DAMAGE TO LEACHATE PIPES.



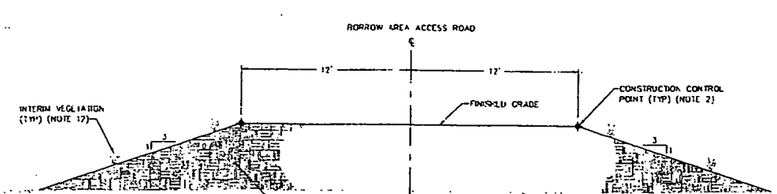
78 / G-5 DETAIL (TYP)
EMERGENCY ACCESS ROAD
SCALE: 1" = 4'



80 / G-5 DETAIL (TYP)
BORROW AREA HAUL ROAD RAMP
SCALE: 1" = 4'



79 / G-4 DETAIL (TYP)
BORROW AREA ACCESS ROAD – CELL 6
SCALE: 1" = 4'



81 / G-6 DETAIL (TYP)
BORROW AREA ACCESS ROAD – CELL 7
SCALE: 1" = 4'

REV NO	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	DWN BY	APR BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	LWG	JJA	TEF	DKP	RB
10	03.12.00	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	LWG	JJA	TEF	DKP	RB
1A	03.10.99	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	LWG	JJA	TEF	DKP	RB
0	02.10.99	CFC SUBMITTAL TO FF/DOE/EPA	LWG	JJA	TEF	DKP	RB
B	03.12.97	PRE-FINAL SUBMITTAL TO FF/DOE	LWG	JJA	TEF	DKP	RB
A	-	NOT ISSUED	-	-	-	-	-

20 10 0 20 40
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

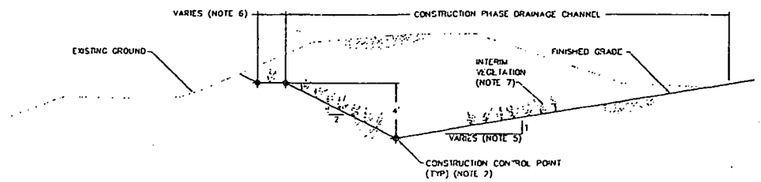
TITLE:
SURFACE-WATER MANAGEMENT SYSTEM DETAILS V

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDING OR CONSTRUCTION, UNLESS SEALED.

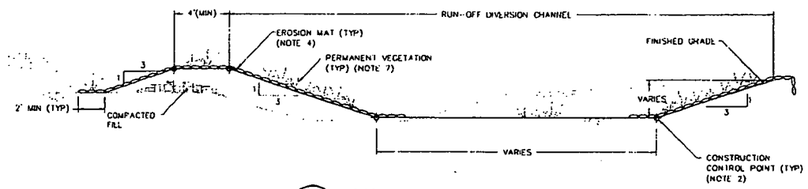
STATE OF OHIO
RUDOLPH BONAPARTE
E-36079
REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

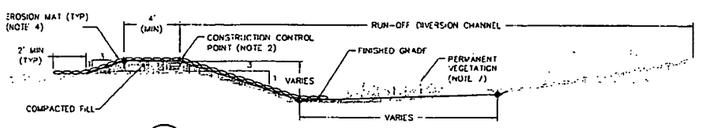
PROJECT NO: 20105
CONTRACT NO: 03F0699
FERNP DRAWING NO: 92X-SOCO-C-02407
GEOSYNTEC PROJECT NO: GU3211-05.04
GEOSYNTEC DOCUMENT NO: F03-1212
SHEET NO: G-40



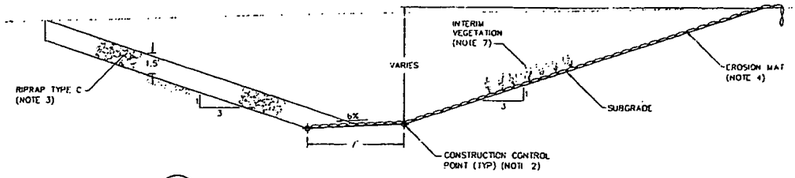
82 / G-3 DETAIL
DRAINAGE CHANNEL AND TEMPORARY RUN-OFF DIVERSION BERM
SCALE: 1" = 4'



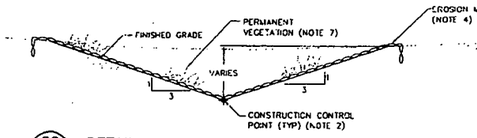
83 / G-4 DETAIL
RUN-OFF DIVERSION CHANNEL TO EXISTING BORROW AREA SEDIMENTATION BASIN
SCALE: 1" = 4'



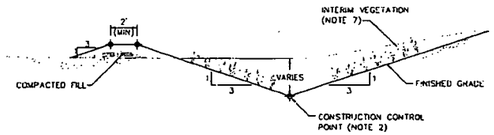
84 / G-6A DETAIL
RUN-OFF DIVERSION CHANNEL SOUTH OF CELL 8
SCALE: 1" = 4'



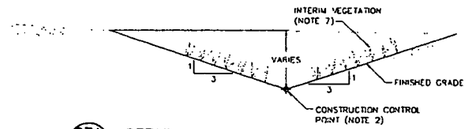
85 / G-8 DETAIL
DRAINAGE CHANNEL EAST OF "F" STREET
SCALE: 1" = 4'



86 / G-8 DETAIL
DRAINAGE CHANNEL SOUTH OF CELL 8
SCALE: 1" = 4'



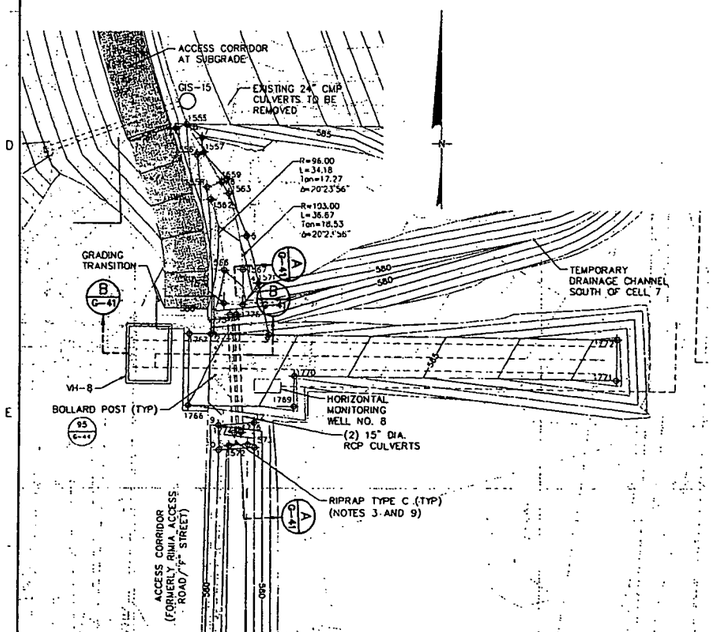
87 / G-4 DETAIL
TEMPORARY DRAINAGE CHANNEL SOUTH OF CELL 6
SCALE: 1" = 4'



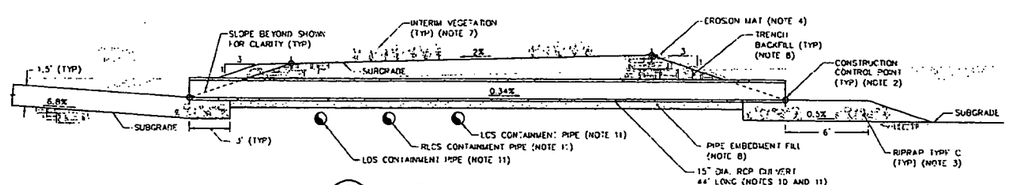
87A / G-8 DETAIL
TEMPORARY DRAINAGE CHANNEL SOUTH OF CELL 7
SCALE: 1" = 4'

SUBGRADE CONSTRUCTION CONTROL POINTS			
POINT NO.	NORTHING	EASTING	ELEVATION
1555	480259.15	1350669.04	583.09
1556	480247.84	1350672.82	582.00
1557	480248.84	1350675.14	582.00
1558	480335.89	1350670.89	581.00
1559	480337.73	1350682.43	581.00
1562	480231.30	1350678.43	580.68
1563	480233.53	1350685.07	581.10
1568	480205.11	1350683.38	578.00
1569	480205.30	1350690.38	578.42
1570	480193.60	1350683.28	578.16
1571	480192.98	1350690.27	578.58
1572	480140.69	1350685.47	577.75
1573	480141.10	1350692.48	578.17
1767	480181.75	1350670.03	581.48
1768	480153.43	1350689.73	582.01
1769	480154.94	1350709.68	583.48
1770	480186.26	1350709.62	583.24
1771	480184.82	1350677.54	582.61
1772	480178.82	1350677.72	582.31
1773	480148.84	1350685.55	578.67
1774	480145.44	1350687.48	578.52
1775	480148.94	1350687.93	578.87
1776	480145.53	1350689.88	578.52

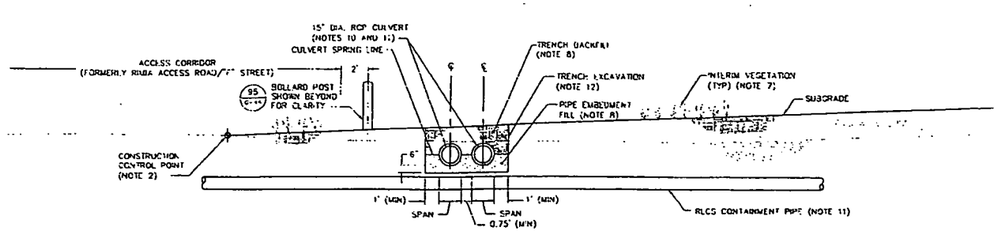
RIPRAP LIMIT CONTROL POINTS		
POINT NO.	NORTHING	EASTING
1	480257.81	1350666.81
2	480181.65	1350678.43
3	480181.38	1350700.10
4	480200.35	1350698.14
5	480217.84	1350691.77
6	480238.84	1350684.33
7	480254.04	1350674.74
8	480259.15	1350669.04
9	480148.18	1350681.44
10	480139.10	1350691.88
11	480139.87	1350694.98
12	480149.73	1350694.77



87B / G-6 PLAN
DRAINAGE CHANNEL EAST OF "F" STREET MODIFICATION AT VALVE HOUSE 8
SCALE: 1"=20'



A / G-41 SECTION
DRAINAGE CHANNEL EAST OF "F" STREET
15-IN DIA. RCP CULVERT CROSSING
SCALE: 1" = 4'



B / G-41 SECTION
DRAINAGE CHANNEL EAST OF "F" STREET
(2) 15" DIA. RCP CULVERT EMBEDMENT

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. CONSTRUCTION CONTROL POINTS FOR SUBGRADE ARE PROVIDED ON DRAWINGS G-3, G-4, G-5, G-6, AND G-6A AND ARE PROVIDED IN TABLE SHOWN ON THIS DRAWING. CONSTRUCTION CONTROL POINTS FOR CULVERT INVERTS AND RIPRAP LIMITS ARE PROVIDED IN TABLE SHOWN ON THIS DRAWING.
3. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 00271.
4. EROSION MAT SHALL BE INSTALLED ON SLOPE LENGTHS OF 8 FEET OR GREATER AS SHOWN AND IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
5. SLOPE OF CHANNEL SIDESLOPE IS 8H:1V FOR WEST PERIMETER OF OSDF AND TRANSITIONS FROM 8H:1V TO 3H:1V SOUTH OF CELL 8.
6. BERM WIDTH VARIES FROM 0 TO 2 FEET WHERE CHANNEL DEPTH REQUIRES BERM
7. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
8. TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
9. PLACE RIPRAP TYPE C WITHIN AREA SHOWN.
10. RCP CULVERTS AND JOINTS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02721. RCP CULVERTS SHALL BE PLACED ON TOP OF RIPRAP 1.5 FEET ABOVE SUBGRADE AS SHOWN ON DRAWINGS.
11. USE EXTREME CAUTION WHEN INSTALLING RCP CULVERTS NEAR LEACHATE PIPES. PIPE EMBEDMENT AND BACKFILL SHALL BE PLACED TO PROVIDE NECESSARY SUPPORT FOR CULVERTS TO AVOID DAMAGE TO LEACHATE PIPES
12. TRENCH EXCAVATION IS SHOWN VERTICAL AS DESIGNED. SHORING AND/OR STABLE TRENCH SIDESLOPES SHALL BE MAINTAINED FOR SAFETY AND TO PROTECT ADJACENT UTILITIES AND STRUCTURES IN ACCORDANCE WITH SPECIFICATION SECTION 02215.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	REV. BY	APP. BY
*	06.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	LMC	JJA	TEZ	DMP	RB
1D	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	LMC	JJA	TEZ	DMP	RB
1A	02.10.08	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	LMC	JJA	TEZ	DMP	RB
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	LMC	JJA	TEZ	DOP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	LMC	JJA	TEZ	DOP	JFB
*	-	NOT ISSUED	-	-	-	-	-

20 10 0 20 40
SCALE IN FEET

OWNER/AGENCY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

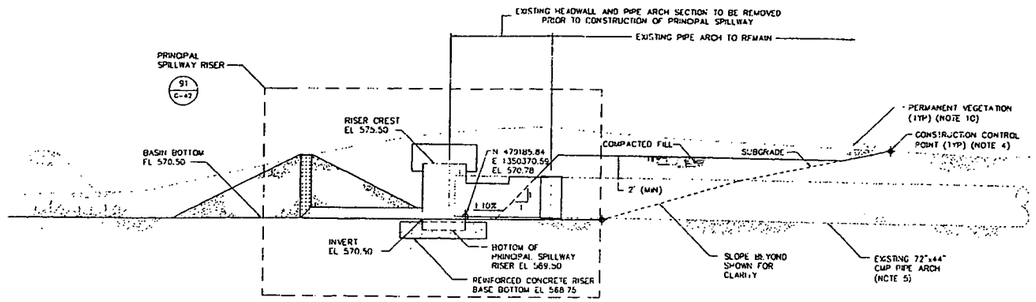
TITLE:
SURFACE-WATER MANAGEMENT SYSTEM DETAILS VI

THIS DRAWING MAY NOT BE USED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED

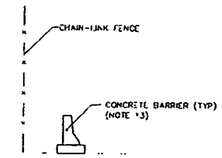
STATE OF OHIO — RUDOLPH BONAPARTE — E-56878 — REGISTERED PROFESSIONAL ENGINEER

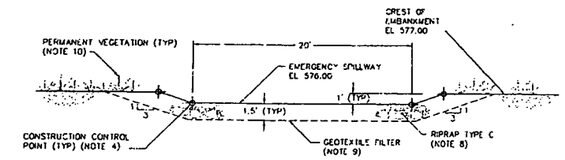
GEOSYNTEC CONSULTANTS

PROJECT NO.: 20125
CONTRACT NO.: 03F0659
FLUOR DRAWING NO.: SCX-6000-G-02403
GEOSYNTEC PROJECT NO.: GC3211-06.04
GEOSYNTEC DOCUMENT NO.: F03-1713

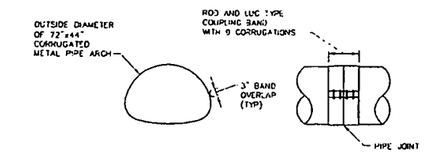


A G-5 SECTION
PRINCIPAL SPILLWAY
SCALE: 1" = 5'

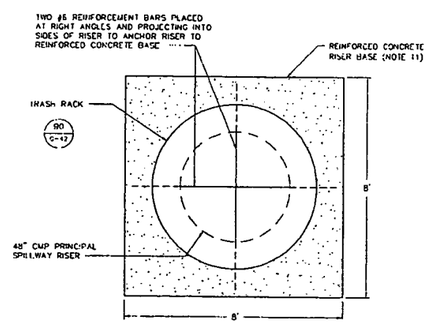




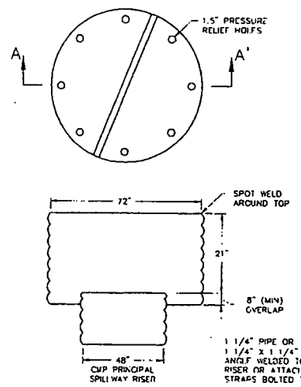
88 G-5 DETAIL
EMERGENCY SPILLWAY
SCALE: 1" = 5'



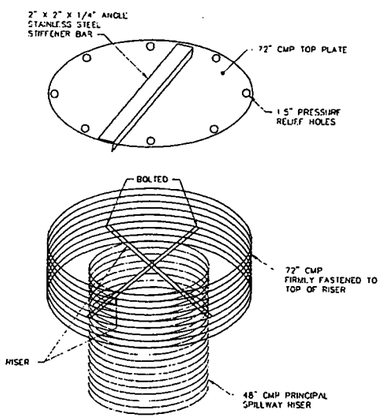
89 G-42 DETAIL
CMP COUPLING BAND
SCALE: NTS



PLAN

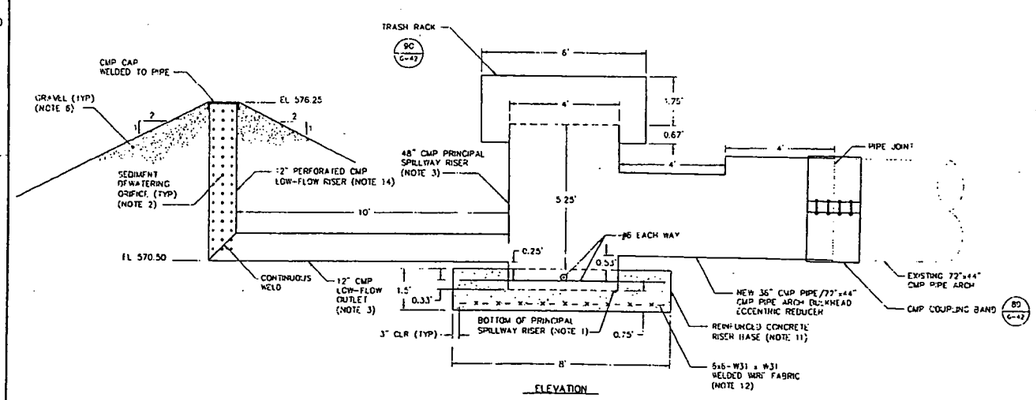


SECTION A–A'



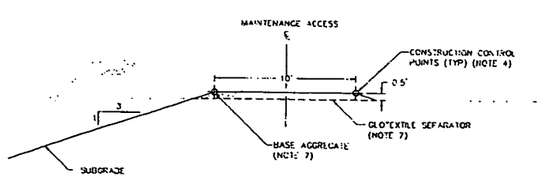
ISOMETRIC VIEW

90 G-42 DETAIL
CONCENTRIC TRASH RACK AND ANTI–VORTEX DEVICE
SCALE: NTS



ELEVATION

91 G-42 DETAIL
PRINCIPAL SPILLWAY RISER
SCALE: 1" = 2'



92 G-5 DETAIL
MAINTENANCE ACCESS
SCALE: 1" = 4'

NOTES:

1. PRINCIPAL SPILLWAY RISER SHALL BE EMBEDDED 0.75 FEET IN REINFORCED CONCRETE RISER BASE.
2. SEDIMENT DEWATERING ORIFICES SHALL BE 1 INCH DIAMETER AND VERTICALLY SPACED AT 4 INCHES ON CENTER WITH 8 ORIFICES AT EACH LEVEL.
3. CULVERTS AND RISERS SHALL BE ALUMINIZED AND IN ACCORDANCE WITH SPECIFICATION SECTION 02721.
4. CONSTRUCTION CONTROL POINTS FOR SUBGRADE AND MAINTENANCE ACCESS ALIGNMENT ARE PROVIDED ON DRAWING G-5.
5. CONTRACTOR SHALL FILL A MINIMUM OF 2 FEET ABOVE CROWN OF EXISTING CMP PIPE ARCH CULVERT. PLACEMENT AND COMPACTION OF FILL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
6. AASHTO NO. 57 STONE SHALL BE USED AROUND 12-INCH PERFORATED CMP LOW-FLOW RISER.
7. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
8. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
9. GEOTEXTILE FILTER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02714.
10. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
11. CONTRACTOR SHALL FURNISH CONCRETE MIX WITH SUFFICIENT AIR ENTRAINING ADMIXTURE TO PROVIDE 5% ± 1% AIR AT POINT OF DELIVERY IN ACCORDANCE WITH ASTM C231 AND A COMPRESSIVE STRENGTH OF 4000 PSI AT 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C39.
12. CONTRACTOR SHALL FURNISH REINFORCING WELDED STEEL WIRE FABRIC IN ACCORDANCE WITH ASTM A185.
13. CONCRETE BARRIERS SHALL BE SUPPLIED BY FLUOR FERNALD, INC.
14. CONTRACTOR SHALL WRAP LOW-FLOW RISER WITH GALVANIZED WIRE MESH OVERLAIN BY TWO WRAPS OF GEOTEXTILE FILTER. GALVANIZED WIRE MESH SHALL HAVE 1/2 INCH SQUARE OPENINGS AND A 0.063 INCH WIRE DIAMETER.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	REVW. BY	APP. BY
1	02.10.10	RESPONSE TO OEPA COMMENTS	UCP	JJA	CDC	DKP	JFB
0	02.01.22	CFC SUBMITTAL TO FF/DOE/EPA	LMC	JJA	TEZ	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	JMC	DMM	TEZ	DCP	JFB
A	01.10.12	PRELIMINARY SUBMITTAL TO FF/DOE	LMC	DMM	TEZ	DCP	JFB

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON–SITE DISPOSAL FACILITY – PHASE V

TITLE:
SURFACE–WATER MANAGEMENT SYSTEM DETAILS VII

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

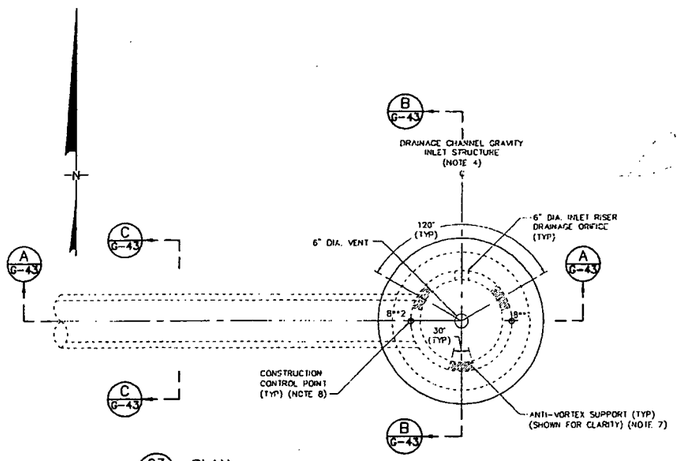
SIGNATURE
10-12-2002

STATE OF OHIO
JOHN T. BEECH
E-58248
REGISTERED PROFESSIONAL ENGINEER

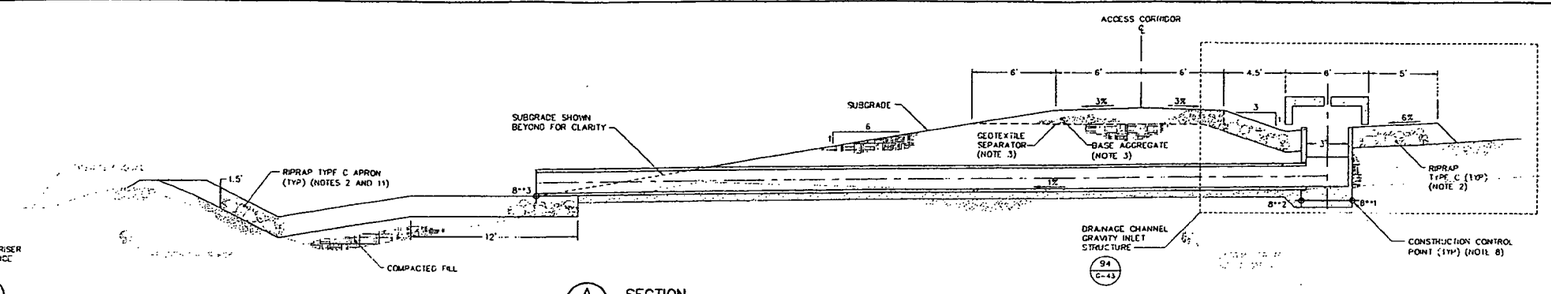
GEOSYNTEC CONSULTANTS
1107 LAKE HOLMES DRIVE
FOREST, FLORIDA 32043 USA

PROJECT NO.	20165
CONTRACT NO.	95P5005078
FLUOR DRAWING NO.	0C4-6500, G-0040A
GEOSYNTEC PROJECT NO.	001312-17-4
GEOSYNTEC DOCUMENT NO.	F02-1040
SHEET NO.	G-42

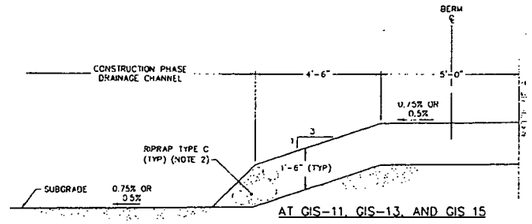
CERTIFIED FOR CONSTRUCTION



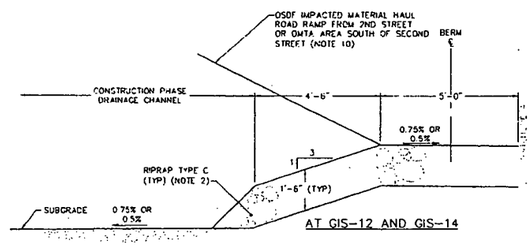
93 G-4 PLAN
DRAINAGE CHANNEL GRAVITY INLET STRUCTURE WITH RCP CULVERT
SCALE: 1" = 2'



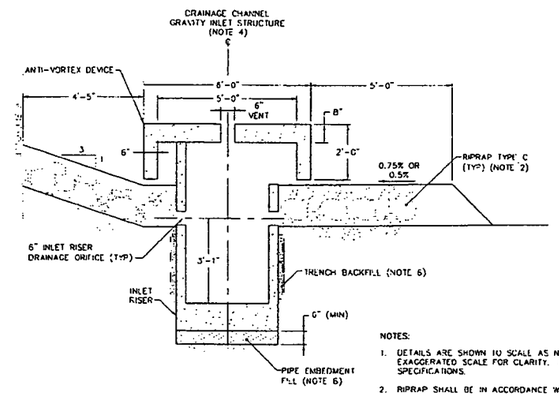
A G-43 SECTION
DRAINAGE CHANNEL GRAVITY INLET STRUCTURE WITH RCP CULVERT
SCALE: 1" = 4'



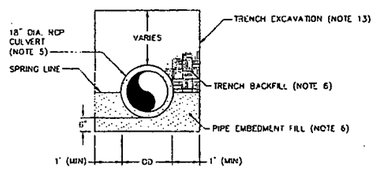
AT GIS-11, GIS-13, AND GIS 15



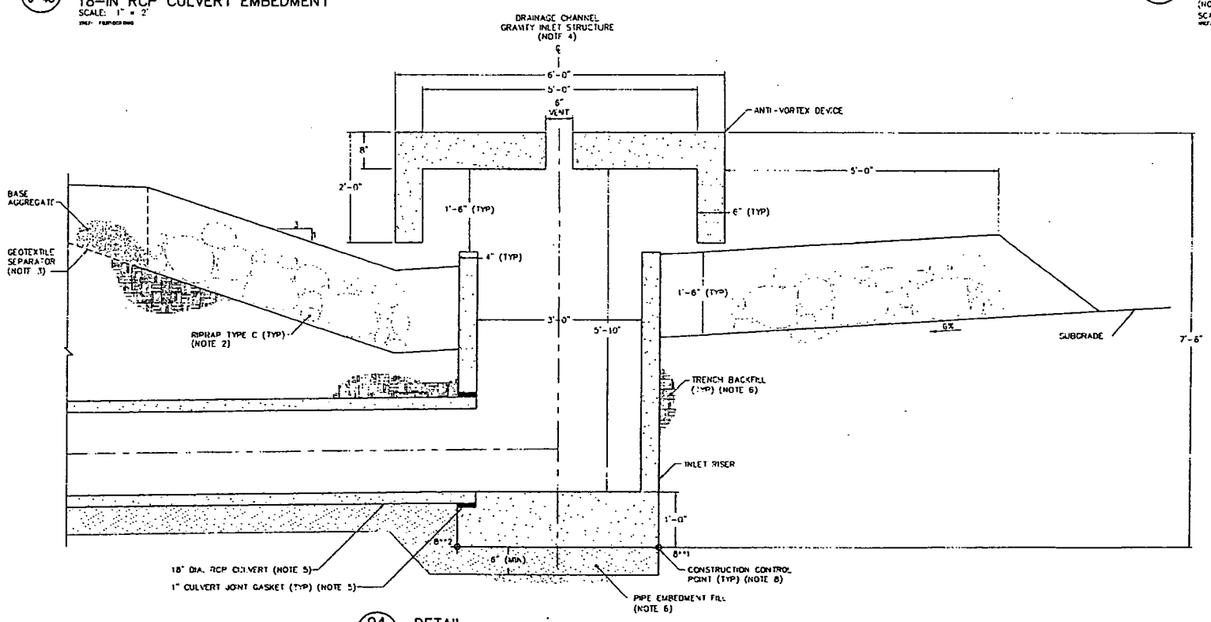
AT GIS-12 AND GIS-14



B G-43 SECTION
DRAINAGE CHANNEL GRAVITY INLET STRUCTURE
(NOTE 12)
SCALE: 1" = 2'



C G-43 SECTION (TYP)
18-IN RCP CULVERT EMBEDMENT
SCALE: 1" = 2'



94 G-43 DETAIL
DRAINAGE CHANNEL GRAVITY INLET STRUCTURE
SCALE: 1" = 1'

DRAINAGE CHANNEL GRAVITY INLET STRUCTURE AND REINFORCED CONCRETE PIPE CONSTRUCTION CONTROL POINTS			
GIS-11, GIS-12, GIS-13, GIS-14, AND GIS-15 (NOTE 8)			
POINT NO.	NORTHING	EASTING	ELEVATION
8111	481005.20	1350661.01	583.64
8112	481005.29	1350657.34	583.64
8113	481005.AA	1350902.09	583.88
8121	480811.84	1350658.66	582.27
8122	480811.89	1350654.99	582.27
8123	480812.56	1350599.74	582.51
8131	480605.18	1350656.13	581.14
8132	480605.23	1350652.47	581.14
8133	480605.90	1350597.21	581.38
8141	480410.16	1350653.76	580.11
8142	480410.21	1350650.10	580.11
8143	480410.88	1350594.83	580.41
8151	480268.30	1350671.06	579.62
8152	480267.13	1350667.58	579.62
8153	480249.46	1350615.28	579.86

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
3. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
4. DRAINAGE CHANNEL GRAVITY INLET STRUCTURE SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02721.
5. REINFORCED CONCRETE PIPE CULVERT AND JOINTS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02721.
6. TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
7. ANTI-VORTEX SUPPORTS DO NOT APPEAR IN ALL SECTIONS. SEE PLAN ON THIS SHEET FOR LOCATIONS.
8. CONSTRUCTION CONTROL POINTS ASSOCIATED WITH DRAINAGE CHANNEL GRAVITY INLET STRUCTURE AND REINFORCED CONCRETE PIPE ARE PROVIDED IN TABLE SHOWN ON THIS DRAWING. THE "**" SYMBOL REPRESENTS THE GRAVITY INLET STRUCTURE FOR WHICH THE APPROPRIATE CONTROL POINTS ARE PROVIDED.
9. EXISTING CONDITIONS SHOWN IN THIS SECTION CORRESPOND TO LOCATION OF GIS-14
10. PRIOR TO CONSTRUCTION OF OSDF IMPACTED MATERIAL HAUL ROAD RAMPS, PLACE GEOTEXTILE SEPARATOR BETWEEN RIPRAP AND COMPACTED FILL.
11. LIMITS OF RIPRAP TYPE C APRON ARE PROVIDED ON DRAWINGS G-4 AND G-6.
12. DRAINAGE CHANNEL SLOPE AT GIS-11 AND GIS-12 IS 0.75%. DRAINAGE CHANNEL SLOPE AT GIS-13, GIS-14, AND GIS-15 IS 0.5%.
13. TRENCH EXCAVATION IS SHOWN VERTICAL AS DESIGNED. SHORING AND/OR STABLE TRENCH SIDESLOPES SHALL BE MAINTAINED FOR SAFETY AND TO PROTECT ADJACENT UTILITIES AND STRUCTURES IN ACCORDANCE WITH SPECIFICATION SECTION 02215.

REV. NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	LMG	VDR	TEZ	DKP	RW
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	LMG	VDR	TEZ	DKP	RB
1A	-	NOT ISSUED	-	-	-	DKP	RW
0	02.01.99	CFC SUBMITTAL TO FF/DOE/EPA	LMG	VDR	TEZ	DCP	JFB
B	01.12.97	PRELIMINARY SUBMITTAL TO FF/DOE	LMG	CAB	TEZ	DCP	JFB
A		NOT ISSUED	—	—	—	—	—

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY - PHASE V

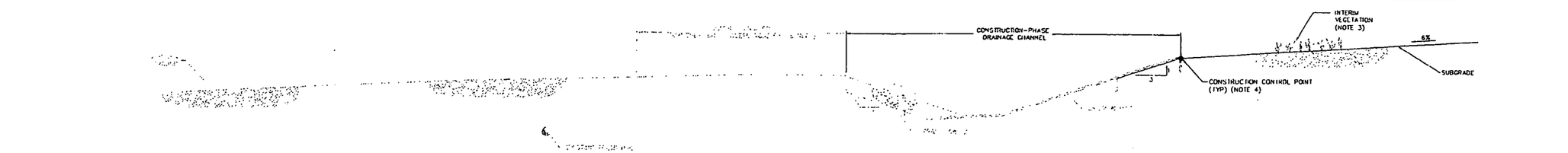
TITLE:
SURFACE-WATER MANAGEMENT SYSTEM DETAILS VIII

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT CHECK OR CONSTRUCTION, UNLESS SEALED

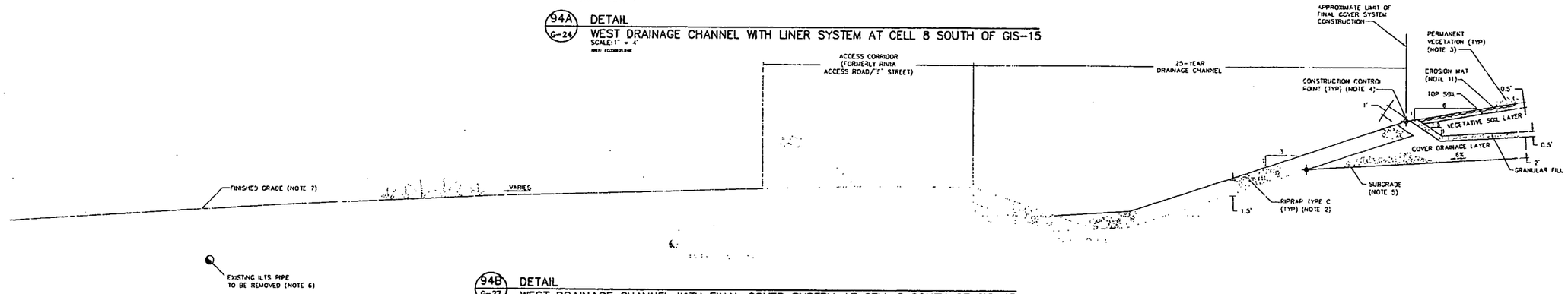
STATE OF OHIO
RUDOLPH BONAPARTE
E-58978
REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS

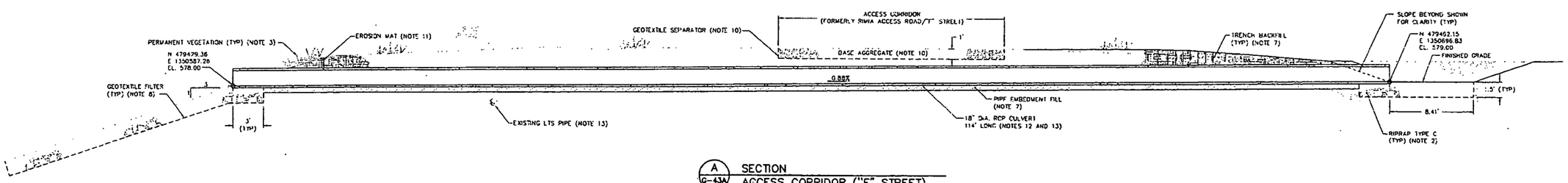
PROJECT NO: 20105
CONTRACT NO: C3FF0699
TEMP DRAWING NO: 90X-6000-S-00405
GEOSYNTEC PROJECT NO: 00321'-06.04
GEOSYNTEC DOCUMENT NO: F03-1045
SHEET NO:



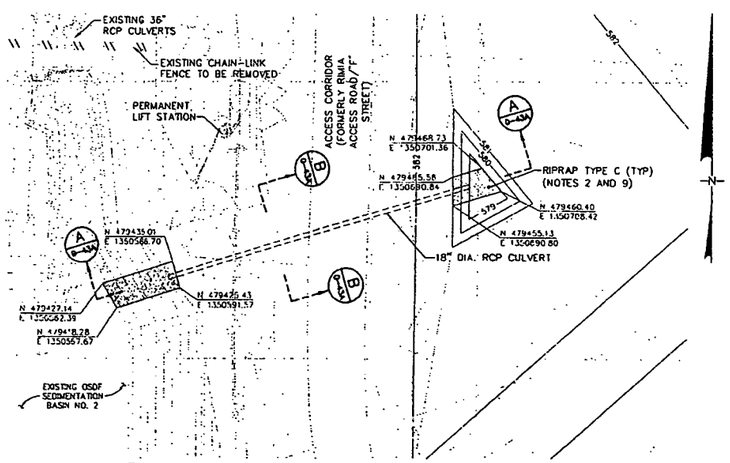
94A / G-24 DETAIL
WEST DRAINAGE CHANNEL WITH LINER SYSTEM AT CELL 8 SOUTH OF GIS-15
SCALE: 1" = 4'



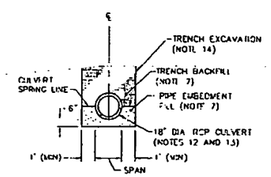
94B / G-27 DETAIL
WEST DRAINAGE CHANNEL WITH FINAL COVER SYSTEM AT CELL 8 SOUTH OF GIS-15
SCALE: 1" = 4'



A / G-43A SECTION
ACCESS CORRIDOR ("F" STREET)
18-IN DIA. RCP CULVERT CROSSING
SCALE: 1" = 4'



94C / G-15A PLAN
ACCESS CORRIDOR ("F" STREET) CULVERT CROSSING
SCALE: 1"=20'



B / G-43A SECTION
ACCESS CORRIDOR ("F" STREET)
18-IN DIA. RCP CULVERT EMBEDMENT
SCALE: 1" = 4'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
3. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
4. CONSTRUCTION CONTROL POINTS FOR SUBGRADE, CONTOURING LAYER, COMPACTED CLAY CAP, AND FINAL COVER SYSTEM ARE PROVIDED ON DRAWINGS G-6A, G-11, G-13A, AND G-15A.
5. CONTRACTOR SHALL RE-ESTABLISH SUBGRADE ELEVATIONS OUTSIDE PERMANENT WORK BASELINE PRIOR TO FINAL COVER SYSTEM CONSTRUCTION. CONSTRUCTION CONTROL POINTS FOR SUBGRADE ARE PROVIDED ON DRAWING G-6A.
6. CONTRACTOR SHALL REMOVE EXISTING INTERIM LEACHATE TRANSMISSION SYSTEM PIPE AFTER ADJACENT CELL CAPS ARE FULLY VEGETATED. CONTRACTOR SHALL PLACE COMPACTED FILL, AS NECESSARY, TO PROVIDE POSITIVE DRAINAGE TO FORMER PRODUCTION AREA AND AWAY FROM OSDF FACILITY.
7. TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
8. GEOTEXTILE FILTER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02714.
9. PLACE RIPRAP TYPE C WITHIN AREA SHOWN.
10. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230
11. EROSION MAT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
12. RCP CULVERTS AND JOINTS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02721.
13. USE EXTREME CAUTION WHEN INSTALLING RCP CULVERTS NEAR LEACHATE PIPES. PIPE EMBEDMENT AND BACKFILL SHALL BE PLACED TO PROVIDE NECESSARY SUPPORT FOR CULVERTS TO AVOID DAMAGE TO LEACHATE PIPES.
14. TRENCH EXCAVATION IS SHOWN VERTICAL AS DESIGNED. SHORING AND/OR STABLE TRENCH SIDESLOPES SHALL BE MAINTAINED FOR SAFETY AND TO PROTECT ADJACENT UTILITIES AND STRUCTURES IN ACCORDANCE WITH SPECIFICATION SECTION 02215

CERTIFIED-FOR-CONSTRUCTION

REV NO.	DATE	DESCRIPTION	DES BY	DR BY	CHK BY	RVW BY	APP BY
0	04.01.22	CFC SUBMITTAL TO FF/DOE/EPA	TEZ	VGR	LMG	DKP	RB
B	03.12.08	PRE-FINAL SUBMITTAL TO FF/DOE	TEZ	VGR	LMG	DKP	RB
A	-	NOT ISSUED	-	-	-	-	-

SCALE IN FEET

OWNER/FACILITY: UNITED STATES DEPARTMENT OF ENERGY FERNALD CLOSURE PROJECT

CLIENT: FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: SURFACE WATER MANAGEMENT SYSTEM DETAILS IX

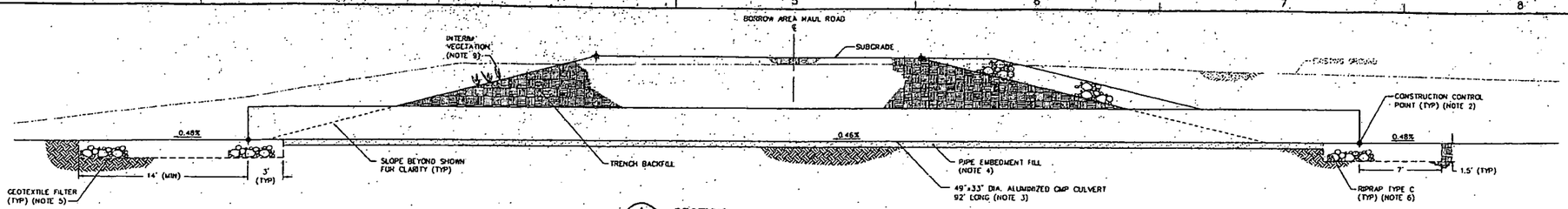
THIS DRAWING MAY NOT BE USED FOR PROJECT BIDDER OR CONSTRUCTION UNLESS SEALED.

Rudolph Bonaparte
SIGNATURE
22 January 04

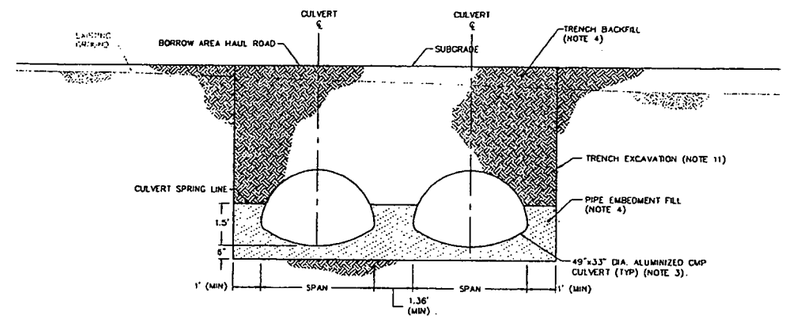
STATE OF OHIO — RUDOLPH BONAPARTE E-54678 — REGISTERED PROFESSIONAL ENGINEER

GEOSYNTEC CONSULTANTS
1900 LAKE WORTH DRIVE
ORLANDO, FLORIDA 32803 USA

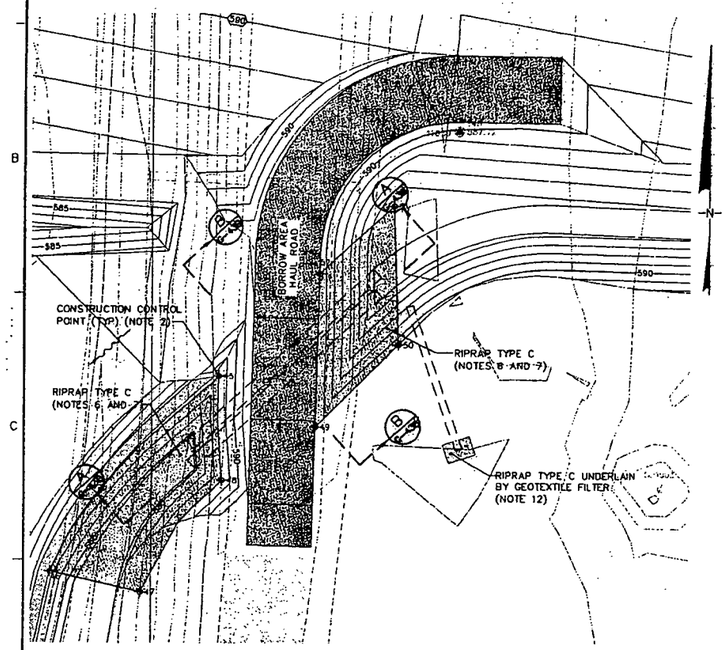
PROJECT NO:	20105
CONTRACT NO:	03FF0899
FLUOR DRAWING NO:	90X-0030-C-00422
GEOSYNTEC PROJECT NO:	GO3211-06.04
GEOSYNTEC DOCUMENT NO:	F03-0065
SHEET NO:	G-43A
REVISION NO:	-



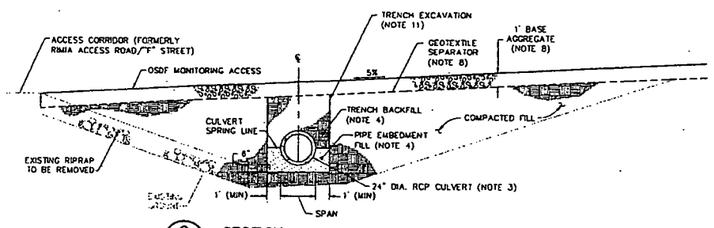
A G-43B SECTION
BORROW AREA HAUL ROAD
49"x33" DIA. ALUMINIZED CMP CULVERT CROSSING
SCALE: 1" = 4'



B G-43B SECTION
BORROW AREA HAUL ROAD
(2) 49"x33" DIA. ALUMINIZED CMP CULVERT EMBEDMENT
SCALE: 1" = 2'

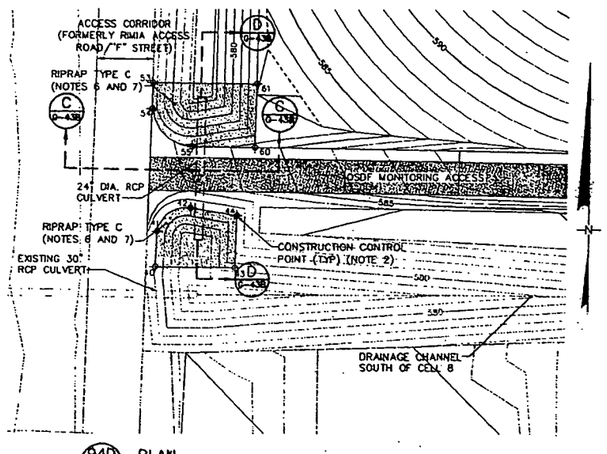


94C G-6A PLAN
RUN-OFF DIVERSION CHANNEL MODIFICATION AT EXISTING BORROW AREA HAUL ROAD
SCALE: 1" = 20'

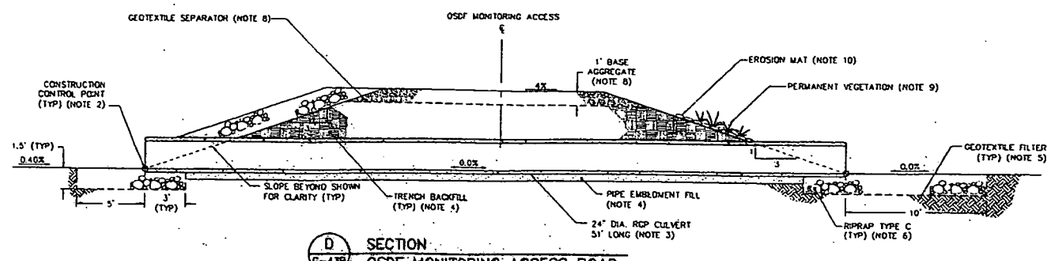


C G-43B SECTION
OSDF MONITORING ACCESS ROAD
24" DIA. RCP CULVERT EMBEDMENT
SCALE: 1" = 4'

RIPRAP LIMITS CONTROL POINTS		
POINT NO.	NORTHING	EASTING
40	479879.48	1350869.44
41	479892.33	1350870.03
42	479700.81	1350882.32
43	479679.15	1350899.15
44	479697.97	1350899.52
45	479616.03	1351024.29
46	479544.95	1350963.04
47	479537.49	1350995.98
48	479578.29	1351025.51
49	479597.71	1351059.82
50	479627.47	1351089.83
51	479677.47	1351088.25
52	479653.01	1351061.28
53	479745.97	1350867.83
54	479736.54	1350867.73
55	479722.90	1350882.61
60	479722.61	1350706.01
61	479745.54	1350706.45



94D G-15A PLAN
DRAINAGE CHANNEL EAST OF "F" STREET MODIFICATION AT OSDF MONITORING ACCESS ROAD
SCALE: 1"=20'



D G-43B SECTION
OSDF MONITORING ACCESS ROAD
24" DIA. RCP CULVERT CROSSING
SCALE: 1" = 4'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. CONSTRUCTION CONTROL POINTS FOR SUBGRADE, CULVERT INVERTS, AND RIPRAP LIMITS ARE PROVIDED IN THE TABLE SHOWN ON THIS DRAWING AND ON DRAWINGS G-6A AND G-15A.
3. ALUMINIZED CMP AND RCP CULVERTS AND JOINTS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02721.
4. TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
5. GEOTEXTILE FILTER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02714.
6. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
7. PLACE RIPRAP TYPE C WITHIN AREA SHOWN.
8. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
9. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
10. EROSION MAT SHALL BE INSTALLED ON SLOPE LENGTHS OF 6' OR GREATER AND IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
11. TRENCH EXCAVATION IS SHOWN VERTICAL AS DESIGNED. SHORING AND/OR STABLE TRENCH SIDESLOPES SHALL BE MAINTAINED FOR SAFETY AND TO PROTECT ADJACENT UTILITIES AND STRUCTURES IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
12. PLACE RIPRAP WITHIN AREA SHOWN. RIPRAP THICKNESS SHALL BE 1.5 FEET. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION 02714. GEOTEXTILE FILTER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
3	05.02.15	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEZ	JJA	LMC	DKP	JFB
1C	–	NOT ISSUED	–	–	–	–	–
1B	–	NOT ISSUED	–	–	–	–	–
1A	–	NOT ISSUED	–	–	–	–	–
0	04.01.22	CFC SUBMITTAL TO FF/DOE/EPA	LMC	JJA	TEZ	DKP	RB
B	03.12.08	PRE-FINAL SUBMITTAL TO FF/DOE	LMC	JJA	TEZ	DKP	RB
A	01.10.28	PRELIMINARY SUBMITTAL TO FF/DOE	LMC	JJA	TEZ	DKP	RB

20 10 0 20 40
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

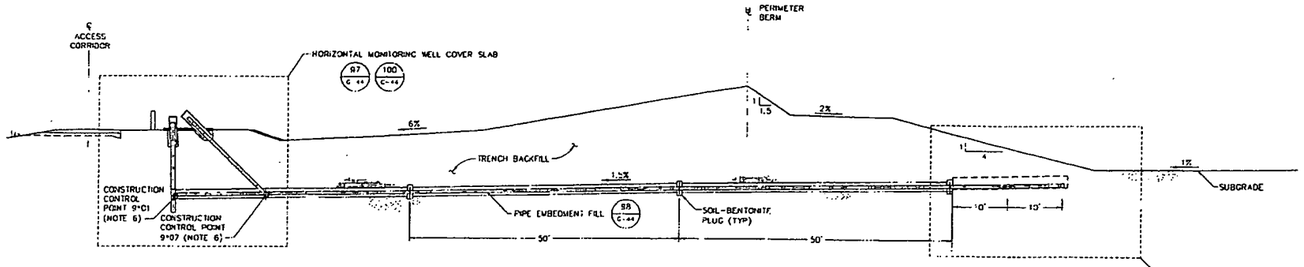
TITLE:
SURFACE-WATER MANAGEMENT SYSTEM DETAILS X

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

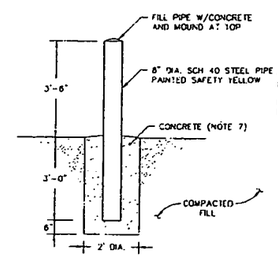
STATE OF OHIO — JOHN J. BEECH — E-58246 — REGISTERED PROFESSIONAL ENGINEER

GeoSynTec Consultants
1120 NORTHS BOULEVARD SUITE 100
NORCROSS, GEORGIA 30093 (404) 923-9000

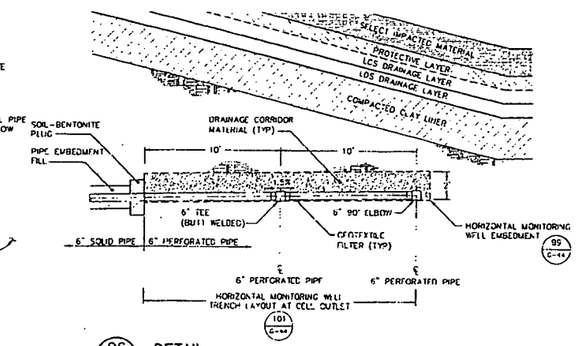
PROJECT NO.:	20105
CONTRACT NO.:	03F0899
FLUOR DRAWING NO.:	90X-6000-G-00423
GEOSYNTEC PROJECT NO.:	003309-02.02
GEOSYNTEC CODENO NO.:	T04-1063
SHEET NO.:	G-2-205



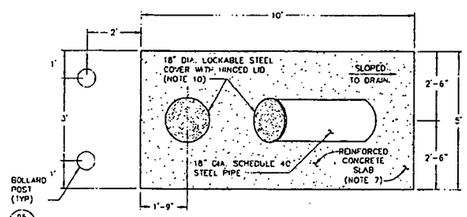
A — SECTION (TYP)
HORIZONTAL MONITORING WELL
(NOTES 1 AND 2)
SCALE: 1" = 10'



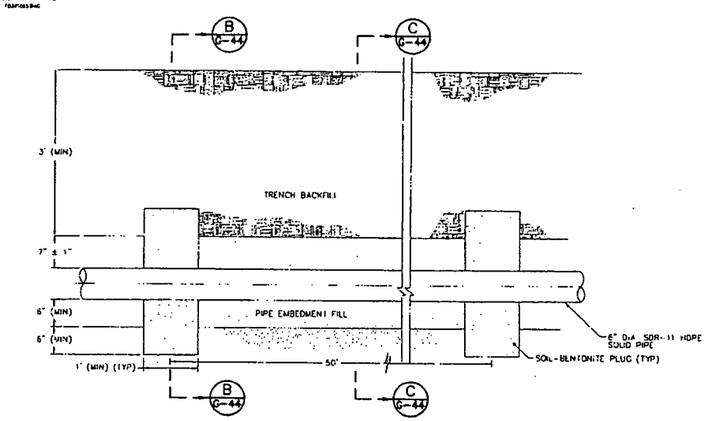
95 G-44 DETAIL
BOLLARD POST
SCALE: 1" = 2'



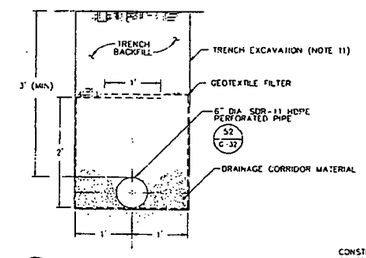
96 G-44 DETAIL
HORIZONTAL MONITORING WELL TRENCH AT CELL OUTLET
SCALE: 1" = 4'



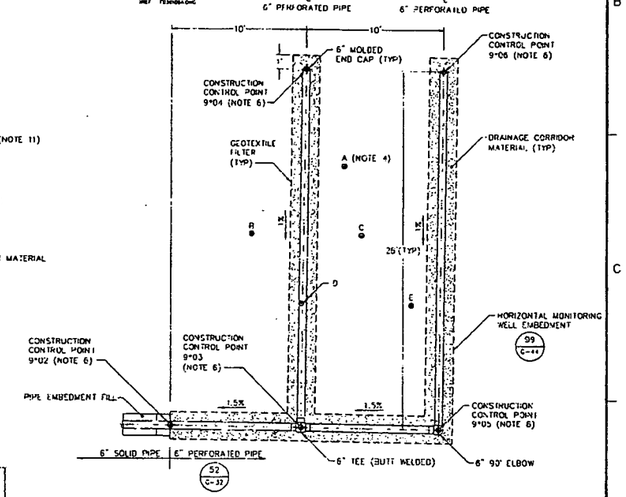
97 G-44 DETAIL
HORIZONTAL MONITORING WELL COVER SLAB
SCALE: 1" = 2'



98 G-44 DETAIL
PIPE EMBEDMENT
(NOTES 1, 2, AND 3)
SCALE: 1" = 1'



99 G-44 DETAIL
HORIZONTAL MONITORING WELL EMBEDMENT
(NOTES 1 AND 3)
SCALE: 1" = 1'

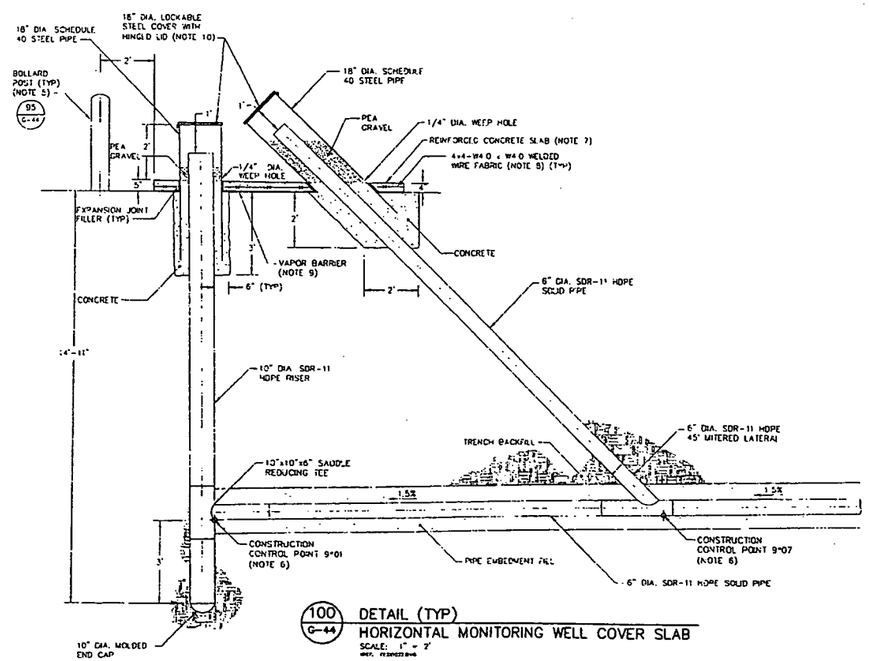


LOCATION OF OVERLYING FEATURE RELATIVE TO TRENCH

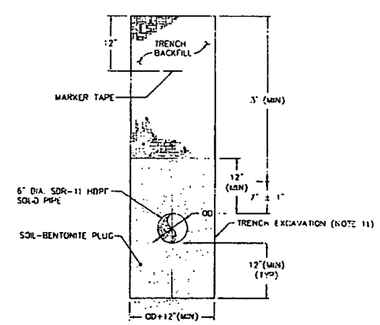
LEGEND:

- A — LDS PIPE SECONDARY LINER PENETRATION
- B — REDUNDANT LCS PIPE SECONDARY LINER PENETRATION
- C — REDUNDANT LCS PIPE PRIMARY LINER PENETRATION
- D — LDS PIPE SECONDARY LINER PENETRATION
- E — LDS PIPE PRIMARY LINER PENETRATION

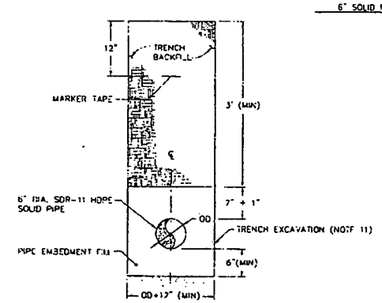
101 G-44 PLAN
HORIZONTAL MONITORING WELL TRENCH LAYOUT AT CELL OUTLET
SCALE: 1" = 4'



100 G-44 DETAIL (TYP)
HORIZONTAL MONITORING WELL COVER SLAB
SCALE: 1" = 2'



B G-44 SECTION
PIPE EMBEDMENT WITH SOIL-BENTONITE PLUG
(NOTES 1, 2, AND 3)
SCALE: 1" = 1'



C G-44 SECTION
PIPE EMBEDMENT
(NOTES 1 AND 3)
SCALE: 1" = 1'

NOTES:

1. TRENCHING AND BACKFILLING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
2. SOIL-BENTONITE PLUG SHALL BE LOCATED 50 FEET ON CENTER AND SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02215.
3. PIPES AND FITTINGS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02505.
4. POINTS "A" THROUGH "E" ILLUSTRATE THE HORIZONTAL LOCATIONS OF LINER PENETRATIONS SITUATED ABOVE THE HORIZONTAL MONITORING WELL TRENCH AT THE CELL OUTLET.
5. BOLLARD POST SHOWN BEYOND FOR CLARITY.
6. CONSTRUCTION CONTROL POINTS ASSOCIATED WITH HORIZONTAL MONITORING WELLS ARE PROVIDED IN TABLE SHOWN ON THIS DRAWING. THE "*" SYMBOL REPRESENTS THE HORIZONTAL MONITORING WELL FOR WHICH THE APPROPRIATE CONTROL POINTS ARE PROVIDED.
7. CONCRETE MIX SHALL HAVE SUFFICIENT AIR ENTRAINING ADMIXTURE TO PROVIDE 5 ± 1% AIR AT POINT OF DELIVERY IN ACCORDANCE WITH ASTM C233 AND A COMPRESSIVE STRENGTH OF 4000 PSI AT 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C39.
8. REINFORCING WELDED STEEL WIRE FABRIC SHALL BE IN ACCORDANCE WITH ASTM A185.
9. VAPOR BARRIER SHALL BE 6-MIL (MINIMUM THICKNESS) POLYETHYLENE SHEET.
10. HINGE FOR LOCKABLE STEEL COVER SHALL BE LOAD-RATED FOR 50 POUNDS OR GREATER. HINGE SHALL BE ATTACHED TO ENSURE HINGE FUNCTIONS AS DESIGNED BY MANUFACTURER.
11. TRENCH EXCAVATION IS SHOWN VERTICAL AS DESIGNED. SHORING AND/OR STABLE TRENCH SIDESLOPES SHALL BE MAINTAINED FOR SAFETY AND TO PROTECT ADJACENT UTILITIES AND STRUCTURES IN ACCORDANCE WITH SPECIFICATION SECTION 02215.

HORIZONTAL MONITORING WELL CONSTRUCTION CONTROL POINTS

CELL NO.	POINT NO.	NORTHING	EASTING	BOTTOM OF PIPE ELEVATION
CELL 7	9701	480563.10	1350656.53	575.61
	9702	480561.38	1350796.81	577.61
	9703	480561.26*	1350806.81	577.76
	9704	480587.26	1350807.13	578.02
	9705	480561.14	1350816.81	577.91
	9706	480587.14	1350817.13	578.17
	9707	480562.90	1350673.07	575.75
CELL 8	9801	480162.57	1350896.97	575.62
	9802	480160.96	1350829.44	575.61
	9803	480160.83	1350839.44	575.76
	9804	480186.83	1350839.76	576.02
	9805	480160.71	1350849.44	575.91
	9806	480186.71	1350849.76	576.17
	9807	480162.37	1350713.50	575.87

CERTIFIED-FOR-CONSTRUCTION

REV. NO.	DATE	DESCRIPTION	DR'S BY	DR BY	CHK BY	PM BY	APP BY
1	04.01.22	CIC REVISION 1 SUBMITTAL TO FF/DOE/EPA	LMC	JJA	TEJ	DKP	RB
1B	03.12.02	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	LMC	JJA	TEJ	DKP	RB
1A	03.10.28	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	LMC	JJA	TEJ	DKP	RB
0	03.01.29	CIC SUBMITTAL TO FF/DOE/EPA	KRD	JWD	KRD	DCP	JTB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWC	KRD	DCP	JTB
A	-	NOT ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY: UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT: **FLUOR FERNALD, INC.**

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: HORIZONTAL MONITORING WELL AND MISCELLANEOUS DETAILS

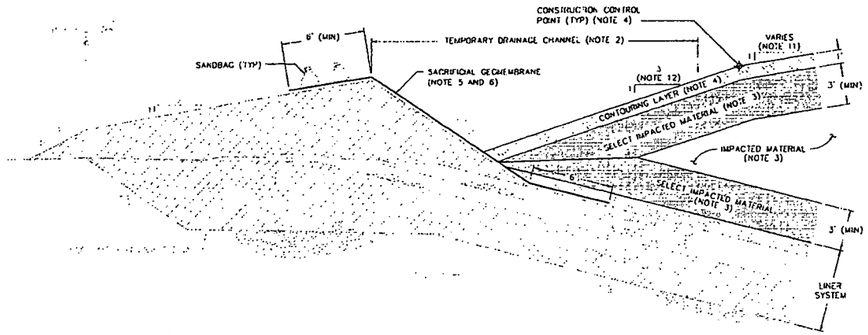
THIS DRAWING MAY NOT BE USED FOR PROJECT REVIEW OR CONSTRUCTION UNLESS SEALED.

SIGNATURE: Rudolph Bonaparte
DATE: 22 January 04

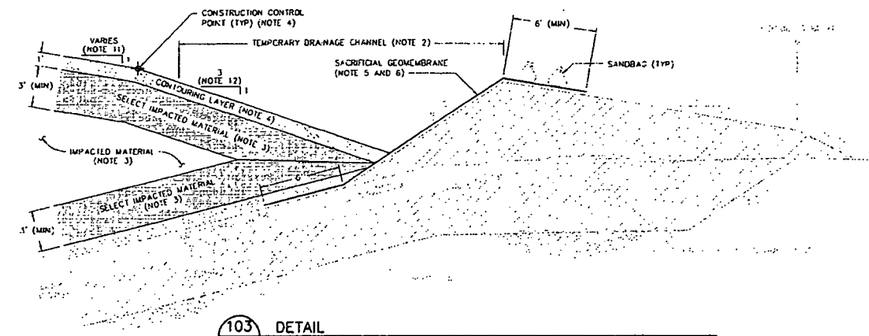
STATE OF OHIO — RUDOLPH BONAPARTE E-56679 — REGISTERED PROFESSIONAL ENGINEER

GEO SYNTEC CONSULTANTS

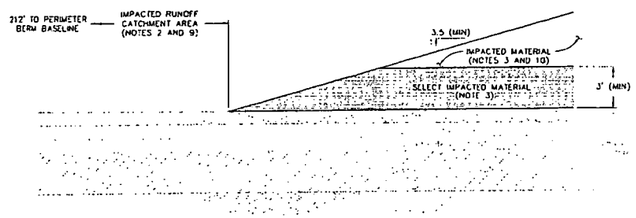
PROJECT NO.:	20105
CONTRACT NO.:	DE-AC24-01OH20699
FLUOR DRAWING NO.:	90X-6000-G-00408
GEOSYNTEC PROJECT NO.:	GO2211-06.04
GEOSYNTEC DOCUMENT NO.:	F03-1046
SHEET NO.:	G-44
REVISION NO.:	1



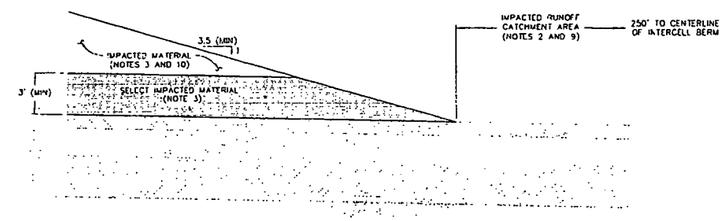
102 – DETAIL
SOUTH AND WEST PERIMETER WITH IMPACTED MATERIAL PLACEMENT
(NOTES 7 AND 8)
SCALE: 1" = 4'



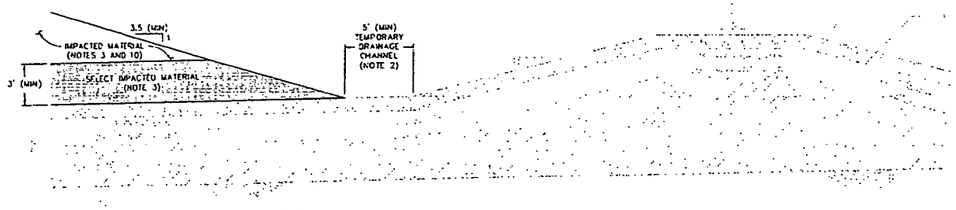
103 – DETAIL
EAST PERIMETER WITH IMPACTED MATERIAL PLACEMENT
SCALE: 1" = 4'



104 – DETAIL
IMPACTED MATERIAL PLACEMENT – CELLS 4 THROUGH 7
EASTERN LIMIT OF IMPACTED RUNOFF CATCHMENT AREA
SCALE: 1" = 4'



105 – DETAIL
IMPACTED MATERIAL PLACEMENT – CELLS 4 THROUGH 7
NORTHERN LIMIT OF IMPACTED RUNOFF CATCHMENT AREA
SCALE: 1" = 4'



106 – DETAIL
IMPACTED MATERIAL PLACEMENT – CELLS 4 THROUGH 7 AT INTERCELL BERM LOCATED OUTSIDE OF IMPACTED RUNOFF CATCHMENT AREA
SCALE: 1" = 4'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE AS SPECIFIED IN TECHNICAL SPECIFICATIONS.
2. PURPOSE OF THIS DRAWING IS TO ILLUSTRATE PLACEMENT OF SELECT IMPACTED MATERIAL, IMPACTED MATERIAL AND CONTOURING LAYER, INCRISS TO AND FORESS FROM CELLS AND CONCURRENT CONTROL OF IMPACTED RUNOFF IN CELLS DURING FELLING. WATER GENERATED DURING CONSTRUCTION AND FILLING OF OSDF SHALL BE CONTAINED AND CONTROLLED IN ACCORDANCE WITH SPECIFICATION SECTION 02270 EROSION CONTROL MEASURES SHALL BE INSTALLED (E.G. STRAW BALES) CONSISTENT WITH THE IMPACTED MATERIAL PLACEMENT PLAN.
3. A MINIMUM THICKNESS OF 3 FEET OF SELECT IMPACTED MATERIAL SHALL BE PLACED ABOVE PROTECTIVE LAYER AND BELOW CONTOURING LAYER. THICKNESS OF SELECT IMPACTED MATERIAL OVERLYING PROTECTIVE LAYER MAY BE REDUCED TO 2 FEET IF FIRST LIFT OF IMPACTED MATERIAL TO BE PLACED OVER SELECT IMPACTED MATERIAL IS CATEGORY 1 IMPACTED MATERIAL. IMPACTED MATERIAL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
4. CONTOURING LAYER SHALL CONSIST OF NON-IMPACTED MATERIAL IN ACCORDANCE WITH SPECIFICATION SECTION 02240.
5. SACRIFICIAL GEOMEMBRANE SHALL BE USED TO CONTROL IMPACTED RUNOFF IN CELLS 4 THROUGH 8 DURING FELLING. EXPOSED SACRIFICIAL GEOMEMBRANE SHALL BE REMOVED BY CUTTING PRIOR TO CONSTRUCTION OF COMPACTED CLAY CAP IN TEMPORARY DRAINAGE CHANNEL.
6. SACRIFICIAL GEOMEMBRANE SHALL CONSIST OF HIGH DENSITY POLYETHYLENE, AS APPROVED BY CONSTRUCTION MANAGER AND PROVIDED BY FLUOR FERNALD, INC. SACRIFICIAL GEOMEMBRANE SHALL BE SECURED IN-PLACE WITH SANDBAGS TO PREVENT DAMAGE FROM WIND.
7. CELLS 4 THROUGH 8 PROTECTIVE LAYER CONSISTS OF NON-IMPACTED GRANULAR MATERIAL IN IMPACTED RUNOFF CATCHMENT AREA.
8. CELL 8 IMPACTED MATERIAL PLACEMENT AT IMPACTED RUNOFF CATCHMENT AREA IS ILLUSTRATED BY DETAIL 108 SHEET G-46.
9. IMPACTED RUNOFF CATCHMENT AREA IN ACTIVE CELL SHALL REMAIN OPEN UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED IN ADJACENT UPGRADIENT CELL AND IMPACTED RUNOFF CATCHMENT AREA IN FUTURE CELLS CONSTRUCTED AND OPERATIONAL.
10. IMPACTED MATERIAL INTERIM SLOPES SHALL BE NO STEEPER THAN 3.5H:1V IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
11. SLOPE OF LOWER PORTION OF FINAL COVER SYSTEM IS 6H:1V FOR EAST, WEST, AND SOUTH PERIMETERS OF OSDF.
12. INSTALL SILT FENCE 10 FEET (MEASURED HORIZONTALLY) UPSLOPE OF 3H:1V SLOPE LINIT. INSTALL ADDITIONAL SILT FENCES AT APPROXIMATELY 50 FEET INTERVALS FOR A TOTAL OF THREE SILT FENCES. SILT FENCES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02273.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	KRD	VGR	KRD	DKF	RB
1B	03.13.06	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	KRD	VGR	KRD	DKF	RB
1A	–	NOT ISSUED	–	–	–	–	–
C	12.01.29	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWD	KRD	DGF	JFB
B	09.13.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWD	KRD	DGF	JFB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	KRD	JWD	KRD	DGF	JFB

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
IMPACTED MATERIAL PLACEMENT DETAILS I

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

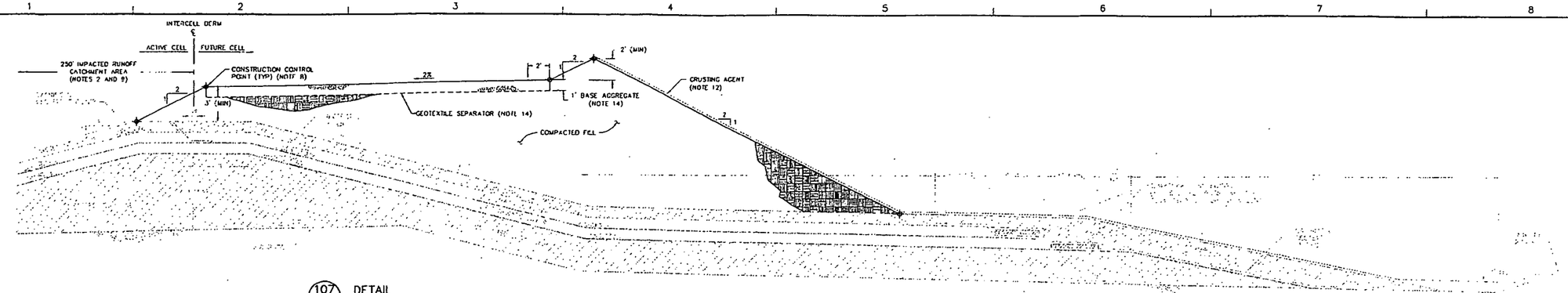
Rudolph Bonaparte
SIGNATURE
22 January 04

STATE OF OHIO
RUDOLPH BONAPARTE
E-56679
REGISTERED PROFESSIONAL ENGINEER

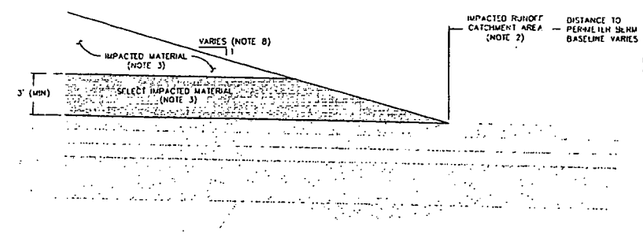
GEOSYNTEC CONSULTANTS
1400 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

PROJECT NO.: 20105
CONTRACT NO.: 0.FN0599
FERN DRAWING NO.: 90X-0100-C-00407
GEOSYNTEC PROJECT NO.: GG3211-05.04
GEOSYNTEC DOCUMENT NO.: F03-1047
SHEET NO.: G-45
REVISION NO.:

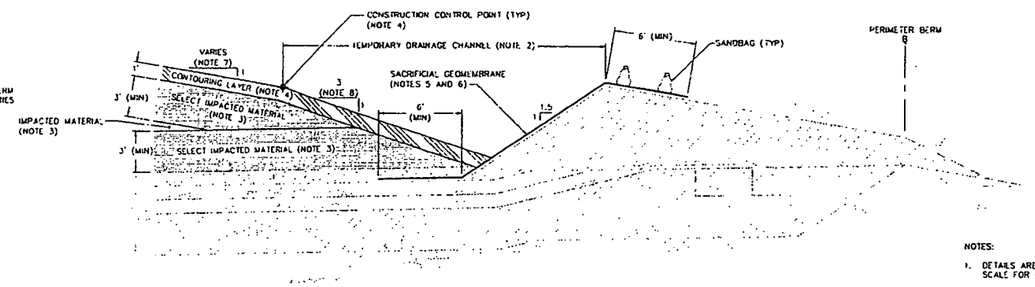
CERTIFIED–FOR–CONSTRUCTION



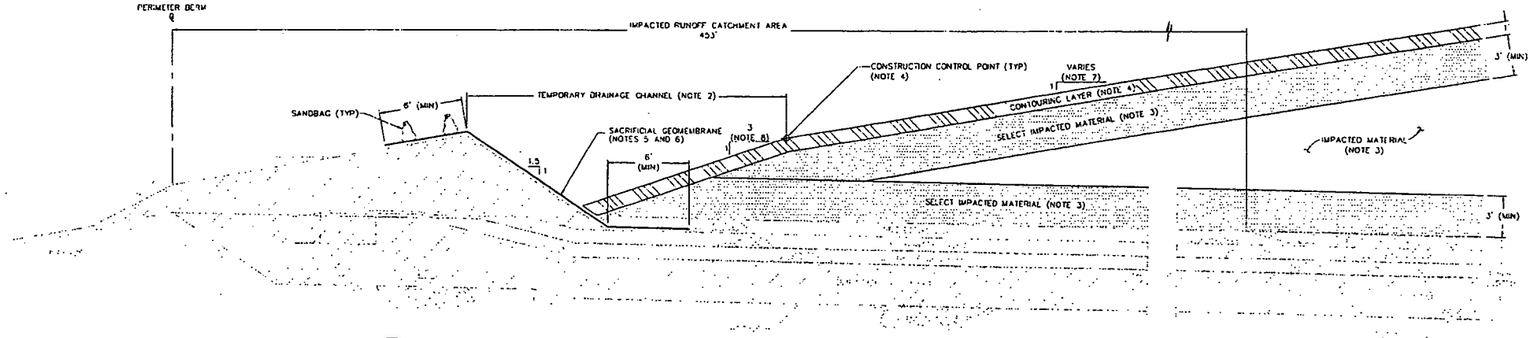
107 / G-17 DETAIL
CELL ACCESS RAMP – CELLS 6 AND 7 AT IMPACTED RUNOFF CATCHMENT AREA
SCALE 1" = 4'



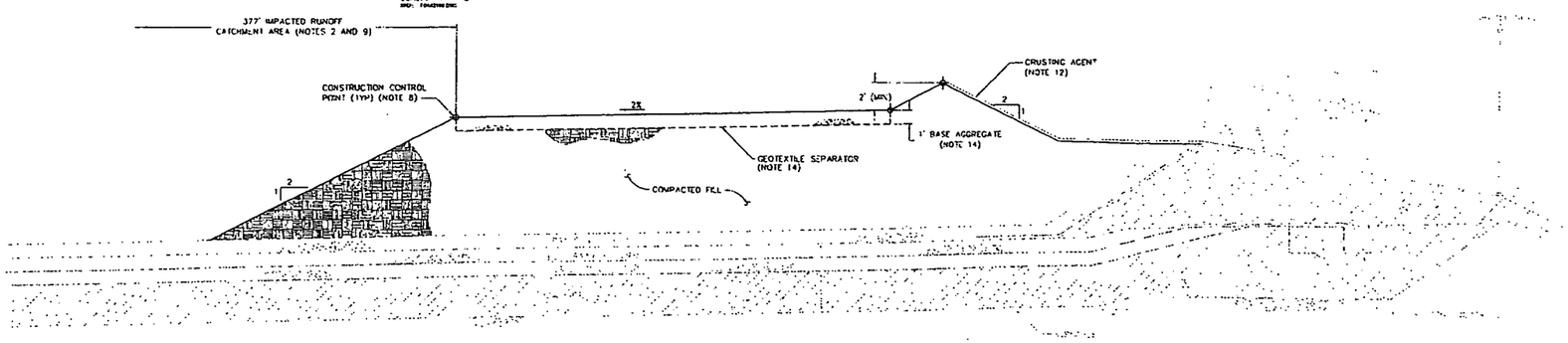
108 / G-20A DETAIL
IMPACTED MATERIAL PLACEMENT – CELL 8 AT LIMIT OF IMPACTED RUNOFF CATCHMENT AREA
SCALE: 1" = 4'



109 / – DETAIL
SOUTH PERIMETER WITH IMPACTED MATERIAL PLACEMENT – CELL 8 OUTSIDE OF IMPACTED RUNOFF CATCHMENT AREA
SCALE: 1" = 5'



110 / – DETAIL
SOUTH PERIMETER WITH IMPACTED MATERIAL PLACEMENT – CELL 8 AT IMPACTED RUNOFF CATCHMENT AREA
SCALE: 1" = 8'



111 / G-18A DETAIL
CELL ACCESS RAMP AT IMPACTED RUNOFF CATCHMENT AREA – CELL 8
SCALE: 1" = 4'

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE AS SPECIFIED IN TECHNICAL SPECIFICATIONS.
2. PURPOSE OF THIS DRAWING IS TO ILLUSTRATE PLACEMENT OF SELECT IMPACTED MATERIAL, IMPACTED MATERIAL AND CONTOURING LAYER, INGRESS TO AND EGRESS FROM CELLS AND CONCURRENT CONTROL OF IMPACTED RUNOFF IN CELLS DURING FILLING. WATER GENERATED DURING CONSTRUCTION AND FILLING OF OSDF SHALL BE CONTAINED AND CONTROLLED IN ACCORDANCE WITH SPECIFICATION SECTION 02270. EROSION CONTROL MEASURES SHALL BE INSTALLED (E.G. STRAW BALES) CONSISTENT WITH THE IMPACTED MATERIAL PLACEMENT PLAN.
3. A MINIMUM THICKNESS OF 3 FEET OF SELECT IMPACTED MATERIAL SHALL BE PLACED ABOVE PROTECTIVE LAYER AND BELOW CONTOURING LAYER. THICKNESS OF SELECT IMPACTED MATERIAL OVERLYING PROTECTIVE LAYER MAY BE REDUCED TO 2 FEET IF FIRST LIFT OF IMPACTED MATERIAL TO BE PLACED OVER SELECT IMPACTED MATERIAL IS CATEGORY 1 IMPACTED MATERIAL. IMPACTED MATERIAL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
4. CONTOURING LAYER SHALL CONSIST OF NON-IMPACTED MATERIAL IN ACCORDANCE WITH SPECIFICATION SECTION 02240.
5. SACRIFICIAL GEOMEMBRANE SHALL BE USED TO CONTROL IMPACTED RUNOFF IN CELLS 4 THROUGH 8 DURING FILLING. EXPOSED SACRIFICIAL GEOMEMBRANE SHALL BE REMOVED BY CUTTING PRIOR TO CONSTRUCTION OF COMPACTED CLAY CAP IN TEMPORARY DRAINAGE CHANNEL.
6. SACRIFICIAL GEOMEMBRANE SHALL CONSIST OF HIGH DENSITY POLYETHYLENE, AS APPROVED BY CONSTRUCTION MANAGER AND PROVIDED BY FLUOR FERNALD, INC. IN-PLACE SACRIFICIAL GEOMEMBRANE SHALL BE SECURED WITH SANDBAGS TO PREVENT DAMAGE FROM WIND.
7. PLACE COMPACTED FILL TO PROVIDE POSITIVE DRAINAGE TO TEMPORARY DRAINAGE CHANNEL.
8. CONSTRUCTION CONTROL POINTS FOR CELL ACCESS RAMP ARE PROVIDED ON DRAWINGS G-17, G-18, AND G18A.
9. IMPACTED RUNOFF CATCHMENT AREA IN ACTIVE CELL SHALL REMAIN OPEN UNTIL COMPACTION OF SECOND LIFT OF COMPACTED CLAY CAP IS COMPLETED IN ADJACENT UPGRADIENT CELL AND IMPACTED RUNOFF CATCHMENT AREA IN FUTURE CELL IS CONSTRUCTED AND OPERATIONAL.
10. IMPACTED MATERIAL INTERIM SLOPES SHALL BE NO STEEPER THAN 3.5H:1V IN ACCORDANCE WITH SPECIFICATION SECTION 13010.
11. SLOPE OF LOWER PORTION OF FINAL COVER SYSTEM IS 6H:1V FROM EAST AND WEST PERIMETERS OF OSDF.
12. CRUSTING AGENT SHALL BE APPLIED AT LOWER SYSTEM TEMPORARY TERMINATION INCLUDING CELL ACCESS RAMP SIDE SLOPE AND BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
13. INSTALL SILT FENCE 10 FEET (MEASURED HORIZONTALLY) UPSLOPE OF 3H:1V SLOPE LIMIT. INSTALL ADDITIONAL SILT FENCES AT APPROXIMATELY 60 FEET INTERVALS FOR A TOTAL OF THREE SILT FENCES. SILT FENCES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
14. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02730.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	PRW. BY	APP. BY
2	05.02.15	CFC REVISION 2 SUBMITTAL TO FF/DOE/EPA	RLF	JAA	RLF	DKP	JTD
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	KRD	VCR	KRD	DKP	WR
10	03.17.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	KRD	VCR	KRD	DKP	RD
1A	-	NOT ISSUED	-	-	-	-	-
0	02.01.79	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWD	KRD	DCP	JTB
5	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWD	KRD	DCP	JTB
A	-	NOT ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:
IMPACTED MATERIAL PLACEMENT DETAILS II

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT START OF CONSTRUCTION UNLESS SEALED

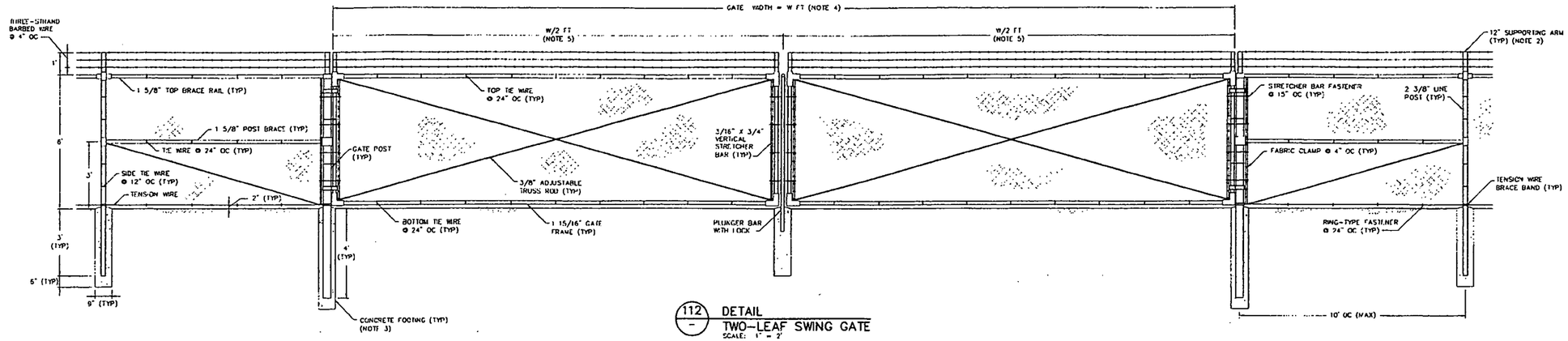
SIGNATURE
15 Feb 2005
DATE

STATE OF OHIO
JOHN J. BEECH
E-58246
REGISTERED PROFESSIONAL ENGINEER
SEAL

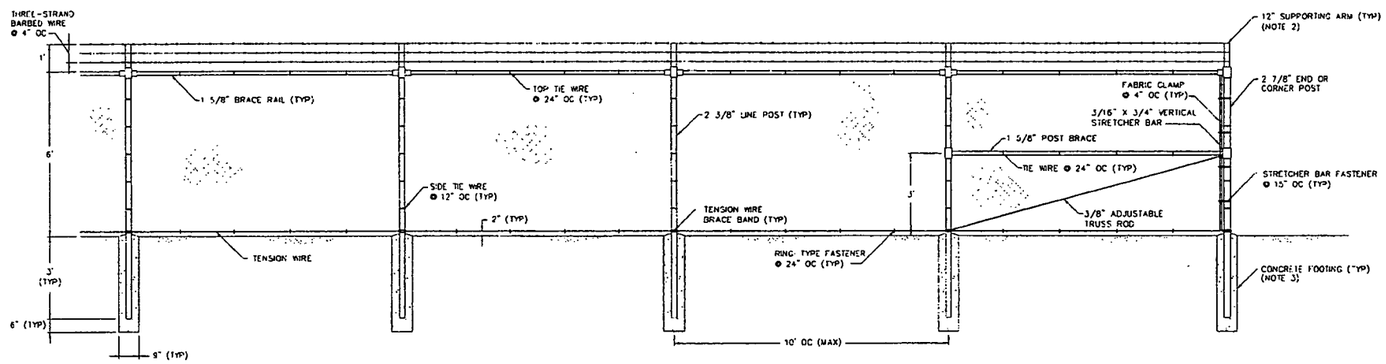
GEOSYNTEC CONSULTANTS
1255 ROBERTS BOULEVARD NW
KENNESAW, GEORGIA 30144 USA

PROJECT NO.:	20195
CONTRACT NO.:	DE-AC24-03-OH/01
TEMP DRAWING NO.:	90X-6300-G-00408
GEOSYNTEC PROJECT NO.:	GC3309-02.02
GEOSYNTEC DOCUMENT NO.:	104-2050
SHEET NO.:	G-46
REVISION NO.	2

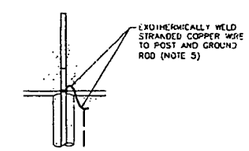
CERTIFIED-FOR-CONSTRUCTION



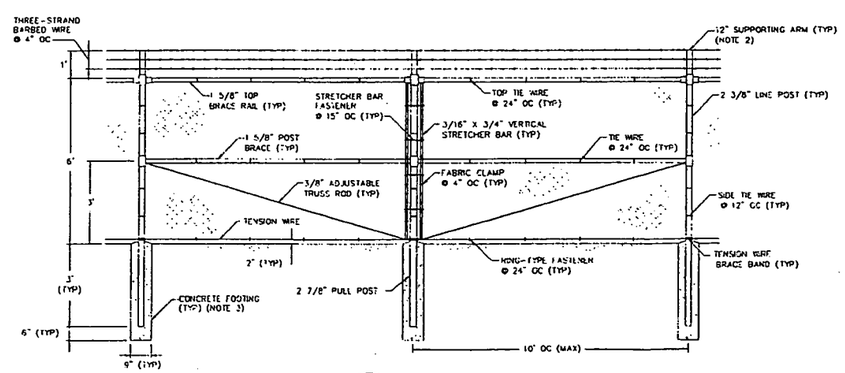
112 DETAIL
TWO-LEAF SWING GATE
SCALE: 1" = 2'



113 DETAIL
LINE POST CONNECTION TO END OR CORNER POST
SCALE: 1" = 2'



114 DETAIL
CHAIN-LINK FENCE GROUND
SCALE: NTS



115 DETAIL
PULL POST
SCALE: 1" = 2'

NOTES:

1. CHAIN-LINK FENCE AND GATES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02831.
2. SUPPORTING ARMS SHALL SLOPE TO OUTSIDE OF FENCED AREA AT 45 DEGREES FROM VERTICAL.
3. CONCRETE SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02831. EXPOSED TOPS OF CONCRETE FOOTINGS SHALL HAVE A 1-INCH CROWN TO PROMOTE DRAINAGE.
4. SEE DRAWINGS G-1, G-3, AND G-5 FOR LOCATION OF CHAIN-LINK FENCE, GATES, AND GATE WIDTHS.
5. GROUNDING INTERVAL SHALL BE EVERY 400 FEET ALONG FENCE, ON BOTH SIDES OF GATES, AND ON BOTH SIDES OF ABOVE GROUND OR BELOW GROUND UTILITIES.

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
C	09.01.99	CFC SUBMITTAL TO FF/DOE/EPA	LMG	JMD	TEZ	GDP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	LMG	JMD	TEZ	GDP	JFB
A	-	INITIAL ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: CHAIN-LINK FENCE AND GATE DETAILS

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDER OR CONSTRUCTION, UNLESS SEALED

STATE OF OHIO — JOHN BEECH E-58248 — REGISTERED PROFESSIONAL ENGINEER

29 Jan 2002

GEOSYNTEC CONSULTANTS
1400 LAKE HEARN DRIVE ATLANTA, GEORGIA 30319 USA

PROJECT NO:	20105
CONTRACT NO:	55P5005028
FERNP DRAWING NO:	90X-6000-G-00409
GEOSYNTEC PROJECT NO:	G01342-7.4
GEOSYNTEC DOCUMENT NO:	F01-0048
SHEET NO:	G-47
REVISION NO:	0

CERTIFIED-FOR-CONSTRUCTION

FINAL QUANTITY ESTIMATES – ADDENDUM

ON-SITE DISPOSAL FACILITY

Revision 1 – Addendum
February 2005

UNITED STATES DEPARTMENT OF ENERGY

Fernald Environmental Management Project
Fernald, Ohio

Prepared by

GeoSyntec Consultants
1255 Roberts Boulevard, Suite 200
Kennesaw, Georgia 30144

Under

Fluor Fernald
Contract No. 03FF0699
Document No. 20105-RP-001

Attachment to: DOE-0164-05

COMPUTATION COVER SHEET

SUBJECT OF COMPUTATIONS OSDF PHASE V QUANTITY ESTIMATES - ADDENDUM

Computations By:
(Cognizant Engineer)

Signature Tamara E. Zettler — Date 2-15-05

Printed Name and Title: Tamara E. Zettler, Engineer

Assumptions and Procedures Checked By:
(Checker)

Signature — Date 2/15/05

Printed Name and Title: Kenneth R. Daly, Project Engineer

Computations Checked by:

Signature — Date 02/15/05

Printed Name and Title: Mehmet Iscimen, Staff Engineer

Computations Backchecked by:
(Cognizant Engineer)

Signature Tamara E. Zettler — Date 2-15-05

Printed Name and Title: Tamara E. Zettler, Engineer

Approved by:
(PDP)

Signature — Date 2/15/05

Printed Name and Title: Kenneth R. Daly, Project Engineer

Approved by:
(DTL / TETL)

Signature — Date 2-15-05

Printed Name and Title: David K. Phillips, Senior Project Engineer

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
0	Submittal to FF/DOE/EPA	29 Jan 01	CDC	MAO	DCP
1	Revision 1 Submittal to FF/DOE/EPA	23 Jan 04	TEZ	KRD	DKP
Addendum	Addendum to Rev. 1 Submittal to FF/DOE/EPA	15 Feb 05	TEZ TEZ	KRD KRD	DKP DKP

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

ADDENDUM TO OSDF – REVISED PHASE V QUANTITY ESTIMATE

This addendum to the OSDF – Revised Phase V Quantity Estimate was prepared to estimate the quantities of soils, materials, and geosynthetics necessary to construct the Cell 8 Final Cover System for the revised Phase V of the On-Site Disposal Facility (OSDF) as presented in the Certified-For-Construction Phase V drawings (construction drawings) developed in February 2005. The quantities estimated herein were calculated to reflect the 100-foot expansion of Cell 8 in the North/South direction.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

OSDF – REVISED PHASE V QUANTITY ESTIMATE

EXECUTIVE SUMMARY

PURPOSE OF ANALYSIS

The purpose of this calculation package is to estimate material quantities for construction of Cell 8 Final Cover System for the revised Phase V of the On-Site Disposal Facility (OSDF) as presented in the Certified-For-Construction Phase V drawings (construction drawings) developed in February 2005.

METHODS OF ANALYSIS

For each material, the applicable Construction Drawing details, cross-sections, and plans were used for calculating quantities. Quantities were calculated using measurements and dimensions from the construction drawings and using the grid/prismoidal volume method within the computer program SOFTDESK for AutoCAD. Quantities are generally presented herein for the Cell 8 final cover system.

CONCLUSIONS

A summary of calculated quantities is provided on the following pages.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

OSDF REVISED-PHASE V QUANTITY ESTIMATE
SUMMARY TABLE

ITEM DESCRIPTION	UNITS	ESTIMATED QUANTITY
		CELL 8 COVER
EARTHWORK		
Removal - Protective Layer & Protective Clay Layer	ICY	7,135
SOIL MATERIALS		
Base Aggregate	ICY	435
Compacted Clay Liner/Cap	ICY	35,059
Granular Drainage Material 1 - Cover Drainage Layer and Temporary Termination	ICY	28,869
Contouring Layer	ICY	15,207
Biointrusion Barrier	ICY	61,525
Choke Stone	ICY	10,532
Granular Filter	ICY	11,894
Vegetative Soil Layer	ICY	46,075
Topsoil	ICY	12,015
Riprap Type C	ICY	3,840
Riprap Type D	ICY	696
EROSION AND SEDIMENT CONTROL		
Erosion Mat - Standard (Including 8% Seaming and Waste) (Approximate)	SF	660,884
Erosion Mat - Coir (Including 8% Overlap and Waste) (Approximate)	SF	41,713
GEOSYNTHETICS		
Geotextile Separator (Includes 8% Overlap & Waste)	SF	25,382
Geotextile Cushion - Cover (Includes 8% Overlap & Waste)	SF	528,269
Geomembrane Liner/Cap (Includes 8% Overlap & Waste)	SF	528,269
GCL Liner/Cap (Includes 8% Overlap & Waste)	SF	528,269
VEGETATION		
Permanent Vegetation (Approximate)	SF	795,305

ICY = In-Place Cubic Yards, LF = Linear Feet, SF = Square Feet,

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

OSDF – REVISED PHASE V QUANTITY ESTIMATE

TABLE OF CONTENTS

Page

Executive Summary 2

Calculation Procedures 6

Data Verification 7

Calculation and Results 8

Appendix A – Construction Drawings with Measurements and Calculations Added

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

LIST OF TABLES*

Page

Table 4 – Removal – Protective Layer 9
Table 5 – Base Aggregate 10
Table 6 – Compacted Clay Liner/Cap 11
Table 11 – Granular Drainage Material 1 12
Table 13 – Contouring Layer 13
Table 14 – Biointrusion Barrier 14
Table 15 – Choke Stone 15
Table 16 – Granular Filter 16
Table 17 – Topsoil 17
Table 18 – Vegetative Soil Layer 18
Table 19 – Riprap (Type C) 19
Table 20 – Riprap (Type D) 20
Table 23 – Erosion Mat 21
Table 25 – Geotextile Separator 22
Table 26 – Geotextile Cushion - Cover 23
Table 30 – Geomembrane 24
Table 31 – Geosynthetic Clay Liner (GCL) 25
Table 37 – Miscellaneous Removal 26
Table 38 – Vegetation 27

*Table numbers were kept consistent with previous Quantity Estimate submittal. Tables omitted from this list did not include materials used to construct the final cover system.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

OSDF – REVISED PHASE V QUANTITY ESTIMATE

CALCULATION PROCEDURES

The purpose of this calculation package is to estimate material quantities for construction of the Cell 8 Final Cover System for the revised Phase V of the On-Site Disposal Facility (OSDF) as presented in the Certified-For-Construction Phase V drawings (construction drawings) developed in February 2005. These quantities are being updated to reflect the expansion of Cell 8, 100-feet in the North/South direction.

For each material, the applicable construction drawing details, cross-sections, and plans were used for calculating quantities. Quantities were calculated using measurements from the construction drawings as described below:

- lengths and areas were determined within the construction drawings using AutoCAD; and
- volumes were calculated using cross-sectional areas and lengths and plan areas and thicknesses.

For each calculation performed, methods, assumptions, and schematic sketches and figures are presented on construction drawings presented in Appendix A.

This calculation package is intended to be an addendum to the Revision 1, Final Revised Phase V Quantity Estimate issued in January 2004. Only quantities related to construction of the Cell 8 Final Cover System are estimated herein. These quantities are reflected on plan drawings G-11A, G-13A, and G-15A. As necessary, plan sheets (i.e., G-15) and detail sheets (i.e., G-26, G-27, G-28, and G-34) have been included to provide the necessary input parameters to estimate quantities. The quantities shown on G-15 and the detail sheets have not been revised from the previous submittal as they have not modified by the expansion of Cell 8.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

OSDF – REVISED PHASE V QUANTITY ESTIMATE

DATA VERIFICATION

The data used to estimate quantities for the OSDF – Revised Phase V construction were obtained directly from the construction drawings. These construction drawings are presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

OSDF – REVISED PHASE V QUANTITY ESTIMATE

CALCULATION AND RESULTS

Calculations are presented on construction drawings included in Appendix A. Results are summarized in the tables presented subsequently. For consistency, table numbers were maintained from the previous submittal. All tables are not presented herein as there are not relevant Cell 8 Final Cover System quantities for each table. For each calculation result, the Construction Drawing Sheet number where the calculation is presented is noted.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 4 – REMOVAL - PROTECTIVE LAYER[1]

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[2]**
Removal of Protective Clay Layer	3,541	ICY	G-11A
Non-impacted Non-granular at Cell 7/8 Tie-In	2,549	ICY	G-15A
Cell 8: Non-impacted Granular at Cell 7/8 Tie-In	1,045	ICY	G-15
Subtotal:	7,135	ICY	
TOTAL:	7,135	ICY	

1. Includes protective layer for temporary liner and cover system terminations and protective clay layer at perimeter berm.
2. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 5 - BASE AGGREGATE

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
Monitoring Access	435	ICY	G-15A
Subtotal:	435	ICY	
TOTAL:	435	ICY	

1. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 (YY) 02 (MM) 15 (DD) Reviewed by: Kenneth R. Daly Date: 05 (YY) 02 (MM) 15 (DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 6 - COMPACTED CLAY LINER/CAP

CELLS 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
Compacted Clay Cap	35,059	ICY	G-13A
Subtotal:	35,059	ICY	
TOTAL:	35,059	ICY	

1. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 (YY) 02 (MM) 15 (DD) Reviewed by: Kenneth R. Daly Date: 05 (YY) 02 (MM) 15 (DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 11 – GRANULAR DRAINAGE MATERIAL 1[2]

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
Cover Drainage Layer	28,869	ICY	G-15A
Subtotal:	28,869	ICY	
TOTAL:	28,869	ICY	

1. Calculations are presented on Drawings presented in Appendix A.
2. Granular Drainage Material 1 includes drainage layer and non-impacted, granular materials. See Specification Section 02710.

Written by: Tamara E. Zettler Date: 05 (YY) 02 (MM) 15 (DD) Reviewed by: Kenneth R. Daly Date: 05 (YY) 02 (MM) 15 (DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 13 – CONTOURING LAYER

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
Contouring Layer	15,207	ICY	G-11A
Subtotal:	15,207	ICY	
TOTAL:	15,207	ICY	

1. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 14 - BIOINTRUSION BARRIER

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
Biointrusion Barrier	61,525	ICY	G-15A
Subtotal:	61,525	ICY	
TOTAL:	61,525	ICY	

1. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 15 - CHOKE STONE

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
Choke Stone (Biointrusion Barrier)	10,532	ICY	G-15A
Subtotal:	10,532	ICY	
TOTAL:	10,532	ICY	

1. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 16 – GRANULAR FILTER

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
Granular Filter	11,894	ICY	G-15A
Subtotal:	11,894	ICY	
TOTAL:	11,894	ICY	

1. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 17 - TOPSOIL

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
Topsoil	12,015	ICY	G-15A
Subtotal:	12,015	ICY	
TOTAL:	12,015	ICY	

1. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 18 - VEGETATIVE SOIL LAYER

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
Vegetative Soil Layer	46,075	ICY	G-15A
Subtotal:	46,075	ICY	
TOTAL:	46,075	ICY	

1. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 19 – RIPRAP - (TYPE C)

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
East Perimeter	1,161	ICY	G-15A
West Perimeter	1,320	ICY	G-15A
Southeast, South, and Southwest Perimeter	1,311	ICY	G-15A
Existing 15-in. RCP Culverts	48	ICY	G-15A
Subtotal:	3,840	ICY	
TOTAL:	3,840	ICY	

1. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 20 - RIPRAP - (TYPE D)

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
Monitoring Access Sub-Base	696	ICY	G-15A
Subtotal:	696	ICY	
TOTAL:	696	ICY	

1. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 23 - EROSION MAT

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
Standard Erosion Mat	611,930	SF	G-15A
Coir Erosion Mat	38,623	SF	G-15A
Subtotal:	650,553	SF	
8 % Seaming & Waste:	52,044	SF	
TOTAL (Including 8% Seaming & Waste):	702,597	SF	

1. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 25 - GEOTEXTILE SEPARATOR(2)

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference(1)**
Monitoring Access	23,502	SF	G-15A
Subtotal:	23,502	SF	
8 % Seaming & Waste:	1,880	SF	
TOTAL (Including % Seaming & Waste):	25,382	SF	

1. Calculations are presented on Drawings presented in Appendix A.
2. Geotextile Separator material properties are provided in Technical Specification Section 02714.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 26 - GEOTEXTILE CUSHION - COVER(2)

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference(1)**
Geotextile Cushion	489,138	SF	G-13A
Subtotal:	489,138	SF	
8 % Seaming & Waste:	39,131	SF	
TOTAL (Including 8% Seaming & Waste):	528,269	SF	

1. Calculations are presented on Drawings presented in Appendix A.
2. Geotextile Cushion – Cover includes geotextile cushion and sacrificial geotextile cushion materials. See Specification Section 02714.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 30 - GEOMEMBRANE

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
Geomembrane Cap	489,138	SF	G-13A
Subtotal:	489,138	SF	
8 % Seaming & Waste:	39,131	SF	
TOTAL (Including 8% Seaming & Waste):	528,269	SF	

1. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 31 – GEOSYNTHETIC CLAY LINER (GCL)

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
Geosynthetic Clay Cap	489,138	SF	G-13A
Subtotal:	489,138	SF	
8 % Seaming & Waste:	39,131	SF	
TOTAL (Including 8% Seaming & Waste):	528,269	SF	

1. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 37 – MISCELLANEOUS REMOVAL

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
24-in. CMP Culvert	55	LF	G-15A
49-in. x 33-in. CMP Culverts	185	LF	G-15A
Subtotal:	N/A		
TOTAL:	N/A		

1. Calculations are presented on Drawings presented in Appendix A.

Written by: Tamara E. Zettler Date: 05 02 15 (YY MM DD) Reviewed by: Kenneth R. Daly Date: 05 02 15 (YY MM DD)

Client: Fluor Fernald, Inc. Project: OSDF – Rev. Phase V Project/Proposal No.: GQ3309 Task No: 02.02

TABLE 38 - VEGETATION

CELL 8 FINAL COVER SYSTEM			
Description	**Quantity**	**Unit**	**Reference[1]**
Permanent Vegetation – Final Cover System	648,755	SF	G-15A
Permanent Vegetation – Outside Cell 8	146,550	SF	G-15A
Subtotal:	N/A	SF	
TOTAL:	N/A		

1. Calculations are presented on Drawings presented in Appendix A.

APPENDIX A

CONSTRUCTION DRAWINGS WITH MEASUREMENTS AND CALCULATIONS ADDED

DRAWINGS INCLUDED IN SUBMITTAL:

G-11A	G-26*
G-13A	G-27*
G-15*	G-28*
G-15A	G-34*

*Drawing included for reference purposes only. Quantity estimates have not been modified from previous submittal.

Cover System Cell 8

Contouring Layer

@6:1 SA = 97,563sf + 77,634sf + 70,713sf = 245,910sf

$V = \frac{245{,}910sf \times 1ft}{27} = 9{,}108$ ICY

@10:1 SA = 55,531sf

$V = \frac{55{,}531sf \times 1ft}{27} = 2{,}087$ ICY

@20:1 SA = 49,661sf

$V = \frac{49{,}661sf \times 1ft}{27} = 1{,}839$ ICY

@3:1 SA = 31,290sf

$V = \frac{31{,}290sf \times 1ft}{27} = 1{,}159$ ICY

@Corners SA = 15,515sf + 12,664sf = 28,179sf

$V = \frac{28{,}179sf \times 1ft}{27} = 1{,}044$ ICY

Total V = 15,207 ICY

Removal of Protective Clay Layer

@West and Southwest Perimeter (6-27)

$V = \frac{52.0sf \times (51.8ft + 57.6ft + 50ft + 76.7ft + 308.2ft + 110.7ft)}{27cf/ICY} = 1{,}261$ ICY

@South, Southeast, and East Perimeters (6-26)

$V = \frac{52.7sf \times (517.5ft + 110.7ft + 539.7)}{27cf/ICY} = 2{,}280$ ICY

Total V = 3,541 ICY

LEGEND

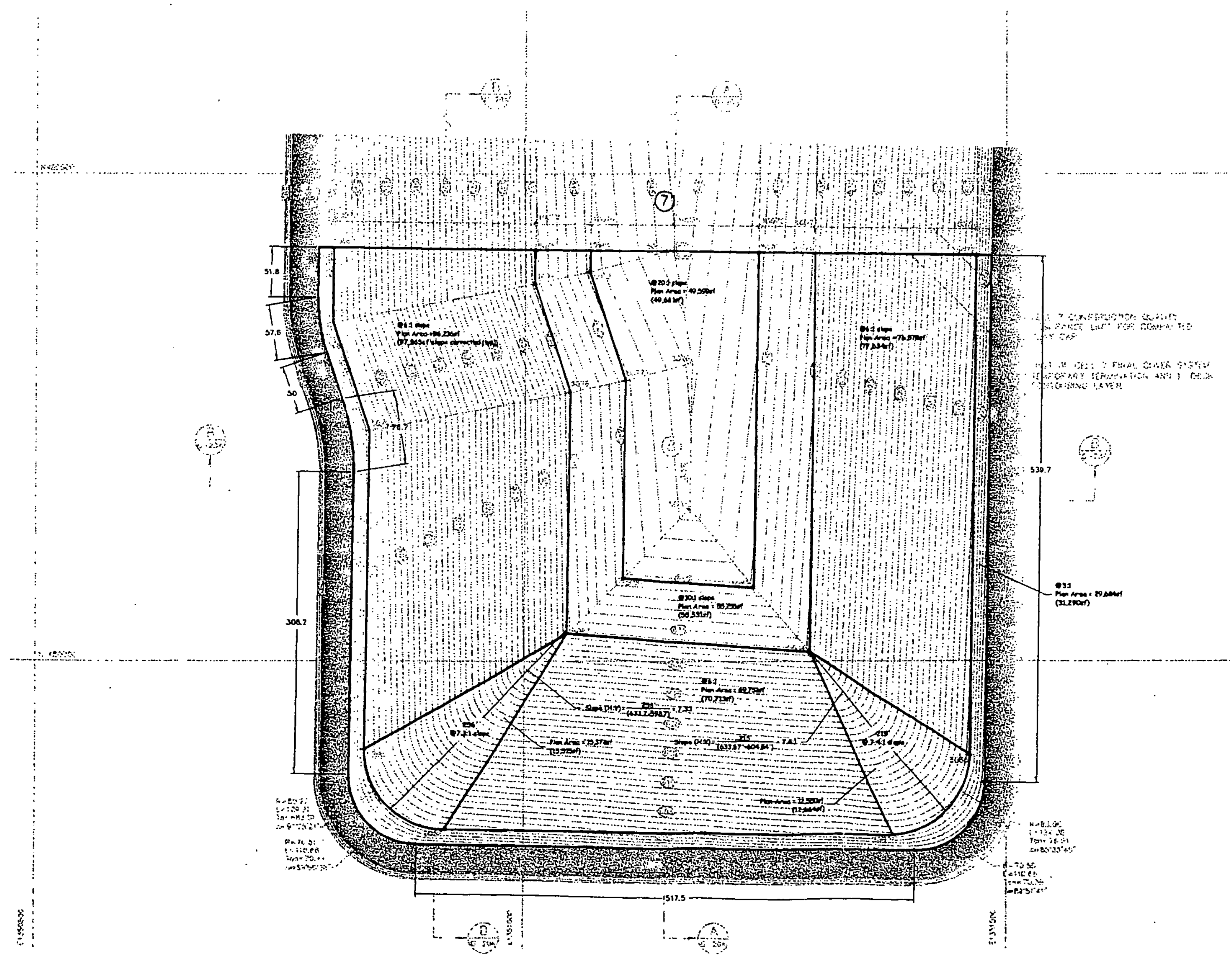
[illegible]

CONTOURING LAYER CONSTRUCTION CONTROL POINTS

[illegible]

[illegible] FOR COMPACTED CLAY CAP CONSTRUCTION CONTROL POINT

[illegible]



NOTES:

[illegible]

0	05.02.15	CFC SUBMITTAL TO FF/DOE/EPA	TEJ	JAM	LMC	DKP	JFB
REV NO	DATE	DESCRIPTION	DES BY	DR. BY	CHK. BY	RVW BY	APP. BY

50 25 0 50 100
SCALE IN FEET

OWNER/FACILITY: UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT: **FLUOR FERNALD, INC.**

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: FINAL COVER SYSTEM CONTOURING LAYER
GRADING PLAN III – CELL 8

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

GeoSyntec Consultants

PROJECT NO.: 20105
CONTRACT NO.: 03FF0699
TEMP DRAWING NO.: 90X-6000-C-00427
GEOSYNTEC PROJECT NO.: GQ3509-02.02
GEOSYNTEC DOCUMENT NO.: Q-F04-0714
SHEET NO.: C-11A
REVISION NO.: 0

CERTIFIED-FOR-CONSTRUCTION

Cover System Cells 8

Compacted Clay Cap

@6:1 $V = \frac{(104,120sf + 71,280sf + 83,679sf) \times 2ft}{27cf/1CY} = 19,191$ 1CY

@10:1 $V = \frac{(24,081sf + 11,985sf + 24,252sf) \times 2ft}{27cf/1CY} = 4,466$ 1CY

@20:1 $V = \frac{(26,128sf + 5,241sf + 25,396sf) \times 2ft}{27cf/1CY} = 4,205$ 1CY

@SW Corner $V = \frac{15,397sf \times 2ft}{27cf/1CY} = 1,141$ 1CY

@SE Corner $V = \frac{13,031sf \times 2ft}{27/1CY} = 965$ 1CY

@Outside of Quantity Lines "A" and "B" [Sheets 6-26 & 6-27]

V (West and SW) $= \frac{46.9sf \times (584.4ft + 157.1ft)}{27/1CY} = 1,837$ 1CY

V (East, SE, and South) $= \frac{77.6sf \times (517.5ft + 157.1ft + 579.2ft)}{27cf/1CY} = 3,604$ 1CY

@Temporary Termination (Reduction) [6-34]

$V = \frac{12.5sf \times 761.3ft}{27cf/1CY} = (352$ 1CY$)$

Total V = 35,099 1CY

Geosynthetic Clay Cap

@6:1 SA = 104,120sf + 71,280sf + 83,679sf = 259,079sf

@10:1 SA = 24,081sf + 11,985sf + 24,252sf = 60,318sf

@20:1 SA = 26,128sf + 5,241sf + 25,396sf = 156,765sf

@SE and SW Corner SA = 15,397sf + 13,032sf = 28,429sf

@East, West and South Perimeter (Extend to Perimeter Baseline)

SA = 27,937sf + 7,794sf + 21,908sf + 7,104sf + 26,349sf = 91,090sf

@Outside of Base Line [Sheets 6-26 & 6-27]

SA = 5ft x (584.4ft + 157.1ft + 517.5ft + 157.1ft + 579.2ft) = 9,977sf

@Temporary Termination (Reduction) [6-34]

SA = 21.7ft x 761.3ft = (16,520sf)

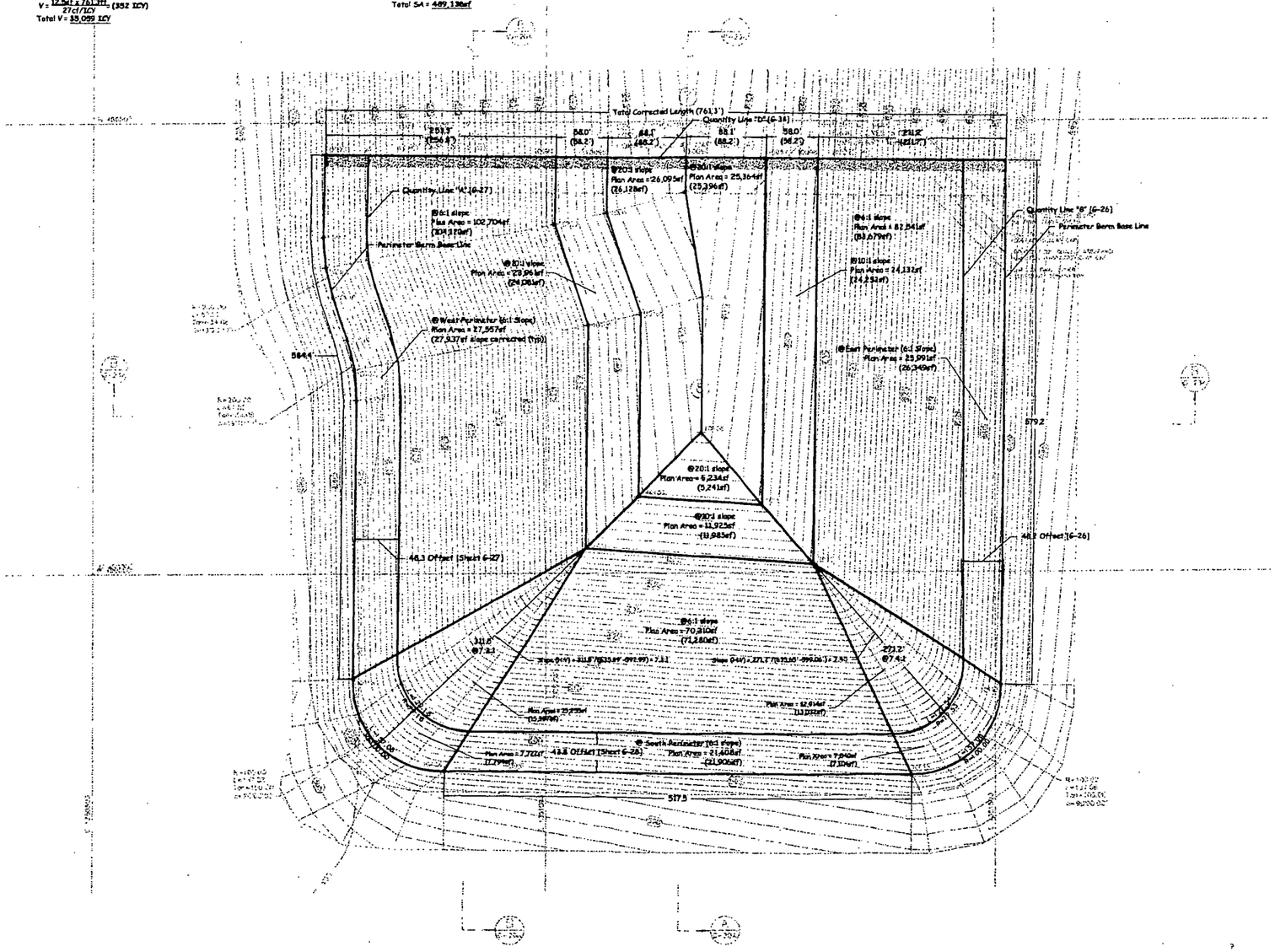
Total SA = 489,138sf

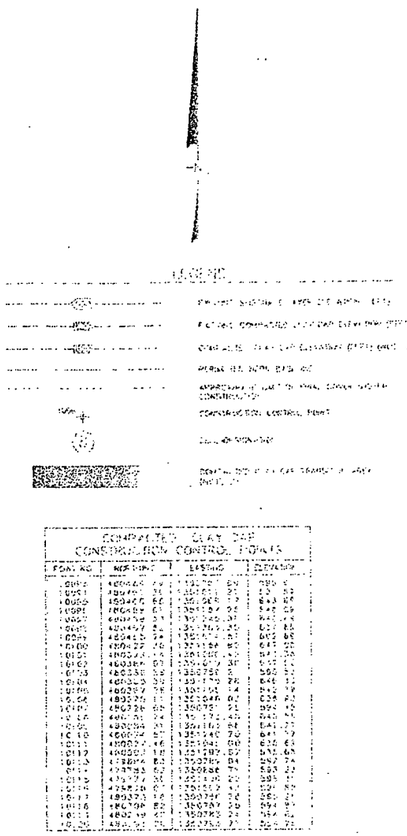
Geomembrane Cap

Total SA = 489,138sf

Geotextile Cushion

Total SA = 489,138sf





NOTES

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	05.02.15	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEJ	JJA	LMC	DKP	JFB
1C	-	NOT ISSUED	-	-	-	-	-
1B	-	NOT ISSUED	-	-	-	-	-
1A	-	NOT ISSUED	-	-	-	-	-
0	04.01.22	CFC SUBMITTAL TO FF/DOE/EPA	TEJ	JJA	KRD	DKP	RB
B	03.12.08	PRE-FINAL SUBMITTAL TO FF/DOE	TEJ	JJA	KRD	DKP	RB
A	03.10.26	PRELIMINARY SUBMITTAL TO FF/DOE	TEJ	JJA	KRD	DKP	RB

50 25 0 50 100
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: FINAL COVER SYSTEM COMPACTED CLAY CAP
GRADING PLAN III – CELL 8

THIS DRAWING MAY NOT BE USED FOR PROJECT BIDDING OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE
DATE

SEAL

GEOSYNTEC CONSULTANTS
1765 NORTH ELSTON AVENUE
CHICAGO, ILLINOIS 60622

PROJECT NO.	20105
CONTRACT NO.	03JT0699
FLMP DRAWING NO.	90X-5000-G-00418
GEOSYNTEC PROJECT NO.	GG3309-02.02
GEOSYNTEC DOCUMENT NO.	G-F04-1059
SHEET NO.	G-13A
REVISION NO.	1

CERTIFIED-FOR-CONSTRUCTION

(**Assume Detail 58 on Sheet G-34 applies to full width of Temporary Termination at Cells 3 through 7)

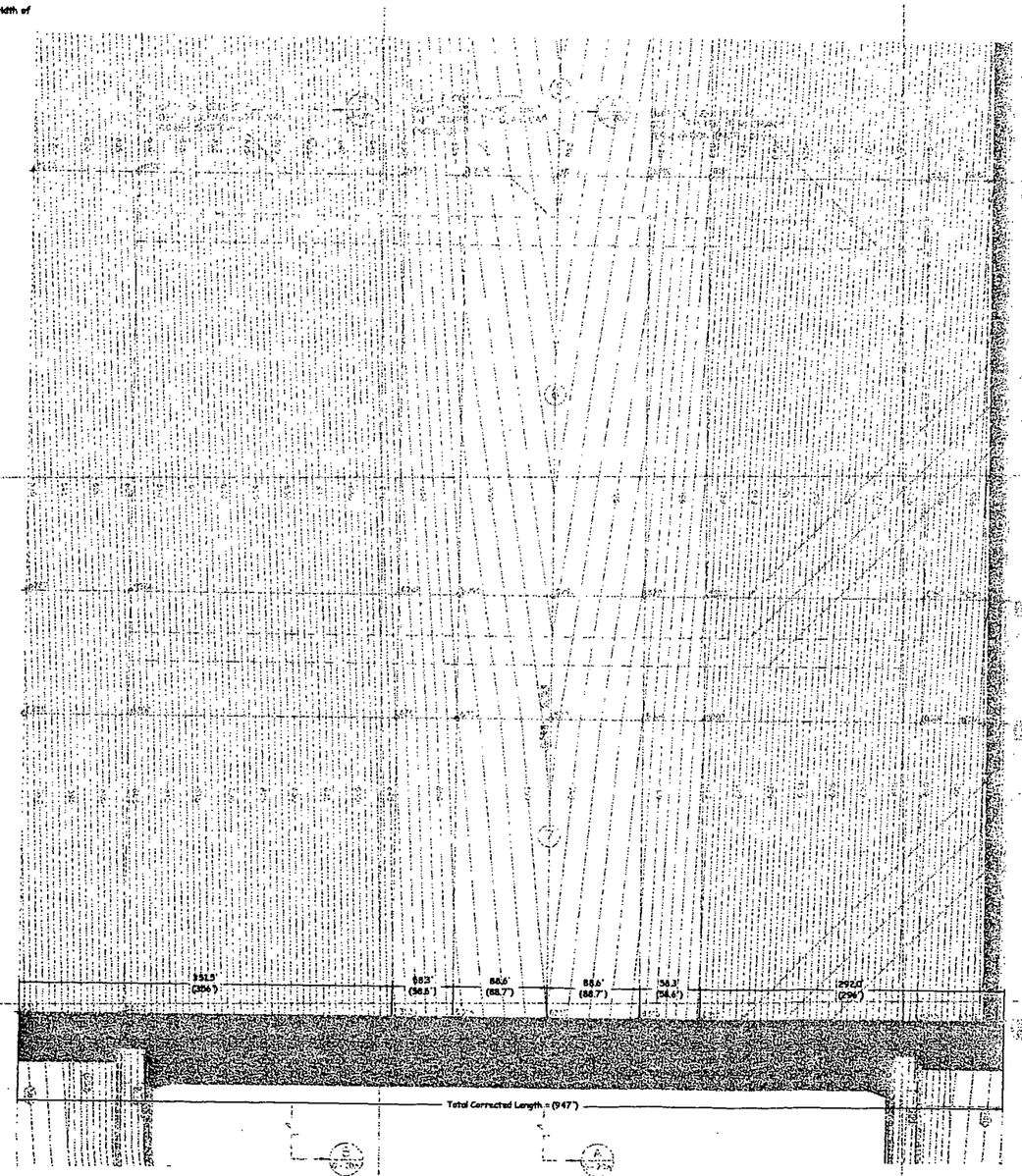
Protective Layer - Non-Impacted, Non-Granular
-Placement and Removal at Temp. Termination (G-34)
V = 73.1cf x 947ft ÷ 27cf/CY = 2,488 LCY

Protective Layer - Non-Impacted, Granular
-Placement and Removal at Temp. Termination (G-34)
V = 29.8cf x 947ft ÷ 27cf/CY = 1,045 LCY

Sacrificial Geotextile Cushion
-Temp. Termination (G-34)
SA = 67.2ft x 947ft = 63,722sf
Additional Sacrificial Geotextile Cushion
- Temp. Termination (G-34)
SA = 20.8ft x 947ft = 19,698sf
TOTAL = 83,420sf

Crushing Agent
-Temp. Termination (G-34)
SA = 54.0ft x 947ft = 51,138sf

Plywood
-Temp. Termination (G-34)
SA = 4.0ft x 947ft = 3,788sf



LEGEND

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.04.22	CFC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TCZ	JJA	KRD	DKP	RB
1B	03.12.08	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TCZ	JJA	KRD	DKP	RB
1A	03.10.26	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	TCZ	JJA	KRD	DKP	RB
0	02.01.29	CFC SUBMITTAL TO FF/DOE/EPA	KRD	JWO	KRD	DKP	JTB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DKP	JTB
A	01.10.22	PRELIMINARY SUBMITTAL TO FF/DOE	KRD	JWO	KRD	DKP	JTB

50 25 0 50 100
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY - PHASE V

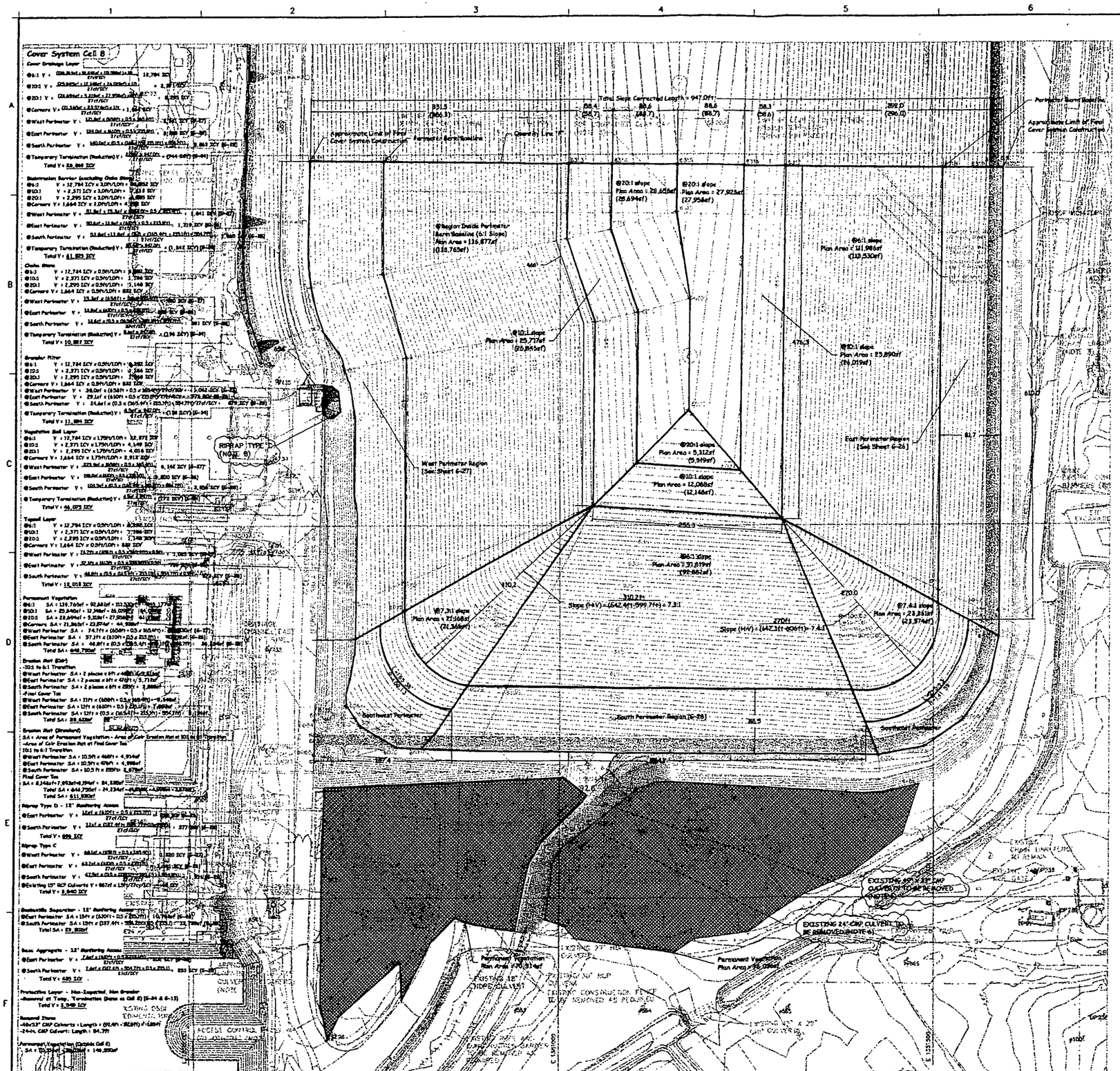
TITLE: FINAL COVER SYSTEM GRADING PLAN II - CELLS 6 AND 7

THIS DRAWING MAY NOT BE USED FOR PROJECT BIDDING OR CONSTRUCTION UNLESS SEALED.

GEOSYNTEC CONSULTANTS
1255 LAKE PLAZA DRIVE
ATLANTA, GEORGIA 30319 USA

PROJECT NO.:	20106
CONTRACT NO.:	03FT0699
FLUOR DRAWING NO.:	8DX-6000-G-00177
GEOSYNTEC PROJECT NO.:	SG3211-D6.03
GEOSYNTEC DOCUMENT NO.:	G-F03-1019
SHEET NO.:	G-15
REVISION NO.:	1

CERTIFIED-FOR-CONSTRUCTION



LEGEND

845	EXISTING FINISHED GRADE ELEVATION (FEET)
845	FINISHED GRADE ELEVATION (FEET) (NOTE 3)
	PROPERTY BOUNDARY
	APPROXIMATE LIMIT OF FINAL COVER SYSTEM CONSTRUCTION
	FOR PROPERTY LINE
	PERIMETER BERM BASELINE
	BOUNDARY AREA LINE
	CONSTRUCTION CONTROL POINT
	SOIL DRY MATERIAL
	SOIL NON-FUNCTIONAL MATERIAL (NOTE 3)
	TOPSOIL LAYER
	GRAVEL LAYER
	SURFACE FLOW DIRECTION
	FENCE

POINT	NORTHING	EASTING	ELEVATION	POINT	NORTHING	EASTING	ELEVATION	POINT	NORTHING	EASTING	ELEVATION
8001	1,363,222.32	1,359,996.32	845.00	8101	1,363,222.32	1,359,996.32	845.00	8201	1,363,222.32	1,359,996.32	845.00
8002	1,363,222.32	1,359,996.32	845.00	8102	1,363,222.32	1,359,996.32	845.00	8202	1,363,222.32	1,359,996.32	845.00
8003	1,363,222.32	1,359,996.32	845.00	8103	1,363,222.32	1,359,996.32	845.00	8203	1,363,222.32	1,359,996.32	845.00
8004	1,363,222.32	1,359,996.32	845.00	8104	1,363,222.32	1,359,996.32	845.00	8204	1,363,222.32	1,359,996.32	845.00
8005	1,363,222.32	1,359,996.32	845.00	8105	1,363,222.32	1,359,996.32	845.00	8205	1,363,222.32	1,359,996.32	845.00
8006	1,363,222.32	1,359,996.32	845.00	8106	1,363,222.32	1,359,996.32	845.00	8206	1,363,222.32	1,359,996.32	845.00
8007	1,363,222.32	1,359,996.32	845.00	8107	1,363,222.32	1,359,996.32	845.00	8207	1,363,222.32	1,359,996.32	845.00

NOTES

1. THIS DRAWING REFLECTS CONSTRUCTION CONTROL POINTS FOR FINAL COVER SYSTEM FOR CELL 8. FINAL CONTROL POINTS, FINISHED GRADE, SURFACE FLOW DIRECTION.
2. FINISHED GRADE ELEVATIONS DESIGNED USING MONITORING ACCESS PERIMETER, TO TOP OF FINAL COVER SYSTEM FORMED, LEVEL. FINAL COVER SYSTEM SHALL BE MAINTAINED AT NOTE 10 DETAILED TO FULL FUNCTIONALITY.
3. COVER SYSTEM CONTROL POINTS FOR LIMITS OF FINAL COVER SYSTEM TEMPORARY MAINTENANCE AND CONSTRUCTION. SHEET 1 - CONSTRUCTION LIMIT FOR INDICATED FINAL COVER SYSTEM FOR CELL 8 ARE PRESENTED ON DRAWINGS G-31 AND G-32.
4. FINAL COVER SYSTEM FOR CELL 1, 2 AND 3 MUST BE CONSTRUCTED CONCURRENTLY WITH CONSTRUCTION OF THE FINAL COVER SYSTEM TEMPORARY TERMINATION CELL. FINAL COVER SYSTEM STRUCTURE ELEMENTS DESCRIBED ON DRAWING G-31.
5. DEBRIS MATERIAL ACCESS DETAILS ARE SHOWN ON DRAWINGS G-31, G-32, AND G-33. ENSURE FENCE PERIMETER DRAIN MAINTENANCE ACCESS ELEVATIONS TO TIE-IN WITH EXISTING ACCESS DRIVE ONE AT REF. A CONTROL ENGINE.
6. PERIMETER EXPANSION ITEMS, WOOD & STEEL MATERIALS, ARE LOCATIONS DESIGNATED IN CONSTRUCTION NOTICES.
7. DENOTES FINAL CONSTRUCTION OF COVER FENCE AND GATES. PERIMETER FENCE AND GATES SHALL BE NOT DISCONTINUED, WITH SOIL DRY & WAY BY OTHER WORK.
8. PLACE MINIMUM RIPRAP CELL SHOWN. RIPRAP THICKNESS SHALL BE 1.5 FEET. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02231.
9. ACCESS CONTROL FACILITY FINAL GRADES AND LOCATION OF 18 INCH HDPE CULVERT SHALL BE IN ACCORDANCE WITH PLAN DRAWING 904-S2000-G-00031 TO BE PROVIDED BY FERNALD.

REV NO	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	05.02.13	CFC REVISION 1 SUBMITTAL TO FT/DOE/EPA	RCJ	JJA	LMC	DKP	JFB
1C	-	NOT ISSUED	-	-	-	-	-
1B	04.08.23	PRE-FINAL REVISION 1 SUBMITTAL TO FT/DOE/EPA PER DCN	RCJ	JJA	LMC	DKP	RB
1A	04.06.19	PRELIMINARY REVISION 1 SUBMITTAL TO FT/DOE PER DCN	RCJ	JJA	LMC	DKP	RB
0	04.01.32	CFC SUBMITTAL TO FT/DOE/EPA	LMC	JJA	TLT	DKP	RB
B	03.12.06	PRE-FINAL SUBMITTAL TO FT/DOE	LMC	JJA	TLT	DKP	RB
A	03.12.38	PRELIMINARY SUBMITTAL TO FT/DOE	RCJ	JJA	KMD	DKP	RB

50 25 0 50 100
SCALE IN FEET

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

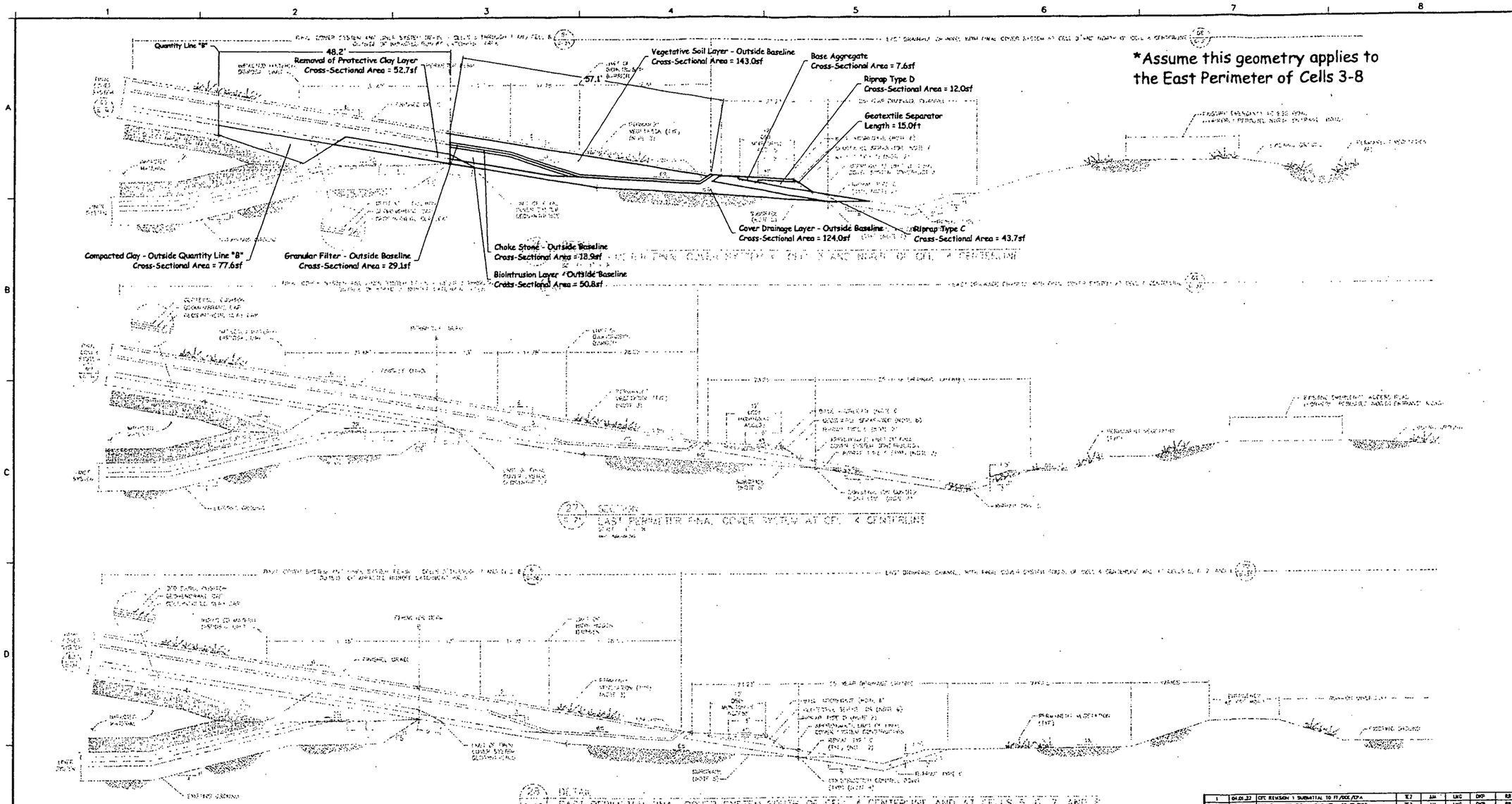
PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: FINAL COVER SYSTEM GRADING PLAN III – CELL 8

THIS DRAWING MAY NOT BE USED FOR PROJECT PURPOSES OR CONSTRUCTION UNLESS SEALED

GEOSYNTEC CONSULTANTS
1255 ROBERTS BOULEVARD NW
KENNESAW, GEORGIA 30144 USA

PROJECT NO.:	20105
CONTRACT NO.:	03FT0699
FEMP DRAWING NO.:	903-S000-G-00417
GEOSYNTEC PROJECT NO.:	0031309-02.02
GEOSYNTEC DOCUMENT NO.:	T04-1056
SHEET NO.:	G-15A
REVISION NO.:	1



NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL THICKNESSES SHALL BE AS NOTED ON DRAWINGS.
2. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02371.
3. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
4. GEOSYNTHETICS CONTROL POINTS FOR CONTAINING LAYER, COMPACTED CLAY COR, AND FINAL COVER SYSTEM ARE PROVIDED ON DRAWINGS C-16, C-17, C-18, C-19.
5. RE-ESTABLISH SUBGRADE ELEVATIONS OUTSIDE PERIMETER BERM BASELINE PRIOR TO FINAL COVER SYSTEM CONSTRUCTION. CONSTRUCTION CONTROL POINTS FOR SUBGRADE ARE PROVIDED ON DRAWINGS C-16, C-17, C-18, AND C-19.
6. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02232.

CERTIFIED--FOR-CONSTRUCTION

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CTC REVISION 1 SUBMITTAL TO FF/DOE/EPA	TEJ	JJM	LMG	DOP	RB
1B	03.12.04	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	TEJ	JJM	LMG	DOP	RB
1A	-	NOT ISSUED	-	-	-	-	-
0	02.01.29	CTC SUBMITTAL TO FF/DOE/EPA	TEJ	PMD	LMG	DOP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	TEJ	PMD	LMG	DOP	JFB
A	-	NOT ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY:

UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:

FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: CELL PERIMETER DETAILS III

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BASIS OF CONSTRUCTION UNLESS SEALED.

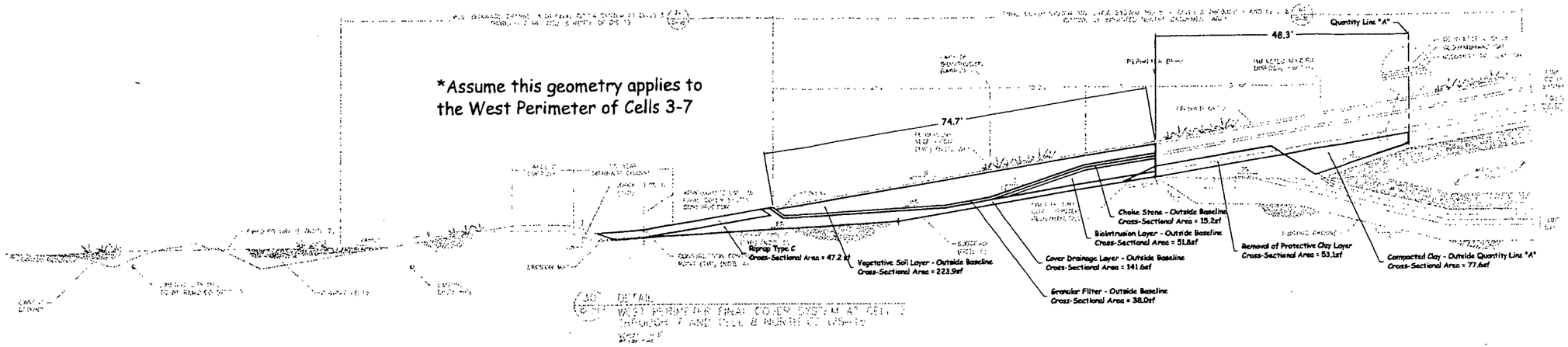
SIGNATURE

DATE

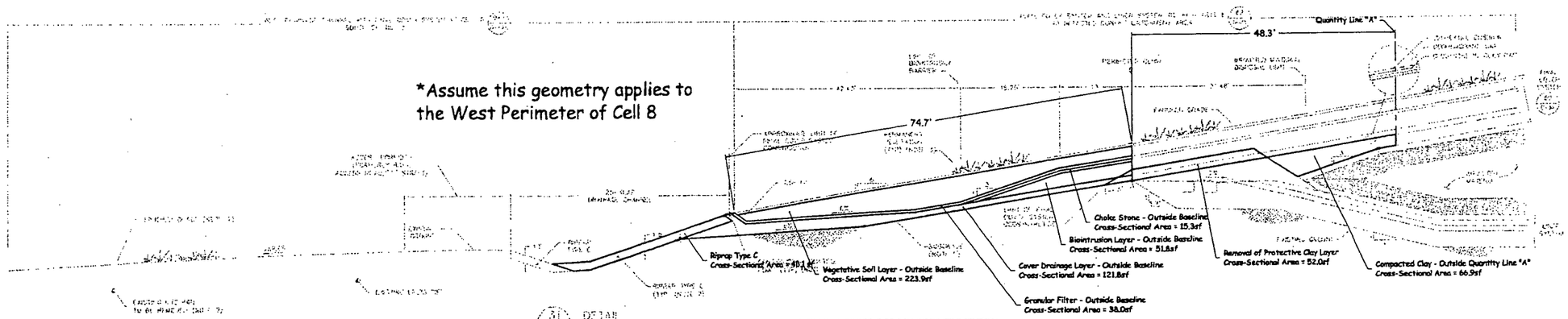
SEAL

GEOSYNTEC CONSULTANTS
1000 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

PROJECT NO.	20105
CONTRACT NO.	03T0699
FLUOR DRAWING NO.	90X-6000-G-00358
GEOSYNTEC PROJECT NO.	003211-06.03
GEOSYNTEC DOCUMENT NO.	G-T03-1028
SHEET NO.	C-26
REVISION NO.	1



DETAIL
WEST PERIMETER FINAL COVER SYSTEM AT CELL 8 SOUTH OF GR-15
SCALE: 1" = 5'



DETAIL
WEST PERIMETER FINAL COVER SYSTEM AT CELL 8 SOUTH OF GR-15
SCALE: 1" = 5'

NOTES

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOMETRIC OF WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN BY SPECIFICATIONS.
2. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271
3. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930
4. CONSTRUCTION CONTROL POINTS FOR CONTROLLING LAYER, COMPACTED CLAY CAP, AND FINAL COVER SYSTEM ARE PROVIDED ON DRAWINGS C-410 THROUGH C-414
5. RE-ESTABLISH SUBGRADE ELEVATIONS OUTSIDE PERIMETER BERM AREAS PRIOR TO FINAL COVER SYSTEM CONSTRUCTION. CONSTRUCTION CONTROL POINTS FOR SUBGRADE ARE PROVIDED ON DRAWINGS C-410 C-414 C-415, AND C-416.
6. BASE AGGREGATE OVER GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230
7. REMOVE EXISTING INTERIM HAZARDOUS TRANSMISSION SYSTEM PIPE AND TEMPORARY BERM-OFF DIVERSION BERM AFTER ACHIEVING FINAL CLEAN UP GOALS AND FINALLY MOVE INTERIM PIPELINE AS NECESSARY TO PROVIDE POSITIVE DRAINAGE TO POWER PRODUCTION AREA AND AWAY FROM CLOSED FACILITY

CERTIFIED - FOR - CONSTRUCTION

REV. NO	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CTC REVISION 1 SUBMITTAL TO FT/DOE/EPA	TEJ	JJA	LMC	DCP	RB
1B	03.12.04	PRE-FINAL REVISION 1 SUBMITTAL TO FT/DOE	TEJ	JJA	LMC	DCP	RB
1A	-	NOT ISSUED	-	-	-	-	-
0	02.01.99	CTC SUBMITTAL TO FT/DOE/EPA	TEJ	JAS	LMC	DCP	JTB
B	01.12.17	PRE-FINAL SUBMITTAL TO FT/DOE	TEJ	PBC	LMC	DCP	JTB
A	-	NOT ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

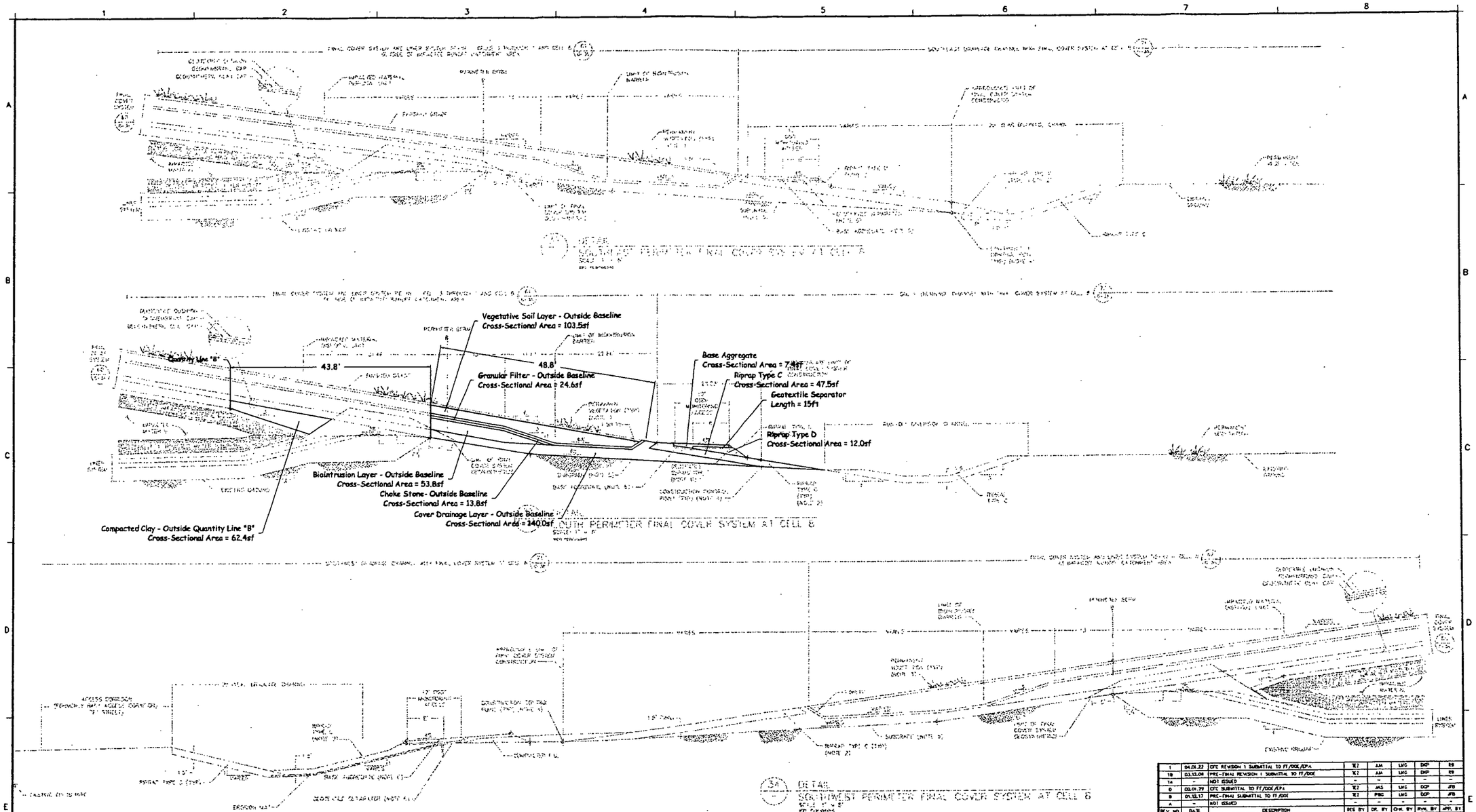
TITLE: CELL PERIMETER DETAILS IV

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BASED ON CONSTRUCTION UNLESS SEALED.

SIGNATURE
DATE
SEAL

GeoSyntec Consultants
300 Lake Ridge Drive
Atlanta, Georgia 30067 USA

PROJECT NO.:	20105
CONTRACT NO.:	03T0699
FEMP DRAWING NO.:	901-6000-G-00389
GEOSYNTEC PROJECT NO.:	003211-06.03
GEOSYNTEC DOCUMENT NO.:	0-F03-1029
SHEET NO.:	G-27
REVISION NO.:	1



NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL THICKNESSES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02931.
3. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
4. CONSTRUCTION CONTROL POINTS FOR CONTOURING LAYER, COMPACTED CLAY CAP, AND FINAL COVER SYSTEM ARE PROVIDED ON DRAWINGS C-31, C-32, AND C-33A.
5. RE-ESTABLISH THROUGH ESTABLISHING OUTSIDE PERIMETER BERM BASELINE PRIOR TO FINAL COVER SYSTEM CONSTRUCTION. CONSTRUCTION CONTROL POINTS FOR SUBGRADE ARE PROVIDED ON DRAWING C-61.
6. BASE AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.

REV NO	DATE	DESCRIPTION	REV BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.22	CFC REVISION 1 SUBMITTAL TO FT/DOE/EPA	TEJ	AJA	LMG	DCP	RB
1B	03.13.08	PRE-FINAL REVISION 1 SUBMITTAL TO FT/DOE	TEJ	AJA	LMG	DCP	RB
1A	-	NOT ISSUED	-	-	-	-	-
0	02.01.79	CFC SUBMITTAL TO FT/DOE/EPA	TEJ	JAS	LMG	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FT/DOE	TEJ	PBG	LMG	DCP	JFB
A	-	NOT ISSUED	-	-	-	-	-

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: CELL PERIMETER DETAILS V

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION UNLESS SEALED.

SIGNATURE

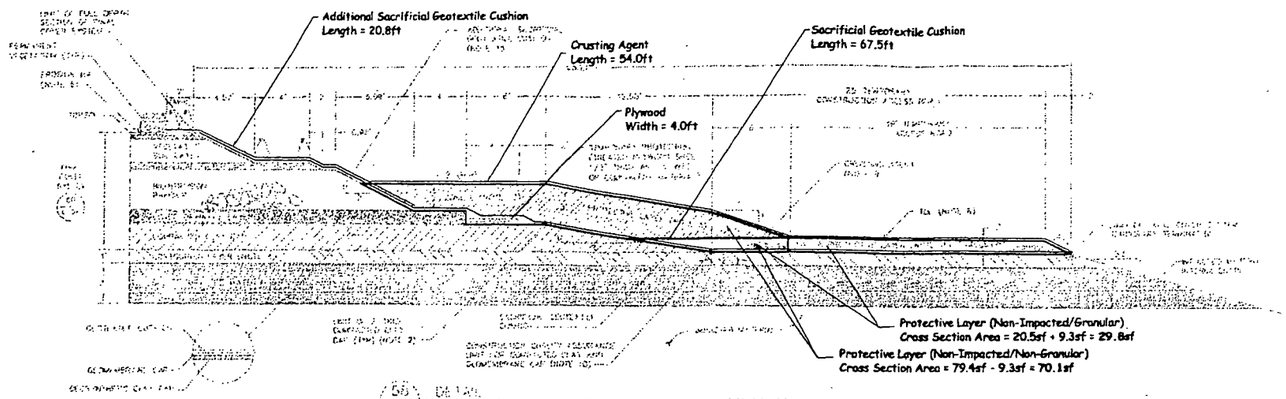
DATE

SEAL

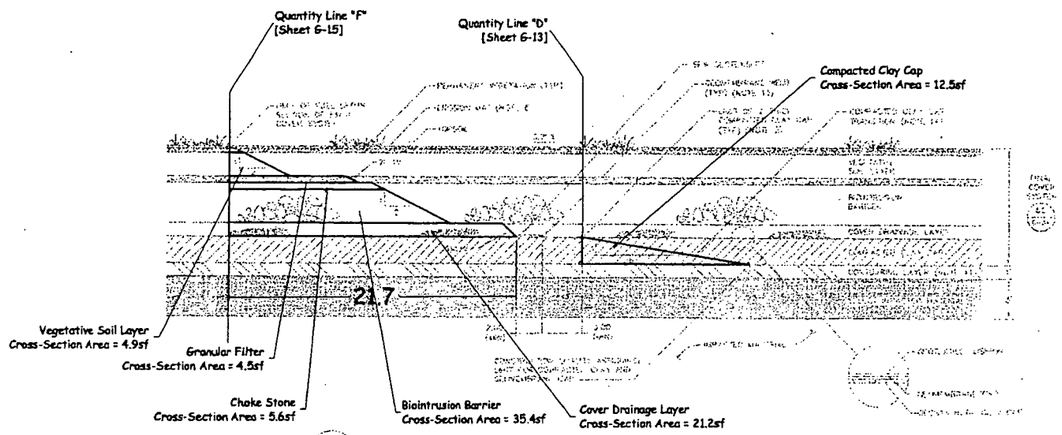
GEOSYNTEC CONSULTANTS
1900 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30317 USA

PROJECT NO.	20105
CONTRACT NO.	03F0699
FEMP DRAWING NO.	00X-6000-C-00390
GEOSYNTEC PROJECT NO.	003211-06.03
GEOSYNTEC DOCUMENT NO.	0-T03-1030
SHEET NO.	C-28
REVISION NO.	1

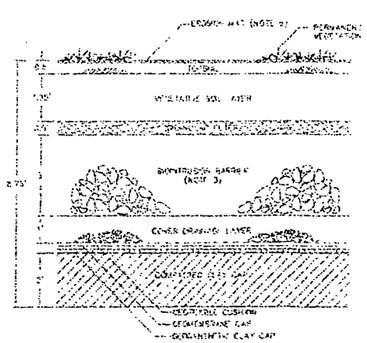
CERTIFIED-FOR-CONSTRUCTION



DETAIL
FINAL COVER SYSTEM TEMPORARY TERMINATION AND EXISTING HAUL ROAD



DETAIL
FINAL COVER SYSTEM TEMPORARY TERMINATION



DETAIL
FINAL COVER SYSTEM

FINAL COVER SYSTEM COMPONENT SUMMARY

	GEOSYNTHETIC CAP	
	GEOSYNTHETIC CLAY CAP	
	GEOTEXTILE CUSHION	
	COMPACTED CLAY CAP	
	COVER DRAINAGE LAYER	
	BIOINTRUSION BARRIER	
	GRANULAR FILTER	
	CHOKE STONE	
	SOIL	
	PROTECTIVE LAYER (NON-IMPACTED/GRANULAR)	
	PROTECTIVE LAYER (NON-IMPACTED/NON-GRANULAR)	
	CONTOURING LAYER (NON-IMPACTED)	
	VEGETATION	
	PERMANENT VEGETATION	

NOTES:

1. DETAILS ARE SHOWN TO SCALE AS NOTED. ENSURE FLAT RESTORATION WORK AREA SURFACE AT SEDIMENT. SCALE FOR QUANTITY MEASUREMENT PURPOSES SHALL BE WITHIN UNITS SHOWN ON SPECIFICATIONS.
2. CONTOUR LINES SHOWN ARE FROM FINAL GEOMEMBRANE COVER. COMPACTED CLAY CAP, COVER DRAINAGE AND BIOINTRUSION BARRIER ARE ADJUSTED AS SHOWN ON DRAWINGS TO MAINTAIN 2' TOTAL COVER.
3. BIOINTRUSION BARRIER SHALL BE PLACED WITHIN TOP 12" OF VEGETATIVE BARRIER IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
4. CONTOURING LAYER SHALL CONSIST OF NON-IMPACTED MATERIAL IN ACCORDANCE WITH SPECIFICATION SECTION 02200. SHALL FROM NON-IMPACTED CONTOURING LAYER SHALL BE PLACED TO INTERMEDIATE MOVEMENT EASEMENT AREA LIMITS. EXCEPTION OF SECTION 1-1 TO CONTOUR. PLANE FOR CONTOUR. COVER DRAINAGE LAYER SHALL BE THE CONTOURING LAYER. CONTOURING PLANE CONSTRUCTION WITH FINAL COVER SYSTEM IN ACCORDANCE WITH FINAL COVER SECTION 02200.
5. ZONE B PROTECTIVE LAYER IN FINAL COVER SYSTEM TEMPORARY TERMINATION SHALL BE NON-IMPACTED MATERIAL. NON-IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
6. EROSION MAT SHALL BE PROVIDED AND INSTALLED IN ACCORDANCE WITH SPECIFICATION SECTION 02200. EROSION MAT WITH 1 YEAR SUN CANOPY COVERAGE SHALL BE USED AT THE LOCATIONS AS LIMITS INDICATED ON SECTION 1-1 DRAWING 2-32, AND AT THE TOP OF THE FINAL COVER SYSTEM SLOPE TRANSITIONS. TWO 6 FOOT WIDTHS OF COW EROSION MAT SHALL BE USED TO COVER EXCAVATION WITH A 3.5 FOOT OVERLAP ON EACH SIDE OF THE TRENCH AS SHOWN.
7. GEOMEMBRANE FOR THE COVER SYSTEM WILL BE SEAMED BY FLUOR FERNALD, INC. AS SPECIFIED IN CONSTRUCTION WORK CONTROL PROCEDURE PROCEDURES.
8. INSTALL SOIL FENCE TO KEEP EROSION MATERIALS UNDERNEATH FROM TOP OF SLOPE. SLOPE AS FINAL COVER SYSTEM TEMPORARY TERMINATION. SOIL FENCE SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
9. CONTOURING AGENT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
10. EXISTING GEOMEMBRANE CAP SOIL, BEYOND TEMPORARY TERMINATION, SOIL AND GEOSYNTHETIC CLAY COMPONENTS DO NOT EXTEND. ONLY THE TEMP SLOPE PROTECTION.
11. ZONE A PROTECTIVE LAYER SHALL CONSIST OF BLADE AGGREGATE IN ACCORDANCE WITH SPECIFICATION SECTION 02200 AND SHALL BE PLACED AFTER INSTALLATION OF COMPACTED CLAY CAP.
12. ZONE B PROTECTIVE LAYER SOIL SHALL BE PLACED AFTER CONSTRUCTION OF GEOSYNTHETIC COMPONENTS OF FINAL COVER SYSTEM.
13. REMOVE OBSOLETE FENCING OR SIGNS OR AS PERMITTED BY FUTURE PLANS TO INSTALL PLAN OF NEW GEOMEMBRANE CAP.
14. TRANSITION FROM EXISTING 3 FOOT THICK COMPACTED CLAY CAP TO REPLACEMENT SECTION OF COMPACTED CLAY CAP SHALL BE CONSTRUCTED IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
15. EXPOSED PORTION OF GEOSYNTHETIC EROSION STRIPS TO BE SECURED IN PLACE WITH SAND BAGS.

REV. NO	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	RVW. BY	APP. BY
1	04.01.23	CTC REVISION 1 SUBMITTAL TO FF/DOE/EPA	KRD	VDR	TLZ	DKP	RB
1B	03.12.04	PRE-FINAL REVISION 1 SUBMITTAL TO FF/DOE	KRD	VDR	TLZ	DKP	RB
1A	03.10.24	PRELIMINARY REVISION 1 SUBMITTAL TO FF/DOE	KRD	VDR	TLZ	DKP	RB
D	00.01.19	CTC SUBMITTAL TO FF/DOE/EPA	KRD	JMD	KRD	DCP	JFB
B	01.12.17	PRE-FINAL SUBMITTAL TO FF/DOE	KRD	JMD	KRD	DCP	JFB
A	01.10.27	PRELIMINARY SUBMITTAL TO FF/DOE	KRD	JMD	KRD	DCP	JFB

SCALE AS SHOWN

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD CLOSURE PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT: ON-SITE DISPOSAL FACILITY – PHASE V

TITLE: FINAL COVER SYSTEM DETAILS I

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT BIDDER OR CONSTRUCTION UNLESS SEALED.

SIGNATURE
DATE
SEAL

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

PROJECT NO.: 20105
CONTRACT NO.: 03FF0699
FFMP DRAWING NO.: 901-6000-G-00398
GEOSYNTEC PROJECT NO.: 003211-06.01
GEOSYNTEC DOCUMENT NO.: G-F03-10.35
SHEET NO.: G-34
REVISION NO.: 1

CERTIFIED-FOR-CONSTRUCTION