BURNS McDONNELL

History of Construction
Martin Lake Steam Electric Station
CCR Surface Impoundments

Luminant Generation Company, LLC

MLSES History of Construction
Project No. 90588

October 5, 2016

Burns & McDonnell
Engineering Firm F-845

History of Construction
Martin Lake Steam Electric Station
CCR Surface Impoundments

prepared for

Luminant Generation Company, LLC
MLSES History of Construction
Rusk County, Texas

Project No. 90588

October 5, 2016

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

INDEX AND CERTIFICATION

Luminant Generation Company, LLC
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Report Index

Certification

I hereby certify, as a Professional Engineer in the state of Texas, that the information in this document was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by Luminant Generation Company, LLC or others without specific verification or adaptation by the Engineer.

Randell Lee Sedlacek

Randell Lee Sedlacek, P.E. (Texas License No. 99056)

Date: 10/5/16

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
BMcD	Burns & McDonnell
CCR	Coal Combustion Residual
CFR	Code of Federal Regulation
EAP	East Ash Pond
EPA	Environmental Protection Agency
GM	Geomembrane
MLSES	Martin Lake Steam Electric Station
PDP5	Permanent Disposal Pond 5
RCRA	Resource Conservation and Recovery Act
NSP	New Scrubber Pond
WAP	West Ash Pond

1.0 INTRODUCTION

Luminant Generation Company, LLC (Luminant) owns and operates the Martin Lake Steam Electric Station (MLSES), located in Rusk County, Texas. MLSES is located adjacent to Martin Lake, which is used as its cooling water source. The plant consists of 3 units which burn lignite and Powder River Basin (PRB) coal. The bottom ash, fly ash, and scrubber gypsum created during electricity generation are stored, conditioned, and/or disposed of in surface impoundments and landfills on-site, or in nearby Luminant owned and operated facilities.

The EPA published the final Rule to regulate Coal Combustion Residuals (CCR) on April 17, 2015. The final Rule establishes minimum criteria for existing and new CCR Landfills and Surface Impoundments (CCR Units). Luminant is subject to the CCR Rule and as such must compile a History of Construction for existing CCR surface impoundments (to the extent feasible) per 40 CFR §257.73. The tables in this document and its attachments provide the History of Construction for the existing surface impoundments at MLSES.

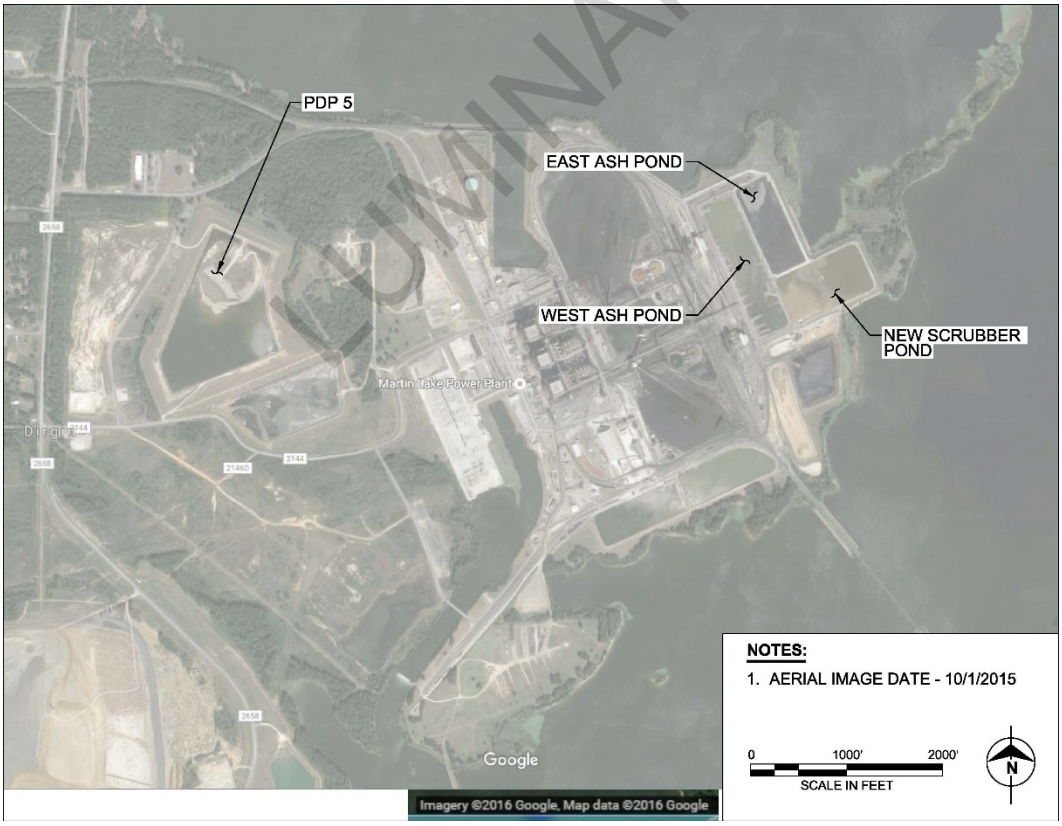


Figure 1 MLSES Site Plan

TABLE 1-1 EAST BOTTOM ASH POND HISTORY OF CONSTRUCTION DATA

Section	CCR Rule Description	Included	Information
§257.73 (c)(1) (i)	Name and address of the owner/operator of the CCR unit	Y	Luminant Generation Company, LLC 1601 Bryan Street Dallas, TX 75201
§257.73 (c)(1) (i)	Name of the CCR units	Y	East Bottom Ash Pond (EAP)
§257.73 (c)(1) (i)	Identification number of the CCR unit	Y	TCEQ WMU No. 023
§257.73 (c)(1) (ii)	Location of the CCR unit on most recent United State Geological Survey (USGS) 7½ minute or 15 minute topographical map	Y	See Attachment 1
§257.73 (c)(1) (iii)	Statement of the purpose for which the CCR unit is being used	Y	Overflow from the bottom ash dewatering bins is sent to the East and West Bottom Ash Ponds. The plant area bottom ash sumps are sluiced directly to these ponds. The East and West Bottom Ash ponds can be used one at a time.
§257.73 (c)(1) (iv)	Name and size of watershed within which the CCR unit is located	Y	HUC12=120100020803, Martin Lake Watershed, AREA in ACRES=28184
§257.73 (c)(1) (v)	Description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed	Y	Foundation Soils include poorly graded sand and silt, silty sand and clayey sand.
§257.73 (c)(1) (vi)	Statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit	Y	Embankment material includes sandy lean clay, medium dense clayey sand, and stiff fat clay.
§257.73 (c)(1) (vi)	The method of site preparation and construction of each zone or stage of the CCR unit	Y	Embankment constructed in lifts of unspecified depth, and compacted to 95% of the Standard Proctor maximum density.
§257.73 (c)(1) (vi)	The approximate dates of construction of each successive stage of construction of the CCR unit	Y	1977, Reline in 2010.
§257.73 (c)(1) (vii)	Detailed Dimensional Drawings Including the Following:	Y	See Attachment 2-East Ash Pond
§257.73 (c)(1) (vii)	Plan view and cross sections of the length and width of the CCR unit	Y	See Attachment 2-East Ash Pond
§257.73 (c)(1) (vii)	Foundation improvements	N	N/A
§257.73 (c)(1) (vii)	Drainage provisions, spillways, diversion ditches, outlets	N	N/A
§257.73 (c)(1) (vii)	Instrumentation locations	N	N/A
§257.73 (c)(1) (vii)	Slope protection	Y	See Attachment 2-East Ash Pond
§257.73 (c)(1) (vii)	Normal operating pool surface elevation	Y	EL 327.67
§257.73 (c)(1) (vii)	Maximum pool surface elevation following peak discharge from the inflow design flood	N	This information is being compiled by another consultant and will be included in the Inflow Design Flood Control System Plan published on Luminant's CCR website.
§257.73 (c)(1) (vii)	Expected maximum depth of CCR within the unit	Y	Approximately 20' (329'-309')
§257.73 (c)(1) (vii)	Any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation	Y	Pipe penetrations, See Attachment 2
§257.73 (c)(1) (viii)	Description of the type, purpose, and location of existing instrumentation	N	None.
§257.73 (c)(1) (ix)	Area-capacity curves for the CCR unit	N	This information is being compiled by another consultant and will be included in the Inflow Design Flood Control System Plan published on Luminant's CCR website.
§257.73 (c)(1) (x)	Description of each spillway and diversion design features and capacities and calculations used in their determination	N	There are no spillways.
§257.73 (c)(1) (xi)	Construction specifications	Y	Attachment 2
§257.73 (c)(1) (xi)	Provisions for surveillance, maintenance, and repair of the CCR unit	N	Weekly and Annual Inspections per §257.83.
§257.73 (c)(1) (xii)	Any record or knowledge of structural instability of the CCR unit	N	None.

TABLE 1-2 WEST BOTTOM ASH POND HISTORY OF CONSTRUCTION DATA

Section	CCR Rule Description	Included	Information
§257.73 (c)(1) (i)	Name and address of the owner/operator of the CCR unit	Y	Luminant Generation Company, LLC 1601 Bryan Street Dallas, TX 75201
§257.73 (c)(1) (i)	Name of the CCR units	Y	West Bottom Ash Pond (WAP)
§257.73 (c)(1) (i)	Identification number of the CCR unit	Y	TCEQ WMU No. 014
§257.73 (c)(1) (ii)	Location of the CCR unit on most recent United State Geological Survey (USGS) 7½ minute or 15 minute topographical map	Y	See Attachment 1
§257.73 (c)(1) (iii)	Statement of the purpose for which the CCR unit is being used	Y	Overflow from the bottom ash dewatering bins is sent to the East and West Bottom Ash Ponds. The plant area bottom ash sumps are sluiced directly to these ponds. The East and West Bottom Ash ponds can be used one at a time.
§257.73 (c)(1) (iv)	Name and size of watershed within which the CCR unit is located	Y	HUC12=120100020803, Martin Lake Watershed, AREA in ACRES=28184
§257.73 (c)(1) (v)	Description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed	Y	Foundation soils generally consisted of stiff to hard sandy clays and firm to very dense sands.
§257.73 (c)(1) (vi)	Statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit	Y	Embankment soils generally consisted of stiff to hard sandy clays and firm to very dense sands.
§257.73 (c)(1) (vi)	The method of site preparation and construction of each zone or stage of the CCR unit	N	No records available.
§257.73 (c)(1) (vi)	The approximate dates of construction of each successive stage of construction of the CCR unit	Y	1977, Relined in 1988.
§257.73 (c)(1) (vii)	Detailed Dimensional Drawings Including the Following:	Y	See Attachment 2-West Ash Pond
§257.73 (c)(1) (vii)	Plan view and cross sections of the length and width of the CCR unit	Y	See Attachment 2-West Ash Pond
§257.73 (c)(1) (vii)	Foundation improvements	N	N/A
§257.73 (c)(1) (vii)	Drainage provisions, spillways, diversion ditches, outlets	N	N/A
§257.73 (c)(1) (vii)	Instrumentation locations	N	N/A
§257.73 (c)(1) (vii)	Slope protection	Y	See Attachment 2-West Ash Pond
§257.73 (c)(1) (vii)	Normal operating pool surface elevation	Y	EL 321
§257.73 (c)(1) (vii)	Maximum pool surface elevation following peak discharge from the inflow design flood	N	This information is being compiled by another consultant and will be included in the Inflow Design Flood Control System Plan published on Luminant's CCR website.
§257.73 (c)(1) (vii)	Expected maximum depth of CCR within the unit	Y	20' (329'-309')
§257.73 (c)(1) (vii)	Any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation	Y	Pipe penetrations, See Attachment 2
§257.73 (c)(1) (viii)	Description of the type, purpose, and location of existing instrumentation	N	None.
§257.73 (c)(1) (ix)	Area-capacity curves for the CCR unit	N	This information is being compiled by another consultant and will be included in the Inflow Design Flood Control System Plan published on Luminant's CCR website.
§257.73 (c)(1) (x)	Description of each spillway and diversion design features and capacities and calculations used in their determination	N	There are no spillways.
§257.73 (c)(1) (xi)	Construction specifications	N	No records available.
§257.73 (c)(1) (xi)	Provisions for surveillance, maintenance, and repair of the CCR unit	N	Weekly and Annual Inspections per §257.83.
§257.73 (c)(1) (xii)	Any record or knowledge of structural instability of the CCR unit	N	None.

TABLE 1-3 NEW SCRUBBER POND HISTORY OF CONSTRUCTION DATA

Section	CCR Rule Description	Included	Information
§257.73 (c)(1) (i)	Name and address of the owner/operator of the CCR unit	Y	Luminant Generation Company, LLC 1601 Bryan Street Dallas, TX 75201
§257.73 (c)(1) (i)	Name of the CCR units	Y	New Scrubber Pond (NSP)
§257.73 (c)(1) (i)	Identification number of the CCR unit	Y	TCEQ WMU No. 013
§257.73 (c)(1) (ii)	Location of the CCR unit on most recent United State Geological Survey (USGS) 7½ minute or 15 minute topographical map	Y	See Attachment 1
§257.73 (c)(1) (iii)	Statement of the purpose for which the CCR unit is being used	Y	The New Scrubber Pond is used to receive thickener overflow, storm water from scrubber/scrubbers solids handling, and scrubber wash-down water. Water from this pond is used for scrubber makeup.
§257.73 (c)(1) (iv)	Name and size of watershed within which the CCR unit is located	Y	HUC12=120100020803, Martin Lake Watershed, AREA in ACRES=28184
§257.73 (c)(1) (v)	Description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed	Y	Foundation soils generally consisted of stiff to hard sandy clays and firm to very dense sands.
§257.73 (c)(1) (vi)	Statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit	Y	Clay, underlain by clayey sand and sandy clays.
§257.73 (c)(1) (vi)	The method of site preparation and construction of each zone or stage of the CCR unit	N	No records available.
§257.73 (c)(1) (vi)	The approximate dates of construction of each successive stage of construction of the CCR unit	Y	Begin Construction - 7/18/88 Complete Construction - 4/20/89
§257.73 (c)(1) (vii)	Detailed Dimensional Drawings Including the Following:	Y	See Attachment 2 - Scrubber Pond
§257.73 (c)(1) (vii)	Plan view and cross sections of the length and width of the CCR unit	Y	See Attachment 2 - Scrubber Pond
§257.73 (c)(1) (vii)	Foundation improvements	N	N/A
§257.73 (c)(1) (vii)	Drainage provisions, spillways, diversion ditches, outlets	N	N/A
§257.73 (c)(1) (vii)	Instrumentation locations	N	N/A
§257.73 (c)(1) (vii)	Slope protection	Y	See Attachment 2 - Scrubber Pond
§257.73 (c)(1) (vii)	Normal operating pool surface elevation	Y	EL 327.67
§257.73 (c)(1) (vii)	Maximum pool surface elevation following peak discharge from the inflow design flood	N	This information is being compiled by another consultant and will be included in the Inflow Design Flood Control System Plan published on Luminant's CCR website.
§257.73 (c)(1) (vii)	Expected maximum depth of CCR within the unit	Y	20' (329-309)
§257.73 (c)(1) (vii)	Any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation	Y	Pipe penetrations, See Attachment 2
§257.73 (c)(1) (x)	Description of each spillway and diversion design features and capacities and calculations used in their determination	N	There are no spillways.
§257.73 (c)(1) (ix)	Area-capacity curves for the CCR unit	N	This information is being compiled by another consultant and will be included in the Inflow Design Flood Control System Plan published on Luminant's CCR website.
§257.73 (c)(1) (viii)	Description of the type, purpose, and location of existing instrumentation	N	None.
§257.73 (c)(1) (xi)	Construction specifications	N	No records available.
§257.73 (c)(1) (xi)	Provisions for surveillance, maintenance, and repair of the CCR unit	N	Weekly and Annual Inspections per §257.83.
§257.73 (c)(1) (xii)	Any record or knowledge of structural instability of the CCR unit	N	None.

TABLE 1-4 PDP 5 HISTORY OF CONSTRUCTION DATA

Section	CCR Rule Description	Included	Information
§257.73 (c)(1) (i)	Name and address of the owner/operator of the CCR unit	Y	Luminant Generation Company, LLC 1601 Bryan Street Dallas, TX 75201
§257.73 (c)(1) (i)	Name of the CCR units	Y	Permanent Disposal Pond 5 (PDP 5)
§257.73 (c)(1) (i)	Identification number of the CCR unit	Y	TCEQ WMU No. 024
§257.73 (c)(1) (ii)	Location of the CCR unit on most recent United State Geological Survey (USGS) 7½ minute or 15 minute topographical map	Y	See Attachment 1
§257.73 (c)(1) (iii)	Statement of the purpose for which the CCR unit is being used	Y	PDP 5 receives excess storm water, excess water from the scrubber loop or the bottom ash loop.
§257.73 (c)(1) (iv)	Name and size of watershed within which the CCR unit is located	Y	HUC12=120100020803, Martin Lake Watershed, AREA in ACRES=28184
§257.73 (c)(1) (v)	Description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed	Y	Prior to the construction of PDP-5 a 3 ft clay layer was placed over top the closed ponds below the new berm. Portions of the embankment were constructed over the existing ash fill.
§257.73 (c)(1) (vi)	Statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit	Y	6-inch thick clay buffer (1x10-5 cm/sec) on top of closed PDPs 1, 2, &3 overlain by a 2 ft thick compacted clay (1x10-7 cm/sec) with leachate collection system
§257.73 (c)(1) (vi)	The method of site preparation and construction of each zone or stage of the CCR unit	Y	Subgrade was scarified 6-inches prior to placement of liner soils. Liner was constructed in 9-inch loose thickness lifts, in parallel or monolithic lifts. The liner was compacted to 95% of the maximum dry density.
§257.73 (c)(1) (vi)	The approximate dates of construction of each successive stage of construction of the CCR unit	Y	PDP 5 was constructed in 2010.
§257.73 (c)(1) (vii)	Detailed Dimensional Drawings Including the Following:	Y	See Attachment 2-PDP 5
§257.73 (c)(1) (vii)	Plan view and cross sections of the length and width of the CCR unit	Y	See Attachment 2-PDP 5
§257.73 (c)(1) (vii)	Foundation improvements	N	N/A
§257.73 (c)(1) (vii)	Drainage provisions, spillways, diversion ditches, outlets	N	N/A
§257.73 (c)(1) (vii)	Instrumentation locations	N	N/A
§257.73 (c)(1) (vii)	Slope protection	Y	See Attachment 2-PDP 5
§257.73 (c)(1) (vii)	Normal operating pool surface elevation	Y	EL 404.1
§257.73 (c)(1) (vii)	Maximum pool surface elevation following peak discharge from the inflow design flood	N	This information is being compiled by another consultant and will be included in the Inflow Design Flood Control System Plan published on Luminant's CCR website.
§257.73 (c)(1) (vii)	Expected maximum depth of CCR within the unit	Y	13' (405-392)
§257.73 (c)(1) (vii)	Any identifiable natural or manmade features that could adversely affect operation of the CCR unit due to malfunction or mis-operation	N	None.
§257.73 (c)(1) (viii)	Description of the type, purpose, and location of existing instrumentation	N	None.
§257.73 (c)(1) (ix)	Area-capacity curves for the CCR unit	N	This information is being compiled by another consultant and will be included in the Inflow Design Flood Control System Plan published on Luminant's CCR website.
§257.73 (c)(1) (x)	Description of each spillway and diversion design features and capacities and calculations used in their determination	N	There are no spillways.
§257.73 (c)(1) (xi)	Construction specifications	Y	Soil Liner Evaluation Report performed by ETTL Engineers and Consultants.
§257.73 (c)(1) (xi)	Provisions for surveillance, maintenance, and repair of the CCR unit	N	Weekly and Annual Inspections per §257.83.
§257.73 (c)(1) (xii)	Any record or knowledge of structural instability of the CCR unit	N	None.

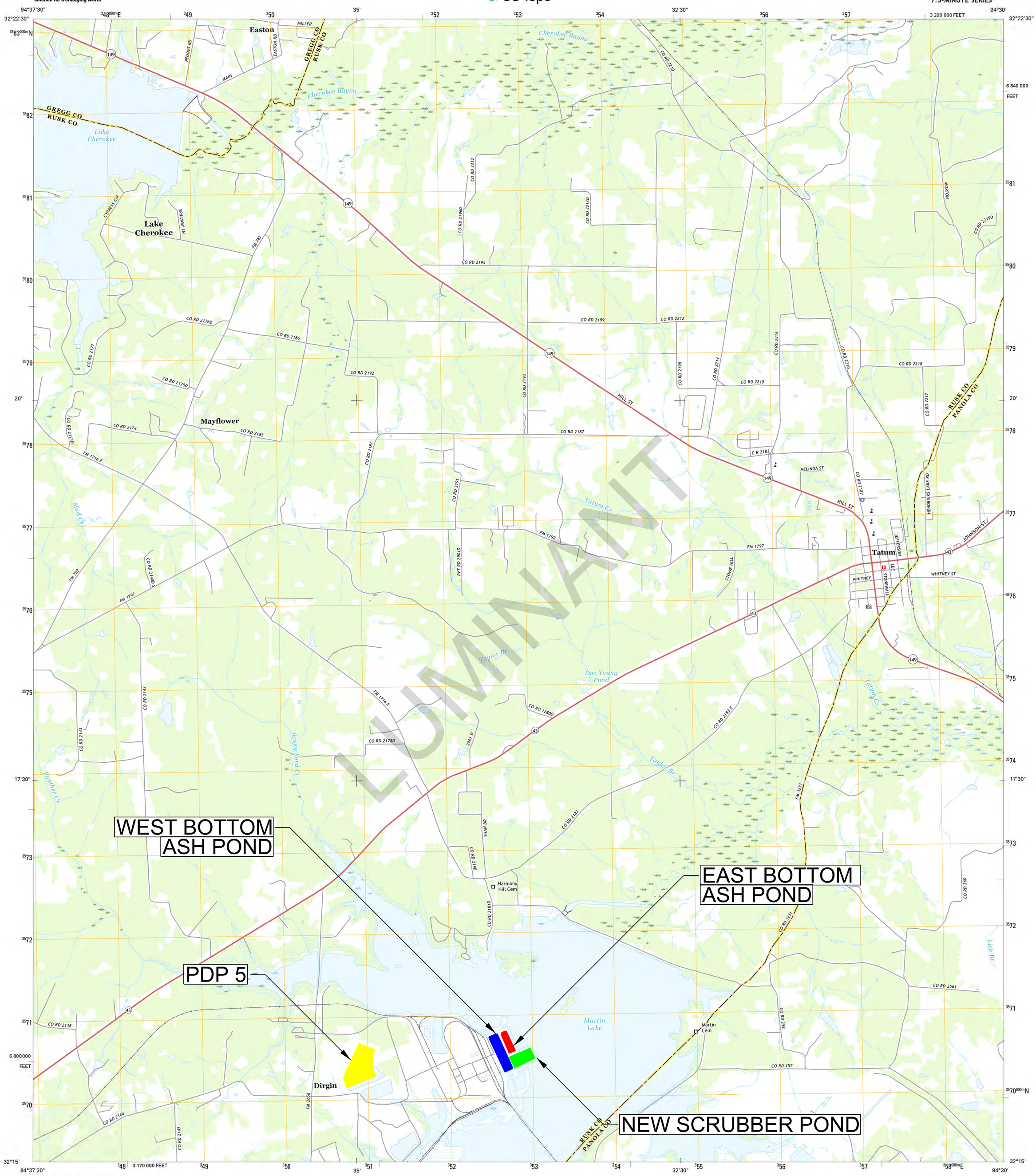
ATTACHMENT 1 - LOCATION OF UNITS ON USGS MAP

USGS science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

TATUM QUADRANGLE
TEXAS
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid: Universal Transverse Mercator, Zone 15S
10 000-foot ticks: Texas Coordinate System of 1983 (north central zone)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, September 2014
Roads..... U.S. Census Bureau, 2014 - 2015
Names.....GNIS, 2015
Hydrography.....National Hydrography Dataset, 2014
Contours.....National Elevation Dataset, 2004
Boundaries.....Multiple sources; see metadata file 1972 - 2015

Wetlands.....FWS National Wetlands Inventory 1977 - 2014

MN 2° 8' 38 MILS
GN 0° 50' 15 MILS
UTM GRID AND 2016 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID
UR
Grid Zone Designation
15S

SCALE 1:24 000
1 KILOMETERS 1 2
1000 METERS 2000
1 MILES 1
1000 FEET 10000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.19

TEXAS
QUADRANGLE LOCATION

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

1 Lakeport
2 Easton
3 Darco
4 Elderville
5 Harris Chapel
6 Church Hill
7 Fair Play
8 Beckville
ADJOINING QUADRANGLES

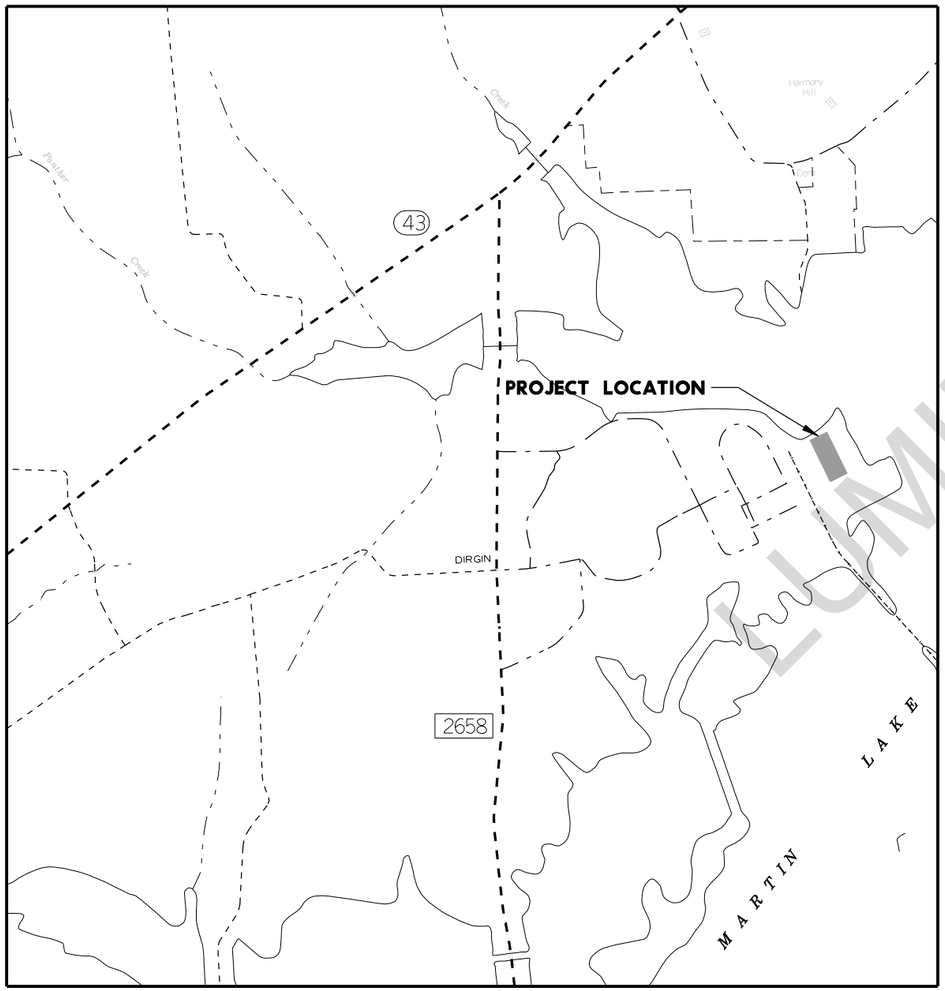
TATUM, TX
2016

NSN 7643016398531
NGA REF NO. USGSX24K4349

ATTACHMENT 2 - DETAILED DIMENSIONAL DRAWINGS

EAST ASH POND

MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND AS BUILT DRAWINGS



SHEET NO.	TITLE
C-1	COVER SHEET
C-2	ABBREVIATIONS & GENERAL NOTES
C-3	SITE LAYOUT
C-4	GRADING PLAN
C-5	LINER SYSTEM LAYOUT
C-6	LINER SECTION AND DETAILS
C-7	AIR-GAS VENTING LAYOUT AND DETAIL
C-8	LEAK DETECTION SUMP SECTION AND DETAILS
C-9	DEWATERING PIPES SECTIONS AND DETAIL
C-10	PIPE RACK PLAN & NOTES
C-11	PIPE RACK SECTIONS & DETAILS
C-12	CROSS SECTIONS
C-13	AS BUILT FINAL CONTOURS
C-14	AS BUILT MISCELLANEOUS DETAILS
C-15	AS BUILT POND ACCESS TYPICAL SECTION
C-16	DEWATERING PIPE FIGURE

DATE: 8/13/2010
TIME: 11:31:55 AM
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FILE: Luminant_Mining_Company_LLC\ML_SES_Reline_East_Ash_Pond\13.00_CAD\Sheet Files\AS BUILTS

PLTDRVER: 11X17LASER_BW_PDF.plt
PENTABLE: 0000000000959991.tbl

Luminant

HDR
HDR Engineering, Inc.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070

Texaas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION
	05/10	AS BUILT

PROJECT MANAGER	D. VOGT
ENGINEER	D. VOGT
CHECKED BY	J. PALUTIS
DESIGNED	D. MONTAGUE
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	91399

THIS RECORD DRAWING IS A COMPILATION OF THE SEALED ENGINEERING DRAWINGS FOR THIS PROJECT, MODIFIED BY ADDENDA AND CHANGE ORDERS. INFORMATION FURNISHED BY THE CONTRACTOR OR OTHERS, NOT ASSOCIATED WITH THE DESIGN ENGINEER, CANNOT BE VERIFIED FOR ACCURACY OR COMPLETENESS. THE ORIGINAL SEALED DRAWINGS ARE ON FILE AT THE OFFICES OF HDR ENGINEERING INC.

MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

COVER SHEET

FILENAME C-1.dgn
SCALE NTS

SHEET
C-1

STANDARD ABBREVIATIONS

&	AND
APPROX	APPROXIMATELY
@	AT
AVG	AVERAGE
BOE	BOTTOM OF EXCAVATION
BOL	BOTTOM OF LINER
X	BY
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CO	CLEAN OUT
CY	CUBIC YARD
DIA	DIAMETER
DET	DETAIL
DWG	DRAWING
E	EAST
ELEV	ELEVATION
EW	EACH WAY
EXIST	EXISTING
EXC	EXCAVATION
FML	FLEXIBLE MEMBRANE LINER
FT	FEET
GAL	GALLON
GND	GROUND
GDL	GRAVEL DRAINAGE LAYER
GNDL	GEONET DRAINAGE LAYER
HDPE	HIGH DENSITY POLYETHYLENE
HORIZ	HORIZONTAL
ID	INSIDE DIAMETER
IN	INCHES
IE	INVERT ELEVATION
LCRS	LEACHATE COLLECTION AND REMOVAL SYSTEM
LCS	LEACHATE COLLECTION SYSTEM
LCP	LEACHATE COLLECTION PIPE
LCPR	LEACHATE COLLECTION PIPE RISER
LF	LINEAR FEET
LB	POUND
MH	MANHOLE
MAX	MAXIMUM
MIL	.001 INCHES
MIN	MINIMUM
MW	MONITOR WELL
MLSES	MARTIN LAKE STEAM ELECTRIC STATION
MSL	MEAN SEA LEVEL
N	NORTH
NIC	NOT IN CONTRACT
NO	NUMBER
NTS	NOT TO SCALE
OC	ON CENTER
OZ	OUNCE
%	PERCENT
PLCP	PERFORATED LEACHATE COLLECTION PIPE
PERF	PERFORATED
PGL	PROFILE GRADE LINE
PDP	PERMANENT DISPOSAL POND
PC	POINT OF CURVATURE
PI	POINT OF INTERSECTION
PVI	POINT OF VERTICAL INTERSECTION
PT	POINT OF TANGENT
PZ	PIEZOMETER
Q	FLOW
QTY	QUANTITY
R	RADIUS
RCP	REINFORCED CONCRETE PIPE
REF	REFERENCE
REQ	REQUIRED
RD	ROAD
SCH	SCHEDULE
SDL	SAND DRAINAGE LAYER
SEC	SECTION
SHT	SHEET
S	SOUTH
SDR	STANDARD DIMENSION RATIO
SP	STEEL PIPE
SQ	SQUARE
STA	STATION
SLQCP	SOIL LINER QUALITY CONTROL PLAN
SS	SIDE SLOPE
T.A.S.	TERMINAL ANCHOR SECTION
TL	TANGENT LENGTH
TOC	TOP OF COVER
TOFC	TOP OF FINAL COVER
TOL	TOP OF LINER
TOS	TOE OF SLOPE
TS	TOP SLOPE
TEMP	TEMPORARY
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VERT	VERTICAL
W	WEST
W/	WITH
YD	YARD

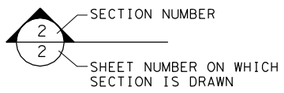
GENERAL NOTES USED DURING POND RECONSTRUCTION

1. ALL WORK UNDER THIS CONTRACT SHALL BE PERFORMED IN ACCORDANCE WITH THE PLANS AND PROJECT SPECIFICATIONS. IN THE EVENT OF A DISCREPANCY BETWEEN THE PLANS AND THE PROJECT SPECIFICATIONS, THE SPECIFICATIONS SHALL GOVERN.
2. COORDINATE SYSTEM IS BASED ON LOCAL SURVEY. THE BENCHMARKS TO BE USED FOR CONSTRUCTION ARE LOCATED AS SHOWN ON DRAWING NO. 3. EXISTING CONTOURS ARE BASED ON TOPOGRAPHICAL SURVEY TAKEN ON OCTOBER 20, 2008 FOR EAST ASH POND BY COLLINS SURVEYING AND MAPPING, LONGVIEW, TEXAS. CURRENT GROUND ELEVATIONS MAY VARY FROM THOSE SHOWN DUE TO SITE WORK THAT HAS BEEN PERFORMED SINCE THE SURVEY WAS PERFORMED.
3. THE CONTRACTOR SHALL VERIFY EXISTING CONTOURS PRIOR TO THE START OF WORK.
4. GROUNDWATER AT THE SITE WILL VARY DEPENDING ON RAINFALL, AND SUBSURFACE CONDITIONS. THERE SHALL NOT BE ANY ADDITIONAL PAYMENT OR EXTENSION OF CONTRACT TIME FOR WORKING WITH SATURATED SOILS OR HANDLING GROUNDWATER SEEPAGE DUE TO RAINFALL, RUNOFF AND INFILTRATION.
5. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PROTECT EXISTING ROADS, BENCHMARKS AND EXISTING GROUNDWATER MONITOR WELLS DURING THE CONSTRUCTION PERIOD. THE CONTRACTOR SHALL BE SOLEY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE INCURRED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PROTECT THE GROUNDWATER MONITOR WELLS, BENCHMARKS AND EXISTING ROADS.
6. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES HAVE NOT BEEN ESTABLISHED BY THE OWNER OR HIS REPRESENTATIVES. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTORS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UTILITIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING PROPER SAFE WORKING DISTANCE FROM ALL UTILITY EASEMENTS OR LINES.
7. EXCAVATION BY "BLASTING" IS NOT PERMITTED ON THIS PROJECT.
8. FINISHED GROUND ELEVATIONS SHALL MATCH EXISTING GROUND ELEVATIONS EXCEPT AS SHOWN ON THE PLANS. ALL EXCESS SOIL FROM THE EXCAVATION AND GRADING SHALL BE PLACED IN DESIGNATED STOCKPILE LOCATIONS AS APPROVED BY THE OWNER. IF WASTE IS ENCOUNTERED DURING EXCAVATION, THE OWNER SHALL BE NOTIFIED AND THE WASTE REMOVED AND PLACED IN AREAS DESIGNATED AS APPROVED BY THE OWNER. TRANSPORT OF SOIL TO FILL AREAS SHALL BE CONDUCTED BY THE CONTRACTOR AT NO ADDITIONAL EXPENSE TO THE OWNER.
9. GEOTECHNICAL INVESTIGATION REPORTS FOR THE SITE ARE AVAILABLE FOR REVIEW AT LUMINANT'S DALLAS OFFICES. THE CONTRACTOR MAY PERFORM ADDITIONAL GEOTECHNICAL INVESTIGATIONS, AS HE DEEMS NECESSARY FOR CONSTRUCTION ACTIVITIES, PROVIDED ALL NECESSARY PERMITS AND APPROVALS ARE OBTAINED FROM LUMINANT PRIOR TO INITIATING SUCH WORK. HOWEVER, THERE SHALL BE NO ADDITIONAL PAYMENT TO THE CONTRACTOR FOR ADDITIONAL GEOTECHNICAL INVESTIGATIONS.
10. THE CONTRACTOR SHALL CONSTRUCT, AND UPON COMPLETION OF THE PROJECT, REMOVE TEMPORARY CONSTRUCTION ACCESS ROADS. SUCH ROADS SHALL BE LOCATED AS APPROVED BY THE OWNER. DRAINAGE PATTERNS AT THE SITE SHALL NOT BE ALTERED BY ROAD CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONSTRUCTION AND MAINTENANCE OF TEMPORARY DRAINAGE STRUCTURES, INCLUDING CULVERTS, AT NO ADDITIONAL COST TO THE OWNER.
11. THE CONTRACTOR SHALL INSTALL, MAINTAIN, AND UPON COMPLETION OF THE PROJECT, REMOVE TEMPORARY EROSION AND SEDIMENT CONTROLS AS APPROVED BY LUMINENT ENVIRONMENTAL SERVICES AND IN ACCORDANCE WITH THE SITE SWPPP AND PURSUANT TO TPDES REQUIREMENTS. SUCH CONTROLS SHALL BE PLACED AT THE LIMITS OF DISTURBED AREAS AND AT INTERMEDIATE LOCATIONS WHERE CONCENTRATED FLOW IS LIKELY.
12. TEMPORARY CONSTRUCTION SLOPES SHALL NOT BE GREATER THAN 2H:1V. STEEPER SLOPES WILL ONLY BE ALLOWED IF THE CONTRACTOR PROVIDES A GEOTECHNICAL ENGINEERING REPORT SPECIFYING MAXIMUM SLOPES AND THE DURATION FOR WHICH SUCH SLOPES SHALL REMAIN IN PLACE.
13. THE CONTRACTOR SHALL REMOVE ALL VEGETATION WITHIN THE CONSTRUCTION LIMITS AS REQUIRED TO CONSTRUCT THE PROJECT. ALL VEGETATION SHALL BE REMOVED BY CONTRACTOR AT NO ADDITIONAL EXPENCE TO OWNER.
14. THE CONTRACTOR SHALL OBTAIN AND CONDUCT WORK CONSISTENT WITH A TPDES PERMIT FOR CONSTRUCTION, REFER TO TECHNICAL SPECIFICATIONS. PREPARATION OF A SWPPP AND OBTAINING THE TPDES PERMIT ARE THE CONTRACTORS RESPONSIBILITY.
15. THE CONTRACTOR SHALL IMMEDIATELY REPORT TO THE ENGINEER ANY ERROR OR DISCREPANCY FOUND ONCE THE CONTRACT DOCUMENT IS CAREFULLY REVIEWED AND ALL ASPECTS OF FIELD WORK HAVE BEEN VERIFIED. IN THE EVENT THE CONTRACTOR CONTINUES TO WORK ON AN ITEM WHERE AN ERROR EXISTS, IT SHALL BE DEEMED THAT THE CONTRACTOR BID AND INTENDED TO EXECUTE THE MORE STRINGENT OR HIGHER QUALITY REQUIREMENT WITHOUT AN INCREASE IN CONTRACT SUM OR TIME. THE CONTRACTOR SHALL ALSO BE RESPONSIBLE TO CORRECT ANY FAILURE OF COMPANY PARTS TO COORDINATE OR FIT PROPERLY INTO FINAL POSITION, AS A RESULT OF CONTRACTOR FAILURE TO RAISE OR RESOLVE A DISCREPANCY.
16. THE DRAWINGS AND SPECIFICATIONS SHOULD AGREE WITH EACH OTHER, AND WORK CALLED FOR BY DRAWINGS AND NOT MENTIONED IN SPECIFICATION, OR VICE VERSA, SHALL BE FURNISHED BY BOTH. WHEN DISCREPANCIES EXIST BETWEEN SCALE AND DIMENSIONS, THE DIMENSIONED FIGURE SHALL BE USED.
17. CONTRACTORS AND EACH SUB CONTRACTOR SHALL VERIFY ALL GRADES, LINES, LEVELS, AND DIMENSIONS AS INDICATED ON DRAWINGS, AND HE SHALL REPORT ERRORS TO THE ENGINEER BEFORE COMMENCING WORK. THE CONTRACTOR SHALL ESTABLISH BENCHMARKS IN AT LEAST TWO WIDELY SEPARATED PLACES, AND AS WORK PROGRESSES THE CONTRACTOR WILL MAINTAIN ADEQUATE HORIZONTAL AND VERTICAL CONTROL.
18. CONTRACTOR SHALL PROVIDE EROSION CONTROL BY SEEDING FOR ALL AREAS DISTURBED BY CONTRACTOR DURING THE CONSTRUCTION OF THIS PROJECT. THE CONTRACTOR SHALL NOT DISTURB ANY AREA WITHOUT THE APPROVAL OF THE ENGINEER. EROSION CONTROL BY SEEDING SHALL CONFORM TO STANDARD SPECIFICATION 02930.
19. CONTRACTOR SHALL INSTALL EROSION AND SEDIMENT CONTROLS AS PER SPECIFICATIONS DURING CONSTRUCTION. SUCH CONTROLS SHALL BE PLACED AT LIMITS OF DISTURBED AREAS AND AT INTERMEDIATE LOCATIONS WHERE CONCENTRATED FLOW IS LIKELY.
20. STORMWATER AND GROUNDWATER WHICH HAS COME INTO CONTACT WITH THE ASH WITHIN THE EXCAVATED CELL IS TO BE CONSIDERED CONTAMINATED. CONTRACTOR WILL CONTROL THE WATER ON SITE IN COMPLIANCE WITH THE TPDES PERMIT.
21. THE CONTRACTOR IS REQUIRED TO PRESENT THE SWPPP TO LUMINANT ENVIRONMENTAL SERVICES FOR APPROVAL PRIOR TO THE COMMENCEMENT OF CONSTRUCTION ACTIVITIES.
22. THE CONTRACTOR IS REQUIRED TO SUBMIT THE NOTICE OF INTENT FOR THE TPDES PERMIT.
23. THE CONTRACTOR IS TO ACQUIRE A DIGGING PERMIT FROM THE PLANT BEFORE COMMENCING ANY EXCAVATION ACTIVITY.
24. ALL HDPE LINER IS TEXTURED

SYMBOLS

SECTION DETAIL INDICATORS

DRAWING ON WHICH SECTION IS CUT:



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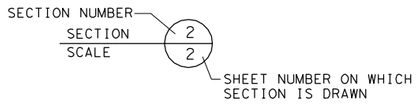

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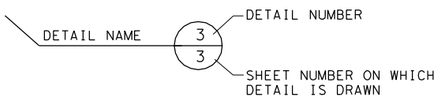

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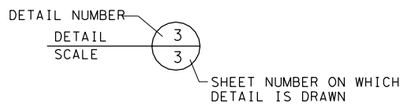
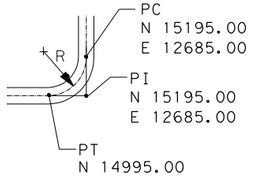
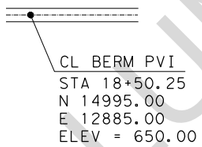
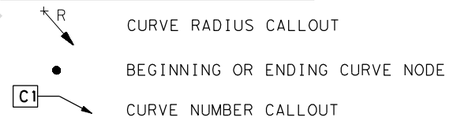


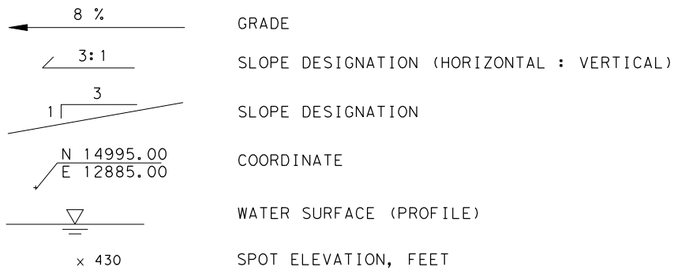




CURVE WITH HORIZONTAL CONTROL:



VERTICAL CONTROL DESIGNATION



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Luminant

HDR Engineering, Inc.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070

Texaas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION
	05/10	AS BUILT

PROJECT MANAGER	D. VOGT
ENGINEER	D. VOGT
CHECKED BY	J. PALUTIS
DESIGNED	D. MONTAGUE
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	91399

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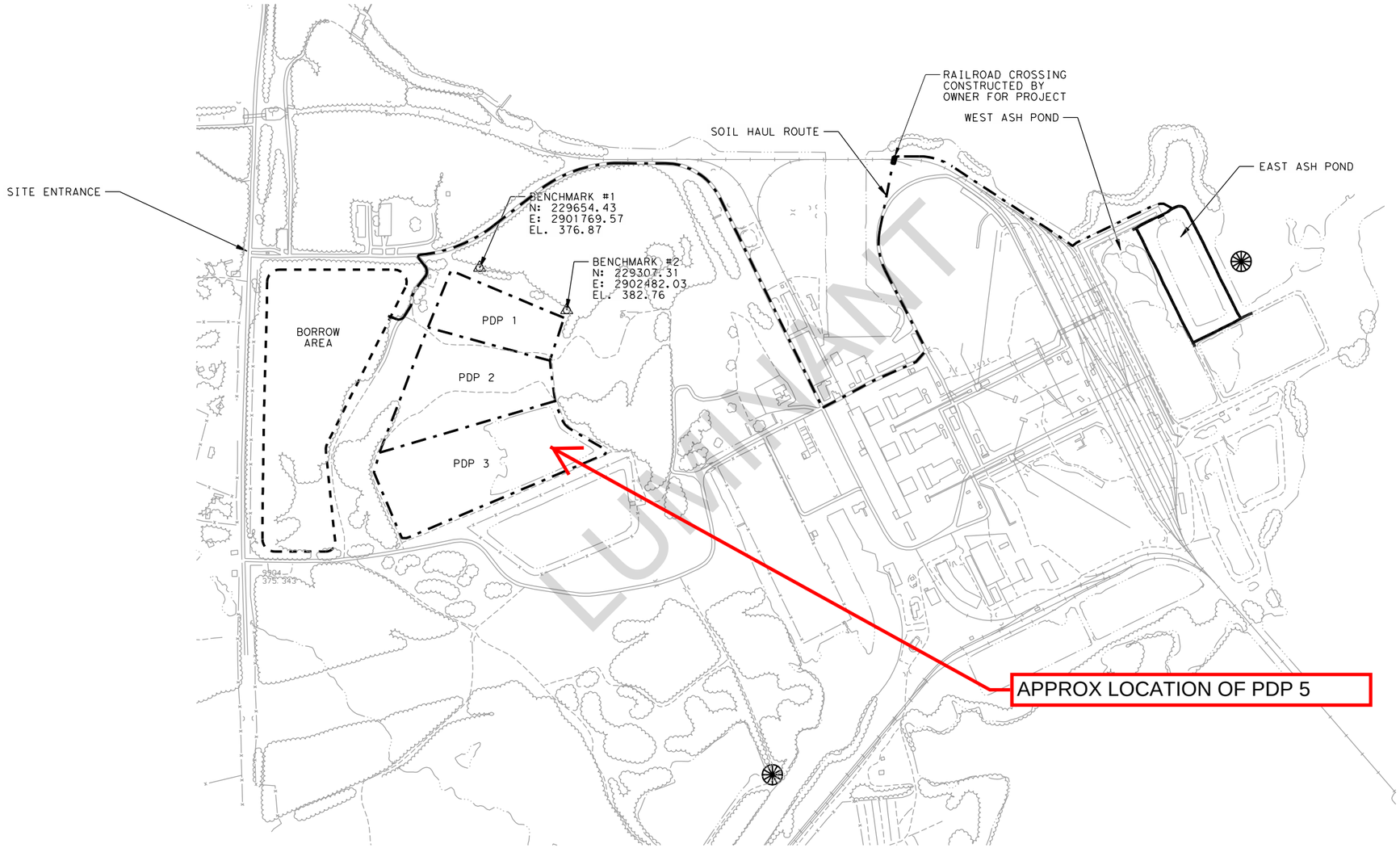
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

ABBREVIATIONS AND GENERAL NOTES

FILENAME	C-2.dgn
SCALE	NONE

SHEET **C-2**



LEGEND

- LIMITS OF CONSTRUCTION
- BORROW AREA
- WATER ACCESS LOCATIONS
- SOIL HAUL ROUTE

BENCHMARKS:

1. BM#1 N 229654.43 E 2901769.57 EL 376.87; BM#2 N 229307.31 E 2902482.03 EL 382.76

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McKinney, Texas 75070

Texaas P.E. Firm
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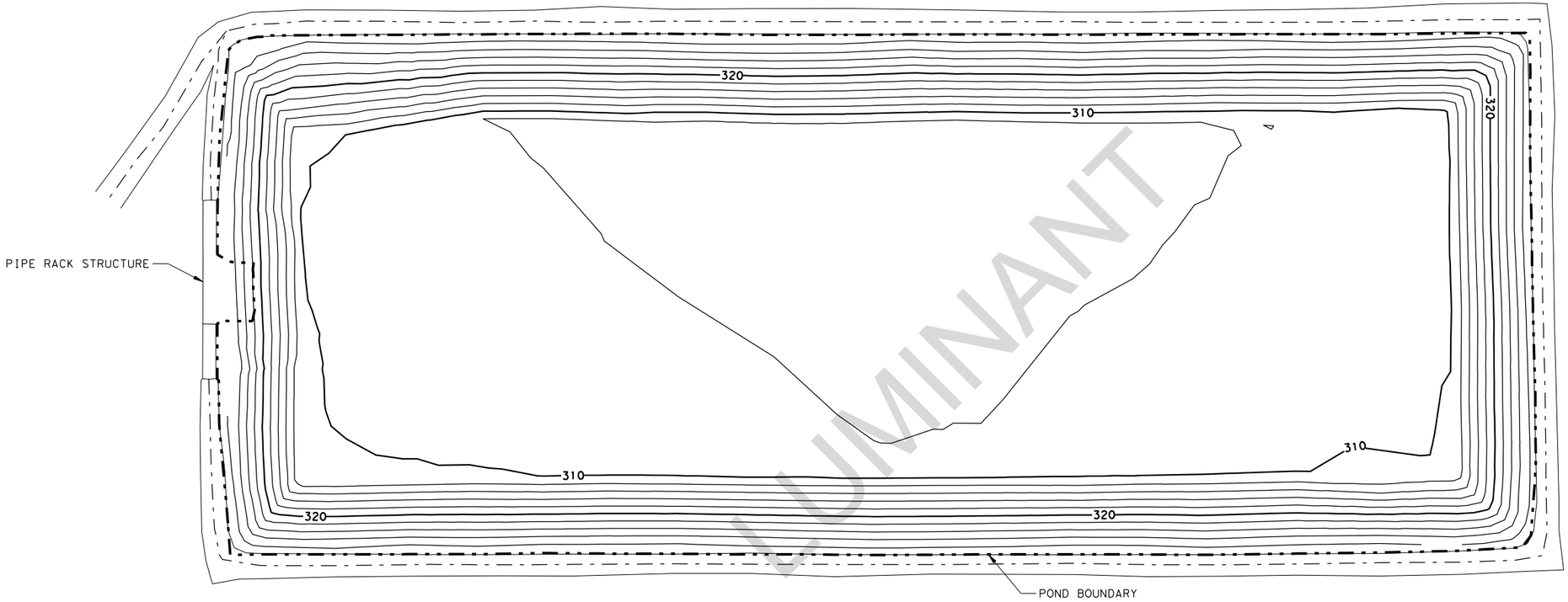
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

SITE LAYOUT

0 500' 1000'

FILENAME C-3.dgn
SCALE AS SHOWN

SHEET C-3



LEGEND

- EXISTING ROAD
- POND BOUNDARY
- FINAL CONTOURS
- CENTERLINE OF ROAD

NOTE: 1. AS BUILT CONTOURS PROVIDED BY COLLINS SURVEYING AND MAPPING, LONGVIEW, TEXAS.

2. CONTOURS SHOWN ARE TOP OF GRADING ELEVATIONS UNLESS OTHERWISE NOTED.

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HDR

HDR Engineering, Inc.
4500 W. Eldorado Parkway
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McKinney, Texas 75070

Texaas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION
1	05/10	AS BUILT CONTOURS

PROJECT MANAGER	D.VOGT
ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	D.MONTAGUE
DRAWN BY	B.COX
QA/QC	M.ODEN
PROJECT NUMBER	91399

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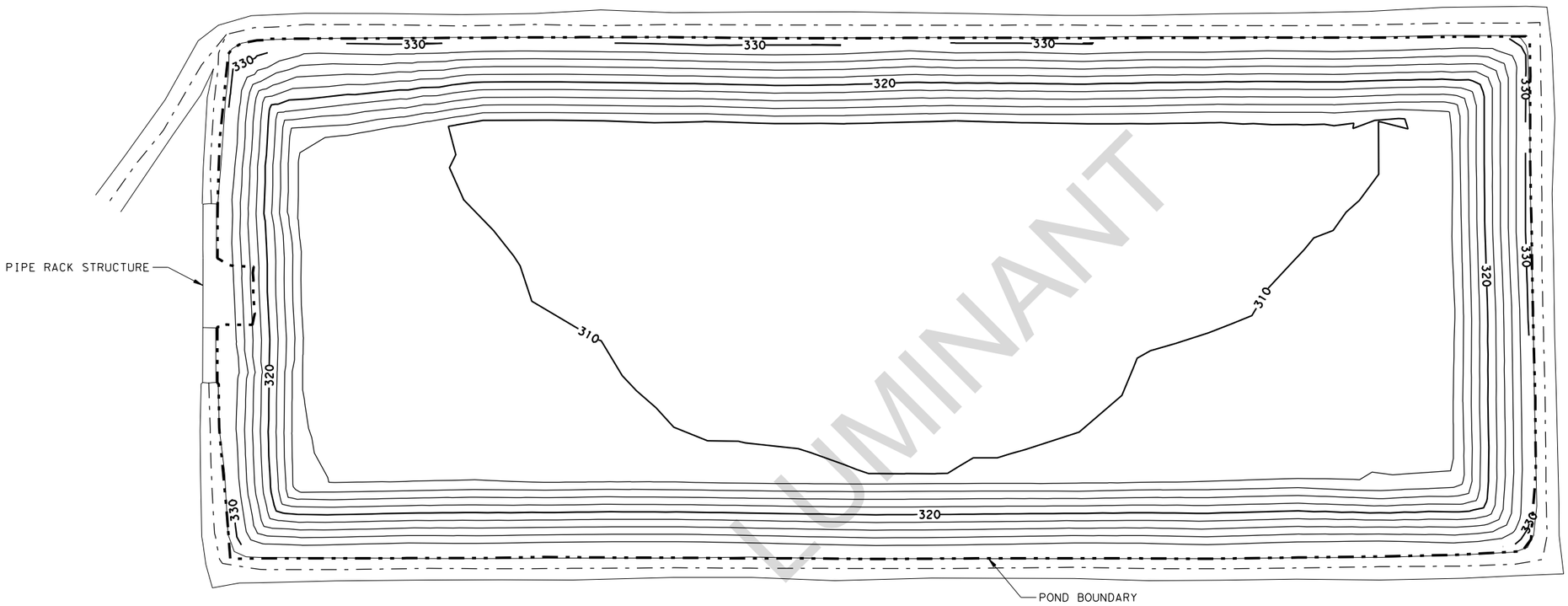
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

AS BUILT GRADING CONTOURS

0 50' 100'

FILENAME	C-4.dgn
SCALE	

SHEET **C-4**



LEGEND

- EXISTING ROAD
- POND BOUNDARY
- FINAL CONTOURS
- CENTERLINE OF ROAD

NOTE: 1. AS BUILT CONTOURS PROVIDED BY COLLINS SURVEYING AND MAPPING, LONGVIEW, TEXAS.

2. CONTOURS SHOWN ARE TOP OF CLAY LINER ELEVATIONS UNLESS OTHERWISE NOTED.

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4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070

Texaas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION
	05/10	AS BUILT

PROJECT MANAGER	D.VOGT
ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	D.MONTAGUE
DRAWN BY	B.COX
QA/QC	M.ODEN
PROJECT NUMBER	91399

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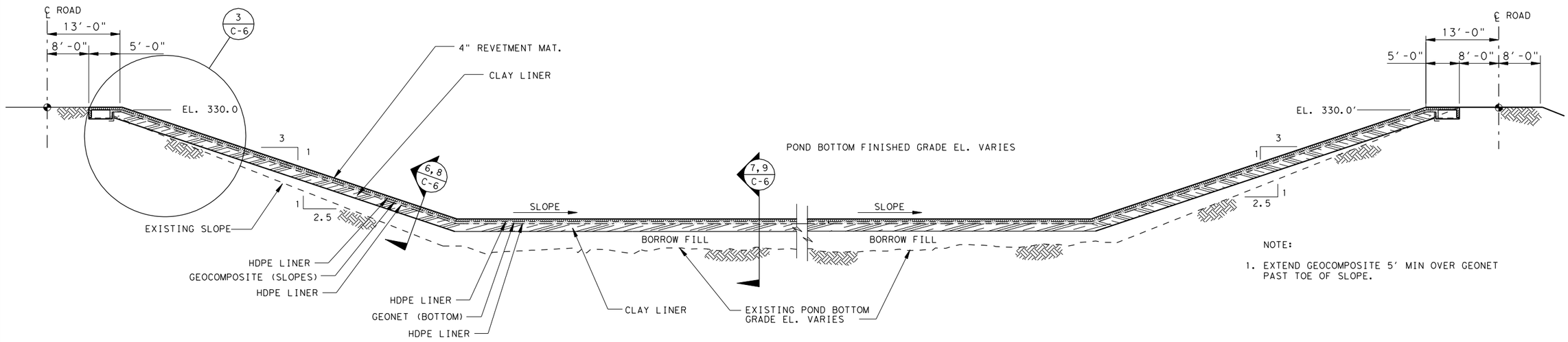
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

AS BUILT LINER CONTOURS

0 50' 100'

FILENAME	C-5.dgn
SCALE	

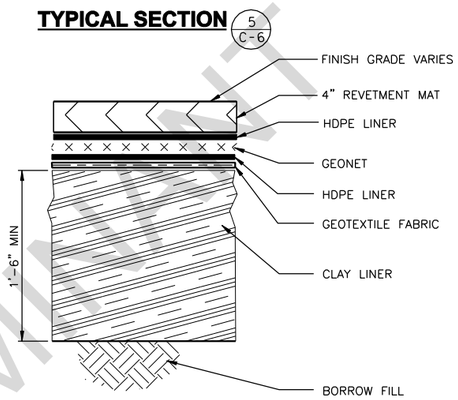
SHEET **C-5**

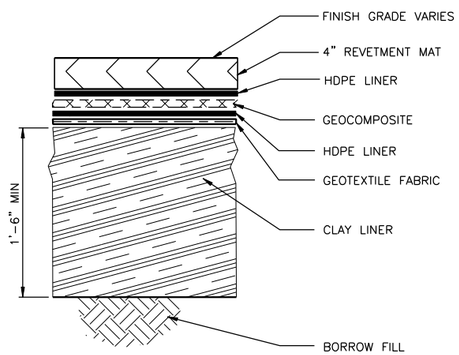


NOTE:

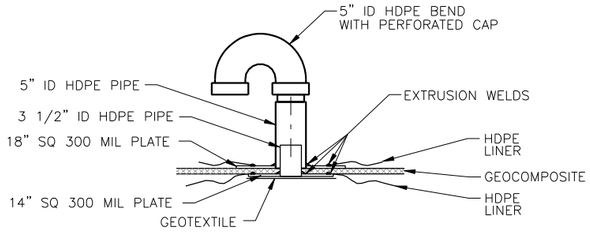
1. EXTEND GEOCOMPOSITE 5′ MIN OVER GEONET PAST TOE OF SLOPE.

TYPICAL SECTION (5 / C-6)

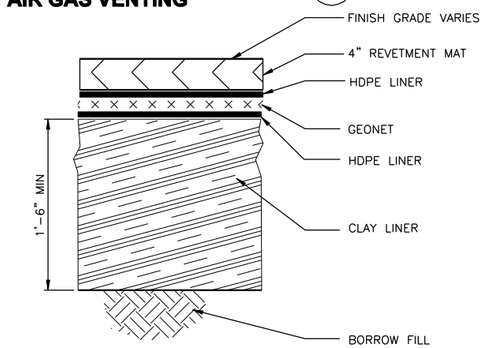




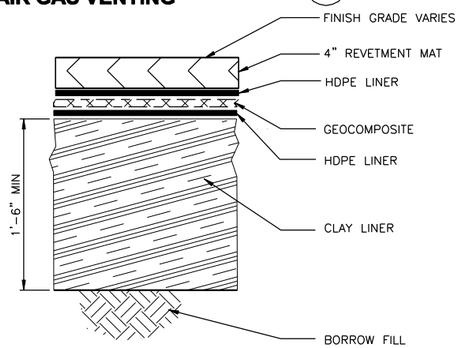
TYPICAL AIR-GAS VENT (4 / C-6)



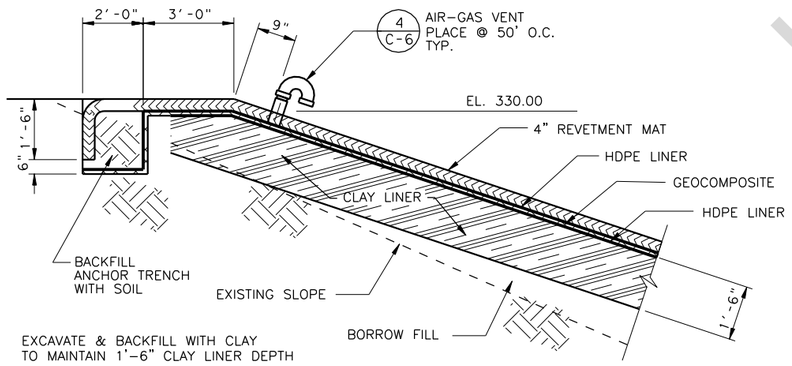
FLOOR LINER SECTION WITH AIR GAS VENTING (9 / C-6)



SLOPE LINER SECTION WITH AIR GAS VENTING (8 / C-6)



TYPICAL TOP OF SLOPE SECTION (3 / C-6)



FLOOR LINER SECTION (7 / C-6)

SLOPE LINER SECTION (6 / C-6)

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USER: rcox
TIME: 11:32:19 AM
DATE: 8/15/2010
FILE: Luminant_Mining_Company_LLC\ML_SES_Reline_East_Ash_Pond\13.00_CAD\Sheet Files\AS BUILTS

Luminant

HDR
HDR Engineering, Inc.
4600 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070
Texaas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION
	05/10	AS BUILT

PROJECT MANAGER	D. VOGT
ENGINEER	D. VOGT
CHECKED BY	J. PALUTIS
DESIGNED	D. MONTAGUE
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	91399

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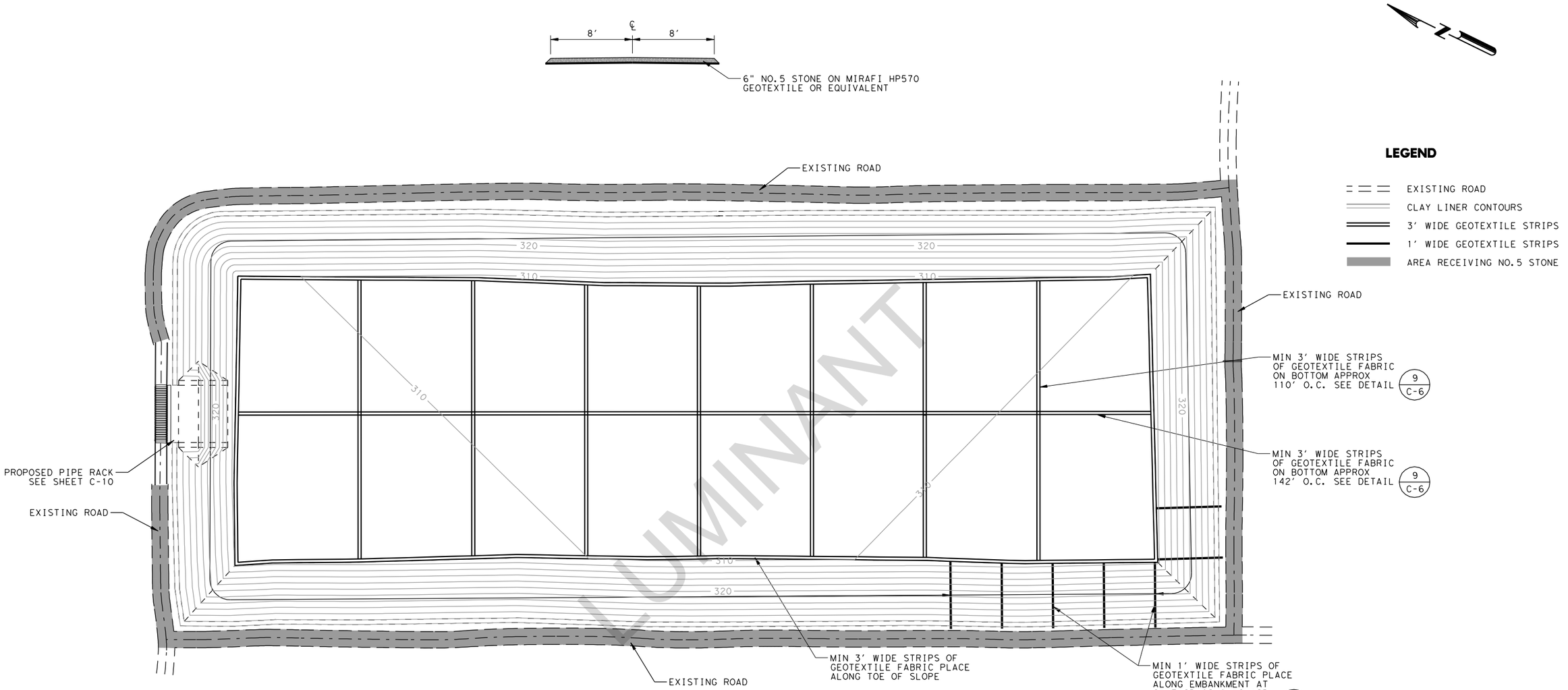
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

LINER SECTION AND DETAILS

FILENAME	C-6.dgn
SCALE	N.T.S

SHEET C-6



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Luminant

HDR
HDR Engineering, Inc.
4500 W. Eldorado Parkway
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McKinney, Texas 75070
Texaas P.E. Firm
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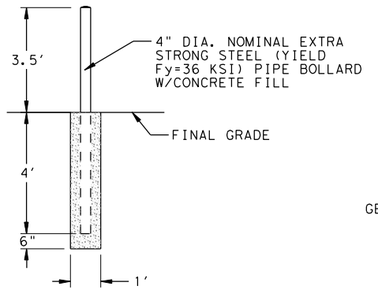
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

AIR-GAS VENTING LAYOUT AND DETAIL

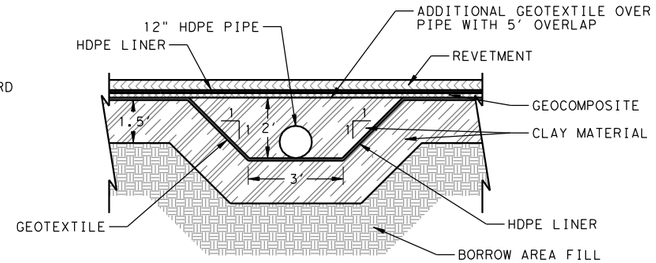
0 50′ 100′

FILENAME C-7.dgn
SCALE

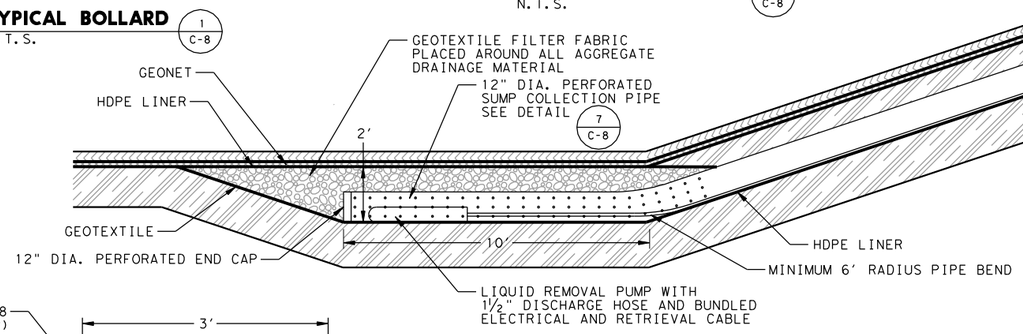
SHEET C-7

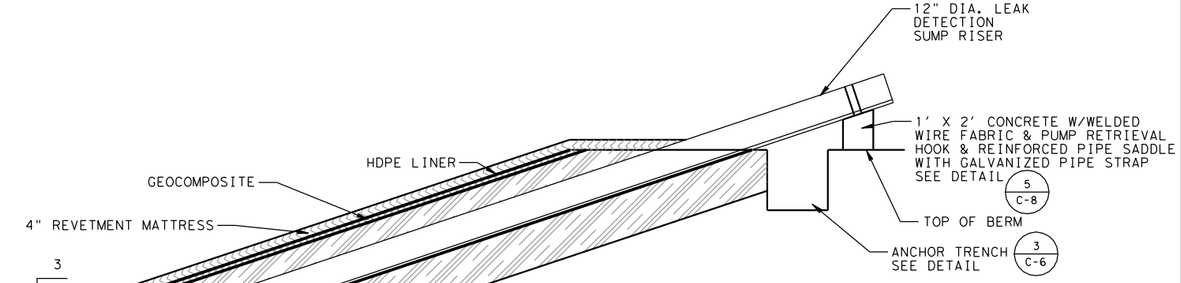


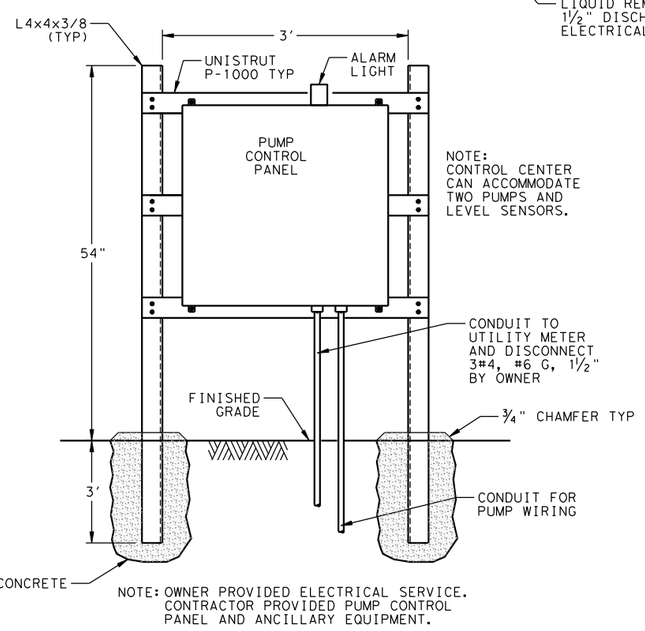
TYPICAL BOLLARD
N.T.S. (1 / C-8)



SUMP PIPE SECTION
N.T.S. (4 / C-8)

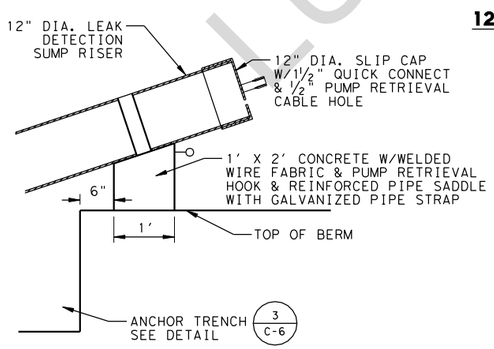




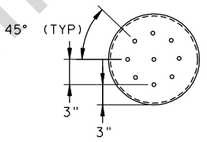


PUMP CONTROL CENTER
N.T.S. (8 / C-8)

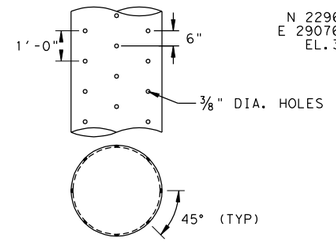
SUMP PROFILE
N.T.S. (3 / C-8)



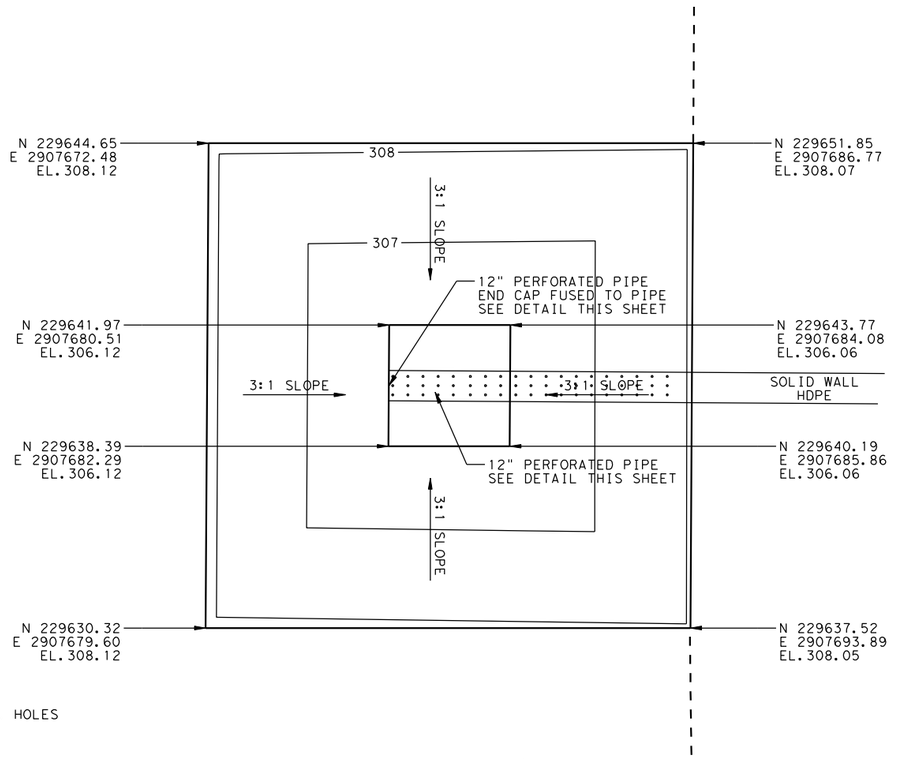
SUMP PIPE TERMINATION
N.T.S. (5 / C-8)



12" DIA. PERFORATED END CAP
N.T.S. (6 / C-8)



12" DIA. PERFORATED SUMP COLLECTION PIPE
N.T.S. (7 / C-8)



SUMP PLAN
N.T.S. (2 / C-8)

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Luminant

HDR
HDR Engineering, Inc.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070
Texaas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION
	05/10	AS BUILT

PROJECT MANAGER	D. VOGT
ENGINEER	D. VOGT
CHECKED BY	J. PALUTIS
DESIGNED	D. MONTAGUE
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	91399

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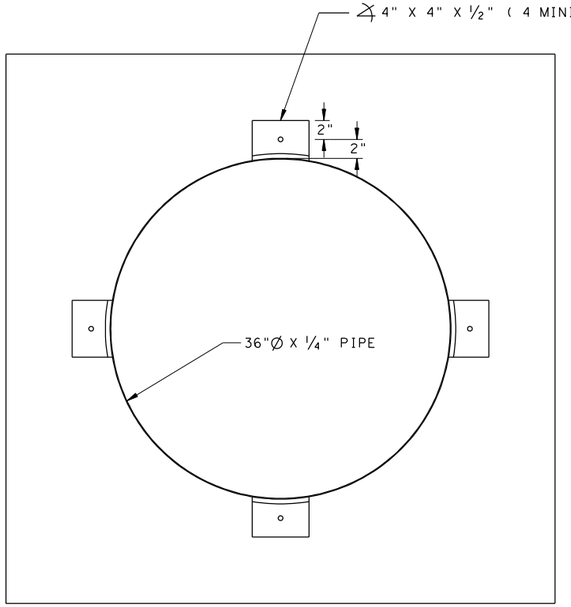
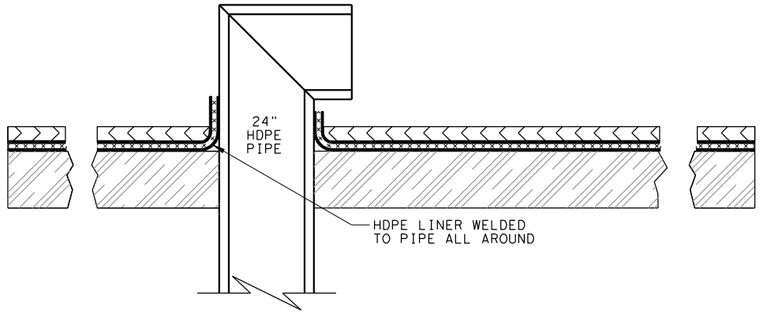
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

LEAK DETECTION SUMP
SECTION AND DETAILS

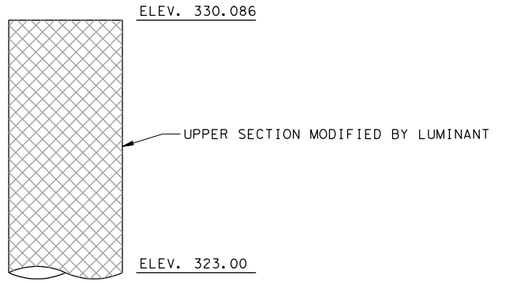
FILENAME C-8.dgn
SCALE N.T.S.
SHEET C-8

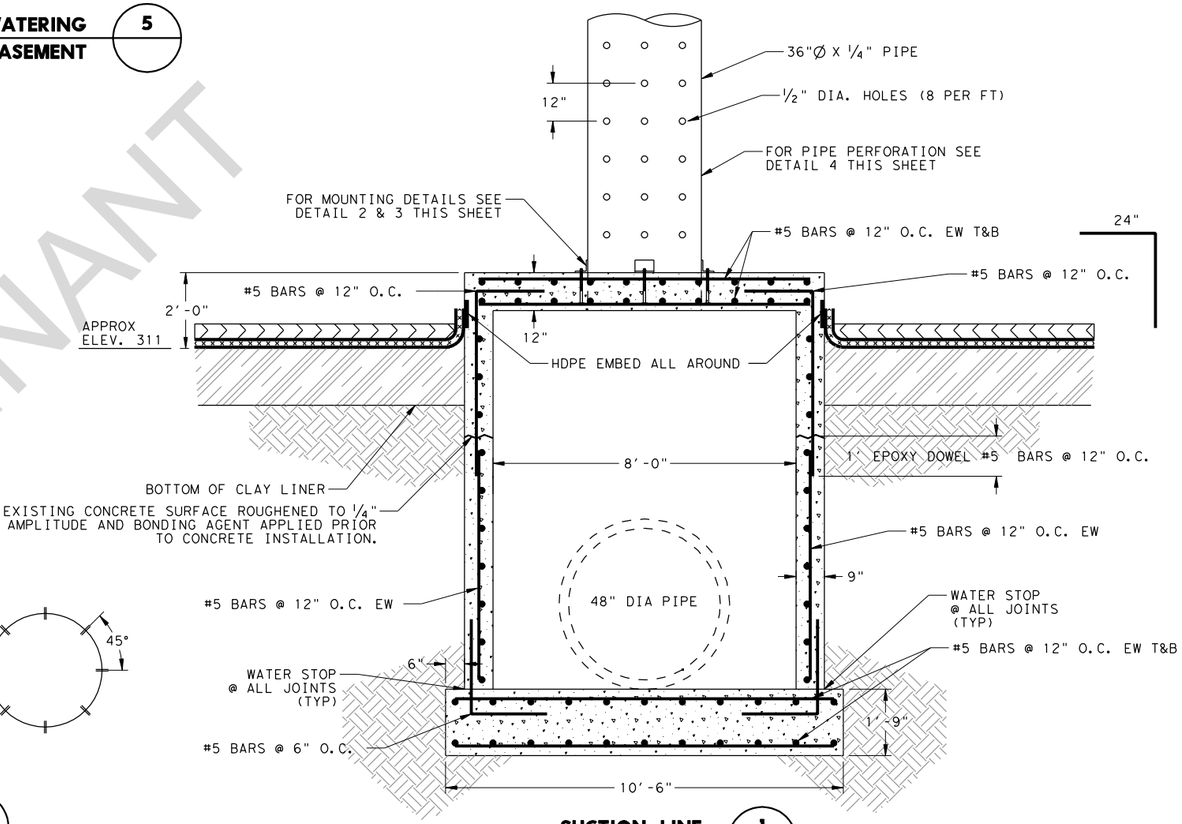


36" PIPE MOUNTING DETAIL (2)
N.T.S.



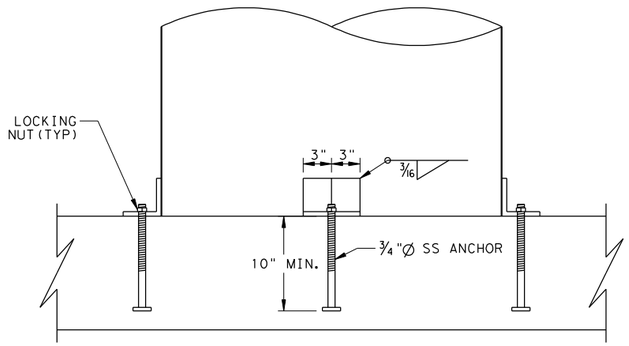
24" DEWATERING LINE ENCASEMENT (5)
N.T.S.



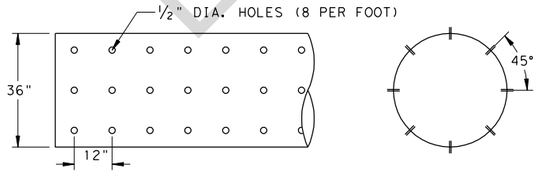


SUCTION LINE INLET STRUCTURE (1)

NOTE:
THE INTERIOR OF THE INLET STRUCTURE WAS LINED WITH AN EPOXY COATING OF RAVEN LINING 405 AT A MINIMUM THICKNESS OF 200 mils.



36" PIPE MOUNTING DETAIL (3)
N.T.S.



36" PIPE PERFORATION DETAIL (4)

NOTE:
ALL STEEL HOT DIP GALVANIZED

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Luminant

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Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION
	05/10	AS BUILT

PROJECT MANAGER	D. VOGT
ENGINEER	D. VOGT
CHECKED BY	
DESIGNED	
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	91399

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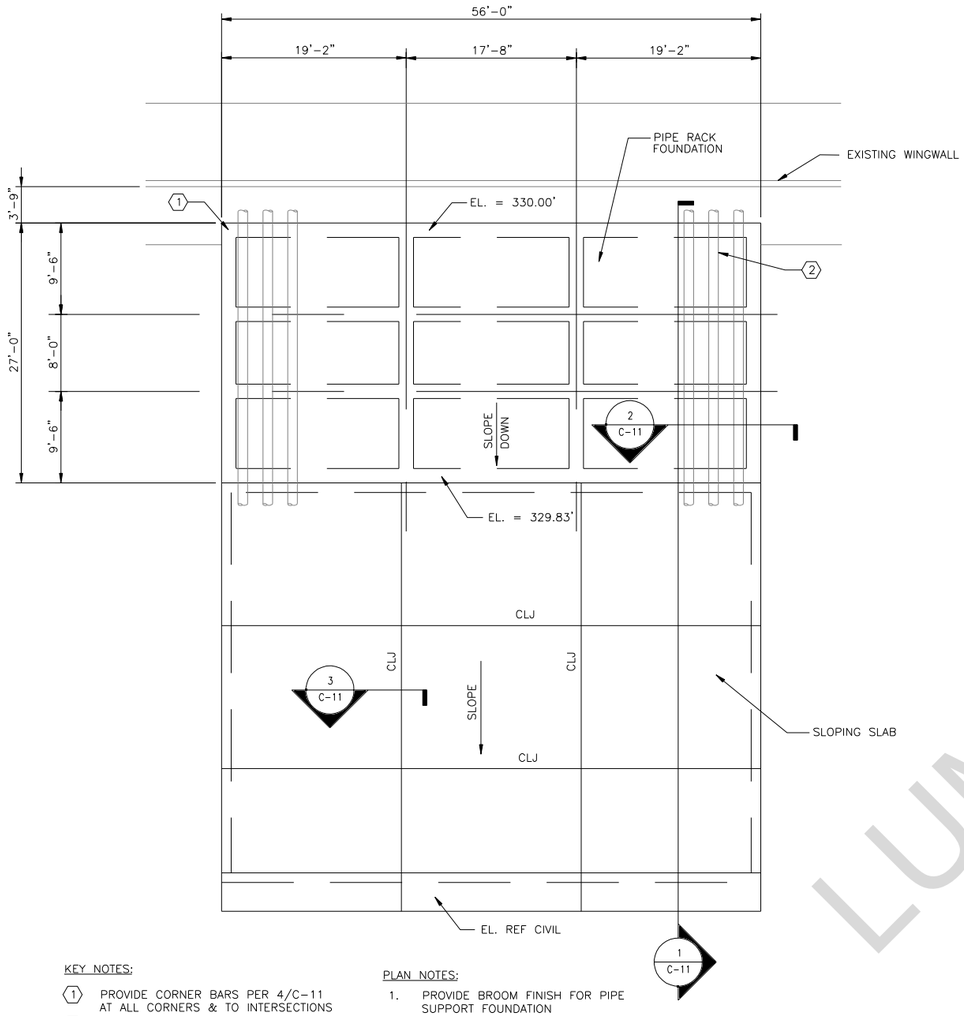
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

AS BUILT STRUCTURE DETAILS

0 2' 4'

FILENAME C-9.dgn
SCALE AS SHOWN

SHEET C-9



KEY NOTES:

1. PROVIDE CORNER BARS PER 4/C-11 AT ALL CORNERS & TO INTERSECTIONS
2. HDPE PIPE BY OTHERS
3. PROVIDE NON-SHRINK GROUT AT BEARING POINTS. BEARING POINTS ARE BEAM LOCATIONS ONLY.

PLAN NOTES:

1. PROVIDE BROOM FINISH FOR PIPE SUPPORT FOUNDATION
2. PROVIDE FLOAT FINISH AT SLOPING SLAB
3. THE HDPE LINER SHALL BE ANCHORED TO THE PIPE RACK FOUNDATION AND EXISTING WINGWALL AS SHOWN ON C-9

1 FOUNDATION PLAN

1/8"= 1'-0"

GENERAL STRUCTURAL NOTES (GSN)

GENERAL

G1. SCOPE
THE NOTES ON THIS SHEET ARE GENERAL AND APPLY TO THE ENTIRE PROJECT WHETHER SPECIFICALLY CALLED OUT OR NOT, EXCEPT WHERE THERE ARE SPECIFIC INDICATIONS TO THE CONTRARY ON STRUCTURAL SHEETS. IF THERE ARE QUESTIONS, THEY SHALL BE SUBMITTED TO THE STRUCTURAL ENGINEER AND ANSWERED IN WRITING PRIOR TO CONSTRUCTION.

G2. APPLICABLE SPECIFICATIONS AND CODES

A. INTERNATIONAL BUILDING CODE, IBC 2006
B. ACI 318

G3. DESIGN CRITERIA

1. APPLIES TO ALL STRUCTURES (UNO)

A. DEAD LOAD:
1. ACTUAL TRIBUTARY STRUCTURE WEIGHT
2. SUPERIMPOSED DEAD LOAD: PIPE (HDPE)

B. LIVE LOAD:
1. SLAB ON GRADE: 250 PSF

C. WIND:
1. BASIC WIND SPEED: 90 MPH
2. EXPOSURE: C
3. IMPORTANCE FACTOR: 1.15

D. SEISMIC:
1. ABOVE GRADE, NON WATER BEARING STRUCTURES:
a. OCCUPANCY CATEGORY III, USE GROUP
b. IMPORTANCE FACTOR: 1.25
c. SPECTRAL RESPONSE ACCELERATION, SS = 0.14
d. SPECTRAL RESPONSE ACCELERATION, S1 = 0.06
e. SITE CLASS: D
f. SEISMIC DESIGN CATEGORY: B
g. SPECTRAL RESPONSE COEFFICIENT, SDS = 0.149
h. SPECTRAL RESPONSE COEFFICIENT, SD1 = 0.096

G4. THE FOLLOWING NON-CONTRACTUAL GEOTECHNICAL REPORT WAS DEVELOPED FOR THIS PROJECT AND IS THE BASIS OF THIS STRUCTURAL DESIGN:

GEOTECHNICAL FIRM NAME: ETTL ENGINEERS & CONSULTANTS
REPORT NUMBER: G2972-081
REPORT DATE 12/12/2008

G5. SAFETY
SAFETY AND STRUCTURE STABILITY DURING CONSTRUCTION IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR. STRUCTURES HAVE BEEN DESIGNED TO RESIST THE DESIGN LIVE LOADS ONLY AS A COMPLETED STRUCTURE.

G6. SPECIAL INSPECTIONS
SPECIAL INSPECTIONS ARE REQUIRED IN ACCORDANCE WITH CHAPTER 1 AND CHAPTER 17 OF THE IBC. PAYMENT FOR THESE INSPECTIONS IS NOT THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL PROVIDE FOR FULL ACCESS TO THE WORK BY THE SPECIAL INSPECTOR AND SHALL PROVIDE FOR THESE INSPECTIONS IN HIS CONSTRUCTION SCHEDULE.

EARTH WORK

E1. BEARING PRESSURE: 2000 PSF

E2. PREPARED SUB-BASE:
SCARIFY 6", AND COMPACT TO 95% MAX DRY DENSITY DETERMINED BY TX DOT METHOD TEX-113-E

E3. ENGINEERED FILL:
FLEXIBLE BASE TYPE S OR C; GRADES 1 OR 2; AS SPECIFIED BY TX DOT, STANDARD SPECIFICATIONS FOR CONSTRUCTION OF HIGHWAYS, STREETS AND BRIDGES, CURRENT EDITION, ITEM 247. COMPACT TO 95% OF MAX DRY DENSITY BY TX DOT METHOD TEX-113-E HOLD WATER CONTENTS TO WITHIN +/- 2% OF OPTIMUM W/6" MAX LIFTS

CONCRETE

C1. DESIGN STRENGTHS:
F'c = 4000 PSI
Fy = 60,000 PSI

C2. CONCRETE COVER
UNLESS OTHERWISE NOTED, PROVIDE CONCRETE COVER FOR REINFORCING AS FOLLOWS:
CONCRETE DEPOSITED AGAINST EARTH: 3"
ALL OTHER: 2"
SEE DRAWINGS FOR EXCEPTIONS

C3. SEE SPECIFICATION 03002 FOR REINFORCING PLACEMENT REQUIREMENTS.

C4. REFER TO OTHER DISCIPLINE DRAWINGS PRIOR TO CONSTRUCTION FOR EMBEDDED ITEMS AND PENETRATIONS NOT SHOWN ON STRUCTURAL DRAWINGS. AS REQUIRED TO ACCOMMODATE ALL WORK SHOWN OR SPECIFIED IN THE CONTRACT DOCUMENTS AND OTHERWISE REQUIRED FOR THE FURNISHING OF A FUNCTIONALLY COMPLETE PROJECT.

C5. PROVIDE 3/4" CHAMFERS AT ALL EXPOSED EDGES NOT ALL CHAMFERS MAY BE SHOWN ON DRAWINGS.

C6. FIELD ADJUST REINFORCING AT OPENINGS AND EMBEDDED ITEMS.

C7. ANCHOR BOLTS NOT SPECIFIED BY ENGINEER SHALL BE DESIGNED AND CERTIFIED BY A REGISTERED PROFESSIONAL ENGINEER, RETAINED BY THE CONTRACTOR, IN ACCORDANCE WITH APPLICABLE PROJECT AND CODE REQUIREMENTS. SUBMIT AS A SHOP DRAWING FOR REVIEW AND APPROVAL BY THE ENGINEER. COORDINATE LOCATION, SIZE AND EMBEDMENT PRIOR TO CASTING CONCRETE.

C8. CONTINUOUS WATERSTOP SHALL BE INSTALLED IN JOINTS SUBJECT TO STATIC WATER PRESSURE. (UNO)

C9. ABSOLUTELY NO WELDING OF REINFORCING BARS OR TORCHING TO BEND REINFORCING BARS SHALL BE ALLOWED WITHOUT SPECIFIC APPROVAL FROM THE STRUCTURAL ENGINEER.

C10. CONTRACTOR SHALL SUBMIT A CONCRETE PLACEMENT PLAN IDENTIFYING JOINT TYPES, JOINT LOCATIONS AND CONCRETE PLACEMENT SEQUENCE.

C11. ALL CAST IN PLACE AND POST-INSTALLED ANCHORS INDICATED IN THE STRUCTURAL DOCUMENTS SHALL COMPLY WITH APPENDIX D OF ACI 318 AND CHAPTER 19 OF THE IBC. ALL EXPANSION AND ADHESIVE ANCHORS SHALL HAVE THE ICC REPORT SHOWING EQUIVALENT LOAD CAPACITY. SUBMIT AND INSTALL PER THE ICC EVALUATION REPORT.

STEEL

S1. DESIGN STRENGTHS:
ALL PLATES AND SHAPES: Fy=36 KSI

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Luminant

HDR Engineering, Inc.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070

Texaas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION
	05/10	AS BUILT

PROJECT MANAGER	D. VOGT
ENGINEER	D. VOGT
CHECKED BY	J. PALUTIS
DESIGNED	D. MONTAGUE
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	91399

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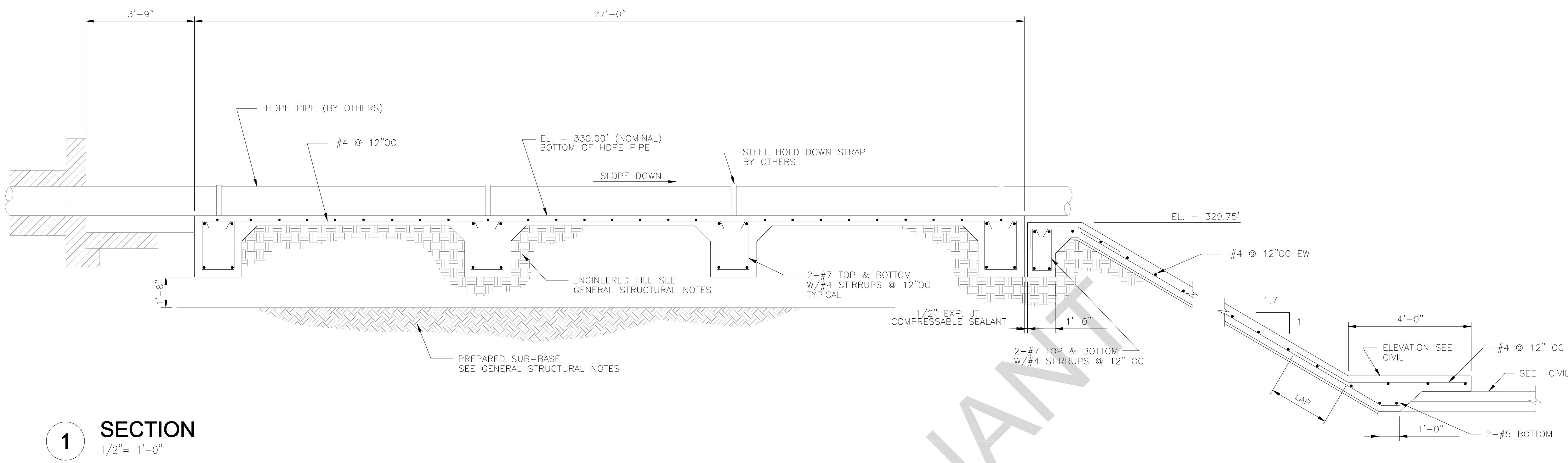
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

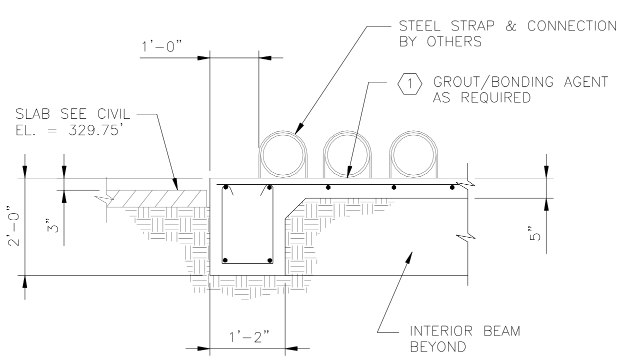
PIPE RACK PLAN & NOTES

FILENAME	C-10.dgn
SCALE	

SHEET C-10



1 **SECTION**
1/2"= 1'-0"



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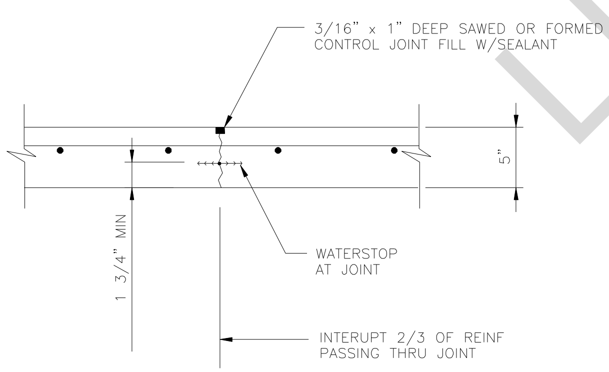
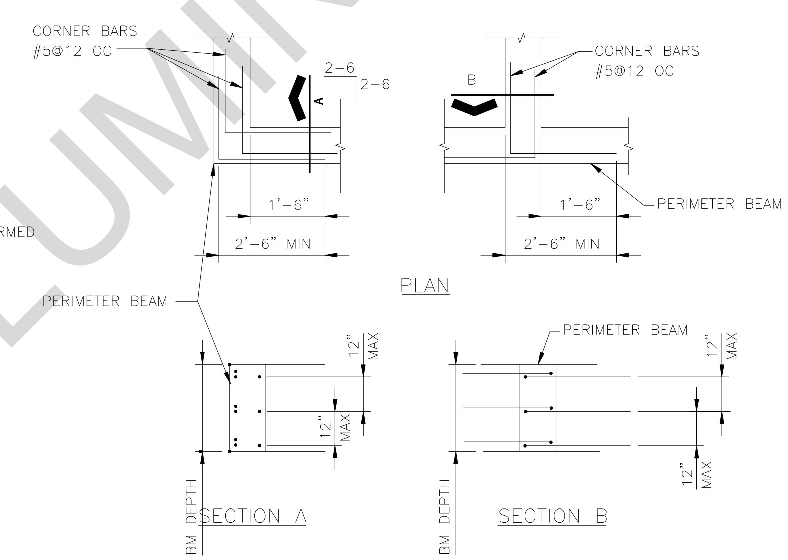
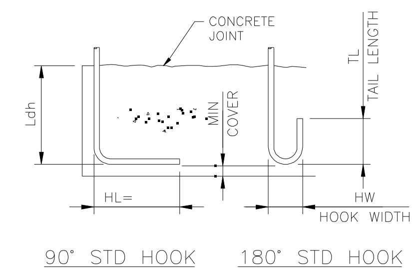


3 **CONTROL JOINT CLJ**
1 1/2"= 1'-0"



4 **PERIMETER BEAM REINFORCEMENT AT CORNERS & INTERSECTIONS**
NTS



BAR SIZE GRADE 60	f'c=4000 psi		
	HL	HW	TL
#3	6"	3"	3"
#4	8"	4"	4 1/2"
#5	10"	5"	5"
#6	1'-0"	6"	6"
#7	1'-2"	7"	7"
#8	1'-4"	8"	8"
#9	1'-7"	11 3/4"	10 1/2"
#10	1'-10"	1'-1 1/4"	11 1/2"
#11	2'-0"	1'-2 3/4"	1'-1"

5 **HOOKS**
NTS

LAP SPLICE AND EMBEDMENT LENGTHS
f'c =4.0 ksi   fy = 60 ksi

BAR	BARS SPACED GREATER THAN 4"	BARS SPACED LESS THAN OR EQUAL TO 4"
#3	14"	20"
#4	19"	32"
#5	29"	46"
#6	39"	62"
#7	55"	87"

NOTES:

1. PROVIDE MINIMUM LAP SPLICE LENGTHS AND EMBEDMENTS PER TABLE UNLESS NOTED OTHERWISE. EMBEDMENT LENGTH EQUALS THE LAP SPLICE LENGTH UNLESS OTHERWISE NOTED.
2. BAR SPACING AT LAP SPLICE IS THE MINIMUM CLEAR DISTANCE BETWEEN LAPPED BARS PLUS ONE BAR DIAMETER
3. ALL SPLICES TO BE CONTACT SPLICES AND WIRED TOGETHER UNLESS OTHERWISE APPROVED BY ENGINEER.

6 **REINFORCING LAP AND EMBEDMENT SCHEDULE**
NTS

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Luminant

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HDR Engineering, Inc.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070

Texaas P.E. Firm
Firm Registration No.F-754

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PROJECT MANAGER	D. VOGT
ENGINEER	D. VOGT
CHECKED BY	J. PALUTIS
DESIGNED	D. MONTAGUE
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	91399

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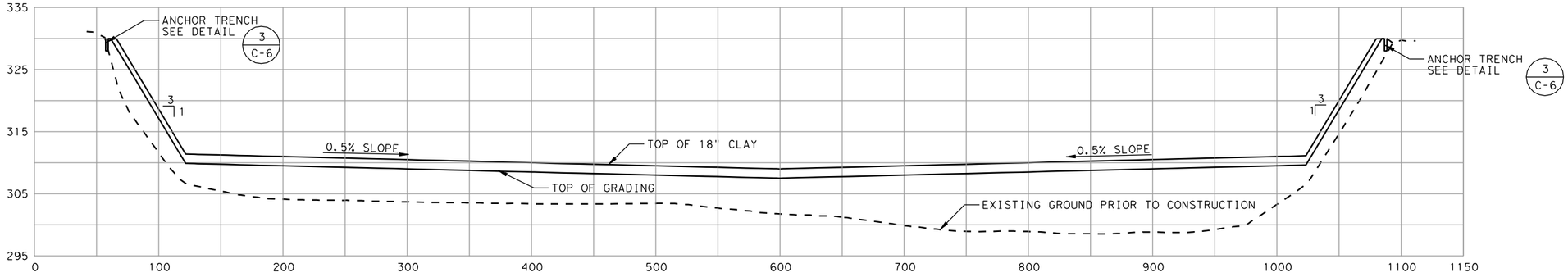
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

PIPE RACK SECTIONS & DETAILS

FILENAME C-11.dgn
SCALE
SHEET
C-11



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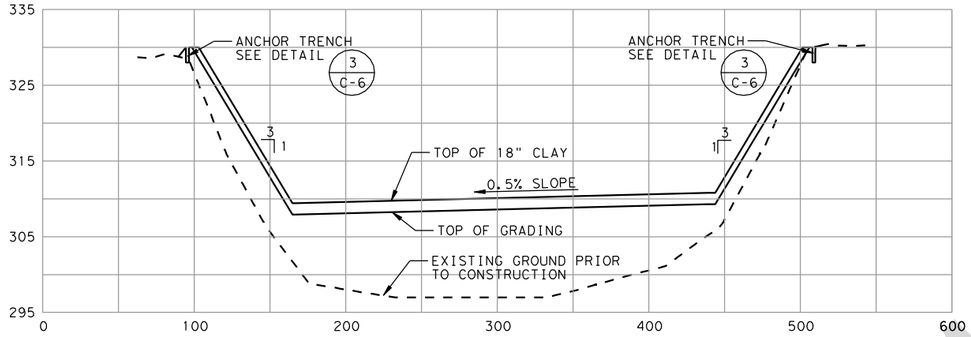

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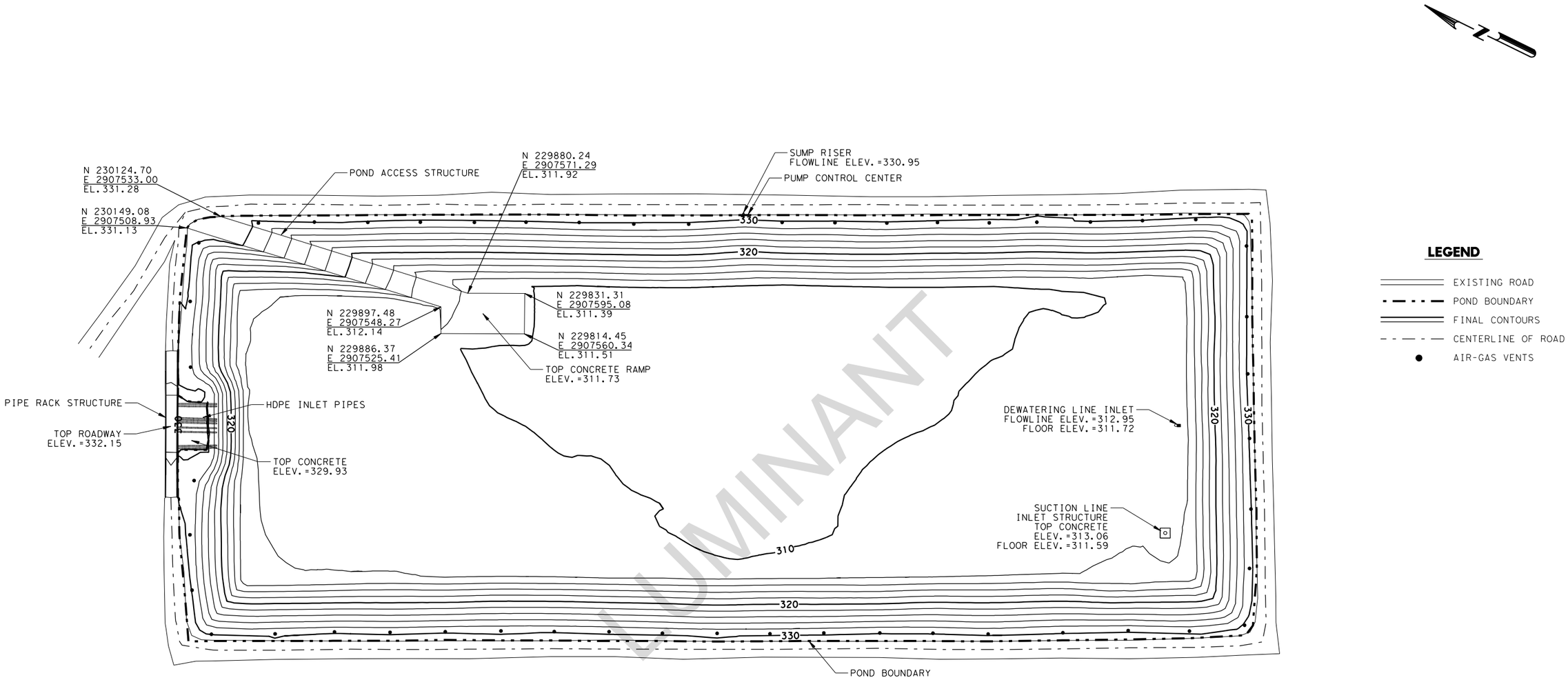
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

CROSS SECTIONS

FILENAME C-12.dgn
SCALE

SHEET C-12



LEGEND

- EXISTING ROAD
- POND BOUNDARY
- FINAL CONTOURS
- CENTERLINE OF ROAD
- AIR-GAS VENTS

NOTE: 1. AS BUILT CONTOURS PROVIDED BY COLLINS SURVEYING AND MAPPING, LONGVIEW, TEXAS.

2. CONTOURS SHOWN ARE TOP OF REVETMENT MATTRESS ELEVATIONS UNLESS OTHERWISE NOTED.

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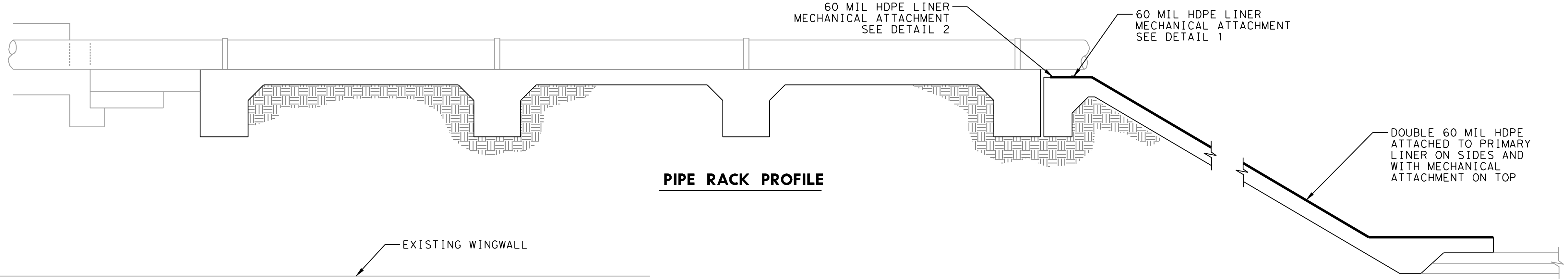
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

AS BUILT FINAL CONTOURS

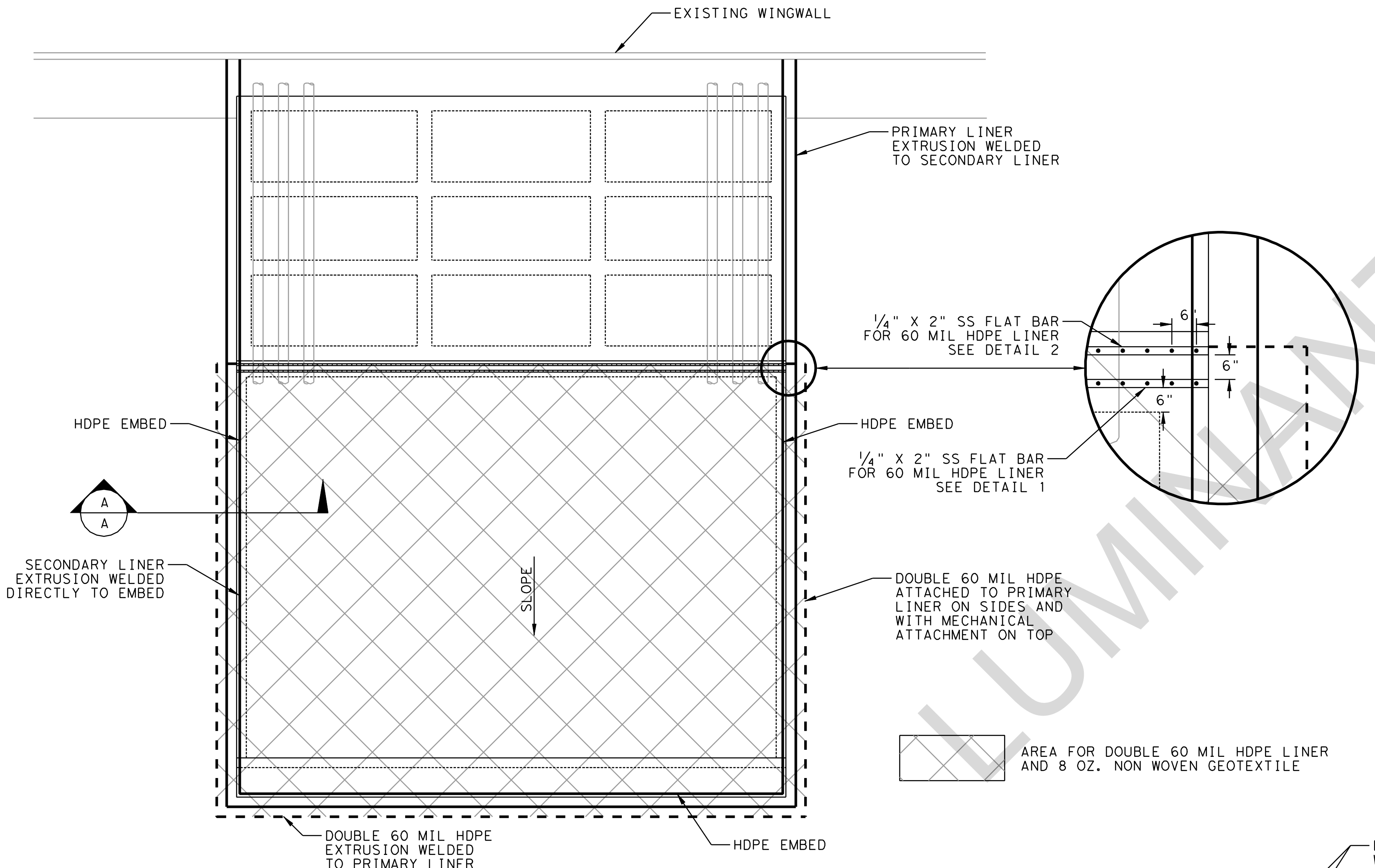
0 50' 100'

FILENAME C-13.dgn
SCALE

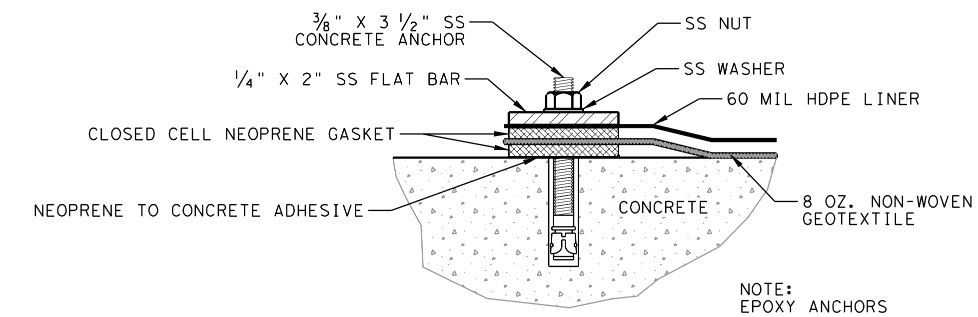
SHEET
C-13



PIPE RACK PROFILE

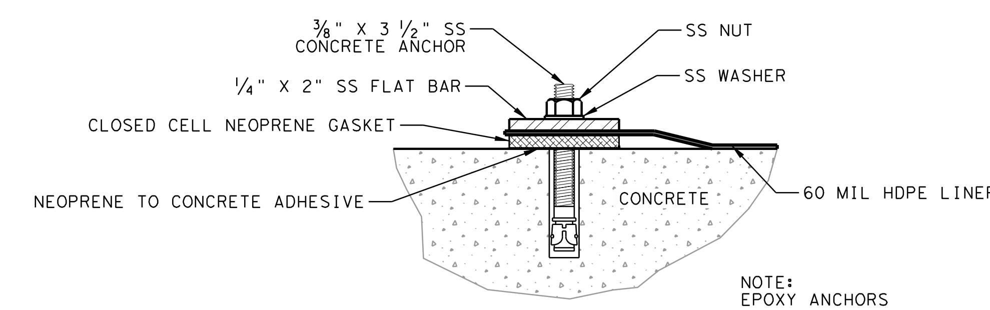


PIPE RACK PLAN



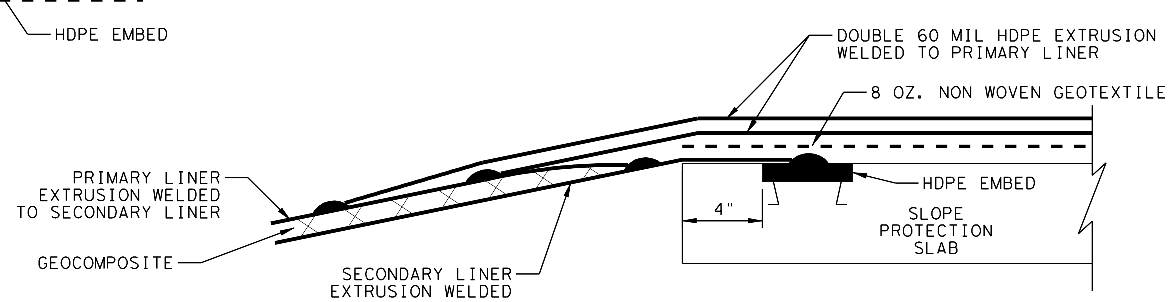
NOTE:
EPOXY ANCHORS
SPACED AT 6" O.C.

MECHANICAL ATTACHMENT TO CONCRETE (1)
60 MIL HDPE LINER W/8 OZ. GEOTEXTILE



NOTE:
EPOXY ANCHORS
SPACED AT 6" O.C.

MECHANICAL ATTACHMENT TO CONCRETE (2)
60 MIL HDPE LINER



SECTION A-A

NOTES:

1. DOUBLE 60 MIL HDPE LINER ADDED OVER PIPE RACK STRUCTURE ON SLOPE.
2. 8 OZ. NON WOVEN GEOTEXTILE ADDED OVER PIPE RACK STRUCTURE ON SLOPE.

DATE: 8/15/2010
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PLTDRVR: 11X17LASER_BW_PDF.plt
PENTABLE: 000000000009399.tbl

Luminant

HDR
HDR Engineering, Inc.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070
Texaas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION
	05/10	AS BUILT

PROJECT MANAGER	D. VOGT
ENGINEER	D. VOGT
CHECKED BY	
DESIGNED	
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	91399

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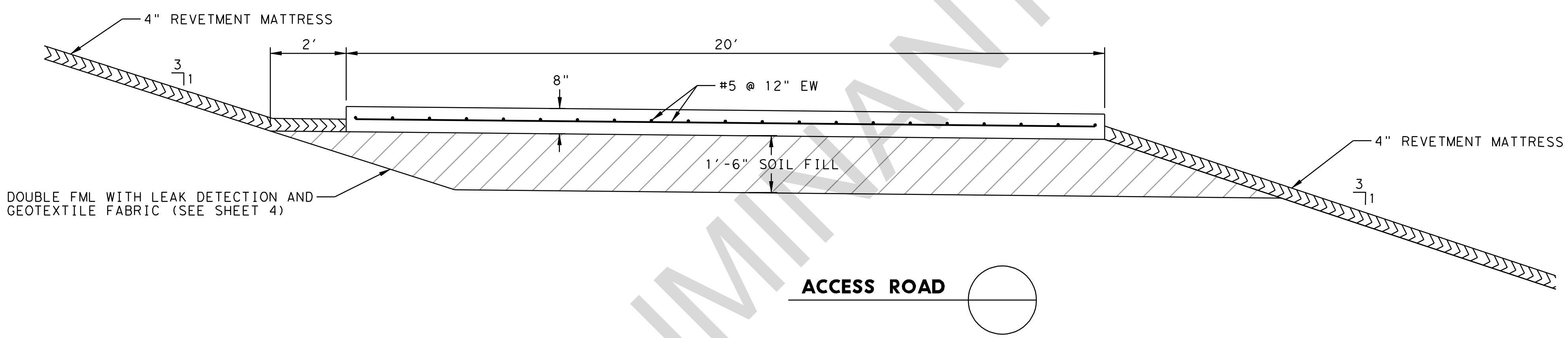
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

AS BUILT MISCELLANEOUS DETAILS

FILENAME	C-14.dgn
SCALE	NOT TO SCALE

SHEET
C-14



NOTE:

8" THICK ACCESS ROAD CONCRETE SECTION USED FOR THE CONCRETE LANDING IN THE POND.

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PENTABLE: 000000000009399.tbl

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ENGINEER	D. VOGT
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DESIGNED	
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	91399

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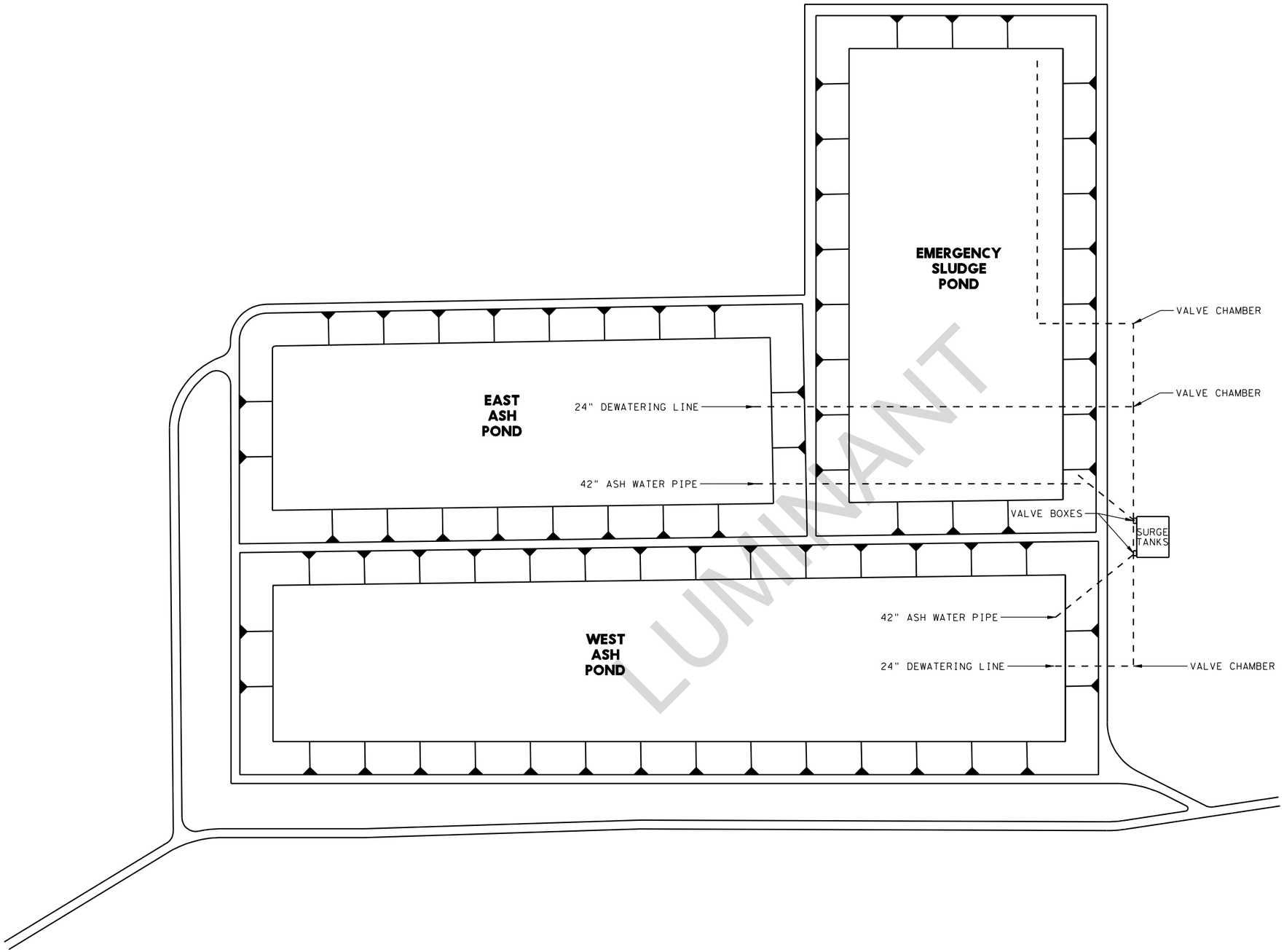
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

AS BUILT POND ACCESS TYPICAL SECTION

0 2' 4'

FILENAME	C-15.dgn
SCALE	AS SHOWN

SHEET C-15



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Luminant

HDR Engineering, Inc.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070

Texaas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION
	05/10	AS BUILT

PROJECT MANAGER	D.VOGT
ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	D.MONTAGUE
DRAWN BY	B.COX
QA/QC	M.ODEN
PROJECT NUMBER	91399

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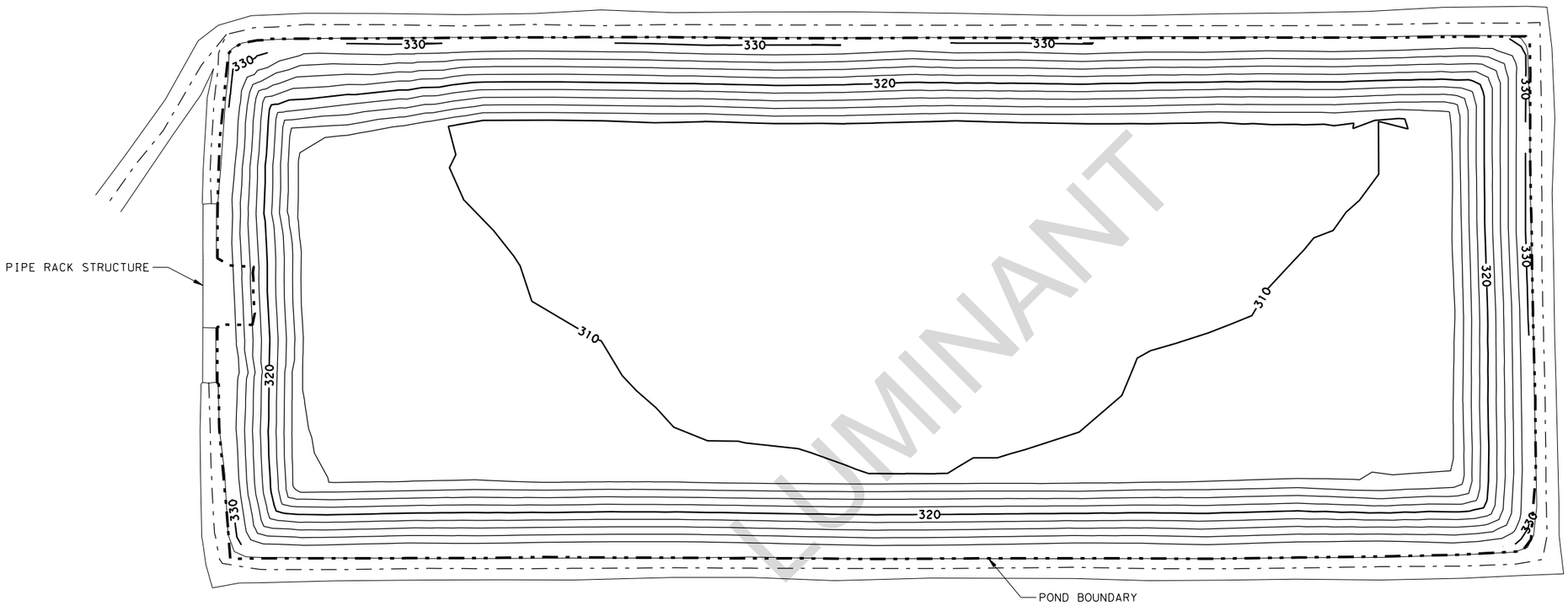
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

DEWATERING PIPE FIGURE

FILENAME	C-16.dgn
SCALE	

SHEET **C-16**



LEGEND

- EXISTING ROAD
- POND BOUNDARY
- FINAL CONTOURS
- CENTERLINE OF ROAD

NOTE: 1. AS BUILT CONTOURS PROVIDED BY COLLINS SURVEYING AND MAPPING, LONGVIEW, TEXAS.

2. CONTOURS SHOWN ARE TOP OF CLAY LINER ELEVATIONS UNLESS OTHERWISE NOTED.

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Luminant

HDR Engineering, Inc.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070

Texaas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION
	05/10	AS BUILT

PROJECT MANAGER	D.VOGT
ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	D.MONTAGUE
DRAWN BY	B.COX
QA/QC	M.ODEN
PROJECT NUMBER	91399

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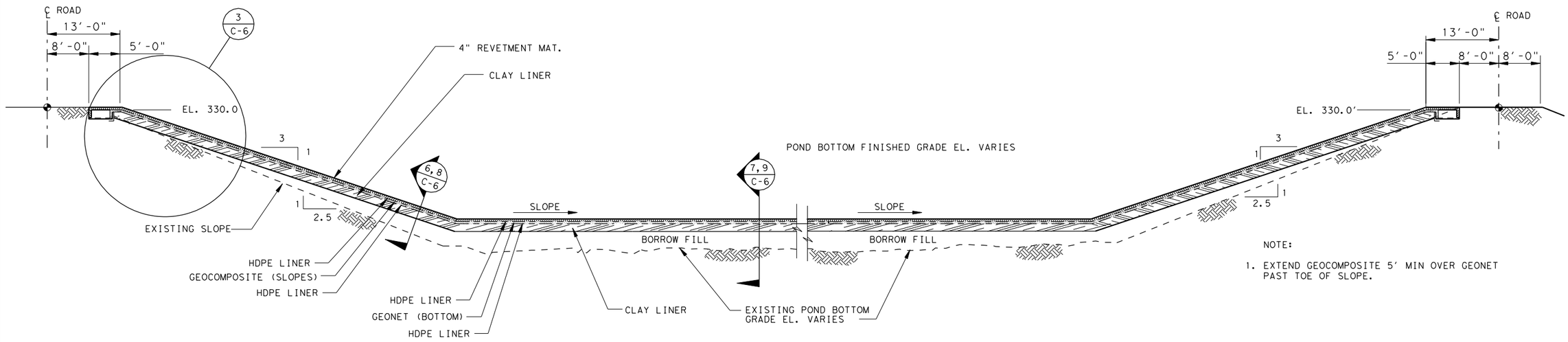
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

AS BUILT LINER CONTOURS

0 50' 100'

FILENAME	C-5.dgn
SCALE	

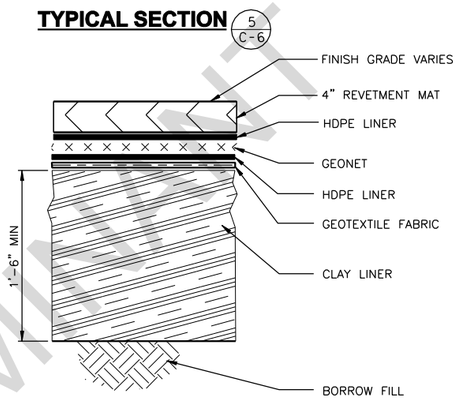
SHEET **C-5**

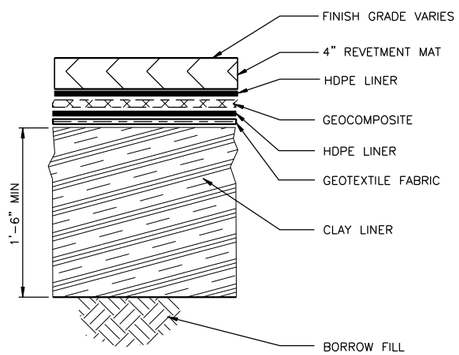


NOTE:

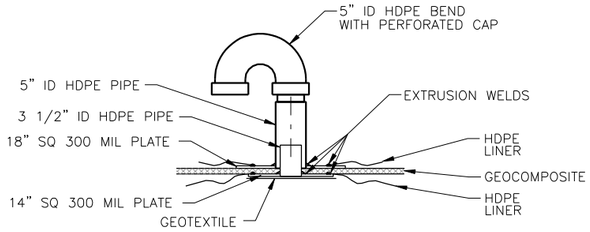
1. EXTEND GEOCOMPOSITE 5′ MIN OVER GEONET PAST TOE OF SLOPE.

TYPICAL SECTION (5 / C-6)

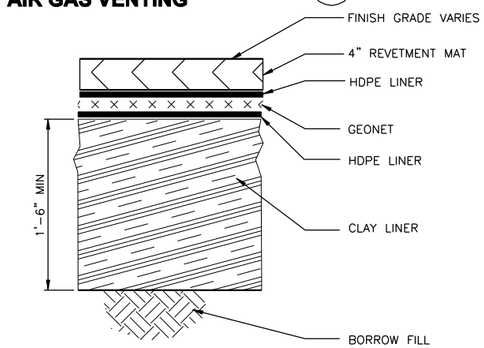




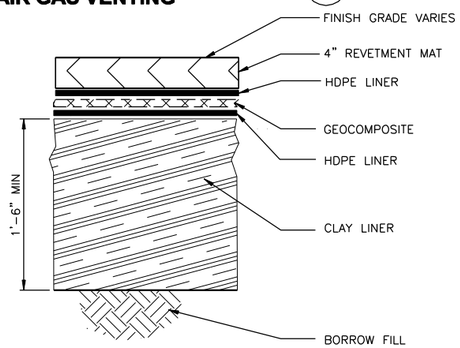
TYPICAL AIR-GAS VENT (4 / C-6)



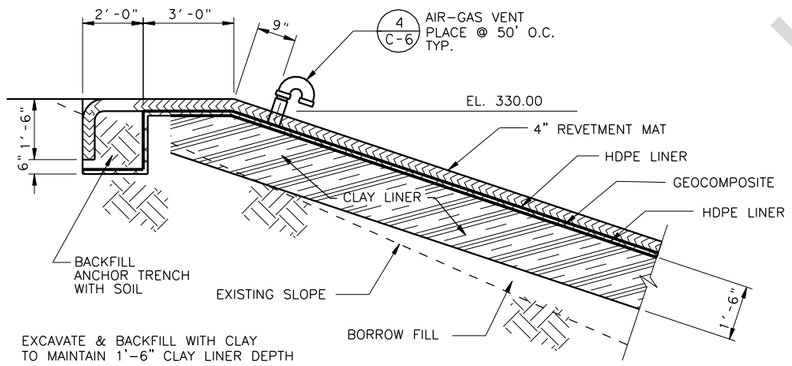
FLOOR LINER SECTION WITH AIR GAS VENTING (9 / C-6)



SLOPE LINER SECTION WITH AIR GAS VENTING (8 / C-6)



TYPICAL TOP OF SLOPE SECTION (3 / C-6)



FLOOR LINER SECTION (7 / C-6)

SLOPE LINER SECTION (6 / C-6)

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FILE: Luminant_Mining_Company_LLC\ML_SES_Reline_East_Ash_Pond\13.00_CAD\Sheet Files\AS BUILTS

Luminant

HDR
HDR Engineering, Inc.
4600 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070
Texaas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION
	05/10	AS BUILT

PROJECT MANAGER	D. VOGT
ENGINEER	D. VOGT
CHECKED BY	J. PALUTIS
DESIGNED	D. MONTAGUE
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	91399

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
RELINE EAST ASH POND

LINER SECTION AND DETAILS

FILENAME	C-6.dgn
SCALE	N.T.S

SHEET C-6

HDR Engineering, Inc.

LUMINANT

DALLAS, TEXAS

RELINE EAST ASH POND

BID DOCUMENTS

CLIENT PROJECT NUMBER: Q090219DLWEASTPOND

CONSTRUCTION SPECIFICATIONS

VOLUME 1 OF 1

2/02/09

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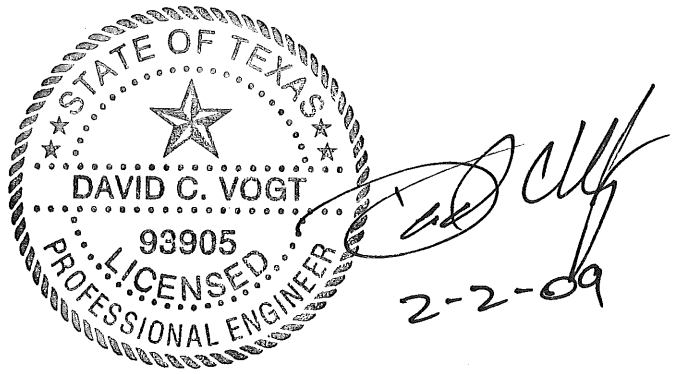
The following specifications were prepared under my direction:

Divisions 1, 2, 3, 11, 15 and the Soil Liner Quality Control Review Plan



David C. Vogt, P.E.
HDR ENGINEERING, INC.
Firm Registration No. 754

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Table of Contents

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DIVISION 1

GENERAL REQUIREMENTS

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SECTION 01024
UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

B. Unit Price is an amount proposed by bidders and stated on the Bid Form as a price per unit of measurement for materials or services added to or deducted from Contract Sum by appropriate modification, if estimated quantities of Work required by Contract Documents are increased or decreased.

C. If quantities originally contemplated are materially changed in a proposed change order so that application of such unit prices to quantities of Work proposed will cause substantial inequity to Owner or Contractor, the applicable unit prices shall be equitably adjusted.

D. Owner will confirm in field the Contractor's measurement of work-in-place that involves use of established unit prices.
   1. If disputes arise, Owner reserves the right to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

1.2 DESCRIPTION

A. Work includes:
   1. Overhead and profit are included in Unit Prices.
   2. Unit Prices are indicated on Bid Form.
   3. Unit Prices indicated on Bid Form will be made part of Contract.

1.3 UNIT PRICES

A. Unit Price No.4: Cost per cubic yard for earthwork in accordance with Section 02200.
   1. The fee will be paid on a cubic yard basis as independently determined by the difference between the pre-excavation survey of the EAP and the post excavation survey of the EAP. The volumetric differences between the two surveys will be converted to a cubic yard quantity for payment to the Contractor.

B. Unit Price No.5: Cost per cubic yard for compacted clay liner in accordance with Section 02276C and Soil Liner Quality Control Plan.
   1. The fee will be paid on a cubic yard basis as independently determined by the difference between the pre-liner survey of the site and the liner completion survey of the site. The volumetric differences between the two surveys will be converted to a cubic yard quantity for payment to the Contractor. However, payment will not be made for additional thickness constructed in order to maintain the minimum thickness requirement.

C. Unit Price No. 7: Cost per cubic yard for concrete pad in accordance with Section 03002.
   1. The fee will be paid on a cubic yard basis as independently determined by the square footage of the area formed multiplied by the specified thickness of the pad. The volume will be converted to cubic yard quantity for payment to the Contractor. However, payment will not be made for additional thickness constructed in order to maintain the minimum thickness requirement.

D. Unit Price No. 10: Cost per square foot for textured HDPE liner in accordance with Section 02775.
   1. The fee will be paid on a square foot basis as independently determined by a survey of the lined area. The survey will be converted to square footage for payment to the Contractor. However, payment will not be made for waste liner, liner used for testing, overlap, and material installed in anchor trenches.

E. Unit Price No. 11: Cost per square foot for geocomposite in accordance with Section 02777.
   1. The fee will be paid on a square foot basis as independently determined by a survey of the area covered with geocomposite. The survey will be converted to square footage for payment to the Contractor. However, payment will not be made for waste material, material used for testing, overlap, and material installed in anchor trenches.

F. Unit Price No. 12: Cost per square foot for geonet in accordance with Section 02777.
   1. The fee will be paid on a square foot basis as independently determined by a survey of the area covered with geonet. The survey will be converted to square footage for payment to the Contractor. However, payment will not be made for waste material, material used for testing, overlap, and material installed in anchor trenches.

G. Unit Price No. 14: Cost per square foot for fabric formed 4 IN concrete revetment mat in accordance with Section 02271.
   1. The fee will be paid on a square foot basis as independently determined by a survey of the area covered with revetment mat. The survey will be converted to square footage for payment to the Contractor. However, payment will not be made for waste material, material used for testing, overlap, and material installed in anchor trenches.

H. Unit Price No. 15: Cost per square yard for flex base in accordance with the plans.
   1. The fee will be paid on a square yard basis as independently determined by a survey of the area covered with flex base. The survey will be converted to square yardage for payment to the Contractor. However, payment will not be made for flex payment installed outside the area identified by the geotechnical professional.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01026

APPLICATIONS FOR PAYMENT AND SCHEDULE OF VALUES (GC)

PART 1 - GENERAL

1.1 SUBMITTALS

A. Project information:
   1. Submittals, prior to first application for payment:
      a. Schedule of Values.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 SCHEDULE OF VALUES

A. Prior to first Application for Payment, submit to Owner's Representative a Schedule of Values allocated to various portions of Work, prepared in such form and supported by such data to substantiate its accuracy as Owner and Owner's Representative may require.

B. At a minimum, subdivide into following allocated items:
   1. Mobilization/Demobilization.
   2. Site preparation.
   3. Demolition.
   4. Earthwork.
   5. Compacted clay liner.
   6. Construct pipe rack.
   7. Construct concrete slope protection at pipe rack.
   8. Construct inlet on 24 IN dewater pipe.
   9. Construct inlet on 48 IN dewater pipe.
   10. Install textured HDPE liner.
   11. Install geocomposite.
   12. Install geonet.
   13. Install leak detection sump.
   14. Install 4 IN concrete revetment mat.
   15. Install flex base on road.
   16. Vegetative cover.

C. The schedule, unless objected to by Owner or Owner's Representative, shall be used as a basis for reviewing percent complete of line items on Contractor's Applications for Payments.

3.2 APPLICATION FOR PAYMENT

A. On or before 5th day of month, Contractor submit to Owner's Representative itemized Application for Payment for work completed during previous calendar month, in accordance with schedule of values.

B. Application for Payment serves as certification of status by Contractor of Project.

3.3 RETAINAGE

A. Until Substantial Completion, 10 percent retainage will be withheld from value of Work completed.

END OF SECTION

SECTION 01060
SPECIAL CONDITIONS

PART 1 - GENERAL

1.1 DEFINITIONS

A. The following terms and definitions shall be used unless defined differently in other Specifications.
   1. Engineer – Consultant responsible for design of specific portions of Project.
   2. Soils Engineer – Engineer hired by Owner to provide design recommendations and Construction materials testing.
   3. Owner - Luminant Power.
   4. MLSES – Martin Lake Steam Electric Station.
   5. EAP – East Ash Pond.

1.2 SUMMARY

A. Section includes:
   1. Preconstruction Conference.
   2. Drawings and Contract Documents for Contractor Use.
   3. Testing.
   4. Order of Construction and Construction Schedule.
   5. Special Considerations.
   6. Historical and Archaeological.

1.3 SUBSTITUTIONS PRIOR TO BIDDING

A. Definitions:
   1. This Section includes administrative and procedural requirements for handling requests for substitutions made prior to bid.
   2. Any product proposed by Contractor which does not meet requirements of the Contract Documents, whether in product characteristics, performance, quality, or manufacturer or brand names, is considered a substitution.
   3. In case of non-availability of materials, contact Engineer for review and action.
   4. For bidding purposes: base all bids on materials, equipment and procedures specified or approved by Addenda.

B. Product Selection – General:
   1. Certain types of products are described in the specifications and the Drawings by means of trade names, catalog numbers and/or manufacturer's names.
      a. This is not intended to exclude from consideration other products which may be capable of accomplishing purpose indicated.
   2. Other types of products may be considered acceptable to Owner and Engineer in place of those specified.
   3. Listing of a manufacturer implies acceptance of them only as supplier of a product which complies with specified item.
   4. Voluntary alternates will be considered. Bidders will provide base bid on bid tabs and supply alternates for consideration on the alternative bid form.

C. Substitution Requests
   1. Only written requests with complete data for evaluation will be considered.
      a. Request must be received at least 5 calendar days prior to bid date.
      b. Requests received late will not be considered.
      c. Submit evaluation data with attached form to Engineer.

2. In making request for substitution, Supplier's representative:
    a. Has personally investigated proposed product, system or method, and has determined that it is equal or superior in all respects to that specified, and that it will perform intended function.
    b. Is in full compliance with applicable code.
    c. Will provide same warranty for substitute item as for product, system or method specified.
    d. Will coordinate installation of accepted substitution into Work and be responsible for such modifications as may be required for Work to be complete and functional in all respects.
    e. Certifies cost data presented is complete and includes all related costs, excluding Engineer's review and redesign cost.
    f. Waives all claims for additional costs or time extensions related to substitution which subsequently become apparent or are caused by substitution.
    g. Will pay additional costs to other trades, subcontractors or contracts caused by substitution.
    h. Will pay all Engineer's review and redesign cost, special inspections, and other costs caused by substitutions or revisions made necessary by the acts or omissions of Contractor due to: product submittal or product not being ordered in a timely manner, ease of construction progress or Work, or which are in interest of or are for convenience of supplier, subcontractor or Contractor.
    i. Acknowledge acceptance of these provisions.
3. Supplier will sign the substitution request in the space provided on the form acknowledging acceptance of terms.

D. Approval of Substitution Request:
1. No verbal or written approvals other than by Addenda will be valid.
    a. Addendum listing approved substitutions will be published prior to Bid date.

E. Rejection of Substitution Requests
1. Substitutions may not be considered if:
    a. Submitted after stipulated date or time period.
    b. Not submitted in accord with this Section.
    c. Acceptance will require substantial revision of Contract Documents
    d. Substitution request does not indicate specific item for which request is submitted.
    e. Substitution Request form is not properly executed and signed.
    f. Substitution request for manufacturer acceptance only.
    g. Insufficient information submitted.
    h. Substitution does not appear to comply with requirements of specifications for base item.

1.4 PRECONSTRUCTION CONFERENCE

A. A preconstruction conference shall be held at the MLSES Project Office after award of Contract.
1. Engineer will notify the Contractor as to the date and time of the conference two weeks in advance of the proposed date.
2. Contractor's Project Manager, and Project Superintendent and Subcontractor Representatives shall attend.

1.5 DRAWINGS AND CONTRACT DOCUMENTS FOR CONTRACTOR USE

A. Contractor shall be provided three (3) copies of the plans and specification at "no charge".
1. Contractor shall pick up all "no-charge" documents within 10 days from date of Notice to Proceed.

B. Additional documents after "no-charge" documents will be furnished to Contractor at cost.

1.6 TESTING

A. Payment for Soil and Other Testing:
   1. Soils testing:
      a. The Owner will pay for "Passing" soils tests on the Project.
      b. Costs of corrective action and costs of "Failing" soils are the sole responsibility of the Contractor.
   2. Other testing:
      a. Required testing, testing procedures, reports, certificates, and costs associated with all phases of securing required satisfactory test information which may be required by individual Sections of Specifications or Drawings are the full responsibility of the Contractor.

1.7 ORDER OF CONSTRUCTION AND CONSTRUCTION SCHEDULE

A. At no time shall Contractor or his employees modify operation of the existing facilities or start construction modifications without approval of the Owner except in an emergency to prevent or minimize damage.

B. Within 15 days after award of Contract, submit a critical path type schedule (Work Schedule) for approval.
   1. Account for schedule of Subcontracts.
   2. Include proper sequence of construction, various crafts, purchasing time, Shop Drawing approval, material delivery, equipment fabrication, startup, demonstration, and similar time consuming factors.
   3. Show on schedule at a minimum, earliest starting, earliest completion, latest starting, latest finish, and free and total float for each task or item.

C. Evaluate schedule no less than once every two weeks.
   1. Update, correct, and rerun schedule and submit to Engineer in triplicate with pay application to show rescheduling necessary to reflect true job conditions.
   2. When shortening of various time intervals is necessary to correct for behind schedule conditions, indicate actions to implement to accomplish work in shorter duration.
   3. Information shall be submitted before implementation to Engineer in writing with revised schedule.

D. If Contractor does not take necessary action to accomplish work according to schedule, Contractor may be ordered by Owner in writing to take necessary and timely action to improve work progress.
   1. Order may require increased work forces, extra equipment, extra shifts or other action as necessary.
   2. Should Contractor refuse or neglect to take such action authorized, under provisions of this Contract, Owner may take necessary actions including, but not necessarily limited to, withholding of payment and termination of Contract.

E. Upon receipt of approved "Work Schedule," within 10 days, submit to Engineer an estimated payment schedule by each month of project duration.
   1. Include a composite curve to show estimated value of work complete and stored materials less specified retainage.
   2. Establish key months when work will be 50, 80, 90, and 100 percent complete.
   3. During the course of work, update with new composite curves at key months or whenever variation is expected to be more than plus or minus 10 percent.

1.8 SPECIAL CONSIDERATIONS

A. Contractor, Contractor’s employees and Subcontractors must abide by Owner’s site rules and regulations at all times.
   1. Viewing of Owner’s safety training video may be required of all Contractor, Subcontractors and employees who will be working on site on this Project.

2. Contractor and his Sub-contractor's activities must not interfere with the everyday activities of the Owner's plant.
3. Owner's Site Representative must be contacted in advance when impending interference with Owner's plant activities is anticipated by Contractor or his Subcontractors.

B. Contractor shall be responsible for negotiations of any waivers or alternate arrangements required to enable transportation of materials to the site and at the contractor's expense.

C. Maintain conditions of access road to site such that access is not hindered as the result of construction related deterioration.

1.9 HISTORICAL AND ARCHAEOLOGICAL

A. If during the course of construction, evidence of deposits of historical or archeological interest are found, the Contractor shall cease operations affecting the find and shall notify Owner immediately.
1. No further disturbance of the deposits shall ensue until the Contractor has been notified by Owner that Contractor may proceed.
2. Owner will issue a notice to proceed after appropriate authorities have surveyed the find and made a determination to Owner.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SECTION)

END OF SECTION

SECTION 01340
SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mechanics and administration of the submittal process for:
      a. Shop Drawings.
      b. Samples.
      c. Miscellaneous submittals.
      d. Operation and maintenance manuals.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Sections in Divisions 2 through 16 identifying required submittals.

1.2 DEFINITIONS

A. Shop Drawings:
   1. See Specification 01060.
   2. Product data and samples are Shop Drawing information.

B. Miscellaneous Submittals:
   1. Submittals other than Shop Drawings.
   2. Representative types of miscellaneous submittal items include but are not limited to:
      a. Construction schedule.
      b. Concrete, soil compaction, and pressure test reports.
      c. Geosynthetic material manufacturer's documentation.
      d. Installed equipment and systems performance test reports.
      e. Manufacturer's installation certification letters.
      f. Warranties.
      g. Service agreements.
      h. Construction photographs.
      i. Survey data.
      j. Cost breakdown (Schedule of Values).
      k. Building components

1.3 TRANSMITTALS

A. Shop Drawings, Samples and Operation and Maintenance Manuals:
   1. Transmit all submittals to:

HDR Engineering, Inc.
4500 West Eldorado Parkway, Suite 3500
McKinney, TX 75070
ATTN: Mr. David C. Vogt, P.E.

   2. Utilize four copies of attached Exhibit "A" to transmit all Shop Drawings and samples.
   3. Utilize four copies of attached Exhibit "B" to transmit all Operation and Maintenance Manuals.
   4. All transmittals must be from Contractor and bear his approval stamp.
      a. Transmittals will not be received from or returned to subcontractors.

b. Shop Drawing transmittal stamp shall read "(Contractor's Name) has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of this submittal".
c. Operation and Maintenance Manual transmittal stamp may be Contractor's standard approval stamp.

5. Provide submittal information defining specific equipment or materials utilized on the project.
   a. Generalized product information not clearly defining specific equipment or materials to be provided will be rejected.
6. Calculations required in individual Specification Sections will be received for information purposes only and will be returned stamped "E. Engineer's Review Not Required" to acknowledge receipt.
7. Submittal schedule:
   a. Schedule of Shop Drawings:
      1) Submitted and approved within 14 days of receipt of Notice to Proceed.
      2) Account for multiple transmittals under any specification section where partial submittals will be transmitted.
   b. Shop drawings:
      1) Submittal and approval prior to 50 percent completion.
   c. Operation and Maintenance Manuals and Equipment Record Sheets:
      1) Initial submittal within 30 days after date shop drawings are approved.
8. A $300.00 review charge will be deducted from the contract amount, for the Engineer's review of the second and subsequent re-submittals of any Shop Drawing.

B. Miscellaneous Submittals:
1. Transmit under Contractor's standard letter of transmittal or letterhead.
2. Submit in quadruplicate or as specified in individual specification section.
3. Transmit to:

HDR Engineering, Inc.
4500 West Eldorado Parkway, Suite 3500
McKinney, TX 75070
ATTN: Mr. David C. Vogt, P.E.

4. For concrete, soils compaction and pressure test reports, send a copy of the letter of transmittal to Owner's Representative.
   a. Transmit one copy to location and individual indicated above for other miscellaneous submittals.

1.4 PREPARATION OF SUBMITTALS

A. Shop Drawings:
1. Scope of any letter of transmittal:
   a. Limited to one Specification Section.
   b. Do not submit under any Specification Section entitled (in part) "Basic Requirements".
2. Numbering letter of transmittal:
   a. Include as prefix the specification section number followed by "-xx" beginning with "01".
   b. If more than one submittal under any specification section, number transmittals consecutively.
3. Describing transmittal contents:
   a. Provide listing of each component or item in submittal capable of receiving an independent review action.
   b. Identify for each item:
      1) Manufacturer and Manufacturer's Drawing or data number.
      2) Contract Document tag number(s).

4. Resubmittals:
    a. Number with original root number and a suffix letter starting with "A" on a (new) duplicate transmittal form.
    b. Do not increase the scope of any prior transmittal.
    c. Account for all components of prior transmittal.
        1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate.
            a) Do not include submittal information for items with prior "A" or "B" Action in transmittal.
        2) Indicate "Outstanding-To Be Resubmitted At a Later Date" for any prior "C" or "D" Action item not included in resubmittal.
            a) Obtain Engineer's prior approval to exclude items.
5. For 8-1/2 x 11 IN, 8-1/2 x 14 IN, and 11 x 17 IN size sheets, provide four (4) copies of each page for Engineer plus the number required by the Contractor.
    a. The number of copies required by the Contractor will be defined at the Preconstruction Conference, but shall not exceed five (5).
6. For items not covered in paragraph 1.4-A.5 submit one reproducible original and one print of each drawing until approval is obtained.
    a. Utilize mailing tube; do not fold.
    b. The Engineer will mark and return the reproducible to the Contractor for his reproduction and distribution.
7. Provide clear space (3 IN x 3 IN) for Engineer stamping of each component submitted or resubmitted.
8. Contractor shall not use red color for marks on transmittals.
    a. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible.
    b. Outline Contractor marks on reproducible original with a rectangular box.
9. Transmittal contents:
    a. Coordinate and identify Shop Drawing contents so that all items can be easily verified by the Engineer.
    b. Identify equipment or material use, tag number, Drawing detail reference, weight, and other project specific information.
    c. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.
    d. Submit items like equipment brochures, cuts of fixtures, product data sheets or catalog sheets on 8-1/2 x 11 IN pages.
        1) Indicate exact item or model and all options proposed.
    e. Include legible scale details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout Drawings, parts catalogs, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data.
        1) Arrange data and performance information in format similar to that provided in Contract Documents.
        2) Provide, at minimum, the detail provided in the Contract Documents.
    f. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet.

B. Samples:
1. Identification:
    a. Identify sample as to transmittal number, manufacturer, item, use, type, project designation, tag number, Standard Specification Section or Drawing detail reference, color, range, texture, finish and other pertinent data.

b. If identifying information cannot be marked directly on sample without defacing or adversely altering samples, provide a durable tag with identifying information securely attached to the sample.

2. Include application specific brochures, and installation instructions.
3. Provide Contractor's stamp of approval on samples or transmittal form as indication of Contractor's checking and verification of dimensions and coordination with interrelated work.
4. Resubmit samples of rejected items.

C. Operation and Maintenance Manuals:
1. Number transmittals for Operation and Maintenance Manual with original root number of the approved shop drawing for the item.
2. Submit two copies until approval is received.
3. Identify resubmittals with the original number plus a suffix letter starting with "A."
4. Submit Operation and Maintenance Manuals printed on 8-1/2 x 11 IN size heavy first quality paper with standard three-hole punching and bound in stiff metal hinged binder constructed as a three-ring style.
   a. Provide binders with titles on front and on spine of binder.
   b. Tab each section of manuals for easy reference with plastic-coated dividers.
   c. Provide index for each manual.
   d. Provide plastic sheet lifters prior to first page and following last page.
5. Reduce drawings or diagrams bound in manuals to an 8-1/2 x 11 IN or 11 x 17 IN size.
   a. However, where reduction is not practical to ensure readability, fold larger Drawings separately and place in vinyl envelopes which are bound into the binder.
   b. Identify vinyl envelopes with drawing numbers.
6. Transmittal Content:
   a. Submission of Operation and Maintenance Manuals is applicable but not necessarily limited to:
      1) Major equipment.
      2) Equipment used with electrical motor loads of 1/6 HP nameplate or greater.
      3) Specialized equipment including valves and instrumentation and control system components for HVAC and process systems such as meters, recorders, and transmitters.
      4) Water control gates.
   b. Operation and Maintenance Manuals shall include, but not necessarily be limited to, the following detailed information, as applicable:
      1) Equipment function, normal operating characteristics, limiting operations.
      2) Assembly, disassembly, installation, alignment, adjustment, and checking instructions.
      3) Operating instructions for start-up, routine and normal operation, regulation and control, shutdown, and emergency conditions.
      4) Lubrication and maintenance instructions.
      5) Guide to "troubleshooting."
      6) Parts list and predicted life of parts subject to wear.
      7) Outline, cross-section, and assembly Drawings; engineering data; and electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams.
      8) Test data and performance curves.
      9) A list of recommended spare parts with a price list and a list of spare parts provided under these Specifications.
      10) Copies of installation instructions, parts lists or other documents packed with equipment when delivered.
      11) Instrumentation or tag numbers relating the equipment back to the Contract Documents.

12) Include a filled-out copy of the Equipment Record Sheet, Exhibits C1 and C2 as the first page(s) of each Operation and Maintenance Manual.
    a) Complete maintenance requirements in detail.
    b) Simple reference to the Manual is not acceptable.
13) For equipment items involving components or subunits, an Equipment Record Sheet for each operating component or subunit is required.

1.5 ENGINEERS REVIEW ACTION:

A. Shop Drawings and samples:
1. Items within transmittals will be reviewed for overall design intent and will receive one of the following actions:
    a. A- FURNISH AS SUBMITTED.
    b. B- FURNISH AS NOTED (BY ENGINEER).
    c. C- REVISE AND RESUBMIT.
    d. D- REJECTED.
    e. E- ENGINEER'S REVIEW NOT REQUIRED.
2. Transmittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp.
    a. Drawings not stamped by the Contractor or stamped with a stamp containing language other than that specified in Paragraph 1.3.A.4b., will not be reviewed for technical content and will be returned without any action.
3. Transmittals returned with Action "A" or "B" is considered ready for fabrication and installation.
    a. If for any reason a transmittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal.
    b. Destroy, or conspicuously mark "SUPERSEDED", all documents having previously received "A" or "B" Action that are superseded by a resubmittal.
4. Transmittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:
    a. The portion of the transmittals given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference).
        1) One copy of the "C" or "D" Drawings will be marked up and returned to the Contractor.
        2) Correct and resubmit items so marked.
    b. Items marked "A" or "B" will be fully distributed.
    c. If a portion of the items or system proposed are acceptable, however, the major part of the individual Drawings or documents are incomplete or require revision, the entire submittal may be given "C" or "D" Action.
        1) This is at the sole discretion of the Engineer.
        2) In this case, some drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package."
        3) Distribution to the Owner and field will not be made (unless previously agreed to otherwise).
5. Failure to include any specific information specified under the submittal paragraphs of the Specifications will result in the transmittal being returned to the Contractor with "C" or "D" Action.
6. Transmittals such as submittals which the Engineer considers as "Not Required," submittals information which is supplemental to but not essential to prior submitted information , or items of information in a transmittal which have been reviewed and received "A" or "B" Action in a prior transmittal, will be returned with Action "E", (Engineer's Review Not Required).

B. Operation and Maintenance Manuals:
1. Engineer will review and indicate one of the following review actions:
    a. ACCEPTABLE.

b. FURNISH AS NOTED.
c. REVISE AND RESUBMIT.
d. REJECTED.

2. Acceptable submittals will be retained with the transmittal form returned with a request for five additional copies.
3. Deficient submittals will be returned along with the transmittal form which will be marked to indicate deficient areas.

END OF SECTION

EXHIBIT A

Shop Drawing Transmittal No. _____-_____

(Spec Section) (Series)

Project Name:		Date Received:	
Project Owner:		Checked By:	
Contractor:	HDR Engineering, Inc.	Log Page:	
Address:	Address:	HDR No.:	
		Spec Section:	
		Drawing/Detail No.:	
Attn:	Attn:	1st. Sub	ReSub.
Date Transmitted:	Previous Transmittal Date:		

Item No.	No. Copies	Description	Manufacturer	Mfr/Vendor Dwg or Data No.	Action Taken*

Remarks:

* The Action designated above is in accordance with the following legend:

A - Furnish as Submitted

B - Furnish as Noted

C - Revise and Submit
1. Not enough information for review.
2. No reproducibles submitted.
3. Copies illegible.
4. Not enough copies submitted.
5. Wrong sequence number.
6. Wrong resubmittal number.
7. Wrong spec. section.
8. Wrong form used.
9. See comments.

D - Rejected

E - Engineer's review not required
1. Submittal not required.
2. Supplemental Information. Submittal retained for informational purposes only.
3. Information reviewed and approved on prior submittal.
4. See comments.

Comments:

By Date

Distribution: Contractor ☐ File ☐ Field ☐ Owner ☐ Other ☐

EXHIBIT B

O&M Manual Transmittal No. _____-_____

(Spec Section) (Series)

Project Name:		Date Received:
Project Owner:		Checked By:
Contractor:	Owner:	Log Page:
Address:	Address:	HDR No.:
Attn:	Attn:	1st. Sub. ReSub.
Date Transmitted:	Previous Transmittal Date:	

No. Copies	Description of Item	Manufacturer	Dwg. or Data No.	Action Taken*

Remarks:

To:

From:
HDR Engineering, Inc.

Date:

* The Action designated above is in accordance with the following legend:

A - Acceptable, provide one (1) additional paper copy and two (2) electronic copies on CD-ROM for final review.

B - ~~Furnish as Noted~~ - Not Used

C - Revise and Resubmit
This Operation and Maintenance Manual Submittal is deficient in the following area:

1. Equipment Records.
2. Functional description.
3. Assembly, disassembly, installation, alignment, adjustment & checkout instructions.
4. Operating instructions.
5. Lubrication & maintenance instructions.
6. Troubleshooting guide.
7. Parts list and ordering instructions.
8. Organization (binder, binder titles, index & tabbing).
9. Wiring diagrams & schematics specific to installation.
10. Outline, cross section & assembly diagrams.
11. Test data & performance curves.
12. Tag or equipment identification numbers.
13. Inclusion of all components & subcomponents.
14. Other - see comments.

D - ~~Rejected~~ - Not Used

Comments:

By Date

Distribution: Contractor ☐ File ☐ Field ☐ Owner ☐ Other ☐

EXHIBIT C1

Equipment Record

Equipment Data and Spare Parts Summary

Project Name			Specification Section:
Equipment Name			Year Installed:
Project Equipment Tag No(s).			
Equipment Manufacturer			Project/ Order No.
Address			Phone
Fax	Web Site	E-mail	
Local Vendor/Service Center			
Address			Phone
Fax	Web Site	E-mail	

MECHANICAL NAMEPLATE DATA

Equip.		Serial No.		
Make		Model No.		
ID No.	Frame No.	HP	RPM	Cap.
Size	TDH	Imp. Sz.	CFM	PSI
Other:				

ELECTRICAL NAMEPLATE DATA

Equip.				Serial No.				
Make				Model No.				
ID No.	Frame No.	HP	V.	Amp.	HZ	PH	RPM	SF
Duty	Code	Ins. Cl.	Type	NEMA	C Amb.	Temp. Rise	Rating	
Other:								

SPARE PARTS PROVIDED PER CONTRACT

Part No.	Part Name	Quantity

RECOMMENDED SPARE PARTS

Part No.	Part Name	Quantity

EXHIBIT C2

Equipment Record

Recommended Maintenance Summary

Equipment Description	Project Equip. Tag No(s).

RECOMMENDED BREAK-IN MAINTENANCE (FIRST OIL CHANGES, ETC.)	INITIAL COMPLETION * FOLLOWING START-UP						
	D	W	M	Q	S	A	Hours

RECOMMENDED PREVENTIVE MAINTENANCE	PM TASK INTERVAL *						
	D	W	M	Q	S	A	Hours

* D = Daily W = Weekly M = Monthly Q = Quarterly S = Semiannual A = Annual Hours = Run Time Interval

EXHIBIT C3

Equipment Record

Lubrication Summary

Equipment Description	Project Equip. Tag No(s).

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

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SECTION 01500

CONSTRUCTION FACILITIES, TEMPORARY CONTROLS AND UTILITIES

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to following:
   1. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
   2. International Building Code – Chapter 33 – Safeguards During Construction.
   3. Building code requirements.
   4. Health and safety regulations.
   5. Utility company regulations.
   6. Police, fire department, and rescue squad rules.
   7. Environmental protection regulations.
   8. Local agencies' requirements and regulations.

B. Required exits, existing structural elements, fire protection devices and sanitary safeguards shall be maintained at all times during remodeling, alterations, repairs or additions to any building or structure.
   1. When such required elements or devices are being remodeled, altered or repaired, adequate substitute provisions shall be made or performed when existing building is not occupied.

C. Arrange for authorities having jurisdiction to inspect and test each temporary utility before use.
   1. Obtain required certifications and permits for temporary utilities and include in base bid all fees, labor and materials for necessary services.

D. Use qualified personnel for installation of temporary facilities.
   1. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of Work.
   2. Relocate and modify facilities as required.

1.2 TEMPORARY UTILITIES - GENERAL

A. All fees, labor and materials, including temporary equipment and connection thereof, required to provide temporary utility services necessary for maintaining existing services and for execution of Work and tests required in various sections of Specifications, shall be provided by Contractor at Contractor's expense, except where otherwise specified.

B. Maintain and keep temporary services and facilities clean and neat in appearance, including those furnished or provided by Owner for Contractor's use.
   1. Operate in a safe and efficient manner.
   2. Coordinate with Owner to relocate temporary services and facilities as Work progresses.
   3. Do not overload facilities or permit them to interfere with progress.
   4. Take necessary fire-prevention measures.
   5. Do not allow hazardous, dangerous, unsanitary conditions or public nuisances to develop or persist on-site.

C. Remove all temporary equipment and connections, and leave premises and existing permanent apparatus in an equivalent condition as existed prior to making temporary connections.
   1. Service utility connections shall be discontinued and capped in accordance with the approved rules and the requirements of the authority having jurisdiction.

1.3 TEMPORARY WATER

A. Make all arrangements to provide equipment, piping, and outlets for an adequate supply of clean water for construction purposes.
   1. Existing water distribution system may be used for temporary service.
   2. Provide temporary meters and pay costs of installation and use.
   3. Provide pressure backflow preventer at each connection.

B. Contractor pays for all potable water used.
   1. Contractor shall provide Owner with monthly totals of potable water used for construction purposes.

C. Furnish drinking water and paper cups for all those connected with the Work.

1.4 TEMPORARY SANITARY FACILITIES

A. Provide temporary sanitary facilities for use by construction workers during construction, remodeling or demolition activities.

B. Do not use existing toilet facilities in occupied areas or new toilet facilities in construction area without Owner's written consent.

C. Provide facilities complying with local, State and Federal sanitary laws and regulations.

D. Keep temporary sanitary facilities maintained, clean and in sanitary condition.

E. Provide adequate supplies of toilet paper, cleaning supplies and other required items.

1.5 PROTECTION OF ADJOINING PROPERTY

A. Adjoining public and private property shall be protected from damage during construction, remodeling and demolition work.
   1. Protection must be provided for footings, foundations, party walls, chimneys, skylights and roofs.
   2. Provisions shall be made to control water runoff and erosion during construction or demolition activities.
   3. Provide written notice to owners of adjoining buildings advising them that excavation is to be made and that adjoining buildings should be protected.
      a. Said notification shall be delivered not less than 10 days prior to the scheduled start date of excavation.

1.6 TEMPORARY STORAGE AND STAGING AREAS

A. Construction equipment and materials shall be stored and placed so as not to endanger the public, construction workers or adjoining property for duration of Project.

B. Temporary use of streets or public property for storage, handling of materials or of equipment required for construction or demolition, and the protection provided to the public shall comply with the provisions of the authority having jurisdiction.

C. Construction materials and equipment shall not be placed or stored so as to obstruct access to fire hydrants, standpipes, fire or police alarm boxes, catch basins or manholes, nor shall such material or equipment be located within 20 FT of a street intersection, or placed so as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.

D. Building materials, fences, sheds or any obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, fire department connection, utility pole, manhole, fire alarm box or catch basin, or so as to interfere with the passage of water in gutter.
   1. Protection against damage shall be provided to such utility fixtures during the progress of Work, but sight of them shall not be obstructed.

E. Prior to start of Work, meet with installers to arrange and prepare plot plan defining staging, storage, field office and traffic areas.
   1. Obtain Owner's approval of plan.
   2. Except as specifically provided, working and storing outside these areas will not be permitted.
   3. Arrange and locate temporary structures and storage to avoid interfering with construction.

F. Within area designated for Contractor and Subcontractor's use, Contractor and Subcontractors provide suitable and sufficient enclosed and covered spaces, with raised flooring, to protect materials and equipment from damage by weather or construction work.
   1. Maintain storage and working areas in clean and orderly condition.

1.7 TEMPORARY PROTECTION

A. Protect Work in progress and adjoining materials in place during handling and installation.

B. Supervise construction operation to assure that Work, completed or in progress, is not subject to harmful, dangerous, damaging or otherwise harmful exposure throughout construction period.
   1. Prevent accumulation of water on site:
      a. Remove standing water.
      b. Pump or direct away from site and adjoining property.
   2. Prevent accumulation of water on slabs, adjacent to the building or foundations, or in utility trenches.
   3. Prevent damage to structural members.

C. Apply protective covering to assure protection of Work from damage or deterioration.
   1. Remove coverings at Substantial Completion.

D. Adjust, lubricate and maintain operable components to assure operability without damaging effects throughout construction period.

1.8 TEMPORARY ACCESS ROADS

A. Provide access on site as required to perform Work.

B. Construction site access roads shall be maintained free of obstruction at all times.

C. Clean up all debris, materials, etc., that falls from vehicles in route to and from site.

D. Do not block access to Owner's facilities.

E. When this access is no longer required, restore to its original condition.

1.9 TRAFFIC CONTROL

A. Provide any traffic control deemed necessary to effectively streamline Owner operations.

B. Provide and maintain adequate traffic control and flagmen's services at all points where transporting of equipment and materials engaged on Work enters and exits from Project site and on site.

1.10 SITE ACCESS AND PARKING

A. Contractor shall use the primary entrance to the facility and park at the area designated as the "Staging Area". Staging Area location will be identified to bidders at the pre-bid meeting.

1.11 COMPLETION OF WORK

A. Upon completion of Work or as progress of work dictates or sooner if directed by Owner or Owner's Representative, remove all temporary facilities, and return all improvements on or about site and adjacent property which are not shown to be altered, removed or otherwise changed, to the condition which existed previous to starting work.

END OF SECTION

SECTION 01505
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Addresses:
   1. Management of municipal solid waste, industrial waste and construction waste.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 WASTE MANAGEMENT:

A. Provide handling, containers, storage, signage, transportation, and other items as required to manage municipal solid waste, industrial waste and construction waste during the entire duration of the Contract. Comply with the following procedures:
   1. Waste bin areas are to be maintained in an orderly manner and clearly marked to avoid contamination of materials.
      a. Inspect containers and bins weekly for contamination and remove contaminated materials if found.
   2. Stockpile processed materials on site without intermixing with other materials.
      a. Place, grade, and shape stockpiles to drain surface water.
      b. Cover to prevent windblown dust.
   3. Store materials away from construction area. Do not store within drip line of remaining trees.
   4. Store components off the ground and protect from weather.
   5. Remove construction waste including, but not limited to, municipal solid waste, hazardous waste and non-hazardous waste generated during construction activities off Owner's property and transport to appropriate receiver or processor.

B. Store Hazardous Wastes in secure areas and comply with the following:
   1. Hazardous wastes shall be separated, stored and disposed of in accordance with local, state and federal regulations with additional criteria listed below:
      a. Building products manufactured with PVC or containing chlorinated compounds shall not be incinerated.
      b. Disposal of fluorescent tubes in open containers is not permitted.

C. Unused fertilizers shall not be co-mingled with construction waste.

D. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate, for the Work occurring at Project site.

E. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied facilities.
   1. Comply with environmental controls specified in Division 01 Section 01500 Temporary Facilities, Construction Controls and Facilities.

3.2 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a manner acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Disposal: Transport waste materials off Owner's property and legally dispose of them. Disposal on Owner's property is prohibited.

END OF SECTION

SECTION 01560
ENVIRONMENTAL PROTECTION AND SPECIAL CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Addresses:
   1. Minimizing the pollution of air, water, or land; control of noise; the disposal of solid waste materials; and protection of deposits of historical or archaeological interest.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

1.2 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340.

B. Prior to the start of any construction activities, submit:
   1. A detailed proposal of all methods of control and preventive measures to be utilized for environmental protection.
   2. An estimate of the amount of water that may be needed for construction activities.
   3. A Drawing of the work area, haul routes, storage areas, access routes and current land conditions including trees and vegetation.
   4. A copy of the NPDES/TPDES permit for storm water discharges (NOI) from construction activities.
      a. Contractor will submit to Luminant's Environmental Services for approval prior to acquiring permits.
   5. A copy of the contractor's approved stormwater pollution prevention plan (SWPPP).
      a. Contractor is responsible for preparation and implementation of the requirements of SWPPP.
      b. Contractor shall submit SWPPP to Luminant's Environmental Services for approval.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Employ and utilize environmental protection methods, obtain all necessary permits, and fully observe all local, state, and federal regulations including, but not limited to the NPDES/TPDES General Permit for Storm Water Discharge and Pollution Prevention Plan, if needed.

B. Land Protection:
   1. Except for any work or storage area and access routes specifically assigned for use by the Contractor, the land areas outside the limits of construction shall be preserved in their present condition.
      a. Contractor shall confine his construction activities to areas defined for work within the Contract Documents.
   2. Manage and control all borrow areas, work or storage areas, access routes and embankments to prevent sediment from entering nearby water or land adjacent to the work site.

3. Restore all disturbed areas including borrow and haul areas and establish permanent type of locally adaptable vegetative cover.
4. Unless earthwork is immediately paved or surfaced, protect all side slopes and backslopes immediately upon completion of final grading until final acceptance by Owner.
5. Plan and execute earthwork in a manner to minimize duration of exposure of unprotected soils.
6. Except for areas designated by the Contract Documents to be cleared and grubbed, the Contractor shall not deface, injure or destroy trees and vegetation, nor remove, cut, or disturb them without approval of the Engineer.
    a. Any damage caused by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense.

C. Surface Water Protection:
1. Utilize, as necessary, erosion control methods to protect side and backslopes and minimize the discharge of sediment to the surface water leaving the construction site as soon as rough grading is complete.
    a. These controls shall be maintained until the site is ready for final grading and landscaping or until they are no longer warranted and concurrence is received from the Engineer.
        1) Physically retard the rate and volume of runon and runoff by:
            a) Implementing structural practices such as diversion swales, terraces, straw bales, compost socks, silt fences, berms, storm drain inlet protection, rocked outlet protection, sediment traps and temporary basins.
            b) Implementing vegetative practices such as temporary seeding, permanent seeding, mulching, sod stabilization, vegetative buffers, hydroseeding, anchored erosion control blankets, sodding, vegetated swales or a combination of these methods.
            c) Providing Construction sites with graveled or rocked access entrance and exit drives and parking areas to reduce the tracking of sediment onto public or private roads.
2. Discharges from the construction site shall not contain pollutants at concentrations that produce objectionable films, colors, turbidity, deposits or noxious odors in the receiving stream or waterway, in accordance with the Contractor’s TPDES Construction permit.

D. Fuel and Chemical Handling:
1. Store and dispose of chemical wastes in a manner approved by regulatory agencies.
2. Take special measures to prevent chemicals, fuels, oils, greases, herbicides, and insecticides from entering drainage ways.
3. Do not allow water used in onsite material processing, concrete curing, cleanup, and other waste waters to enter a drainage way(s) or stream.
4. The Contractor shall provide containment around fueling and chemical storage areas to ensure that spills in these areas do not reach waters of the state.

E. Control of Dust:
1. The control of dust shall mean that no construction activity shall take place without applying all such reasonable measures as may be required to prevent particulate matter from becoming airborne so that it remains visible beyond the limits of construction.
    a. Reasonable measures may include paving, frequent road cleaning, planting vegetative groundcover, and application of water.
2. Utilize methods and practices of construction to eliminate dust in full observance of agency regulations.
3. The Engineer will determine the effectiveness of the dust control program and may request the Contractor to provide additional measures at no additional cost to Owner.

F. Disposal of Vegetative Waste Materials:
1. Do not burn combustible materials on site without approved permits.
2. Submit approved permits to Luminant’s Environmental Services prior to performing any burning.

3. Material may temporarily be stored onsite, in locations and pile sizes approved by Luminant's Environmental Services.
4. Do not bury organic matter on site unless approved by Luminant's Environmental Services.
5. Chipped clearing debris may temporarily be stored in a location approved by Luminant's Environmental Services.

G. Control of Noise:
1. Control noise by fitting equipment with appropriate mufflers.

H. Completion of Work:
1. Upon completion of work, leave area in a clean, natural looking condition.
2. Ensure all signs of temporary construction and activities incidental to construction of required permanent work are removed.
3. Grade, fill and seed all disturbed areas outside the EAP area, including soil stockpiles.

I. Historical Protection:
1. If during the course of construction, evidence of deposits of historical or archaeological interests are found, cease work affecting find and notify Owner and Engineer immediately.
2. Do not disturb deposits until written notice from Engineer is given to proceed.

J. Site Access and Parking:
1. Contractor shall use the primary entrance to the facility and park at the area designated as the "Staging Area". Staging Area location will be identified to bidders at the pre-bid meeting.

K. Water:
1. Water for dust control, soil use and liner construction can be taken from Martin Lake in locations identified on the Plans.
    a. Contractor will keep records on the quantity of water removed from the lake and will provide these records to Owner monthly and upon project completion.

END OF SECTION

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SECTION 01600
PRODUCT DELIVERY, STORAGE, AND HANDLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Scheduling of product delivery.
   2. Packaging of products for delivery.
   3. Protection of products against damage from:
      a. Handling.
      b. Exposure to elements or harsh environments.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

C. Payment:
   1. No payment will be made to Contractor for equipment or materials not properly stored and insured or without approved shop drawings.
      a. Previous payments for items will be deducted from subsequent progress estimate(s) if proper storage procedures are not observed.

1.2 DELIVERY

A. Scheduling:
   1. Schedule delivery of products or equipment as required to allow timely installation and to avoid prolonged storage.

B. Packaging:
   1. Deliver products or equipment in manufacturer's original unbroken cartons or other containers designed and constructed to protect the contents from physical or environmental damage.

C. Identification:
   1. Clearly and fully mark and identify as to manufacturer, item and installation location.

D. Protection and Handling:
   1. Provide manufacturer's instructions for storage and handling.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3.1 PROTECTION, STORAGE AND HANDLING

A. Manufacturer's Instruction:
   1. Protect all products or equipment in accordance with manufacturer's written directions.
      a. Store products or equipment in location to avoid physical damage to items while in storage.
      b. Handle products or equipment in accordance with manufacturer's recommendations and instructions.
   2. Protect equipment from exposure to elements and keep thoroughly dry.

3. Store pumps, motors, electrical equipment and other equipment having antifriction or sleeve bearings in watertight warehouses which are maintained at a temperature of at least 50° F.

3.2 FIELD QUALITY CONTROL

A. Inspect Deliveries:
   1. Inspect all products or equipment delivered to the site prior to unloading. Reject all products or equipment that are damaged, used, or in any other way unsatisfactory for use on Project.

B. Monitor Storage Area:
   1. Monitor storage area to ensure suitable temperature and moisture conditions are maintained.

END OF SECTION

DIVISION 2

SITE WORK

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SECTION 02073
BUILDING/STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition of all structures and improvements including but not limited to:
      a. Pipe rack.
      b. Concrete slope protection at pipe rack.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 01505 – Construction Waste Management.
   4. Section 01560 – Environmental Protection and Special Controls.
   5. Section 02200 - Earthwork.

C. Health and Safety Plan:
   1. The Contractor shall complete all work in conformance with their site specific Health and Safety Plan and as applicable to the situation.

D. Material Ownership: Materials shall become Contractor's property and shall be removed from site.

1.2 QUALITY ASSURANCE

A. All work shall comply with all applicable Codes, Standards, federal, state, and local regulations including but not limited to the following:
   1. United States Environmental Protection Agency (EPA):
      a. 40 CFR 268.45, Treatment for Hazardous Debris.
   2. OSHA Requirements.

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items.

B. Clean: Uncontaminated, non-hazardous as defined by applicable federal, state and local regulations.

1.4 BASIS OF PAYMENT

A. Payment for building/structure demolition shall be lump sum.

1.5 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Demolition schedule.

B. Miscellaneous Submittals:
   1. Site Specific Health and Safety Plan.
   2. Copies of permits and approvals required by law.
   3. Photographs or videotape, sufficiently detailed, of pre-existing conditions of adjacent facilities and structures that might be misconstrued as damage caused by demolition conditions.
   4. Record Drawings at Project closeout.

5. Identify and accurately locate utilities and other subsurface structural, electrical, or mechanical improvements.

1.6 SITE CONDITIONS

A. Pre-work Conditions:
   1. Buildings/structures to be demolished shall be vacated and their use discontinued before start of demolition work.
   2. Contractor shall record pre-existing conditions with photographs or video.
   3. See "Submittals" above.

B. Contractor Responsibility:
   1. Contractor shall field verify all material to be demolished prior to submitting their bid.
   2. Contractor shall obtain local demolition permits and approvals required by law.
      a. Contractor shall inform appropriate fire and health official of intended activities.

C. Owner Responsibility:
   1. Owner assumes no responsibility for actual conditions of buildings and structures to be demolished.
   2. Conditions existing at time of inspection for bidding purposes will be maintained by Owner as far as practical.

1.7 SCHEDULING

A. Schedule Submittal and Approval Requirements:
   1. Contractor shall prepare and submit to Engineer a demolition schedule as part of the Work Schedule prepared per Section 01060.

PART 2 - PRODUCTS

2.1 ITEMS FOR SALVAGE

A. No items are scheduled for salvage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions and correlate with requirements indicated to determine extent of demolition work.

3.2 DEMOLITION PREPARATION

A. Install construction fence as required by local building code.
   1. Contractor's limits of proposed construction fence must be approved in writing by the Owner.

B. Conduct demolition operations and remove debris to ensure minimum interference with roads, street, walks, and other adjacent structures and facilities.

C. Conduct demolition operations to prevent injury to people and damage to adjacent structures and facilities to remain.
   1. Ensure safe passage of people around demolition area.

D. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of adjacent structures and facilities to remain.

E. Conduct all facility equipment disassembly and dust removal and control, and other necessary prerequisite work specified elsewhere, prior to demolition.

1. Suspect material identified by Contractor after removal activities and during demolition shall be sampled for disposal purposes by the Contractor.

F. Before demolition begins for each building or structure assure that all features and requirements for water management, dust control, and health and safety provisions are in place.

3.3 POLLUTION/DUST CONTROLS

A. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt.
   1. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations.
   2. Return adjacent areas to conditions existing before start of demolition.

B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

C. Fugitive Dust Emissions:
   1. At no time will a fugitive dust plume or cloud be allowed to cross the site property lines.
      a. If a complaint is received by Owner concerning fugitive dust emissions, the process will be halted immediately until the issue is investigated and a satisfactory resolution can be implemented.

D. Stockpile Protection:
   1. The surface of any stockpiled material capable of producing fugitive dusts will be covered to prevent fugitive dust.
   2. Contractor shall designate an individual to visually monitor the stockpiled materials during all operating hours for fugitive dust emissions.

E. High Wind Protection:
   1. The stockpiled material shall be situated in such a manner or control measures implemented to prevent airborne transport of materials during periods of high winds events.

F. Debris Pile Minimization: The quantity of debris shall be kept to a minimum.

G. Truck Loading:
   1. Trucks shall be loaded so that no part of the debris making contact with any sideboard, side panel or rear panel comes within six inches of the top of the enclosure.

H. Truck Tarping: All trucks transporting waste or debris shall be completely covered with tarpaulins.

I. Truck Emptying:
   1. Residue shall be cleaned from the inside of the trucks after emptying.
   2. If residue has not been completely removed after emptying truck material, tarpaulins shall be placed in the bed of the truck to cover the remaining material.

J. Debris Drop Distance: The drop distance of the material onto the pile, truck, etc., shall not exceed 6 FT.

K. Container Leakage: All equipment transporting material shall be maintained in such a way to prevent leakage and spillage.

3.4 DEMOLITION

A. Contractor shall conduct work in accordance with these specifications.
   1. Contractor shall perform demolition in a fashion that protects all on-site personnel, protects the environment, complies with all applicable laws and regulations, and preserves the structural integrity of systems necessary to maintain safe working conditions.
   2. Contractor shall demolish all buildings and structures identified in the Contract Documents.

3.5 BACKFILLING

A. Backfilling back to existing grade prior to demolition shall be as provided in Section 02200.

3.6 CHARACTERIZATION OF MATERIALS

A. Contractor is responsible for any sampling and/or analysis necessary for off-site shipment of reusable/ recyclable demolition material.
   1. This includes collection of material core/chip samples to be composited for analysis by others.
   2. Contractor shall provide manpower and equipment necessary to safely obtain sample.

B. Contractor shall sort demolition material into types identified prior to characterization or sampling.
   1. Contractor shall provide equipment and personnel to obtain samples.
   2. Contractor shall provide assistance for all samples not reachable and liftable by persons standing at grade.

3.7 UTILIZATION OF DEMOLITION MATERIALS

A. Order of preference for final disposition of demolition material shall be as follows:
   1. Off-Site reuse/recycle.
   2. Off-Site management or disposal.

3.8 DOCUMENTATION

A. Contractor shall maintain a daily log, including photos, of demolition activities.

B. Maintain copies of all required manifests for off-site shipments.

END OF SECTION

SECTION 02110
SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Site clearing, tree protection, stripping topsoil and demolition.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02200 - Earthwork.
   4. Section 02221 - Trenching, Backfilling, and Compacting for Utilities.
   5. Section 02270 - Soil Erosion and Sediment Control.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SECTION)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect existing trees and other vegetation to prevent damage.
   1. Provide temporary protection as required.

B. Contractor must obtain authority for removal and alteration work on adjoining property, if needed.

3.2 SITE CLEARING

A. Topsoil Removal:
   1. Strip topsoil to depths encountered.
      a. Remove heavy growths of grass before stripping.
      b. Stop topsoil stripping sufficient distance from such trees to prevent damage to main root system.
      c. Separate from underlying subsoil or objectionable material.
   2. Stockpile topsoil where directed at the permanent disposal pond area.
      a. Construct storage piles to freely drain surface water.
      b. Seed or cover storage piles to prevent erosion.
      c. Transport contaminated topsoil to the Permanent Disposal Pond area for disposal.
      d. Topsoil may be used as protective cover in the Permanent Disposal Pond. Coordinate with the Vertical Expansion Contractor.
   3. Do not strip topsoil in wooded areas where no change in grade occurs.
   4. Borrow topsoil:
      a. Reasonably free of subsoil, remove objects over 2 inch diameter, weeds and roots.

B. Clearing and Grubbing:
   1. Clear from within limits of construction all trees not marked to remain.
      a. Include shrubs, brush, downed timber, rotten wood, heavy growth of grass and weeds, vines, rubbish, structures and debris.
   2. Grub (remove) from within limits of construction all stumps, roots, root mats, logs and debris encountered.

C. Disposal of Vegetative Waste Materials:
   1. Do not burn combustible materials on site without approved permits.
   2. Submit approved permits to Luminant's Environmental Services prior to performing any burning.
   3. Material may temporarily be stored onsite in locations and pile sizes approved by Luminant's Environmental Services.
   4. Do not bury organic matter on site unless approved by Luminant's Environmental Services.
   5. Chipped clearing debris may temporarily be stored in location approved by Luminant's Environmental Services.

3.3 ACCEPTANCE

A. Upon completion of the site clearing, obtain Engineer's acceptance of the extent of clearing, depth of stripping and rough grade.

END OF SECTION

SECTION 02200
EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Earthwork.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02276C – Constructed Clay Liner

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society for Testing and Materials International (ASTM):
      a. D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3).
      b. D4253, Standard Test Methods for Maximum Index Density of Soils Using a Vibratory Table.
      c. D4254, Standard Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Certifications.
   4. Test reports:
      a. Soils inspection and testing results.

B. Samples:
   1. Submit samples and source of fill and backfill materials proposed for use.
   2. Submit samples and source of borrow materials proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

1. Fill and Backfill: Selected material approved by Soils Engineer from site excavation or from off site borrow.

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect existing surface and subsurface features on-site and adjacent to site as follows:
   1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.

2. Protect and maintain bench marks, monuments, monitor wells or other established reference points and property corners.
    a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
3. Verify location of utilities.
    a. Omission or inclusion of utility items on Contract Documents does not constitute non-existence or definite location.
    b. Secure and examine local utility records for location data.
    c. Take necessary precautions to protect existing utilities from damage due to any construction activity.
    d. Repair damages to utility items at own expense.
    e. In case of damage, notify Engineer at once so required protective measures may be taken.
4. Existing structures not indicated to be removed shall be maintained free of damage.
    a. Any item known, or unknown, or not properly located that is inadvertently damaged shall be repaired to original condition.
    b. All repairs to be made and paid for by Contractor.
5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner.
6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
7. Avoid surcharge or excavation procedures which can result in heaving, caving or slides.

B. Salvageable Items: Carefully remove items to be salvaged, and store on Owner's premises unless otherwise directed.

C. Legally dispose of waste materials off site.
1. Burning, as a means of waste disposal, is not permitted unless approved by Luminant's Environmental Services.

3.2 SITE EXCAVATION AND GRADING

A. The work includes all operations in connection with excavation, borrow, construction of fills, rough grading and disposal of excess materials in connection with the preparation of the site(s) for construction of the proposed facilities.

B. Excavation and Grading: Perform as required by the Contract Drawings.
1. Contract Drawings may indicate both existing grade and finished grade required for construction of Project.
    a. Stake all units, structures, piping, and roads, and establish their elevations.
    b. Perform other layout work required.
    c. Replace property corner markers to original location if disturbed or destroyed.
2. Preparation of ground surface for embankments or fills:
    a. Before fill is started, scarify to a minimum depth of 6 IN in all proposed embankment and fill areas.
    b. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.
3. Protection of finish grade:
    a. During construction, shape and drain embankment and excavations.
    b. Maintain ditches and drains to provide drainage at all times.
    c. Protect graded areas against action of elements prior to acceptance of work.
    d. Reestablish grade where settlement or erosion occurs.
4. If lignite is exposed at the limit of excavation, the lignite will be over-excavated and replaced with fill material.

C. On-site Borrow:
1. Provide necessary amount of approved fill compacted to density equal to that indicated in this Specification.

2. Include cost of all borrow material in base proposal.
3. Fill material to be approved by Soils Engineer prior to placement.

D. Construct embankments and fills as required by the Contract Drawings:
   1. Construct embankments and fills at locations and to lines of grade indicated.
      a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.
   2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 IN.
      a. Ensure that stones larger than 4 IN are not placed in upper 6 IN of fill or embankment.
      b. Do not place material in layers greater than 8 IN loose thickness.
      c. Place layers horizontally and compact each layer prior to placing additional fill.
   3. Compact by sheepsfoot, pneumatic rollers, vibrators or by other equipment as required to obtain specified density.
      a. Control moisture for each layer necessary to meet requirements of compaction.

3.3 ROCK EXCAVATION

A. All rock excavation shall be under one classification.
   1. This classification shall include solid ledge rock in its natural location that requires systematic quarrying or drilling for its removal and boulders that exceed 1/2 CY in volume.

B. When rock is encountered, strip free of earth.
   1. Employ an independent surveyor to determine rock quantities before removal operation begins.
   2. In computing the volumetric content of rock excavation for payment, the pay lines shall be taken as follows:
      a. For structures: 3 FT outside the exterior limits of foundations and from rock surface to 6 IN below bottom of foundations.
      b. For piping and utilities: A width 18 IN wider than the outside diameter of the pipe or conduit and from rock surface to 6 IN below bottom exterior surface of the pipe or conduit.

3.4 USE OF EXPLOSIVES

A. Blasting with any type of explosive is prohibited.

3.5 FIELD QUALITY CONTROL

A. Do not include in bid price the cost of inspection services indicated herein as being performed by the Soils Engineer.

B. Moisture density relations, to be established by the Soils Engineer, is required for all materials to be compacted.

C. Extent of compaction testing will be as necessary to assure compliance with Specifications.

D. Give minimum of 24 HR advance notice to Soils Engineer when ready for compaction or subgrade testing and inspection.

E. Should any compaction density test or subgrade inspection fail to meet Specification requirements, perform corrective work as necessary.

F. Pay for all costs associated with corrective work and retesting resulting from failing compaction density tests.

3.6 COMPACTION DENSITY REQUIREMENTS

A. Obtain approval from Soils Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.

B. Provide dewatering system to successfully complete compaction and construction requirements, as necessary.

C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by Soils Engineer.

D. Stabilize subgrade with well graded granular materials as directed by Soils Engineer.

E. Assure by results of testing that compaction densities comply with the following requirements:
   1. Sitework:

LOCATION	COMPACTION DENSITY
Under Piping:	
Cohesive soils	>95 percent per ASTM D698
Cohesionless soils	75 percent relative density per ASTM D4253 and ASTM D4254
All Other Fill Areas (non-clay liner):	
Cohesive soils	95 percent of ASTM D698
Cohesionless soils	60 percent relative density per ASTM D4253 and ASTM D4254
Clay Liner	See Section 02276C – Compacted Clay Liner

3.7 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

A. General:
   1. In general, work includes, but is not necessarily limited to, excavation for structures, removal of underground obstructions and undesirable material, backfilling, filling, backfill, and subgrade compaction.
   2. Obtain fill and backfill material necessary to produce grades required.
      a. Materials and source to be approved by Soils Engineer.
      b. Excavated material approved by Soils Engineer may also be used for fill and backfill.
   3. In the paragraphs of this Section of the Specifications, the word "soil" also includes any type of rock subgrade that may be present at or below existing subgrade levels.

B. Excavation Requirements for Structures:
   1. General:
      a. Do not commence excavation for structures until Soils Engineer approves:
         1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.
         2) Density and moisture content of site area compacted fill material meets requirements of specifications.
         3) Site surcharge or mass fill material can be removed from entire construction site or portion thereof.
      b. Engineer grants approval to begin excavations.
   2. Dimensions:
      a. Excavate to elevations and dimensions indicated or specified.
      b. Allow additional space as required for construction operations and inspection of foundations.
   3. Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute work indicated on Contract Drawings.
      a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by Soils Engineer.

4. Level off bottoms of excavations to receive compacted fill.
    a. Remove loose materials and bring excavations into approved condition to receive concrete or fill material.
    b. Where compacted fill material must be placed to bring subgrade elevation up to underside of construction, scarify existing subgrade upon which fill material is to be placed to a depth of 6 IN and then compact to density stated in this Specification Section before fill material can be placed thereon.
    c. Do not carry excavations lower than shown for foundations except as directed by Soils Engineer or Engineer.
    d. If any part of excavations is carried below required depth without authorization, maintain excavation and start foundation from excavated level with concrete of same strength as required for superimposed foundation, and no extra compensation will be made to Contractor therefore.
5. Make excavations large enough for working space, forms, dampproofing, waterproofing and inspection.
6. Notify Soils Engineer and Engineer as soon as excavation is completed in order that subgrades may be inspected.
    a. Do not commence further construction until subgrade under compacted fill material has been inspected and approved by the Soils Engineer as being free of undesirable material, being of compaction density required by this specification, and being capable of supporting the allowable design bearing pressures and superimposed fill loads to be placed thereon.
    b. Soils Engineer shall be given the opportunity to inspect subgrade below fill material both prior to and after subgrade compaction.
    c. Place fill material and equipment support pads as soon as weather conditions permit after excavation is completed, inspected and approved, and after forms and reinforcing are inspected and approved.
    d. Before concrete or fill material is placed, protect approved subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations or other reasons.
7. Dewatering:
    a. Where groundwater is or is expected to be encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade below fill material, to allow fill material to be placed in the dry, and to maintain a stable excavation side slope.
    b. Groundwater shall be maintained at least 3 FT below the bottom of any excavation.
    c. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
    d. Employ dewatering specialist for selecting and operating dewatering system.
    e. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.
    f. Dispose of groundwater to the West Ash Pond or offsite in accordance with approved SWPPP and TPDES.
        1) Install groundwater monitoring wells as necessary.
    g. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
8. Subgrade stabilization:
    a. If subgrade under fill material or equipment support pads is in a loose, wet, or soft condition before construction is placed thereon, remove loose, wet, or soft material and replace with approved compacted material as directed by Soils Engineer.
    b. Provide compaction density of replacement material as stated in this specification Section.
    c. Loose, wet, or soft materials, when approved by Soils Engineer, may be stabilized by a compacted working mat of well graded crushed stone.
    d. Compact stone mat thoroughly into subgrade to avoid future migration of fines into the stone voids.
    e. Remove and replace frozen materials as directed by Soils Engineer.

f. Method of stabilization shall be performed as directed by Soils Engineer.
g. Do not place further construction on the repaired subgrades, until the subgrades have been approved by the Soils Engineer.

9. Do not set equipment support pads until subgrade below has been approved, piping has been tested and approved, reinforcement placement has been approved, and Contractor receives approval to commence construction.
   a. Do not place equipment support pads when temperature of air surrounding the slab and pads is or is expected to be below 40 DegF before structure is completed and heated to a temperature of at least 50 DegF.
10. Protection of structures:
   a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.
   b. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water, or due to construction operations.
11. Shoring:
   a. Shore, sheet pile, slope, or brace excavations as required to prevent them from collapsing.
   b. Remove shoring as backfilling progresses, but only when banks are stable and safe from caving or collapse.
12. Drainage:
   a. Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures.
   b. Maintain excavations free of water where equipment support pads or fill material are to be placed.
   c. Provide pumping required to keep excavated spaces free of water during construction.
   d. Should any water be encountered in the excavation, notify Engineer and Soils Engineer.
   e. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.

C. Fill and Backfill Equipment Support Pads and Piping:
1. General:
   a. Subgrade to receive fill or backfill shall be free of undesirable material as determined by Soils Engineer and scarified to a depth of 6 IN and compacted to density specified herein.
   b. Surface may be stepped at not more than 12 IN per step or may be sloped at not more than 2 percent.
   c. Do not place any fill or backfill material until subgrade under fill or backfill has been inspected and approved by Soils Engineer as being free of undesirable material and compacted to specified density.
2. Obtain approval of fill and backfill material and source from Soils Engineer prior to placing the material.
3. Fill and backfill placement:
   a. Prior to placing fill and backfill material, optimum moisture and maximum density properties for proposed material shall be obtained from Soils Engineer.
   b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
   c. Compact material by means of equipment of sufficient size and proper type to obtain specified density.
   d. Use hand operated equipment for filling and backfilling next to walls.
   e. Do not place fill and backfill when the temperature is less than 40 DegF and when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.
   f. Use vibratory equipment to compact granular material; do not use water.

D. Filling and Backfilling Outside of Structures.
   1. This paragraph of this Specification applies to fill and backfill placed outside of structures above bottom level of piping.
   2. Provide material as approved by Soils Engineer for filling and backfilling outside of structures.
   3. Fill and backfill placement:
      a. Prior to placing fill and backfill material, obtain optimum moisture and maximum density properties for proposed material from Soils Engineer.
      b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
      c. Compact material with equipment of proper type and size to obtain density specified.
      d. Use only hand operated equipment for filling and backfilling next to walls and retaining walls.
      e. Do not place fill or backfill material when temperature is less than 40 DegF and when subgrade to receive material is frozen, wet, loose, or soft.
      f. Use vibratory equipment for compacting granular material; do not use water.

E. Backfilling Outside of Structures Under Piping:
   1. When backfilling outside of structures requires placing backfill material under piping, the material shall be placed from bottom of excavation to underside of piping at the density required for fill under piping as indicated in this Section.
   2. This compacted material shall extend transversely to the centerline of piping at a horizontal distance from each side of the exterior edges of piping equal to the depth of backfill measured from bottom of excavation to underside of piping or paving.
   3. Provide special compacted bedding or compacted subgrade material under piping as required by other sections of these Specifications.

3.8 SPECIAL REQUIREMENTS

A. Erosion Control:
   1. Conduct work to minimize erosion of site.
   2. Construct stilling areas to settle and detain eroded material.
   3. Retrieve eroded material washed off site.
   4. Clean streets daily of any spillage of dirt, rocks or debris from equipment entering or leaving site.

B. Soil stock pile
   1. Remove topsoil and store for later use.
   2. Maintain erosion control around stockpile.
   3. Upon completion, place topsoil as indicated on the plans and establish vegetation.

END OF SECTION

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SECTION 02221
TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Excavation, trenching, backfilling and compacting for all underground utilities.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 01340 - Submittals
   4. Section 02200 - Earthwork.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society for Testing and Materials International (ASTM):
      a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

1.3 DEFINITIONS

A. Excavation: All excavation will be defined as unclassified.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   3. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.
   4. Submit sieve analysis reports on all granular materials.

B. Miscellaneous Submittals:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Trench shield (trench box) certification if employed:
      a. Specific to Project conditions.
      b. Re-certified if members become distressed.
      c. Certification by a professional structural engineer registered in the state of Texas.
      d. Engineer is not responsible to, and will not, review and approve.

1.5 SITE CONDITIONS

A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.
   1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.

B. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.

C. Protect and maintain bench marks, monuments or other established points and reference points. If disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.

D. Verify location of existing underground utilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Material: Onsite soils compacted to 95 percent standard proctor. ASTM D 698.

B. Bedding Materials: Onsite soils compacted to 100 percent standard proctor. ASTM D 698.

PART 3 - EXECUTION

3.1 GENERAL

A. Remove and dispose of unsuitable materials as directed by Soils Engineer to site provided by Owner.

3.2 EXCAVATION

A. Unclassified Excavation: Remove rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone as directed by Soils Engineer.

B. Excavation for Appurtenances:
   1. 12 IN (minimum) clear distance between outer surface and embankment.
   2. See Section 02200 for applicable requirements.

C. Groundwater Dewatering:
   1. Where groundwater is, or is expected to be, encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade and to allow pipe, bedding and backfill material to be placed in a dry trench, and to maintain a stable trench wall or side slope.
   2. Groundwater shall be drawn down and maintained at least 3 FT below the bottom of any trench or manhole excavation prior to excavation.
   3. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
      a. Employ dewatering specialist for selecting and operating dewatering system.
   4. Keep dewatering system in operation until dead load of pipe, structure and backfill exceeds possible buoyant uplift force on pipe or structure.
   5. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
   6. Install groundwater monitoring wells as necessary.
   7. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
   8. Unless a unit bid price is provided for groundwater dewatering, cost of groundwater dewatering shall be included in the price of the pipe installation.

D. Trench Excavation:
   1. Excavate trenches by open cut method to depth shown on Drawings and necessary to accommodate work.
      a. Support existing utility lines and yard piping where proposed work crosses at a lower elevation.
         1) Stabilize excavation to prevent undermining of existing utility and yard piping.
   2. Open trench outside buildings, units, and structures:
      a. No more than the distance between two structures, units, or 300 LF, whichever is less.
      b. Field adjust limitations as weather conditions dictate.

3. Any trench or portion of trench, which is opened and remains idle for seven (7) calendar days, or longer, as determined by the Owner, may be directed to be immediately refilled, without completion of work, at no additional cost to Owner.
    a. Said trench may not be reopened until Owner is satisfied that work associated with trench will be prosecuted with dispatch.
4. Observe following trenching criteria:
    a. Trench size:
        1) Excavate width to accommodate free working space.
        2) Maximum trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than what is shown in the Standard Details.
        3) Cut trench walls vertically from bottom of trench to 1 FT above top of pipe, conduit, or utility service.
        4) Keep trenches free of surface water runoff.
            a) Cost of surface water control shall be included in the price of the pipe installation.
            b) No separate payment for surface water runoff pumping will be made.

3.3 PREPARATION OF FOUNDATION FOR PIPE LAYING

A. Over-Excavation:
1. Backfill and compact to 90 percent of maximum dry density per ASTM D698.
2. Backfill with granular bedding material as option.

B. Rock Excavation:
1. Excavate minimum of 6 IN below bottom exterior surface of the pipe or conduit.
2. Backfill to grade with suitable earth or granular material.
3. Form bell holes in trench bottom.

C. Subgrade Stabilization:
1. Stabilize the subgrade when directed by the Owner.
2. Observe the following requirements when unstable trench bottom materials are encountered.
    a. Notify Owner when unstable materials are encountered.
        1) Define by drawing station locations and limits.
    b. Remove unstable trench bottom caused by Contractor failure to dewater, rainfall, or Contractor operations.
        1) Replace with subgrade stabilization with no additional compensation.

3.4 BACKFILLING METHODS

A. Do not backfill until tests to be performed on system show system is in full compliance to specified requirements.

B. Carefully Compacted Backfill:
1. Furnish where indicated on Drawings, specified for trench embedment conditions and for compacted backfill conditions up to 12 IN above top of pipe or conduit.
2. Comply with the following:
    a. Place backfill in lifts not exceeding 8 IN (loose thickness).
    b. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill.
    c. Observe specific manufacturer's recommendations regarding backfilling and compaction.
    d. Compact each lift to specified requirements.

C. Common Trench Backfill:
1. Perform in accordance with the following:
    a. Place backfill in lift thicknesses capable of being compacted to densities specified.
    b. Observe specific manufacturer's recommendations regarding backfilling and compaction.
    c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.

D. Water flushing for consolidation is not permitted.

E. Backfilling for Electrical Installations:
   1. Observe Paragraph 3.4B. or C. or when approved by the Engineer.

3.5 COMPACTION

A. General:
   1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.
   2. In no case shall degree of compaction below minimum compactions specified be accepted.

3.6 FIELD QUALITY CONTROL

A. Testing:
   1. Perform in-place moisture-density tests as directed by the Owner.
   2. Perform tests through recognized testing laboratory approved by Owner.
   3. Costs of "Passing" tests paid by Owner.
   4. Perform additional tests as directed until compaction meets or exceeds requirements.
   5. Cost associated with "Failing" tests shall be paid by Contractor.
   6. Reference to Engineer in this section will imply Soils Engineer when employed by Owner and directed by Engineer to undertake necessary inspections as approvals as necessary.
   7. Assure Owner has immediate access for testing of all soils related work.
   8. Ensure excavations are safe for testing personnel.

END OF SECTION

SECTION 02260
TOPSOILING AND FINISHED GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Topsoiling and finished grading.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02110 - Site Clearing.
   4. Section 02200 - Earthwork.
   5. Section 02930 - Seeding, Sodding and Landscaping.

C. Location of Work: Soils borrow area and all areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.

1.2 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Project Data: Test reports for furnished topsoil.

1.3 SITE CONDITIONS

A. Verify amount of topsoil stockpiled and determine amount of additional topsoil, if necessary, to complete work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil:
   1. Original surface soil typical of the area.
   2. Existing topsoil stockpiled under Section 02110.
   3. Capable of supporting native plant growth.

2.2 TOLERANCES

A. Finish Grading Tolerance: 0.1 FT plus/minus from required elevations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Correct, adjust and/or repair rough graded areas.
   1. Cut off mounds and ridges.
   2. Fill gullies and depressions.
   3. Perform other necessary repairs.
   4. Bring all sub-grades to specified contours, even and properly compacted.

B. Loosen surface to depth of a minimum of 2 inches.

C. Remove all stones and debris over 2 IN in any dimension.

3.2 ROUGH GRADE REVIEW

A. Reviewed by Owner prior to placement of topsoil.

3.3 PLACING TOPSOIL

A. Do not place when subgrade is wet or frozen enough to cause clodding.

B. Spread to compacted depth of 4 IN for all disturbed earth areas.

C. If topsoil stockpiled is less than amount required for work, furnish additional topsoil at no cost to Owner.

D. Provide finished surface free of stones, sticks, or other material 1 IN or more in any dimension.

E. Provide finished surface smooth and true to required grades.

F. Restore stockpile area to condition of rest of finished work.

3.4 ACCEPTANCE

A. Upon completion of topsoiling, obtain Engineer's acceptance of grade and surface.

B. Make test holes where directed to verify proper placement and thickness of topsoil.

END OF SECTION

SECTION 02270
SOIL EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Soil erosion and sediment control.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02930 – Seeding, Sodding and Landscaping

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. Erosion control standards: "Standards and Specifications for Soil Erosion and Sediment Control in Developing Areas" by the U.S. Department of Agriculture, Soil Conservation Service, College Park, Maryland.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Straw bales, twine or wire tied.

B. Compost Logs.

C. Silt Fencing.

D. Pipe Riser and Barrel: 16 GA corrugated metal pipe (CMP) of size indicated.

E. Stone for Stone Filter: 2 IN graded gravel or crushed stone.

F. Grass Seed: See Section 02930 – Seeding, Sodding and Landscaping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Carry out in accordance with SWPPP prepared by Contractor and approved by Luminant's Environmental Services.

B. Prior to General Stripping Topsoil and Excavating:
   1. Install perimeter dikes and swales.
   2. Excavate and shape sediment basins and traps.
   3. Construct pipe spillways and install stone filter where required.
   4. Machine compact all berms, dikes and embankments for basins and traps.
   5. Install straw bales where needed.
      a. Provide two stakes per bale.
      b. First stake angled toward previously installed bale to keep ends tight against each other.

C. Construct sediment traps where needed during rough grading as grading progresses.

D. Temporarily seed basin slopes and topsoil stockpiles:
   1. Rate: 1/2 LB/1000 SF.

2. Reseed as required until 70% coverage of grass is achieved.

3.2 DURING CONSTRUCTION PERIOD

A. Maintain Basins, Dikes, Traps, Stone Filters, Straw Bales, Etc.:
   1. Inspect regularly especially after rainstorms.
   2. Repair or replace damaged or missing items.

B. After rough grading, sow temporary grass cover over all exposed earth areas not draining into sediment basin or trap.

C. Construct inlets as soon as possible.
   1. Excavate and tightly secure straw bales completely around inlets.

D. Provide necessary swales and dikes to direct all water towards and into sediment basins and traps.

E. Do not disturb existing vegetation (grass and trees).

F. Excavate sediment out of basins and traps when capacity has been reduced by 50 percent.
   1. Remove sediment from behind bales to prevent overtopping.

G. Topsoil and Fine Grade Slopes and Swales, Etc.:
   1. Seed and mulch as soon as areas become ready.

3.3 NEAR COMPLETION OF CONSTRUCTION

A. Eliminate basins, dikes, traps, etc.

B. Grade to finished or existing grades.

C. Fine grade all remaining earth areas, then seed and mulch.

END OF SECTION

SECTION 02271
FABRIC-FORMED CONCRETE REVETMENT MAT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fabric-formed Concrete Revetment Mat

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02200 - Earthwork.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society for Testing and Materials International (ASTM):
      a. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
      b. C33, Standard Specification for Concrete Aggregates.
      c. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      d. C150, Standard Specification for Portland Cement.
      e. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
      f. C494, Standard Specification for Chemical Admixtures for Concrete.
      g. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
      h. C939, Standard Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method)
      i. D2256, Standard Test Method for Tensile Properties of Yarns by the Single-Strand Method.
      j. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
      k. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
      l. D4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
      m. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
      n. D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
      o. D4873, Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
      p. D4884, Standard Test Method for Strength of Sewn or Thermally Bonded Seams of Geotextiles.
      q. D5199, Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
      r. D5261, Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Material and method of installation and details for completed system.
      c. Manufacturer’s construction and quality control manual.
      d. Concrete mix design.

3. The Contractor shall submit a manufacturer's certificate that the supplied fabric forms meet the criteria of these Specifications, as measured in full accordance with the test methods and standards referenced herein.
    a. The certificates shall include the following information about each fabric form delivered:
        1) Manufacturer's name and current address,
        2) Full product name,
        3) Style and product code number,
        4) Form number(s),
        5) Composition of yarn, and
        6) Manufacturer's certification statement.
4. Fabric form layout plan with proposed size, type, number, position, and sequencing of fabric form panels.
    a. Show the location and direction of all field and factory seams.
    b. Show proposed details for making field connections of the fabric forms.
    c. Show proposed details for connecting the fabric forms to appurtenances.
5. Submit all tests and certification in a single coordinated submittal.

1.4 DELIVERY, STORAGE AND HANDLING

A. See Section 01600.

B. The fabric forms shall be kept dry and wrapped such that they are protected from the elements during shipping and storage.

C. If stored outdoors, the fabric forms shall be elevated and protected with a waterproof cover that is opaque to ultraviolet light.

D. Fabric forms labeling: per ASTM D 4873.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fabric-formed Concrete Revetment Mat:
1. Subject to compliance with the Specifications, the following are approved fabric-formed concrete revetment mat manufacturers:
    a. Donnelly Fabricators, Inc. (Texicon), Lawrenceville, GA, (770) 399-0108.
    b. Hydrotex, Atlanta, GA, (800) 253-0561.
2. The fabric form shall be uniform section lining, with the following typical dimensions and weights:
    a. Average thickness: 4.0 IN.
    b. Mass per unit area: 45 LB/FT^2.
    c. Drop point spacing: 3 x 4 IN.
    d. Concrete coverage: 75 FT^2/YD^3.
    e. Shear resistance: 18 LB/FT^2.
3. The uniform section fabric shall possess properties which meet or exceed the following minimum average roll values:

Property	Test Method	Minimum Average Roll Value
Physical		
Composition of yarns		Nylon or polyester
Mass per unit area (double-layer), oz/yd^2	ASTM D 5261	12
Thickness, mils	ASTM D 5199	25
Mill width, in		76
Mechanical		

Property	Test Method	Minimum Average Roll Value
Wide-width strip tensile strength, lb/in	ASTM D4595	
- machine		140
- cross		110
Elongation at break, %	ASTM D4595	
- machine		20
- cross		30
Trapezoidal tear strength, lb	ASTM D 4533	
- machine		150
- cross		100
Hydraulic		
Apparent opening size (AOS), U.S. Standard Sieve	ASTM D4751	40
Flow rate, gal/min/ft^2	ASTM D 4491	90

4. The fabric forms shall be composed of synthetic yarns formed into a woven fabric.
   a. Yarns used in the manufacture of the fabric shall be composed of nylon and/or polyester.
   b. Forms shall be woven with a minimum of 50% textured yarns (by weight) to improve adhesion to fine aggregate concrete and to improve filtration.
   c. Partially-oriented, drawn-textured, and/or staple yarns shall not be used in the manufacture of the fabric.
   d. Each layer of fabric shall conform to the physical, mechanical and hydraulic requirements referenced herein.
   e. The fabric forms shall be free of defects and flaws that significantly affect their physical, mechanical, or hydraulic properties.
5. Fabric forms shall consist of double-layer woven fabric joined together by spaced, interwoven cords of uniform length to form a concrete lining with a finished average thickness and nominal mass per unit area listed in part 2.1A.2.
   a. Cord minimum breaking strength: Minimum 160 lb when tested in accordance with ASTM D 2256.
   b. After the form has been filled with fine aggregate concrete, the cords' drop points shall be spaced as listed in part 2.1A.2.
   c. The cords shall connect the two layers of fabric to form a comparatively uniform surface appearance.
6. Mill widths of fabric shall be as listed in part 2.1A.3.
   a. Each selvage edge of the top and bottom layers of fabric shall be reinforced for a width of not less than 1.35 inches by adding a minimum of 6 warp yarns to each selvage construction.
   b. Mill width rolls shall be cut to the length required, and the double-layer fabric separately joined, bottom layer to bottom layer and top layer to top layer, by means of sewing thread, to form multiple mill width panels with sewn seams on not less than 72-inch centers.
7. All factory-sewn seams shall be downward facing.
   a. All seams sewn in the factory: Minimum 90 lb/in when tested in accordance with ASTM D 4884.
   b. All sewn seams and zipper attachments shall be made using a double line of U.S. Federal Standard Type 401 stitch.
   c. All stitches shall be sewn simultaneously and be parallel to each other, spaced between 0.25 inches to 0.75 inches apart.
   d. Each row of stitching shall consist of 4 to 7 stitches per inch.
   e. Thread used for seaming shall be nylon and/or polyester.

8. Baffles shall be installed at predetermined mill width intervals to regulate the distance of lateral flow of fine aggregate concrete.
    a. The baffle material shall be non-woven filter fabric.
9. Whenever plastic weep tubes for the relief of hydrostatic uplift pressure are required, they shall be inserted through the fabric forms at locations specified in the Contract Documents.
    a. The lower ends of the weep tubes shall be securely covered by filter fabric, or the fabric forms shall be placed over filter fabric.
10. Fine aggregate concrete:
    a. Mix Portland cement, fine aggregate and water to provide a readily pourable slurry.
        1) The consistency of the fine aggregate concrete delivered to the concrete pump shall be proportioned and mixed as to have an efflux time of 9 – 12 seconds when passed through the 0.75-inch orifice of the standard flow cone (ASTM C 939).
        2) Ready mix from plant which is certified by the National Ready-Mix Concrete Association. Field mixes subject to approval.
            a) Portland cement: ASTM C150, Type I or Type II.
            b) Fine aggregate: ASTM C33.
            c) Water: Clean, free from injurious amounts of oil, acid, salt, alkali, organics or other impurities.
            d) Pozzolan: ASTM C618, Class F.
            e) Plasticizing admixture: ASTM C 494, if used.
            f) Air entraining admixture: ASTM C 260, if used.
    b. Pozzolan grade fly ash shall be substituted for cement to the maximum percentage allowed by the manufacturer.
    c. Admixtures may be used with Engineer's approval.
    d. Hardened fine aggregate concrete compressive strength: Minimum 2000 psi at 28 days when specimens are made and tested in accordance with ASTM C31 and ASTM C39.

2.2 SOURCE QUALITY CONTROL

A. Perform all tests required to demonstrate source and material specifications are satisfied.

B. Contractor shall test all Fine Aggregate Concrete delivered to the site for compressive strength and air content, and provide test results to Owner and Engineer.

PART 3 - EXECUTION

3.1 FOUNDATION PREPARATION

A. General: Areas on which fabric forms are to be placed shall be constructed to the lines and grades shown on the Contract Drawings and to the tolerances specified in the Contract Documents, and approved by the Engineer.

B. Grading:
    1. Grade slope to a smooth plane surface to provide intimate contact between the slope face and the interface surface of the fabric forms.
        a. All slope deformities, roots, grade stakes and stones which project normal to the local slope face must be regraded or removed.
        b. No holes, “pockmarks”, slope board teeth marks, footprints, or other voids greater than 1 IN in depth normal to the local slope face shall be permitted.
        c. No grooves or depressions greater than 0.5 IN in depth normal to the local slope face with a dimension exceeding 1 FT in any direction shall be permitted.
        d. Compact subgrade to density specified for structural backfill in accordance with Section 02200.
    2. Correction:
        a. Defective areas shall be brought to grade by placing compacted homogeneous material.
        b. The slope and slope face shall be uniformly compacted.

c. Depth of layers, homogeneity of soil and amount of compaction shall be as specified in Section 02200.

3.2 INSTALLING FABRIC-FORMED CONCRETE REVETMENT MAT

A. General: Placed within the specified lines and grades shown on the Contract Drawings.

B. Placement on adjoining geosynthetic:
   1. Place on the geosynthetic in such a manner as to produce a smooth plane surface in intimate contact with the geosynthetic.

C. Prior to fine aggregate concrete injection, position the fabric at its approximate design location, making appropriate allowance for the contraction of the fabric in each direction which will occur as a result of fine aggregate concrete injection.
   1. Anchoring of the fabric forms shall be accomplished through the use of anchor trenches.
   2. Panels of fabric are to be factory assembled in predetermined sizes and jointed together side-by-side at the jobsite by means of a sewn seam or zipper closures attached to the upper and lower layers of fabric.
      a. Avoid field seaming to the extent possible.
      b. Machine sew seams shall be made with two lines of U.S. Federal Standard Type 101 stitches.
      c. The two (2) top layers of fabric and the two (2) bottom layers of fabric shall be separately joined so as to ensure full block thickness.
      d. Grab tensile strength of sewn seams shall be a minimum 100 LBS/IN per ASTM D4632.
      e. Face all sewn seams downward.
      f. Field seaming will only be allowed to join factory assembled panels together.
      g. There shall be no gaps in the seaming.
   3. Place fabric forms immediately following slope preparation.
   4. When conventional joining of fabric forms is impractical or where called for in the Contract Documents, adjacent forms may be overlapped a minimum of three (3) feet to form a lap joint.
      a. The lap joint shall be constructed as recommended in the manufacturers construction and quality control manual.
      b. Based on the predominant flow direction, the downstream edge of the form shall overlap the upstream edge of the next form.
      c. In no case shall simple butt joints between forms be permitted.
   5. Immediately prior to filling with fine aggregate concrete, the assembled fabric forms shall be inspected by the Engineer.
      a. No fine aggregate concrete shall be pumped into the fabric forms until their placement has been approved.
      b. At no time shall the fabric forms be exposed to ultraviolet light (including direct sunlight) for a period exceeding five (5) days.

D. Following placement and seaming of the fabric, inject fine aggregate concrete between the top and bottom layers of fabric to the specified dimensions.
   1. Tightly wrap injection pipe at injection point while pumping.
   2. Inject fine aggregate concrete in such a way that the fabric form is fully inflated and excessive pressure on the fabric forms and cold joints are avoided.
      a. A cold joint is defined as one in which the pumping of the fine aggregate concrete into a given form is discontinued or interrupted for an interval of forty-five (45) minutes or more.
      b. Repair damage to the fabric form caused by over-inflation to the satisfaction of the Engineer and at no cost to the Owner.
   3. After pumping, minimize spillage of the fine aggregate concrete on the surface of the fabric.
   4. Sequence injection of fine aggregate concrete such as to insure complete filling of the fabric form to the thickness specified.

5. Holes in the fabric forms left by the removal of the filling pipe shall be temporarily closed by inserting a piece of nonwoven fabric or similar material.
    a. The nonwoven fabric shall be removed when the concrete is no longer fluid.
    b. The concrete surface at the hole shall be cleaned and smoothed by hand.

E. Do not permit foot traffic on the freshly pumped mat when such traffic will cause permanent indentations in the mat surface.
1. Use walk boards where necessary.
2. Clean up excessive fine aggregate concrete that has been inadvertently spilled on the mat surface.
3. Do not permit the use of a water hose to remove spilled fine aggregate concrete from the surface of freshly pumped mat.

F. The backfilling and compaction of anchor and terminal trenches shall proceed in not less than one hour behind the concrete filling of the fabric formed mat.
1. Backfilling and compaction shall be as specified in Section 02200.
2. Trenches shall be backfilled and compacted to the top of the mat.
3. The trenches of completed sections of mats shall be backfilled and compacted by the end of the work day.

G. Measure block thickness during fine aggregate concrete injections.
1. Reject any block measuring less than 90 percent of the average of all thickness measurements until acceptable thickness has been attained.
    a. Average must be 4 IN or greater.

3.3 MANUFACTURER'S REPRESENTATIVE

A. A manufacturer's representative shall be present for a minimum of 10 percent of the installation of the fabric form unless the Contractor can prove adequate experience in this technology.

END OF SECTION

SECTION 02276C
CONSTRUCTED CLAY LINER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Contractor to furnish all labor, materials, tools, equipment, and services for all clay liner materials, as indicated, in accordance with provisions of Contract Documents.
   2. Completely coordinate with work of all other trades.
   3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

B. Related Sections:
   1. Division 1 - General Requirements.
   2. Section 02200 - Earthwork.
   3. Appendix A - Soils and Liner Quality Control Plan (SLQCP).

C. Location of work: All areas within limits of the East Ash Pond (EAP) and the Soils Borrow Area.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society for Testing and Materials International (ASTM:
      a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.

B. The bottom of the clay liner must be at or below the required top of subgrade elevation.
   1. The liner will be constructed to the thickness indicated on the plans as measured perpendicular to the surface.

C. Finished grading tolerance:
   1. 0.1 FT plus from required elevations for the top of the clay liner.
   2. Clay liner thickness shall be a minimum of 18 IN.

D. The Geotechnical Professional (see SLQCP) will prequalify all materials to be used for Liner Construction.
   1. Soil borrow areas are shown on the plans. Soil stockpile locations will be identified to bidders at the pre-bid meeting.

E. The Geotechnical Professional will have final decision concerning any discrepancy between this document and the SLQCP including materials, equipment, methods, payment, etc.

1.3 JOB CONDITIONS

A. Verify conditions of subgrade prior to commencing work.

PART 2 - PRODUCTS

A. Clay:
   1. Provide and install clay materials meeting the requirements of the SLQCP.
   2. A copy of the SLQCP is attached to these specifications as Appendix A.

3. Information from previous testing of on-site material is available for review, but is not a Contract Document, and is not to be construed as assurance that on-site material will meet all Specifications.

B. The Contractor may use on-site material from the borrow area, as long as the material is prequalified by the Contractor as described in the SLQCP, and accepted by the Geotechnical Professional.
   1. The Contractor is responsible for meeting all requirements for clay liner construction regardless of the source from which clay material is obtained.

PART 3 - EXECUTION

3.1 CONSTRUCTION METHODS

A. General: Prior to placing any material for liner construction:
   1. An adequate quantity of preconditioned liner material may be stockpiled in the EAP to avoid any unnecessary delay in liner construction.
   2. A 100 FT grid marker system utilizing the existing coordinate system shall be established and maintained over the entire area to be lined.
      a. Applicable survey control methods are defined within the SLQCP.
      b. Instrument control is the only survey method allowed.
   3. Provide bottom grade necessary to control drainage in the excavation.
   4. Disturbance of the surface of the excavation, including plowed loosened ground or surface roughened by erosion or equipment travel shall be restored to the original grade by blading or other methods and, compacted by sprinkling and rolling.
   5. Trees, stumps, roots, vegetation, rocks, solid waste or other unsuitable materials shall not be placed in the constructed clay liner.
   6. Clay liners shall be constructed to the grade established in the plans.
      a. Completed liners shall correspond to the general shape of the typical sections shown on the plans.

B. Constructed Clay Liner:
   1. Constructed clay liner shall be defined as composed principally of clay material other than rock, and shall be constructed of accepted clay material from an approved borrow source.
   2. Except as otherwise specified, clay liners shall be constructed in successive layers for the full width of the cross section and in such lengths as are best suited to the moisturization and compaction methods utilized.
      a. Each completed lift shall be scarified and sprinkled as deemed necessary by the Contractor prior to the placement of successive lifts.
   3. Layers of clay liner may be formed by utilizing equipment which will spread the materials as it is dumped, or they may be formed by being spread by blading or other acceptable methods from piles or windrows dumped from excavating or hauling equipment in such amounts that material can be evenly distributed.
   4. Each layer of clay liner shall be uniform as to material, density and moisture content before beginning compaction.
      a. No material placed in the clay liner by dumping in a pile or windrow shall be incorporated in a layer in that position, but all such piles or windrows shall be moved by blading or similar methods.
      b. Clods or lumps of materials shall be reduced in size to a maximum dimension of 1 IN and the clay liner material mixed by blading, harrowing, disking or similar methods to the end that a uniform material of uniform density is secured in each layer.
      c. As described in the SLQCP, it may be necessary to reduce particle size to less than 1 IN to achieve a uniform moisture content.

d. Water required for sprinkling to bring the material to the moisture content necessary for maximum compaction shall be evenly applied and it shall be the responsibility of the Contractor to secure a uniform moisture content throughout the layer by such methods as may be necessary.
e. In order to facilitate uniform wetting of the clay liner material, the Contractor may apply water at the material source or in the stockpile area.
f. Such procedure shall be subject to the approval of the Geotechnical Professional.

C. Density of Constructed Clay Liner:
1. Compaction of clay liners shall be obtained by the method hereinafter described as the "Density Control" method.
a. Under the "Density Control" method of compaction, each layer shall be compacted to the required density utilizing either a pad/tamping foot or a sheepsfoot roller.
b. The compaction equipment must have adequate cleaning devices to allow full penetration of the lift thickness.
c. Bulldozers and other low pressure, high vibration equipment may not be used to compact clay liner.
d. The depth of layers prior to compaction shall depend upon the type of sprinkling and compacting equipment used.
e. The loose lift thickness shall not exceed the pad/foot length of the compaction equipment prior to and in conjunction with the rolling operation.
f. In no instance shall loose-lift thickness exceed eight (8) IN.
g. Each layer shall be brought to the moisture content necessary to obtain the required density and shall be kept leveled with suitable equipment to insure uniform compaction over the entire layer.
2. For each layer of clay liner material, it is the intent of this specification to provide the density as required herein.
a. Clay materials shall be sprinkled as required to provide not less than optimum moisture and compacted to at least 95 percent of Standard Proctor Density (ASTM D698).
b. After each layer of clay liner is complete, testing will be conducted by the Geotechnical Professional in accordance with the SLQCP.
c. If the clay liner layer fails to meet the minimum standard specified in the SLQCP, the layer shall be reworked as necessary to meet the minimum standards.
d. The compaction/moisturization method shall be altered on subsequent work, as necessary, to obtain minimum standards.
e. Such procedure shall be determined by, and subject to, the approval of the Geotechnical Professional.

D. Tolerances:
1. Any tests falling outside of the minimum standards established by these Specifications and in the SLQCP shall require the Contractor to rework the area not conforming to these Specifications and retest to establish conformance with these Specifications.
a. Retesting shall be paid for by the Contractor as described in the Contract Documents.

E. Construction of Clay Liner:
1. As shown in the typical section of the plans and in the SLQCP, a clay liner will be constructed in the areas identified on the plans.
a. The liner will be constructed using clay materials obtained from the borrow area.
b. The clay borrow shall meet the minimum standards described in the SLQCP.
c. The liner shall be compacted in maximum 8 IN loose lifts at a moisture content of optimum to 4 percent above and compacted to the extent necessary to obtain at least 95 percent of Standard Protector Density.
d. Equipment shall be adequately equipped to moisten or dry the soil to meet the moisture requirement.
e. Scarification and moisture application shall be provided between lifts, as necessary, to ensure adequate lift bonding.

f. The clay liner shall actually be one continuous, homogeneous soil mass without any change in soil material or discernable interfaces of any sort.
g. This method of construction shall be continued up to the lines and grades shown in the plans.
h. Equipment traffic across completed liner sections/lift should be avoided to minimize problems associated with rutting and/or over compaction.
i. Water should not be allowed to pond on completed lifts and/or liner section.
j. Lifts that become desiccated and/or disturbed shall be reworked and retested.
k. It is recommended that in periods of hot weather or impending rain that the surface of the clay liner be smooth rolled at the end of each day to minimize desiccation or introduction of excess moisture.

2. The final lift surface of the clay liner shall be free of particles larger than 3/8 IN or other objectionable material.
3. The finished clay liner shall be smooth-rolled and maintained in a moist condition.

END OF SECTION

SECTION 02405
CARE OF WATER DURING CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Addresses:
   1. Removal of surface water and groundwater as needed to perform the required construction in accordance with the specifications.
      a. It includes building and maintaining all necessary temporary impounding works, channels, and diversions, furnishing all labor and installing and operating all necessary pumps, piping trenches and other facilities.
      b. It also includes equipment and materials, and removing all such temporary works, equipment and materials after they have served their purposes in strict accordance with this Section of the Specifications and the applicable Drawings, and subject to the terms and conditions of the Contract Documents.

PART 2 - PRODUCTS

2.1 GEOTEXTILE

A. The geotextile for the dewatering trench, if needed, shall be in accordance with Specification Section 02778.

2.2 DRAIN PIPE

A. The drain pipe, if needed, shall be in accordance with Specification Section 15065 and the Contract Drawings.

2.3 AGGREGATE

A. The aggregate shall be in accordance with Specification Section 15065.

PART 3 - EXECUTION

3.1 GENERAL

A. Plans and procedures for handling flood flows and dewatering excavations shall be submitted for approval.
   1. Any construction modifications to the system shall also be submitted.
   2. Approval does not relieve the Contractor of full responsibility and liability for care of water during construction.

3.2 FLOOD FLOWS AND OTHER WATER

A. The Contractor shall be responsible for handling and diverting any flood flows, surface water, perched water, groundwater or any other water encountered during the progress of the work.

B. The Contractor shall build, maintain, and operate all channels, flumes, sumps, and other temporary works needed to pass floodwater or pass other surface water or groundwater through or around the construction site and away from construction work while it is in progress.

C. Unless otherwise approved by the Engineer, a diversion must discharge into the same natural watercourse in which its headworks are located.

D. All permanent work shall be constructed in areas free from water.

E. Full responsibility for the successful dewatering of the work areas shall rest with the Contractor.
   1. The removal of all protective works, after having served their purpose, shall be in a manner satisfactory to the Engineer.

F. Impounded water may be used for construction so long as the quality of the water does not interfere with the desired results of the product.

3.3 DEWATERING EXCAVATED AND OTHER FOUNDATION AREAS

A. The Contractor shall be responsible for dewatering foundations for all areas during construction of the works of improvement, including areas of required backfills.
   1. Those areas shall have the water table lowered to keep all areas free of standing water or excessive muddy conditions as needed for proper performance of the construction work.

B. The Contractor shall install the underdrain system, piping, filtering system and de-watering sumps at the earliest possible time in order to draw the water table down prior to construction of the clay liner.

C. The Contractor shall furnish or prepare all drains, sumps, casings, well points and other equipment needed to dewater areas for required construction work.
   1. The Contractor shall keep available standby equipment to provide the proper and continuous operation of the dewatering system.

D. The Contractor shall provide continuous monitoring (24 HRS/DAY) of the dewatering system to provide continuous operation.

3.4 DEWATERING BORROW AREAS

A. Unless otherwise specified on the Drawings, the Contractor shall maintain the borrow areas in drainable condition or otherwise provide for timely removal of surface water that accumulate, for any reason, within the borrow areas. Upon completion of the project the borrow areas shall be graded so they do not impound water.

3.5 EROSION CONTROL

A. See Specification Section 02270.

3.6 HANDLING OF ASH-WASTE CONTAMINATED WATER

A. Groundwater or runoff water which has come in contact with the coal combustion by-products shall be designated as “contaminated” and must not be allowed to enter adjacent streams or otherwise exit the site.
   1. The contractor may use any of the following three options for managing this water:
      a. Coordinate with Owner to pump water into the West Ash Pond and back into Plant operations;
      b. Treat water and release in accordance with SWPPP; or
      c. Pump to an approved designated holding area on the interior of the site, as approved by Luminant’s Environmental Services.
         1) Such designated holding areas will be located within 2,000 LF of the excavation being dewatered.

B. The Contractor shall be required to construct temporary earthen dikes or take other precautionary measures as required to contain any contaminated water when encountered and until pumped to designated contaminated water areas.
   1. Any dewatering equipment or materials used in contaminated water shall be flushed or washed with uncontaminated water prior to reusing such equipment or materials in uncontaminated water areas.
   2. All wash water shall also be pumped to an approved designated contaminated water holding areas.

3. All Contaminated water created during construction shall be treated and properly disposed at no additional cost to the Owner.

END OF SECTION

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SECTION 02515
PRECAST CONCRETE MANHOLE STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Precast concrete manhole structures and appurtenant items.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02221 - Trenching, Backfilling, and Compacting for Utilities.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. A48, Standard Specification for Gray Iron Castings.
      b. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
      c. D1227, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
      d. D4586, Standard Specification for Asphalt Roof Cement, Asbestos-Free.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.

1.4 SITE CONDITIONS

A. For this project, the groundwater elevation encountered during soil boring operations was approximately 306 FT.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Manhole rings, covers and frames:
      a. Neenah Foundry.
      b. Deeter Foundry.
   2. Black mastic joint compound:
      a. Kalktite 340.
      b. Tufflex.
      c. Plastico.
   3. Premolded joint compound:
      a. Ram Nec.
      b. Kent Seal.
   4. Emulsified fibrated asphalt compound:
      a. Sonneborn Hydrocide 700B Semi-Mastic.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MANHOLE STRUCTURE COMPONENTS

A. Manhole Components:
   1. Reinforcement: ASTM C478.
   2. Minimum wall thickness: 5 IN.
   3. Minimum base thickness: 12 IN.
   4. Provide the following components for each manhole structure:
      a. Base cast-in-place.
      b. Precast barrel section(s).
      c. Precast eccentric transition section.
      d. Precast adjuster ring(s).
      e. Precast concrete transition section.
      f. Precast flat top.
   5. Provide manhole sections with inside dimensions as noted on the plans.

B. Nonpressure Type Frames and Cover:
   1. Cast iron frame and covers: ASTM A48, Class 35 (minimum).
   2. Use only cast iron of best quality, free from imperfections and blow holes.
   3. Furnish frame and cover of heavy-duty construction a minimum total weight of 450 LBS.
   4. Machine all horizontal surfaces.
   5. Furnish unit with solid nonventilated lid that can be bolted closed, and with concealed pickholes.
   6. Ensure minimum clear opening of 24 IN DIA.

C. Special Coatings and Joint Treatment:
   1. Joints of precast sections:
      a. Black mastic compound: ASTM D4586.
   2. Vertical wall surfaces:
      a. Emulsified fibrated asphalt compound meeting ASTM D1227 Type I for all exterior vertical wall surfaces.

PART 3 - EXECUTION

3.1 MANHOLE CONSTRUCTION

A. General:
   1. Construct cast-in-place concrete base slabs.
   2. Make inverts with a semi-circular bottom conforming to the inside contour of the adjacent pipe sections.
   3. Shape inverts accurately and steel trowel finish.
      a. Pour base slab integral with bottom barrel section.

B. Build each manhole to dimensions shown on plans and at such elevation that pipe sections built into wall of manhole will be true extensions of line of pipe.

C. Install a resilient O-ring type gasket or pre-molded joint compound for all horizontal joints.

D. Seal all pipe penetrations in manhole.
   1. Form pipe openings smooth and well shaped.
   2. After installation, seal cracks with, non shrink grout.
   3. After grout cures, wire brush smooth and apply two coats emulsified fibrated asphalt compound to minimum wet thickness of 1/8 IN to ensure complete seal.

E. Set and adjust frame and cover final 6 IN (minimum) to 18 IN (maximum) to match elevation of precast flat top of manhole.

END OF SECTION

SECTION 02775

HIGH-DENSITY POLYETHYLENE (HDPE) GEOMEMBRANE LINER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Furnishing, installation, quality control, and testing of a HDPE geomembrane liner.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02200 - Earthwork.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society for Testing and Materials (ASTM):
      a. D413, Standard Test Method for Rubber Property Adhesion to Flexible Substrate.
      b. D638, Standard Test Method for Tensile Properties of Plastics.
      c. D792, Standard Test Methods for Specific Gravity and Density of Plastics by Displacement.
      d. D882, Standard Test Methods for Tensile Properties of Thin Plastic Sheeting.
      e. D1004, Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
      f. D1505, Standard Test Method for Density of Plastics by the Density-Gradient Technique.
      g. D1603, Standard Test Method for Carbon Black in Olefin Plastics.
      h. D3895, Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry.
      i. D4218, Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.
      j. D4437, Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes.
      k. D4833, Index Puncture Resistance of Geotextiles, Geomembranes and Related Products.
      l. D4873, Identification, Storage and Handling of Geosynthetic Rolls.
      m. D5199, Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.
      n. D5397, Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test.
      o. D5596, Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.
      p. D5641, Geomembrane Seam Evaluation by Vacuum Chamber.
      q. D5721, Standard Practice for Air-Oven Aging of Polyolefin Geomembranes.
      r. D5820, Pressurized Air Channel Evaluation of Dual Seamed Geomembranes.
      s. D5885, Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry.
      t. D5994, Standard Test Method for Measuring the Core Thickness of Textured Geomembranes.
      u. D6392, Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.
   2. Geosynthetic Research Institute (GRI):
      a. GM11, Accelerated Weathering of Geomembranes Using a Fluorescent UVA-Condensation Exposure Device.

b. GM12, Measurement of the Asperity Height of Textured Geomembranes Using a Depth Gage.
c. GM13, Test Properties, Testing Frequency and Recommended Warrant for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes.

B. Quality Assurance Testing by Owner:
1. The Owner or Engineer's representative will conduct independent testing to support the construction quality assurance program and to provide documentation of such.
2. Facilitate and provide opportunities as required.

C. Qualifications:
1. Manufacturer: Demonstrate 5 years continuous experience with a minimum of 10,000,000 SF of HDPE geomembranes.
2. Installer:
a. Demonstrate five (5) years continuous experience with a minimum 10,000,000 SF of HDPE geomembranes.
b. Trained by at least one of the named manufacturers in this Specification (not necessarily the Manufacturer supplying materials for this Project).
3. Independent Testing Laboratory shall demonstrate three (3) years of continuous experience in similar geosynthetic materials testing.
a. The Independent Testing Laboratory shall be employed by the Contractor, not the Installer.

D. Certifications:
1. Certifications are required for various aspects of the project related to the HDPE geomembrane liner system construction.
a. Unless alternately approved, the certificates provided at the end of this Section shall be used and no alterations, additions, deletions, or exception shall be made to the specified language.

1.3 DEFINITIONS

A. Manufacturer:
1. Manufacturer producing geomembrane sheets from resin and additives, and/or fabricating special items from HDPE materials.

B. Installer:
1. When reference is made to Installer as a person, the Installer is the crew foreman actually performing or supervising the hands-on work in the field.
2. Provide certification of Installer's training, experience and methods for welding, seaming, jointing and inspecting geosynthetic materials installations in compliance with Manufacturer's standards and with Quality Assurance requirements of this Specification (Article 1.2).

C. Independent Testing Laboratory:
1. The firm hired by the Contractor to perform destructive testing of the HDPE geomembrane.
2. Firm shall be acceptable to Engineer and the Owner.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Submit Shop Drawings for Engineer's approval, including:
a. Manufacturer's certification that raw materials and sheet materials comply with required material properties.
1) No faxed copies.
b. Manufacturer/Fabricator/Installer quality control manuals.
c. Qualifications and experience of key personnel involved in installation/inspection of the geosynthetic materials.

d. HDPE Geomembrane layout plan with proposed size, type, number, position and sequencing of liner panels and showing the location and direction of all field or factory seams.
    1) Proposed details for connecting the geosynthetic materials to appurtenances.
    2) Proposed methods of welding, seaming or jointing geosynthetic materials.
    3) Proposed method and sequencing for placement of geocomposite and geonet on top of the lower HDPE geomembrane liner, and concrete revetment mat on the upper HDPE geomembrane liner.
    4) Proposed method of testing HDPE geomembrane and other geosynthetic materials, joints and connections at appurtenances for continuity.

B. Miscellaneous Submittals:
1. Test results:
    a. Resin tests, tests of sheet material and factory seam tests at frequency specified in respective quality control manuals.
        1) Results shall include or bracket the rolls delivered for use in the Work.
    b. Daily test seam results.
    c. Daily results of production seam testing.
    d. Destructive seam test results by Installer and Independent Testing Laboratory.
2. Warranties as described below.
3. Submit written certifications that:
    a. Utilize certification forms from this Section unless alternately approved.
        1) Make appropriate number of copies, as required.
        2) Complete and sign appropriate form daily.
    b. The HDPE geomembrane material delivered to site meets the requirements of this Specification.
    c. The HDPE geomembrane was received and accepted in undamaged condition from shipper.
    d. The subgrade has been properly prepared and acceptable for the placement of the HDPE geomembrane.
    e. The HDPE geomembrane liner was installed in accordance with this Specification and with approved Shop Drawings.
    f. The field tensiometer and gages were calibrated within six months of use on this project.
    g. The HDPE geomembrane joints were inspected, tested for strength and continuity, and passed all inspections and tests.
        1) All test and inspection data shall be incorporated into this certification.
    h. The geocomposite, geonet, geotextiles, granular material and concrete revetment mat on top of the HDPE geomembrane liner were placed properly and carefully.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle and store HDPE geomembrane in accordance with the manufacturer's recommendations and ASTM D4873.

B. Label each roll with the manufacturers name, type, lot number, roll number, and roll dimensions (length, width, gross weight).
1. Repair or replace HDPE geomembrane or plastic wrapping damaged as a result of storage or handling, as directed.
2. Do not expose HDPE geomembrane to temperatures in excess of 71 DegC (160 DegF) and below 0 DegC (32 DegF).

C. Do not use hooks, tongs or other sharp instruments to handle the HDPE geomembrane.
1. Do not lift rolls by use of cables or chains in contact with the HDPE geomembrane.
2. Do not drag HDPE geomembrane along the ground.

1.6 WARRANTIES

A. Written warranties addressing HDPE geomembrane material and installation workmanship shall be furnished by the Contractor and shall be made out to the Owner.

B. Submit material samples and warranties prior to shipment.

C. Suitability of geosynthetic liner system shall be subject to Owner approval of warranty.
   1. The Manufacturer's warranty shall state that the furnished material meets all requirements of the Contract Drawings and Specifications and that under local atmospheric conditions the sheet material is warranted for 20 years, prorated.
   2. The Installer's warranty shall state that the materials were properly installed, properly (field and factory) welded, seamed and jointed and will not fail within two years of the installation under similar conditions.
      a. Warranty shall not be prorated.

D. Warranties shall provide for complete repair/replacement at no additional cost to the Owner for the warranty period.

1.7 PROJECT/SITE CONDITIONS

A. When the weather is of such a nature as to endanger the integrity and quality of the installation whether this is due to rain, high winds, cold temperatures, or other weather elements, stop the installation until the weather conditions are satisfactory.

B. Ensure that adequate dust control methods are in effect to prevent the unnecessary accumulation of dust and dirt on surfaces which hamper efficient field seaming or performance.

C. Maintain surface water drainage diversions around the work area and provide for the disposal of water which may collect in the work area from precipitation falling within the area or from inadequate diversion structures or practices.

D. Coordinate with the installation of the materials installed above the HDPE geomembrane.

E. When damage is suspected, uncover area, repair damage if required, and recover area at no cost to the Owner.
   1. Suspect areas may be identified by the Owner or Engineer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents the following Manufacturers are acceptable:
   1. HDPE Geomembrane liners:
      a. GSE Lining Technology, Inc., 19103 Gundle Rd., Houston, Texas 77073.
      b. Agru America, Inc., 700 Rockmead, Suite 150, Kingwood, Texas 77339.
      c. Poly-Flex, Inc., 2000 West Marshall Drive, Grand Prairie, Texas 75051.

B. Submit request for substitution in accordance with Specification Section 01640.

2.2 MATERIALS

A. HDPE Geomembrane Liner:
   1. Consist of unreinforced polyethylene.
      a. HDPE geomembrane, smooth both sides: Thickness 60 mils.
      b. HDPE geomembrane, textured both sides: Thickness 60 mils.
      c. Manufactured from virgin, first quality resin designed and formulated specifically for liquid containment in hydraulic structures.
      d. Reclaimed polymer shall not be added to the resin; except use of polymer recycled during the manufacturing process shall be allowed provided that recycled polymer shall be clean and shall not exceed 10 percent by weight.

e. Add no fillers or post consumer resin prior to or during manufacture of the HDPE geomembrane.

2. Manufactured to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter.
   a. Any such defects shall be cause for rejection of the material.
   b. Minor defects may be repaired in accordance with Manufacturer's recommendations if approved by the Engineer.
3. Manufactured as seamless rolls or as prefabricated panels.
   a. Minimum width: 22 FT as delivered to the site.
   b. All factory seams shall be inspected and tested for strength and continuity prior to delivery to the site.
4. Contractor shall coordinate with Manufacturer to consider if roll lengths could be provided that would extend across the short length of the area to be lined without requiring a field seam.
5. Specifications:
   a. Smooth and textured HDPE geomembrane shall possess properties which meet or exceed the following minimum GRI GM-13 requirements:

PROPERTY	TEST METHOD	TEST VALUE	
		SMOOTH	TEXTURED
Thickness (min average)		60 mils	60 mils
- lowest indiv. For 8 out of 10 values	D5994/D5199	-10 %	-10%
- lowest indiv. For any of the 10 values		NA	-15%
Asperity Height (min. ave.)	GM12	NA	10 mil
Density (min. ave.)	D1505/D792	0.940 g/cc	0.940 g/cc
Tensile Properties (min. ave.) (1)	D638 Type IV		
- yield stress		126 LB/IN	126 LB/IN
- break stress		288 LB/IN	90 LB/IN
- yield elongation		12 %	12%
- break elongation		700%	100%
Tear Resistance (min. ave.)	D1004	42 LB	42 LB
Puncture Resistance (min. ave.)	D4833	108 LBS	90 LB
Stress Crack Resistance (2)	D5397 (App.)	300 HR	300 HR
Carbon Black Content (range)	D1603 (3)	2.0-3.0%	2.0-3.0%
Carbon Black Dispersion	D5596	Note (4)	Note (4)
Oxidative Induction time (OIT) (min. ave.)			
(a) Standard OIT	D3895	100 min	100 min
or			
(b) High Pressure OIT	D5885	400 min	400 min
Oven Aging at 85 DegC (5), (6)	D5721		
(a) Standard OIT (min. ave.)	D3895	55 %	55%
or			
(b) High Pressure OIT (min. ave.) % retained after 90 days	D5885	80%	80%
UV Resistance (7)	GM11		

PROPERTY	TEST METHOD	TEST VALUE	
		SMOOTH	TEXTURED
(a) High Pressure OIT (min. Ave.) % retained after 1600 HRS (8)	D5885	50%	50%

1) Machine direction (MD) and cross machine direction (XMD) average values shall be on the basis of 5 test specimens each direction:
   a) Yield elongation is calculated using a gage length of 1.3 IN.
   b) Break elongation is calculated using a gage length of 2.0 IN.
2) The SP-NCTL test shall be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
   a) The yield stress used to calculate the applied load for the SP-NCTL test shall be the manufacturer's mean value via MQC testing.
3) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to ASTM D1603 (tube furnace) has been established.
4) Carbon black dispersion for 10 different views:
   a) Minimum 8 of 10 in Categories 1 or 2.
   b) All 10 in Categories 1, 2, or 3.
5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
6) Evaluate supplies at 30 and 60 days to compare with the 90 day response.
7) The condition of the test should be 20 HR UV cycle at 75 DegC followed by 4 HR condensation at 60 DegC.
8) UV resistance is based on percent retained value regardless of the original HP-OIT value.

2.3 EQUIPMENT AND ACCESSORIES

A. Welding and Seaming Equipment:
   1. Equipped with gages showing temperatures at the nozzle (extrusion welder) or at the wedge (wedge welder).
   2. Maintained in adequate numbers to avoid delaying work.
   3. Supplied by a power source capable of providing constant voltage under a combined-line load.
   4. Do not place electric generator directly on the HDPE geomembrane.

B. Field Tensiometer:
   1. Provide a tensiometer for on-site shear and peel testing of HDPE geomembrane seams.
      a. Tensiometer shall be in good working order.
      b. Built to ASTM specifications.
      c. Accompanied by evidence of calibration of equipment and gages within the past six months.
   2. Tension meter:
      a. Motor driven.
      b. Jaws capable of traveling a measure rate of 2 IN per minute.
      c. Equipped with a gauge that measures the force in unit pounds exerted between the jaws.
      d. Digital readout:
         1) Analog dial type gauges will be accepted provided they meet the criteria in Part 2.3F of this section, and are equipped to display peak values.

C. Punch Press:
   1. Provide a punch press for the onsite preparation of specimens for testing.
   2. Capable of cutting specimens in accordance with ASTM D4437.

D. Vacuum Box:

1. Provide a vacuum box for onsite testing of HDPE geomembrane seams in accordance with ASTM D5641.

E. Equipment necessary to perform "Pressurized Air Channel Evaluation of Dual Seamed Geomembranes" in accordance with ASTM D5820.

F. Gages:
   1. Calibrated within past six months.
   2. Specified test values reading near mid-range of the gage scale.

2.4 MANUFACTURE AND FABRICATION

A. Produce geomembrane sheet which complies with this Specification.

B. Provide resin and additive quality control.

C. Fabricated Specials:
   1. Subject to same level of manufacturer's quality control.
   2. Fabricated from project rolls.
      a. Provide traceability of resin and roll stock.

PART 3 - EXECUTION

3.1 GEOSYNTHETIC LINER SYSTEM

A. Geomembrane Subgrade:
   1. Protect subgrade at all times from damage until such time as the placement of HDPE geomembrane liner and other components of the geosynthetic liner system are complete.
   2. The subgrade shall be prepared in a manner consistent with proper subgrade preparation techniques for the installation of HDPE geomembrane.
      a. The subgrade shall be properly compacted so as not to settle and cause excessive strains in the HDPE geomembrane or other synthetic liner materials.
      b. Prior to installation, ensure a surface free of debris, roots, or angular stones larger than 1/2 IN.
      c. In addition, ensure that the subgrade has been smooth rolled to provide a uniform surface.
      d. During installation, ensure that rutting or raveling is not caused by installation equipment or weathering.
   3. See Section 02200.

B. Anchorages:
   1. Geosynthetic materials placed on side slopes shall be anchored as detailed on the plans.
   2. Excavation, backfill and compaction shall be in accordance with Section 02200.

C. HDPE Geomembrane:
   1. General:
      a. Installer of HDPE geomembranes is responsible for handling, fitting, welding, seaming, jointing and testing the geomembranes.
      b. These responsibilities include but are not limited to:
         1) Acceptance (in writing) of the geomembrane materials from the transporter.
         2) Acceptance (in writing) of the soil or liner subgrade which will serve as a base for the HDPE geomembrane.
            a) This acceptance shall precede installation of the HDPE geomembrane.
            b) Shall state that the Installer has inspected the surface, and reviewed the Specifications for material and placement, and finds all conditions acceptable for placement of HDPE geomembrane liners.
            c) Shall explicitly state any and all exceptions to acceptance.

3) Handling, welding, seaming, jointing, testing and repair of HDPE geomembranes in compliance with this Specification and with written procedures manuals prepared by the Manufacturer or Fabricator.
    a) HDPE Geomembrane shall not be placed upon frozen foundation, standing water or other conditions which will result in deterioration of the foundation.
    b) HDPE Geomembrane liner materials shall be laid out according to plans previously approved by the Engineer.
    c) Adjacent rolls of HDPE geomembrane shall overlap a minimum of 4 IN, provided that greater overlap may be required to allow seaming in accordance with the Manufacturer's instructions.
4) Repair or replacement of defects in the geosynthetic materials as required by the Engineer.

2. Panel deployment:
    a. Only those panel/sheets that can be seamed in 1 day shall be deployed.
    b. Place panels with minimal handling.
        1) Orient sheets to eliminate or minimize number of horizontal seams on side slopes.
        2) Protect panels from tear, puncture or abrasion.
        3) No seams will be permitted in trenches.
        4) Do not drag sheets for deployment.
    c. Equipment used to deploy the geomembrane shall not rut the constructed clay liner.
        1) A rut is defined as a 0.1 FT depression over a 10 FT straight-edged length.
    d. Minimize foot traffic.
        1) Do not allow personnel access to wet or slippery liners without adequate safety precautions.
    e. Ballast with sandbags to prevent wind uplift as recommended by Manufacturer and based on local climatic conditions.
        1) Remove and replace all wind damaged panels at no additional cost to Owner.
        2) If wind causes panels to be displaced, displaced panel may not be reused.
        3) Do not throw or slide sandbags across geomembrane.
    f. Install HDPE geomembrane in stress free, tension free and relaxed condition.
        1) Account for temperature and weather-related impacts when deploying and covering.
        2) Stretching to fit and folding are not permitted.
    g. Do not allow HDPE geomembrane to bubble, fold, or create ripples as a result of placement of overlying liner system components.
        1) Except as noted on the plans, no folds in HDPE geomembrane will be allowed.
    h. Any panel exhibiting stretching caused by placement, covering techniques, or wind shall be removed and may not be incorporated in the final construction.
3. Field seaming:
    a. Perform in accordance with seaming recommendations furnished by the geomembrane Manufacturer.
    b. Surfaces to be seamed shall be clean and dry at the time of seaming.
        1) Precipitation and ponding of water on the HDPE geomembrane shall cause termination of seaming operations.
        2) Do not seam HDPE geomembrane when ambient temperatures are below 32º F or above 104º F, without written consent of HDPE geomembrane Manufacturer and Engineer.
    c. Seam sheets continuously without fishmouths or breaks in the seam.
        1) Where fishmouths are unavoidable, slit sheet to a point such that the sheet lies flat and with no remaining wrinkle.
        2) The two (2) edges of the slit shall be seamed together provided that the overlap for this seam shall be a minimum of 6 IN.
        3) Areas of the slit which do not achieve an overlap of 6 IN, including the terminus of the slit, shall be provided with a patch as discussed below.
    d. Seam all HDPE geomembranes with thermal fusion methods as recommended by the HDPE geomembrane manufacturer.

1) HDPE geomembrane seaming shall be double wedge weld unless otherwise approved or prohibited by construction.

e. Manufacturer's seaming instructions shall specifically address subgrade preparation, seaming materials, temporary and permanent jointing, seaming temperatures including temperatures for seaming materials, seam finishing and curing.

f. A copy of manufacturer's seaming instructions shall be available on site at all times and shall not be deviated from without written approval of the Manufacturer and Engineer.

g. All panels/sheets should be overlapped a minimum of 4 IN.
   1) If horizontal seams are required on side slopes, lap the upper panel over the lower panel.

h. Do not conduct seaming in the presence of standing water and/or soft subgrades.
   1) Clean the seamed area of dust, dirt and foreign material prior to and during the seaming operation.

i. Extend seaming to the outside edge of panels/sheets to be placed in anchor and/or drainage trenches.

j. Tack welds shall conform with Manufacturer's seaming techniques and shall not damage underlying membrane.

4. Patching:
   a. Repair defects in and damage to HDPE geomembrane sheets by seaming a patch over the defect.
      1) Use an undamaged piece of HDPE geomembrane cut to provide a minimum of 6 IN of overlap in all directions from the defect.
      2) Round the corners on all patches.
      3) Replace torn or permanently twisted HDPE geomembrane at no expense to the Owner.
   b. Test all patch seams using one of the following nondestructive tests: vacuum tests, spark tests, or ultrasonic tests.
      1) Test patch seams destructively as directed by the Engineer.
      2) This destructive testing may be accomplished using demonstration seams performed adjacent to the liner installation.

3.2 FIELD QUALITY CONTROL

A. Trial Seam Testing:
   1. Trial seams shall be made each half-day prior to production seaming, or seaming is interrupted for more than 10 minutes, and at other times as the discretion of the Installer and Engineer.
      a. The location of trial seam shall be in an area proposed for the day's production seaming.
      b. Equipment, methods and personnel shall be the same as proposed for the day's seaming.
   2. Samples shall be cut and tested in accordance with ASTM D6392 and tested in accordance with ASTM D413 and ASTM D882.
      a. To be acceptable, five (5) of five (5) replicate test specimens must meet specified seam strength requirements and failures shall be Film Tear Bond.
      b. If the field tests fail to meet these requirements, the entire operation shall be repeated.
      c. If the additional test seams fail, the seaming apparatus or seamer shall not be accepted or used for seaming until the deficiencies are corrected and two consecutive successful test seams are achieved.

B. Non-Destructive Seam Testing:
   1. All field seams shall be non-destructively tested over their full length.
      a. Seam testing shall be performed as the seaming work progresses, not at the completion of field seaming.
      b. All testing shall be documented.
      c. Any seams which fail shall be repaired and documented.
   2. Non-destructively test all field seams continuously using one of the following nondestructive seam tests: Vacuum box, ultrasonic tests, spark tests, or pressurized air channel test.

C. Destructive Seam Testing:
   1. Frequency of samples:
      a. Not exceeding one (1) test per 500 LF of seamed length.
      b. Other samples as Engineer determines appropriate, shall be obtained at locations specified by the Engineer.
      c. The sample frequency may be increased or decreased, based on the Engineer's review of the Work, installer's quality control procedures and test results.
   2. Sample locations shall not be identified prior to seaming.
      a. The samples shall be a minimum of 12 IN wide by 48 IN long with the seam centered lengthwise.
      b. All destructive seam sample holes shall be repaired the same day as cut.
      c. Cut each sample into three equal pieces with one piece retained by the Installer, one piece given to an Independent Testing Laboratory, and the remaining piece given to the Engineer for quality assurance testing and/or permanent record.
      d. Each sample shall be numbered and recorded on the final panel layout record drawing, and cross-referenced to a field log which identifies:
         1) Panel/sheet number.
         2) Seam number.
         3) Top of sheet.
         4) Date and time cut.
         5) Ambient temperature.
         6) Seaming unit designation.
         7) Name of seamer.
         8) Seaming apparatus temperature and pressures (where applicable).
   3. Cut a minimum of ten (10) 1 IN wide replicate specimens from the Installer's sample.
      a. Test a minimum of five (5) specimens for shear strength and five (5) for peel adhesion using an approved field quantitative tensiometer.
      b. Jaw separation speed shall be 2 IN per minute.
      c. To be acceptable, four (4) out of five (5) replicate test specimens must meet the specified seam strength requirements and fail as Film Tear Bond.
   4. The minimum required seam strengths:
      a. 60 mil HDPE geomembrane:

MODE	TEST METHOD	MINIMUM VALUE (LBS/IN)
Peel	ASTM D6392	78
Shear	ASTM D6392	120

   5. If the field tests pass, five (5) specimens shall be tested at the Independent Testing Laboratory for shear strength and five (5) for peel adhesion in accordance with ASTM D6392.
      a. Test both sides of a dual-track weld.
      b. To be acceptable, four (4) out of five (5) replicate test specimens must meet the specified seam strength requirements and fail as Film Tear Bond.
      c. If the field or laboratory tests fail, the seam shall be repaired in accordance with the Manufacturer's Quality Control manual.
      d. Certified test results on all field seams shall be submitted to and approved by the Engineer prior to acceptance of the seam.
   6. The Engineer may separately conduct destructive testing for quality assurance.
      a. If samples tested by Engineer fail based on above criteria, seam will be classified as failed.
   7. A map showing the locations, number, date and type of all patches shall be prepared and provided to the Owner.

3.3 HDPE GEOMEMBRANE LINER ACCEPTANCE

A. Contractor shall retain all ownership and responsibility for the HDPE geomembrane liner until final acceptance by the Owner. The Owner will accept the HDPE geomembrane liner installation when the installation is finished and all required warranties, test results, and documentation from the Contractor, Manufacturer, and Installer has been received and approved, and verification of the adequacy of all field seams and repairs, including associated testing, is complete.

B. Submittal of such documentation shall be a condition precedent to Substantial Completion.

3.4 SCHEDULE OF CERTIFICATIONS

A. The schedule of required certifications and signing parties follows the end of this Section.

B. The certificates following the end of this Section shall be completed and signed by the required parties, and the original certificates delivered to the Engineer's representative as a part of the completion of that particular phase of the geosynthetic liner system installation.

END OF SECTION

LUMINENT MARTIN LAKE STEAM ELECTRIC STATION
RELINE EAST ASH POND
RUSK COUNTY, TEXAS

	CERTIFICATE	**SIGNATURES REQUIRED**
1.	Certification of Raw and Fabricated Material	Manufacturer Fabricator
2.	Certification of Material Acceptance from Shipper	Installer Contractor
3.	Certification of Acceptance of Subgrade	Installer Contractor
4.	Certification of Material Installation	Installer Contractor
5.	Certification of Material Joints	Installer Contractor
6.	Certification of Placement of Adjacent Liner Components	Installer Contractor

LUMINENT MARTIN LAKE STEAM ELECTRIC STATION
RELINE EAST ASH POND
RUSK COUNTY, TEXAS

CERTIFICATION OF RAW AND FABRICATED MATERIAL
(To Accompany Each Shipment) (Circle Material Type)

DATE:_____

MATERIAL DESCRIPTION:_____

_____
(include lot and roll/panel numbers)

WE THE UNDERSIGNED CERTIFY THAT THE RAW MATERIAL AND FINISHED [*HDPE GEOMEMBRANE MATERIAL, GEOCOMPOSITE, GEONET, GEOTEXTILES*] FURNISHED FOR THE EAST ASH POND COMPLY WITH SPECIFICATION SECTION 02775, 02777, 02778 FOR RELINING THE EAST ASH POND.

_____
MANUFACTURER NAME

_____
MANUFACTURER SIGNATURE (Authorized Representative)

_____
FABRICATOR NAME

_____
FABRICATOR SIGNATURE (Authorized Representative, if different from Manufacturer)

LUMINENT MARTIN LAKE STEAM ELECTRIC STATION
RELINE EAST ASH POND
RUSK COUNTY, TEXAS

CERTIFICATION OF MATERIAL ACCEPTANCE FROM SHIPPER
(Per shipment; each roll or container) (Circle Material Type)

REPORT NO.:_____ DATE:_____

PANEL, ROLL, AND CONTAINER NUMBER REFERENCES_____

_____

WE THE UNDERSIGNED ACCEPT THE [*HDPE GEOMEMBRANE MATERIALS (ROLLS, SHEETS, BLANKETS), GEOCOMPOSITE, GEONET, GEOTEXTILES*] FROM THE TRANSPORTER. THESE MATERIALS WERE RECEIVED IN UNDAMAGED CONDITION BASED UPON OUR VISUAL INSPECTION.

_____
INSTALLER SIGNATURE

_____
CONTRACTOR SIGNATURE

LUMINENT MARTIN LAKE STEAM ELECTRIC STATION
RELINE EAST ASH POND
RUSK COUNTY, TEXAS

CERTIFICATION OF ACCEPTANCE OF SUBGRADE - Daily Certification
(Circle Material Type)

REPORT NO.:_____ DATE:_____

AREA REFERENCED:_____

_____

LINER PANEL NUMBERS INSTALLED OVER REFERENCED AREA THIS DATE:

_____

WE THE UNDERSIGNED CERTIFY THAT WE HAVE INSPECTED THE ENTIRE SURFACE, AND HAVE REVIEWED THE SPECIFICATION SECTION [*02775, 02777, 02778*] AND RELATED SHOP DRAWINGS FOR MATERIAL AND PLACEMENT, AND FIND ALL CONDITIONS ACCEPTABLE FOR PLACEMENT OF THE [*HDPE GEOMEMBRANE LINER, GEOCOMPOSITE, GEONET, GEOTEXTILE*].

WE SPECIFICALLY TAKE THE FOLLOWING EXCEPTIONS TO THE ACCEPTANCE OF THE SUBGRADE ON THIS DATE:

_____

_____

_____

(Note: All exceptions shall be approved by Owner or Engineer prior to geosynthetic installation)

_____
INSTALLER SIGNATURE

_____
CONTRACTOR SIGNATURE

LUMINENT MARTIN LAKE STEAM ELECTRIC STATION
RELINE EAST ASH POND
RUSK COUNTY, TEXAS

CERTIFICATE OF MATERIAL INSTALLATION - Daily Certification
(Circle Material Type)

REPORT NO.:_____ DATE:_____

AREA REFERENCED:_____

_____

LINER PANEL NUMBERS INSTALLED THIS DATE:_____

_____

_____

WE THE UNDERSIGNED CERTIFY THAT THE [*HDPE GEOMEMBRANE LINER, GEOCOMPOSITE, GEONET, GEOTEXTILES*] WAS INSTALLED IN ACCORDANCE WITH THE SPECIFICATION SECTION [*02775, 02777, 02778*] AND WITH APPROVED SHOP DRAWINGS.

_____
INSTALLER SIGNATURE

_____
CONTRACTOR SIGNATURE

LUMINENT MARTIN LAKE STEAM ELECTRIC STATION
RELINE EAST ASH POND
RUSK COUNTY, TEXAS

CERTIFICATION OF MATERIAL JOINTS - Daily Certification Per Test
(As Shop Drawings and as a Compiled Report at the end of Project)
(Circle Material Type)

TEST REPORT NO.:_____ DATE:_____

FIELD LOG NO.:_____

LIST OF ALL DEFICIENCIES AND SUBSEQUENT REPAIRS, COPIES OF ALL FIELD AND FACTORY TESTS AND INSPECTION DATA INCLUDING RECORDS OF ALL NON-DESTRUCTIVE TESTING (Field Logs) AND REPAIRS ARE ATTACHED.

WE THE UNDERSIGNED CERTIFY THAT THE [*HDPE GEOMEMBRANE AND ITS JOINTS WERE INSPECTED AND TESTED FOR STRENGTH AND CONTINUITY, GEOCOMPOSITE/GEONET SEAMS WERE TESTED FOR CONTINUITY, GEOTEXTILE SEAMS WERE INSPECTED FOR CONTINUITY, CONCRETE REVETMENT MAT SEAMS WERE TESTED FOR CONTINUITY]* AND PASSED ALL INSPECTIONS AND TESTS. WHERE FAILING TESTS OR DEFICIENCIES OCCURRED, THE AREA OF FAILURE WAS IDENTIFIED IN ACCORDANCE WITH THE APPROVED QUALITY CONTROL PROGRAM FOR THE PROJECT AND REPAIRED. THE AREAS OF FAILING TESTS, DEFICIENCIES AND THE SUBSEQUENT RETESTS OR TESTS TO DELINEATE THE LIMITS OF FAILURE ARE IDENTIFIED IN THE ATTACHED SEAM TESTS AND INSPECTION DATA.

_____
INSTALLER SIGNATURE

_____
CONTRACTOR SIGNATURE

LUMINENT MARTIN LAKE STEAM ELECTRIC STATION
RELINE EAST ASH POND
RUSK COUNTY, TEXAS

CERTIFICATION OF PLACEMENT OF ADJACENT LINER COMPONENTS –
Daily Certifications; Per Material and Location (Circle Material Type)

REPORT NO.:_____ DATE:_____

COMPONENT BEING PLACED:_____

SUBSTRATE:_____

LOCATION:_____

WE THE UNDERSIGNED CERTIFY THAT THE [*HDPE GEOMEMBRANE, GEOCOMPOSITE, GEONET, LEAKAGE COLLECTION SUMP, CONCRETE REVETMENT MAT]* ON TOP OF THE [*CONSTRUCTED CLAY LINER, HDPE GEOMEMBRANE, GEOTEXTILE, GEOCOMPOSITE, GEONET]* WAS CAREFULLY PLACED UNDER MY DIRECT SUPERVISION/OBSERVATION THIS DATE, AND WITHOUT DAMAGING ANY OF THE UNDERLYING OR ADJACENT SUBSTRATE.

_____
INSTALLER SIGNATURE

_____
CONTRACTOR SIGNATURE

SECTION 02777
GEOCOMPOSITE/GEONET

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Geocomposite for use as a leak detection layer.
   2. Geonet-only for use as a leak detection layer.

B. Related sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02775 - High-Density Polyethylene (HDPE) Geomembrane Liner.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society for Testing and Materials International (ASTM):
      a. D4355, Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
      b. D4491, Water Permeability of Geotextiles by Permittivity.
      c. D4533, Trapezoid Tearing Strength of Geotextiles.
      d. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
      e. D4716, Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products.
      f. D4751, Determining Apparent Opening Size of A Geotextile.
      g. D4833, Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
      h. D4873, Identification, Storage and Handling of Geosynthetic Rolls.
      i. D5035, Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method).
      j. D5199, Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
      k. D5261, Test Method for Measuring Mass Per Unit Area of Geotextiles.
      l. D7005, Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites.

B. Qualifications:
   1. Each manufacturing firm shall demonstrate 5 years continuous experience, including a minimum of 5,000,000 SF of geocomposite and geonet production in the past 3 years.
   2. Installer shall attend pre-construction conference.

C. Certifications:
   1. Certifications are required for various aspects of the project related to the geocomposite and geonet.
      a. Unless alternately approved, the certificates provided at the end of Section 02775 shall be used and no alterations, additions, deletions, or exception shall be made to the specified language.

1.3 DEFINITIONS

A. Manufacturer: Manufacturer producing geocomposites from geonet cores and geotextiles, and manufacturer producing geonet.

B. Installer: The Installers are the individuals actually performing the hands-on work in the field.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340.
   2. Shop Drawings:
      a. Manufacturer's documentation that raw materials and roll materials comply with required geocomposite and geonet physical properties.
         1) No faxed copies.
      b. Manufacturer and Installer quality control manuals.
      c. Test results for resins and roll material at frequency specified in respective quality control manuals.
         1) Include or bracket the rolls delivered for use in the Work.
         2) No faxed copies.
      d. Proposed details of anchor trench if different than included in Contract Documents.

B. Miscellaneous Submittals:
   1. Qualification documentation specified in Article 1.2.
   2. Submit written certifications that:
      a. Utilize certification forms from Section 02775 unless alternately approved.
         1) Make appropriate number of copies, as required.
         2) Complete and sign appropriate form daily.
      b. The geocomposite and geonet material delivered to site meets the requirements of this Specification.
      c. The geocomposite and geonet were received and accepted in undamaged condition from shipper.
      d. The subgrade has been properly prepared and acceptable for the placement of the geocomposite and geonet.
      e. The geocomposite and geonet were installed in accordance with this Specification and with approved Shop Drawings.
      f. The HDPE geomembrane liner on top of the geocomposite and geonet was placed properly and carefully.

1.5 DELIVERY, STORAGE AND HANDLING

A. See Section 01600.

B. Label, handle, and store geocomposites and geonets in accordance with ASTM D4873 and as specified herein.

C. Wrap each roll in an opaque and waterproof layer of plastic during shipment and storage.
   1. Do not remove the plastic wrapping until deployment.

D. Label each roll with the manufacturer’s name, material type, lot number, roll number, and roll dimensions (length, width, gross weight).

E. Repair or replace, as directed by the Engineer, geocomposite, geonet, or plastic wrapping damaged as a result of storage or handling.

F. Do not expose geocomposite or geonet to temperatures in excess of 71 DegC (160 DegF) or below 0 DegC (32 DegF) unless recommended by the Manufacturer.

G. Do not use hooks, tongs or other sharp instruments for handling the geocomposite or geonet.

H. Do not lift rolls by use of cables or chains in contact with the geocomposite or geonet.

I. Do not drag geocomposite or geonet along the ground or across textured geomembranes.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   1. Agru America, Inc., 800-373-2478.
   2. GSE Lining Technology, Inc., 800-435-2008.
   3. Poly-Flex, Inc., 888-765-9359.

2.2 MATERIALS AND MANUFACTURE

A. Geonet:
   1. Use nonthermally degraded polyethylene polymer which is clean and free of any foreign contaminants.
   2. Manufactured geonet to conform to the minimum average roll values (MARV) requirements listed in Table 1 and be free of defects including tears, nodules or other manufacturing defects which may affect its serviceability.

Table 1 - Geonet Properties

PROPERTY	TEST METHOD	MARV	
		Geonet Core	Geonet-only
Thickness	ASTM D 5199	200 mil	275 mil
Transmissivity	ASTM D 4716	1 x 10^{-3} m^2/sec	6 x 10^{-3} m^2/sec
Tensile Strength (MD)	ASTM D 5035	45 LB/IN	65 LB/IN

B. Geotextile:
   1. For geocomposites, cover the geonet core on both sides with a non-woven geotextile complying with the minimum average roll values (MARV) requirements listed in Table 2 and be free of defects including tears or other manufacturing defects which may affect its serviceability.

Table 2 – Nonwoven Geotextile Properties

PROPERTY	TEST METHOD	MARV
Mass per Unit Area, oz/yd^2	ASTM D5261	≥ 6
AOS, U.S. Sieve	ASTM D4751	≤#70
Permittivity, SEC-1	ASTM D4491	≥ 1.3
Puncture, LBS	ASTM D4833	≥ 90
Grab Tensile, LBS	ASTM D4632	≥ 160
Trapezoidal Tear, LBS	ASTM D4533	≥ 65
Ultraviolet Degradation % retained @ 500 HRS	ASTM D4355	≥ 70

   2. Testing frequencies are outlined in Appendix A – SLQCP.

C. Geocomposite:
   1. Create a composite by heat bonding geotextiles to the geonet.
      a. Ply adhesion MARV: 1.0 LB/IN when tested in accordance with ASTM D 7005.
   2. Transmissivity MARV: ≥1x10^{-4} m^2/sec when tested in accordance with ASTM D 4716.
      a. Gradient of 0.1, normal load of 10,000 LB/FTt^2, water at 70° F, seating period of 15 minutes.
      b. Attach geotextiles to the geonet in the same configuration as will be used in the field for transmissivity testing.
      c. Sandwich the geocomposite between rigid platens on the bottom and on the top.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to placement of the geocomposite and geonet, clean the surface of the HDPE geomembrane of all soil, rock, and other materials which could damage the geocomposite or geonet.

3.2 INSTALLATION

A. Deploy the geocomposite and geonet ensuring that the geocomposite, geonet, and underlying materials are not damaged.
   1. Replace or repair faulty or damaged geocomposite or geonet as directed by Engineer.

B. Unroll geocomposite and geonet downslope keeping in slight tension to minimize wrinkles and folds.

C. Maintain free of dirt, mud, or any other foreign materials at all times during construction.
   1. Clean or replace rolls which are contaminated.

D. Place adequate loading (e.g. sandbags) to prevent uplift by wind.

E. Overlap adjacent rolls a minimum of 6 IN.

F. Use manufacturer's fasteners to join adjacent rolls. Metallic fasteners will not be allowed.
   1. Space fasteners a maximum of 5 FT along downslope roll overlaps and a maximum of 2 FT along cross slope roll overlaps.
   2. Use fasteners of contrasting color from the geocomposite and geonet to facilitate visual inspection.
   3. Do not weld geocomposite or geonet to geomembranes.

G. Heat tack overlap of the upper geotextile to the upper geotextile of the adjacent rolls.

H. Repairs holes or tears in the geocomposite or geonet by placing a patch of geocomposite or geonet (as appropriate) extending a minimum of 2 FT beyond the edges of the hole or tear.
   1. Use approved fasteners, spaced every 6 IN around the patch, to fasten the patch to the original roll.

I. Penetration details shall be as recommended by the Manufacturer and as approved by the Engineer.

J. Cover the geocomposite and geonet within 14 days.

3.3 FIELD QUALITY CONTROL

A. The Owner will accept the geocomposite and geonet installation when the installation is finished and all required test results, and documentation from the Contractor, Manufacturer, Inspector and Installer has been received and approved, and verification of the adequacy of all field seams and repairs, is complete.

B. Submittal of such documentation shall be a condition precedent to Substantial Completion.

END OF SECTION

SECTION 02778
GEOTEXTILES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Non-woven geotextile material, used separately from a geocomposite.

B. Related Sections:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02240 – Leak Detection System.
   4. Appendix A – Soil and Liner Quality Control Plan (SLQCP).

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society for Testing and Materials International (ASTM):
      a. D3786, Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method.
      b. D4355, Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
      c. D4491, Water Permeability of Geotextiles by Permittivity.
      d. D4533, Trapezoid Tearing Strength of Geotextiles.
      e. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
      f. D4751, Determining Apparent Opening Size of A Geotextile.
      g. D4833, Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
      h. D5261, Test Method for Measuring Mass Per Unit Area of Geotextiles.

B. Qualifications:
   1. Each manufacturing, fabricating firm shall demonstrate 5 years continuous experience, including a minimum of 10,000,000 SF of geotextile installation in the past 3 years.
   2. Installer shall attend pre-construction conference.

1.3 DEFINITIONS:

A. Manufacturer: Manufacturer producing geotextile sheets from resin and additives.

B. Installer: The Installers are the individuals actually performing the hands-on work in the field.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340.
   2. Manufacturer's documentation that raw materials and roll materials comply with required geotextile physical properties.
   3. Manufacturer and Installer quality control manuals.
   4. Original test results for resins, roll material and factory seam tests at frequency specified in respective quality control manuals.
      a. Results shall include or bracket the rolls delivered for use in the Work.
   5. Proposed details of anchoring and overlapping if different than included in Contract Documents.

B. Miscellaneous Submittals:
   1. Qualification documentation specified in Article 1.2.

1.5 DELIVERY, STORAGE AND HANDLING

A. See Section 01600.

B. Label, handle, and store geotextiles in accordance with SLQCP (Appendix A).

C. Wrap each roll in an opaque and waterproof layer of plastic during shipment and storage.
   1. Do not remove the plastic wrapping until deployment.

D. Label each roll with the manufacturer's name, geotextile type, lot number, roll number, and roll dimensions (length, width, gross weight).

E. Repair or replace geotextile or plastic wrapping damaged as a result of storage or handling.

F. Do not expose geotextile to temperatures in excess of 71 DegC (160 DegF) or less than 0 DegC (32 DegF) unless recommended by the manufacturer.

G. Do not use hooks, tongs or other sharp instruments for handling geotextile.
   1. Do not lift rolls lifted by use of cables or chains in contact with the geotextile.
   2. Do not drag geotextile along the ground.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   1. GSE Lining Technology, Inc., 800-435-2008.
   2. Propex Geosynthetics, 800-621-1273.
   3. TenCate Mirafi, 706-693-2226.
   4. Other manufactures whose materials meet these Specifications and are accepted by the Engineer.

B. Submit requests for substitution in accordance with Specification Section 01640.

2.2 MATERIALS AND MANUFACTURE

A. Geotextile:
   1. Geotextile materials shall consist of non-woven polypropylene, filament material manufactured from virgin, first quality resin stabilized for exposure to ultra-violet light.
   2. The geotextile shall be manufactured to be free of holes, undispersed raw materials, any sign of contamination by foreign matter.
      a. Any such defect shall be cause for rejection of the defective geotextile.
      b. Minor defects may be repaired in accordance with the manufacturer's recommendations if the repair is approved by the Engineer.
   3. The geotextile physical properties shall equal or exceed the minimum average roll values listed below. Values shown are for the weaker principal direction.

PROPERTY	TEST METHOD	MINIMUM AVERAGE ROLL VALUE
Mass per Unit Area, oz/yd^2	ASTM D5261	$\geq$ 8
AOS, U.S. Sieve	ASTM D4751	$\leq$0.18mm (#80 sieve)
Permittivity, SEC-1	ASTM D4491	$\geq$ 1.1
Permeability (min. avg.)	ASTM D4491	0.30
Puncture, LBS	ASTM D4833	$\geq$ 110
Grab Tensile, LBS	ASTM D4632	$\geq$ 205
Grab Elongation (%) (min. avg.)	ASTM D4632	50%

PROPERTY	TEST METHOD	MINIMUM AVERAGE ROLL VALUE
Trapezoidal Tear, LBS	ASTM D4533	≥ 80
Burst Strength, lb/in^2	ASTM D3786	≥ 350
Ultraviolet Degradation % retained @ 500 HRS	ASTM D4355	≥ 70

4. Testing frequencies are outlined in Appendix A – SLQCP.

PART 3 - EXECUTION

3.1 PREPARATION

A. Construct the surface underlying the geotextiles smooth and free of ruts or protrusions which could damage the geotextiles.

3.2 INSTALLATION

A. Install geotextiles in accordance with manufacturer's written recommendations.

B. Create geotextile sleeves to place around geotextile penetrations.
   1. Finished sleeves shall be large enough to fit around the outer diameter of the pipe with a maximum sleeve diameter to be no greater than 1 IN of the outer diameter of the appropriate pipe fittings for that size.

C. Seam Construction:
   1. Sew seams continuously unless otherwise recommended by the manufacturer and approved by Engineer.
   2. Tie off thread at the end of each seam to prevent unraveling.
   3. Sew skipped stitches or discontinuities with an extra line of stitching with 18 IN of overlap.

D. Place overlying material in accordance with SLQCP.

E. Protect geotextiles from clogging, tears, and other damage during installation.

F. Geotextile Repair:
   1. Place a patch of the same type of geotextile which extends a minimum of 12 IN beyond the edge of the damage or defect.
   2. Fasten patches continuously using a sewn seam or other approved method.
   3. Align machine direction of the patch with the machine direction of the geotextile being repaired.
   4. Replace geotextile which cannot be repaired.

G. Do not leave geotextile uncovered for more than 14 days.

END OF SECTION

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SECTION 02930
SEEDING, SODDING AND LANDSCAPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Seeding, sodding and landscape planting:
      a. Soil preparation.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.
   3. Section 02270 – Soil Erosion and Sediment Control

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Nursery and Landscape Association/American National Standards Institute (ANLA/ANSI):
      a. Z60.1, American Standard for Nursery Stock.
   2. AOAC International (AOAC).
   3. ASTM International (ASTM):
      a. D2028, Standard Specification for Cutback Asphalt (Rapid-Curing Type).
      b. D5276, Standard Test Method for Drop Test of Loaded Containers by Free Fall.

B. Quality Control:
   1. Fertilizer:
      a. Upon completion of Project, a final check of total quantities of fertilizer used will be made against total area seeded.
      b. If minimum rates of application have not been met, Contractor will be required to distribute additional quantities to make up minimum application specified.

1.3 SUBMITTALS

A. Shop Drawings:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
      c. Signed copies of vendor's statement for seed mixture required, stating botanical and common name, place of origin, strain, percentage of purity, percentage of germination, and amount of Pure Live Seed (PLS) per bag.
      d. Type of herbicide to be used during first growing season to contain annual weeds and application rate.
   3. Certification that each container of seed delivered will be labeled in accordance with Federal and State Seed Laws and equals or exceeds Specification requirements.

B. Miscellaneous Submittals:
   1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
   2. Copies of delivery tickets for fertilizer used on Project showing grade furnished, along with certification of quality and warranty.

1.4 SEQUENCING AND SCHEDULING

A. Installation Schedule:
   1. Show schedule of when lawn type and other grass areas are anticipated to be planted.
   2. Indicate anticipated dates Engineer will be required to review installation for initial acceptance and final acceptance.

B. Pre-installation Meeting:
   1. Meet with Engineer and other parties as necessary to discuss schedule and methods, unless otherwise indicated by Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Native Grass Seeding: Certified seed of locally adapted strains.

B. Application:
   1. Broadcast seeding.
   2. Apply as hydro-mulch mixture.

C. Water:
   1. Water free from substances harmful to grass or sod growth.
   2. Provide water from source approved prior to use.

D. Acceptable seeding rates:
   1. Spring: March - September (Combination of Bermuda and Bahia).
      a. Bahia Seed – 20LB/acre.
      b. Bermuda Seed “hulled” – 25 LB/acre.
      c. Fertilizer – 600 LB/acre.
   2. Fall: October – February:
      a. Rye (use in critical areas that require a quick growing time) – 20 LB/acre.
      b. Wheat – 120 LB/acre.
      c. Fertilizer – 400 LB/acre.

PART 3 - EXECUTION

3.1 SOIL PREPARATION

A. General:
   1. Limit preparation to areas which will be planted soon after.
   2. Provide facilities to protect and safeguard all persons on or about premises.
   3. Protect existing trees designated to remain.
   4. Verify location and existence of all underground utilities.
      a. Take necessary precaution to protect existing utilities from damage due to construction activity.
      b. Repair all damages to utility items at sole expense.

B. Preparation for Seeding:
   1. Loosen surface to minimum depth of 4 IN.
   2. Remove stones over 1 IN in any dimension and sticks, roots, rubbish, and other extraneous matter.
   3. Prior to applying fertilizer, loosen areas to be seeded with a double disc or other suitable device if the soil has become hard or compacted.
   4. Correct any surface irregularities in order to prevent pocket or low areas which will allow water to stand.
   5. Distribute fertilizer uniformly over areas to be seeded.

6. Incorporate fertilizer into soil to a depth of at least 2 IN by disking, harrowing, or other approved methods.
7. Remove stones or other substances from surface which will interfere with turf development or subsequent mowing operations.
8. Grade to a smooth, even surface with a loose, uniformly fine texture.
    a. Roll and rake, remove ridges and fill depressions, as required to meet finish grades.
    b. Limit fine grading to areas which can be planted soon after preparation.
9. Restore areas to specified condition if eroded or otherwise disturbed after fine grading and before planting.

3.2 INSTALLATION

A. Pasture Seeding:
1. Do not use seed which is wet, moldy, or otherwise damaged.
2. Perform seeding work from April 20 to May 15 for spring planting, and August 1 to September 15 for fall planting, unless otherwise approved by Engineer.
3. Employ satisfactory methods of sowing using mechanical power-driven drills or seeders, mechanical hand seeders, or other approved equipment.
4. Distribute seed evenly over entire area with 50 percent sown in one direction, and the remainder at right angles sown to first sowing.
5. Stop work when work extends beyond most favorable planting season for species designated, or when satisfactory results cannot be obtained because of drought, high winds excessive moisture, or other factors.
    a. Resume work only when favorable conditions develop.
6. Lightly rake seed into soil followed by light rolling or cultipacking.
7. Immediately protect seeded areas against erosion by mulching.
    a. Spread mulch in continuous blanket using 1-1/2 tons per acre to a depth of 4 or 5 straws.
    b. Anchor as required to prevent displacement.
8. Protect seeded slopes against erosion with erosion netting or other methods approved by Engineer.
    a. Protect seeded areas against traffic or other use by erecting barricades and placing warning signs.

3.3 MAINTENANCE AND REPLACEMENT

A. General:
1. Begin maintenance of planted areas immediately after each portion is planted and continue until final acceptance or for a specific time period as stated below, whichever is the longer.
2. As required provide and maintain temporary piping, hoses, and watering equipment to convey water from water sources and to keep planted areas uniformly moist for proper growth.
3. Protection of new materials:
    a. Provide barricades, coverings or other types of protection necessary to prevent damage to existing improvements indicated to remain.
    b. Repair and pay for all damaged items.
4. Replace unacceptable materials with materials and methods identical to the original specifications unless otherwise approved by the Engineer.

B. Seeded Areas:
1. Maintain seeded areas for a minimum of 90 days, minimum, after installation and acceptance of entire project area to be planted.
2. Maintenance period begins at completion of planting and establishment of at least 70% coverage.
3. Engineer will review seeded area after installation for initial acceptance.
4. Maintain seeded area by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, uniform area, free of weeds and eroded or bare areas.

5. Lay out temporary watering system and arrange watering schedule to avoid walking over muddy and newly seeded areas.
    a. Use equipment and water to prevent puddling and water erosion and displacement of seed or mulch.
6. Mow seeded area as soon as there is enough top growth to cut with mower set at recommended height for principal species planted.
    a. Repeat mowing as required to maintain height.
    b. Do not delay mowing until grass blades bend over and become matted.
    c. Do not mow when grass is wet.
    d. Time initial and subsequent mowings as required to maintain a height of 1-1/2 to 2 IN.
    e. Do not mow lower than 1-1/2 IN.
7. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations until disturbed areas have been sufficiently covered.
    a. Anchor as required to prevent displacement.
8. Unacceptable plantings are those areas that do not meet the quality of the specified material, produce the specified results, or were not installed to the specified methods.
9. Replant bare areas using same materials specified.
10. Engineer will review final acceptability of installed areas at end of maintenance period.
11. Maintain repaired areas until remainder of maintenance period or approved by Engineer, whichever is the longer period.

END OF SECTION

DIVISION 3

CONCRETE

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SECTION 03002
CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cast-in-place concrete and grout.
   2. Concrete mixes, proportioning, and source quality control for precast concrete.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Concrete Institute (ACI):
      a. 116R, Cement and Concrete Terminology.
      b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
      c. 212.3R, Chemical Admixtures for Concrete.
      d. 304R, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
      e. 304.2R, Placing Concrete by Pumping Methods.
      f. 305R, Hot Weather Concreting.
      g. 306R, Cold Weather Concreting.
      h. 318, Building Code Requirements for Structural Concrete.
      i. 347R, Recommended Practice for Concrete Formwork.
   2. ASTM International (ASTM):
      a. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
      b. A185, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
      c. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
      d. A775, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
      e. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
      f. C33, Standard Specification for Concrete Aggregates.
      g. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      h. C94, Standard Specification for Ready-Mixed Concrete.
      i. C138, Standard Method of Test for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
      j. C143, Standard Test Method for Slump of Hydraulic Cement Concrete.
      k. C150, Standard Specification for Portland Cement.
      l. C157, Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete.
      m. C172, Standard Practice for Sampling Freshly Mixed Concrete.
      n. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
      o. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
      p. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
      q. C289, Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).

r. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
s. C494, Standard Specification for Chemical Admixtures for Concrete.
t. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
u. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
v. D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
w. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
x. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
y. D1709, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
z. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
aa. E96, Standard Test Methods for Water Vapor Transmission of Materials.
bb. E329, Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
cc. E1745, Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

3. Corps of Engineers (COE):
   a. CRD-C572, Specifications for Polyvinylchloride Waterstops.
   b. CRD-C621, Standard Specification for Packaged, Dry, Hydraulic-Cement Grout (Nonshrink).

B. Quality Control:
1. Concrete testing agency:
   a. Contractor to employ and pay for services of a testing laboratory to:
      1) Perform materials evaluation.
      2) Design concrete mixes.
      3) Perform testing of concrete placed during construction.
   b. Concrete testing agency to meet requirements of ASTM E329.
2. Do not begin concrete production until proposed concrete mix design has been approved by Engineer.
   a. Approval of concrete mix design by Engineer does not relieve Contractor of his responsibility to provide concrete that meets the requirements of this Specification.
3. Adjust concrete mix designs when material characteristics, job conditions, weather, strength test results or other circumstances warrant.
   a. Do not use revised concrete mixes until submitted to and approved by Engineer.
4. Perform structural calculations as required to prove that all portions of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its own weight plus the loads placed thereon.

C. Qualifications:
1. Ready mixed concrete batch plant certified by National Ready Mixed Concrete Association (NRMCA).
2. Formwork, shoring and reshoring for slabs and beams, except where cast on ground, is to be designed by a professional engineer currently registered in the state where the project is located.

1.3 DEFINITIONS

A. Per ACI 116R except as modified herein:
1. Concrete fill: Non-structural concrete.
2. Concrete Testing Agency: Testing agency employed to perform materials evaluation, design of concrete mixes or testing of concrete placed during construction.
3. Exposed concrete: Exposed to view after construction is complete.

4. Indicated: Indicated by Contract Documents.
5. Lean concrete: Concrete with low cement content.
6. Nonexposed concrete: Not exposed to view after construction is complete.
7. Required: Required by Contract Documents.
8. Specified strength: Specified compressive strength at 28 days.
9. Submitted: Submitted to Engineer.

1.4 SUBMITTALS

A. Shop Drawings:
1. See Section 01340 for requirements for the mechanics and administration of the submittal process.
2. Concrete mix designs proposed for use.
   a. Concrete mix design submittal to include the following information:
      1) Sieve analysis and source of fine and coarse aggregates.
      2) Test for aggregate organic impurities.
      3) Test for deleterious aggregate per ASTM C289.
      4) Proportioning of all materials.
      5) Type of cement with mill certificate for cement.
      6) Type of fly ash with certificate of conformance to specification requirements.
      7) Slump.
      8) Air content.
      9) Brand, type, ASTM designation, and quantity of each admixture proposed for use.
      10) 28-day cylinder compressive test results of trial mixes per ACI 318 and as indicated herein.
      11) Shrinkage test results.
      12) Standard deviation value for concrete production facility.
3. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Manufacturers and types:
      1) Joint fillers.
      2) Curing agents.
      3) Chemical sealer.
      4) Bonding and patching mortar.
      5) Construction joint bonding adhesive.
      6) Non-shrink grout with cure/seal compound.
      7) Waterstops.
4. Reinforcing steel:
   a. Show grade, sizes, number, configuration, spacing, location and all fabrication and placement details.
   b. Include sufficient detail to permit installation of reinforcing without having to make reference to Contract Drawings.
   c. Obtain approval of Shop Drawings by Engineer before fabrication.
   d. Mill certificates.
5. Strength test results of in place concrete including slump, air content and concrete temperature.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Storage of Material:
1. Cement and fly-ash:
   a. Store in moistureproof, weathertight enclosures.
   b. Do not use if caked or lumpy.
2. Aggregate:
   a. Store to prevent segregation and contamination with other sizes or foreign materials.
   b. Obtain samples for testing from aggregates at point of batching.

c. Do not use frozen or partially frozen aggregates.
d. Do not use bottom 6 IN of stockpiles in contact with ground.
e. Allow sand to drain until moisture content is uniform prior to use.

3. Admixtures:
   a. Protect from contamination, evaporation, freezing, or damage.
   b. Maintain within temperature range recommended by manufacturer.
   c. Completely mix solutions and suspensions prior to use.
4. Reinforcing steel: Support and store all rebars above ground.

B. Delivery:
1. Concrete:
   a. Prepare a delivery ticket for each load for ready-mixed concrete.
   b. Truck operator shall hand ticket to Owner's Representative at the time of delivery.
   c. Ticket to show:
      1) Mix identification mark.
      2) Quantity delivered.
      3) Amount of each material in batch.
      4) Outdoor temperature in the shade.
      5) Time at which cement was added.
      6) Numerical sequence of the delivery.
      7) Amount of water added.
2. Reinforcing steel:
   a. Ship to jobsite with attached plastic or metal tags with permanent mark numbers.
   b. Mark numbers to match Shop Drawing mark number.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following products and manufacturers are acceptable:
1. Nonshrink, nonmetallic grout:
   a. Sika "SikaGrout 212."
   b. Euclid Chemial "NS Grout."
   c. BASF Admixtures, Inc. "Masterflow 713."
2. Expansion joint fillers:
   a. Permaglaze Co.
   b. Rubatex Corp.
   c. Williams Products, Inc.
3. Form coating:
   a. Richmond "Rich Cote."
   b. Industrial Lubricants "Nox-Crete Form Coating."
   c. Euclid Chemical "Eucoslip VOX."
4. Prefabricated forms:
   a. Simplex "Industrial Steel Frame Forms."
   b. Symons "Steel Ply."
   c. Universal "Uniform."
5. Chemical sealer:
   a. L & M Construction Chemicals, Inc.
   b. Euclid Chemical Company.
   c. Dayton Superior.
6. Bonding agent:
   a. Euclid Chemical Co.
   b. BASF Admixtures, Inc.
   c. L & M Construction Chemicals Inc.

2.2 MATERIALS

A. Portland Cement: Conform to ASTM C150 Type II.

B. Fly Ash:
   1. ASTM C618, Class F or Class C.
   2. Nonstaining.
      a. Hardened concrete containing fly ash to be uniform light gray color.
   3. Maximum loss on ignition: 4 percent
   4. Compatible with other concrete ingredients.
   5. Obtain proposed fly ash form a source approved by the Texas State Highway Department for use in concrete for bridges.
   6. PCY: Minimum cement content in pounds per cubic yard to be provided in the mix. Increase cement content if necessary to satisfy the strength and slump requirements listed for the mix. As option, the contractor/supplier may use fly ash for partial replacement of cement. Each unit of cement removed shall be replaced with two units of Class F fly ash or one unit of Class C fly ash. The maximum amount of cement replaced shall not exceed 40% of the minimum content listed for the mix.

C. Water: Potable, clean, free of oils, acids and organic matter.

D. Aggregates:
   1. Normal weight concrete: ASTM C33, except as modified below.
   2. Fine aggregate:
      a. Clean natural sand.
      b. No manufactured or artificial sand.
   3. Coarse aggregate:
      a. Crushed rock, natural gravel, or other inert granular material.
      b. Maximum amount of clay or shale particles: 1 percent.
   4. Gradation of coarse aggregate:
      a. Lean concrete and concrete topping: Size #7.
      b. All other concrete: Size #57 or #67.

E. Concrete Grout:
   1. Nonshrink nonmetallic grout:
      a. Nonmetallic, noncorrosive, nonstaining, premixed with only water to be added.
      b. Grout to produce a positive but controlled expansion.
      c. Mass expansion not to be created by gas liberation.
      d. Minimum compressive strength of nonshrink grout at 28 days: 6500 psi.
      e. In accordance with COE CRD-C621.
   2. Epoxy grout:
      a. 3-component epoxy resin system.
         1) Two liquid epoxy components.
         2) One inert aggregate filler component.
      b. Each component packaged separately for mixing at jobsite.

F. Reinforcing Steel:
   1. Reinforcing bars: ASTM A615, Grade 60.
   2. Welded wire reinforcement: ASTM A185.
      a. Minimum yield strength: 60,000 psi.
   3. Column spirals: ASTM A82.

G. Forms:
   1. Prefabricated or job built.
   2. Wood forms:
      a. New 5/8 or 3/4 IN 5-ply structural plywood of concrete form grade.
      b. Built-in-place or prefabricated type panel.
      c. 4 x 8 FT sheets for built-in-place type except where smaller pieces will cover entire area.

d. When approved, plywood may be reused.

3. Metal forms:
   a. Metal forms excluding aluminum may be used.
   b. Forms should be tight to prevent leakage, free of rust and straight without dents to provide members of uniform thickness.
4. Chamfer strips: Clear white pine with planed surface against concrete.
5. Form ties:
   a. Removable end, permanently embedded body type with cones on outer ends not requiring auxiliary spreaders.
   b. Cone diameter: 3/4 IN minimum to 1 IN maximum.
   c. Embedded portion 1-1/2 IN minimum back from concrete face.
   d. If not provided with threaded ends, constructed for breaking off ends without damage to concrete.
   e. Provide ties with built-in waterstops at all walls that will be in contact with process liquid during plant operation.
6. Form release: Nonstaining and shall not prevent bonding of future finishes to concrete surface.

H. Expansion Joint Filler:
1. In contact with water:
   a. Closed cell neoprene.
   b. ASTM D1056, Class SC (oil resistant and medium swell) of 2 to 5 psi compression deflection (Grade SCE41).

2.3 CONCRETE MIXES

A. General:
1. All concrete to be ready mixed concrete conforming to ASTM C94.
2. Provide concrete of specified quality capable of being placed without segregation and, when cured, of developing all properties required.
3. All concrete to be normal weight concrete.

B. Strength:
1. Provide specified strength and type of concrete for each use in structure(s) as follows:

TYPE	WEIGHT	SPECIFIED STRENGTH*
Precast concrete	Normal weight and lightweight	5000 psi
All other general use concrete	Normal weight	4000 psi

- Minimum 28-day compressive strength.

C. Substitution of fly ash: Maximum 25% by weight of cement at rate of 1 LB fly ash to 1 LB of cement.

D. Slump - 4 IN maximum, 1 IN minimum:
1. Measured at point of discharge of the concrete into the concrete construction member.
2. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
3. Pumped concrete:
   a. Provide additional water at batch plant to allow for slump loss due to pumping.
   b. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified above.
4. Determine slump per ASTM C143.

E. Selection of Proportions:
1. General:
   a. Proportion ingredients to:

1) Produce proper workability, durability, strength, and other required properties.
2) Prevent segregation and collection of excessive free water on surface.

2. Minimum cement contents and maximum water cement ratios for concrete to be as follows:

SPECIFIED STRENGTH	MINIMUM CEMENT, LB/CY MAXIMUM AGGREGATE SIZE			MAXIMUM WATER CEMENT RATIO BY WEIGHT
	1/2 IN	3/4 IN	1 IN	
4000	611	611	611	0.45
5000	---	686	665	0.40

3. Sand cement grout:
   a. Three parts sand.
   b. One part Portland cement.
   c. Entrained air: Six percent plus or minus one percent.
   d. Sufficient water for required workability.
   e. Minimum 28-day compressive strength: 3,000 psi.
4. Normal weight concrete:
   a. Proportion mixture to provide desired characteristics using one of methods described below:
      1) Method 1 (Trial Mix): Per ACI 318, Chapter 5, except as modified herein.
         a) Record and report temperature of trial mixes.
         b) Proportion trial mixes per ACI 211.1.
      2) Method 2 (Field Experience): Per ACI 318, Chapter 5, except as modified herein:
         a) Field test records must be acceptable to Engineer to use this method.
         b) Test records shall represent materials, proportions and conditions similar to those specified.
5. Required average strength to exceed the specified 28-day compressive strength by the amount determined or calculated in accordance with the requirements of Paragraph 5.3 of ACI 318 using the standard deviation of the proposed concrete production facility as described in Paragraph 5.3.1 of ACI 318.

F. Allowable Shrinkage: 0.048 percent per ASTM C157.

PART 3 - EXECUTION

3.1 FORMING AND PLACING CONCRETE

A. Formwork:
1. Contractor is responsible for design and erection of formwork.
2. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.
   a. Allowable tolerances: As recommended in ACI 347R.
3. Provide slabs and beams of minimum indicated depth when sloping foundation base slabs or elevated floor slabs to drains.
   a. For slabs on grade, slope top of subgrade to provide floor slabs of minimum uniform indicated depth.
   b. Do not place floor drains through beams.
4. Openings: Provide openings in formwork to accommodate work of other trades.
   a. Accurately place and securely support items built into forms.
5. Chamfer strips: Place 3/4 IN chamfer strips in forms to produce 3/4 IN wide beveled edges on permanently exposed corners of members.
6. Clean and adjust forms prior to concrete placement.
7. Tighten forms to prevent mortar leakage.
8. Coat form surfaces with form release agents prior to placing reinforcing bars in forms.

B. Reinforcement:

1. Position, support and secure reinforcement against displacement.
2. Locate and support with chairs, runners, bolsters, spacers and hangers, as required.
3. Set wire ties so ends do not touch forms and are directed into concrete, not toward exposed concrete surfaces.
4. Lap splice lengths: ACI 318 Class B top bar tension splices unless indicated otherwise on the Drawings.
5. Extend reinforcement to within 2 IN of concrete perimeter edges.
   a. If perimeter edge is earth formed, extend reinforcement to within 3 IN of the edge.
6. Minimum concrete protective covering for reinforcement: As shown on Drawings.
7. Unless otherwise indicated, provide minimum concrete cover as follows:
   a. Concrete deposited against earth: 3 IN.
   b. Formed surfaces exposed to weather or in contact with earth: 2 IN for reinforcing bars #6 or larger; 1-1/2 IN for reinforcing bars less than #6.
   c. Formed surfaces exposed to or located above any liquid: 2 IN.
8. Do not weld reinforcing bars.
9. Welded wire reinforcement:
   a. Install welded wire reinforcement in maximum practical sizes.
   b. Splice sides and ends with a splice lap length measured between outermost cross wires of each fabric sheet not less than:
      1) One spacing of cross wires plus 2 IN.
      2) 1.5 x development length.
      3) 6 IN.
   c. Development length: ACI 318 basic development length for the specified fabric yield strength.

C. Construction, Expansion, and Contraction Joints:
1. Provide at locations indicated.
2. Locate wall vertical construction joints at 30 FT maximum centers and wall horizontal construction joints at 10 FT maximum centers.
3. Locate construction joints in floor slabs and foundation base slabs so that concrete placements are approximately square and do not exceed 2500 SF.
4. Install construction joints perpendicular to main reinforcement with all reinforcement continued across construction joints.
5. At least 48 HRS shall elapse between placing of adjoining concrete construction.
6. Thoroughly clean and remove all laitance and loose and foreign particles from construction joints.
7. Before new concrete is placed, coat all construction joints with an approved bonding adhesive used and applied in accordance with manufacturer's instructions.

D. Embedments:
1. Set and build in anchorage devices and other embedded items required for other work that is attached to, or supported by concrete.
2. Use setting diagrams, templates and instructions for locating and setting.

E. Placing Concrete:
1. Place concrete in compliance with ACI 304R and ACI 304.2R.
2. Place in a continuous operation within planned joints or sections.
3. Begin placement when work of other trades affecting concrete is completed.
4. Place concrete by methods which prevent aggregate segregation.
5. Do not allow concrete to free fall more than 4 FT.
6. Where free fall of concrete will exceed 4 FT, place concrete by means of tremie pipe or chute.

F. Consolidation: Consolidate all concrete using mechanical vibrators supplemented with hand rodding and tamping, so that concrete is worked around reinforcement and embedded items into all parts of forms.

G. Protection:

1. Protect concrete from physical damage or reduced strength due to weather extremes.
2. In cold weather, comply with ACI 306R except as modified herein.
   a. Do not place concrete on frozen ground or in contact with forms or reinforcing bars coated with frost, ice or snow.
   b. Minimum concrete temperature at the time of mixing:

OUTDOOR TEMPERATURE AT PLACEMENT (IN SHADE)	CONCRETE TEMPERATURE AT MIXING
Below 30 DegF	70 DegF
Between 30-45 DegF	60 DegF
Above 45 DegF	50 DegF

   c. Do not place heated concrete that is warmer than 80 DegF.
   d. If freezing temperatures are expected during curing, maintain the concrete temperature at or above 50 DegF for 7 days or 70 DegF for 3 days.
   e. Do not allow concrete to cool suddenly.
3. In hot weather, comply with ACI 305R except as modified herein.
   a. At air temperature of 90 DegF and above, keep concrete as cool as possible during placement and curing.
   b. Do not allow concrete temperature to exceed 90 DegF at placement.
   c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
   d. Do not place concrete when the actual or anticipated evaporation rate equals or exceeds 0.2 LBS/SF/HR as determined from ACI 305R, Figure 2.1.5.

H. Curing:
1. Begin curing concrete as soon as free water has disappeared from exposed surfaces.
2. Cure concrete by use of moisture retaining cover, burlap kept continuously wet or by membrane curing compound.
3. Provide protection as required to prevent damage to concrete and to prevent moisture loss from concrete during curing period.
4. Provide curing for minimum of 7 days.
5. Form materials left in place may be considered as curing materials for surfaces in contact with the form materials except in periods of hot weather.
6. In hot weather, follow curing procedures outlined in ACI 305R.
7. In cold weather, follow curing procedures outlined in ACI 306R.
8. If forms are removed before 7 days have elapsed, finish curing of formed surfaces by one of above methods for the remainder of the curing period.
9. Curing vertical surfaces with a curing compound:
   a. Cover vertical surfaces with a minimum of two coats of the curing compound.
   b. Allow the preceding coat to completely dry prior to applying the next coat.
   c. Apply the first coat of curing compound immediately after form removal.
   d. Vertical surface at the time of receiving the first coat shall be damp with no free water on the surface.
   e. A vertical surface is defined as any surface steeper than 1 vertical to 4 horizontal.

I. Form Removal:
1. Remove forms after concrete has hardened sufficiently to resist damage from removal operations or lack of support.
2. Where no reshoring is planned, leave forms and shoring used to support concrete until it has reached its specified 28-day compressive strength.

3.2 CONCRETE FINISHES

A. Tolerances:
1. 1/4 IN in 10 FT.

B. Surfaces Exposed to View:
1. Provide a smooth finish for exposed concrete surfaces and surfaces that are:

a. To be covered with a coating or covering material applied directly to concrete.
b. Scheduled for grout cleaned finish.

2. Remove fins and projections, and patch voids, air pockets, and honeycomb areas with cement grout.
3. Fill tie holes with nonshrink nonmetallic grout.

C. Surfaces Not Exposed to View:
1. Patch voids, air pockets and honeycomb areas with cement grout.
2. Fill tie holes with nonshrink nonmetallic grout.

D. Slab Float Finish:
1. After concrete has been placed, consolidated, struck off, and leveled, do no further work until ready for floating.
2. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operation.
3. During or after first floating, check planeness of entire surface with a 10 FT straightedge applied at not less than two different angles.
4. Cut down all high spots and fill all low spots during this procedure to produce a surface within Class B tolerance throughout.
5. Refloat slab immediately to a uniform sandy texture.

E. Broom Finish: Immediately after concrete has received a float finish as specified, give it a transverse scored texture by drawing a broom across surface.

3.3 GROUT

A. Preparation:
1. Nonshrinking nonmetallic grout:
a. Clean concrete surface to receive grout.
b. Saturate concrete with water for 24 HRS prior to grouting.

B. Application:
1. Nonshrinking nonmetallic grout:
a. Mix in a mechanical mixer.
b. Use no more water than necessary to produce flowable grout.
c. Place in accordance with manufacturer's instructions.
d. Completely fill all spaces and cavities below the bottom of baseplates.
e. Provide forms where baseplates and bedplates do not confine grout.
f. Where exposed to view, finish grout edges smooth.
g. Except where a slope is indicated on Drawings, finish edges flush at the baseplate, bedplate, member, or piece of equipment.
h. Protect against rapid moisture loss by covering with wet rags or polyethylene sheets.
i. Wet cure grout for 7 days, minimum.

3.4 FIELD QUALITY CONTROL

A. Owner will employ and pay for services of a concrete testing laboratory to perform testing of concrete placed during construction.
1. Contractor to cooperate with Owner in obtaining and testing samples.

B. Tests During Construction:
1. Strength test - procedure:
a. Three cylinders, 6 IN DIA x 12 IN high, will be taken from each sample per ASTM C172 and ASTM C31.
b. Cylinders will be tested per ASTM C39:
1) One at 7 days.
2) Two at 28 days.
2. Strength test - frequency:
a. Not less than one test for each concrete structure.
3. Slump test:

a. Per ASTM C143.
b. Determined for each strength test sample.
c. Additional slump tests may be taken.

4. Temperature: Determined for each strength test sample.

C. Evaluation of Tests:
1. Strength test results:
a. Average of 28-day strength of two cylinders from each sample.
1) If one cylinder manifests evidence of improper sampling, molding, handling, curing or testings, strength of remaining cylinder will be test result.
2) If both cylinders show any of above defects, test will be discarded.

D. Acceptance of Concrete:
1. Strength level of each type of concrete shall be considered satisfactory if both of the following requirements are met:
a. Average of all sets of three consecutive strength tests equals or exceeds the required specified 28-day compressive strength.
b. No individual strength test falls below the required specified 28-day compressive strength by more than 500 psi.
2. If tests fail to indicate satisfactory strength level, perform additional tests and/or corrective measures as directed by Engineer.
a. Perform additional tests and/or corrective measures at no additional cost to Owner.

3.5 SCHEDULES

A. Form Types:
1. Surfaces exposed to view:
a. Prefabricated or job-built wood forms.
b. Laid out in a regular and uniform pattern with long dimensions vertical and joints aligned.
c. Produce finished surfaces free from offsets, ridges, waves, and concave or convex areas.
d. Construct forms sufficiently tight to prevent leakage of mortar.
2. Surfaces normally submerged or not normally exposed to view: Wood or steel forms sufficiently tight to prevent leakage of mortar.
3. Other types of forms may be used:
a. For surfaces not restricted to plywood or lined forms.
b. As backing for form lining.

B. Grout:
1. Nonshrinking nonmetallic grout: General use.

C. Concrete:
1. All concrete can be cast in place or precast.

D. Concrete Finishes:
1. Grout cleaned finish: Where indicated on Drawings.

END OF SECTION

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DIVISION 11

EQUIPMENT

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SECTION 11076

PUMPING EQUIPMENT: SUBMERSIBLE LEACHATE PUMP

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Submersible pumps, controls, and accessories for dewatering sumps.
   2. Control panel for pumps.

B. Related Sections include but are not necessarily limited to:
   1. Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 - General Requirements.

C. Manufacturer shall warrant all equipment specified in this section for a period of not less than one year from acceptance by owner.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Iron and Steel Institute (AISI):
      a. Steel Products Manual.
   2. American National Standard Institute (ANSI).
   3. American Society for Testing and Materials (ASTM):
      a. A48, Standard Specification for Gray Iron Castings.
   4. Factory Mutual (FM).
   5. Hydraulic Institute Standards for Centrifugal, Rotary and Reciprocating Pumps (HI).
   6. National Electrical Manufacturer's Association (NEMA):
      a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
      b. ICS 6, Enclosures for Industrial Controls.
   7. National Fire Protection Agency (NFPA):
      a. 70, National Electrical Code (NEC).
   8. Underwriters Laboratories, Inc.(UL).

1.3 SUBMITTALS

A. Shop Drawings:
   1. General for all equipment:
      a. See Section 01340 for requirements for the mechanics and administration of the submittal process.
      b. Data sheets that include manufacturer's name and complete product model number.
         1) Clearly identify all optional accessories that are included.
      c. Acknowledgement that products submitted comply with the requirements of the standards referenced.
      d. Manufacturer's delivery, storage, handling, and installation instructions.
      e. Equipment identification utilizing numbering system and name utilized in Drawings.
      f. Equipment installation details:
         1) Manufacturer's installation instructions.
      g. Equipment area classification rating.
      h. Shipping and operating weight.
      i. Equipment physical characteristics:
         1) Dimensions (both horizontal and vertical).
      j. Manufacturer's recommended spare parts list.
      k. Equipment lining and coatings.
      l. Equipment electrical utility requirements.

2. Electrical and control equipment:
    a. Electric motor information:
        1) Nameplate data as required by the NEC.
            a) Manufacturer's name.
            b) Rated voltage.
            c) Full load current.
            d) Rated frequency.
            e) Number of phases.
            f) Rated full load speed.
            g) Time rating: 5, 15, 30 or 60 minutes or continuous.
            h) Rated HP.
    b. Electrical gear:
        1) Equipment ratings: Voltage, continuous current, kVa, watts, short circuit with stand, etc., as applicable.
    c. Control panels:
        1) Panel construction.
        2) Point-to-point ladder diagrams.
        3) Scaled panel face and subpanel layout.
        4) Technical product data on panel components.
        5) Panel and subpanel dimensions and weights.
        6) Panel access openings.
        7) Nameplate schedule.
        8) Panel anchorage.
3. Systems schematics and data:
    a. Provide system schematics where required in system specifications.
        1) Acknowledge all system components being supplied as part of the system.
        2) Provide technical data for each system component showing compliance with the Contract Document requirements.
4. Source quality control test reports.

B. Operation and Maintenance Manuals:
    1. See Section 01340.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
    1. Submersible dewatering sump pumps:
        a. EPG Companies, Inc.
        b. Grundfos.
        c. Or approved equal

B. Submit requests for substitution in writing in accordance with Specification Section 01060.

2.2 MATERIALS

A. Pumps:
    1. Major components to be constructed from 304 Stainless Steel.
    2. Bearings and Seals: E-Glide
    3. O-rings: Teflon or approved equal.
    4. Bolts and nuts: 304 Stainless Steel.
    5. Lifting chains and cables: 304 Stainless Steel.

2.3 EQUIPMENT

A. Performance and Configuration Requirements:

1. Design condition: 40 gpm at 55 FT TDH with minimum pump efficiency of 70 percent, for each pump.
2. Shutoff condition: 0 gpm at 55 FT TDH, for each pump.
3. Pump configuration:
   a. Submersible
4. Nominal pump speed: 3450 rpm.
5. Nameplate driver horsepower: 1.0 HP.
6. Drive type: Constant speed.
7. Suction screened, discharge 1.5 IN DIA minimum.
8. Motor Requirements:
   a. Minimum motor efficiency: 50 percent.
   b. Minimum power factor: 50 percent.
   c. Power supply voltage: 230 volts, single phase, 60 Hertz.
9. The sump drainer shall be supplied as a sealed unit which draws all liquid past the motor. A vent shall be provided to assist with the evacuation of air from the sump drainer.

2.4 ACCESSORIES

A. Power Cable:
   1. Provide power and control cable from pump control panel to pump suitable for submersible and control applications in leachate and indicate same by a code or legend permanently embossed on cable.
   2. Size cable in accordance with applicable NEC specifications.
   3. Provide power cable and control cable as needed.
   4. Provide each cable with a strain relief and cord grip.

B. Level Controls:
   1. Provide level indicator system and automatic control to pump and provide alarm signal.
   2. Level and pump control system shall provide the following:
      a. Start and stop pump automatically or manually.
      b. Automatic stop pump on low sump level.
      c. Provide high level alarm.
   3. Level Sensor(s) shall be capable of being removed in conjunction with removal of pump.
   4. A panel mounted controller with digital readout displays shall provide level indication of the sump. The pump "ON-OFF-HIGH LEVEL" selection shall be through setpoint current relays located on the inner door. The digital controller shall be equipped with a "HIGH-HIGH" shutdown feature which will lock out the pump(s) if the level exceeds 288 inches.
   5. A submersible transducer shall be provided with a suitable cable. The transducer shall be all 316 stainless steel and shall be mounted in the center axis of the pump carriage at the suction end. The unit shall provide a 4-20 ma signal output to the control unit over the entire range at levels encountered in the sump. Static accuracy rating shall be no less than 1%.
   6. A filter dryer with seal pressure/temperature compensation diaphragm shall be provided to be mounted in the control panel or junction box to prevent moisture in the level sensor vent tube. Unit shall extend the operating life of the desiccant filter.

C. Control Panel:
   1. Connect pump to control panel.
   2. The control panel shall be supplied by the same manufacturer as the pump and will be sized to house the level control, pump operation, and motor protection. The control panel will have space for an additional pump to be installed at a later date.
   3. The control panel shall be NEMA 4X stainless steel and have an enclosure with a rain guard and lockable outer cover. The door shall open a minimum of 180 degrees.
   4. The inner door shall be painted steel. The inner door shall contain cutouts for the mounted equipment and operator accessible equipment and provide protection of personnel from live internal wiring.

5. The back plate shall consist of 12 gauge sheet steel and finished with a primer coat and two coats of baked on enamel. All hardware mounted to the subpanel shall be accomplished with the machine thread tapped holes. Sheet metal screws are not acceptable. All devices shall be permanently identified by labels.
6. The panel power distribution shall include all necessary components and shall be completely wired with standard copper conductors rated at 90 degrees C. Control wiring shall be a minimum of 16 gauge and installed in Panduit type wiring trays.
7. Individual fuses shall be provided for main power, pump, and control circuits.
8. A control transformer shall be used to provide the 120V AC power for control circuits.
    a. Provide primary and secondary fusing for the circuit.
9. Provide surge protection and voltage protection.
10. Provide a transducer simulator, to check transducer operation.
11. Provide a thermostat controlled heater to control the inside temperature below the dew point and alleviate the buildup of condensate in the control enclosure.
12. Provide a corrosion inhibitor within the enclosure.
13. Provide a weatherproof top-mounted rotating, red visual high level alarm beacon.
14. Provide a 120 V duplex GFCI outlet and 100 watt switchable light fixture inside control panel.
15. Provide an elapsed time meter.
16. Provide a padlock hasp.

D. Discharge Hose and Fittings:
1. Provide a 2" ID HDPE discharge pipe with a 6” max bend radius from the pump to the sump access structure.
    a. Discharge pipe shall have a length adequate to allow the pump to rest on the bottom of the sump collection pipe, travel through the riser pipe, connect to a 2” quick connector at the top of the riser pipe and extend a minimum of 5 feet into the East Ash Pond.
2. Provide all fittings, including 2-inch stainless steel sliding discharge adapter with threaded stem that extends through the thickness of the riser pipe.
    a. All fittings to be stainless steel.

E. Wheeled Drainers:
1. Pump shall be installed in a 300-series stainless steel, wheeled, sump drainer for use in a 12” HDPE riser pipe with a constant diameter set at a 3:1 H:V slope.
2. The sump drainer shall be supplied as a sealed unit which draws all liquid past the motor. A vent valve shall be provided to assist with the evacuation of air from the sump drainer.
3. The pump shall be designed to allow easy removal of unit should it be required.
4. Provide a retrieval cable of 300 series stainless steel complete with stainless steel clamps and associated hardware.
5. A submersible level sensor mount shall be located at the center bottom of the sump drainer at the suction end for liquid level monitoring and pump control.

F. Break Out Junction Boxes
1. Breakout boxes, for power leads, level sensor leads, flow sensor leads, and float leads shall be provided for installation near the top of the riser pipe or sump.
2. Breakout boxes to be NEMA 4X fiberglass and include proper sized cord restraint and ½” conduit gastight seal fitting.

G. Flow Meter System
1. A Flow Meter System shall be provided to register liquid flow rate and to record total flow.

H. Backflow Preventer
1. Provide backflow preventer on each pump discharge.

2.5 FABRICATION

A. General:
1. Provide pumps capable of handling industrial landfill leachate.

2. Design pump to allow for removal without entering the sump and without removal of bolts, nuts or other fastenings.
3. Provide pump unit connecting to discharge connection with a simple downward motion without rotation.
4. Where watertight sealing is required, machine and fit mating surfaces with O-rings.

B. Impeller:
1. Provide wear ring as necessary to assure efficient sealing between volute and impeller.
2. Provide closed impeller in accordance with Hydraulic Institute Standards.

C. Wheeled Well Pump Carriage:
1. Manufactured from a pipe type 304 Stainless Steel Schedule 40 Welded Pipe of sufficient diameter to hold the pump, casters and wheels while maintaining adequate space to allow for pump placement in and retrieval from the 12" riser pipe.
2. Length of pipe to be equal to pump length minus 2 IN.
3. Suspend pump in center of carriage by attaching Stainless Steel vertical pipe support clamps to carriage pipe wall at each end.
4. Attach four (4) casters at 90 Deg, on each end of carriage pipe. Casters to be constructed of type 304 Stainless Steel with a 200 lbs capacity. No lubrication required, rust resistant bearings. Wheels constructed of urethane. Bolt casters to carriage pipe.
5. Provide stainless steel lifting cable of sufficient strength to permit removal of the unit.
   a. Cable shall be of sufficient length to allow the pump to rest on the bottom of the 12" sump collection pipe, travel through the 12" riser pipe and terminate approximately 1 ft beyond the 1/2" diameter retrieval hole in the sump riser.
   b. Terminate cable with a knot and attach to access structure to prevent cable from slipping back into riser pipe.

D. Shaft:
1. Design pump shaft of sufficient size to transmit full driver output.
2. Use shaft which is accurately machined and constructed with 304 stainless steel and rotates on E-Glide bearings.
3. Design shaft for a maximum deflection of 0.002 IN measured at the stuffing box.

E. Shaft Seal:
1. Provide seals requiring neither routine maintenance nor adjustment, but capable of being easily inspected and replaced.
2. Hold interface in contact by its own spring system.

F. Bearings:
1. Support shaft on upper and lower permanently lubricated bearings.

G. Motors:
1. Provide motor of totally submersible design, constructed with epoxy or poly-seal encapsulated windings, air-filled or dielectric oil filled, with Class F insulation and rated for continuous duty operation.
2. Motor shall be 1 HP, 60 cycle, 230 V 3-phase.
3. Motor windings shall be hermetically sealed within the casing and epoxy coated.

H. Coatings:
1. To the exterior of the pump casing and motor housing, apply polyamidoamine epoxy system.
2. Protect all metallic surfaces coming into contact with leachate except stainless steel and bronze by a corrosion-resistant coating.

2.6 SOURCE QUALITY CONTROL

A. Secure from the pump manufacturer the following inspections and tests on each pump before shipment from factory:
1. Check impeller, motor rating and electrical connections for compliance with Specification.
2. Test motor and cable insulation for moisture content or insulation defects.

3. Run pump for 30 minutes submerged, a minimum of 4 FT under water.
4. After operational test #3 above, perform insulation test (#2 above) again.

B. Factory test of head (FT) versus flow (gpm) for one pump of each service category.

C. System Ground
1. Factory trained installer shall ground system, measuring impedance to ground, to less than or equal to 1.0 Ohms using 780 Series Ground Resistance Tester, Model #61-781, as manufactured by Ideal Industries, Inc., Sycamore, IL.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installer shall be factory certified by the pump manufacturer.

B. Seal pump cable end with a high quality protective covering, to make it impervious to moisture or water seepage prior to electrical installation.

3.2 FIELD QUALITY CONTROL

A. Provide services of equipment manufacturer's field service representative(s) to:
1. Inspect equipment covered by the Specifications.
2. Supervise pre-start adjustments and installation checks, including grounding.
3. Conduct initial startup of equipment and perform operational checks.
4. Provide a written statement from the manufacturer that the equipment has been installed properly, started up and is ready for operation by Owner's personnel.

END OF SECTION

DIVISION 15

MECHANICAL

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SECTION 15065
HDPE PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

A. General:
   1. Furnish all labor, materials, tools, equipment and services for all pipe in accordance with provisions of the Contract Documents.
   2. Completely coordinate with work of all other trades.
   3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound and complete installation.

B. Work included consists of, but is not necessarily limited to:
   1. Leak detection system riser pipes.

C. Related Sections include, but are not necessarily limited to:
   1. Bidding Requirements, Contract Forms and Conditions of the Contract.
   2. Section 02221 – Trenching, Backfilling, and Compacting for Utilities.
   3. Section 02777 – Geocomposite/Geonet.
   4. Section 02278 – Geotextiles.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society for Testing and Materials International (ASTM):
      a. C33, Standard Specification for Concrete Aggregate.
      b. C330, Standard Specification for Lightweight Aggregates for Structural Concrete.
      c. D638, Test Method for Tensile Properties of Plastics.
      d. D696, Linear Thermal Expansion Coefficient.
      e. D746, Brittleness Temp.
      f. D790, Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
      g. D1238, Test Method for Flow Rates of Thermal Plastics by Extrusion Plastometer.
      h. D1248, Specification for Polyethylene Plastics Molding and Extrusion Materials.
      i. D1505, Text Method for Density of Plastics by the Density Gradient Technique.
      j. D1525, Vicat Softening Temp.
      k. D1603, Carbon Black in Olefin Plastics.
      l. D2122, Method for Determining Dimensions of Thermal Plastic Pipe and Fittings.
      m. D2240, Standard Test Method for Rubber Property - Durometer Hardness
      n. D2837, Method for obtaining Hydrostatic Design Basis for Thermal Plastic Pipe Materials.
      o. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
      p. D3350, Specification for Polyethylene Platic Pipe and Fittings Material.
      q. F714, Standard Specification for Polyethylene Plastic Pipe Based on Outside Diameter.
      r. F1473, Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins

B. The pipe manufacturer shall provide certifications and test reports indicating that samples of the production pipe from which the furnished materials were obtained have been tested in accordance with ASTM D2837.
   1. The minimum hydrostatic design basis shall be 1600 psi at 73.4 DegF and 800 psi at 140 DegF.

1.3 SUBMITTALS

A. See Section 01340.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
   1. Pipe:
      a. Driscopipe/Plexco.
      b. Polypipe.
      c. Approved equal.

B. Submit request for substitutions in accordance with Specification Section 01640.

2.2 PIPE AND APPURTENANCES

A. Materials:
   1. Pipe: High Density Polyethylene Pipe, perforated and solid wall shall conform to requirements of ASTM D1248.
   2. Polyethylene for the manufacture of pipe shall be high-density polyethylene conforming to the following minimum physical requirements:

PROPERTY	UNIT	TEST[(1)] PROCEDURE	TYPICAL VALUE
Material Designation	--	PPI/ASTM	PE 3408
Material Classification	--	D1248	III C 5 P34
Cell Classification	--	D3350	345464C
Density (3)	gm/cm^3	D1505	0.955
Melt Flow (4)	gm/10 min.	D1238	0.1
Flexural Modulus (5)	psi	D790	>110,000
Tensile Strength (4)	psi	D638	3,200
PENT	hrs	F1473	>100
UV Stabilizer (C)	%Carb. Blck	D1603	2 TO 3
Elastic Modulus	psi	D638	125,000
Brittleness Temperature	DegF	D746	<-100
Vicat Softening Temp.	DegF	D1525	255
Thermal Expansion	in/in/DegF	D696	1.2×10^{-4}
Hardness	Shore D	D2240	62
Molecular Weight Category	--		EXTRA HIGH
Average Molecular Weight	--	GPC	330,000
HDB @ 73.4 DegF	psi	D2837	1600
HDB @ 140 DegF	psi	D2837	800

[(1)] Test procedures are ASTM unless otherwise noted. (PPI – Plastic Pipe Institute; GCP Permeation Chromatography.)

   3. Pipe and fittings shall be butt fusible at 440 DegF or 500 DegF.
   4. Pipe shall be manufactured in accordance with ASTM F714.
   5. Fittings shall be butt fusion type, meeting the requirements of ASTM D3261 and this Specification.
      a. All fittings shall be pressure rated to match the system piping to which they are fused.

b. At the point of fusion, the outside diameter and minimum wall thickness Specifications of ASTM F714 for the same size of pipe.
c. The side slope riser fittings shall be factory fabricated and shall have a smooth interior surface.

6. The 12 IN Sump Riser Pipe shall be perforated by the Manufacturer as shown on the Drawings.
   a. Above the floor of the sump, the Sump Riser Pipe shall be solid wall SDR 17.
   b. The End Cap shall be perforated by the Manufacturer as shown on the Drawings and fusion welded to the Sump Riser Pipe.
7. All bends shall be "long sweep" with 6 FT minimum radius.

B. Requirements:
1. Workmanship:
   a. Exterior and interior surfaces shall be smooth with no sharp projections.
   b. The surfaces shall be free of foreign inclusions and major surface defects.
   c. Polyethylene pipe shall be as uniform as commercially practical in color, opacity, density, and other physical properties.
   d. The product function shall be considered when judging external defects.

C. Plastic Pipe:
1. Plastic pipe shall consist of nominal HDPE pipe manufactured from virgin, first quality resin and designed and formulated specifically for hydraulic transmission.
2. Riser pipe shall be SDR 17 polyethylene pipe conforming to ASTM D1248, of the size and configuration shown on the Construction Drawings.

2.3 GRANULAR DRAINAGE MATERIAL

A. Granular drainage material will consist of gravel installed in the sump as shown on the plans.
1. Gravel used shall consist of washed rounded river-run gravel meeting the requirements of ASTM C-33 for coarse aggregate.
   a. Crushed material will not be acceptable.
   b. The gravel should meet the gradation requirements of Size No. 6 (Nominal size 3/4 to 1/2 IN) or coarser.
   c. In addition, the gravel will have a permeability of $1x10^{-2}$ CM/SEC or greater, and the percent of calcium carbonate by weight will not exceed 15 percent per J&L Test Designation S-105-89.
   d. The aggregate can be tested at a modified pH of 4 for the J&L Test.
2. As an alternative to the rounded, river-run gravel, washed rotary kiln produced light-weight aggregates (ASTM C-330) of a rounded shape with no sharp edges may be considered by the Engineer.
   a. However, the material must also meet ASTM C-33 requirements for gradation, durability, and soundness.
   b. The material shall have a minimum size of 3/8 IN, a permeability of $1x\ 10^{-2}$ CM/SEC or greater and the percent of calcium carbonate not exceeding 15 percent by weight.
   c. The aggregate can be tested at a modified pH of 4 for the J&L Test.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install buried pipe as indicated on Drawings.
2. The Contractor shall insure that kinking or excessive bend diameters of the pipe do not occur during the installation process.
3. The Contractor shall insure that the pipe installed in the trench is firmly supported.
4. The Contractor shall cap all open pipe ends at the end of the work day.

5. Contractor shall remove any cave-in portions of the trench prior to placing sand bagging around the pipe.
6. HDPE pipe and fittings shall be by the same manufacturer.
    a. The minimum strength of the fittings shall not be less than that of the pipe.
7. Changes in direction of HDPE Pipe:
    a. Pipe may be cold-bent to minimum radius of 20 times the pipe diameter as it is installed.
    b. If fittings or fusions are present in the bend, the minimum recommended cold bending radius is 125 times the outside diameter of the pipe.
8. Remove cutting and threading burrs.

B. Joining Procedures:
1. HDPE pipe joints shall be fused on the surface prior to installation into the trench.
    a. Alternative methods of fusing shall be approved by the Engineer.
    b. HDPE pipe 1 IN and under shall be socket fused.
    c. HDPE pipe joints 1-1/2 IN and over shall be buttfused.
2. Fusion joiner must be qualified by type of fusion (i.e., butt fusion, socket fusion or sidewall fusion) and fuse pipe only as qualified.
3. Each joint must be visually inspected inside and outside for damage, dirt, moisture, or any other abnormalities prior to fusing.
4. All joint fusion shall be performed in strict accordance with the manufacturer's specifications.
5. All fusion equipment must be approved by the manufacturer and operated by qualified and certified operators.
    a. Cost for testing and certifying personnel shall be born by the Contractor.

C. Granular Drainage Material:
1. Gravel shall be placed in the sump.
    a. The Contractor shall utilize care to avoid damage to any underlying component.
    b. Any damaged component shall be replaced in accordance with manufacturer’s recommendations.
2. Fill around pipes shall be placed so that deflection or load damage to the pipe does not occur.
3. The granular material shall be protected from fine soil contamination including slope wash down.
    a. The Contractor shall replace the granular material at his expense should contamination occur.
4. The granular material shall be sampled and tested for gradation and permeability.
5. The granular material in the sump shall be wrapped with a minimum 8 OZ geotextile.
    a. The geotextile shall be placed by hand and appropriately lapped and secured with stitching in accordance with the geotextile manufacturer’s recommendations.

3.2 FIELD QUALITY CONTROL

A. The first butt fusion of each day, for each fusion machine, shall be destructively tested by the "bent strap" test.
1. This test method is presented in PLEXCO Bulletins Nos. 105Y and 106.

3.3 PIPE SUPPORTS

A. Construct sump access structure to provide support as shown on the Drawings.

B. Provide additional supports as required to support piping such that its weight is not supported by pumps or equipment.

3.4 CLEANING

A. Keep inside of all pipe, fittings, and valves clean and free from dirt and debris.

B. Thoroughly clean piping as specified by manufacturer.

3.5 INSPECTION AND TESTING

A. Piping shall be tested as described in Paragraph 3.2.

END OF SECTION

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APPENDIX A

SOIL AND LINER QUALITY CONTROL PLAN

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Soil and Liner Quality Control Plan

for

Luminant Martin Lake SES
Reline East Ash Pond
Rusk County, Texas

February 2009

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Luminant Martin Lake SES
Reline East Ash Pond
Soil and Liner Quality Control Plan

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1.0 GENERAL

1.1 General

This Soil and Liner Quality Control Plan (SLQCP) presents engineering and quality control requirements for construction of the Luminant Martin Lake SES Reline East Ash Pond in conformance with the requirements of the Texas Commission of Environmental Quality (TCEQ) Technical Guideline No. 4 "Nonhazardous Industrial Solid Waste Surface Impoundment."

The SLQCP shall be used in conjunction with the final construction drawings and specifications. The SLQCP shall address the following:

- Lines of communication, responsibilities and role of Quality Assurance team and other related project personnel.
- A Quality Assurance Program and the Quality Assurance Procedures to be implemented during the clay liner construction including field observation, laboratory and field testing, and acceptance criteria for constructed work.
- Recording and documenting procedures to demonstrate that the constructed liners meet the requirements of project plans and specifications.
- Report submittals.

The construction and testing of all elements of the landfill liner will be in accordance with the SLQCP.

1.2 Definitions

This section provides the definitions for terms used in this SLQCP.

Contractor or General Contractor– The firm or agency responsible for performance of the construction contract, including the performance of all subcontractors.

Earthwork Contractor - The firm or agency responsible for subgrade preparation and clay liner construction.

Geocomposite – Drainage conductor consisting of geonet and geotextile components assembled by the manufacturer.

Geonet - A netlike configuration of extruded HDPE ribs used as a planar conductor of drainage.

Geotechnical Professional (GP) - Person(s) or firm(s) authorized by the Owner to manage and oversee the execution of the work. This includes a professional engineer licensed in the State of Texas who possesses professional experience in geotechnical engineering and testing. The GP is also responsible for observing, testing and documenting activities related to liner quality assurance during the installation of the lining systems, and for issuing the final report. The GP or his representative will be on site continuously for all liner construction or testing. All completed work is subject to approval of the GP. The GP will sign the Construction Documentation Report. For clay liners only, a Texas Professional Geologist or Texas Professional Engineer may serve as GP and sign the Construction Documentation Report. A licensed engineer must sign all work involving geosynthetics.

Geotextile - A permeable synthetic textile used with soil, rock, sand, gravel or any other similar materials as an integral part of the drainage system. It serves as a filter interface between two types of soil materials, as a drainage conductor, or as soil reinforcement.

Manufacturer - Firm(s) responsible for the production of geomembrane, geotextile and geonet materials, pipe, fittings and other equipment.

Owner –Luminant Power.

Project Documents - All contractor submittals, construction plans, as-built plans, construction specifications, QA plan, safety plan and project schedule.

Project Plans and Specifications - All project related plans and specifications including design modifications and as-built plans.

Qualified Engineering Technician - The qualified representative of the GP who meets the qualifications of a NICET- Certified in Geotechnical Engineering Technology at Level 2 or higher, who is an engineering technician with a minimum of four years of directly related experience or a graduate engineer/geologist with one year of directly related experience.

Quality Assurance - Actions taken by the GP to assure conformity of the liner system production and installation with the Quality Assurance Plan, drawings and specifications. QA is provided by a party independent of installation.

Quality Assurance Laboratory - The firm responsible for conducting tests on clay liner and geosynthetic samples taken from the site. The laboratory shall be independent of the Owner, Manufacturer, Earthwork Contractor and any party involved with the manufacture and/or installation of any part of the liner system.

Work - All tools, equipment, supervision, labor and material or supplies necessary to complete the project as specified herein and as shown on the plans.

2.0 CONSTRUCTED CLAY LINER

2.1 General

Construction of the clay liner will begin after the subgrade has been finished to the proper lines and grade. The depth of the subgrade prior to liner construction shall coincide with the bottom of the liner. All constructed clay liners will be constructed on stable subgrade, keyed into an underlying formation of sufficient strength, or otherwise constructed to ensure stability. Those portions of the pond below the water table will be properly dewatered to resist hydrostatic uplift and ensure constructability. Operating dewatering systems, if installed, will not be discontinued until construction is complete and approved by the Owner. Prior to liner construction, the pond grid coordinate system will be established in and around the construction area. The markers will be visible to personnel in the construction area. The minimum constructed clay liner thickness, measured perpendicular to the surface being lined, will be 1 ½ feet. New liner sections will be properly tied back into previous liner sections to ensure continuous liner coverage. The surface of the finished clay liner will be smooth rolled and kept moist prior to installation of the remaining components of the lining systems.

If stormwater ponds on the clay liner during construction, the Contractor will remove it as rapidly as possible. Stormwater that collects over any portion of the liner system will be removed as quickly as possible, until the liner system has been accepted by the Owner.

For excavation surfaces with a slope of 3 Horizontal to 1 Vertical (3H:1V) or flatter, liner construction may utilize lifts parallel to the finished surface. For excavation surfaces that have steeper than 3H:1V slopes, linings will be placed in successive horizontal soil lifts; however, such lifts must be sufficiently wide to safely accommodate both the construction equipment and the related placement and compaction operations.

2.2 Preliminary Sampling and Testing Procedures

Preliminary soil sampling and testing will be performed on clay soils before they are used for construction of liners. Additional tests will be performed for each borrow source and if the soil characteristics change within a borrow source. Only clayey soils which meet the minimum

requirements of a coefficient of permeability of no more than 1.0 x 10^{-5} cm/sec., a liquid limit of no less than 30, a plasticity index of no less than 15, and percent passing No. 200 sieve of no less than 30 will be used for liner construction. Quality control of the soil plasticity will be closely adhered to and maintained during material selection for liner construction. All soil material must pass the one-inch sieve and will not contain rocks or stones that total more than 10 percent by weight.

Composite samples will be obtained by collecting equal volumes of soil from a number of locations within the soil source. If soil characteristics appear to change within the stockpile or borrow source, one composite sample will be obtained from each soil type. Samples will be sealed, labeled, and delivered to the laboratory for evaluation.

The laboratory will test each sample for Atterberg Limits, percent passing the No. 40 and 200 sieves, and the moisture-density relationship. The test procedures to be used are ASTM D4318, ASTM D422 and ASTM D698, respectively. A moisture-density relationship will be determined for each borrow source to be used in soil liner construction. The moisture-density compaction curve will include a zero-air-voids line based upon an estimated or measured specific gravity of the compacted soil.

Once the maximum dry density and the optimum moisture content of the soil samples have been determined for each borrow source and each soil type, a sample will be compacted to 95 percent of the maximum compacted dry density at the optimum moisture content, or wetter, as necessary to meet density requirements. A Falling Head permeability test (Appendix VII of the Corps of Engineers Manual, EM 1110-2-1906, May 1, 1980, or more current version, Laboratory Soils Testing) will then be performed on this sample. A Constant Head permeability test (ASTM D5084 or EM 1110-2-1906, Appendix VII) may be used as an alternative. The permeant fluid must be tap water or water with a 0.05N solution of $CaSO_4$. The maximum acceptable coefficient of permeability value will not be greater than 1.0 x 10^{-5} cm/sec. When a coefficient of 1.0 x 10^{-5} cm/sec is achieved, the density value of the compacted sample and its moisture content are considered the minimum acceptable for checks of that liner material during construction. In no

instance will the percentage of maximum compacted Standard Proctor Density be less than 95 or the moisture content be less than optimum.

2.3 Sampling and Testing for Constructed Clay Liners

Sidewall liner evaluations for lifts constructed parallel to the surface of the excavation will be evaluated by using the same criteria and frequency of testing as for the bottom. All holes dug or created during any sampling and/or testing shall be backfilled with a mixture of at least 20% bentonite-enriched liner soil and compacted by hand tamping, or filled with an appropriate bentonite grout. Each sidewall and floor area must be separately evaluated unless the two areas are constructed in a continuous monolithic fashion. All soil samples will be visually inspected for compaction planes, permeable zones, poor compaction, or other problems as well as to determine soil type. Any liner sections not meeting the minimum standards on the first test will be reworked, or replaced and retested until they meet the minimum standards. All test and sample locations will be identified by lift number and pond grid coordinates on a drawing of the construction area.

2.3.1 Density and Moisture Content

For parallel lifts, one test will be conducted per each 8,000 square feet, or less, of surface area of lining for each 6 inches of depth (but no less than 3 density tests per 6 inch lift). For horizontal lifts, one test will be conducted for each 100 lineal feet for each 12 inches of thickness. The test locations will be evenly distributed across each lift being tested. Any area appearing to be of questionable quality will be tested instead of, or in addition to, the area previously planned for testing. Test procedures for determining moisture-density relationships in the laboratory will utilize ASTM D 698 (Standard Proctor density). The density obtained in the field must be at least 95 percent of the maximum Standard Proctor value with a moisture content at or above optimum, as determined using a nuclear density gauge in accordance with ASTM D2922. Sections of compacted soil liner which do not pass the density and moisture requirements shall be reworked and retested until the section in question passes.

2.3.2 Sieve Analysis and Atterberg Limits

Bulk samples will be collected for analysis to determine the Atterberg limits and the percent passing the No. 40 and 200 sieves. For parallel lifts, a minimum of one test sample will be conducted for each 100,000 square feet of surface per lift, or major fraction thereof, but no less than one test per 6 inch lift of parallel liner. For horizontal lifts, a minimum of one test per 2,000 lineal feet per 12 inches of horizontal liner. Test procedures to be followed in the laboratory will be ASTM D422 for Sieve Analysis (+1, +200, and -200) and ASTM D4318, for Atterberg Limits. The liner soil must have a liquid limit of no less than 30, a plasticity index of no less than 15, and percent passing No. 200 sieve of no less than 30. If either the LL or PI varies by 10 or more points when compared against the appropriate moisture/density curve used for that soil borrow source, the soil is considered as a distinct soil borrow source and a new test series including moisture/density, compaction relationship, sieve analysis and coefficient of permeability will be determined and these results used for field construction control.

2.3.3 Coefficient of Permeability

Undisturbed samples of the constructed liner will be collected for permeability testing. These samples will be collected using a 3-inch or larger diameter sampling device. All permeability test data shall be submitted regardless of test method used. At a minimum, the calculations of the last data set reported for each sample and the resultant coefficient of permeability shall be reported as supporting data. Any deviation from the methods in the approved SLQCP will be fully justified and explained to the GP and his permission granted prior to their use. These variations will also be noted and GP authorization documented in the Construction Documentation Report.

For parallel lifts, a minimum of one test sample for each 100,000 square feet of surface per lift, or major fraction thereof, but no less than one test per 6 inch lift of parallel liner will be performed. For horizontal lifts, a minimum of one test per 2,000 lineal feet per 12 inches of horizontal liner will be performed. Each sample will be tested in the laboratory using a Falling Head procedure (Appendix VII of the Corps of Engineers Manual, EM1110-2-1906, Laboratory Soils Testing, or more recent version), or a Constant Head procedure (ASTM D 5084 or EM

1110-2-1906, Appendix VII). The permeant fluid will be tap water or water with a 0.05N solution of $CaSO_4$. The liner coefficient of permeability will not exceed 1×10^{-5} cm/sec.

2.3.4 Thickness Verification

Elevation of grid points taken before and after clay placement with field surveying equipment will be used to determine constructed liner thickness. Elevations will be taken at a minimum of one per 5,000 square feet of surface area or major fraction thereof. If the lined area under evaluation is less than 5,000 square feet, a minimum of two reference points are required for verification. Probe holes that disturb finished clay liner may not be used to determine thickness.

2.4 Construction of Clay Liners

Construction of clay liners will be monolithic - sidewalls and floor will be constructed as one unit. This construction method will eliminate the need for a sidewall keyway. Placement of clay liners will be performed in accordance with the following guidelines:

1. Prior to placement of clay liner material, the subgrade in the bottom and sidewall (3 Horizontal to 1 Vertical slope or flatter) areas will be brought within design lines and grades. The liner subgrade area will be proof rolled with heavy construction equipment to detect soft or unstable areas. Unstable areas will be undercut to stable materials and filled with suitable earth materials. The fill will be recompacted to at least 95 percent of maximum Standard Proctor density at a moisture content within plus or minus 3 percent of optimum moisture content. Recompacted subgrade sections are not part of the constructed liner section. All surface areas shall be properly scarified a minimum of two (2) inches and prepared to receive the liner. The surface of each lift shall not contain particles greater than 3/8-inch in size.

2. Liner borrow source soil shall be hydrated by adding water after clod size reduction by discing, pulverizing, or screening as necessary to thoroughly break up and blend the liner soil. Watered and mixed soil shall be stockpiled if necessary to allow proper hydration. Water will be clean and not have come into contact with waste or any objectionable material.

3. All soil liners will be constructed in compacted layers or lifts using a maximum loose lift thickness of eight inches (6-inch nominal compacted thickness). Layers may be formed by utilizing equipment which will spread the material as it is dumped, or the layers may be formed by spreading or blading from piles or windrows previously dumped from excavating or hauling equipment in such amounts that the material is evenly distributed. Water used for sprinkling will be clean and will not have been in contact with solid waste or other objectionable matter. Water required to bring the material to the moisture content necessary for maximum compaction will be sprinkled evenly at the bottom of each lift so as to achieve a uniform moisture content throughout each lift. The liner soil material will not contain rocks or stones larger than one inch or have more than 10 percent rock by weight. The maximum clod size shall be one inch in diameter. In all cases, soil clods will be reduced to the smallest size necessary to achieve the coefficient of permeability reported by the testing laboratory and to destroy any macrostructure after the compaction of the clods under density-controlled conditions. The surface of each lift shall not contain particles greater than 3/8-inch in size.

4. Each constructed soil lift, or layer of liner, shall not exceed eight inches of loose depth, and will be compacted to at least 95% Standard Proctor maximum dry density at or above the optimum moisture content. Each lift will be compacted with a pad/tamping-foot or sheeps-foot roller. The lift thickness will be controlled so that there is total penetration through the loose lift under compaction into the top of the previously compacted lift; therefore, the loose lift thickness must not be greater than the pad or prong length. This is necessary to achieve adequate bonding between lifts and reduce seepage pathways. Adequate cleaning devices will be in place and maintained on the compaction roller so that the prongs or pad feet do not become clogged with clay soils to the point that they cannot achieve full penetration during initial compaction. The footed roller is necessary to achieve bonding and to reduce the individual clods and achieve a blending of the soil matrix through its kneading action. In addition to the kneading action, weight of the compaction equipment is important. The minimum weight of the compaction equipment will be 1,500 pounds per linear foot of drum length. A minimum of eight passes over the liner section is recommended for the compaction equipment. The top of each lift shall be scarified to a shallow depth prior to the placement of the next lift of soil for compaction.

5. New liner sections shall be properly tied back into previous liner sections to ensure continuous liner cover. Continuous floor liners shall not be constructed by butting the entire thickness of a new liner segment to the previous section with a vertical or near vertical joint between the two sections. Proper tie-in of the two sections will use a stair-step construction method with benches, no steeper than a five horizontal to one vertical face. This procedure will tie the two sections together without superimposed construction joints.

6. The clay liner will be keyed into an underlying formation of sufficient strength to ensure stability of the constructed lining.

7. Survey control shall be maintained throughout placement of clay liner material. This will be accomplished by the use of instrument survey method only.

8. The top surface of the completed soil liner will be proof rolled with a smooth-wheel roller prior to final liner thickness surveying. The surface of the soil liner will be proof rolled when construction is shut down for more than 24 hours to mitigate the effects of desiccation. This will be done on a routine basis at the end of each day's liner construction during the summer months.

9. Soil liner construction and testing will be conducted in a systematic and timely fashion. Delays will be avoided in liner completion. Construction and testing of soil liners should not exceed 60 working days from beginning to completion. There will be no more than a 14-day interruption in construction unless adverse weather prevents construction progress. The reasons for any liner construction project taking more than 60 working days to complete will be fully explained in the Construction Documentation Report.

10. All quality testing of soil liners will be performed during the construction of the liner. In no instance will any quality control field or laboratory testing be undertaken after completion of liner construction, except for that testing required of the final constructed lift or confirmation of liner thickness.

11. All soil testing and evaluation of constructed soil liners shall be complete prior to installing an overlying component of the liner system.

3.0 GEOMEMBRANE LINING

3.1 General

This Section covers the work necessary to construct and test the geomembrane lining (geomembrane) system, which will consist of a 60 mil High Density Polyethylene (HDPE) liner. The overall objective is to provide an effective lining system at the completion of the work.

3.2 Submittals

The Contractor will submit written certification by the lining Manufacturer that the lining materials conform to the requirements of the SLQCP; are similar and of same formulation as that for which certification is submitted; and has been demonstrated by actual usage to be satisfactory for the intended application.

The lining Manufacturer and the Contractor, each, will submit a complete description of its quality control program, as applicable, for manufacturing, handling, installing, testing, repairing and providing a completed lining in accordance with requirements of the SLQCP. The description will include, but not be limited to, polymer resin supplier, product identification, acceptance testing, fabrication and production testing, installation testing, documentation of changes, alterations and repairs, retests and acceptance.

The Contractor will submit installation drawings, description of installation procedures, and a schedule for performing/completing the Work. Installation drawings will show a lining sheet layout with proposed size, number, position, and sequence of placing of all sheets and indicating the location of all field seams. Installation drawings will also show complete details and/or methods for anchoring the lining at its perimeter, making field seams, and making anchors/seals to pipes and structures.

The Contractor will submit for approval by the GP samples of lining material(s) and field seams prior to the start of construction.

The Contractor will submit a complete description of welding procedures for making field seams and repairs. The welding procedures will conform to the latest procedures recommended by the lining Manufacturer and to the SLQCP.

The Contractor will submit, for approval by the GP, certification that the surface(s) on which the lining will be placed is acceptable. Installation of the lining will not commence until this certification is furnished to the GP.

The lining Manufacturer will furnish a written lining material warranty on a pro-rata basis for a period of 20 years. The warranty will be against manufacturing defects or workmanship and against deterioration due to ozone, ultraviolet or other normal weather aging.

The Contractor will furnish a written guarantee that the entire lining work constructed by him to be free of defects in material and workmanship and installed pursuant to the SLQCP for a period of two (2) years following the date of acceptance of the Work by the GP. During the 23rd month, a pre-guarantee expiration inspection will be conducted to identify any necessary repair work covered by the guarantee. The Contractor will agree to make any repairs or replacements made necessary by defects in materials or workmanship in the work, which become evident within said guarantee period. The Contractor will make repairs and/or replacements promptly. If the Owner does so, and the Contractor will be liable to the Owner for the cost of such repairs and/or replacements.

3.3 Quality Assurance

Prior to start of work, the lining Manufacturer and the Contractor, each, will submit for approval by the GP, documented evidence of its ability and capacity to perform this Work. Each will have successfully manufactured and/or installed a minimum of two (2) million square feet of similar lining material in containment structures. The Contractor can meet these criteria by teaming with a subcontractor who is identified in the bid along with the firm's experience.

The Contractor will submit the name and qualifications of its project superintendent that will be on the project whenever lining materials are being handled/installed plus the names and qualifications of senior installation personnel on the project.

The Quality Control Plan(s) to be implemented for the Work by the lining Manufacturer and the Contractor will be in accordance with applicable paragraphs of the SLQCP.

The GP will initiate a pre-installation meeting with the Contractor and subcontractor (if applicable) prior to installation of the lining system. Topics for review/discussion will include, as a minimum, project plans and specifications, approved submittals, training and qualification procedures for Contractor personnel, and demonstration of making a field welded seam(s) including peel and shear tests.

Prior to installation of the lining system, the Contractor will instruct the workmen of the hazards of installation, such as handling sheets of lining material in high winds; use of equipment; application of solvents, adhesives and caulks; and walking on lining surfaces. All work will be performed in accordance with OSHA work standards.

The GP will notify the Contractor if he observes what he believes to be improper installation procedures or other activity that may result in a defective liner.

The Contractor and subcontractor (if applicable), shall submit for approval by the GP, written certification that the lining system was installed in accordance with the Manufacturer's recommendation, the SLQCP, project specifications and drawings, and approved submittals.

3.4 Delivery, Storage and Handling

The Contractor will submit for approval by the GP, a method(s) for handling and storage of lining material(s) that have been delivered to the project site. These materials will be stored in accordance with the Manufacturer's recommendation.

Lining materials delivered to the site will be inspected for damage, unloaded, and stored with a minimum of handling. Materials will not be stored directly on the ground. The storage area will be such that all materials are protected from mud, soil, dirt and debris. The stacking of lining materials will not be higher than five rolls.

Under no circumstances will the lining be subjected to materials, sandbags, equipment or other items being dragged across its surface. Personnel shall not down slopes atop the lining. Smoking on the geomembrane liner area is strictly prohibited. All scuffed surfaces resulting from abuse of any kind caused by the Contractor in performance of the Work will be repaired at the GP's direction.

The Contractor will be completely responsible for shipping, storage, handling, and installation of all lining materials in compliance with the SLQCP.

3.5 Products

The HDPE lining materials shall be new, first quality products designed and manufactured specifically for the purposes of the Work and will have satisfactorily demonstrated, by prior use, to be suitable and durable for such purposes. The geomembrane shall be an unmodified HDPE containing no plasticizers, fillers, chemical additives, reclaimed polymers, or extenders. For ultraviolet resistance, the geomembrane material will contain not less than 2.0 percent carbon black as determined by ASTM D 1603. The only other compound ingredients to be added to the geomembrane resin will be anti-oxidants and heat stabilizers required for manufacturing. The geomembrane will be supplied as a single ply continuous sheet with no factory seams and in rolls with a minimum width of 15 FT. The roll length will be maximized to provide the largest manageable sheet for the fewest field seams.

Prior to use at the site, the tests outlined in Table 1 will be performed on the geomembrane materials.

Table 1: Standard Tests on HDPE Geomembrane Material

Test	Type of Test	Standard Test Method	Frequency of Testing
Resin	Specific Gravity/Density	ASTM D 1505/ D792	per 100,000 ft ^{2} and every resin lot
	Melt Flow Index	ASTM D1238	per 100,000 ft ^{2} and every resin lot
	Oven Aging at 85°	ASTM D 5721 ASTM D 3895 ASTM D 5885	per each formula
	UV Resistance	GM 11 ASTM D 3895 ASTM D 5885	per each formula
Manufacturer's Quality Control	Thickness	ASTM D 5199 (smooth) or D 5994[A] (textured)	per roll
	Specific Gravity/Density	ASTM D 1505/ D 792	per 200,000 lb. and every resin lot
	Carbon Black Content	ASTM D 1603	per 20,000 lb
	Carbon Black Dispersion	ASTM D 5596[B]	per 45,000 lb.
	Tensile Properties	ASTM D 6693 Type IV [C]	per 20,000 lb.
	Tear	ASTM D 1004	per 45,000 lb.
	Puncture	ASTM D 4833	per 45,000 lb.
	Dimensional Stability (Shrinkage)	ASTM D 1204 NSF 54 Modified	per 100,000 ft ^{2} and every resin lot
	Stress Crack Resistance	ASTM D 5397	Per GRI-GM10
	Oxidative Induction Time	ASTM D 3895 or D 5885	Per 200,000 lb.
	Asperity Height (Textured Only)	GM 12	Every 2nd roll
Conformance Testing by 3rd Party Independent Laboratory	Thickness [D]	ASTM D 5199 (smooth) or D 5994[A] (textured)	per 50,000 ft ^{2} and every resin lot
	Specific Gravity/Density	ASTM D 1505 / D 792	per 100,000 ft ^{2} and every resin lot
	Carbon Black Content	ASTM D 1603	per 100,000 ft ^{2} and every resin lot
	Carbon Black Dispersion	ASTM D 5596[B]	per 100,000 ft ^{2} and every resin lot
	Tensile Properties	ASTM D 638 Type IV [C]	per 100,000 ft ^{2} and every resin lot

Notes: All test values in accordance with GRI Test Method GM13

A - For textured liners acceptable alternative procedure in accordance with industry standard is to use micrometer with 1/32 radius points

B - NSF 54 Modified (microtome sample preparation procedure)

C - NSF 54 Modified with 2 initial gauge length assumed for elongation at break

D - Field thickness measurements for each panel must be conducted. Use ASTM D374 and perform one series of measurements along the leading edge of each panel, with individual measurements no greater than five feet apart. No single measurements shall be less than 10%below the required nominal thickness in order for the panel to be acceptable.

Extrusion welding rod will be HDPE produced from the same resin as the HDPE sheet resin. Physical properties will be the same as HDPE lining sheets.

3.6 Installation Procedures

Prior to installation of the geomembrane, a site inspection will be conducted by the GP and the Contractor to verify measurements, structures and surface conditions necessary to support the geomembrane. The surface of the subgrade will contain no particles greater than 3/8 inch in size.

The Contractor will provide written documentation to the GP that surfaces to receive the geomembrane have been inspected and are acceptable for installation of the lining.

All earth subgrade surfaces will be maintained in a smooth, uniform, and compacted condition during installation of the lining. Excessive cracking (defined as cracks of a least 1” in depth and at least 1' in length) of the surfaces will be repaired as directed by the GP. Immediately prior to installation of the lining, any erosion or other damage to the subgrade which has occurred since completion of earthwork will be corrected. Adequate drainage of the subgrade will be provided and maintained until installation of the lining is completed. No vehicles will be permitted to travel the completed subgrade.

Before the work begins, the Contractor will inspect all lining materials for damage from transit. Materials that cannot be repaired will be rejected and removed from the work area and site.

During unwrapping of lining materials for use and placement, the Contractor will visually inspect all materials, particularly surfaces of lining sheets, for imperfections and faulty areas. All such defective places will be marked and repaired in accordance with approved methods.

The geomembrane will be installed as shown on the project plans and approved installation drawings. Placement of the geomembrane will be done such that good fit, without bridging, is provided on all covers and grade changes. Excessive slack will be avoided to minimize rippling during the soil cover operation.

Sheets of geomembrane materials will be of such lengths and widths and will be placed in such a manner as to reduce field seaming to a minimum. The lining will be anchored in accordance with details shown on approved plans and drawings. Backfill will be compacted to at least 95% maximum standard proctor density, plus or minus 3% of optimum moisture. The lining will be anchored and sealed to structures, pipes and other types of penetrations, (if any), in accordance with details shown on approved plans and drawings. All changes in approved installation drawings and procedures must be approved by the GP.

Extreme care will be taken during installation of the lining to be certain no damage is done to any part of the lining. Dragging of the geomembrane material on the subgrade will be avoided. Smoking by installation personnel will be prohibited. All handling and installation procedures will be performed by workers wearing shoes with smooth soles. Shoes with soles that have patterns in relief will be prohibited. No foot traffic will be allowed on the geomembrane except with approved shoes. No vehicular traffic will be allowed on the lining. All motor driven equipment using fuel will have spark arrestors. No gasoline driven generators or cans of gas or solvent will be placed directly on the lining material. Under no circumstances will the lining be used as a work area to prepare patches or to store tools and supplies. If needed, a tarpaulin of approved material will be spread out as a work area.

During installation, the Contractor will be responsible for protecting the lining against adverse effects of high winds such as uplift. Sand bags will be used as required to hold the lining material in position during installation. Sand bags will be sufficiently close-knit to preclude fines from working through any portion of the bag. Paper bags, whether or not lined with plastic, will not be permitted. Burlap bags, if used, must be lined with plastic. Sand bags will contain not less than 40 or more than 60 pounds of sand having 100 percent passing a number 8 screen and will be tied closed after filling, using only plastic ties. Metal or wire ties will not be used. Bags that are split, torn, or otherwise losing their contents will be immediately removed from the work area and any spills immediately cleaned up.

The geomembrane material will not be installed under adverse climatic conditions, unless the Contractor can demonstrate that his installation techniques adequately compensate for such adverse conditions and quality of workmanship is not compromised. Adverse climatic conditions occur when the air temperature measured 6 inches above the geomembrane surface is less than 32°F and decreasing, or greater than 104°F; when it is raining; when there is frost on the ground; or during conditions of high winds.

Field seams between sheets of geomembrane material will be made using approved fusion welding systems, equipment and techniques. Approved fusion welding systems include extrusion weld and lap weld using single or double wedge welder.

Geomembrane field seams will be lap seams as shown on approved plans and drawings. The lap seams will be formed by lapping the edges of geomembrane sheets a minimum of 4 inches. The contact surfaces of the sheets will be wiped clean to remove dirt, dust, moisture, and other foreign materials. For extrusion weld seams, bevel edge of geomembrane and clean oxidation from surfaces to receive extrudate by disk grinding or equivalent not more than one hour before seaming.

Lap seam intersections involving more than 3 thicknesses of lining material will be avoided, and all seam intersections will be offset at least 2 ft. No horizontal field seams will be allowed on the slope. Sheets of lining material on the slopes will extend down slope out onto bottom a minimum of 5 ft from toe of slope.

Any necessary repairs to the geomembrane will be made with the lining material itself, using approved fusion welding systems, equipment and techniques. The patch size will be 6 inches larger in all directions than the area to be patched. All corners of the patch will be rounded with a 1 inch minimum radius.

All seams and seals of the geomembrane will be tightly bonded on completion of the work. Any lining surface showing damage due to scuffing or penetration by foreign objects or showing distress will be replaced or repaired as directed by the GP.

Cleanup within the work area will be an ongoing responsibility of the Contractor. Particular care will be taken to insure that no trash, tools, and other unwanted materials are trapped beneath the lining. Care will be taken to insure that all scraps of lining material are removed from the work area prior to completion of the installation.

3.7 Field Quality Control

3.7.1 Observation

Inspection and testing of the installation of the geomembrane will involve the full time observation by the GP or his representative. This will include observing the making and testing of lining seams and patches and periodic measurement of the liner material thickness to insure compliance. The contractor who does field sampling and testing shall act in compliance with the provision of the Texas Engineering Practices Act.

The Contractor shall make visual inspection of the lining sheets, seams, anchors, seals, and repairs as the installation progresses and again on completion of the installation. Defective and questionable areas will be clearly marked and repaired. Final approval of repairs will be given by the GP.

3.7.2 Thickness Measurement

Field thickness measurements must be taken for each panel before it is seamed. The material thickness will be checked using a micrometer at a minimum frequency of one measurement per five feet along the leading edge of each panel but at least, at a minimum, five measurements along the leading edge of the panel. No single measurement will be less than 10% below the required nominal thickness in order for the panel to be accepted.

3.7.3 Trial Seams

Trial seams will be made to verify that adequate conditions exist for field seaming to proceed. Each seamer and machine will produce a trial seam at the beginning of each shift to determine the peel and tensile strength of the seam. The GP may require a trial seam be made at any time during seaming production to verify equipment/operator performance and seam integrity. In addition, if a seaming operation has been suspended for more than 1/2 hour or if a breakdown of the seaming equipment occurs, a trial seam will be produced prior to resumption of seaming operations.

The trial seams will be made of the same HDPE sheet, welding rods, and equipment using the same installation procedures as the geomembrane installation itself. Five samples (coupons) will be taken from each trial seam. The coupons will have a width of 1 inch and length of 12 inches. Each coupon will be tested for shear and peel strength. All coupons will fail by Film Tear Bond. At a minimum, the peel adhesion and bonded shear strength must be 62% and 95%, respectively, of the strength of the parent material, but no less than 78 ppi and 120 ppi respectively. All five coupons must pass the tests, or else the trial seam fails. In that case a new trial seam must be made and tested. This process will continue until all five coupons from the trial seam pass.

3.7.4 Non-Destructive Testing

Depending on seam welding equipment used, all seams and repairs will be tested by a vacuum testing device, a spark testing device and/or air pressure. Standards for vacuum testing and air pressure testing are given in Table 2:

Table 2: Standard Non-Destructive Seam Field Tests on HDPE Geomembrane Material

Type of Test	Standard Test Method	Frequency of Testing	Criteria
Air Pressure	GR1 GM6	All dual-track fusion	27 lb/in^2 (min.) 30 lb/in^2 (max.)
Vacuum	ASTM 4437-99	All non-air pressure tested seams when possible	no bubbles at 3" to 5" suction for 10 sec.

If an extrusion weld or single hot-wedge fusion lap weld is used to weld seams, the Contractor will test the seams by vacuum box. All vacuum box testing will be done in the presence of the GP or his representative. The area to be tested will be cleaned of all dust, debris, dirt and other foreign matter. A soap solution will be applied to the test area and a vacuum of 10 inches Mercury (Hg) will be induced and held at least 10 seconds to mark for repair any suspicious areas as evidenced by bubbles in the soap solution.

As an alternative for testing extrusion welds, the Contractor may test all seams and repairs in the geomembrane by using a high voltage spark detector. The setting of the detector will be 20,000 volts. In order to conduct this test, all seams to be tested will be provided with gauge 24-30 copper wires properly embedded in the seams and grounded. All spark testing will be done in the presence of the GP. All defective areas will be marked for repair.

If the double hot-wedge is used, the Contractor will test all seams in the geomembrane by using the air pressure test. This test consists of inserting a needle with gauge in the air space between welds. Air will be pumped into the space to 30 psi and held for 5 minutes. If the pressure does not drop more than 4 psi, then the seam is acceptable.

All costs of retesting of the geomembrane including reruns of field weld tests and all repairs will be at the Contractor's expense.

3.7.5 Destructive Testing

During the field seaming operation, the Contractor will remove destructive samples from field seams at locations selected by the GP. A minimum of one sample per 500 linear feet of field seam will be made. Additional destructive test samples may be taken if deemed necessary by the GP or his representative. Destructive seam-testing locations will be cap-stripped with the same liner material being sampled (and from the same roll, if available) and of 8 inches minimum width. It will be positioned over the center of the field seam and welded to the lining using an extrusion weld. Capped sections will be non-destructively tested. The destructive sample will have a width of 12 inches plus the seam width and length of 48 inches. From this sample, a 12-inch length will be given to the Owner, another 12-inch length kept for independent laboratory

testing, and the remainder kept by the Contractor. Ten (10) coupons will be cut from the Contractor's length from which five (5) will be field tested for peel adhesion and five (5) will be field tested for shear strength. Four out of five coupons must pass each test as described in Section 3.7.3.

For field destructive samples which have failed the passing criterion, the Contractor shall reconstruct all the field seams between any two previous passed seam locations which include the failed seam or will go on both sides of the failed seam location (10 feet minimum), take another sample from each side and test both. If both pass, the Contractor will reconstruct the field seam between the two locations. If either fails, the Contractor will repeat the process of taking additional samples for testing. In all cases, acceptable field seams must be bounded by two passed test locations. The decision of the GP will be final.

Once a seam is shown to pass the field test, the 12-inch length kept for the laboratory will be shipped to an independent laboratory to confirm these results. The passing criterion for independent laboratory testing is that four of five samples must pass in shear and four of five must pass in peel, as well as fail in FTB. Testing by the independent laboratory will be paid for by the Owner. The independent testing agency will save all test samples including specimens tested until notified by the GP relative to their disposal. All specimens which have failed under testing will be shipped immediately by express delivery to the GP for determination of corrective measures to be taken, which includes retest or repair of failed section.

For nondestructive samples that have failed, the Contractor will cap all field seams represented by the failed sample and a new test sample submitted for retest. The decision of the GP will be final. All costs of retesting of the geomembrane including reruns of field weld tests and all repairs will be at the Contractor's expense.

3.7.6 Liner Acceptance

The Contractor will retain responsibility for the integrity of the geomembrane system until acceptance by the GP. The geomembrane will be accepted by the GP when:

a) Written certification letters including as built drawings, have been received by the GP.
b) Installation is completed.
c) Documentation of completed installation, including all reports, is complete.
d) Verification of adequacy of field seams and repairs, including associated testing, is complete.

Acceptance of the completed work will include receipt of all submittals and all work completed to the satisfaction of the GP.

4.0 LEAK DETECTION SYSTEM

The leak detection system (LDS) shall be designed and constructed to detect leaks that may occur in the overlying geomembrane lining. The system will be physically and chemically resistant to field conditions.

The LDS will be placed above the constructed composite liner system. The LDS installation will be monitored by the GP or his representative on a full time basis. Testing will be conducted by a third party independent laboratory on a full time basis. On the side slopes, the LDS will consist of a heat bonded HDPE geonet/geotextile drainage composite (geocomposite) hand placed on the geomembrane. The geotextile will be bonded on both sides of the geonet. The geotextile on both sides of the geonet will be a minimum 6-ounce non-woven material. On the floor, the LDS will consist of a geonet only, which will also be hand placed on the geomembrane. The geonet will be constructed of polyethylene polymer. The thickness of the geonet in the geocomposite will be 200 mil and the thickness of the geonet-only will be 275 mil. A second geomembrane will be laid above the LDS following the procedures in Section 3. The LDS will include a sump with an embedded sump discharge pipe. The sump will consist of rounded, river-run gravel meeting the requirements of ASTM C-33 for coarse aggregate. Crushed material will not be acceptable. The gravel will meet the gradation requirements of Size No. 6 (Nominal size 3/4 inch to 3/8 inch) or coarser with a maximum gravel size of 2 inches. A minimum 8-ounce non-woven geotextile filter will be hand-placed around the gravel sump.

Placement of granular materials in the sump will generally not proceed at ambient temperatures below 32ºF or above 104ºF, but should be conducted at the coolest part of the day to minimize the development of wrinkles or folding of the geosynthetic materials below the sump. The placement of the LDS will be controlled to avoid damage to the liner; however, the granular material in the sump does not need to be density controlled.

Granular materials will be selected to meet the specifications described above. At least one set of pre-construction tests will be conducted on the granular material from the proposed source. Gravel sources will include a complete grain-size analysis, including Minus No. 200 Sieve, by

ASTM D 422. The required thickness of the granular material in the sump will be verified by survey methods.

The tests described in Table 3 will be required on the geotextile materials.

Table 3: Standard Tests on Geotextile Materials

Test	Type of Test	Standard Test Method	Frequency of Testing
Manufacturer's Quality Control	Fabric Weight	ASTM D 3776	per 100,000 ft^2
	Thickness	ASTM D1777	per 100,000 ft^2
	Grab Tensile Strength (lbs)(MD/CD) [1]	ASTM D4632	per 100,000 ft^2
	Grab Elongation (%)(MD/CD) [1]	ASTM D4632	per 100,000 ft^2
	Puncture Resistance (lbs)	ASTM D4833	per 100,000 ft^2
	Permeability	ASTM D4491	per 100,000 ft^2
Conformance	Thickness	ASTM D1777	per 100,000 ft^2
Testing by 3rd Party	Fabric Weight	ASTM D3776	per 100,000 ft^2
Independent Laboratory	Grab Tensile Strength	ASTM D4632	per 100,000 ft^2
	Grab Elongation	ASTM D4632	per 100,000 ft^2
	Puncture Resistance	ASTM D4833	per 100,000 ft^2
	Permeability	ASTM D 4491	per 100,000 ft^2

1. MD/CD = MD – Machine Direction/CD – Cross Direction

The tests described in Table 4 will be required on the geonet materials:

Table 4: Standard Tests on Geonet Material

Test	Type of Test	Standard Test Method	Frequency of Testing
Resin	Specific Gravity/Density	ASTM D 1505	per 100,000 ft^2 and every resin lot
	Melt Flow Index	ASTM D 1238	per 100,000 ft^2 and every resin lot
Manufacturer's Quality Control	Thickness	ASTM D 1777	per manufacturer's quality control specifications
	Mass per Unit Area	ASTM D 3776 (Option C)	per 100,000 ft^2 and every resin lot
	Polyethylene Content	--	per 100,000 ft^2 and every resin lot
	Density (black resin)	ASTM D 1505	per 100,000 ft^2 and every resin lot
	Carbon Black Content	ASTM D 1603	per 100,000 ft^2 and every resin lot
	Melt Index	ASTM D 1238 (Condition 190/216)	per 100,000 ft^2 and every resin lot
	Tensile Strength	ASTM D 1682	per 100,000 ft^2 and every resin lot
	Transmissivity	ASTM D 4716	per 100,000 ft^2 and every resin lot
Conformance Testing by 3rd Party Independent Laboratory	Thickness	ASTM D 751	per 100,000 ft^2 and every resin lot
	Mass per unit area	ASTM D 3776	per 100,000 ft^2 and every resin lot
	Carbon black content	ASTM D 1603	per 100,000 ft^2 and every resin lot
	Tensile Strength	ASTM D 1682	per 100,000 ft^2 and every resin lot
	Transmissivity	ASTM D 4716	per 100,000 ft^2 and every resin lot

5.0 FABRIC-FORMED CONCRETE REVETMENT MAT

A four-inch thick fabric-formed concrete revetment mat will be placed on top of the upper geomembrane liner on the floor and sidewall areas.

Placement of the revetment mat fabric forms will generally not proceed at ambient temperatures below 32ºF or above 104ºF, but should be conducted at the coolest part of the day to minimize the development of wrinkles or folding of the geosynthetic materials below the revetment mat. Care will be exercised in placement and filling the revetment mats so as not to shift, wrinkle, or damage the underlying geosynthetic layers. Placement methods will be documented.

6.0 FIELD PROCEDURES FOR GEOTECHNICAL PROFESSIONAL

The following actions will be taken by the GP to validate that the excavation foundation is suitable for construction of the clay liner.

- The GP will walk the entire floor of the excavation and visually look for cracking, fissures, seeps, depressions, and foreign objects that would indicate unsatisfactory conditions to construct the clay liner. In addition, the GP will thoroughly review the final survey data to verify that the proper excavation grades have been achieved prior to beginning clay liner construction.
- The GP will document the conditions of the foundation of the inspected areas.
- If any of the foundation appears to exhibit any of the characteristics noted above, then the GP will notify the Contractor to take appropriate actions to correct the problems. Actions the Contractor may take include 1) grubbing and re-grading areas that do not meet proper excavation grades, or 2) scarifying and re-compacting the sub-grade to achieve adequate density prior to clay lining.

Areas that are repaired will be re-surveyed to verify the appropriate grades have been achieved prior to constructing the clay liner.

7.0 CONSTRUCTION DOCUMENTATION REPORT

Upon completion of all required liner construction and evaluation, the GP will prepare and submit a Construction Documentation Report. This report will contain a narrative describing the conduct of work and testing programs required by the Contract Docouments, record drawings, and appendices of field and laboratory data. Because the volume of data for these projects can be quite large, the documents may be subdivided for ease of review. The preferred document format will include the narrative, record drawings, and summaries of test results in a single volume. The remaining appendices will be placed in accompanying volumes. The Construction Documentation Report and will be signed and sealed by the GP, and countersigned by the Site Manager or an authorized representative.

The Construction Documentation Report will contain or discuss the following information, at a minimum, for geosynthetics:

- Roll shipment and receipt information
- Manufacturer's quality control certificates and results
- Storage and handling information
- Conformance test sampling and test results
- Subgrade acceptance
- 100 percent visual inspection for defects, damage, etc.
- Destructive testing methods, criteria and results
- Material properties and placement of all geosynthetics and drainage materials
- Seamer's names and resume of experience and qualifications
- Anchor trench preparation and backfilling
- Panel deployment, identification and placement
- Panel wrinkling and manufacturer's creases
- Seam preparation, orientation and identification
- Weather and ambient temperatures
- Equipment placed on the geomembrane
- Trial seams for each combination of seaming equipment and personnel
- Seaming methods, times, temperature, equipment shutdowns and start-ups
- Continuous 100 percent non-destructive seam testing, methods, criteria and results
- Repairs including preparation procedures, failure delineation, patch size and shape, and retesting

The reports will also include pertinent record drawings including:

- Record drawings showing elevations of constructed soil liner layers to confirm its thickness.
- Plan view map showing soil liner field test and sample locations for each six-inch lift.

- Record panel layout drawings showing location of destructive test samples, patches and repairs.
- Record drawings showing final elevations of the completed liner system.

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EXHIBIT A

Example Geomembrane/Geosynthetic Liner Evaluation Report

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
MUNICIPAL SOLID WASTE FACILITY
GEOMEMBRANE/GEOSYNTHETIC LINER
EVALUATION REPORT

*****READ THESE INSTRUCTIONS BEFORE COMPLETING THIS FORM******

This form is to be completed by a knowledgeable professional engineer experienced in geotechnical engineering and is experienced in geosynthetic clay liner testing, the interpretation of these test results, and the proper methods of constructing impermeable geomembrane/geosynthetic clay liners that meet the requirements of the Texas Commission on Environmental Quality (TCEQ) rules.

The certifying engineer or a member of his or her staff qualified by training and experience shall monitor liner construction, but the final evaluation must be made by the aforementioned engineer.

The purpose of the geomembrane/geosynthetic clay liner evaluation report is to assure that groundwater, as defined in the TCEQ rules, is protected from contamination resulting from the storage, processing, and disposal of municipal solid waste. This liner evaluation report is required to document that the liner was constructed as designed in accordance with the issued registration or permit and meets the TCEQ regulatory requirements prior to unit operation.

This report is to be supplemented with those quality-assurance/quality-control (QA/QC) tests as detailed in the liner quality control plan (LQCP) and shall be the basis of documentation of the quality control and acceptance of the constructed liner.

The term "GCL" as used in this report form refers to geosynthetic clay liner. The term "GCLER" refers to geosynthetic clay liner evaluation report and is synonymous with the term "SLER" as described in the TCEQ rules when GCL is used to replace or supplement a soil liner as part of an alternative liner design.

Attach additional sheets as needed, and on each sheet identify the appropriate Part and Paragraph number for each reference.

If the geosynthetic clay liner is to be covered by a geomembrane, complete Part F and G of this form with the geomembrane liner evaluation report.

Provide an interim status report within six (6) months completion of the protective cover as stated in Part E.3 and each 6 months thereafter until the entire liner system is covered by municipal solid waste. This report should be developed by a qualified independent consultant and submitted to the TCEQ. No formal report form exists for this purpose. The integrity and required thickness of the protective cover must be verified. If erosion of the protective cover has occurred, then it must be replaced and reported as such and verified by the consultant that it meets the thickness requirement. If repairs are necessary on the synthetic liner, then these repairs must be completed in accordance with the approved LQCP and reported to the TCEQ in a supplemental liner evaluation report.

Important: Three signed, sealed, and dated copies of this form which includes one original copy and all attachments (drawings, comments, etc.) must be provided to the TCEQ.

(SUBMIT THIS REPORT TO THE TCEQ IN TRIPLICATE)

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
MUNICIPAL SOLID WASTE FACILITY
GEOMEMBRANE/GEOSYNTHETIC LINER
EVALUATION REPORT

PART A: FACILITY IDENTIFICATION

Permittee: _____

Permit No.: _____ Operational Classification Type: _____

County: _____

PART B: GENERAL INFORMATION

1. What type of liner system is required by the permit and is detailed in the site development plan (SDP)? _____

2. Is this the first liner element of a composite liner system? _____

3. Does the SDP require a leachate collection system (LCS) for this liner system? _____

4. Date of the current approved LQCP that was used to develop this GLER/GCLER? _____

   a. Was this plan followed? _____

   b. If not followed, why not? _____

PART C: LOCATIONS AND/OR DESCRIPTON OF AREAS CURRENTLY BEING EVALUATED

1. Attach to this report a copy of the latest approved sectorized fill layout plan showing the areas or sectors of the landfill or waste management unit currently under evaluation and noting areas previously filled. The required grid system must be shown on this drawing.

2. On a sketch(es) or drawing(s) of the area or areas under evaluation, indicate the following:

   a. Boundary lines distinguishing the bottom and sidewall areas of the trenches or fill areas being evaluated and SLER/GCLER/GLER boundary markers.

   b. Geomembrane/GCL panel layout with number designation and location of all repairs.

   c. As-built elevations of subgrade or liner.

3. Are boundary markers in place at the time of this submittal? _____ (See 30 TAC §330.143).

4. Present evaluation location and area of coverage:

   a. Trench, sector, or area identification or number (include SLER/GCLER/GLER boundary coordinates) of this evaluation: _____

   b. Excavation depth _____ft.; Actual elevation of trench at: top _____ ft.; bottom _____ ft.; Width of excavation at: top _____ ft.; bottom _____ ft.; and ration of side slopes _____ H: _____V.

   c. total square footage of liner construction for the floor _____ $ft.^2$ and for each individual side slope: (1) _____$ft.^2$; (2) _____ $ft.^2$; (3) _____ $ft.^2$; (4) _____ $ft.^2$ (if evaluated area has more than four sides, list all others below) _____

PART D: LINER MATERIALS

1. Geomembrane Liner

   a. Indicate type of geomembrane used on floor and sidewalls _____

   b. Indicate geomembrane roll dimensions _____

   c. Does the geomembrane material meet the specifications and the requirements given in the SDP and the LQCP? _____. If not, please explain _____ Attach roll delivery documentation, manufacturer's certification, and conformance testing results. Provide information on a geosynthetics inventory table 6 if not provided elsewhere.

2. Geosynthetic Clay Liner

   a. Indicate type of GCL used on floor and sidewalls:

   _____ Needle-punched geotextile-encased GCL placed with nonwoven side up and woven side down.

   _____ Needle-punched geotextile-encased GCL placed with woven side up and non-woven side down.

   _____ Needle-punched GCL with nonwoven geotextile on both sides.

   _____ Adhesive-bonded GCL with woven geotextile on both sides.

   _____ Stitch-bonded GCL with woven geotextile on both sides.

   _____ Geomembrane-backed adhesive bonded GCL placed with geomembrane side down.

   _____ Geomembrane-backed adhesive-bonded GCL placed with geomembrane side up.

   _____ Other (describe) _____

b. GCL roll dimensions _____

c. Does the GCL material meet the specifications and the requirements given in the SDP and LQCP? _____. If not, please explain _____

Attach roll delivery documentation and manufacturer's certification and test results. Provide information on geosynthetics inventory form (attached) if not provided elsewhere.

PART E: INSTALLATION OF THE GEOMEMBRANE/GEOSYNTHETIC CLAY LINER

Describe concisely on attached sheets the field and laboratory activities performed by the certifying engineer and/or the engineer's staff to accomplish this evaluation. Please indicate the method used to determine testing locations, testing procedures, testing locations and repairs, and field and laboratory methods that were followed.

1. Dates geomembrane/geosynthetic clay liner was installed. _____

2. Dates the engineer visited the site. _____

3. Dates the protective cover was installed. _____

4. Name(s) of the engineer's technician and dates on site. _____

_____

5. Submit subgrade acceptance certificates.

6. Were all the QA/QC tests and the rate of testing preformed in conformance with the current LQCP? _____. If not, please explain. _____

7. Attach any independent laboratory conformance test results for geomembrane liner or GCL if performed. These data must include copies of all laboratory permeability test data sheets. Also, include any miscellaneous tests such as any required field density tests on subgrade.

8. Submit geomembrane/geosynthetic clay liner panel development summary and geomembrane seam summary.

9. Geomembrane installation.

a. Types of field seaming used? _____

b. Start-Up Testing

Were peel and shear test seams made by each seamer each day at the start-up of each seaming period and after the mid-day break, for each seaming apparatus he or she used that day? _____. Did each seamer make at least one test seam each day he or she performed seaming? _____. Submit applicable geomembrane fusion trial seam summary and geomembrane extrusion trial seam summary tables.

c. Non-Destructive Testing

1) Was continuous, non-destructive testing performed on all seams? _____

2) Type of non-destructive testing: vacuum box _____, air pressure _____, other (please explain) _____

_____

3) Submit air pressure test summary table and other non-destructive test documentation on the applicable geomembrane seam summary and geomembrane repair summary table.

d. Destructive Testing (if performed)

1) Number of locations where destructive tests were performed. _____ Total length of seaming _____ feet. Attach destructive tests results.

2) Minimum number of peel tests required to be performed by quality control laboratory. _____. Number actually performed? _____ (Dual track welds must be tested independently).

3) Minimum number of shear tests required to be performed by quality control laboratory. _____. Number actually performed? _____

4) Where are samples from each destructive testing archived? _____

5) Submit destructive test summary table and laboratory destructive test data.

e. Repairs

Were all seams which failed destructive or non-destructive testing and other areas requiring repairs repaired in accordance with the LQCP? _____ Submit geomembrane repair summary table.

10. Geosynthetic Clay Liner Installation

a. How much overlap was provided at the edges of the GCL panels? _____. Was granular bentonite placed in the overlaps? _____ If so, please describe the placement procedure, the rate of bentonite placement, and the procedure used to verify the amount of bentonite placed. _____

b. Were the GCL panels placed by unrolling or by dragging the rolls across the subgrade? _____

c. Did any GCL hydrate prematurely prior to covering with geomembrane or protective cover? _____. If so, were the hydrated areas removed and replaced? _____. If not, please explain. _____ _____

d. How was the GCL tied into existing liner from any adjacent lined areas? _____
_____.
Attach sketch showing tie-in if necessary.

PART F: LEACHATE COLLECTION SYSTEM/PROTECTIVE COVER

1. Gradient of bottom of evaluated area. _____.

2. Gradient of leachate collection lines. _____.

3. What method of placement was used for the LCS and/or protective cover over the geomembrane liner/GCL? _____

_____

_____.

4. Was the liner system (including LCS/protective cover placement) completed prior to the engineer's final field visit? _____.

5. Do protective cover soil and leachate collection system materials (trench backfill; leachate collection layer soil; drainage, filter or cushion geosynthetics; collector pipes) meet the required specifications? _____.

6. Attach result of any required permeability, grain size, and calcium carbonate content tests on soil drainage and protective cover materials by suppliers and independent laboratory. For geosynthetic materials; attach roll delivery documentation, suppliers' certifications and test results, and results of any conformance tests required by the LQCP.

7. Attach survey documentation from a registered surveyor for thickness verification of LCS and protective cover. Also attach a sketch showing the liner/LCS/protective cover cross-section.

PART G: BALLAST

Does this liner system require any ballast to overcome hydrostatic pressure? _____.
Include a demonstration of stability during construction (or post-construction BER if desired) with this GLER/GCLER. This documentation must include: (1) the seasonal high water table and how it was derived (a table showing the groundwater elevations from monitor wells or piezometers is sufficient); (2) the depth of the excavation (Part C.2.c above); and (3) a narrative explaining why ballasting is required with respect to the depth of excavation and the seasonal high water table elevation.

PART H: SIGNATURE OF THE PROFESSIONAL OF RECORD

I certify that the liner and associated components have been constructed as designed in accordance with the issued permit and in general compliance with the regulations.

AFFIX PROFESSIONAL ENGINEER'S SEAL (Date & Sign)

_____
(Typed or printed name)

_____
(Phone number)

_____ _____
(Date signed) (Fax number)

_____
(Company or business name)

_____
(Address, city, zip code)

Note: A professional engineer must be registered in Texas.

PART I: SIGNATURE OF PERMITTEE

1. I have read and fully understand the findings of this GLER/GCLER submittal.
2. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

_____ _____
(Signature) (Typed or Printed Name)

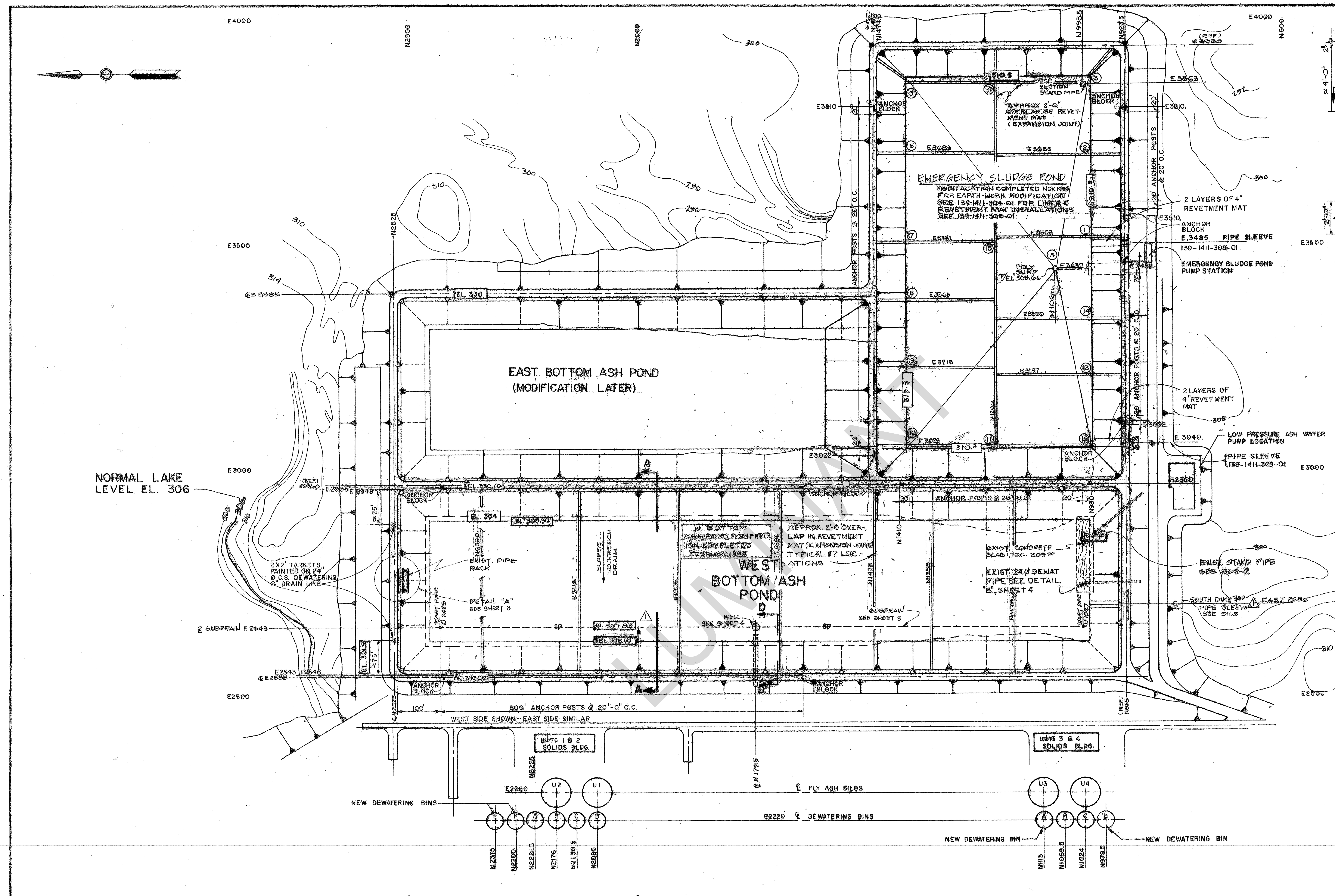
_____ _____
(Title) (Date Signed)

_____ _____
(Phone Number) (Fax Number)

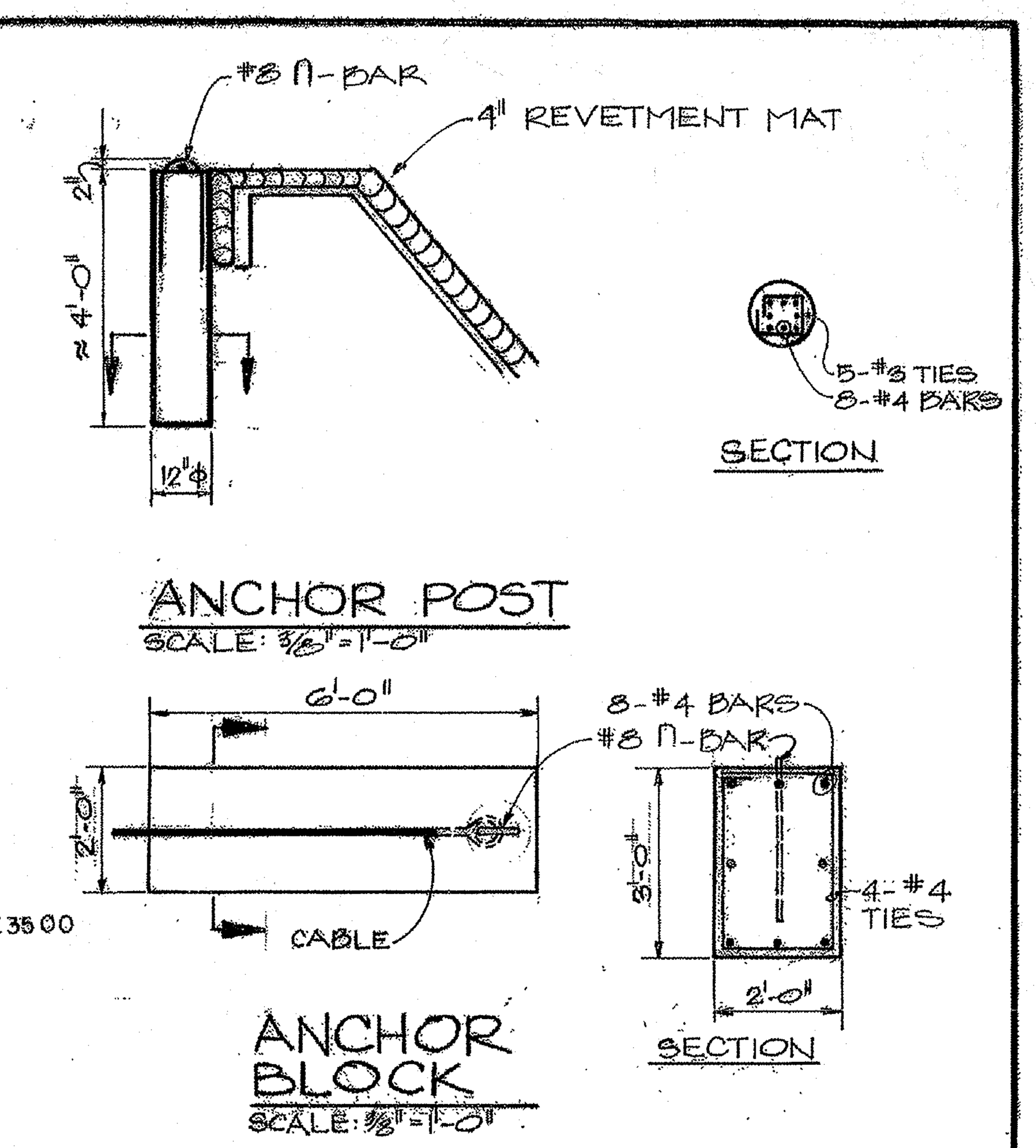
_____
(Company or Business Name)

_____
(Address, City, Zip Code)

WEST ASH POND



EMERGENCY SLUDGE POND
MODIFACATION COMPLETED NOV.1989
FOR EARTH-WORK MODIFICATION
SEE 139-1411-304-01 FOR LINER & REVETMENT MAT INSTALLATIONS
SEE 139-1411-305-01
EAST BOTTOM ASH POND
(MODIFICATION LATER)
WEST BOTTOM ASH POND
W. BOTTOM ASH POND MODIFICATION COMPLETED FEBRUARY 1988
APPROX. 2'-0" OVERLAP IN REVETMENT MAT (EXPANSION JOINT) TYPICAL @ 7 LOCATIONS
APPROX 2'-0" OVERLAP OF REVETMENT MAT (EXPANSION JOINT)
ESP SUCTION STAND PIPE
POLY SUMP T/EL 305.66
NORMAL LAKE LEVEL EL. 306
ANCHOR BLOCK
ANCHOR POSTS @ 20' O.C.
800' ANCHOR POSTS @ 20'-0" O.C.
WEST SIDE SHOWN - EAST SIDE SIMILAR
2 LAYERS OF 4" REVETMENT MAT
E.3485 PIPE SLEEVE
139-1411-308-01
EMERGENCY SLUDGE POND PUMP STATION
LOW PRESSURE ASH WATER PUMP LOCATION
(PIPE SLEEVE 139-1411-308-01
EXIST. STAND PIPE SEE 302-2
SOUTH DIKE PIPE SLEEVE SEE SH.5
EAST 2686
EXIST. CONCRETE SLAB T.O.C. 305.00
EXIST. 24" Ø DEWAT PIPE SEE DETAIL "B", SHEET 4
2'X2' TARGETS PAINTED ON 24" Ø C.S. DEWATERING 8" DRAIN LINE
EXIST. PIPE RACK
DETAIL "A" SEE SHEET 3
SLOPES TO FRENCH DRAIN
SUBDRAIN SEE SHEET 3
WELL SEE SHEET 4
℄ SUBDRAIN E 2648
EL. 330
EL. 330.40
EL. 304
EL. 309.90
EL. 307.95
EL. 308.90
EL. 330.00
EL. 321.5
UNITS 1 & 2 SOLIDS BLDG.
UNITS 3 & 4 SOLIDS BLDG.
℄ FLY ASH SILOS
℄ DEWATERING BINS
NEW DEWATERING BINS
NEW DEWATERING BIN
U1
U2
U3
U4
E4000
E3500
E3000
E2500
E2000
N2500
N2000
N1500
N1000
N500



LEGEND:

INSIDE POND AREA ONLY

- ▷ - - - DASHED LINES — ORIGINAL
- ▶—— SOLID LINES — NEW CONSTRUCTION.
- —SD— SUBDRAIN.
- ▭ FINISH FLOOR ELEVATIONS ⚠ (TOP OF REVETMENT MAT)
- ○ *TOP ELEVATION @ REVETMENT MAT LAPS

LOCATION	ELEVATION
A	306.2'
1	309.6'
2	309.4'
3	310.6'
4	310.0'
5	310.0'
6	310.3'
7	310.3'
8	310.2'
9	309.8'
10	310.7'
11	309.9'
12	311.8'
13	309.6'
14	309.3'
15	308.0'

FOR WEST B.A. POND ONLY

NOTE: ⚠ FOR PHASE III CONTRACT WORK. THIS DRAWING SUPERSEDES DRAWING 139-1411-301-01 REV.6

*ELEVATION SHOWN REPRESENTS THE AVERAGE ELEVATION TAKEN ON TOP OF THE REVETMENT MAT OVER LAP. (EXPANSION JOINT)

— REFERENCE DRAWINGS CTM - DWG. # 2925-1-311400 REV 10

UNIT 1, 2, & 3

TASK NO'S: 139-1411, 139-1219, 133-1220

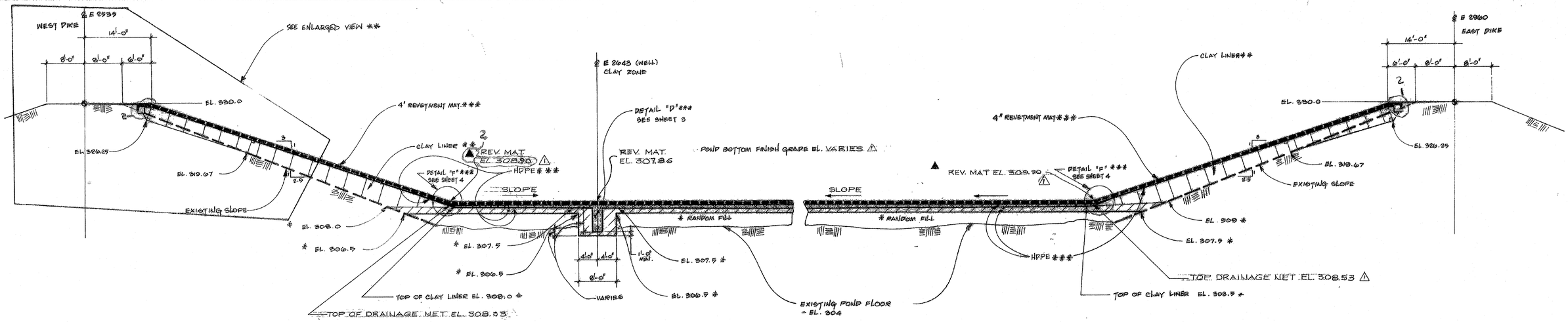
REV.	DATE	DESCRIPTION	BY	CHK	APP
5	11-18-91	"AS BUILT" P.I.D.139-1411 EMERGENCY SLUDGE POND	WLR	[illegible]	[illegible]
4	8-31-89	FOR CONSTRUCTION	JTT	[illegible]	[illegible]
4	6-12-89	FOR BIDS, FOR ESP PHASE 3 REVETMENT INSTALLATION	WLR	RHD	[illegible]
3	11-2-88	FOR BIDS, FOR ESP PHASE 2 AS-BUILT WEST B.A. POND P.I.D.#139-1411	WLR	RHD	[illegible]
2	6-14-88	FOR CONSTRUCTION ESP PHASE 1	ACB	RHD	[illegible]
2	4-26-88	FOR BIDS, FOR ESP PHASE 1	ACB	RHD	[illegible]
1	4-7-87	ADD SOUTH DIKE PIPE SLEEVE REVISED POND BOTTOM ELEVATIONS	G.S.	[illegible]	[illegible]
0	2-20-87	FOR CONSTRUCTION	GCN	[illegible]	[illegible]

MARTIN LAKE S.E.S.

BOTTOM ASH COLLECTING EQUIPMENT LAYOUT & POND MODIFICATION.
HDPE LINER

TEXAS UTILITIES GENERATING Co.

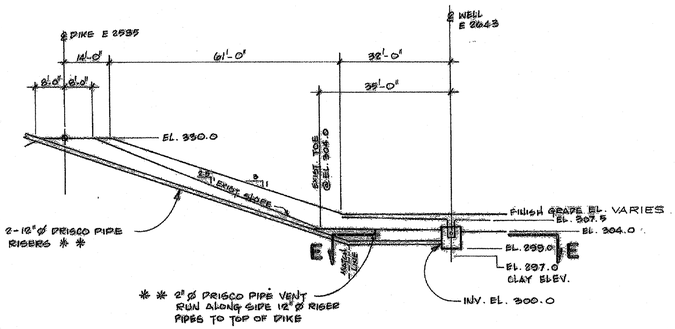
DRAWN BY: GCN	APPROVED: Milton Vela			
DATE: 2-20-87	CHECKED BY: [illegible]	SCALE: 1" = 100'		
DRAWING No.: 139-1411-302	SHEET: 01	REV.: 5		

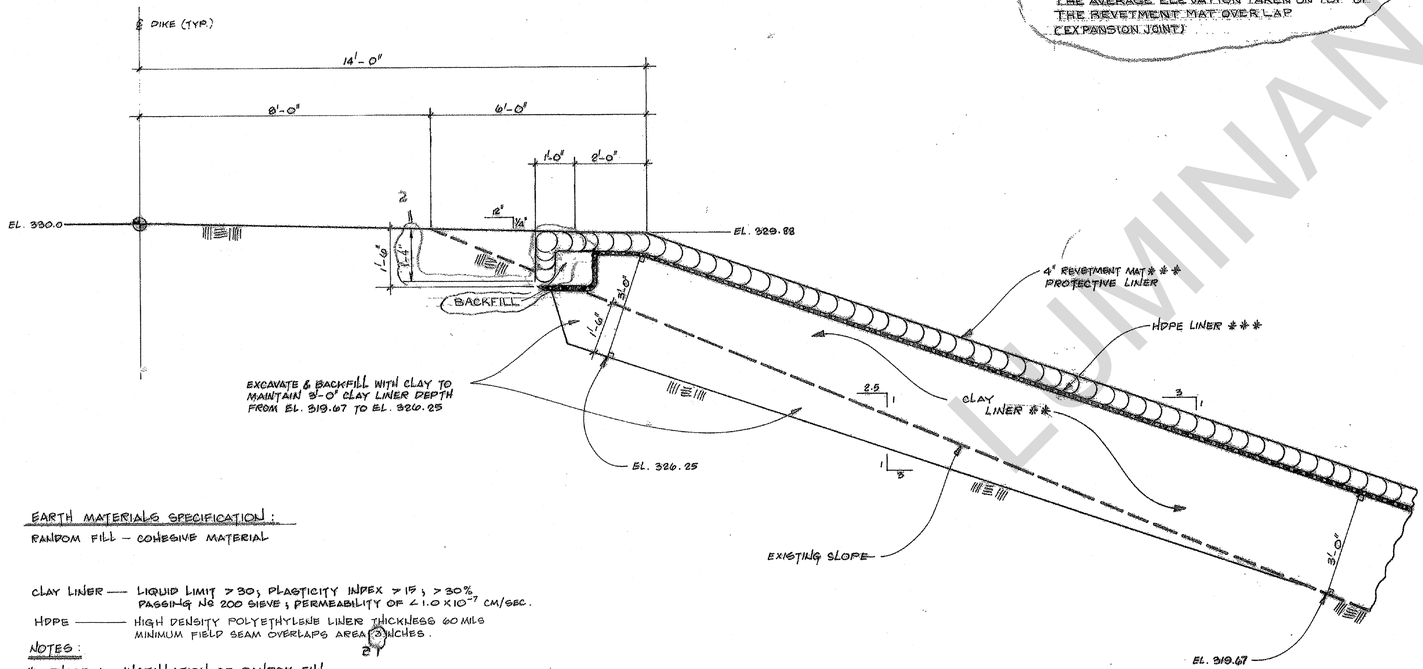


SECTION A-A

POND CROSS SECTION LOOKING NORTH
(SCALE : 1"=10'-0")

⚠ THE REVETMENT MAT ELEVATION REPRESENTS THE AVERAGE ELEVATION TAKEN ON TOP OF THE REVETMENT MAT OVERLAP (EXPANSION JOINT)





ENLARGED VIEW (TYP) **

SCALE : ½" = 1'-0"

EARTH MATERIALS SPECIFICATION :

RANDOM FILL — COHESIVE MATERIAL

CLAY LINER — LIQUID LIMIT > 30; PLASTICITY INDEX > 15 ; > 30% PASSING NO 200 SIEVE ; PERMEABILITY OF $< 1.0 \times 10^{-7}$ CM/SEC.

HDPE — HIGH DENSITY POLYETHYLENE LINER THICKNESS 60 MILS MINIMUM FIELD SEAM OVERLAPS AREA 3 INCHES.

NOTES :

* PHASE 1. INSTALLATION OF RANDOM FILL
INSTALLATION OF CLAY LINER FOR BOTTOM OF POND
INSTALLATION OF CLAY ZONE FOR SUBDRAIN.

* * PHASE 2. INSTALLATION OF CLAY LINER FOR SLOPES.
EXCAVATE AND BACKFILL MATERIALS FOR 2"ø AND 12"ø DRISCO PIPES. (DRISCO PIPES INSTALLED BY MARTIN LAKE S.E.S. PLANT — PANISL).

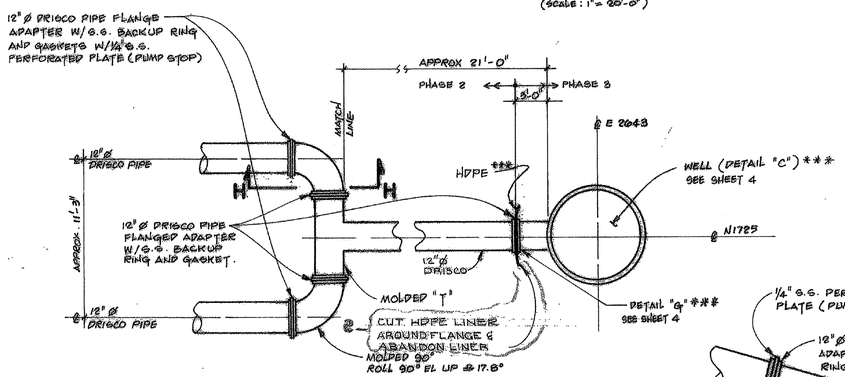
* * * PHASE 3. INSTALLATION OF DRAINAGE NET SUBDRAIN, LATERALS SUBDRAIN WELL, HDPE, AND REVETMENT MAT; ALSO INCLUDING MODIFICATIONS AT THE PIPE RACK, STANDPIPE, 24" DEWATERING PIPE, AND APPLICATION OF HERBICIDE.

4. FOR GENERAL NOTES FOR HDPE LINER SEE DWG. 139-1411-302-04.

5. FOR DRAINAGE NET DETAILS SEE DWG. 139-1411-302-05

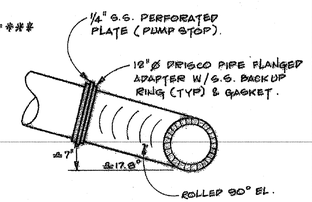
SECTION D-D * *

(scale : 1"= 20'-0")



SECTION E-E * *

NTS.



SECTION H-H

NTS.

UNITS 1, 2, & 3

⚠ NOTE:
FOR PHASE III CONTRACT WORK
THIS DRAWING SUPERSEDES
DRAWING NO. 139-1411-301-01 REV.3

NOTE FOR RISER PIPES (PHASE 2)

1. ALL PRISCO PIPE TO BE 8600 SERIES (110 PSI) - SDR 17.5
2. ALL PRISCO PIPE FURNISHED BY OWNER & INSTALLED BY PANEL CONSTRUCTION
3. EXCAVATION AND BACKFILL BY PHASE 2 CONTRACTOR.

REV.	DATE	DESCRIPTION	BY	CHK	APP
2	11-1-88	ADDED NOTES, REV'S, & "AS BUILTS"	WR	[illegible]	[illegible]
1	4-8-87	DELETED SAND BLANKET-ADD DRAINAGE NET	G.S.	[illegible]	[illegible]
0	2-20-87	FOR CONSTRUCTION	GCN	[illegible]	[illegible]

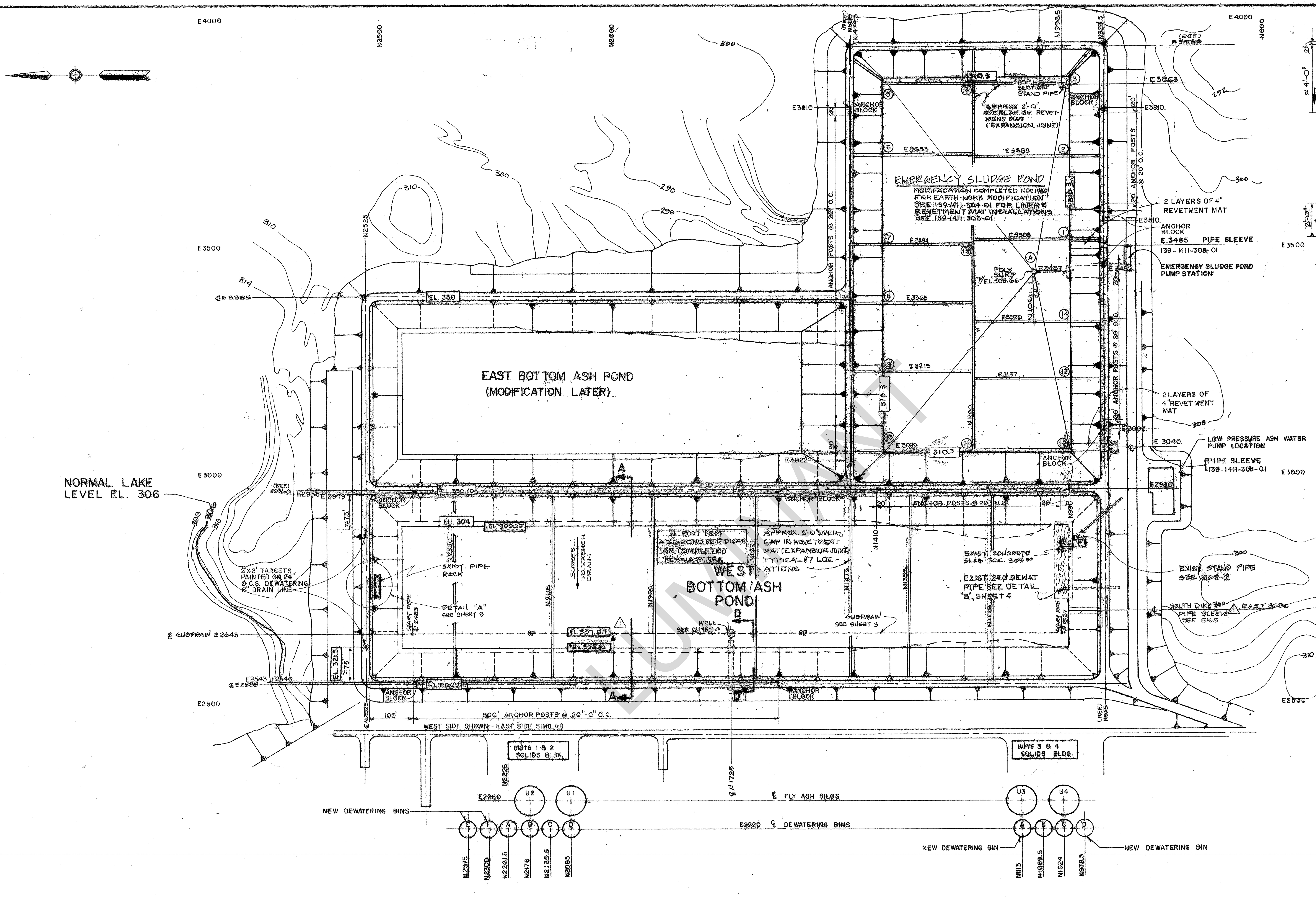
MARTIN LAKE S.E.S.

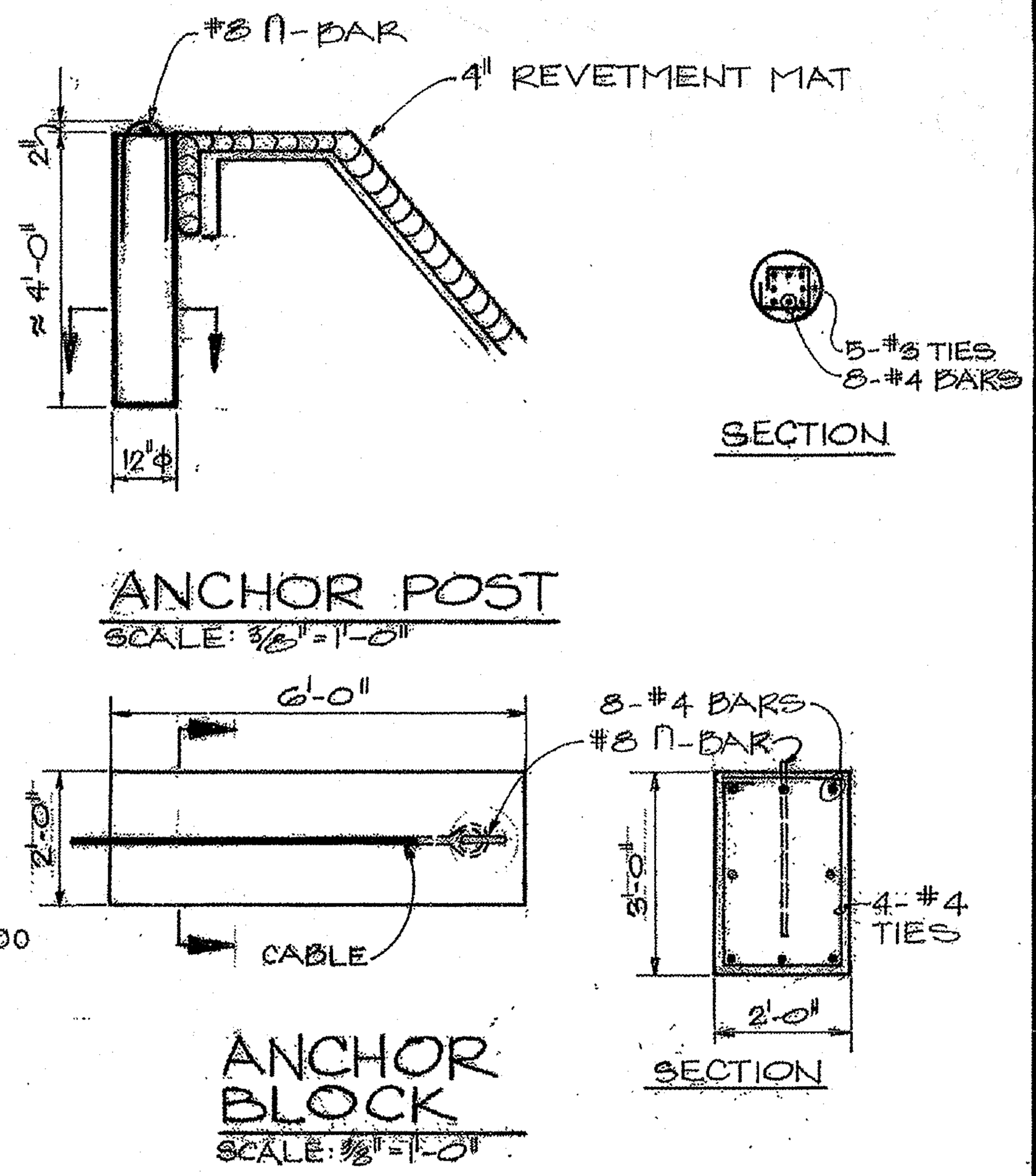
MODIFICATION TO BOTTOM ASH POND EARTHWORK PHASE 1 & 2
CROSS SECTIONS (HDPE LINER)

TEXAS UTILITIES GENERATING Co.

DRAWN BY: GCN		APPROVED: [signature]	
DATE: 2-19-87	CHECKED BY: [signature]	SCALE: AS SHOWN	
DRAWING No. 139-1411-302	SHEET 02	REV. 2	

NEW SCRUBBER POND


EAST BOTTOM ASH POND
(MODIFICATION LATER)
WEST BOTTOM ASH POND
W. BOTTOM ASH POND MODIFICATION COMPLETED FEBRUARY 1988
EMERGENCY SLUDGE POND
MODIFACATION COMPLETED NOV.1989
FOR EARTH-WORK MODIFICATION SEE 139-1411-304-01 FOR LINER & REVETMENT MAT INSTALLATIONS SEE 139-1411-305-01
NORMAL LAKE LEVEL EL. 306
ANCHOR BLOCK
ANCHOR POSTS @ 20' O.C.
800' ANCHOR POSTS @ 20'-0" O.C.
WEST SIDE SHOWN - EAST SIDE SIMILAR
UNITS 1 & 2 SOLIDS BLDG.
UNITS 3 & 4 SOLIDS BLDG.
℄ FLY ASH SILOS
℄ DEWATERING BINS
NEW DEWATERING BINS
NEW DEWATERING BIN
2 LAYERS OF 4" REVETMENT MAT
E.3485 PIPE SLEEVE 139-1411-308-01
EMERGENCY SLUDGE POND PUMP STATION
LOW PRESSURE ASH WATER PUMP LOCATION
(PIPE SLEEVE 139-1411-308-01
EXIST. STAND PIPE SEE 302-2
SOUTH DIKE PIPE SLEEVE SEE SH.5
EAST 2686
EXIST. CONCRETE SLAB T.O.C. 305.80
EXIST. 24" Ø DEWAT PIPE SEE DETAIL "B", SHEET 4
APPROX. 2'-0" OVERLAP IN REVETMENT MAT (EXPANSION JOINT) TYPICAL @ 7 LOCATIONS
APPROX. 2'-0" OVERLAP OF REVETMENT MAT (EXPANSION JOINT)
ESP SUCTION STAND PIPE
POLY SUMP T/EL 305.66
SUBDRAIN SEE SHEET 3
WELL SEE SHEET 4
EXIST. PIPE RACK
DETAIL "A" SEE SHEET 3
SLOPES TO FRENCH DRAIN
2'X2' TARGETS PAINTED ON 24" Ø C.S. DEWATERING 8" DRAIN LINE
℄ SUBDRAIN E 2648
EL. 330
EL. 330.40
EL. 304
EL. 309.90
EL. 307.95
EL. 308.90
EL. 330.00
EL. 321.5



LEGEND:

INSIDE POND AREA ONLY

- ▷- - - DASHED LINES – ORIGINAL
- ▶—— SOLID LINES – NEW CONSTRUCTION
- —SP— SUBDRAIN
- ▭ FINISH FLOOR ELEVATIONS ⚠ (TOP OF REVETMENT MAT)
- ○ *TOP ELEVATION @ REVETMENT MAT LAPS

LOCATION	ELEVATION
A	306.2'
1	309.6'
2	309.4'
3	310.6'
4	310.0'
5	310.0'
6	310.3'
7	310.3'
8	310.2'
9	309.8'
10	310.7'
11	309.9'
12	311.8'
13	309.6'
14	309.3'
15	308.0'

FOR WEST B.A. POND ONLY

NOTE: ⚠ FOR PHASE III CONTRACT WORK. THIS DRAWING SUPERSEDES DRAWING 139-1411-301-01 REV.6

*ELEVATION SHOWN REPRESENTS THE AVERAGE ELEVATION TAKEN ON TOP OF THE REVETMENT MAT OVER LAP. (EXPANSION JOINT)

— REFERENCE DRAWINGS CTM-DWG. # 2925-1-311400 REV 10

UNIT 1, 2, & 3
TASK NO'S: 139-1411, 139-1219, 133-1220

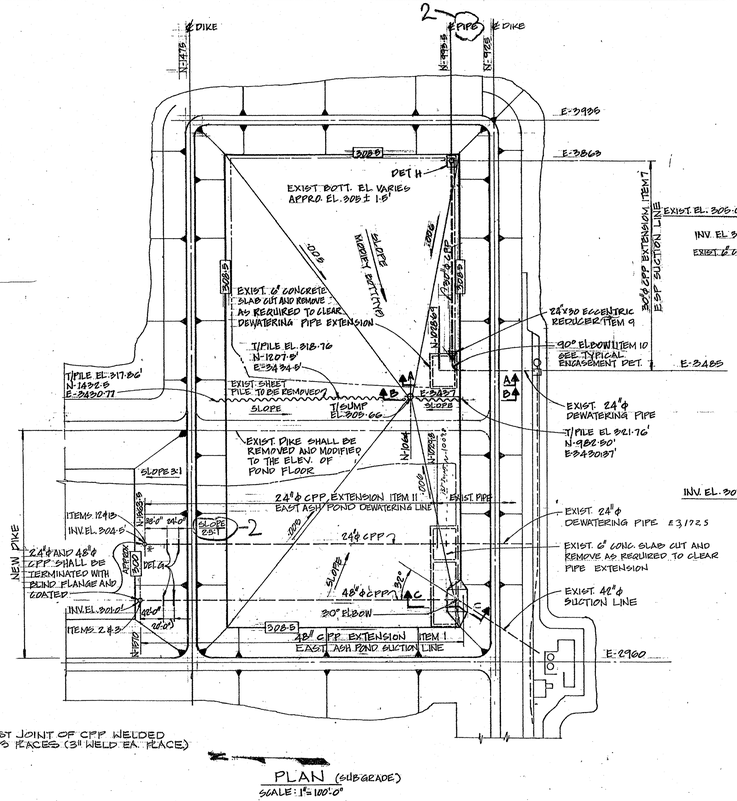
REV.	DATE	DESCRIPTION	BY	CHK.	APP.
5	11-18-91	"AS BUILT" P.I.D.139-1411 EMERGENCY SLUDGE POND	WLR		
4	8-31-89	FOR CONSTRUCTION	JTT		
4	6-12-89	FOR BIDS, FOR ESP PHASE 3 REVETMENT INSTALLATION	WLR	RHO	
3	11-2-88	FOR BIDS, FOR ESP PHASE 2 AS-BUILT WEST B.A. POND P.I.D.#139-1411	WLR		
2	6-14-88	FOR CONSTRUCTION ESP PHASE 1	ACB		
2	4-26-88	FOR BIDS, FOR ESP PHASE 1	ACB	RHO	
1	4-7-87	ADD SOUTH DIKE PIPE SLEEVE REVISED POND BOTTOM ELEVATIONS	G.S.		
0	2-20-87	FOR CONSTRUCTION	GCN		

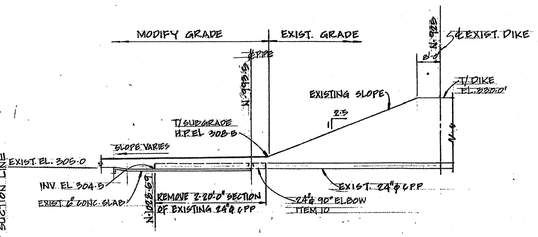
MARTIN LAKE S.E.S.

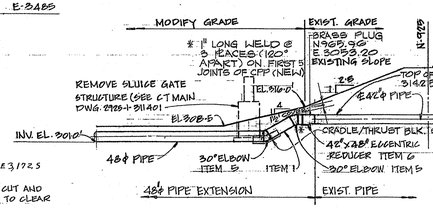
BOTTOM ASH COLLECTING EQUIPMENT LAYOUT & POND MODIFICATION.
HDPE LINER

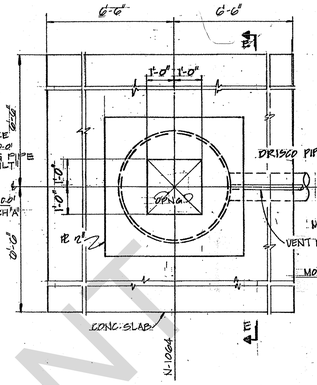
TEXAS UTILITIES GENERATING Co.

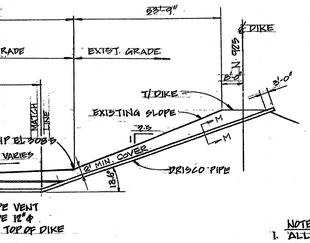
DRAWN BY	APPROVED		
GCN	Milton Vila		
DATE	CHECKED BY	SCALE	
2-20-87		1" = 100'	
DRAWING No.		SHEET	REV.
139-1411-302		01	5

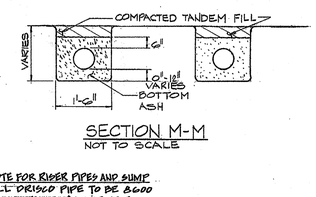


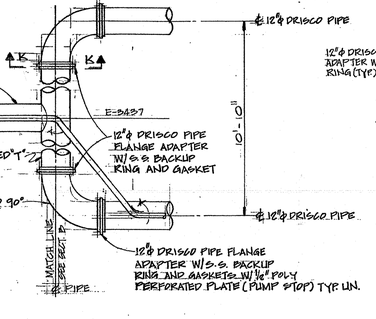


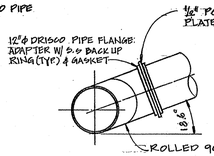


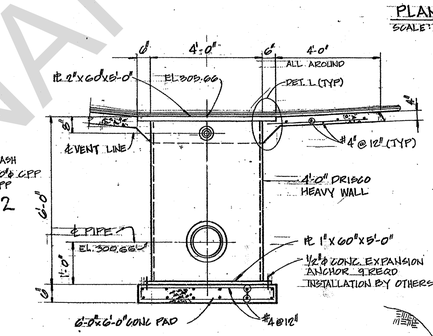


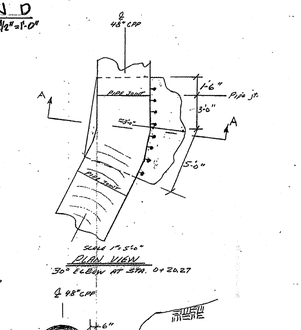


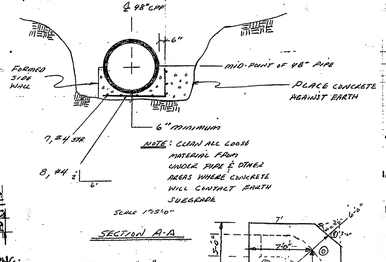


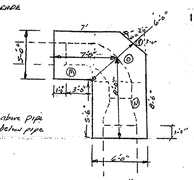












* LAST JOINT OF CPP WELDED @ 3 PLACES (3" WELD EA. PLACE)

PLAN (SUBGRADE)
SCALE: 1"=100'-0"

SECTION A
SCALE: 1"=20'-0"

SECTION B
SCALE: 1"=20'-0"

SECTION M-M
NOT TO SCALE

NOTE FOR RISER PIPES AND SUMP

1. ALL DRISCO PIPE TO BE 8600 SERIES (110 PSI) - SDR 15.5
2. ALL DRISCO PIPE FURNISHED BY OWNER
3. EXCAVATION AND BACK FILL BY EARTHWORK CONTRACTOR

PLAN D
SCALE: 1/2"=1'-0"

SECTION K

SECTION C
SCALE: 1"=20'-0"

TYPICAL TRENCHING & BEDDING DETAIL
CONCRETE PRESSURE PIPE
SCALE: NONE

SECTION E
SCALE: 1/2"=1'-0"

TYPICAL SECTION OF GEONET AND LINERS
SCALE: NONE

SEEPAGE COLLAR
DETAIL G
TYP. 4 PLACES

SECTION A-A

SKETCH "A"
NOT TO SCALE

SECTION F

PARTIAL PLAN OF GEONET
TOP FLEXIBLE LINER NOT SHOW FOR CLARITY
SCALE: NONE

PLAN SECTION
HORIZONTAL ELBOW ENCASEMENT (SEE SKETCH "B")
SCALE: NONE

SKETCH "B"
NOT TO SCALE

DETAIL M
SCALE: NONE

DETAIL H
PIPE ENCASEMENT
SCALE: NONE

DETAIL L
SCALE: NONE

ABBREVIATION

ESP = EMERGENCY SLUDGE POND
HDPE = HIGH DENSITY POLYETHYLENE
CPP = CONCRETE PRESSURE PIPE
SS = STAINLESS STEEL
TYP = TYPICAL
CONC. = CONCRETE
T/ = TOP

GENERAL NOTES

1. RANDOM FILL COHESIVE MATERIAL COMPACTION REQUIREMENTS PER TEX 113-E, 95% @ -2% + 6% OPTIMUM MOISTURE CONTENT.
2. CONCRETE STRENGTH SHALL BE 3,000 PSI @ 28 DAYS.
3. REINFORCING BARS SHALL BE ASTM A615 GRADE 60.

THE HDPE LINER SPEC. (PHASE 2)

4. THE HDPE LINER CONTRACTOR SHALL FURNISH
   (a) DESIGN, MATERIALS, FABRICATION, AND INSTALLATION OF AIR-GAS VENTS ALONG THE PERIMETER OF THE FACILITY.

5. ALL FIELD SEAMS SHALL OVERLAP A MINIMUM OF FOUR (4") INCHES
6. ALL FIELD SEAMS ON THE SLOPE SHALL RUN PERPENDICULAR TO THE TOE OF THE SLOPE
7. NO MORE MATERIAL THAN CAN BE SEAMED SHALL BE LAID OUT IN A WORKDAY. LINER WHICH IS ROLLED OUT INTO FACILITY BOTTOM, MUST BE SEAMED COMPLETELY BEFORE THE END OF A WORK DAY.

SCOPE OF WORK

8. PHASE 1 - EARTHWORK CONTRACT:
   EARTHWORK, CPP, FITTINGS, & 30"φ/90° ELBOW POLY PIPE, MISCELLANEOUS CONCRETE WORK, EXCAVATION AND BACKFILL FOR LEACHATE COLLECTION SYSTEM, HERBICIDE APPLICATION, AND SUBGRADE PREPARATION, BOTTOM LINER TRENCHING
9. PHASE 2 - LINER INSTALLATION CONTRACT:
   INSTALLATION OF LINER, GEONET, AIR GAS VENTS, AND TOP LINER TRENCHING
10. PHASE 3 REVETMENT MAT CONTRACT:
    INSTALLATION OF REVETMENT MAT TO INCLUDE TOE DITCH WORK
11. FOR ITEMS SEE SPECIFICATION/SCHEDULE FOR CPP

REFERENCE DRAWINGS

CT MAIN 2925-1-311400 REV. 10
2925-1-311401 REV. 3

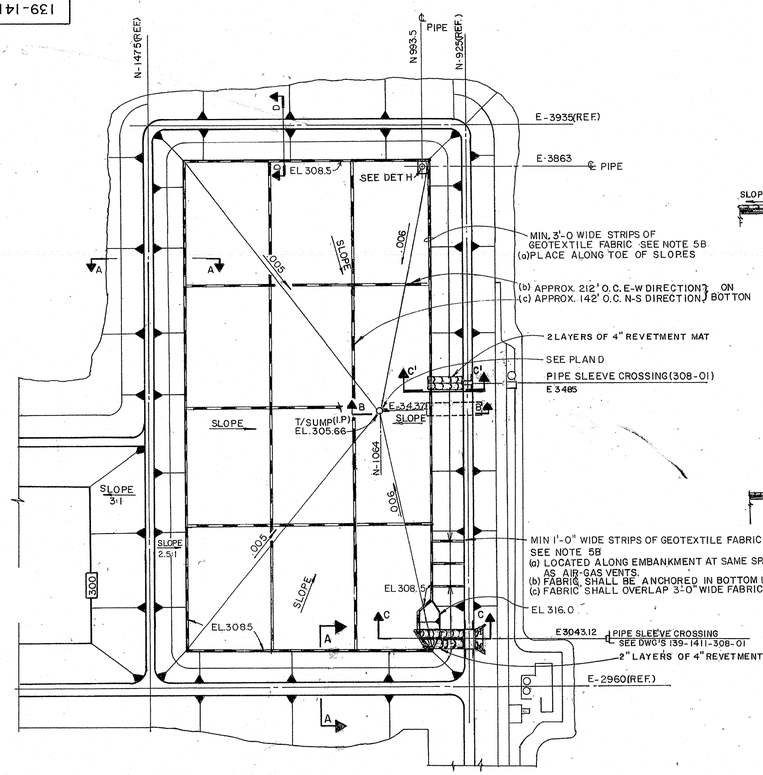
REV.	DATE	DESCRIPTION	BY	CHK.	APP.
3	7/31/95	AS-BUILT PER ESP PHASE 1, T-14203	MW	RHD	RHD
2	8-14-88	FOR CONSTRUCTION ESP PHASE 1 REV. PLAN	ACB	RHD	RHD
1	5-4-88	REVISED EL. FOR DET. H ADD ITEM # FOR CPP	ACB	RHD	MV
0	4-26-88	FOR BIDS, FOR ESP PHASE 1	ACB	RHD	MV

MARTIN LAKE S.E.S

MODIFICATION TO BOTTOM ASH POND
NEW EMERGENCY SLUDGE POND
SECTIONS AND DETAILS

TEXAS UTILITIES GENERATING Co.

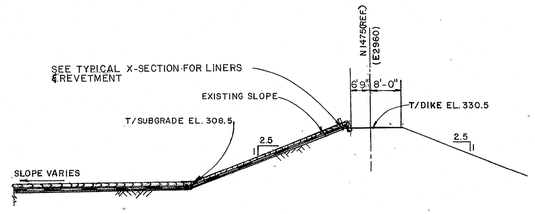
DRAWN BY
APPROVED Milton Vila
DATE 4/26/88
CHECKED BY
SCALE AS NOTED
DRAWING No. 139-1411-304
SHEET 01
REV. 3

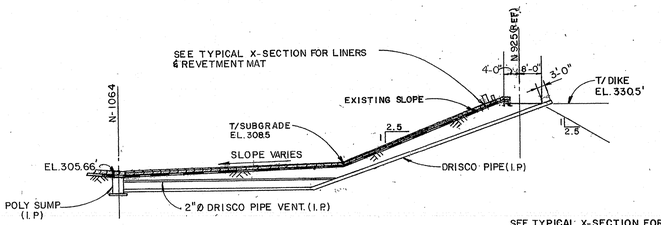


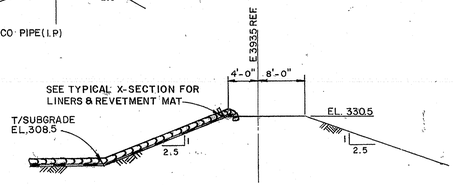
NOTE:
1. EL 308.5 ARE TOP OF SUBGRADE ELEVATION
2. ADD 4" TO SUBGRADE ELEVATIONS FOR FINISH GRADE FOR REVETMENT MAT

NORTH

PLAN (SUBGRADE GEOTEXTILE FABRIC LAYOUT)
SCALE: 1"= 100'-0"

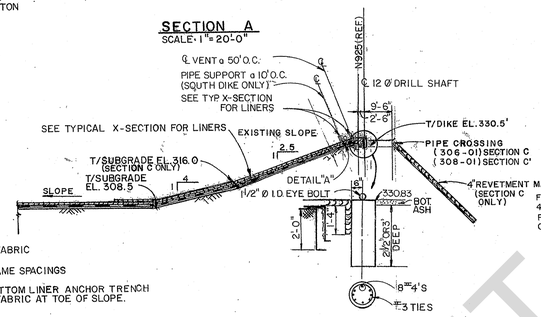






SECTION D

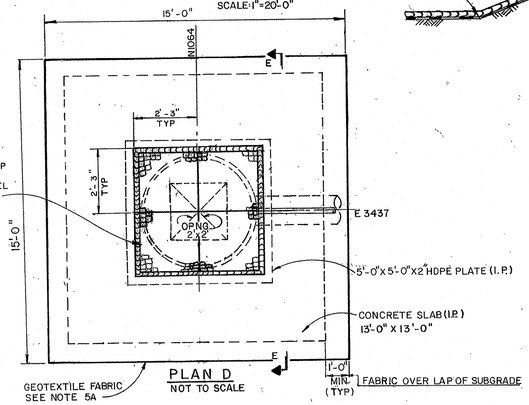
SECTION A
SCALE: 1"= 20'-0"



SECTION C
SCALE: 1"= 20'-0"

SECTION C'
SIMILAR

SECTION B
SCALE: 1"= 20'-0"



PLAN D
NOT TO SCALE

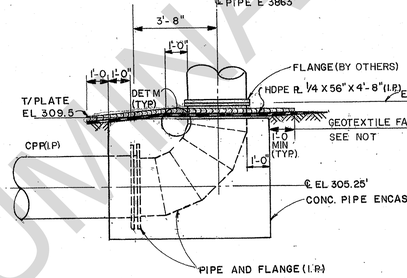
ABREVIATION

ESP = EMERGENCY SLUDE POND
HDPE = HIGH DENSITY POLYETHYLENE
CPP = CONCRETE-PRESSURE PIPE
I.P = IN PLACE
TYP = TYPICAL
CONC = CONCRETE
T/ = TOP

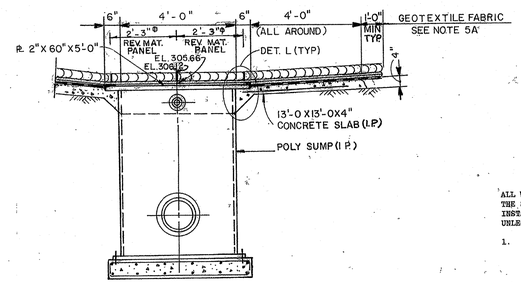
PHASE 3

NOTES

1. REVETMENT MAT INSTALLATION SHALL BE IN ACCORDANCE WITH SPECIFICATION FOR NEW EMERGENCY SLUDGE POND PHASE 3 INSTALLATION OF REVETMENT MAT.



DETAIL H
PIPE ENCASEMEMENT
SCALE: NONE

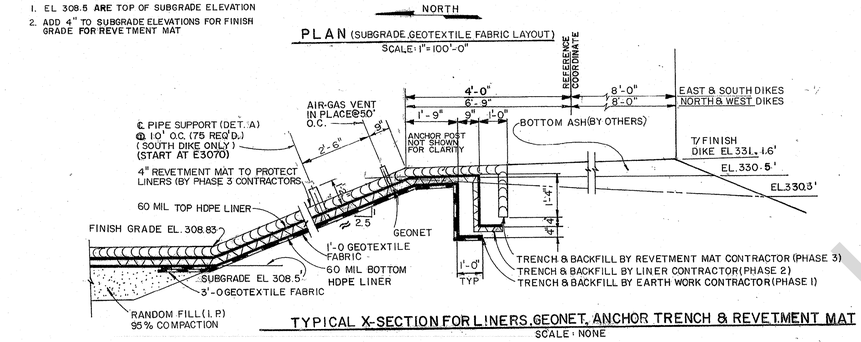


PHASE 2

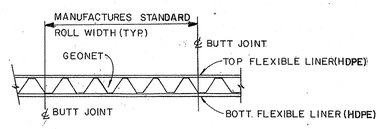
NOTES

ALL WORK SHOWN ON THIS DRAWING SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS FOR NEW EMERGENCY SLUDGE POND - PHASE 2 INSTALLATION OF HIGH DENSITY POLYETHYLENE MEMBRANE LINERS, UNLESS NOTED.

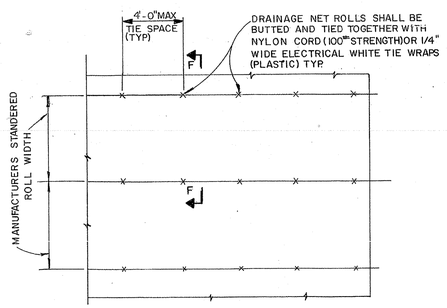
1. THE HDPE LINER CONTRACTOR SHALL FURNISH:
   - (A) MATERIALS, FABRICATION, AND INSTALLATION OF 60 MILS HDPE FLEXIBLE MEMBRANE LINERS.
   - (B) MATERIALS AND INSTALLATION OF .25" HDPE DRAINAGE NET (GEONET).
   - (C) DESIGN, MATERIALS, FABRICATION, AND INSTALLATION OF AIR-GAS VENTS.
     - (1) THE AIR-GAS VENTS SHALL BE INSTALLED ALONG A STRAIGHT LINE ON OR NEAR THE CREST OF THE EMBANKMENT. THE VENTS SHALL EXTEND THROUGH THE 4 INCH REVETMENT MAT.
     - (2) THE AIR-GAS VENTS SHALL BE DESIGNED TO ALLOW AIR OR GAS TO ESCAPE FROM BENEATH THE BOTTOM LINER AND BETWEEN THE BOTTOM LINER AND THE TOP LINER.
   - (D) MATERIALS AND INSTALLATION OF GEOTEXTILE FABRIC
2. ALL LINER FIELD SEAMS SHALL OVERLAP A MINIMUM OF FOUR (4") INCHES.
3. ALL LINER FIELD SEAMS ON THE SLOPE SHALL RUN PERPENDICULAR TO THE TOE OF THE SLOPE.
4. NO MORE MATERIAL THAN CAN BE SEAMED SHALL BE LAID OUT IN A WORKDAY. LINER PANELS THAT ARE ROLLED OUT INTO FACILITY, MUST BE SEAMED OR LEISTERED COMPLETELY BEFORE THE END OF A WORK DAY.
5. GEOTEXTILE FABRIC TO BE USED AS:
   - (A) A CUSHION BETWEEN CONCRETE SURFACES AND THE BOTTOM LINER.
   - (B) A GAS VENTILATION BETWEEN SUBGRADE AND THE BOTTOM LINER.



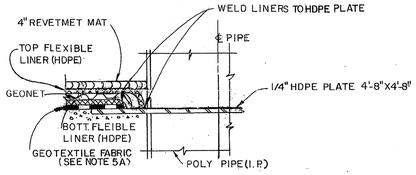
TYPICAL X-SECTION FOR LINERS, GEONET, ANCHOR TRENCH & REVETMENT MAT
SCALE: NONE



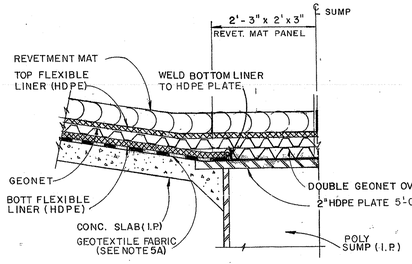
SECTION F



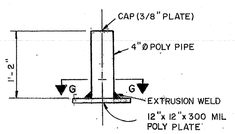
PARTIAL PLAN OF GEONET
TOP FLEXIBLE LINER NOT SHOW FOR CLARITY
SCALE: NONE



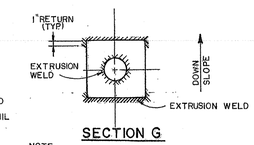
DETAIL M
SCALE: NONE



DETAIL L
SCALE: NONE

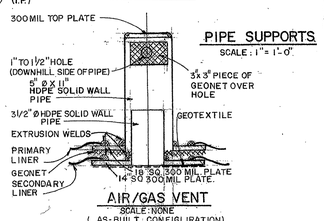


DETAIL A



SECTION G

NOTE: EXTRUSION WELD 3/8" POLY TOP (PRIMARY) HDPE TO SECURE SUPPORTS & ASSURE ALIGNMENT DURING REVETMENT MAT INSTALLATION.



PIPE SUPPORTS
SCALE: 1"= 1'-0"

AIR/GAS VENT
SCALE: NONE
(AS-BUILT CONFIGLIRATION)

REFERENCE DRAWINGS

139-1411-302-01
139-1411-306-01
139-1411-308-01

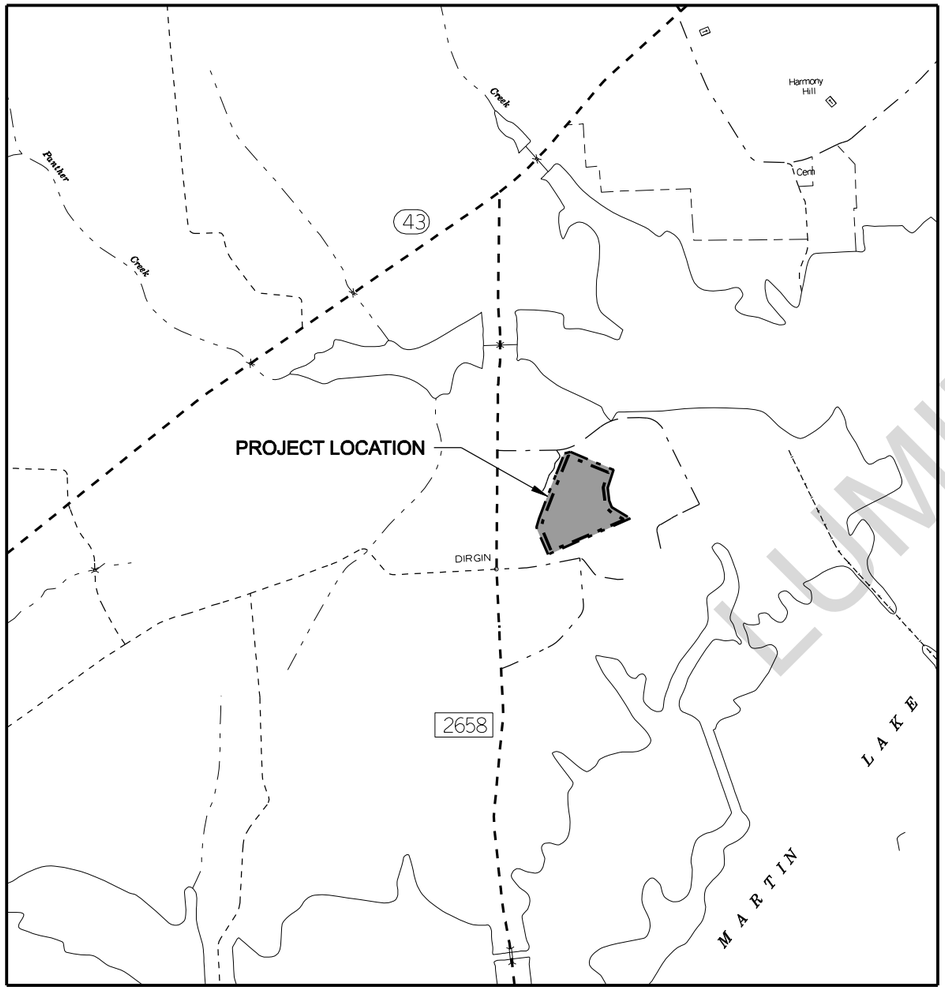
REV.	DATE	DESCRIPTION	BY	CHK.	APP.
4	11-18-91	"AS BUILT" P.I.D. 139-1411	WLR	RWS	DWD
3	8-31-89	FOR CONSTR. CHG. PER AD.1 PR NO ST. 00036	JTT		
2	6-12-89	FOR BID, FOR ESP PHASE 3 REV. MAT INSTAL	WLR		
1	1-11-89	FOR CONSTR FOR ESP PHASE 2 LIN. INST	WR		
0	11-2-88	FOR BIDS, FOR ESP PHASE 2 LIN. INST	WR		

MARTIN LAKE S.E.S. UNIT 1,283
MODIFICATION TO BOTTOM ASH POND
NEW EMERGENCY SLUDE POND
HDPE LINERS, GEONET & REVETMENT MAT SECT. & DETAILS
TEXAS UTILITIES GENERATING Co.

DRAWN BY: W.L.R. | APPROVED | CHECKED BY: 11-2-88 | DATE: 11-2-88 | SCALE: AS NOTE | DRAWING No. 139-1411-305 | SHEET 01 | REV. 4

PDP 5

MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS
PERMANENT DISPOSAL POND #5
AS RECORDED DRAWINGS



SHEET NO.	TITLE
C-1	COVER SHEET
C-2	ABBREVIATIONS & GENERAL NOTES
C-3	SITE PLAN
C-4	KEY MAP & CROSS SECTION LOCATIONS
C-5	HORIZONTAL CONTROL DATA
C-6	AS BUILT LINER CONTOUR PLAN
C-7	AS BUILT LINER CONTOUR PLAN
C-8	AS BUILT LINER CONTOUR PLAN
C-9	AS BUILT FINAL CONTOUR PLAN
C-10	AS BUILT FINAL CONTOUR PLAN
C-11	AS BUILT FINAL CONTOUR PLAN
C-12	AS BUILT CAUSEWAY CONTOUR PLAN
C-13	OVERFLOW STANDPIPE & DETAILS
C-14	BORROW AREA EXCAVATION PLAN
C-15	BORROW AREA BORING LOGS(OMITTED FOR AS BUILTS)
C-16	BORROW AREA BORING LOGS(OMITTED FOR AS BUILTS)
C-17	ACCESS ROAD 1 PLAN & PROFILE
C-18	ACCESS ROAD 2 PLAN & PROFILE
C-19	LEACHATE LINE 1 PLAN & PROFILE
C-20	LEACHATE LINE 1 PLAN & PROFILE
C-21	LEACHATE LINE 1 PLAN & PROFILE
C-22	LEACHATE LINE 2 PLAN & PROFILE
C-23	LEACHATE LINE 2 PLAN & PROFILE
C-24	SLURRY CHANNEL PLAN & SECTION
C-25	LEACHATE COLLECTION SYSTEM SUMP PLAN
C-26	DEWATERING SYSTEM SUMP PLAN
C-27	TYPICAL CROSS SECTIONS
C-28	TYPICAL CROSS SECTIONS
C-29	MISCELLANEOUS DETAILS
C-30	MISCELLANEOUS DETAILS
C-31	MISCELLANEOUS DETAILS
C-32	WATER ACCESS LOCATION
C-33	GRID LAYOUT
E-1	LEACHATE COLLECTION PLAN - ELECTRICAL
E-2	ELECTRICAL DETAILS
E-3	PANELBOARD SCHEDULES
139-E001-301	DECANT PUMP & OVERFLOW DRAIN SUPPORT & ACCESS STRUCTURE
139-E001-301	DECANT PUMP & OVERFLOW DRAIN SUPPORT & ACCESS STRUCTURE

PLTDRVER: 11X17LASER_BW_PDF.plt
PENTABLE: 139-E001-305(as built).tbl
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USER: rcox
TIME: 12:47:35 PM
DATE: 2/9/2011

Luminant

HDR
HDR ENGINEERING, INC.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070

Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D. VOGT
CIVIL ENGINEER	D. VOGT
CHECKED BY	
DESIGNED	B. COX
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

COVER SHEET
139-E001-305
AS RECORDED

FILENAME	ML-COV01-AB.dgn
SCALE	NTS

SHEET
C-1

STANDARD ABBREVIATIONS

&	AND
APPROX	APPROXIMATELY
@	AT
AVG	AVERAGE
BOE	BOTTOM OF EXCAVATION
BOL	BOTTOM OF LINER
X	BY
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CO	CLEAN OUT
CY	CUBIC YARD
DIA	DIAMETER
DET	DETAIL
DWG	DRAWING
E	EAST
ELEV	ELEVATION
EW	EACH WAY
EXIST	EXISTING
EXC	EXCAVATION
FML	FLEXIBLE MEMBRANE LINER
FT	FEET
GAL	GALLON
GND	GROUND
GDL	GRAVEL DRAINAGE LAYER
GNDL	GEONET DRAINAGE LAYER
HDPE	HIGH DENSITY POLYETHYLENE
HORIZ	HORIZONTAL
ID	INSIDE DIAMETER
IN	INCHES
IE	INVERT ELEVATION
LCRS	LEACHATE COLLECTION AND REMOVAL SYSTEM
LCS	LEACHATE COLLECTION SYSTEM
LCP	LEACHATE COLLECTION PIPE
LCPR	LEACHATE COLLECTION PIPE RISER
LF	LINEAR FEET
LB	POUND
MH	MANHOLE
MAX	MAXIMUM
MIL	.001 INCHES
MIN	MINIMUM
MW	MONITOR WELL
MLSES	MARTIN LAKE STEAM ELECTRIC STATION
MSL	MEAN SEA LEVEL
N	NORTH
NIC	NOT IN CONTRACT
NO	NUMBER
NTS	NOT TO SCALE
OC	ON CENTER
OZ	OUNCE
%	PERCENT
PLCP	PERFORATED LEACHATE COLLECTION PIPE
PERF	PERFORATED
PGL	PROFILE GRADE LINE
PDP	PERMANENT DISPOSAL POND
PC	POINT OF CURVATURE
PI	POINT OF INTERSECTION
PVI	POINT OF VERTICAL INTERSECTION
PT	POINT OF TANGENT
PZ	PIEZOMETER
Q	FLOW
QTY	QUANTITY
R	RADIUS
RCP	REINFORCED CONCRETE PIPE
REF	REFERENCE
REQ	REQUIRED
RD	ROAD
SCH	SCHEDULE
SDL	SAND DRAINAGE LAYER
SEC	SECTION
SHT	SHEET
S	SOUTH
SDR	STANDARD DIMENSION RATIO
SP	STEEL PIPE
SQ	SQUARE
STA	STATION
SLQCP	SOIL LINER QUALITY CONTROL PLAN. SEE APPENDIX A OF SPECIFICATION
SS	SIDE SLOPE
SWPPP	STORM WATER POLLUTION PREVENTION PLAN
TDLR	TEXAS DEPARTMENT OF LICENSING AND REGULATIONS
TPDES	TEXAS POLLUTION DISCHARGE ELIMINATION SYSTEM
TL	TANGENT LENGTH
TOC	TOP OF COVER
TOFC	TOP OF FINAL COVER
TOL	TOP OF LINER
TOS	TOE OF SLOPE
TS	TOP SLOPE
TEMP	TEMPORARY
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VERT	VERTICAL
W	WEST
W/	WITH
YD	YARD

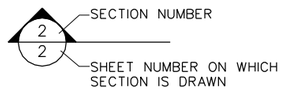
GENERAL NOTES

1. HISTORICAL OPERATIONS AT PERMANENT DISPOSAL PONDS 1, 2 AND 3 INCLUDED LIMITED SOLID DISPOSAL OF REGULATED AND NON-REGULATED ASBESTOS-CONTAINING MATERIALS. THESE MATERIALS WERE COVERED DAILY AND IT IS NOT ANTICIPATED THAT EXPOSURE TO THESE MATERIALS WILL BE ENCOUNTERED DURING CONSTRUCTION OF THE VERTICAL EXPANSION OF PDP'S • 1, 2, & 3. SHOULD THE CONSTRUCTION CONTRACTOR UNCOVER SUSPECTED ASBESTOS-CONTAINING MATERIALS, WORK IN THE AREA SHOULD CEASE AND THE CONSTRUCTION MANAGER AND LUMINANT SHOULD IMMEDIATELY BE NOTIFIED FOR FURTHER INVESTIGATION AND POTENTIAL EVALUATION.
2. ALL WORK UNDER THIS CONTRACT SHALL BE PERFORMED IN ACCORDANCE WITH THE PLANS AND PROJECT SPECIFICATIONS. IN THE EVENT OF A DISCREPANCY BETWEEN THE PLANS AND THE PROJECT SPECIFICATIONS, THE SPECIFICATIONS SHALL GOVERN.
3. COORDINATE SYSTEM IS BASED ON LOCAL SURVEY. THE BENCHMARKS TO BE USED FOR CONSTRUCTION ARE LOCATED AS SHOWN ON DRAWING NO. C-3. EXISTING CONTOURS ARE BASED ON TOPOGRAPHICAL SURVEY TAKEN ON SEPTEMBER 20, 2007 FOR PDP •1 & PDP •2, AND OCTOBER 21, 2008 FOR PDP •3, BY COLLINS SURVEYING & MAPPING INC., LONGVIEW, TEXAS. INTERIOR SURVEY PERFOMED BY CSM ON JULY 20 & 21, 2009. CURRENT GROUND ELEVATIONS MAY VARY FROM THOSE SHOWN DUE TO SITE WORK THAT HAS BEEN PERFORMED SINCE THE SURVEY WAS PERFORMED.
4. GROUNDWATER AT THE SITE WILL VARY DEPENDING ON RAINFALL, AND SUBSURFACE CONDITIONS. THERE SHALL NOT BE ANY ADDITIONAL PAYMENT OR EXTENSION OF CONTRACT TIME FOR WORKING WITH SATURATED SOILS OR HANDLING GROUNDWATER SEEPAGE DUE TO RAINFALL, RUNOFF AND INFILTRATION.
5. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PROTECT EXISTING ROADS, BENCHMARKS AND EXISTING GROUNDWATER MONITOR WELLS DURING THE CONSTRUCTION PERIOD. THE CONTRACTOR SHALL BE SOLEY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE INCURRED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PROTECT THE GROUNDWATER MONITOR WELLS, BENCHMARKS AND EXISTING ROADS.
6. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES HAVE NOT BEEN ESTABLISHED BY THE OWNER OR HIS REPRESENTATIVES. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTORS FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UTILITIES. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING PROPER SAFE WORKING DISTANCE FROM ALL UTILITY EASEMENTS OR LINES.
7. EXCAVATION BY "BLASTING" IS NOT PERMITTED ON THIS PROJECT.
8. FINISHED GROUND ELEVATIONS SHALL MATCH EXISTING GROUND ELEVATIONS EXCEPT AS SHOWN ON THE PLANS. ALL EXCESS SOIL FROM THE EXCAVATION AND GRADING SHALL BE PLACED IN DESIGNATED STOCKPILE LOCATIONS AS AS APPROVED BY THE OWNER. IF WASTE IS ENCOUNTERED DURING EXCAVATION, THE OWNER SHALL BE NOTIFIED AND THE WASTE REMOVED AND PLACED IN AREAS DESIGNATED AS APPROVED BY THE OWNER. TRANSPORT OF SOIL TO FILL AREAS SHALL BE CONDUCTED BY THE CONTRACTOR AT NO ADDITIONAL EXPENSE TO THE OWNER.
9. GEOTECHNICAL INVESTIGATION REPORTS FOR THE SITE ARE AVAILABLE FOR REVIEW AT LUMINANT'S DALLAS OFFICES, AND CAN BE MADE AVAILABLE ON SITE IF NEEDED. THE CONTRACTOR MAY PERFORM ADDITIONAL GEOTECHNICAL INVESTIGATIONS, AS HE DEEMS NECESSARY FOR CONSTRUCTION ACTIVITIES, PROVIDED ALL NECESSARY PERMITS AND APPROVALS ARE OBTAINED FROM LUMINANT PRIOR TO INITIATING SUCH WORK. HOWEVER, THERE SHALL BE NO ADDITIONAL PAYMENT TO THE CONTRACTOR FOR ADDITIONAL GEOTECHNICAL INVESTIGATIONS.
10. THE CONTRACTOR SHALL CONSTRUCT, AND UPON COMPLETION OF THE PROJECT, REMOVE TEMPORARY CONSTRUCTION ACCESS ROADS. SUCH ROADS SHALL BE LOCATED AS APPROVED BY THE OWNER. DRAINAGE PATTERNS AT THE SITE SHALL NOT BE ALTERED BY ROAD CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONSTRUCTION AND MAINTENANCE OF TEMPORARY DRAINAGE STRUCTURES, INCLUDING CULVERTS, AT NO ADDITIONAL COST TO THE OWNER.
11. TEMPORARY CONSTRUCTION SLOPES SHALL NOT BE GREATER THAN 2H:1V. STEEPER SLOPES WILL ONLY BE ALLOWED IF THE CONTRACTOR PROVIDES A GEOTECHNICAL ENGINEERING REPORT SPECIFYING MAXIMUM SLOPES AND THE DURATION FOR WHICH SUCH SLOPES SHALL REMAIN IN PLACE.
12. THE CONTRACTOR SHALL REMOVE ALL VEGETATION WITHIN THE CONSTRUCTION LIMITS AS REQUIRED TO CONSTRUCT THE PROJECT. ALL VEGETATION SHALL BE REMOVED BY CONTRACTOR AT NO ADDITIONAL EXPENSE TO OWNER.
13. THE CONTRACTOR SHALL IMMEDIATELY REPORT TO THE ENGINEER ANY ERROR OR DISCREPANCY FOUND ONCE THE CONTRACT DOCUMENT IS CAREFULLY REVIEWED AND ALL ASPECTS OF FIELD WORK HAVE BEEN VERIFIED. IN THE EVENT THE CONTRACTOR CONTINUES TO WORK ON AN ITEM WHERE AN ERROR EXISTS, IT SHALL BE DEEMED THAT THE CONTRACTOR BID AND INTENDED TO EXECUTE THE MORE STRINGENT OR HIGHER QUALITY REQUIREMENT WITHOUT AN INCREASE IN CONTRACT SUM OR TIME. THE CONTRACTOR SHALL ALSO BE RESPONSIBLE TO CORRECT ANY FAILURE OF COMPANY PARTS TO COORDINATE OR FIT PROPERLY INTO FINAL POSITION, AS A RESULT OF CONTRACTOR'S FAILURE TO RAISE OR RESOLVE A DISCREPANCY.
14. THE DRAWINGS AND SPECIFICATIONS SHOULD AGREE WITH EACH OTHER, AND WORK CALLED FOR BY DRAWINGS AND NOT MENTIONED IN SPECIFICATION, OR VICE VERSA, SHALL BE FURNISHED BY BOTH. WHEN DISCREPANCIES EXIST BETWEEN SCALE AND DIMENSIONS, THE DIMENSIONED FIGURE SHALL BE USED.
15. CONTRACTORS AND EACH SUB CONTRACTOR SHALL VERIFY ALL GRADES, LINES, LEVELS, AND DIMENSIONS AS INDICATED ON DRAWINGS, AND HE SHALL REPORT ERRORS TO THE ENGINEER BEFORE COMMENCING WORK. THE CONTRACTOR SHALL ESTABLISH BENCHMARKS IN AT LEAST TWO WIDELY SEPARATED PLACES, AND AS WORK PROGRESSES THE CONTRACTOR WILL MAINTAIN ADEQUATE HORIZONTAL AND VERTICAL CONTROL.
16. THE CONTRACTOR IS REQUIRED TO PRESENT THE SWPPP TO LUMINANT ENVIRONMENTAL SERVICES FOR APPROVAL PRIOR TO THE COMENCEMENT OF CONSTRUCTION ACTIVITIES.
17. THE CONTRACTOR IS REQUIRED TO SUBMIT THE NOTICE OF INTENT FOR THE TPDES PERMIT.
18. THE CONTRACTOR SHALL OBTAIN AND CONDUCT WORK CONSISTENT WITH A TPDES PERMIT FOR CONSTRUCTION, REFER TO TECHNICAL SPECIFICATIONS. PREPARATION OF A SWPPP AND OBTAINING THE TPDES PERMIT ARE THE CONTRACTORS RESPONSIBILITY.
19. CONTRACTOR SHALL INSTALL EROSION AND SEDIMENT CONTROLS AS PER SPECIFICATIONS DURING CONSTRUCTION. SUCH CONTROLS SHALL BE PLACED AT LIMITS OF DISTRUBED AREAS AND AT INTERMEDIATE LOCATIONS WHERE CONCENTRATED FLOW IS LIKELY.
20. STORMWATER AND GROUNDWATER WHICH HAS COME INTO CONTACT WITH THE ASH WITHIN THE EXPANSION IS TO BE CONSIDERED CONTAMINATED. CONTRACTOR WILL CONTROL THE WATER ON-SITE IN COMPLIANCE WITH THE TPDES PERMIT.
21. THE CONTRACTOR SHALL INSTALL, MAINTAIN, AND UPON COMPLETION OF THE PROJECT, REMOVE TEMPORARY EROSION AND SEDIMENT CONTROLS AS APPROVED BY LUMINANT ENVIRONMENTAL SERVICES AND IN ACCORDANCE WITH THE SITE SWPPP AND PURSUANT TO TPDES REQUIREMENTS. SUCH CONTROLS SHALL BE PLACED AT THE LIMITS OF DISTURBED AREAS AND AT INTERMEDIATE LOCATIONS WHERE CONCENTRATED FLOW IS LIKELY.
22. CONTRACTOR SHALL PROVIDE EROSION CONTROL BY SEEDING FOR ALL AREAS DISTURBED BY CONTRACTOR DURING THE CONSTRUCTION OF THIS PROJECT. THE CONTRACTOR SHALL NOT DISTURB ANY AREA WITHOUT THE APPROVAL OF THE ENGINEER. EROSION CONTROL BY SEEDING SHALL CONFORM TO STANDARD SPECIFICATION 02930.
23. LUMINANT INTENDS TO RAISE THE HEIGHT OF THE IMPOUNDMENT BERM IN THE FUTURE. ALL REFERENCES TO "PHASE II" REFER TO A FUTURE PROJECT THAT IS NOT INCLUDED IN THE CONTRACT FOR THIS PROJECT (PHASE I).
24. CONTRACTOR TO FIELD VERIFY LIMITS OF EXISTING FILL PRIOR TO STARTING WORK. CARE SHOULD BE TAKEN NOT TO DAMAGE THE EXISTING CLAY LINERS OF PDPS• 2 & 3 AND THE SYNTHETIC LINER OF PDP• 1. ANY DAMAGE CAUSED BY CONTRATOR IS TO BE REPAIRED BY CONTRACTOR AT CONTRACTORS EXPENSE.
25. CONTRACTOR TO ACQUIRE A DIGGING PERMIT FROM THE PLANT BEFORE COMMENCING ANY EXCAVATION ACTIVITY.
26. PROTECT PREVIOUSLY COMPLETED CLAY LINER AND PROTECTIVE COVER.
27. DETERMINE EXTENTS OF SUBSURFACE LINER PRIOR TO BEGINNING LINER EXTENSION TO BERM AND CONSTRUCTION OF DEWATERING SUMPS.

SYMBOLS

SECTION DETAIL INDICATORS

DRAWING ON WHICH SECTION IS CUT:



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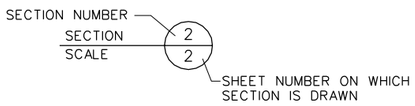

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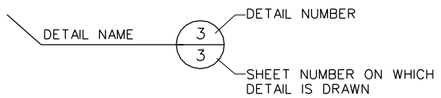

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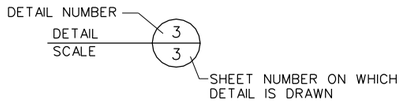
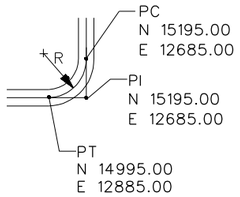
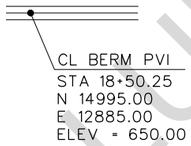
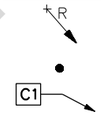


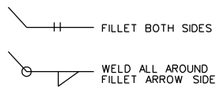




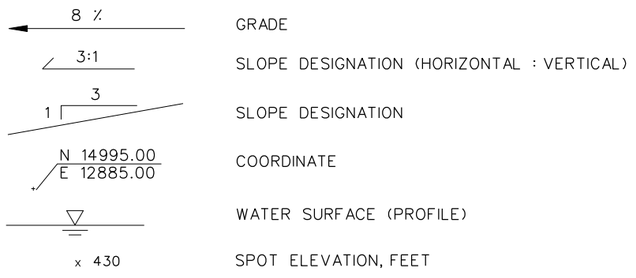
CURVE WITH HORIZONTAL CONTROL:



WELDING SYMBOLS



VERTICAL CONTROL DESIGNATION



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DATE: 2/9/2011
TIME: 12:47:40 PM
USER: rcox

Luminant

HDR ENGINEERING, INC.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070

Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D.VOGT
CIVIL ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	B.COX
DRAWN BY	B.COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

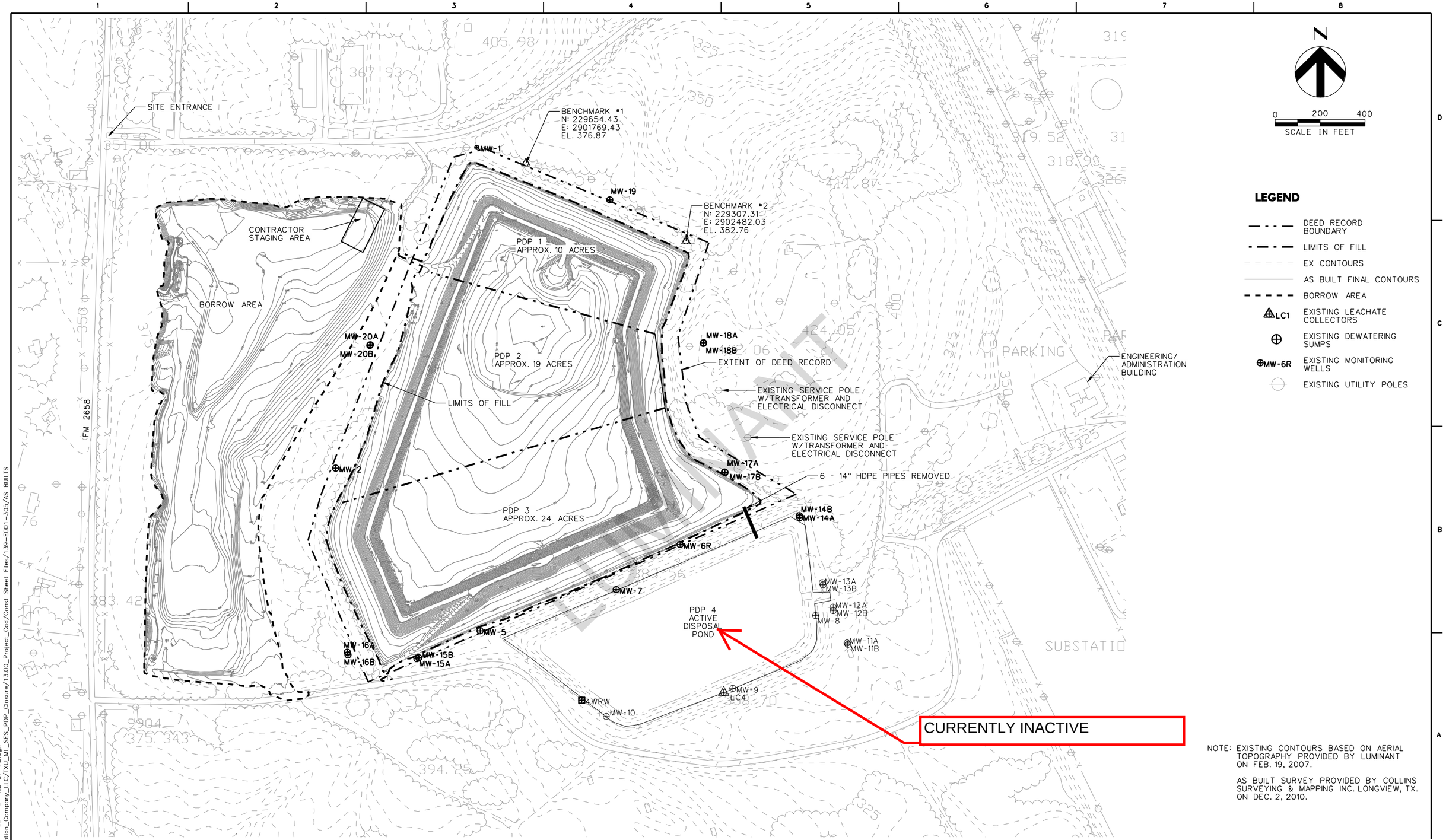
PERMANENT DISPOSAL POND #5
PHASE I

ABBREVIATIONS AND GENERAL NOTES

139-E001-305
AS RECORDED

FILENAME	ML-GN-AB.dgn
SCALE	NOT TO SCALE

SHEET C-2



NOTE: EXISTING CONTOURS BASED ON AERIAL TOPOGRAPHY PROVIDED BY LUMINANT ON FEB. 19, 2007.

AS BUILT SURVEY PROVIDED BY COLLINS SURVEYING & MAPPING INC. LONGVIEW, TX. ON DEC. 2, 2010.

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

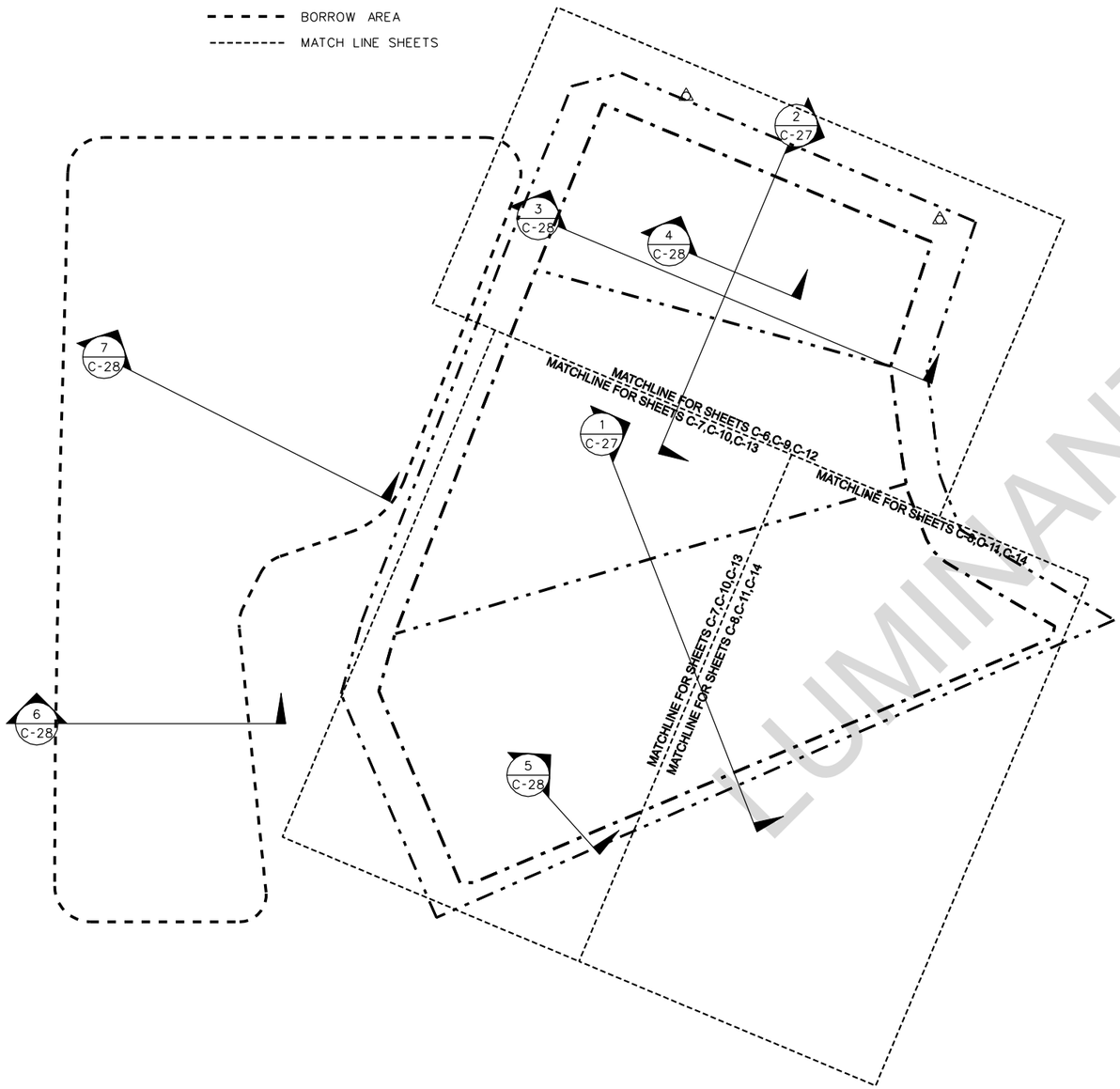
SITE PLAN
139-E001-305
AS RECORDED

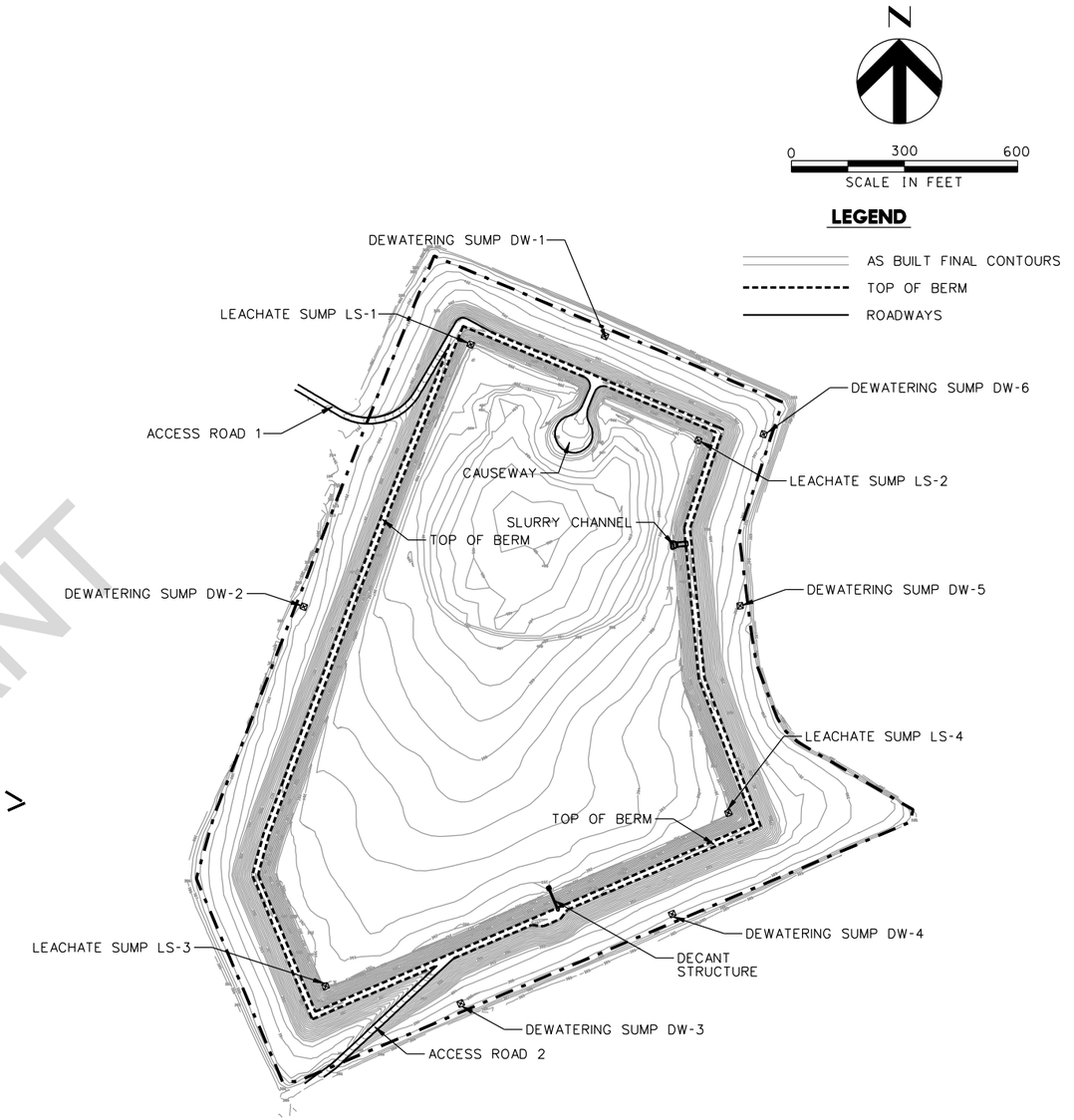
FILENAME	ML-SP-AB.dgn
SCALE	AS SHOWN

SHEET
C-3

LEGEND

- DEED RECORD BOUNDARY
- LIMITS OF FILL
- BORROW AREA
- MATCH LINE SHEETS





AS BUILT POND CAPACITY W/2' FREEBOARD = 62,000,000 GALLONS

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

KEY MAP & CROSS SECTION LOCATIONS

139-E001-305
AS RECORDED

FILENAME	ML-KM-AB.dgn
SCALE	AS SHOWN

SHEET **C-4**

Beginning chain BERM description

Point B100 N 229,164.45 E 2,902,283.00 Sta 10+00.00
Course from B100 to B101 N 67° 13' 05.59" W Dist 727.25

Point B101 N 229,446.06 E 2,901,612.49 Sta 17+27.25
Course from B101 to B102 S 21° 42' 49.81" W Dist 503.88

Point B102 N 228,977.93 E 2,901,426.07 Sta 22+31.13
Course from B102 to B103 S 20° 22' 56.34" W Dist 939.90

Point B103 N 228,096.88 E 2,901,098.72 Sta 31+71.03
Course from B103 to B104 S 15° 19' 55.34" W Dist 108.30

Point B104 N 227,992.43 E 2,901,070.08 Sta 32+79.33
Course from B104 to B105 S 22° 34' 51.12" E Dist 393.01

Point B105 N 227,629.56 E 2,901,220.99 Sta 36+72.34
Course from B105 to B106 N 66° 48' 13.00" E Dist 1,264.55

Point B106 N 228,127.64 E 2,902,383.32 Sta 49+36.89
Course from B106 to B107 N 20° 46' 34.13" W Dist 410.67

Point B107 N 228,511.61 E 2,902,237.64 Sta 53+47.56
Course from B107 to B108 N 5° 31' 02.85" W Dist 401.28

Point B108 N 228,911.03 E 2,902,199.06 Sta 57+48.83
Course from B108 to B109 N 18° 19' 36.70" E Dist 266.96

Point B109 N 229,164.45 E 2,902,283.00 Sta 60+15.80

Ending chain BERM description

Beginning chain ACCESS ROAD1 description

Point H12 N 229,284.47 E 2,901,170.24 Sta 10+00.00

Course from H12 to PC HAUL-1 S 59° 24' 40.79" E Dist 134.32

Curve Data

Curve HAUL-1
P.I. Station 12+84.20 N 229,139.84 E 2,901,414.89
Delta = 89° 57' 21.83" (LT)
Degree = 38° 11' 49.87"
Tangent = 149.89
Length = 235.50
Radius = 150.00
External = 62.05
Long Chord = 212.05
Mid. Ord. = 43.89
P.C. Station 11+34.32 N 229,216.12 E 2,901,285.86
P.T. Station 13+69.82 N 229,268.81 E 2,901,491.26
C.C. N 229,345.24 E 2,901,362.19
Back = S 59° 24' 40.79" E
Ahead = N 30° 37' 57.38" E
Chord Bear = N 75° 36' 38.29" E

Course from PT HAUL-1 to H13 N 30° 37' 57.38" E Dist 206.74

Point H13 N 229,446.70 E 2,901,596.60 Sta 15+76.56

Ending chain ACCESS ROAD1 description

Beginning chain ACCESS ROAD2 description

Point H200 N 227,447.47 E 2,901,218.06 Sta 10+00.00

Course from H200 to PC HAUL2-1 N 53° 57' 30.87" E Dist 57.57

Curve Data

Curve HAUL2-1
P.I. Station 10+66.74 N 227,486.74 E 2,901,272.03
Delta = 7° 00' 10.75" (LT)
Degree = 38° 11' 49.87"
Tangent = 9.18
Length = 18.33
Radius = 150.00
External = 0.28
Long Chord = 18.32
Mid. Ord. = 0.28
P.C. Station 10+57.57 N 227,481.34 E 2,901,264.61
P.T. Station 10+75.90 N 227,493.00 E 2,901,278.74
C.C. N 227,602.62 E 2,901,176.36
Back = N 53° 57' 30.87" E
Ahead = N 46° 57' 20.12" E
Chord Bear = N 50° 27' 25.50" E

Course from PT HAUL2-1 to H201 N 46° 57' 20.12" E Dist 392.50

Point H201 N 227,760.91 E 2,901,565.59 Sta 14+68.40

Ending chain ACCESS ROAD2 description

Beginning chain LEACHATE1 description

Point L10 N 229,432.03 E 2,901,922.86 Sta 10+00.00

Course from L10 to PC LEACH1-1 N 67° 14' 51.56" W Dist 347.26

Curve Data

Curve LEACH1-1
P.I. Station 13+98.43 N 229,586.12 E 2,901,555.44
Delta = 91° 19' 03.90" (LT)
Degree = 114° 35' 29.61"
Tangent = 51.16
Length = 79.69
Radius = 50.00
External = 21.54
Long Chord = 71.52
Mid. Ord. = 15.05
P.C. Station 13+47.26 N 229,566.33 E 2,901,602.62
P.T. Station 14+26.95 N 229,538.50 E 2,901,536.74
C.C. N 229,520.22 E 2,901,583.28
Back = N 67° 14' 51.56" W
Ahead = S 21° 26' 04.53" W
Chord Bear = S 67° 05' 36.48" W

Course from PT LEACH1-1 to PC LEACH1-2 S 21° 26' 04.53" W Dist 1,506.61

Curve Data

Curve LEACH1-2
P.I. Station 29+36.03 N 228,133.80 E 2,900,985.27
Delta = 5° 37' 59.16" (LT)
Degree = 114° 35' 29.61"
Tangent = 2.46
Length = 4.92
Radius = 50.00
External = 0.06
Long Chord = 4.91
Mid. Ord. = 0.06
P.C. Station 29+33.57 N 228,136.09 E 2,900,986.16
P.T. Station 29+38.48 N 228,131.43 E 2,900,984.60
C.C. N 228,117.81 E 2,901,032.71
Back = S 21° 26' 04.53" W
Ahead = S 15° 48' 05.37" W
Chord Bear = S 18° 37' 04.95" W

Course from PT LEACH1-2 to PC LEACH1-3 S 15° 48' 05.37" W Dist 135.19

Curve Data

Curve LEACH1-3
P.I. Station 30+91.30 N 227,984.38 E 2,900,942.98
Delta = 38° 51' 28.57" (LT)
Degree = 114° 35' 29.61"
Tangent = 17.64
Length = 33.91
Radius = 50.00
External = 3.02
Long Chord = 33.26
Mid. Ord. = 2.85
P.C. Station 30+73.67 N 228,001.35 E 2,900,947.78
P.T. Station 31+07.58 N 227,968.16 E 2,900,949.89
C.C. N 227,987.74 E 2,900,995.90
Back = S 15° 48' 05.37" W
Ahead = S 23° 03' 23.20" E
Chord Bear = S 3° 37' 38.92" E

Course from PT LEACH1-3 to PC LEACH1-4 S 23° 03' 23.20" E Dist 483.99

Curve Data

Curve LEACH1-4
P.I. Station 36+41.44 N 227,476.94 E 2,901,158.97
Delta = 89° 51' 31.58" (LT)
Degree = 114° 35' 29.61"
Tangent = 49.88
Length = 78.42
Radius = 50.00
External = 20.62
Long Chord = 70.62
Mid. Ord. = 14.60
P.C. Station 35+91.56 N 227,522.83 E 2,901,139.44
P.T. Station 36+69.98 N 227,496.36 E 2,901,204.91
C.C. N 227,542.41 E 2,901,185.44
Back = S 23° 03' 23.20" E
Ahead = N 67° 05' 05.22" E
Chord Bear = S 67° 59' 08.99" E

Course from PT LEACH1-4 to L11 N 67° 05' 05.22" E Dist 764.96

Point L11 N 227,794.21 E 2,901,909.50 Sta 44+34.94

Ending chain LEACHATE1 description

Beginning chain LEACHATE2 description

Point L3000 N 229,069.70 E 2,902,365.16 Sta 10+00.00

Course from L3000 to PC LEACH2-1 S 18° 14' 24.79" W Dist 168.91

Curve Data

Curve LEACH2-1
P.I. Station 11+80.29 N 228,898.48 E 2,902,308.73
Delta = 25° 38' 53.23" (LT)
Degree = 114° 35' 29.61"
Tangent = 11.38
Length = 22.38
Radius = 50.00
External = 1.28
Long Chord = 22.20
Mid. Ord. = 1.25
P.C. Station 11+68.91 N 228,909.29 E 2,902,312.30
P.T. Station 11+91.29 N 228,887.19 E 2,902,310.20
C.C. N 228,893.64 E 2,902,359.78
Back = S 18° 14' 24.79" W
Ahead = S 7° 24' 28.44" E
Chord Bear = S 5° 24' 58.17" W

Course from PT LEACH2-1 to PC LEACH2-2 S 7° 24' 28.44" E Dist 337.89

Curve Data

Curve LEACH2-2
P.I. Station 15+35.12 N 228,546.23 E 2,902,354.53
Delta = 13° 33' 02.15" (LT)
Degree = 114° 35' 29.61"
Tangent = 5.94
Length = 11.83
Radius = 50.00
External = 0.35
Long Chord = 11.80
Mid. Ord. = 0.35
P.C. Station 15+29.18 N 228,552.12 E 2,902,353.77
P.T. Station 15+41.01 N 228,540.68 E 2,902,356.66
C.C. N 228,558.56 E 2,902,403.35
Back = S 7° 24' 28.44" E
Ahead = S 20° 57' 30.59" E
Chord Bear = S 14° 10' 59.52" E

Course from PT LEACH2-2 to PC LEACH2-3 S 20° 57' 30.59" E Dist 465.43

Curve Data

Curve LEACH2-3
P.I. Station 20+54.75 N 228,060.92 E 2,902,540.42
Delta = 88° 02' 35.81" (RT)
Degree = 114° 35' 29.61"
Tangent = 48.32
Length = 76.83
Radius = 50.00
External = 19.53
Long Chord = 69.49
Mid. Ord. = 14.05
P.C. Station 20+06.43 N 228,106.04 E 2,902,523.14
P.T. Station 20+83.27 N 228,042.10 E 2,902,495.91
C.C. N 228,088.16 E 2,902,476.44
Back = S 20° 57' 30.59" E
Ahead = S 67° 05' 05.22" W
Chord Bear = S 23° 03' 47.32" W

Course from PT LEACH2-3 to L3001 S 67° 05' 05.22" W Dist 636.66

Point L3001 N 227,794.21 E 2,901,909.50 Sta 27+19.92

Ending chain LEACH2 description

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DATE: 2/9/2011
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USER: rcox

Luminant

HDR
HDR ENGINEERING, INC.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070
Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D.VOGT
CIVIL ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	B. COX
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

THIS RECORD DRAWING IS A COMPILATION OF THE SEALED ENGINEERING DRAWINGS FOR THIS PROJECT, MODIFIED BY ADDENDA AND CHANGE ORDERS. INFORMATION FURNISHED BY THE CONTRACTOR OR OTHERS, NOT ASSOCIATED WITH THE DESIGN ENGINEER, CANNOT BE VERIFIED FOR ACCURACY OR COMPLETENESS. THE ORIGINAL SEALED DRAWINGS ARE ON FILE AT THE OFFICES OF HDR ENGINEERING INC.

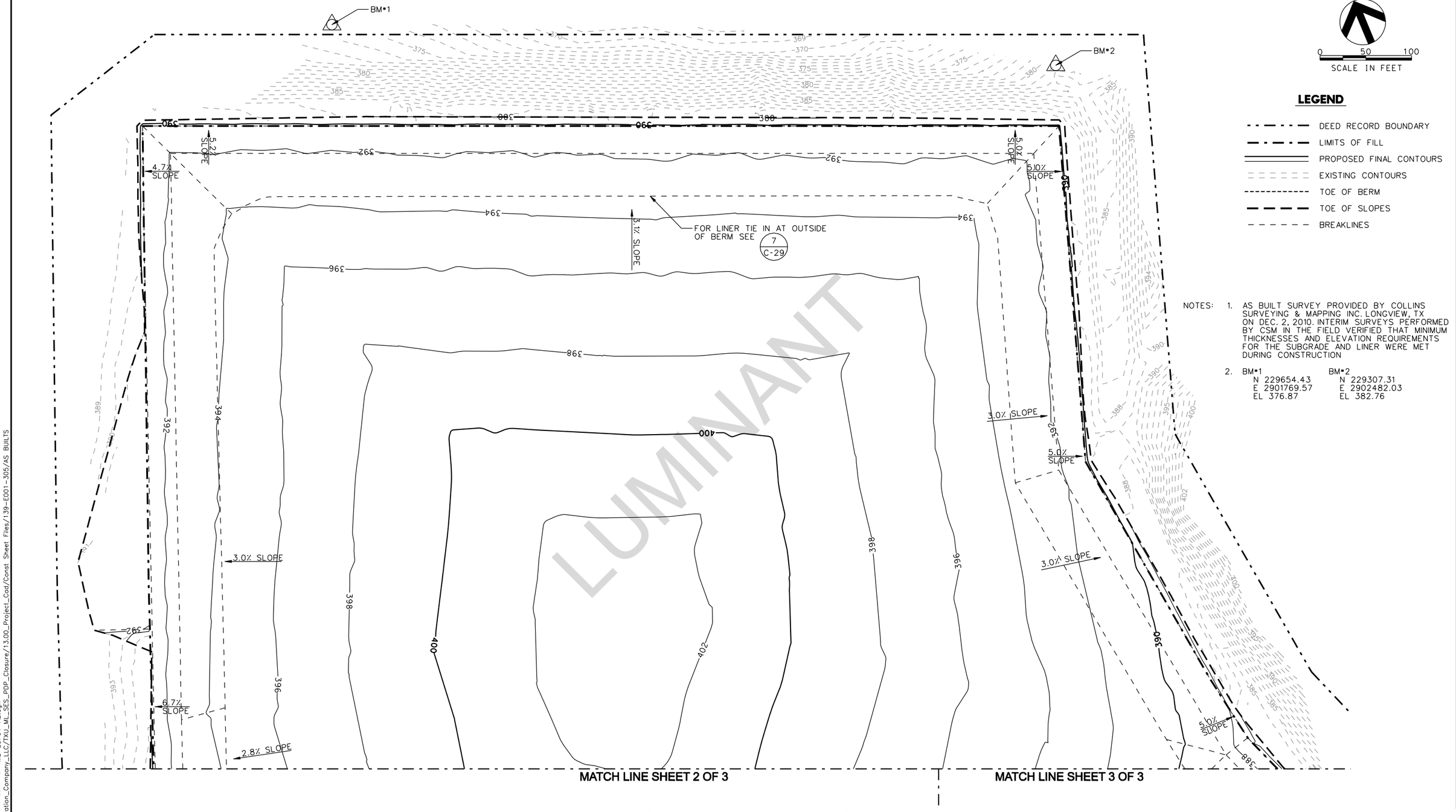
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

HORIZONTAL CONTROL DATA
139-E001-305
AS RECORDED

FILENAME	ML-HCD-AB.dgn
SCALE	AS SHOWN

SHEET C-5



NOTES:

1. AS BUILT SURVEY PROVIDED BY COLLINS SURVEYING & MAPPING INC. LONGVIEW, TX ON DEC. 2, 2010. INTERIM SURVEYS PERFORMED BY CSM IN THE FIELD VERIFIED THAT MINIMUM THICKNESSES AND ELEVATION REQUIREMENTS FOR THE SUBGRADE AND LINER WERE MET DURING CONSTRUCTION
2. BM-1 N 229654.43 E 2901769.57 EL 376.87; BM-2 N 229307.31 E 2902482.03 EL 382.76

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DATE: 2/9/2011
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USER: rcox

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HDR
HDR ENGINEERING, INC.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070
Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D.VOGT
CIVIL ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	B. COX
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

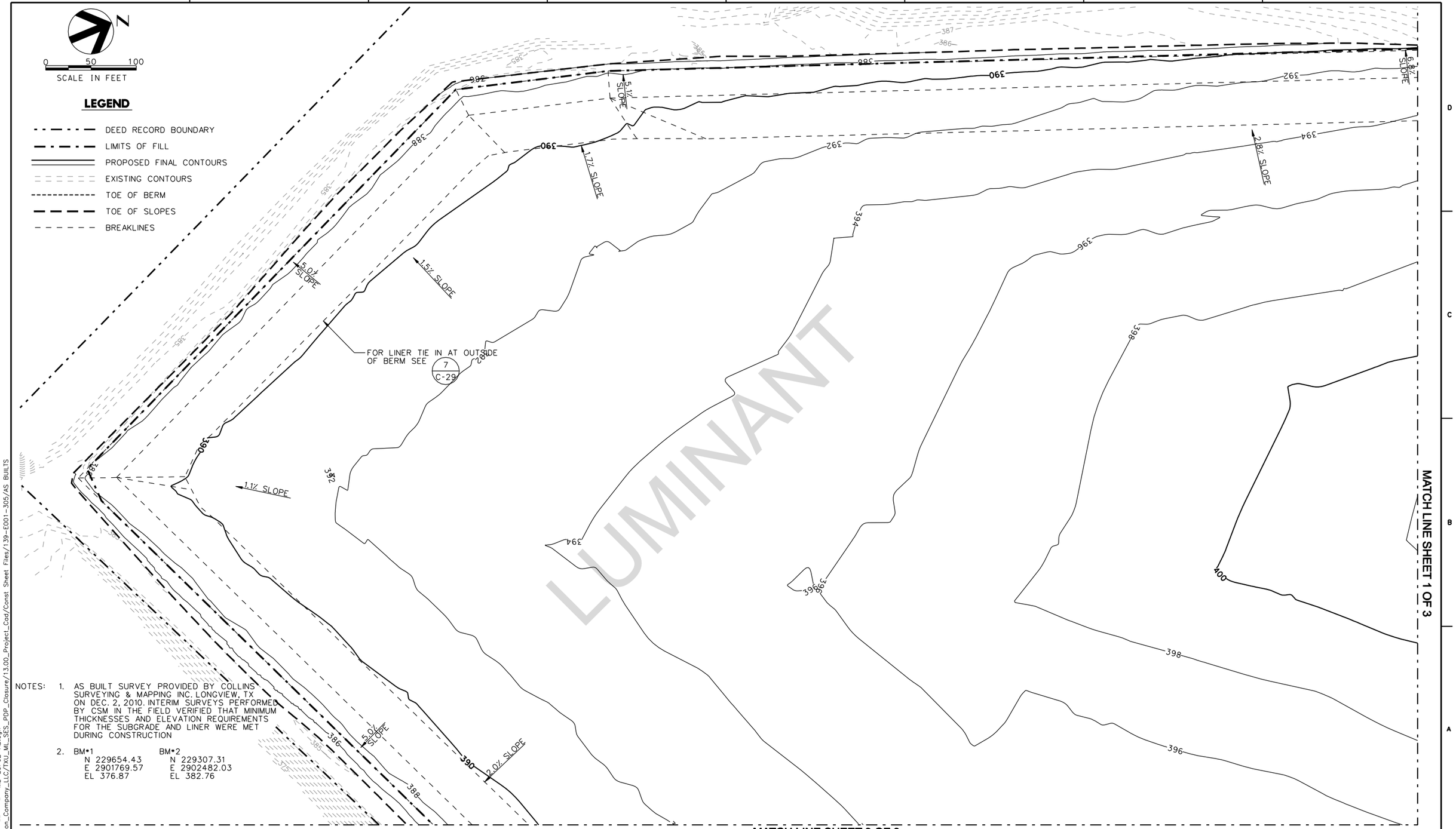
PERMANENT DISPOSAL POND #5
PHASE I

LINER CONTOUR PLAN

SHEET 1 OF 3
139-E001-305
AS RECORDED

FILENAME	ML-LCP01-AB.dgn
SCALE	AS SHOWN

SHEET C-6



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HDR
HDR ENGINEERING, INC.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070
Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D.VOGT
CIVIL ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	B. COX
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

LINER CONTOUR PLAN
SHEET 2 OF 3
139-E001-305
AS RECORDED

FILENAME	ML-LCP02-AB.dgn
SCALE	AS SHOWN

SHEET C-7

MATCH LINE SHEET 2 OF 3

MATCH LINE SHEET 1 OF 3

N

0 50 100
SCALE IN FEET

LEGEND

- DEED RECORD BOUNDARY
- LIMITS OF FILL
- PROPOSED FINAL CONTOURS
- EXISTING CONTOURS
- TOE OF BERM
- TOE OF SLOPES
- BREAKLINES

NOTES:
1. AS BUILT SURVEY PROVIDED BY COLLINS SURVEYING & MAPPING INC. LONGVIEW, TX ON DEC. 2, 2010. INTERIM SURVEYS PERFORMED BY CSM IN THE FIELD VERIFIED THAT MINIMUM THICKNESSES AND ELEVATION REQUIREMENTS FOR THE SUBGRADE AND LINER WERE MET DURING CONSTRUCTION
2. BM•1 N 229654.43 E 2901769.57 EL 376.87; BM•2 N 229307.31 E 2902482.03 EL 382.76

FOR LINER TIE IN AT OUTSIDE OF BERM SEE 7 C-29

6 - 14" HDPE PIPES WERE REMOVED AND BERM RESTORED TO ORIGINAL CONDITIONS BEFORE LINER WAS PLACED IN THIS AREA

PLTDRVER: 11X17LASER_BW_PDF.plt
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DATE: 2/9/2011

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4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070

Texas P.E. Firm
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ISSUE	DATE	DESCRIPTION

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DESIGNED	B. COX
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QA/QC	M. ODEN
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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

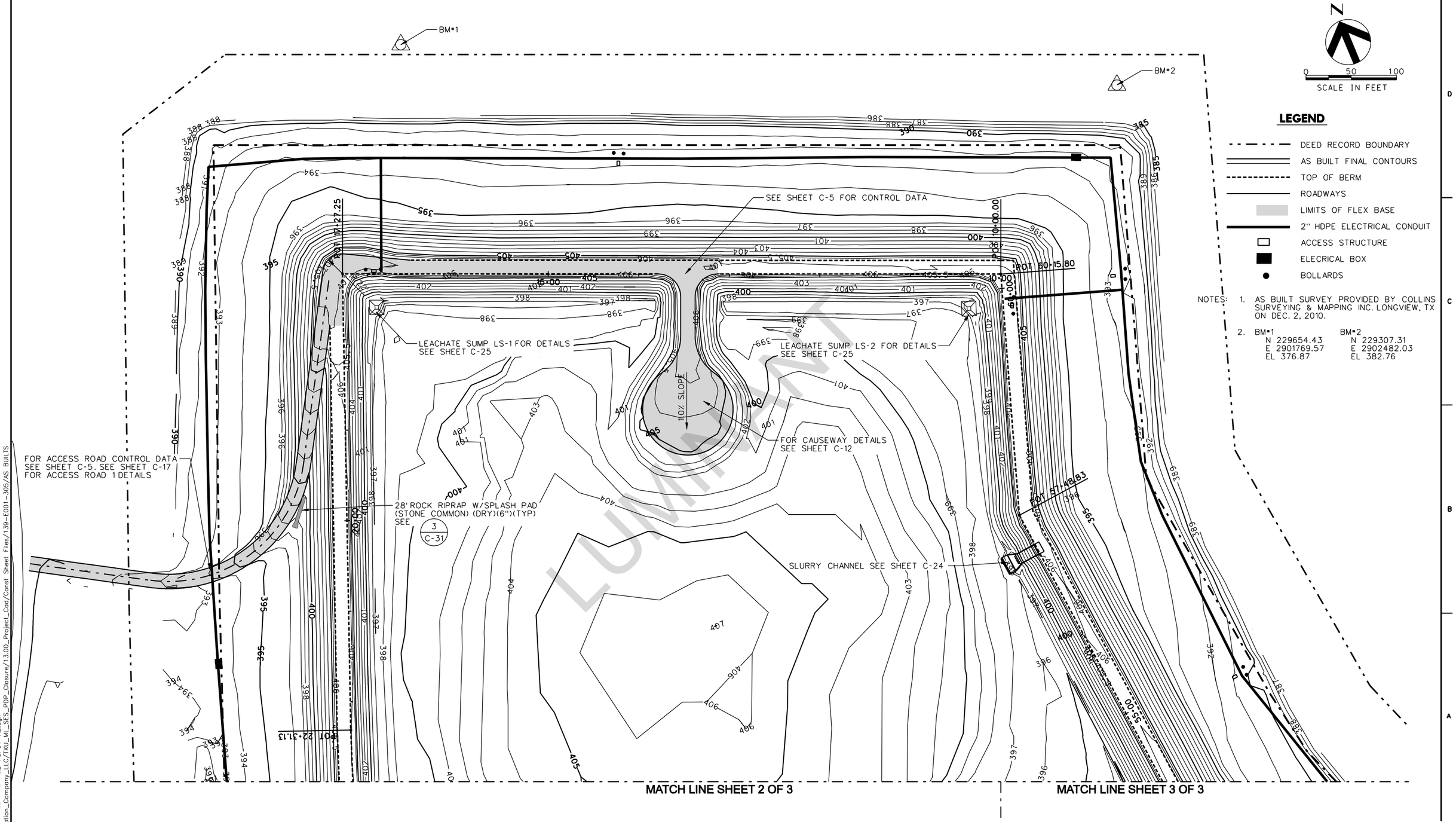
PERMANENT DISPOSAL POND #5
PHASE I

LINER CONTOUR PLAN

SHEET 3 OF 3
139-E001-305
AS RECORDED

FILENAME	ML-LCP03-AB.dgn
SCALE	AS SHOWN

SHEET C-8



LEGEND

- DEED RECORD BOUNDARY
- AS BUILT FINAL CONTOURS
- TOP OF BERM
- ROADWAYS
- LIMITS OF FLEX BASE
- 2" HDPE ELECTRICAL CONDUIT
- ACCESS STRUCTURE
- ELECRICAL BOX
- BOLLARDS

NOTES:
1. AS BUILT SURVEY PROVIDED BY COLLINS SURVEYING & MAPPING INC. LONGVIEW, TX ON DEC. 2, 2010.
2. BM•1 N 229654.43 E 2901769.57 EL 376.87; BM•2 N 229307.31 E 2902482.03 EL 382.76

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Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D.VOGT
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CHECKED BY	
DESIGNED	B. COX
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

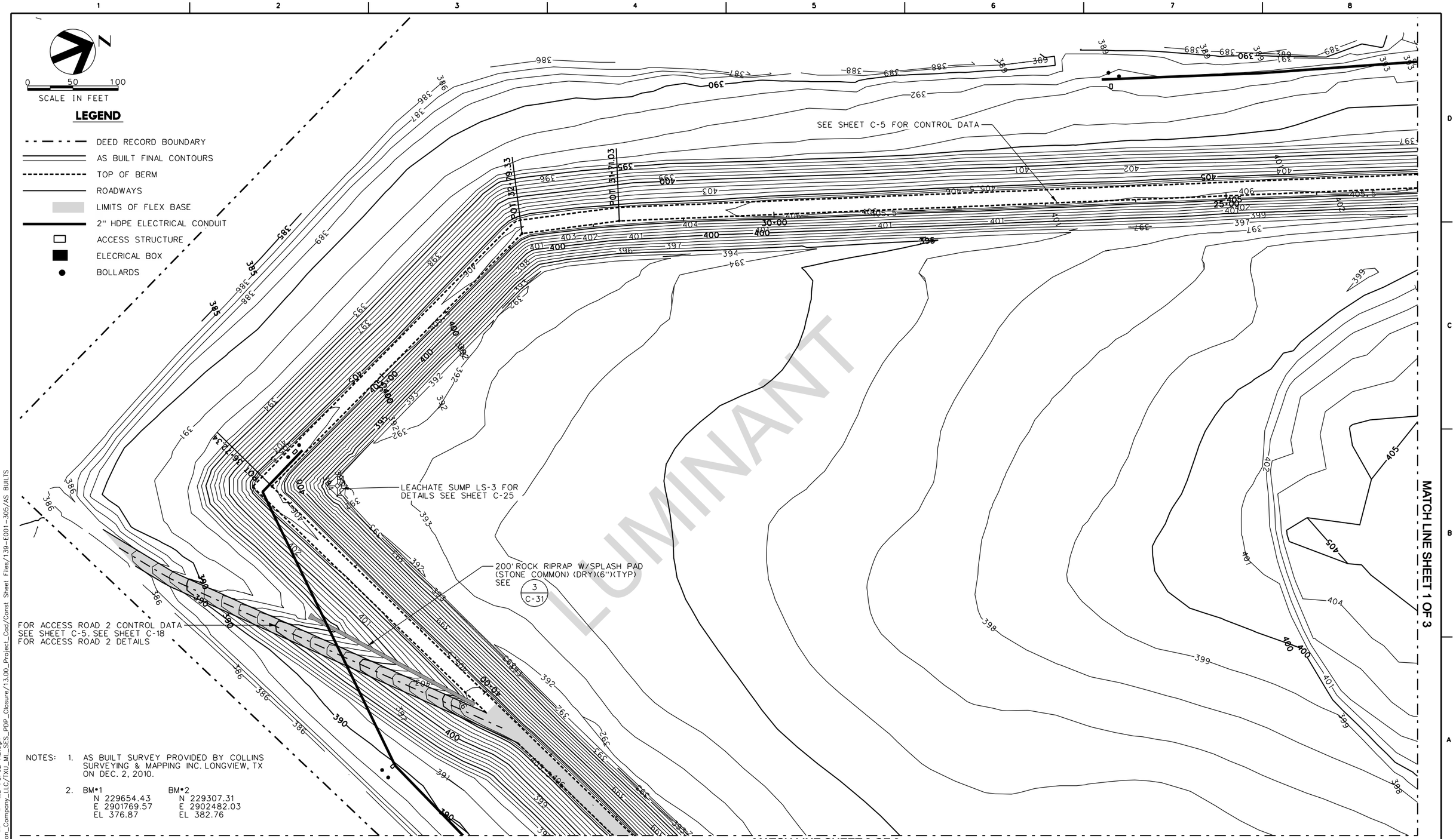
PERMANENT DISPOSAL POND #5
PHASE I

FINAL CONTOUR PLAN

SHEET 1 OF 3
139-E001-305
AS RECORDED

FILENAME	ML-FCP01-AB.dgn
SCALE	AS SHOWN

SHEET C-9



NOTES:
1. AS BUILT SURVEY PROVIDED BY COLLINS SURVEYING & MAPPING INC. LONGVIEW, TX ON DEC. 2, 2010.
2. BM•1 N 229654.43 E 2901769.57 EL 376.87; BM•2 N 229307.31 E 2902482.03 EL 382.76

PLTDRVER: 11X17LASER_BW_PDF.plt
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ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D.VOGT
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CHECKED BY	
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QA/QC	M. ODEN
PROJECT NUMBER	53925

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

FINAL CONTOUR PLAN

SHEET 2 OF 3
139-E001-305
AS RECORDED

FILENAME	ML-FCP02-AB.dgn
SCALE	AS SHOWN

SHEET C-10

MATCH LINE SHEET 2 OF 3

MATCH LINE SHEET 1 OF 3

N

0 50 100

SCALE IN FEET

LEGEND

- DEED RECORD BOUNDARY
- AS BUILT FINAL CONTOURS
- TOP OF BERM
- ROADWAYS
- LIMITS OF FLEX BASE
- 2" HDPE ELECTRICAL CONDUIT
- ACCESS STRUCTURE
- ELECRICAL BOX
- BOLLARDS

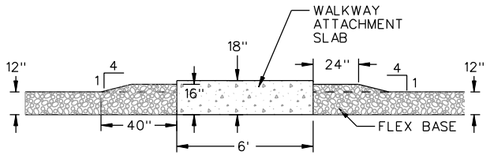
NOTES:

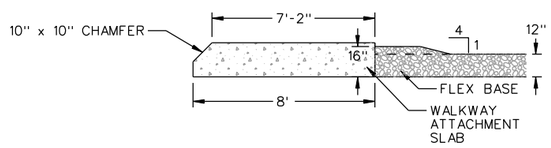
1. AS BUILT SURVEY PROVIDED BY COLLINS SURVEYING & MAPPING INC. LONGVIEW, TX ON DEC. 2, 2010.
2. BM#1 N 229654.43 E 2901769.57 EL 376.87; BM#2 N 229307.31 E 2902482.03 EL 382.76

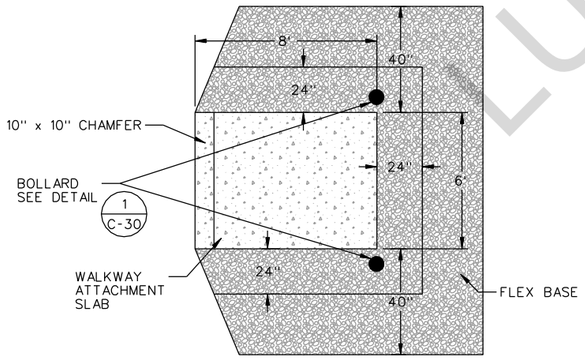
DECANT STRUCTURE & WALKWAY SEE SHEETS 1& 2 OF DWG. 139-E001-301

WALKWAY ATTACHMENT SLAB SEE DETAIL THIS SHEET AND SHEETS 1& 2 OF DWG. 139-E001-301

LEACHATE SUMP LS-4 FOR DETAILS SEE SHEET C-25







WALKWAY ATTACHMENT SLAB — 1 / C-11

N.T.S.

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Luminant

HDR
HDR ENGINEERING, INC.
4500 W. Eldorado Parkway
Suite 3500
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Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D.VOGT
CIVIL ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	B. COX
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

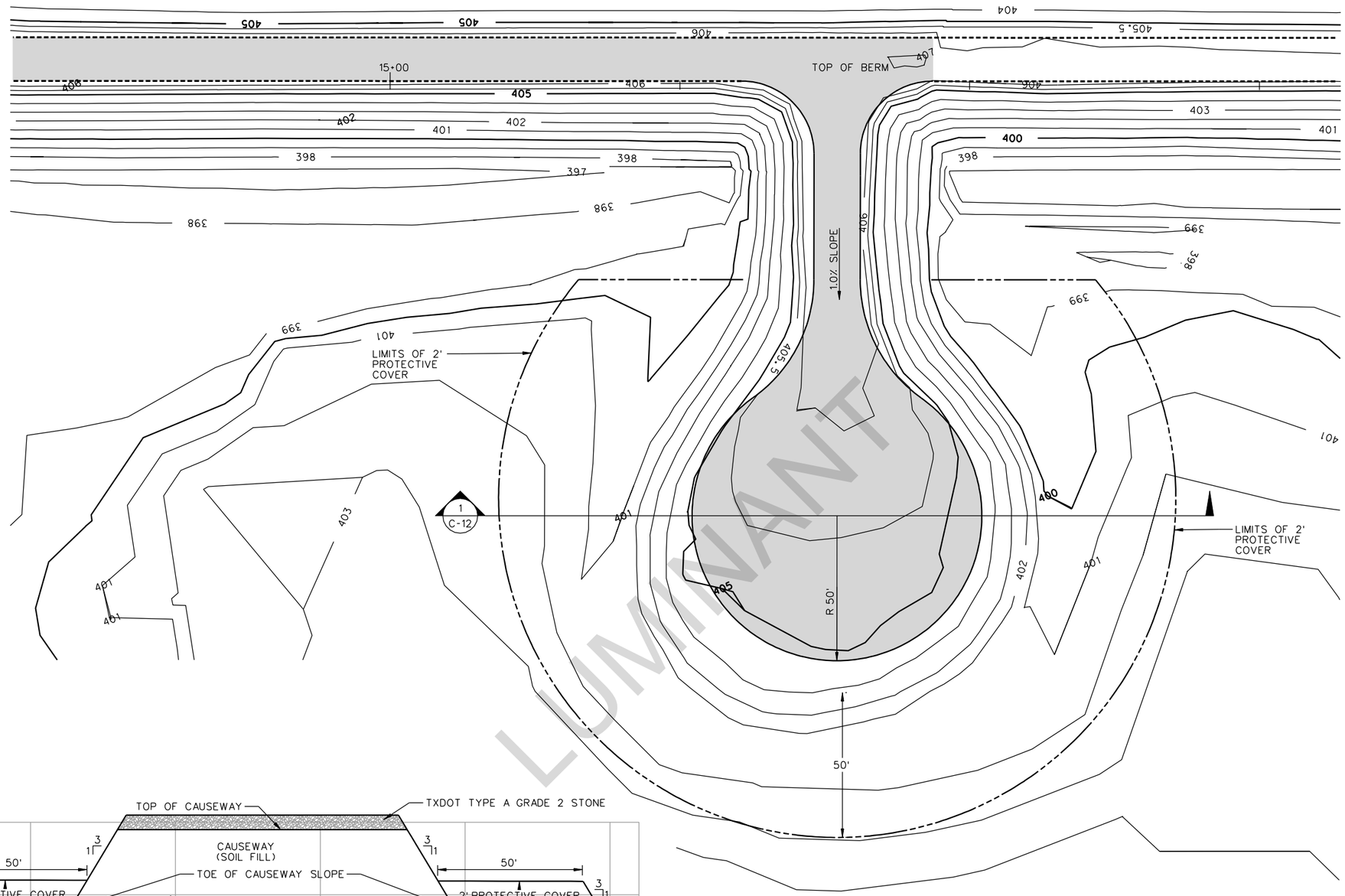
PERMANENT DISPOSAL POND #5
PHASE I

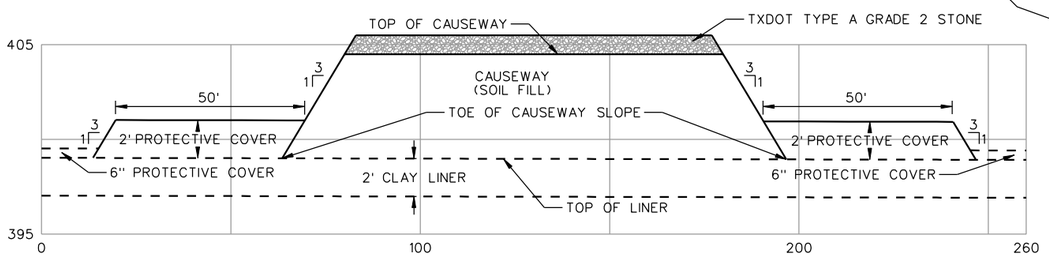
FINAL CONTOUR PLAN

SHEET 3 OF 3
139-E001-305
AS RECORDED

FILENAME	ML-FCP03-AB.dgn
SCALE	AS SHOWN

SHEET C-11





CROSS SECTION 1 / C-12

5V:1H

LEGEND

- DEED RECORD BOUNDARY
- AS BUILT FINAL CONTOURS
- TOP OF BERM
- ROADWAYS
- LIMITS OF FLEX BASE

NOTES:
1. AS BUILT SURVEY PROVIDED BY COLLINS SURVEYING & MAPPING INC. LONGVIEW, TX ON DEC. 2, 2010.
2. BM#1 N 229654.43 E 2901769.57 EL 376.87; BM#2 N 229307.31 E 2902482.03 EL 382.76

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TIME: 12:48:43 PM

Luminant

HDR
HDR ENGINEERING, INC.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070
Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D.VOGT
CIVIL ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	B. COX
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

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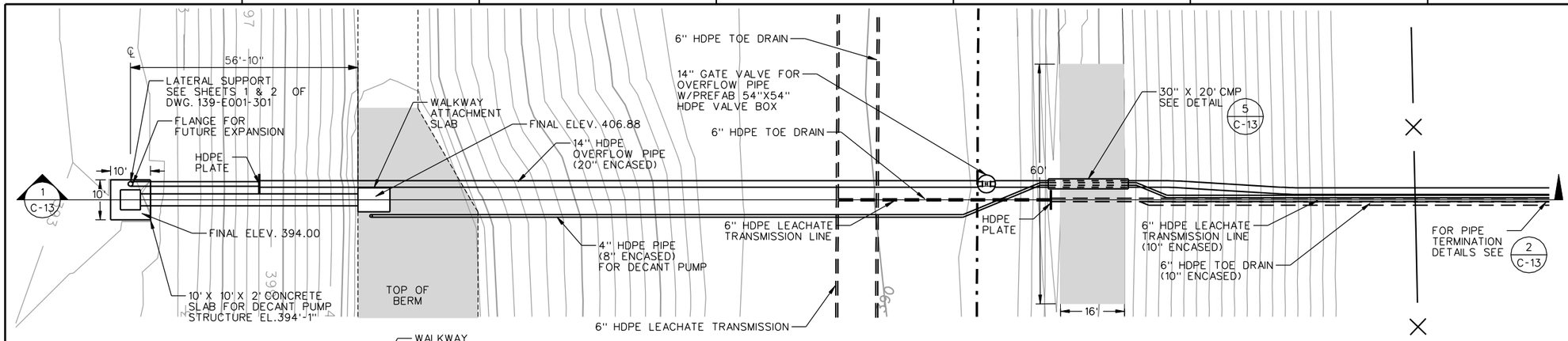
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

CAUSEWAY CONTOUR PLAN
139-E001-305
AS RECORDED

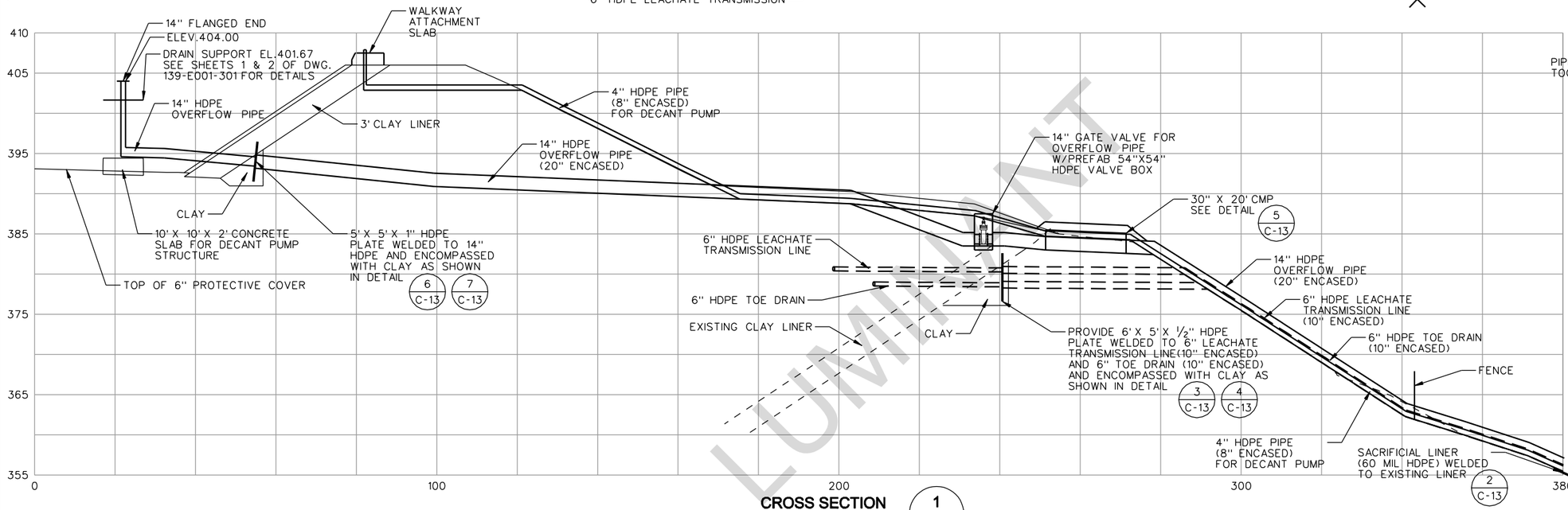
FILENAME	ML-CD01-AB.dgn
SCALE	AS SHOWN

SHEET C-12



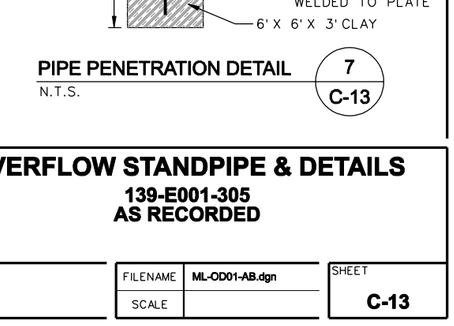
LEGEND

- LIMITS OF FILL
- AS BUILT FINAL CONTOURS
- TOP OF BERM
- TOE OF SLOPES
- ROADWAYS
- LIMITS OF FLEX BASE



CROSS SECTION 1 C-13

2V:1H



PIPE TERMINATION DETAIL 2 C-13

N.T.S.

TRENCH DETAIL FOR PIPE CROSSINGS

PIPE PENETRATION DETAIL 3 C-13

N.T.S.

PIPE PENETRATION DETAIL 4 C-13

N.T.S.

CMP PIPE DETAIL 5 C-13

N.T.S.

PIPE PENETRATION DETAIL 6 C-13

N.T.S.

PIPE PENETRATION DETAIL 7 C-13

N.T.S.

PLTDRVER: 11X17LASER_BW_PDF.plt
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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

OVERFLOW STANDPIPE & DETAILS

139-E001-305
AS RECORDED

FILENAME	ML-OD01-AB.dgn
SCALE	

SHEET C-13

NOTES:

1. AS BUILT SURVEY PROVIDED BY COLLINS SURVEYING & MAPPING INC. LONGVIEW, TX ON DEC. 2, 2010.
2. SEE GEOTECHNICAL REPORT FOR BORROW AREA.
3. 2" HDPE FORCE MAIN LOCATION IS APPROXIMATE, CONTRACTOR FIELD VERIFIED AND PROTECTED AS NEEDED.

Luminant

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McKinney, Texas 75070
Texas P.E. Firm
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ISSUE	DATE	DESCRIPTION
0	04/10	ISSUED FOR CONSTRUCTION

PROJECT MANAGER	D.VOGT
CIVIL ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	B.COX
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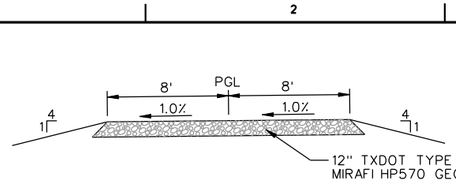
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

BORROW AREA EXCAVATION PLAN
139-E001-305
AS RECORDED

FILENAME	ML-BA-AB.dgn
SCALE	AS SHOWN

SHEET C-14



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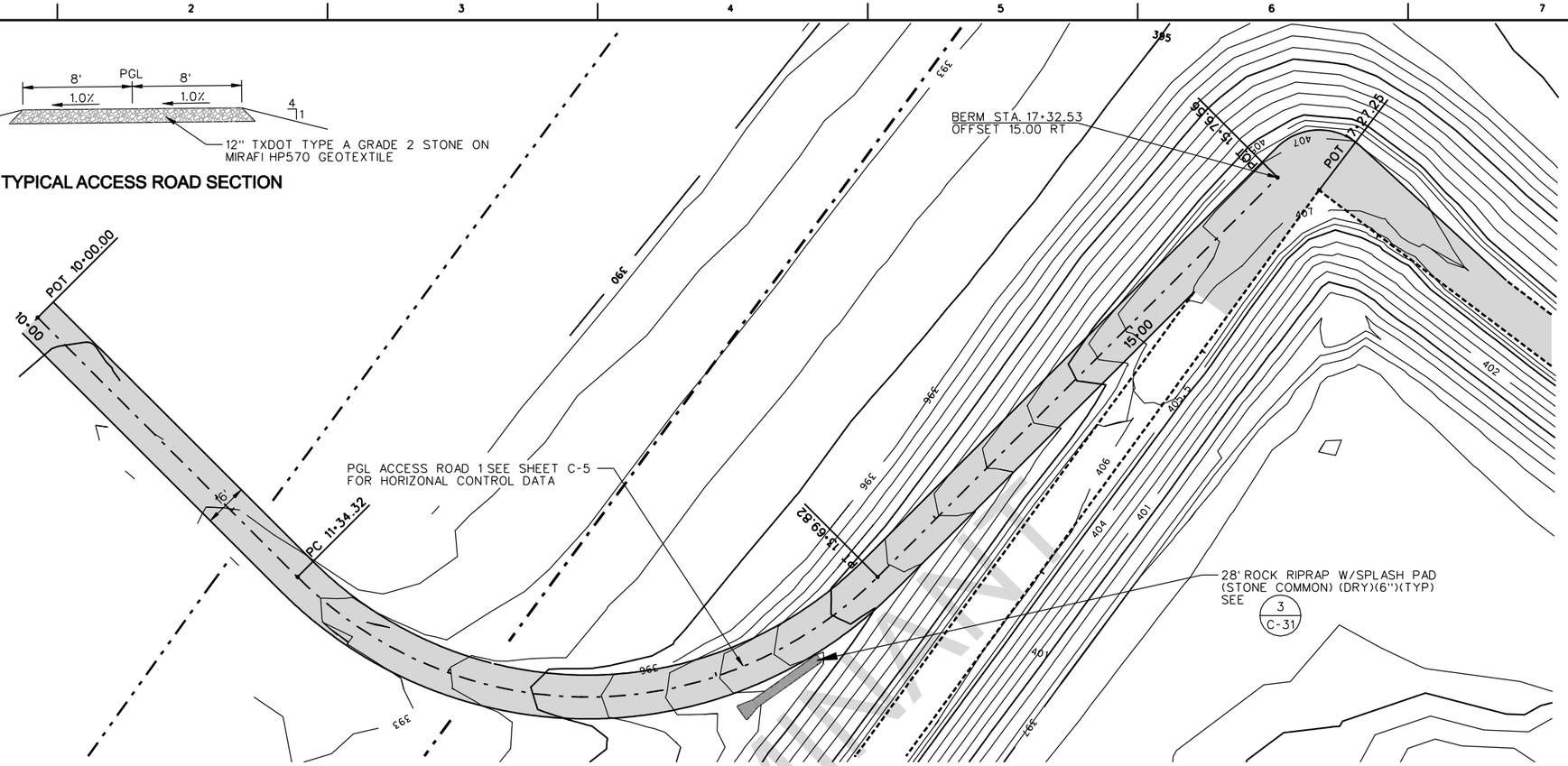
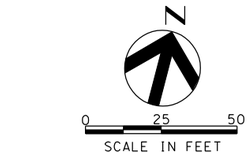
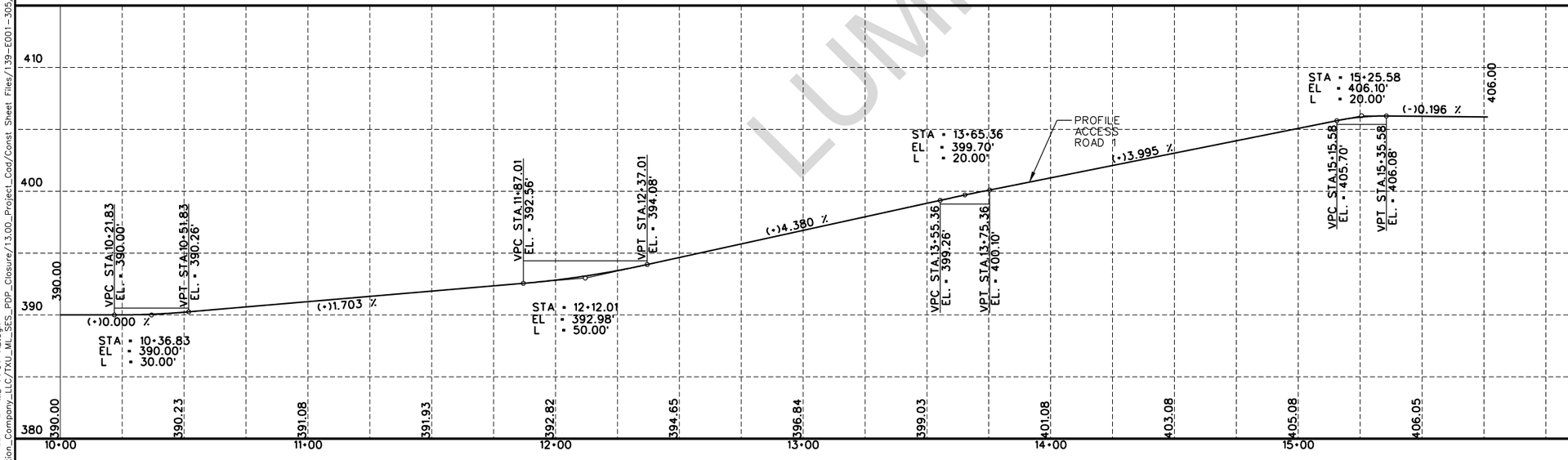




LEGEND

- DEED RECORD BOUNDARY
- LIMITS OF FILL
- AS BUILT FINAL CONTOURS
- TOP OF BERM
- ROADWAYS
- LIMITS OF FLEX BASE

AS BUILT SURVEY PROVIDED BY COLLINS SURVEYING & MAPPING INC. LONGVIEW, TX ON DEC. 2, 2010.



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USER: rcox
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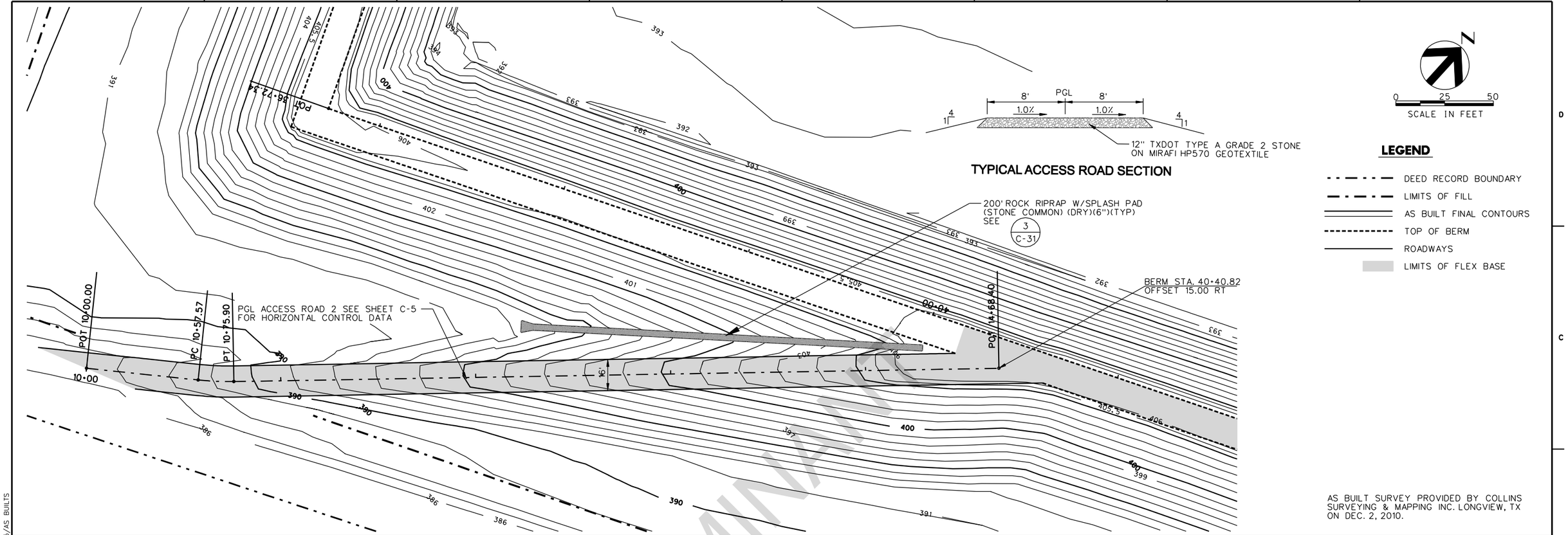
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

ACCESS ROAD 1 PLAN & PROFILE
139-E001-305
AS RECORDED

FILENAME	ML-PP01-AB.dgn
SCALE	AS SHOWN

SHEET **C-17**



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TIME: 12:49:12 PM
USER: rcox

Luminant

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4500 W. Eldorado Parkway
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Texas P.E. Firm
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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

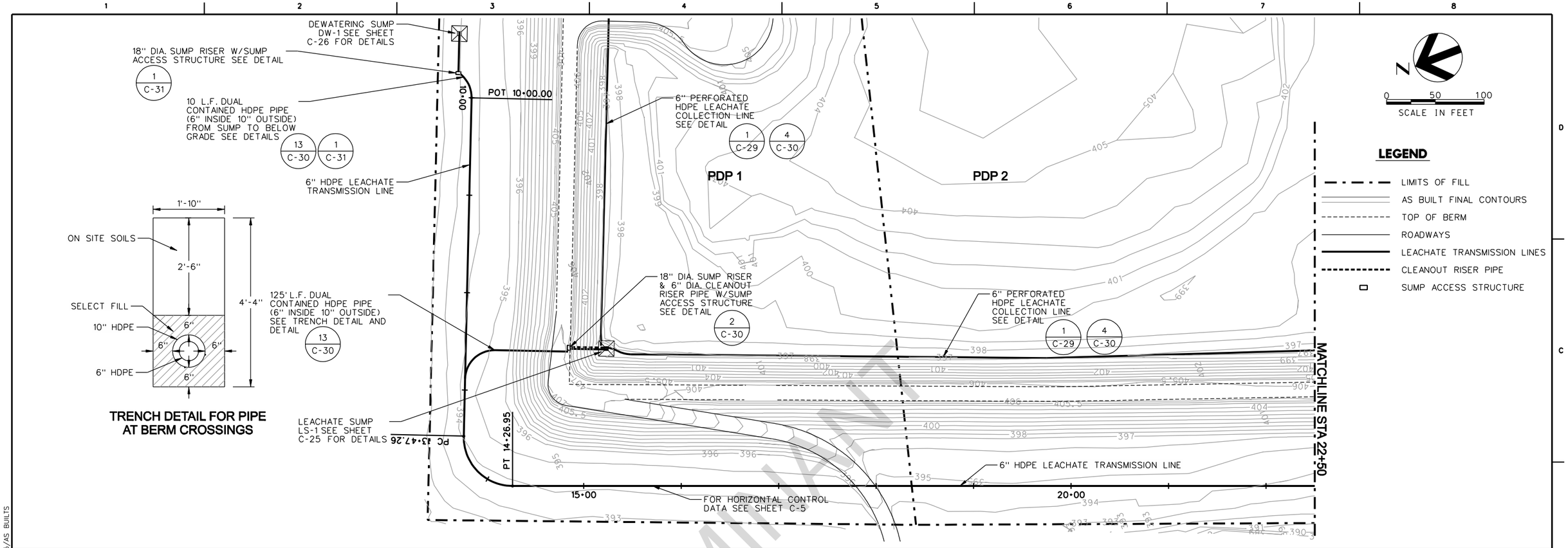
PERMANENT DISPOSAL POND #5
PHASE I

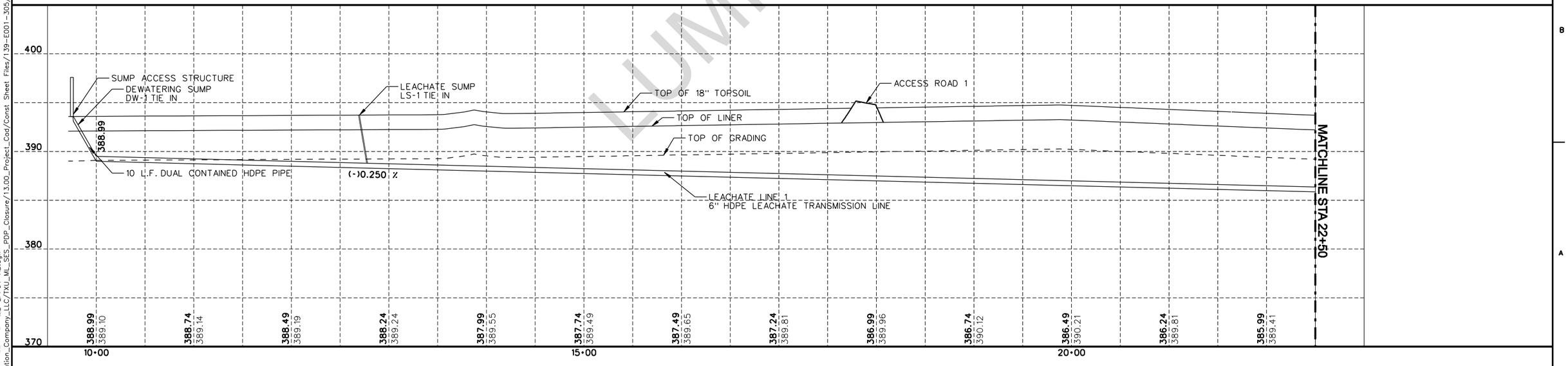
ACCESS ROAD 2 PLAN & PROFILE

139-E001-305
AS RECORDED

FILENAME	ML-PP02-AB.dgn
SCALE	AS SHOWN

SHEET **C-18**





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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

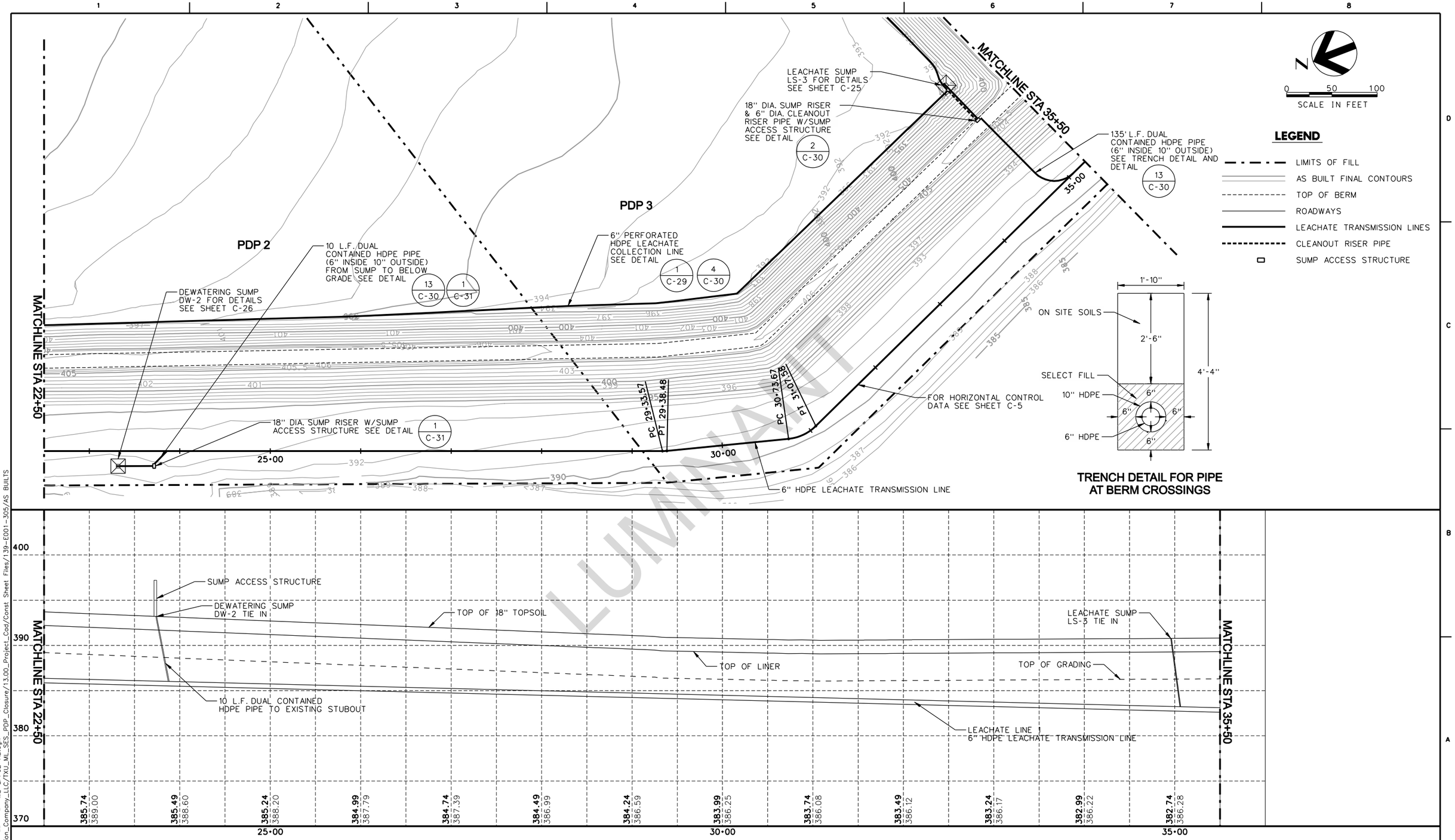
PERMANENT DISPOSAL POND #5
PHASE I

LEACHATE LINE 1 PLAN & PROFILE

SHEET 1 OF 3
139-E001-305
AS RECORDED

FILENAME	ML-LPP01-AB.dgn
SCALE	

SHEET **C-19**



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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

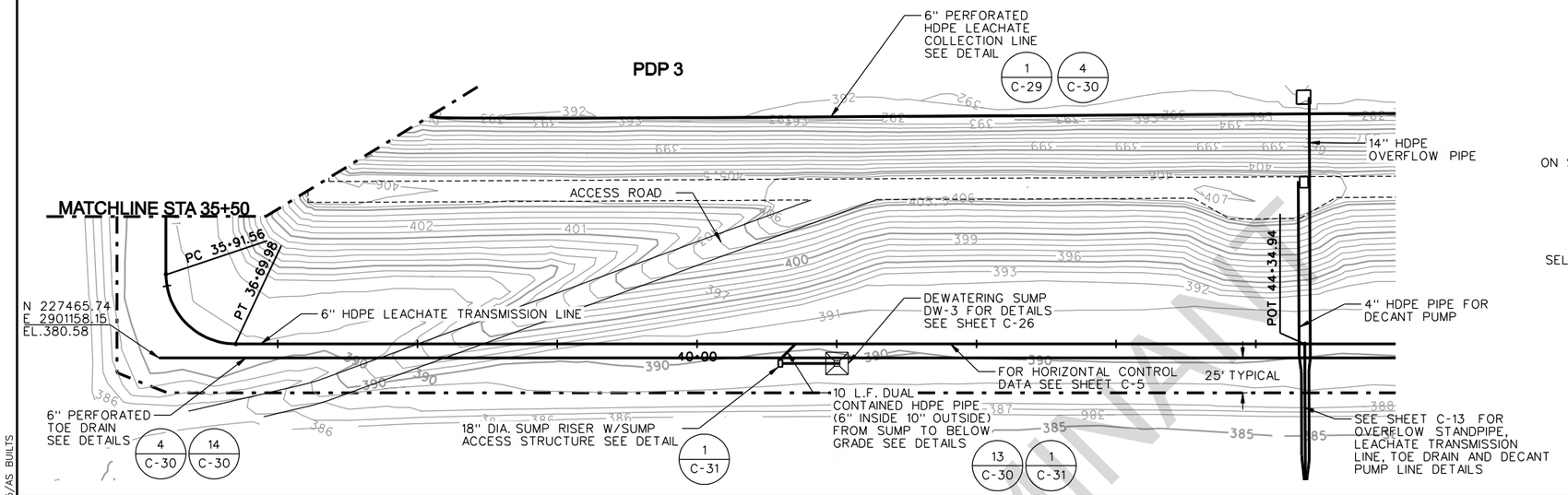
PERMANENT DISPOSAL POND #5
PHASE I

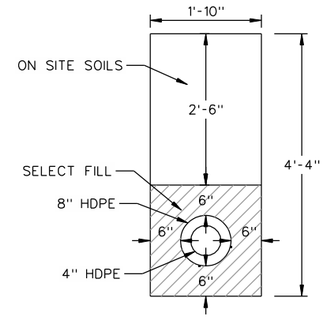
LEACHATE LINE 1 PLAN & PROFILE

SHEET 2 OF 3
139-E001-305
AS RECORDED

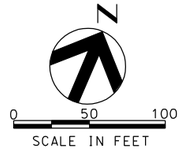
FILENAME	ML-LPP02-AB.dgn
SCALE	

SHEET **C-20**



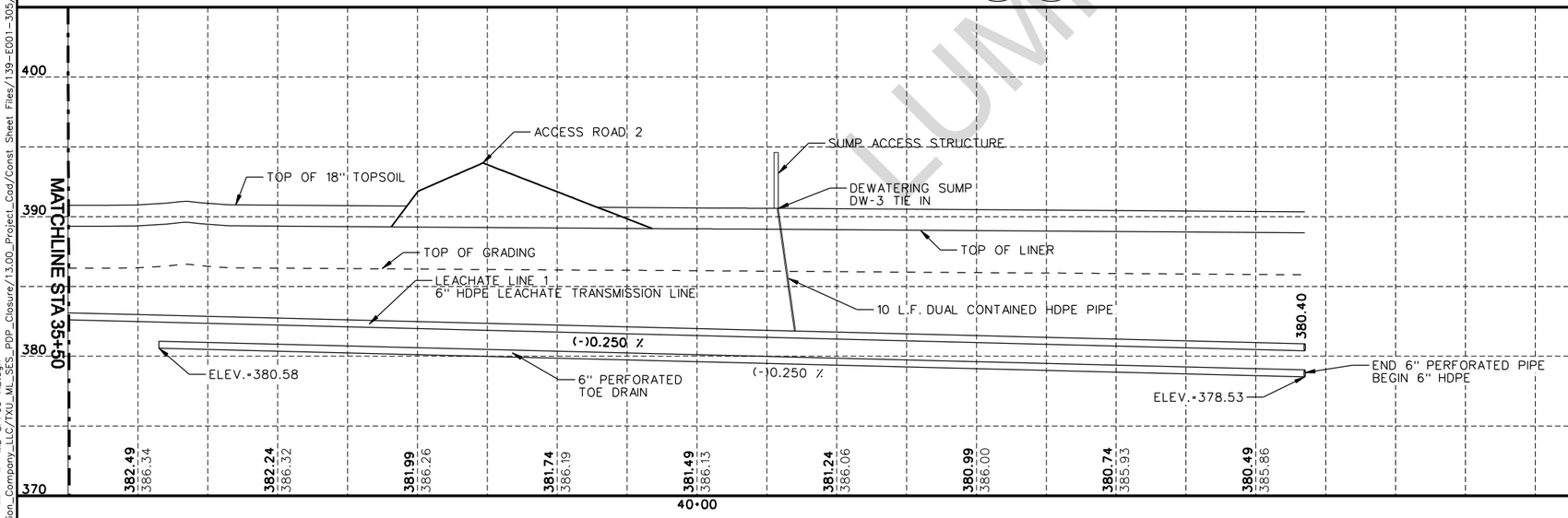


TRENCH DETAIL FOR PIPE AT BERM CROSSINGS



LEGEND

- LIMITS OF FILL
- AS BUILT FINAL CONTOURS
- TOP OF BERM
- ROADWAYS
- LEACHATE TRANSMISSION LINES
- CLEANOUT RISER PIPE
- SUMP ACCESS STRUCTURE



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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

LEACHATE LINE 1 PLAN & PROFILE

SHEET 3 OF 3
139-E001-305
AS RECORDED

FILENAME	ML-LPP03-AB.dgn
SCALE	

SHEET **C-21**

DEWATERING SUMP DW-6 FOR DETAILS SEE SHEET C-26

LEACHATE SUMP LS-2 FOR DETAILS SEE SHEET C-25

75 L.F. DUAL CONTAINED HDPE PIPE (6" INSIDE 10" OUTSIDE) FROM SUMP TO BELOW GRADE SEE DETAILS (13/C-30) (1/C-31)

PROCESS LINE 18

125' L.F. DUAL CONTAINED HDPE PIPE (6" INSIDE 10" OUTSIDE) SEE TRENCH DETAIL AND DETAIL (13/C-30)

POT 10+00.00

10+00

VALVE VAULTS

PROCESS LINE 18

PC 11+68.91

PT 11+91.29

150' L.F. DUAL CONTAINED HDPE PIPE (10" INSIDE 14" OUTSIDE)

DEWATERING SUMP DW-5 FOR DETAILS SEE SHEET C-26

PC 15+29.18

PT 15+41.01

15+00

18" DIA. SUMP RISER & 6" DIA. CLEANOUT RISER PIPE W/SUMP ACCESS STRUCTURE SEE DETAIL (2/C-30)

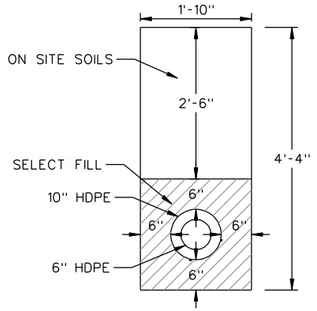
6" PERFORATED HDPE LEACHATE COLLECTION LINE SEE DETAIL (1/C-29) (4/C-30)

10 L.F. DUAL CONTAINED HDPE PIPE (6" INSIDE 10" OUTSIDE) FROM SUMP TO BELOW GRADE SEE DETAILS (13/C-30) (1/C-31)

PDP 1

PDP 2

PDP 3



TRENCH DETAIL FOR PIPE AT BERM CROSSINGS

N 228151.03
E 2902779.26
EL.380.88

6" PERFORATED TOE DRAIN SEE DETAILS (4/C-30) (14/C-30)

PC 20+06.43

20+00

FOR HORIZONTAL CONTROL DATA SEE SHEET C-5

6" HDPE LEACHATE TRANSMISSION LINE

25' TYP.

PT 20+83.27

MATCHLINE STA 21+00

LEACHATE SUMP LS-4 FOR DETAILS SEE SHEET C-25

18" DIA. SUMP RISER & 6" DIA. CLEANOUT RISER PIPE W/SUMP ACCESS STRUCTURE SEE DETAIL (2/C-30)

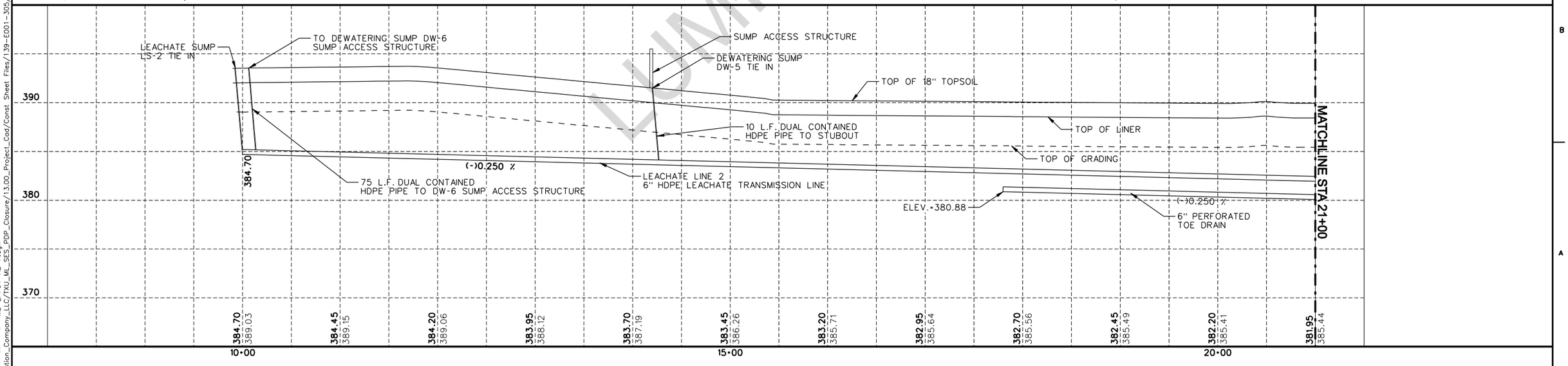
N

0 50 100

SCALE IN FEET

LEGEND

- LIMITS OF FILL
- AS BUILT FINAL CONTOURS
- TOP OF BERM
- ROADWAYS
- LEACHATE TRANSMISSION LINES
- CLEANOUT RISER PIPE
- SUMP ACCESS STRUCTURE



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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

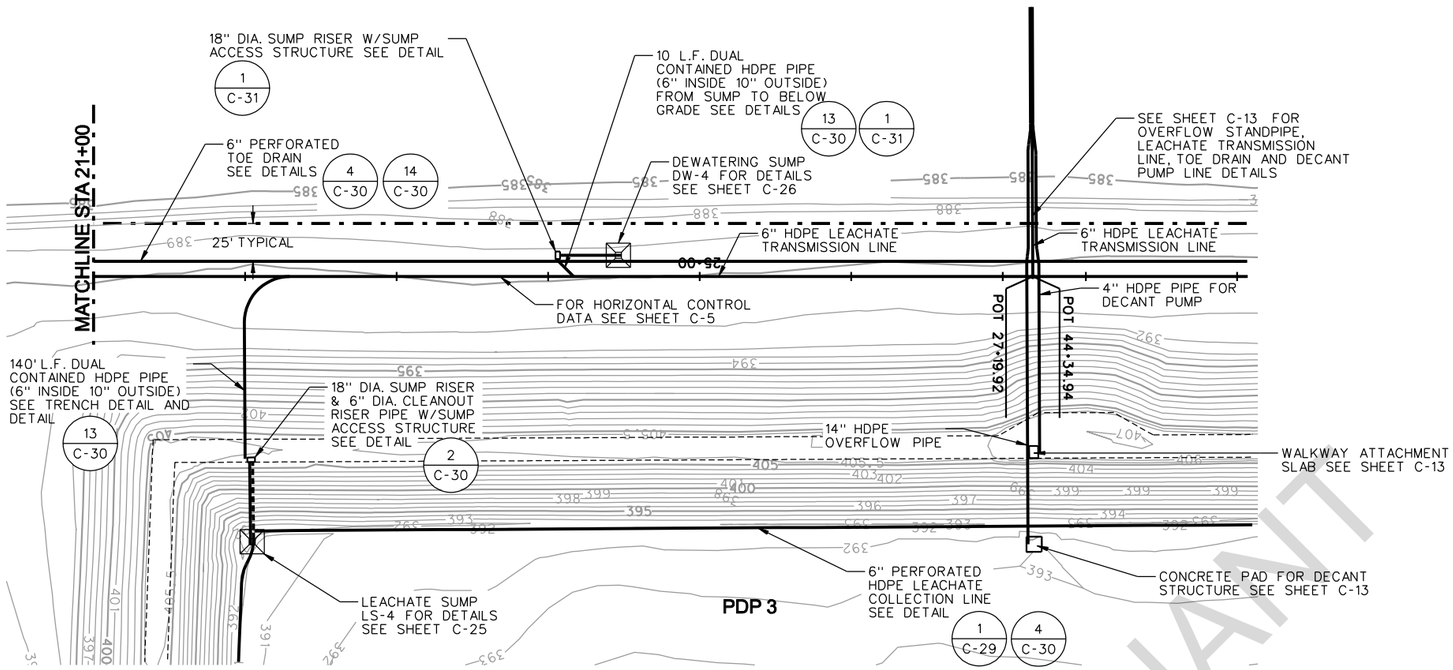
PERMANENT DISPOSAL POND #5
PHASE I

LEACHATE LINE 2 PLAN & PROFILE

SHEET 1 OF 2
139-E001-305
AS RECORDED

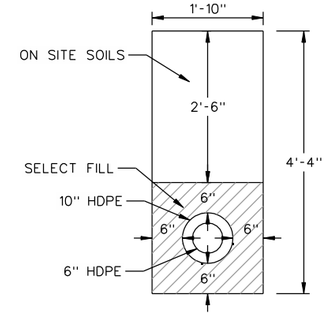
FILENAME	ML-LPP04-AB-A.dgn
SCALE	

SHEET C-22

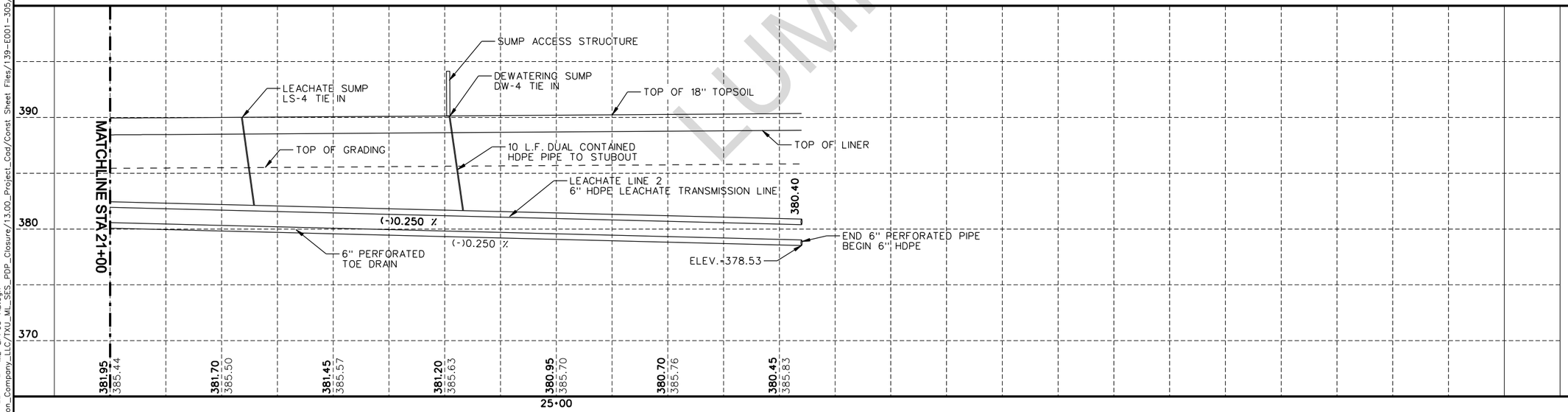


LEGEND

- LIMITS OF FILL
- AS BUILT FINAL CONTOURS
- TOP OF BERM
- ROADWAYS
- LEACHATE TRANSMISSION LINES
- CLEANOUT RISER PIPE
- SUMP ACCESS STRUCTURE



TRENCH DETAIL FOR PIPE AT BERM CROSSINGS



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USER: rcox
TIME: 12:49:40 PM
DATE: 2/9/2011

Luminant

HDR ENGINEERING, INC.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070

Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D.VOGT
CIVIL ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	B.COX
DRAWN BY	B.COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

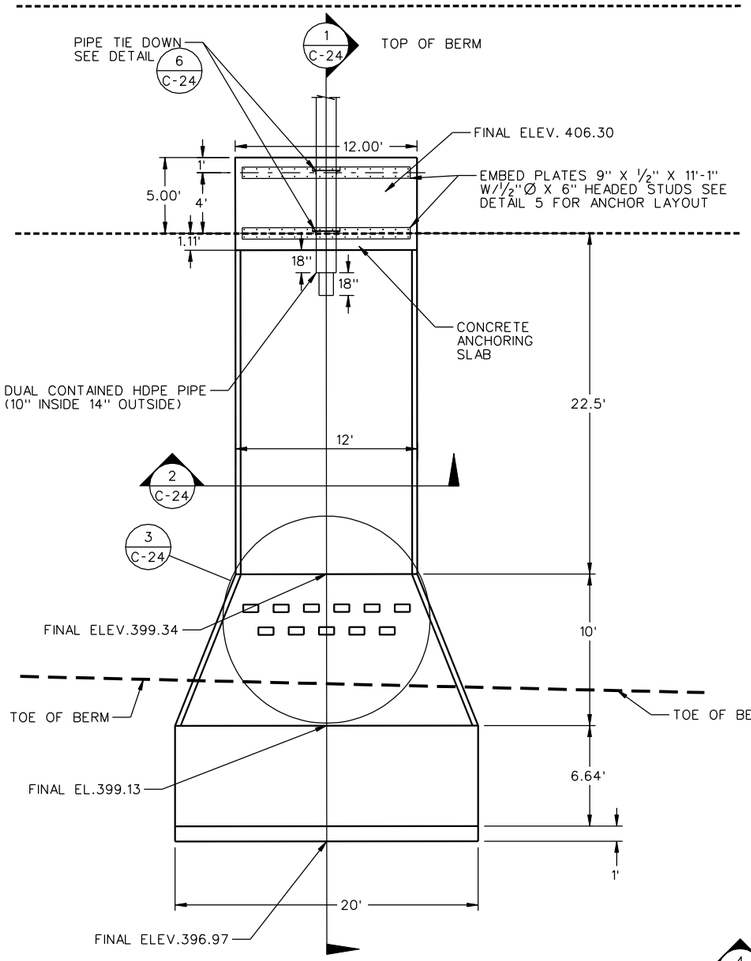
PERMANENT DISPOSAL POND #5
PHASE I

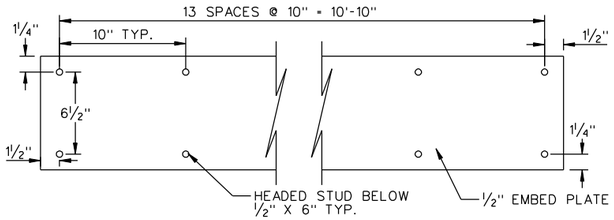
LEACHATE LINE 2 PLAN & PROFILE

SHEET 2 OF 2
139-E001-305
AS RECORDED

FILENAME	ML-LPP05-AB.dgn
SCALE	

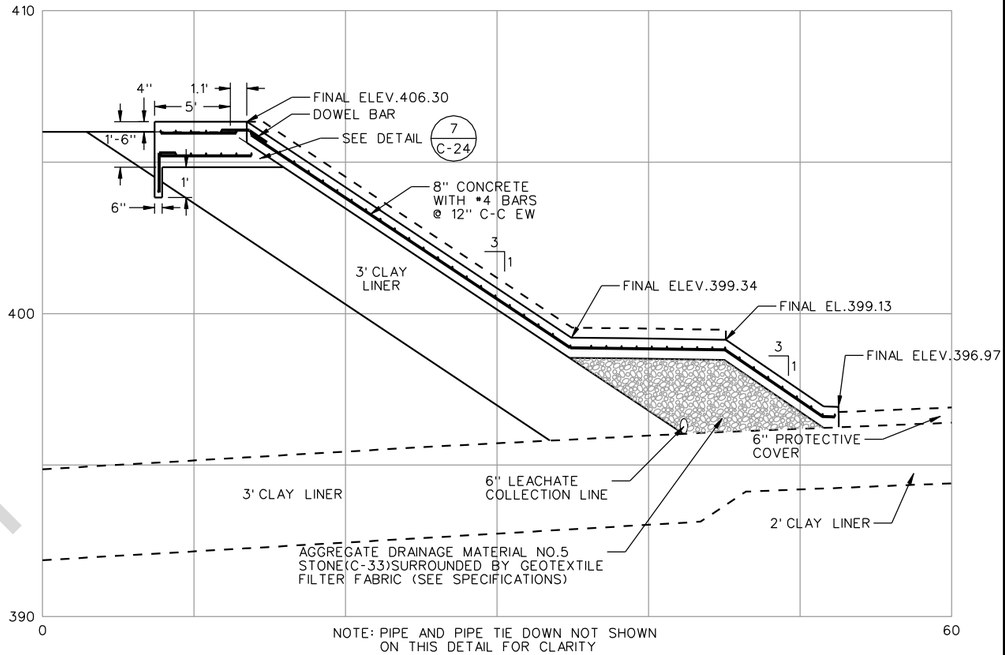
SHEET **C-23**





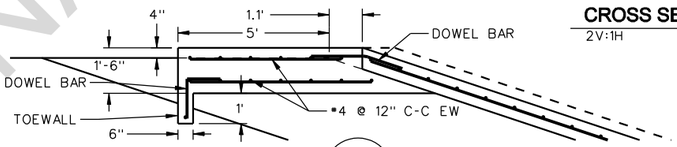
NOTE: PIPE AND PIPE TIE DOWN NOT SHOWN ON THIS DETAIL FOR CLARITY

DETAIL 5 N.T.S. C-24

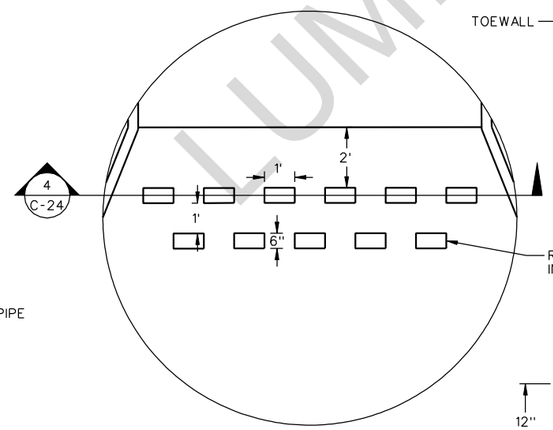


NOTE: PIPE AND PIPE TIE DOWN NOT SHOWN ON THIS DETAIL FOR CLARITY

CROSS SECTION 1 2V:1H C-24



DETAIL 7 N.T.S. C-24



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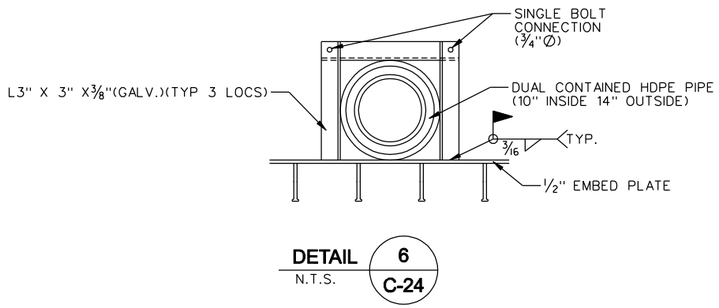

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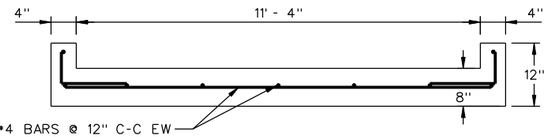
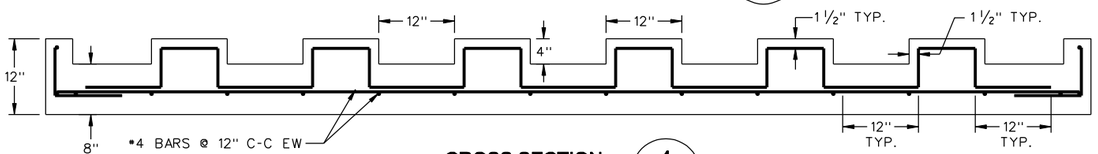


CROSS SECTION 2 N.T.S. C-24



CROSS SECTION 4 N.T.S. C-24

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Luminant

HDR
HDR ENGINEERING, INC.
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Suite 3500
McKinney, Texas 75070

Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D.VOGT
CIVIL ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	B. COX
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

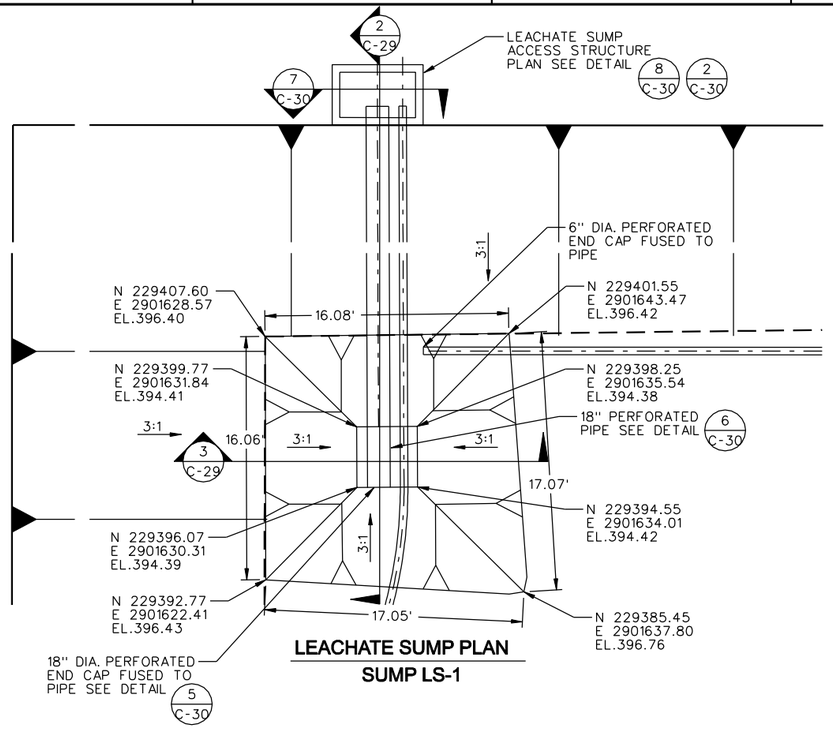
PERMANENT DISPOSAL POND #5
PHASE I

SLURRY CHANNEL PLAN & SECTION

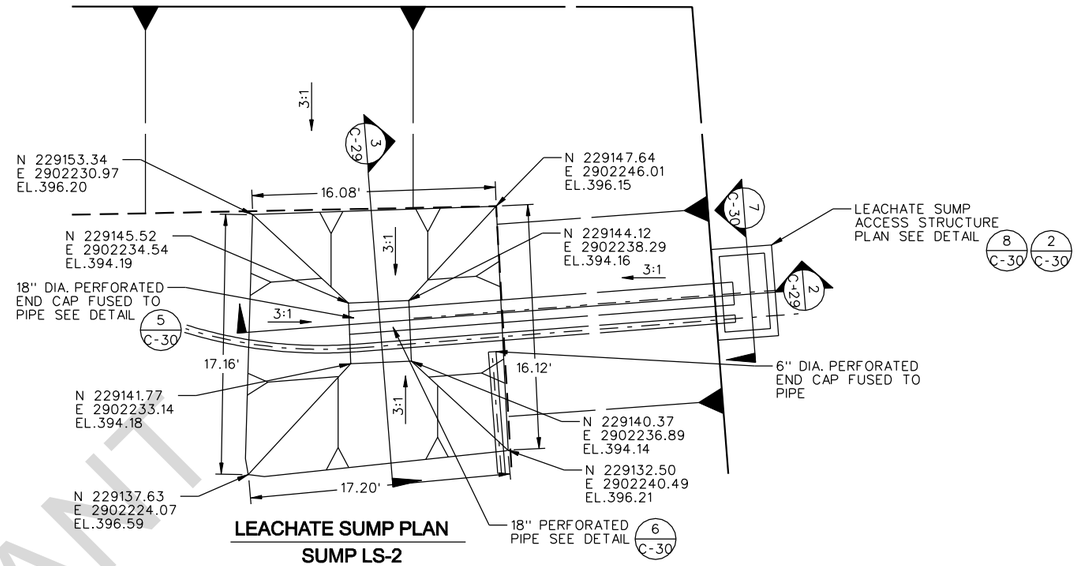
139-E001-305
AS RECORDED

FILENAME	ML-SC01-AB.dgn
SCALE	AS SHOWN

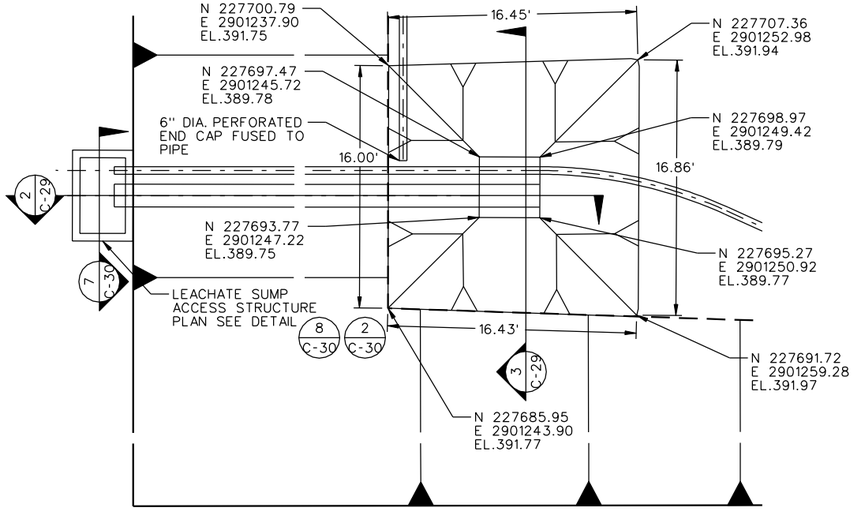
SHEET **C-24**



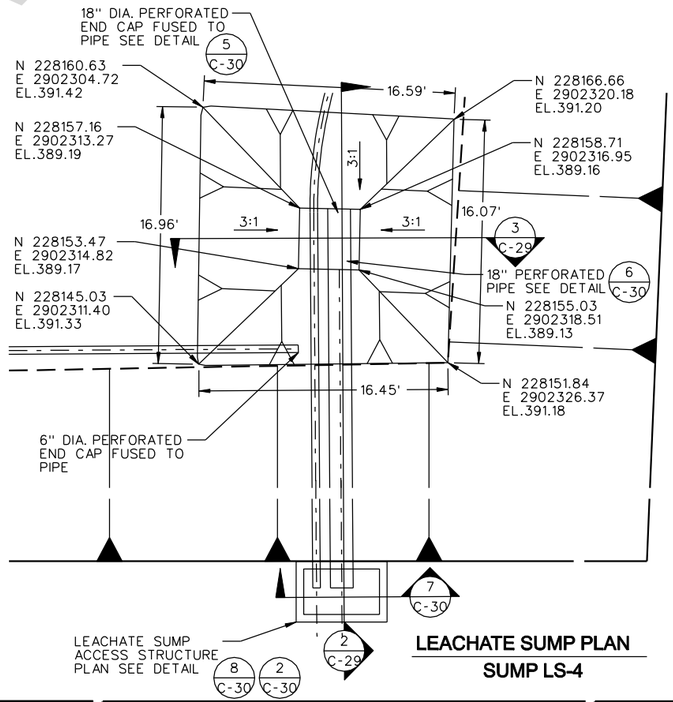
LEACHATE SUMP PLAN
SUMP LS-1



LEACHATE SUMP PLAN
SUMP LS-2



LEACHATE SUMP PLAN
SUMP LS-3



LEACHATE SUMP PLAN
SUMP LS-4

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DATE: 2/9/2011
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Luminant

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Texas P.E. Firm
Firm Registration No.F-754

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CIVIL ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	B. COX
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

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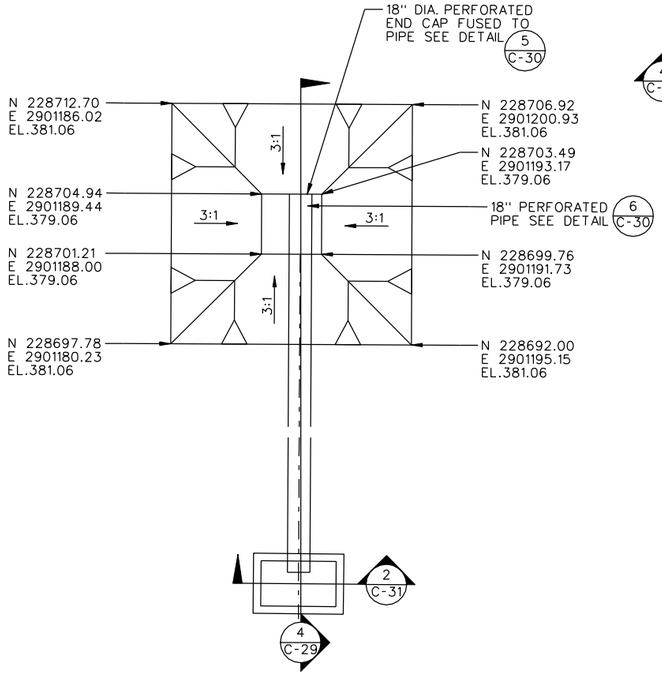
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

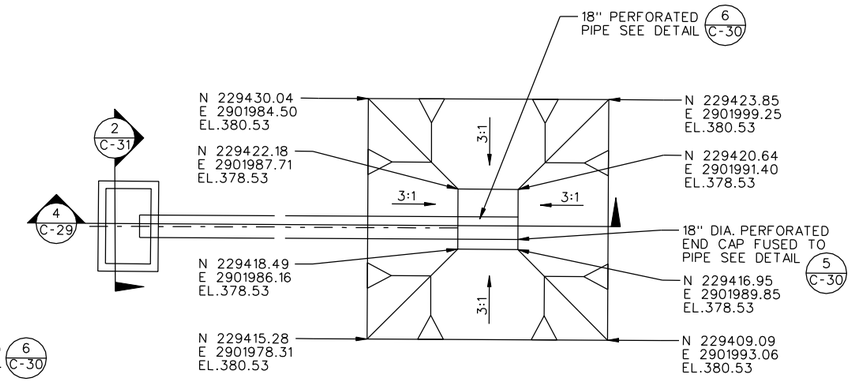
LEACHATE COLLECTION SYSTEM
SUMP PLAN
139-E001-305
AS RECORDED

FILENAME	ML-LS01-AB.dgn
SCALE	1" = 5'

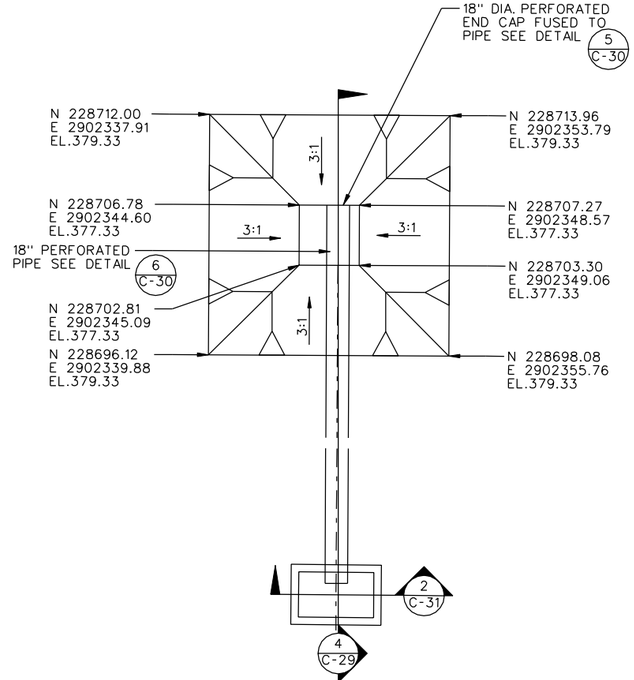
SHEET **C-25**



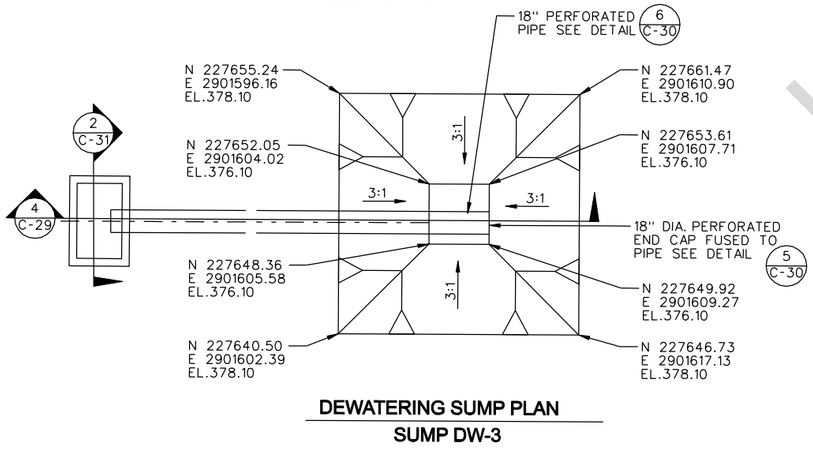
DEWATERING SUMP PLAN
SUMP DW-2



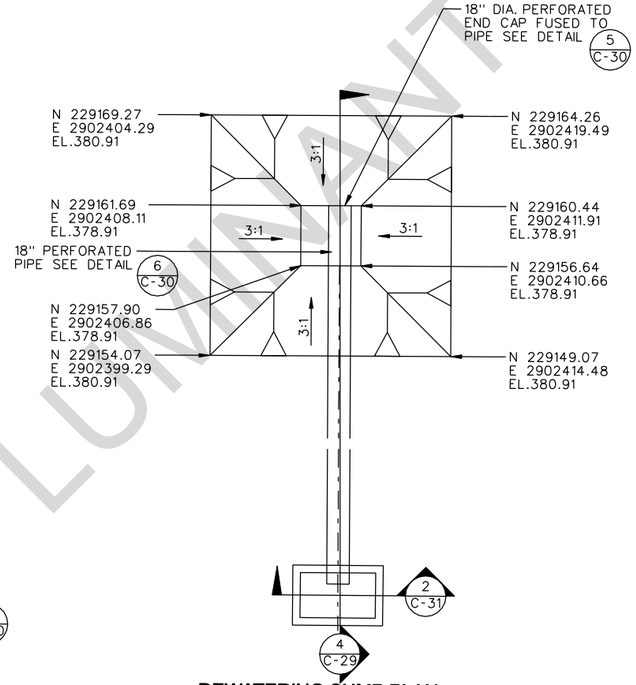
DEWATERING SUMP PLAN
SUMP DW-1



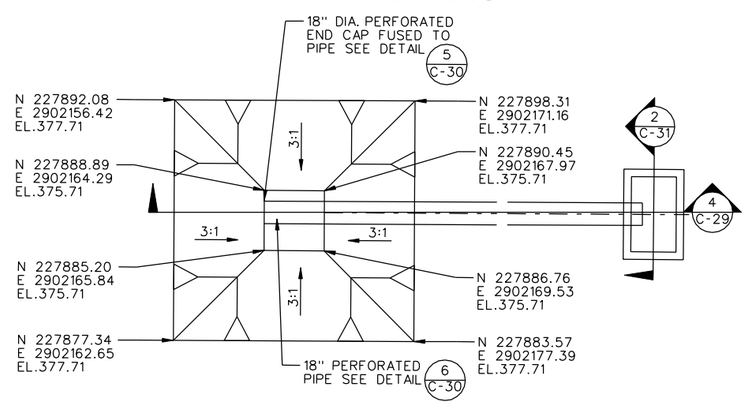
DEWATERING SUMP PLAN
SUMP DW-5



DEWATERING SUMP PLAN
SUMP DW-3



DEWATERING SUMP PLAN
SUMP DW-6



DEWATERING SUMP PLAN
SUMP DW-4

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USER: rcox
TIME: 12:49:54 PM
DATE: 2/9/2011

Luminant

HDR
HDR ENGINEERING, INC.
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Suite 3500
McKinney, Texas 75070
Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D.VOGT
CIVIL ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	B.COX
DRAWN BY	B.COX
QA/QC	M.ODEN
PROJECT NUMBER	53925

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

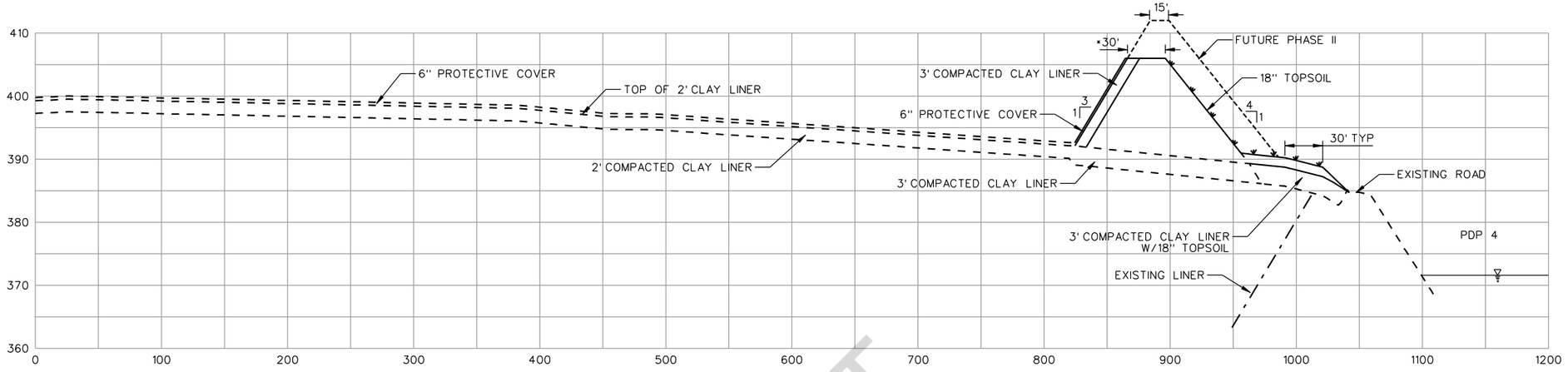
DEWATERING SYSTEM SUMP PLAN

139-E001-305

AS RECORDED

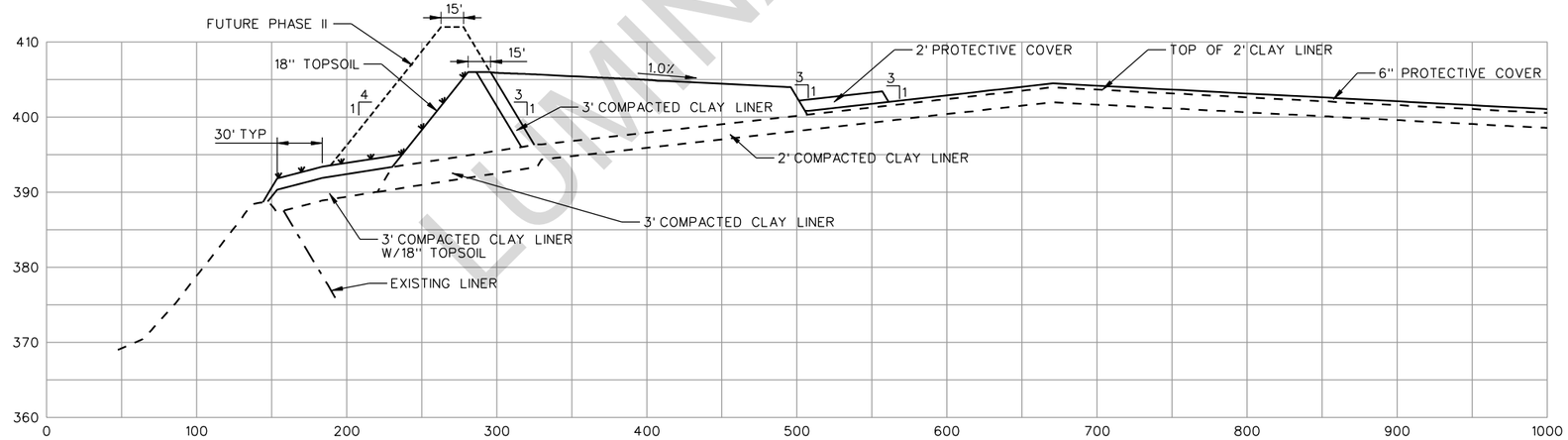
FILENAME	ML-DWS01-AB-A.dgn
SCALE	

SHEET **C-26**



CROSS SECTION 1 — C-27
5V:1H

* 30' FOR TURNAROUND AREA (15' TYP.)



CROSS SECTION 2 — C-27
5V:1H

NOTES:
1. 3' COMPACTED CLAY LINER CONSTRUCTED FROM FILL LIMITS TO OUTSIDE TOE OF BERM. 18" OF TOPSOIL AND VEGETATION CONSTRUCTED FROM OUTSIDE OF BERM TO LIMITS OF DISTURBANCE.
2. FOR CROSS SECTION LOCATIONS SEE SHEET C-4 .

DATE: 2/9/2011
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Luminant

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4500 W. Eldorado Parkway
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McKinney, Texas 75070

Texas P.E. Firm
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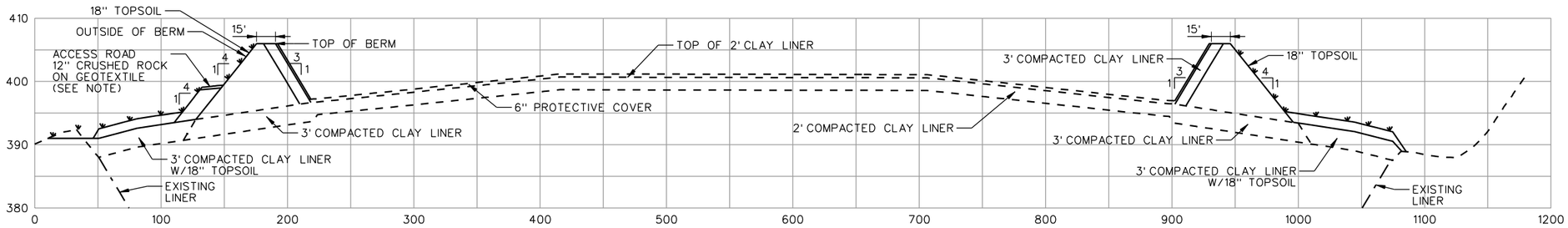
MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

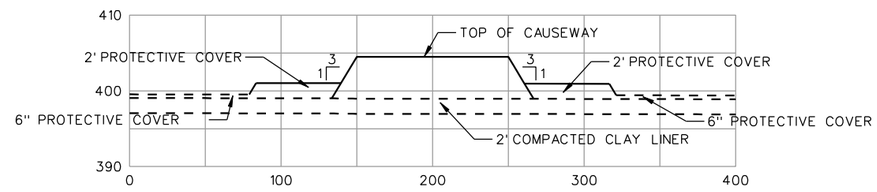
TYPICAL CROSS SECTIONS
139-E001-305
AS RECORDED

FILENAME	ML-TCS01-AB.dgn
SCALE	

SHEET C-27



CROSS SECTION 3 — C-28
5V:1H



CROSS SECTION 4 — C-28
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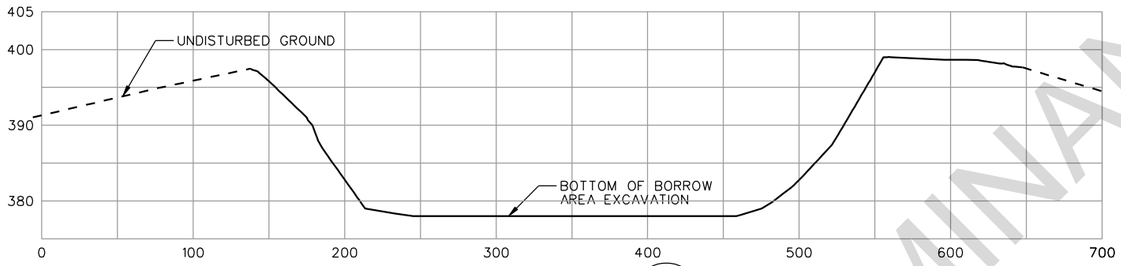
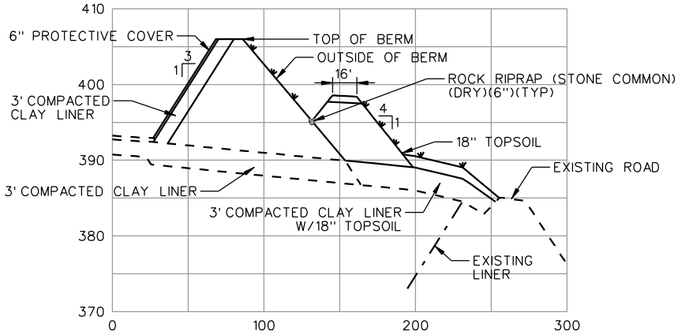
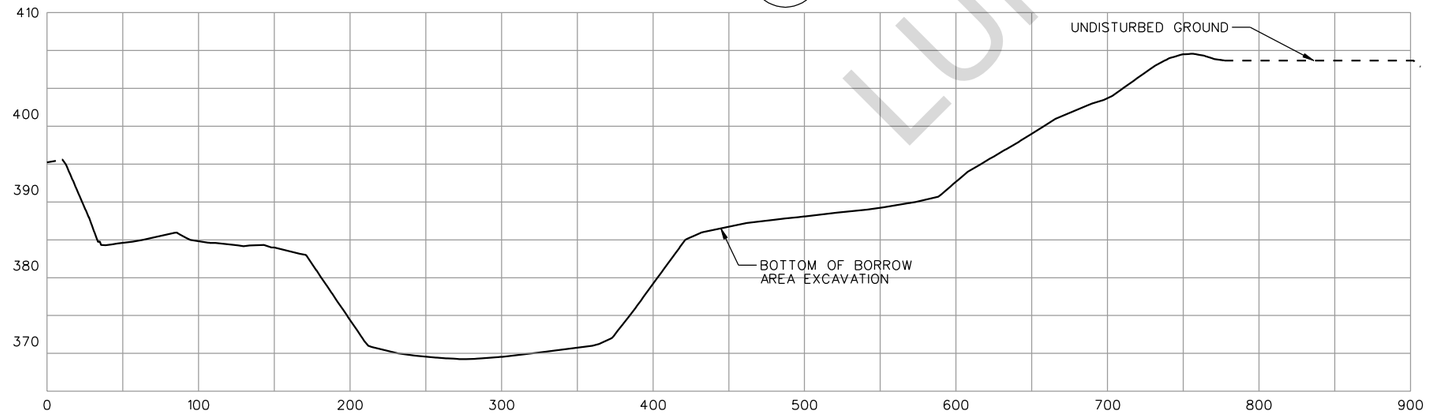


CROSS SECTION 6 — C-28
5V:1H



CROSS SECTION 5 — C-28
5V:1H



CROSS SECTION 7 — C-28
5V:1H

NOTE: 1. 3' COMPACTED CLAY LINER CONSTRUCTED FROM FILL LIMITS TO OUTSIDE TOE OF BERM. 18" OF TOPSOIL AND VEGETATION CONSTRUCTED FROM OUTSIDE OF BERM TO LIMITS OF DISTURBANCE.

2. 12" THICK TXDOT TYPE A GRADE 2 ROCK ON GEOTEXTILE - 16' WIDE BY LENGTH OF ACCESS ROAD PLUS ADDITIONAL 10' ON UPPER AND LOWER ENDS.

3. FOR CROSS SECTION LOCATIONS SEE SHEET C-4 .

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Texas P.E. Firm
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CIVIL ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	B.COX
DRAWN BY	B.COX
QA/QC	M. ODEN
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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

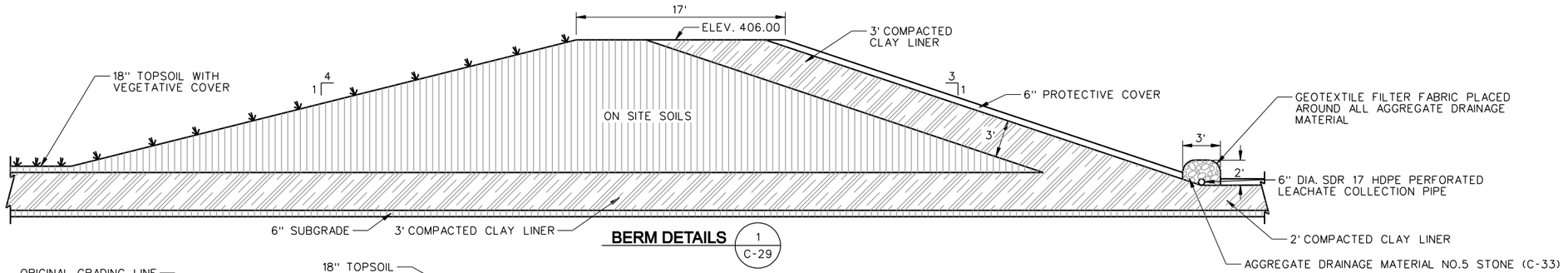
PERMANENT DISPOSAL POND #5
PHASE I

TYPICAL CROSS SECTIONS

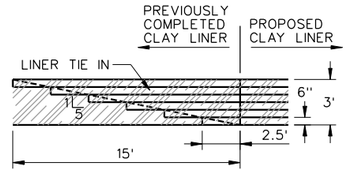
139-E001-305
AS RECORDED

FILENAME	ML-TCS02-AB.dgn
SCALE	

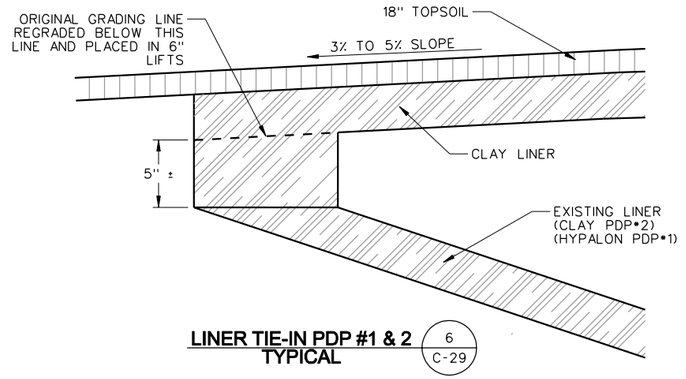
SHEET **C-28**



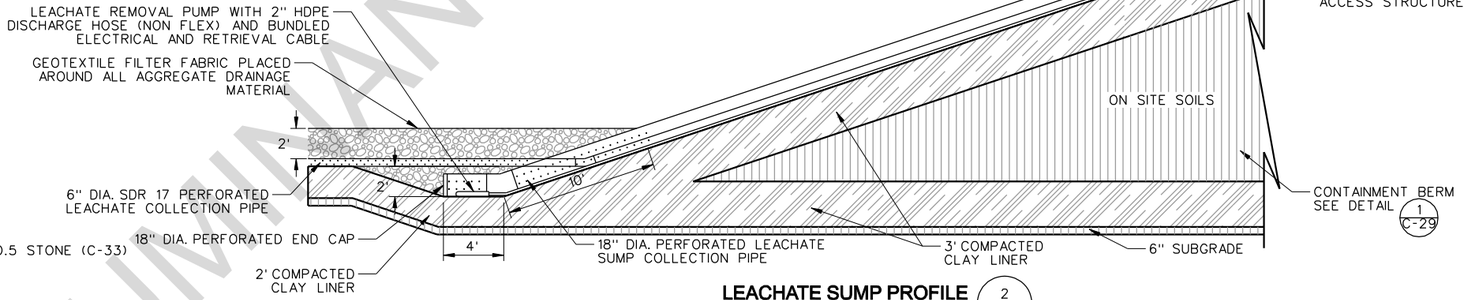
BERM DETAILS 1 / C-29



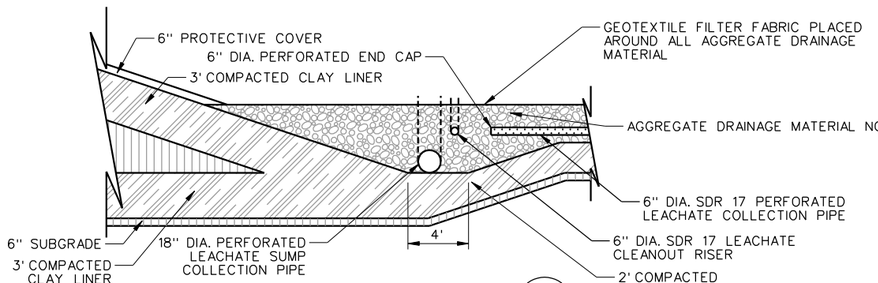
LINER TIE-IN AT OUTSIDE OF BERM TYPICAL 7 / C-29



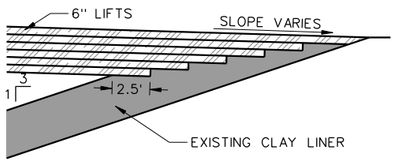
LINER TIE-IN PDP #1 & 2 TYPICAL 6 / C-29



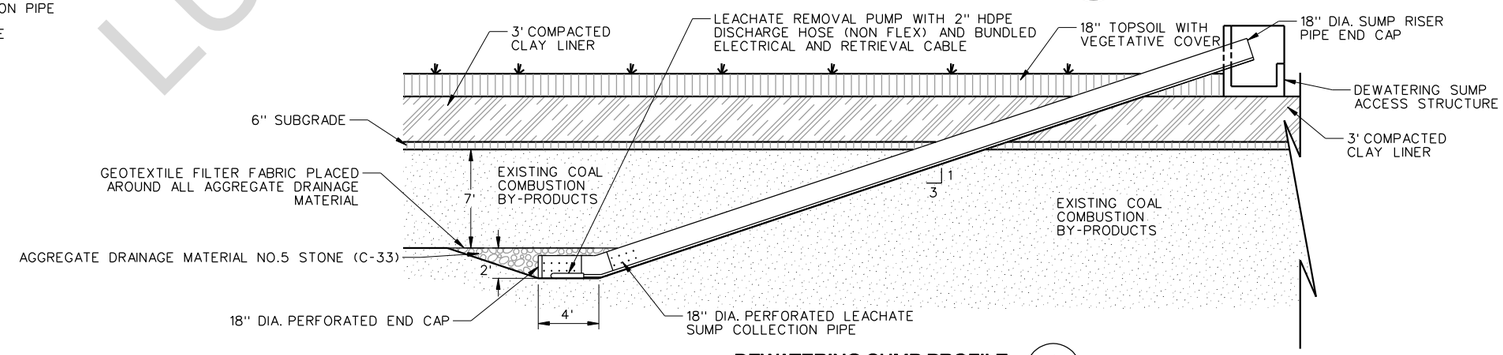
LEACHATE SUMP PROFILE 2 / C-29



LEACHATE SUMP SECTION 3 / C-29



LINER TIE-IN PDPS #2 & 3 TYPICAL 5 / C-29



DEWATERING SUMP PROFILE 4 / C-29

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Luminant

HDR
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Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D. VOGT
CIVIL ENGINEER	D. VOGT
CHECKED BY	
DESIGNED	B. COX
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

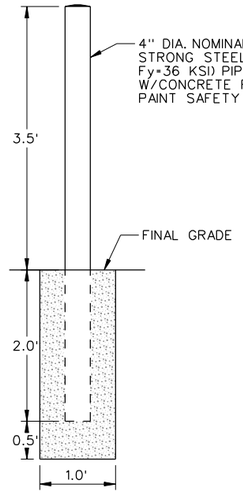
PERMANENT DISPOSAL POND #5
PHASE I

MISCELLANEOUS DETAILS

139-E001-305
AS RECORDED

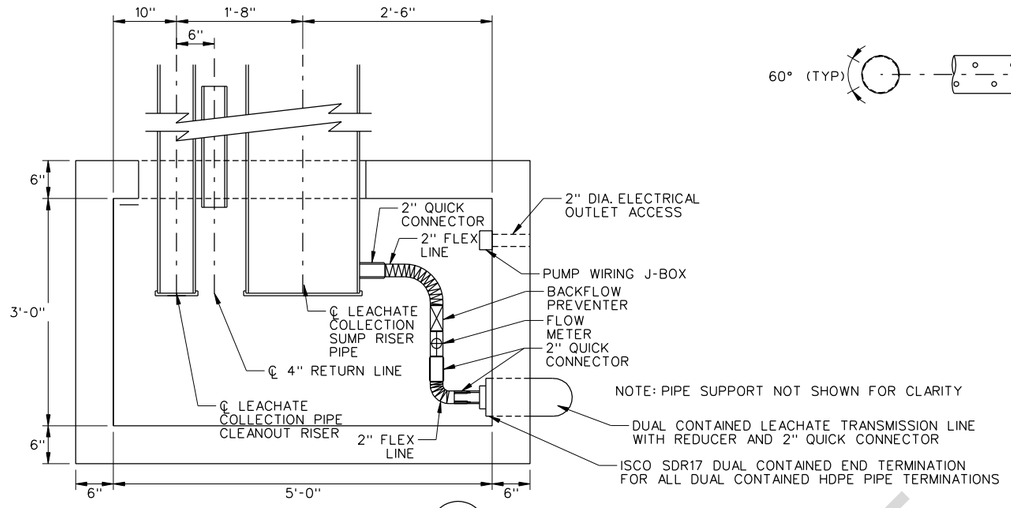
FILENAME	ML-DET01-AB.dgn
SCALE	N.T.S.

SHEET **C-29**

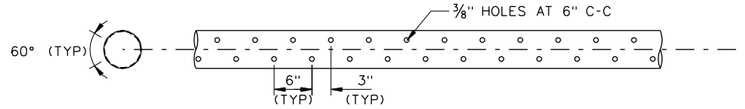


TYPICAL BOLLARD 1 / C-30

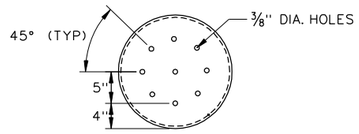
NOTE: TWO PROVIDED FOR EACH SUMP ACCESS STRUCTURE.



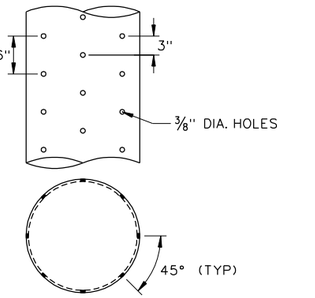
LEACHATE SUMP ACCESS STRUCTURE PLAN 2 / C-30



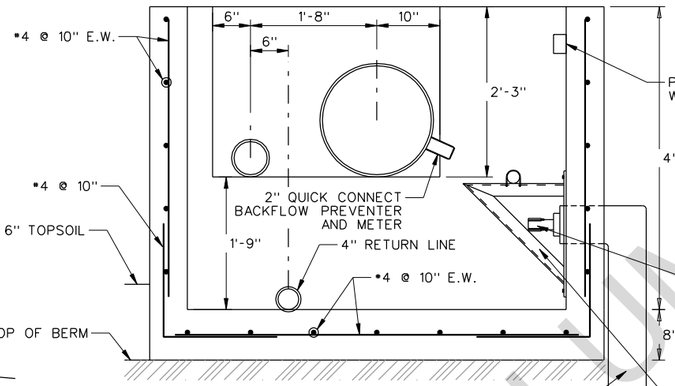
6" DIA. PERFORATED LEACHATE COLLECTION / TOE DRAIN PIPE 4 / C-30



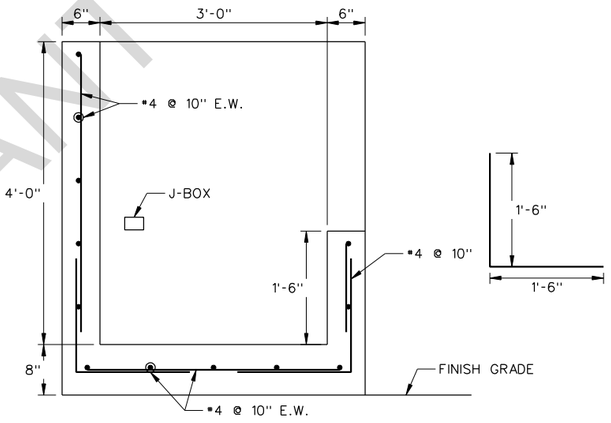
18" DIA. PERFORATED END CAP 5 / C-30



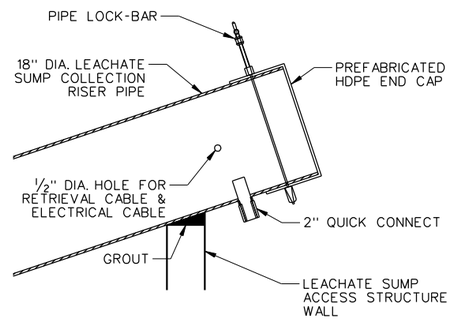
18" DIA. PERFORATED LEACHATE SUMP COLLECTION PIPE 6 / C-30



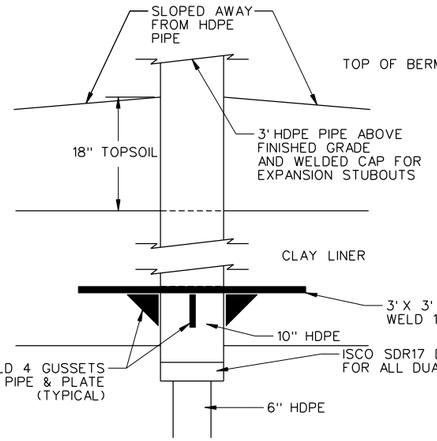
LEACHATE SUMP ACCESS STRUCTURE - SECTION 7 / C-30



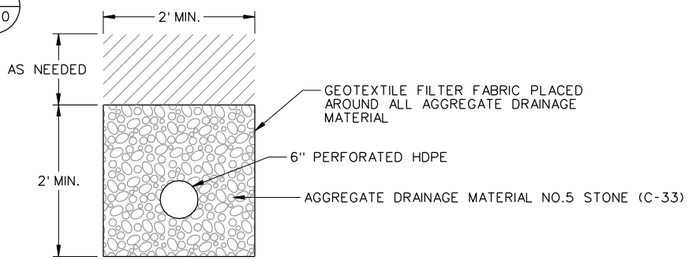
LEACHATE SUMP ACCESS STRUCTURE SECTION 8 / C-30



18" DIA. SUMP RISER PIPE 9 / C-30

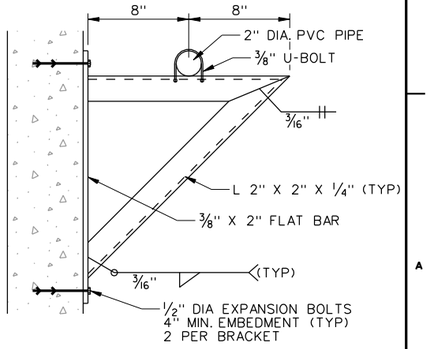


DUAL CONTAINED HDPE PIPE TERMINATION 13 / C-30
N.T.S.



TOE DRAIN TRENCH SECTION 14 / C-30

NOTE: ISCO SDR17 DUAL CONTAINED END TERMINATION (OR APPROVED EQUAL) FOR ALL DUAL CONTAINED HDPE PIPE TERMINATIONS



TYPICAL PIPE SUPPORT BRACKET 12 / C-30
N.T.S.

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Luminant

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Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D. VOGT
CIVIL ENGINEER	D. VOGT
CHECKED BY	
DESIGNED	B. COX
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

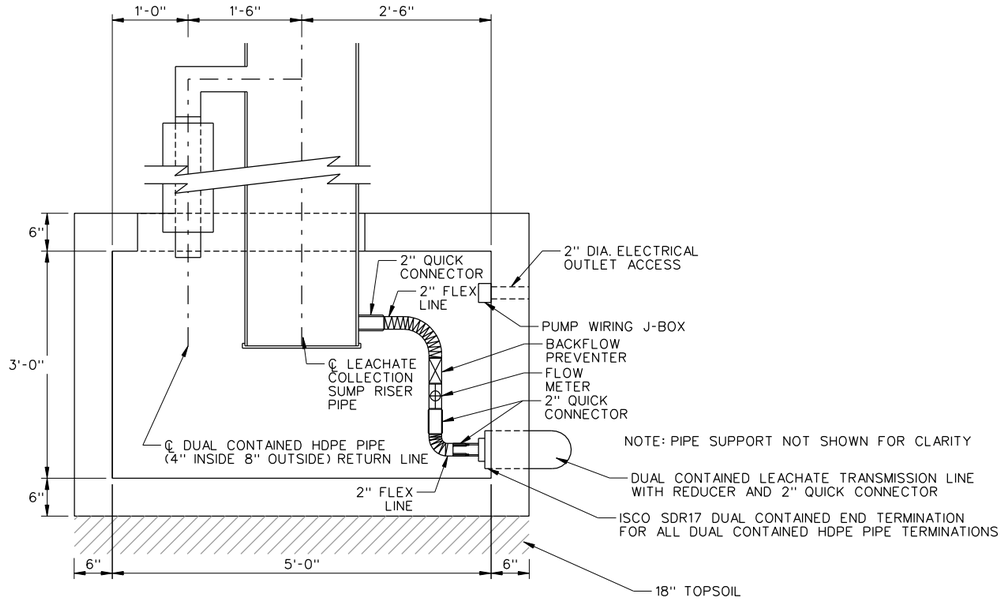
PERMANENT DISPOSAL POND #5
PHASE I

MISCELLANEOUS DETAILS

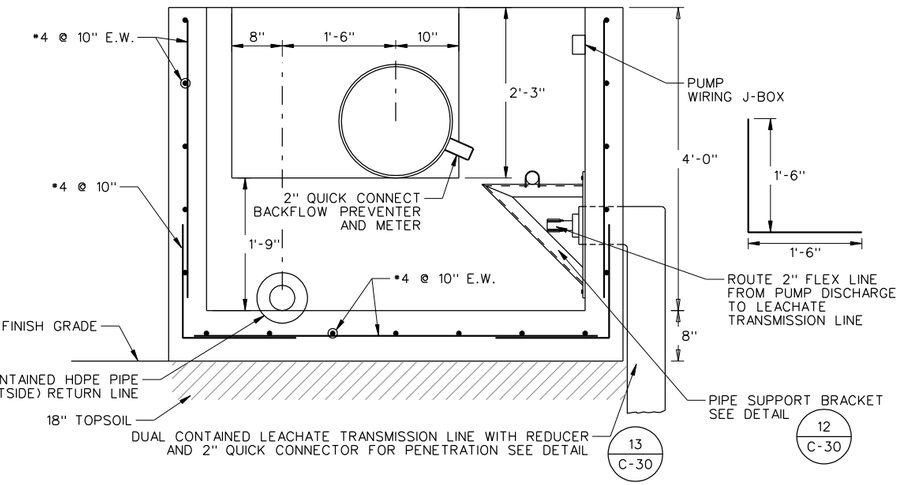
139-E001-305
AS RECORDED

FILENAME	ML-DET03-AB.dgn
SCALE	1" = 1'

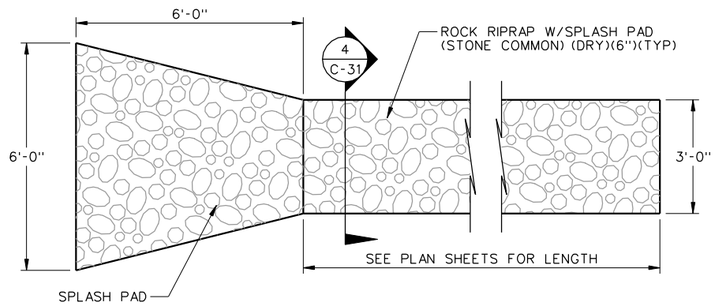
SHEET **C-30**



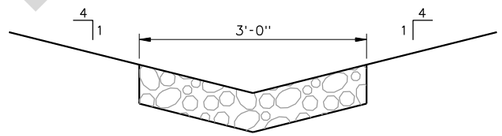
DEWATERING SUMP ACCESS STRUCTURE PLAN (1 / C-31)



DEWATERING SUMP ACCESS STRUCTURE - SECTION (2 / C-31)



ROCK RIPRAP AT ACCESS ROADS (3 / C-31)



RIPRAP SECTION (4 / C-31)

NOTE: ISCO SDR17 DUAL CONTAINED END TERMINATION FOR ALL DUAL CONTAINED HDPE PIPE TERMINATIONS

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Luminant

HDR ENGINEERING, INC.
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McKinney, Texas 75070

Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D. VOGT
CIVIL ENGINEER	D. VOGT
CHECKED BY	
DESIGNED	B. COX
DRAWN BY	B. COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

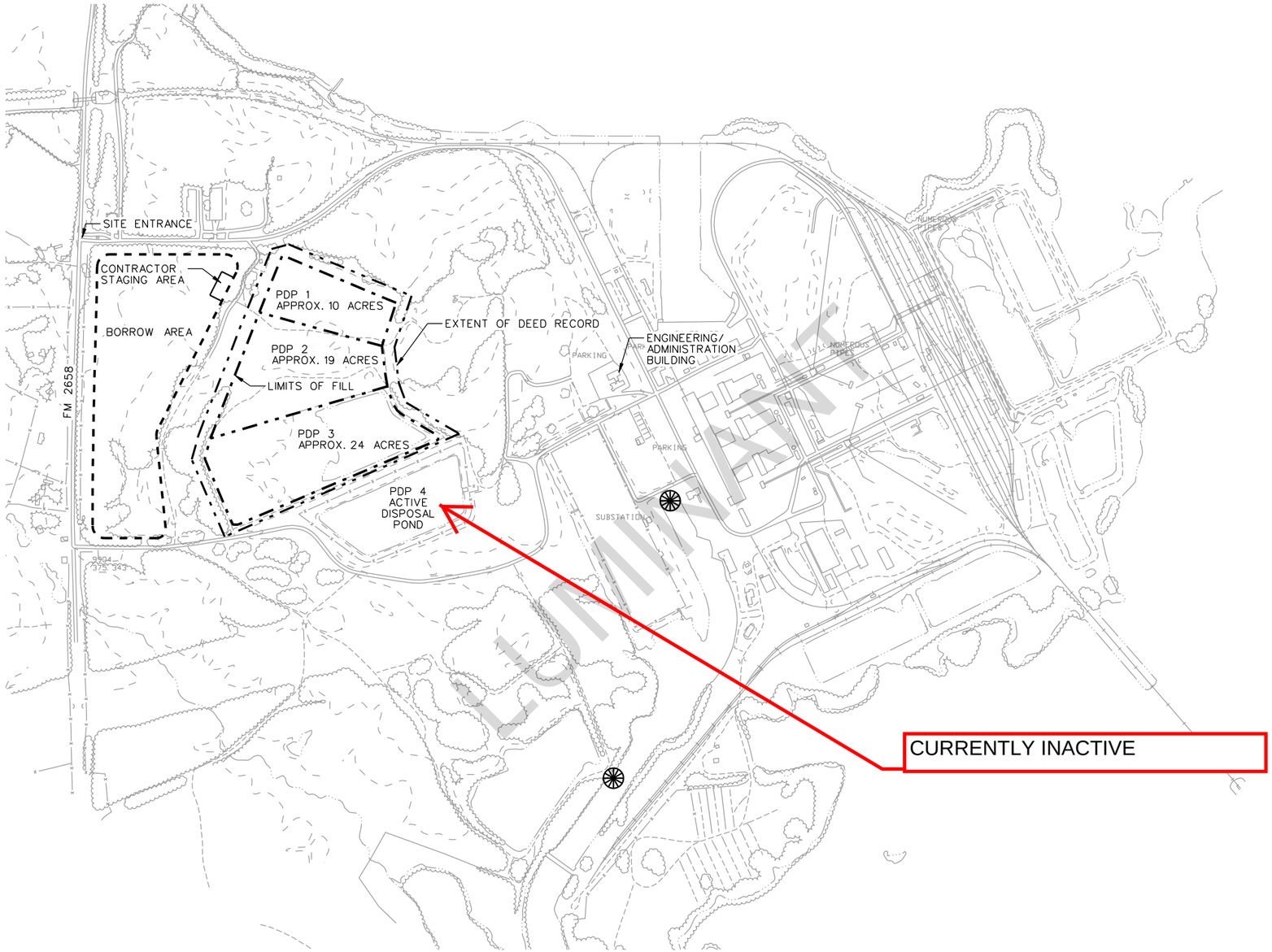
PERMANENT DISPOSAL POND #5
PHASE I

MISCELLANEOUS DETAILS

139-E001-305
AS RECORDED

FILENAME	ML-DET04-AB.dgn
SCALE	1" = 1'

SHEET **C-31**



N

0 500 1000

SCALE IN FEET

LEGEND

- DEED RECORD BOUNDARY
- LIMITS OF FILL
- BORROW AREA
- WATER ACCESS LOCATIONS

NOTE: CONTOURS BASED ON AERIAL TOPOGRAPHY PROVIDED BY LUMINANT ON 2/19/07.

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Luminant

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Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D.VOGT
CIVIL ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	B.COX
DRAWN BY	B.COX
QA/QC	M. ODEN
PROJECT NUMBER	53925

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

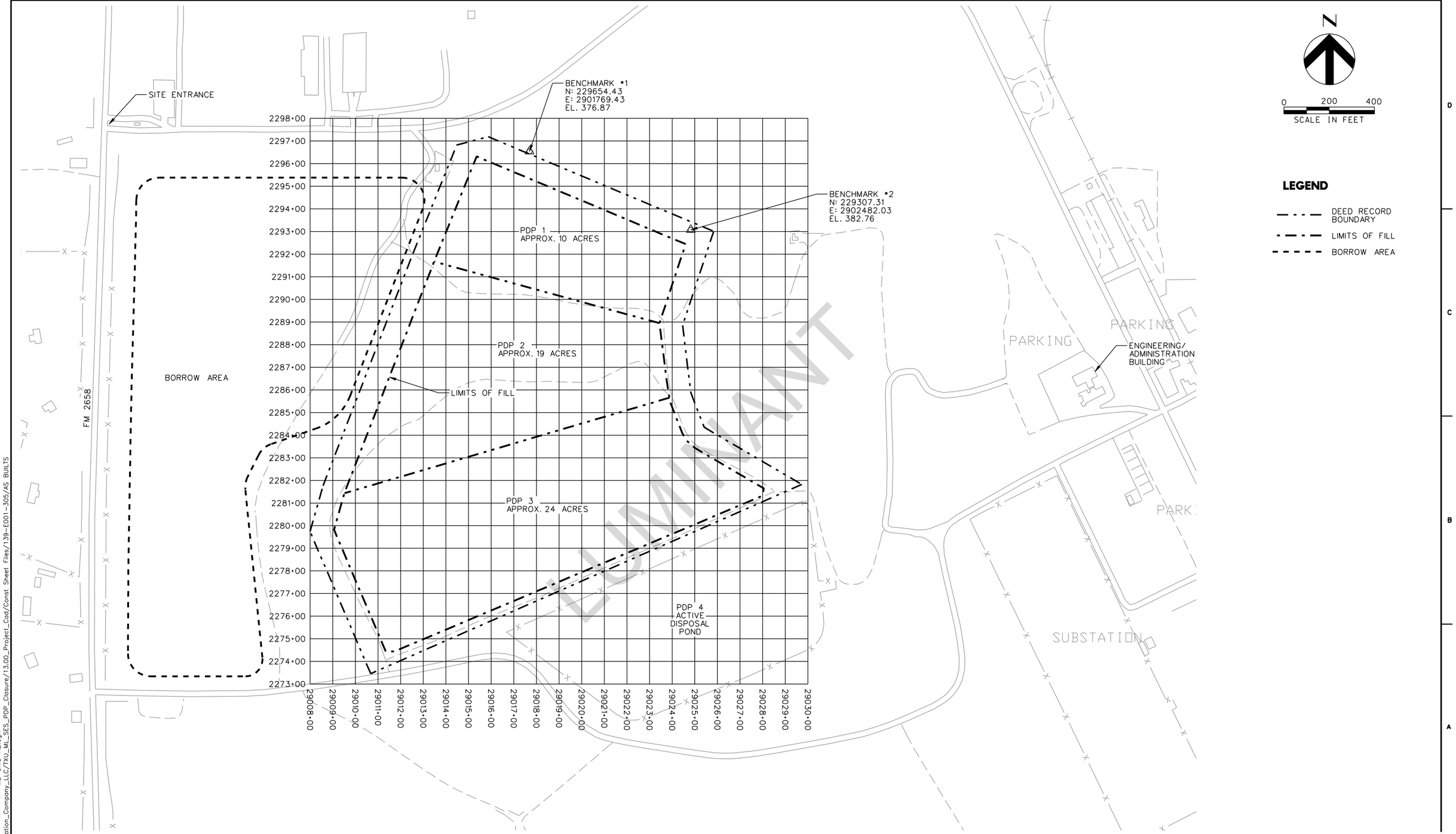
PERMANENT DISPOSAL POND #5
PHASE I

WATER ACCESS LOCATION

139-E001-305
AS RECORDED

FILENAME	ML-WAL-AB.dgn
SCALE	AS SHOWN

SHEET **C-32**



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DATE: 2/9/2011
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HDR ENGINEERING, INC.
4500 W. Eldorado Parkway
Suite 3500
McKinney, Texas 75070

Texas P.E. Firm
Firm Registration No.F-754

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	D.VOGT
CIVIL ENGINEER	D.VOGT
CHECKED BY	
DESIGNED	B.COX
DRAWN BY	B.COX
QA/QC	M.ODEN
PROJECT NUMBER	

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MARTIN LAKE STEAM ELECTRIC STATION
RUSK COUNTY, TEXAS

PERMANENT DISPOSAL POND #5
PHASE I

GRID LAYOUT
AS RECORDED

FILENAME	ML-GRID-AB.dgn
SCALE	

SHEET
C-33

BURNS McDONNELL

CREATE AMAZING.

Burns & McDonnell World Headquarters
9400 Ward Parkway
Kansas City, MO 64114
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