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PART 36
PERMIT
APPLICATION

Volume 2

2 of 3

Revised Application

October 23, 2019

Permit Application For
Surface Waste Management Facility

South Ranch Surface Waste Management Facility
Lea County, New Mexico

October 2019
Project No. 35187378

MICHAEL P. BRADFORD
19240
10/17/19

Prepared for:

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Volume 2 of 2

Appendix I
Hydrogeological Report

Hydrogeological Report

South Ranch Surface Waste Management Facility
Lea County, New Mexico

Project No. 35187378

October 2019

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

Prepared for:

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Environmental ■ Facilities ■ Geotechnical ■ Materials

Table of Contents

List of Figures

List of Attachments

1.0 Introduction

This Hydrogeological Report documents investigations conducted for the proposed NGL Waste Services, LLC (NGL) South Ranch Surface Waste Management Facility (Facility) located southwest of Jal near Bennett, Lea County, New Mexico. Data were compiled by Terracon Consultants, Inc. (Terracon), in accordance with the Energy, Minerals and Natural Resources Department, Oil Conservation Division (NMOCD or Division) requirements and the *New Mexico Administrative Code (NMAC)* Section **19.15.** NGL owns the property proposed for the landfill and associated facilities.

Section 2.0 of this report describes the regional geologic and hydrogeological characterization for the area surrounding the NGL South Ranch facility. Section 3.0 references site-specific information gathered for the generation of this document. Section 4.0 lists the references used.

1.1 Site Location

The NGL South Ranch SWMF site is located within Section 27 of T26S, R36E approximately 4.25 miles southwest of the City of Bennett in Lea County, New Mexico as seen in **Figure 1**.

1.2 Background

NGL is currently preparing a Permit Application to develop a new Surface Waste Management Facility (SWMF). The location of the site and the proposed development areas are shown on **Figure 1**. This application will establish an oil field solid waste landfill footprint area consisting of approximately 112 acres with a waste capacity of approximately 21,481,852 cubic yards. **Figure 2** illustrates the site layout within the permitted boundary. The NMOCD requires a review and summary of the hydrogeology and geology of the region and facility that illustrates the location of the SWMF facilities.

2.0 Regional Characterization

This section discusses the regional hydrogeologic setting of the area surrounding the SWMF including hydrology, geology, hydrogeology, and groundwater quality. This information was compiled from published sources including sections of the 1961 Geology and Ground-Water Condition in Southern Lea County, New Mexico report by the State Bureau of Mines and Mineral Resources, New Mexico Institute of Mining and Technology and Terracon's January 2019 Geotechnical Engineering Report of the site.

2.1 Regional Hydrology

The SWMF landfill is located within the Pecos watershed of the Rio Grande Region. Surface drainage from the landfill property generally flows downward towards the east. No integrated drainage is present in southern Lea County, thus there is no discharge to the Pecos River, which is located southwest of the area. Tributaries of the Pecos River are located approximately 20 miles southwest of the landfill site in southwestern Lea County. The Pecos River flows south and merges with the Rio Grande in southern Texas along the Texas-Mexico border.

2.2 Regional Geology

This section describes the geologic setting of the region, including soils, regional stratigraphy, and regional structural geology and geomorphology. A geologic map of New Mexico is provided in **Figure 3.** A map showing the location of water wells within a one-mile radius of the site is presented in **Figure 4**, and a local depth to groundwater surface map is provided in **Figure 5**.

The New Mexico State Geologic Map (1:500 000) indicates the general surfacial geology of the landfill site consists of Quaternary eolian and piedmont deposits (Qep) (Holocene to middle Pleistocene). Qep is comprised of interlayered eolian sands and piedmont-slope deposits. The unconsolidated eolian sands consist of sands and loess; the piedmont-slope deposits include deposits of higher gradient tributaries near major stream valleys, alluvial veneers of the piedmont slope, and alluvial fans, and may locally include uppermost Pliocene deposits.

2.2.1 Regional Soils

Based on the information provided by the Web Soil Survey (March 26, 2019) and the United States Department of Agriculture Soil Conservation Service, the predominant soils underlying the development area at the site are the Kermit-Wink complex, 0 to 3 percent slopes (KE) throughout central and northern portions of the site (59%), Pyote and Maljamar fine sands (PU) in southwest portions (24%), with Jal Association (JA) soils areas lying north of the proposed landfill footprint (14%).

The Kermit-Wink Complex is about 70 percent Kermit fine sand, about 20 percent Wink fine sand and about 10 percent minor components. These are deep sandy soils subject to severe soil blowing. The landscape is one of hummocks and dunes, resulting from the accumulation and removal of sands. The Kermit soil is on stabilized sand dunes, and the Wink soil is in depressions. The complex consists of fine sands to 60 inches that are Hydrologic Soil Group A with a high capacity to transmit water (2.00 to 6.00 in/hr). The depth to water is greater than 80 inches.

The Pyote and Maljamar fine sands consist of Maljamar fine sand from 0 to 24 inches, sandy clay loam from 24 to 50 inches, and cemented (caliche) material from 50 to 60 inches; and Pyote fine sand from 0 to 30 inches underlain by fine sandy loam from 30 to 60 inches.. The Maljamar, a Hydrologic Soil Group B soil, is well drained with a very low to moderately low capacity to transmit water through the most limiting layer (0.00 to 0.06 in/hr). The Pyote, a Hydrologic Soil Group A soil, is well drained with a high capacity to transmit water through the most limiting layer (2.00 to 6.00 in/hr).The depth to water is reported to be greater than 80 inches.

The Jal Association consist of sandy loam from 0 to 12 inches and loam from 12 to 60 inches. It consists of about 55 percent Jal and similar soils, about 30 percent Drake and similar soils and about 15 percent minor components. The Jal Association, a Hydrologic Soil Group B soil, is well drained with a moderately high to high capacity to transmit water through the most limiting layer (0.06 to 2.00 in/hr). The depth to water is reported to be greater than 80 inches.

Based on the January 2019 Geotechnical Engineering report, encountered soils during drilling activities at the site were divided into three strata: the first stratum consisted of clayey sand, silty sand, silty sand with interbedded layers of caliche, poorly graded sand with silt and interbedded layers of caliche and ranged in depths from 26 to 47 feet bgs; the second stratum consisted of silty sand, poorly graded sand, interbedded caliche layers classified as silty sand and poorly graded sand and ranged in depth from 26 to 100 feet bgs; the third stratum ranged in depths between 50 to 100 feet bgs and consisted of fine-grained, poorly to moderately compacted sandstone.

The observed caliche materials are underlain by medium to finely weathered sandstone extending to boring-termination depths of 150 feet below existing grades. Soil porosity and intrinsic permeability observed during drilling ranged from 0.32 to 0.37 and 9.69 x 10^{-12} to 1.67 x 10^{-10} cm^2, respectively, and hydraulic conductivity ranged from 9.46 x 10^{-07} to 1.63 x 10^{-05} cm/sec.

2.2.2 Regional Stratigraphy

The surface geology of the landfill site consists of the Quaternary Eolian and Piedmont Deposits (Qep) (Holocene to middle Pleistocene), which is the primary geologic formation at the surface in this area. Small outcrops of Quaternary Piedmont Alluvial Deposits (Qp)

(Holocene to lower Pleistocene) are located to the north of the site and overlie the Qep deposits. The Tertiary Ogallala Formation (To) (lower Pliocene and middle Miocene) is exposed northeast of the site but was not noted in the site investigation. The Ogallala consists of alluvial and eolian deposits and petrocalcic soils of the southern high plains.

Triassic rocks of the Chinle Formation and Santa Rosa Sandstone of the Dockum Group underlie southern Lea County and is exposed southwest of the site. The Chinle Formation is described as a red to green claystone with minor fine-grained sandstone and siltstones. The Chinle is present in all of the eastern part of southern Lea County but thins westward and is absent in extreme western portions. Thickness of the Chinle varies from 0 to 1,270 feet. The Santa Rosa Sandstone is described as a primarily red, fine-to-coarse grained sandstone, is exposed only in minor outcrops, and the thickness ranges from 140 to 300 feet.

Undifferentiated Paleozoic rocks, consisting of siltstone, shale and sandstone, underlie the Dockum Group in southern Lea County. Thickness of these undifferentiated rocks is approximately 90 to 400 feet.

2.2.3 Regional Structural Geology and Geomorphology

The major structure features of southern Lea County are the Permian age Delaware Basin and the Central Basin Platform in the subsurface. Few structural features are present in the area due to the lack of tectonic movement within the basin since the close of the Permian.

The landfill site is located within the Southern High Plains physiographic region of the state. The High Plains covers the eastern quarter of the state and consists of mildly deformed Permian and Triassic sedimentary rocks capped by the late Miocene-Pliocene Ogallala Formation and Quaternary deposits, which are exposed in the southeastern and east-central parts of the state. Furthermore, the northwest part of the oil and gas-rich Permian Basin underlies southeastern New Mexico. No major surface faults or structural features are located in the vicinity of the landfill site.

Geomorphic features consist of windblown eolian and loess deposits in generally flat terrain that typically lacks integrated drainage systems.

2.3 Regional Hydrogeology

Potable groundwater in southern Lea County comes from three principal geologic units: the Dockum Group, Tertiary Ogallala Formation, and Quaternary Alluvium. The Triassic Santa Rosa sandstone, or the basal unit of the Dockum Group, is the principal aquifer in the western third of southern Lea County and underlies the landfill area. The Ogallala Formation and Quaternary Alluvium aquifers are the principal aquifers in the eastern portion of Lea County and are considered unsaturated in the western portion.

According to published data, the Santa Rosa Sandstone yields an average of about 47 gallons per minute (gpm); however, some wells are reported to yield as much as 100 gpm in some areas. The Sandstone is recharged by precipitation on sand dunes, by precipitation and runoff on outcrops, and groundwater flow from the overlying Ogallala Formation and Quaternary Alluvium. Porosity of the Santa Rosa Sandstone is reported at around 13 percent with very low permeability, and incomplete well-test data indicate a specific capacity of less than 0.2 gpm per foot of drawdown.

Depth to water reported for water wells within the Township and Range of the landfill vary from approximately 150 feet in the southern portion to 175 feet in the northern portion.

2.4 Regional Groundwater Quality

The Dockum Group is the principal potable aquifer in the landfill area. Several domestic and municipal wells penetrate this aquifer in the western portion of the region. Groundwater from the Triassic rocks of the Dockum Group are typically low in silica, vary in range in calcium and magnesium, high in sodium, moderately high in sulfate, and moderately low in chloride. The dissolved solid concentrations are typically higher than water derived from the Ogallala Formation.

3.0 Site Hydrogeologic Investigation

The material presented in this section describes site-specific information gathered for the generation of this document.

3.1 Geotechnical Engineering Report

A Geotechnical Engineering Report was prepared by Terracon to present subsurface exploration, geologic, hydrogeologic and geotechnical engineering findings. A number of recommendations related to subsurface soil/rock conditions, groundwater conditions, seismic site classification, site preparation and earthwork and site excavation are presented and were generated in conformance with the Siting and Subsurface Investigation Work Plan dated October 17, 2018 submitted to and approved by the NMOCD. A copy of the Geotechnical Engineering Report is attached to this narrative in **Attachment A**.

3.2 Site Geology

The NGL South Ranch SWMF is located within an area of historical oil and gas production, largely in undeveloped ranch areas covered with creosote and mesquite trees. The area is underlain by interlayered eolian sands and piedmont-slope deposits which are underlain by the Dockum Group. Subsurface soil and rock are illustrated on geological cross-section figures attached to this report. **Figure 6** shows the alignments of the cross-sections on a Facility map. **Figure 7a** through **Figure 7c** show geologic cross-sections based on the boring data collected in the Geotechnical Engineering Report in **Attachment A**.

3.3 Site Hydrogeology

Groundwater was not encountered at the site during the boring program which advanced four (4) borings to a depth of approximately 150 feet and one (1) boring to a depth of approximately 100 feet below ground surface. The uppermost aquifer is estimated to be encountered at depths greater than 160 feet below ground surface. **Figure 5** shows the approximate depth to groundwater in the Facility area.

4.0 References

New Mexico Bureau of Geology and Mineral Resources, Scholle, Peter A., State Geologist, Geologic Map of New Mexico (1:500 000), 2003.

New Mexico Bureau of Geology and Mineral Resources. Provinces of New Mexico – Geologic Tour of the High Plains, https://geoinfo.nmt.edu/tour/provinces/high_plains/home.html, accessed March 2019.

New Mexico Department of Agriculture. Watersheds in New Mexico - http://www.nmda.nmsu.edu/wp-content/uploads/2012/07/Watershed-info-and-NM-watersheds-7-9-2012-phd.pdf, accessed March 2019.

New Mexico Institute of Mining and Technology, State Bureau of Mines and Mineral Resources Division and the New Mexico State Engineer. Geology and Ground-Water Conditions in Southern Lea County, New Mexico – 1961

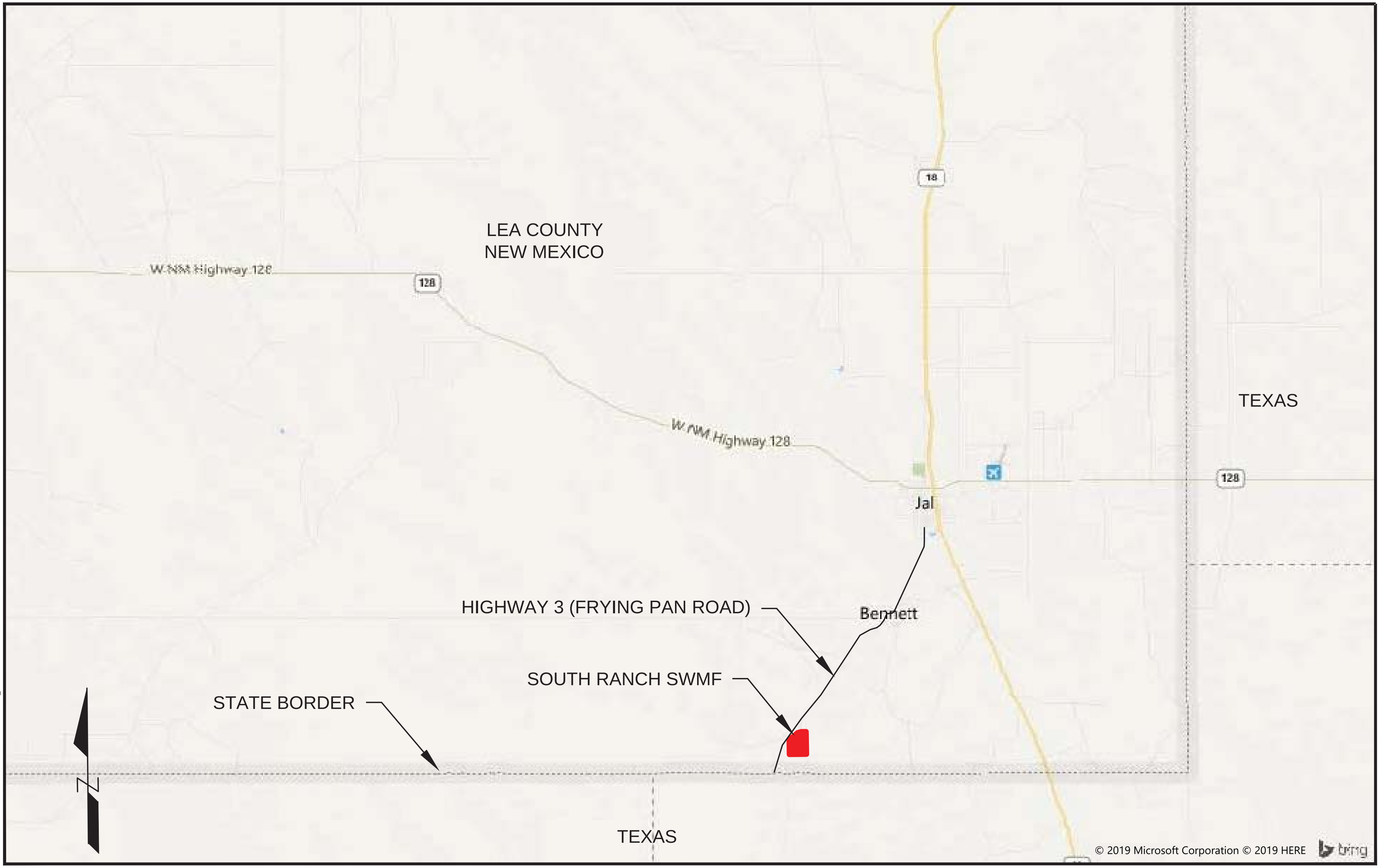
New Mexico Office of the State Engineer, New Mexico Water Rights Reporting System, http://nmwrrs.ose.state.nm.us/nmwrrs/meterReport.html, accessed March 2019.

Terracon, Geotechnical Engineering Report, Beckham Ranch Landfill – January 2019 (Non-technical revision May 2019).

United State Department of Agriculture (USDA) Soil Conservation Service. Soil Survey of Lea County, New Mexico – March 2019.

Web Soil Survey, Beckham Ranch Landfill – March 2019.

Figures



REV.	DATE	BY	DESCRIPTION

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SITE LOCATION MAP

PERMIT APPLICATION FIGURE

SURFACE WASTE MANAGEMENT FACILITY

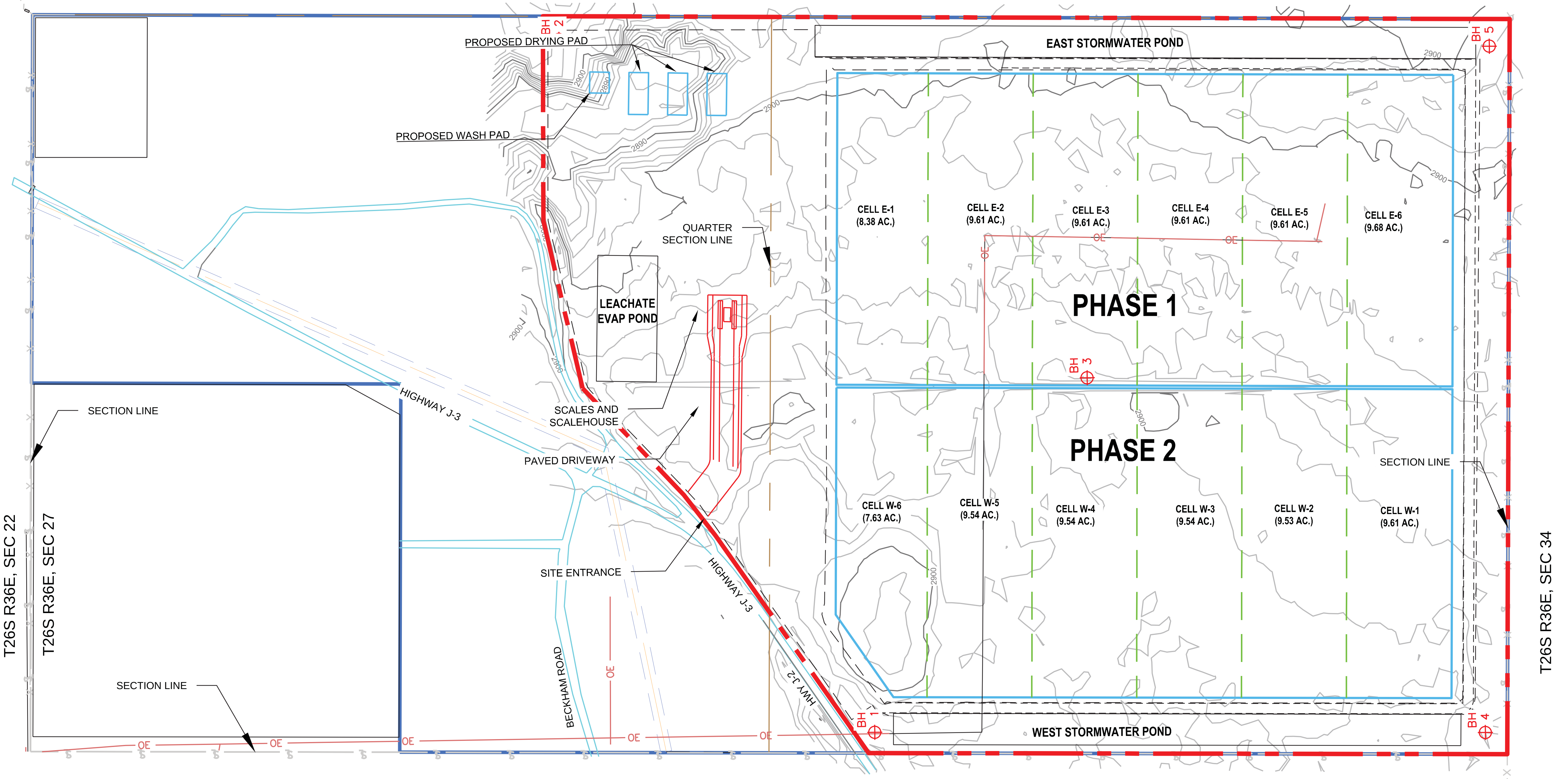
SOUTH RANCH

LEA COUNTY NEW MEXICO

FIG. 1

DESIGNED BY:	-
DRAWN BY:	DEW
APPVD. BY:	MPB
SCALE:	1" = 10,000'
DATE:	SEPTEMBER 2019
JOB NO.	35187378
ACAD NO.	572/002
SHEET NO.:	1 OF 1

N:\GECARCHIVE\CAD\572002\BECKHAM\35187378 DESIGN PERMITTING\PERMIT DRAWINGS_FIGURES\PERMIT FIGURES\PERMIT NARRATIVE\FIG 1 - SITE LOCATION MAP.DWG



LEGEND:

3300	EXISTING GRADE CONTOURS (11-30-2018, 2' CONTOURS)
▬ ▬ ▬	PERMIT BOUNDARY AND SECURITY FENCELINE
OE	OVERHEAD ELECTRIC
▬▬▬	NGL PROPERTY LINE
℄	SURVEY SECTION LINE
— — —	CELL BOUNDARIES
▬▬▬	PHASE BOUNDARIES

NOTES:

1. EXISTING TOPOGRAPHY WAS PERFORMED NOVEMBER 30, 2018 AND VERTICAL ELEVATIONS ARE BASED ON THE NAVD 88 NM_E.

N

400 0 200 400

SCALE IN FEET

REV.	DATE	BY	DESCRIPTION

SITE DEVELOPMENT
SOUTH RANCH SURFACE WASTE MANAGEMENT FACILITY
NGL WASTE SERVICES, LLC
PERMIT APPLICATION DRAWING
LEA COUNTY
NEW MEXICO

Terracon
Consulting Engineers and Scientists
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BRYANT, AR 72022
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FAX. (501) 847-9210

FIGURE 2

DESIGNED BY:	MPB
DRAWN BY:	DEW
APPVD. BY:	MPB
SCALE:	SEE SCALEBAR
DATE:	JUNE 2019
JOB NO.	35187378
ACAD NO.	572-002
SHEET NO.:	

N:\GECARCHIVE\CAD\572\002\BECKHAM\35187378 DESIGN PERMITTING\PERMIT DRAWINGS_FIGURES\PERMIT FIGURES\PERMIT NARRATIVE\FIG 8 - SITE DEVELOPMENT.DWG

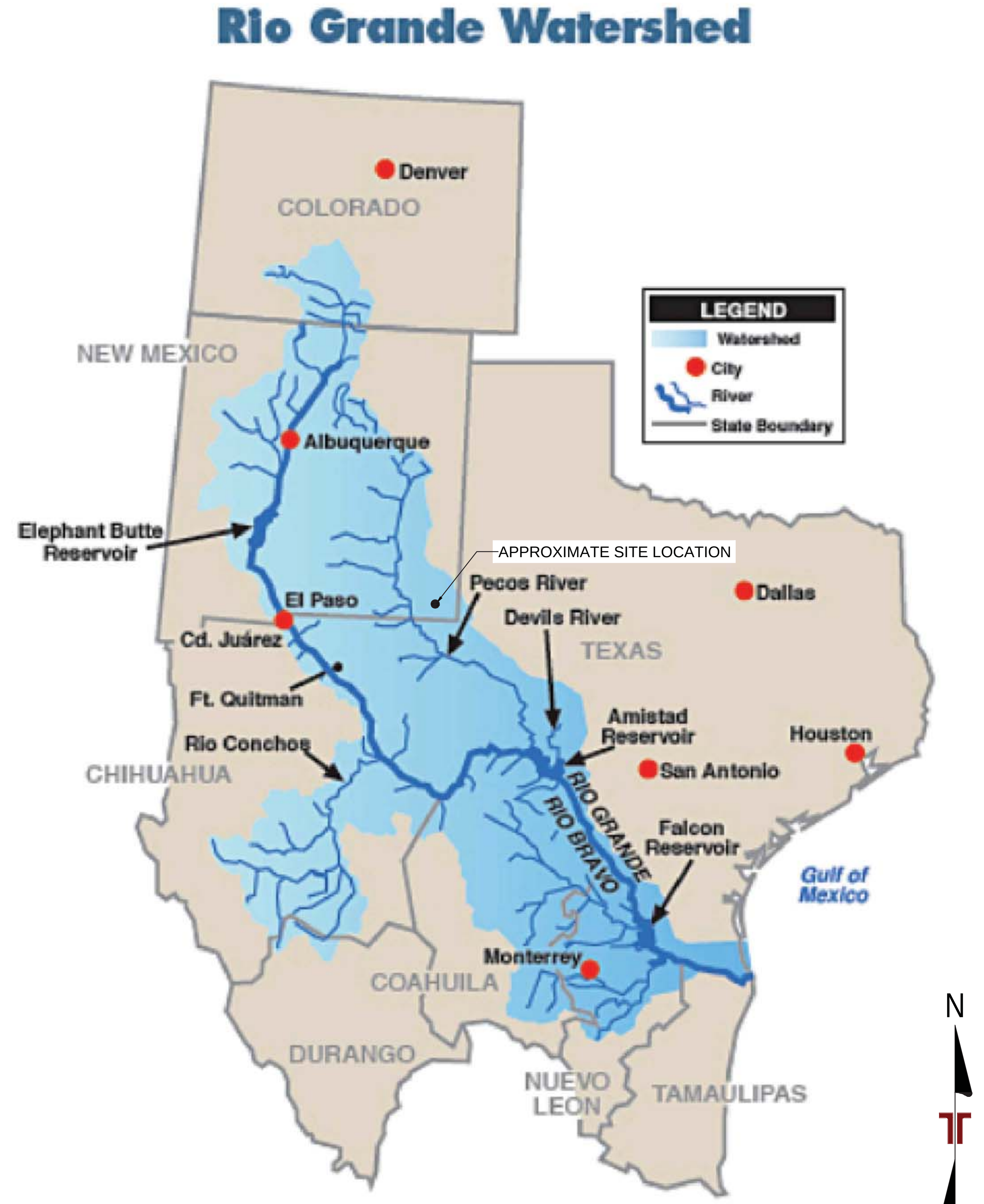

IMAGE SOURCE: TEXAS COMMISSION OF ENVIRONMENTAL QUALITY
https://www.tceq.texas.gov/assets/public/comm_exec/pubs/sfr/057_16/RGMap.jpg

N:\GECARCHIVE\CAD\572002\MCCLOY\PERMIT TEXT FIGURES\HYDRO GEO\FIG 3 - WATERSHED MAP.DWG

Project Mngr:	MPB	Project No.	35187378
Drawn By:	DEW	Scale:	AS SHOWN
Checked By:	MPB	File No.	572-002
Approved By:	FOC	Date:	SEPT. 2019

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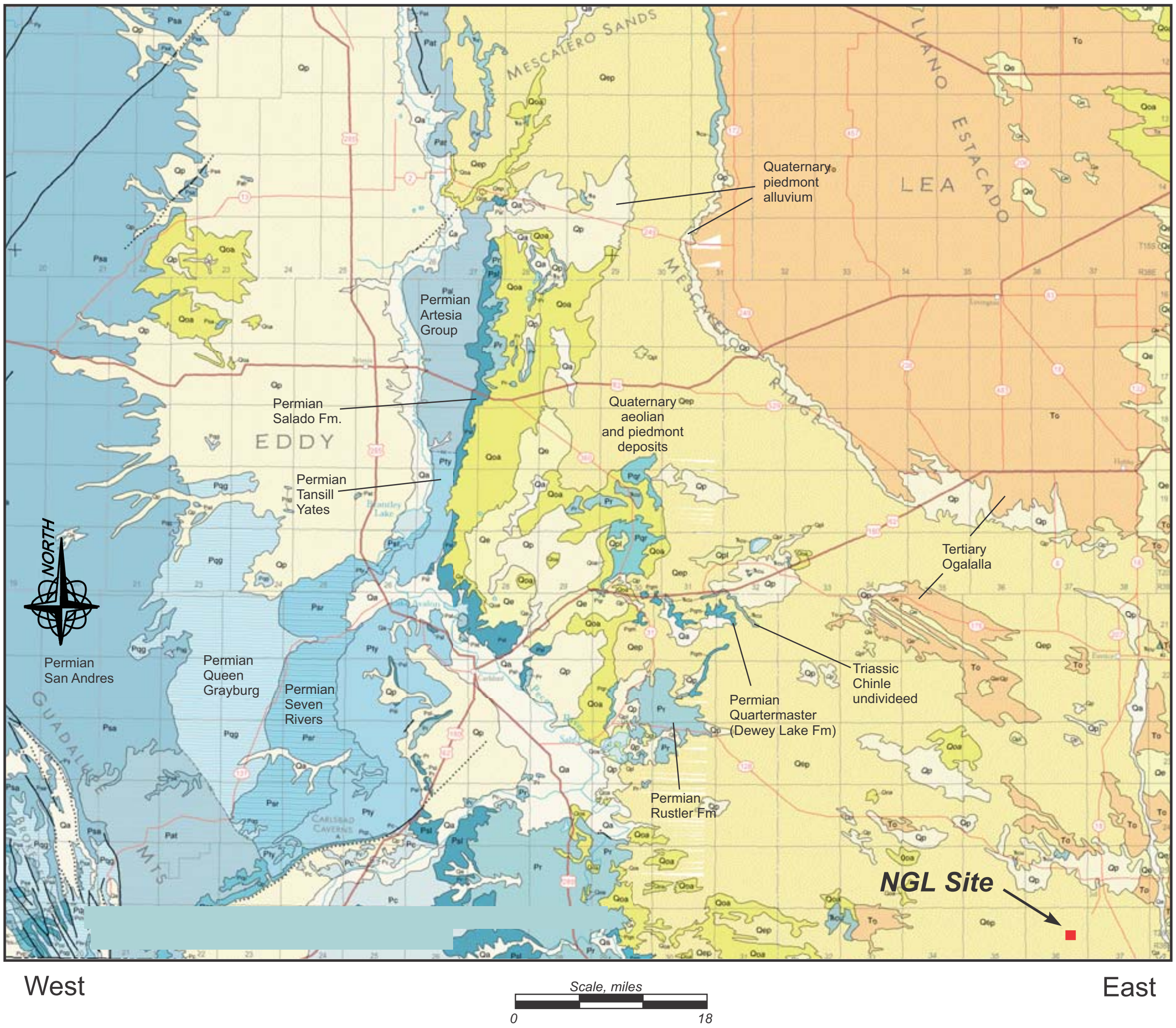
RIO GRANDE WATERSHED
PERMIT APPLICATION FIGURE
NGL WASTE SERVICES, LLC
SOUTH RANCH SURFACE WASTE MANAGEMENT FACILITY
LEA COUNTY NEW MEXICO

FIG. No.
3



LEGEND OF FORMATIONS NEAR SITE

Quaternary

Qp	Piedmont alluvial deposits (Holocene to lower Pleistocene)—Includes deposits of higher gradient tributaries bordering major stream valleys, alluvial veneers of the piedmont slope, and alluvial fans. May locally include uppermost Pliocene deposits
Qep	Eolian and piedmont deposits (Holocene to middle Pleistocene)—Interlayed eolian sands and piedmont-slope deposits along the eastern flank of the Pecos River valley, primarily between Roswell and Carlsbad. Typically capped by thin eolian deposits

Tertiary

To	Ogallala Formation (lower Pliocene to middle Miocene)—Alluvial and eolian deposits, and petrocalcic soils of the southern High Plains. Locally includes Qoa

Triassic

Ꞧcu	Upper Chinle Group, Garita Creek through Redonda Formations, undivided

Fig 4

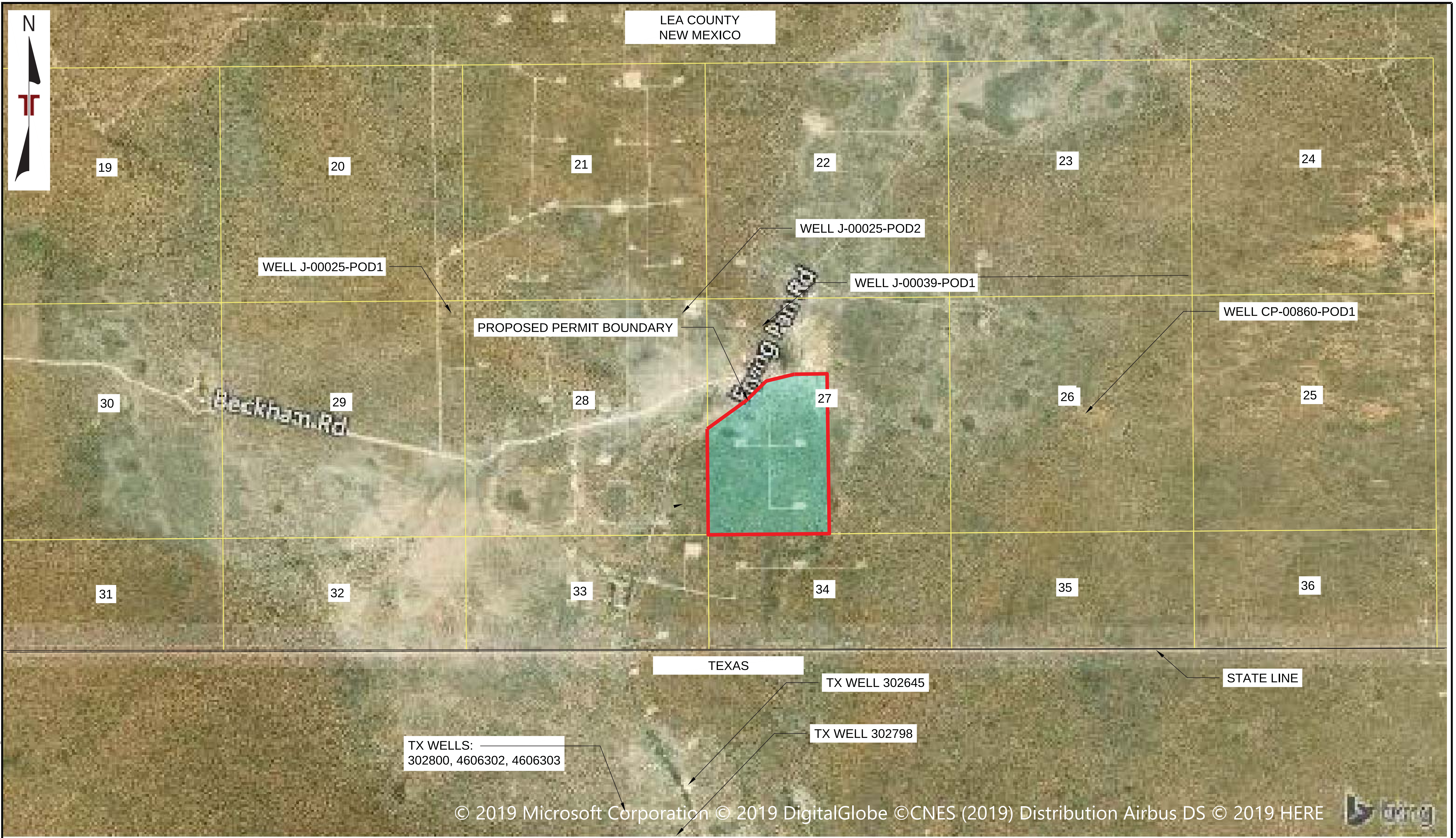
NGL South Ranch SWMF, Lea County, NM

Regional Surface Geology

Southeastern New Mexico

Modified from NM Bureau of Geology and Minerals, 2003
1:500,000 Geologic Map of New Mexico

Terracon



NOTE:

1. WATER WELL INFORMATION OBTAINED FROM NEW MEXICO OFFICE OF THE STATE ENGINEER POD LOCATION GIS APPLICATION AND THE TEXAS WATER DEVELOPMENT BOARD WATER DATA INTERACTIVE MAPPER.
2. SHOWN TOWNSHIP 25S RANGE 36 E, SECTIONS AS LABELED

N:\GECARCHIVE\CAD\572\002\BECKHAM\35187378 DESIGN PERMITTING\PERMIT DRAWINGS_FIGURES\PERMIT FIGURES\PERMIT NARRATIVE\FIG 9 - WATER WELL MAP.DWG

Project Mngr: MPB
Drawn By: JBM
Checked By: MPB
Approved By: MPB

Project No. 35187378
Scale: 1"=2000'
File No. 572-002
Date: APRIL 2019

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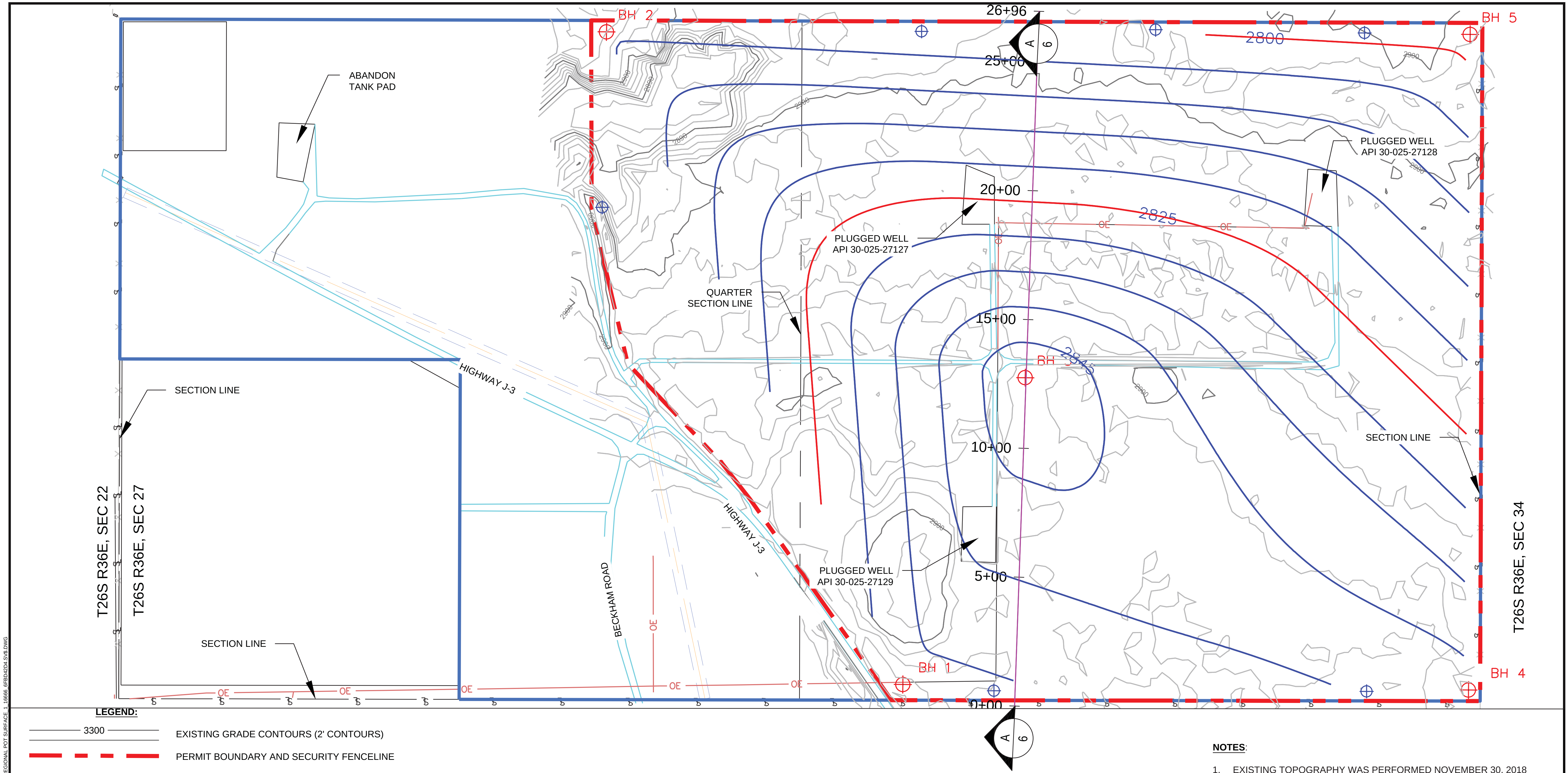
WATER WELLS NEAR FACILITY
PERMIT DRAWING
SURFACE WASTE MANAGEMENT FACILITY
SOUTH RANCH
LEA COUNTY NEW MEXICO

FIG. No.
5

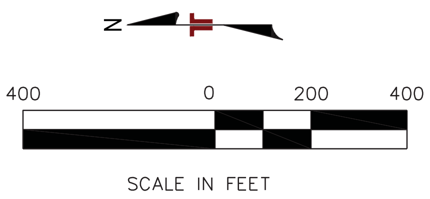


LEGEND:

3300	EXISTING GRADE CONTOURS (2' CONTOURS)
	PERMIT BOUNDARY AND SECURITY FENCELINE
OE	OVERHEAD ELECTRIC
G G G	EXISTING GAS LINES / GAS EASEMENT
X X	EXISTING FENCE LINE
	EXISTING EDGE OF ROADS
BH 1 ⊕	SITE INVESTIGATION GEOTECHNICAL BOREHOLE LOCATIONS
30-02-30458 (PLUGGED)	EXISTING WELLS
	NGL PROPERTY LINE
S	SURVEY SECTION LINE
	APPROXIMATED TOP OF CHINLE FORMATION CONTOURS
⊕	PROPOSED VADOSE ZONE MONITORING WELL LOCATION

NOTES:

1. EXISTING TOPOGRAPHY WAS PERFORMED NOVEMBER 30, 2018 AND VERTICAL ELEVATIONS ARE BASED ON THE NAVD 88 NM_E.
2. TOP OF CHINLE FORMATION (REDBEDS) DERIVED FROM SITE INVESTIGATION BORINGS.



REV.	DATE	BY	DESCRIPTION

APPROXIMATE TOP OF CHINLE FORMATION
SOUTH RANCH SURFACE WASTE MANAGEMENT FACILITY
NGL WASTE SERVICES, LLC
PERMIT APPLICATION DRAWING
LEA COUNTY NEW MEXICO

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FIGURE 6

DESIGNED BY:	MPB
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SCALE:	SEE SCALEBAR
DATE:	JUNE 2019
JOB NO.	35187378
ACAD NO.	572-002
SHEET NO.:	- OF

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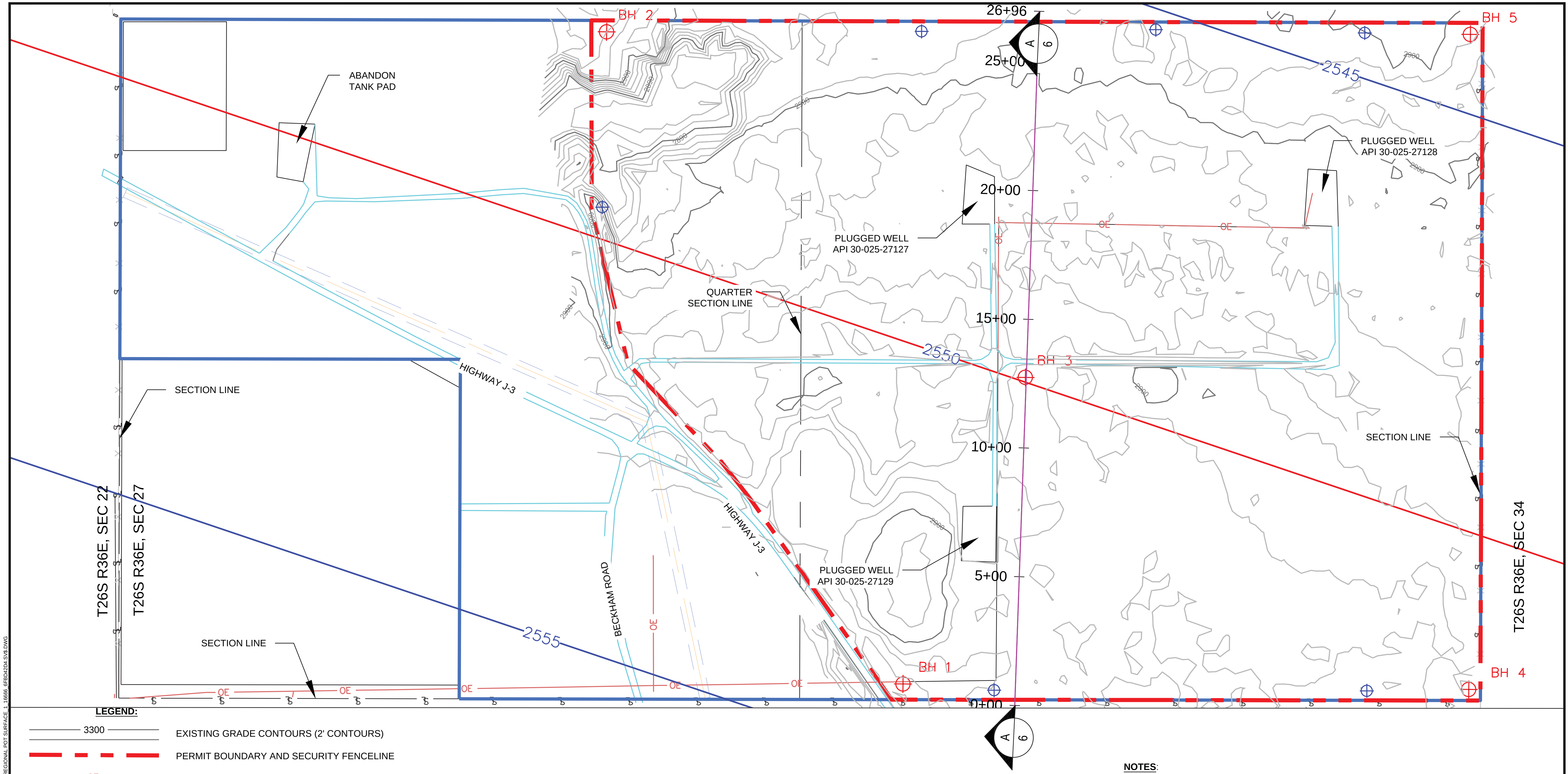

LEGEND:

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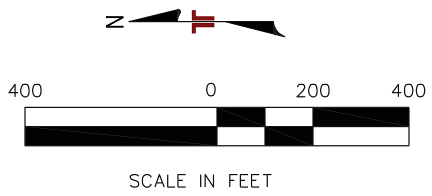
OE	OVERHEAD ELECTRIC
G G G	EXISTING GAS LINES / GAS EASEMENT
X X	EXISTING FENCE LINE
— —	EXISTING EDGE OF ROADS
BH 1 ⊕	SITE INVESTIGATION GEOTECHNICAL BOREHOLE LOCATIONS
30-02-30458 (PLUGGED)	EXISTING WELLS
—	NGL PROPERTY LINE
S	SURVEY SECTION LINE
2740	APPROXIMATED TOP OF SANTA ROSA FORMATION CONTOURS
⊕	PROPOSED VADOSE ZONE MONITORING WELL LOCATION

NOTES:

1. EXISTING TOPOGRAPHY WAS PERFORMED NOVEMBER 30, 2018 AND VERTICAL ELEVATIONS ARE BASED ON THE NAVD 88 NM_E.
2. TOP OF SANTA ROSA FORMATION CONTOURS DERIVED FROM STRUCTURAL SANDSTONE MAP, GORDON ENVIRONMENTAL/GOLDER ASSOCIATES, 2016, WATER WELL NO. 1 (26.37.7.331) JAL NO. 1 PLANT - EL PASO NATURAL GAS CO. AND WATER WELL NO. 320104103120301(26.37.19.433143). AND INTERPOLATED TOWARDS ACROSS THE FACILITY



REV.	DATE	BY	DESCRIPTION

APPROXIMATE TOP OF SANTA ROSA FORMATION
SOUTH RANCH SURFACE WASTE MANAGEMENT FACILITY
NGL WASTE SERVICES, LLC
PERMIT APPLICATION DRAWING
LEA COUNTY NEW MEXICO

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FIGURE 7

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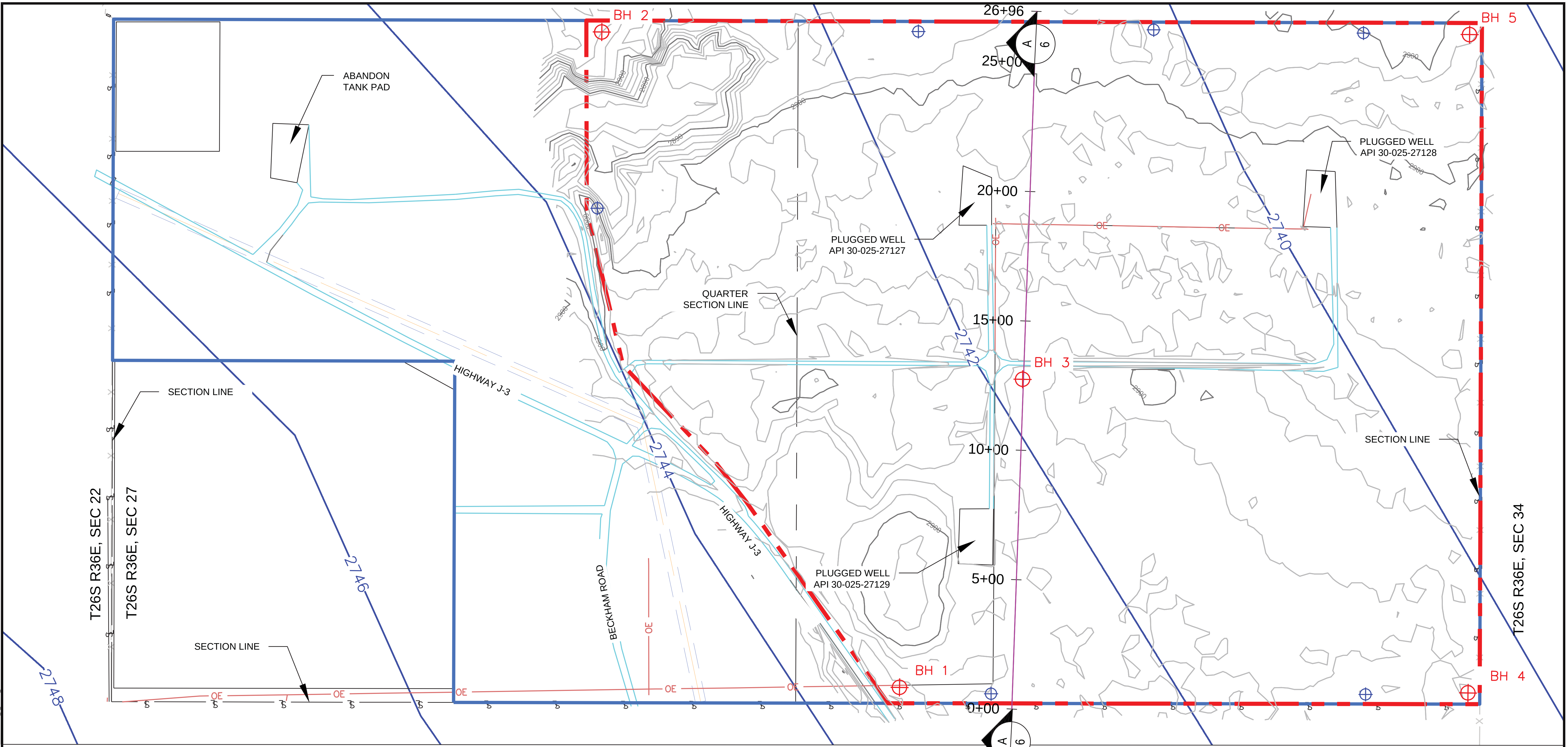
SCALE:	SEE SCALEBAR
DATE:	JUNE 2019
JOB NO.	35187378
ACAD NO.	572-002
SHEET NO.:	- OF

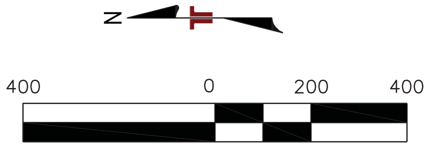


LEGEND:

3300	EXISTING GRADE CONTOURS (2' CONTOURS)
▬ ▬ ▬	PERMIT BOUNDARY AND SECURITY FENCELINE
OE	OVERHEAD ELECTRIC
G G G	EXISTING GAS LINES / GAS EASEMENT
X X	EXISTING FENCE LINE
— —	EXISTING EDGE OF ROADS
BH 1	SITE INVESTIGATION GEOTECHNICAL BOREHOLE LOCATIONS
30-02-30458 (PLUGGED)	EXISTING WELLS
▬	NGL PROPERTY LINE
℄	SURVEY SECTION LINE
2740	APPROXIMATED REGIONAL GROUNDWATER POTENTIOMETRIC SURFACE CONTOURS (SEE NOTE 2)
⊕	PROPOSED VADOSE ZONE MONITORING WELL LOCATION

NOTES:

1. EXISTING TOPOGRAPHY WAS PERFORMED NOVEMBER 30, 2018 AND VERTICAL ELEVATIONS ARE BASED ON THE NAVD 88 NM_E.
2. REGIONAL GROUNDWATER POTENTIOMETRIC SURFACE CONTOURS APPROXIMATED USING PUBLICLY AVAILABLE GROUNDWATER LEVEL DATA FROM APPROXIMATELY LOCATED MONITORING WELLS FROM THE USGS NATIONAL WATER INFORMATION SYSTEM, THE TEXAS WATER DEVELOPMENT BOARD'S WATER DATA INTERACTIVE, AND THE NEW MEXICO OFFICE OF THE STATE ENGINEERS POD LOCATIONS GIS.



SCALE IN FEET

FOR PERMITTING PURPOSES ONLY

REV.	DATE	BY	DESCRIPTION

APPROXIMATE REGIONAL POTENTIOMETRIC SURFACE - SHALLOW GROUNDWATER
SOUTH RANCH SURFACE WASTE MANAGEMENT FACILITY
NGL WASTE SERVICES, LLC
PERMIT APPLICATION DRAWING
LEA COUNTY
NEW MEXICO

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PH. (501) 847-9292
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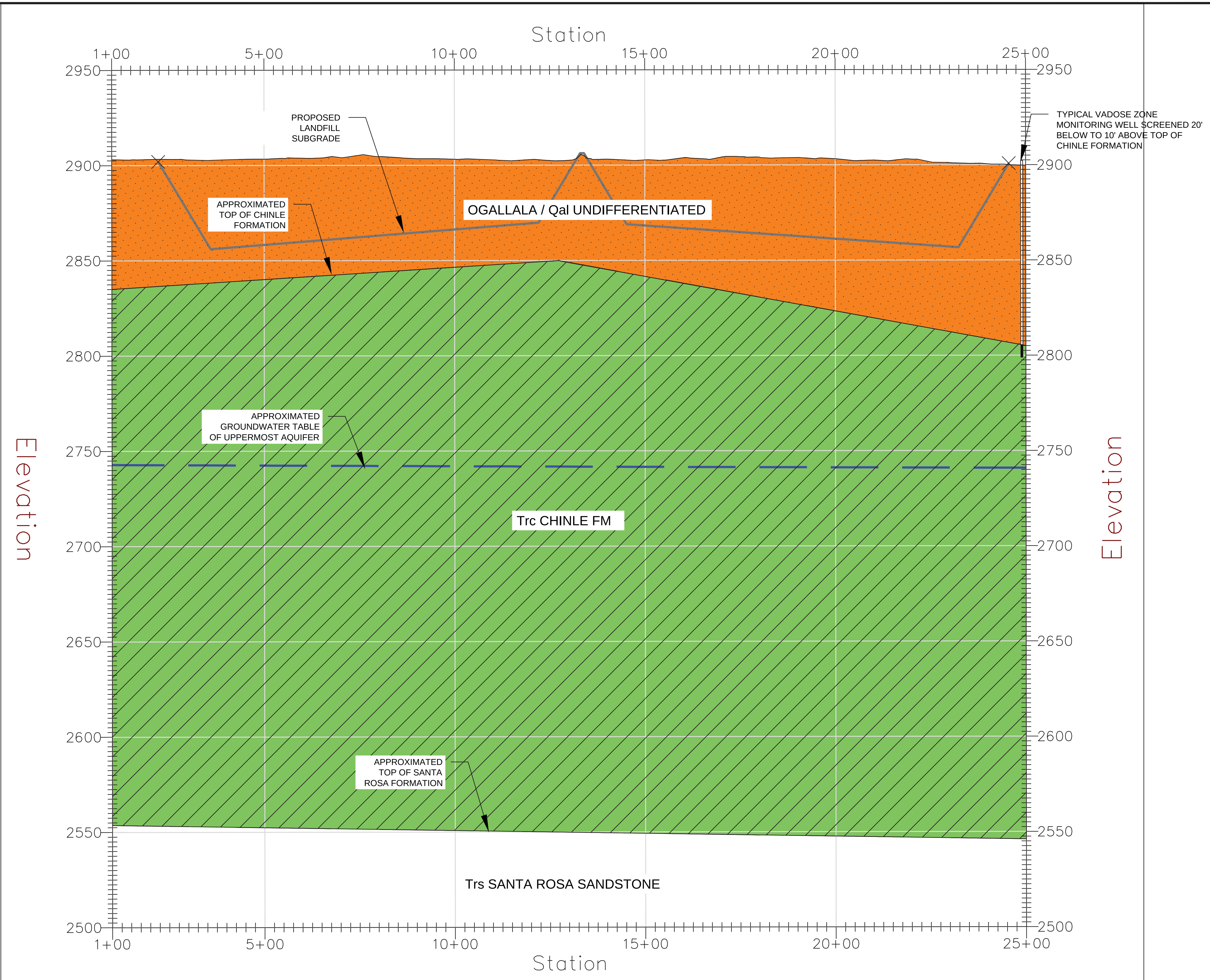
FIGURE 8

DESIGNED BY:	MPB
DRAWN BY:	DEW
APPVD. BY:	MPB
SCALE:	SEE SCALEBAR
DATE:	JUNE 2019
JOB NO.	35187378
ACAD NO.	572-002
SHEET NO.:	- OF

C:\USERS\MPBRADFORD\ONEDRIVE - TERRACON CONSULTANTS INC\DESKTOP\WORK\TRAMMELL\BECKHAM\003 - 006 - SR REGIONAL POT SURFACE_1_16666_6FBD42D4.SV$.DWG



REV	DATE	BY	DESCRIPTION

VADOSE ZONE CROSS SECTION
SOUTH RANCH SURFACE WASTE MANAGEMENT FACILITY
NGL WASTE SERVICES, LLC
PERMIT APPLICATION DRAWING
LEA COUNTY
NEW MEXICO

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH
BRYANT, AR 72022
PH. (501) 847-9292
FAX. (501) 847-9210

FIGURE 9

DESIGNED BY:	MPB
DRAWN BY:	DEW
APPVD. BY:	MPB
SCALE:	SEE SCALEBAR
DATE:	JUNE 2019
JOB NO.	35187378
ACAD NO.	572-002
SHEET NO.:	- OF

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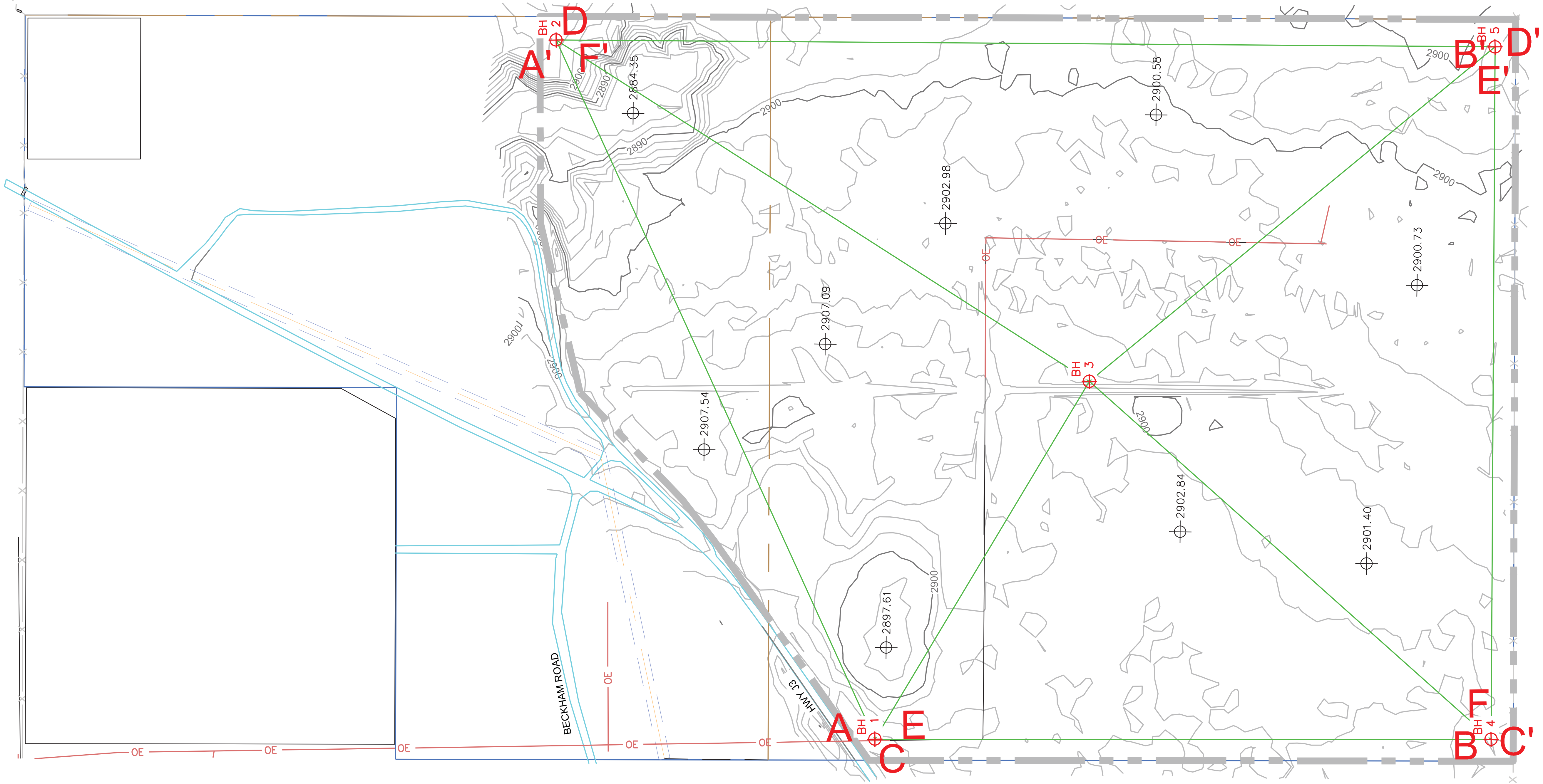
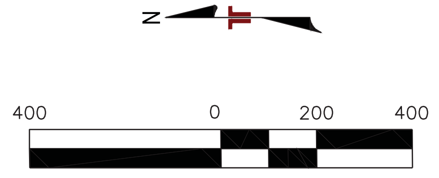


LEGEND:

3300	EXISTING GRADE CONTOURS (11-30-2018, 2' CONTOURS)
▬ ▬ ▬	PERMIT BOUNDARY AND SECURITY FENCELINE
OE	OVERHEAD ELECTRIC
G — G — G	EXISTING GAS LINES / GAS EASEMENT
X — X	EXISTING WATER LINE
—	EXISTING CENTERLINE
BH ⊕ #	BOREHOLE LOCATIONS
—	NGL PROPERTY LINE
—	CROSS-SECTION CUT LINE
⊕ 3000	SPOT ELEVATIONS

NOTES:

1. EXISTING TOPOGRAPHY WAS PERFORMED NOVEMBER 30, 2018 AND VERTICAL ELEVATIONS ARE BASED ON THE NAVD 88 NM_E.
2. GAS AND OVERHEAD ELECTRIC TO BE RELOCATED BY OWNER PRIOR TO CELL CONSTRUCTION IN THIS AREA



SCALE IN FEET

FOR PERMITTING PURPOSES ONLY

REV.	DATE	BY	DESCRIPTION

GEOLOGICAL CROSS-SECTION ALIGNMENTS
SOUTH RANCH SURFACE WASTE MANAGEMENT FACILITY
NGL WASTE SERVICES, LLC
PERMIT APPLICATION DRAWING
LEA COUNTY
NEW MEXICO

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH
BRYANT, AR 72022
PH. (501) 847-9292
FAX. (501) 847-9210

FIGURE 10

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DRAWN BY:	DEW
APPVD. BY:	MPB
SCALE:	SEE SCALEBAR
DATE:	JUNE 2019
JOB NO.	35187378
ACAD NO.	572-002
SHEET NO.:	OF

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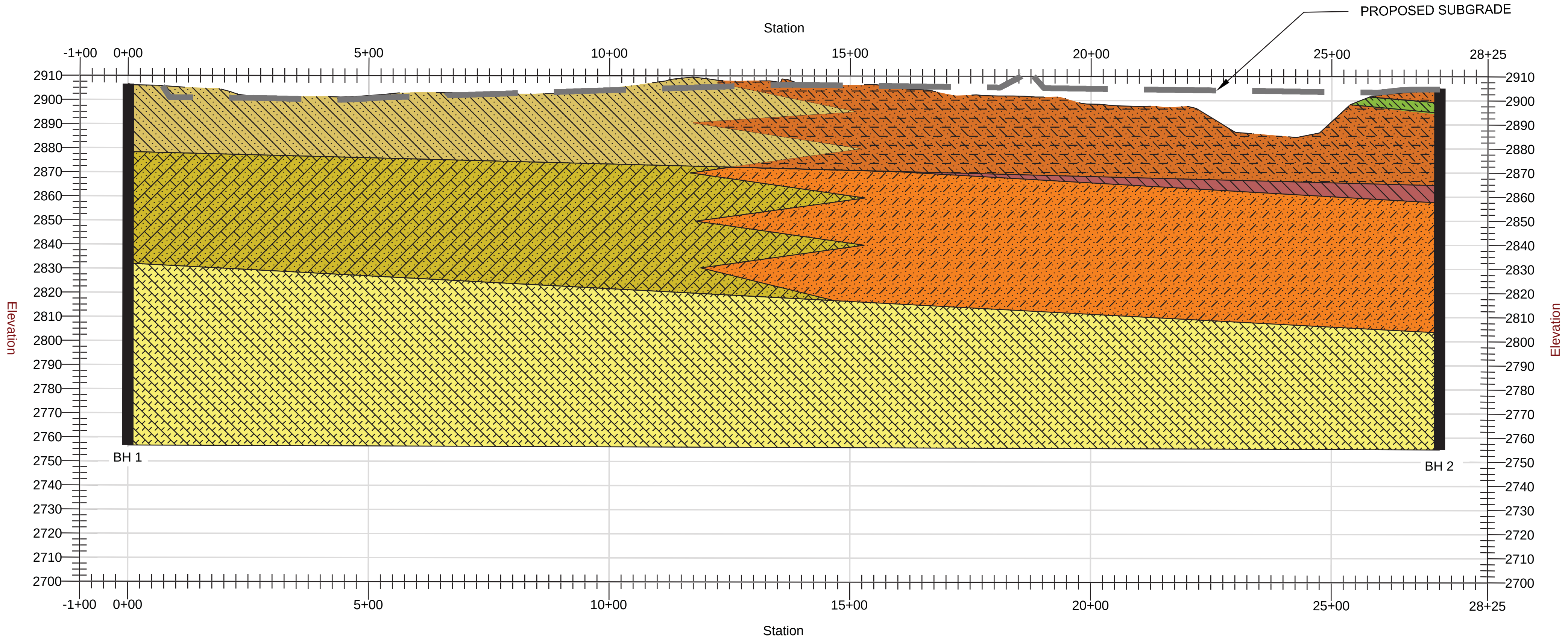
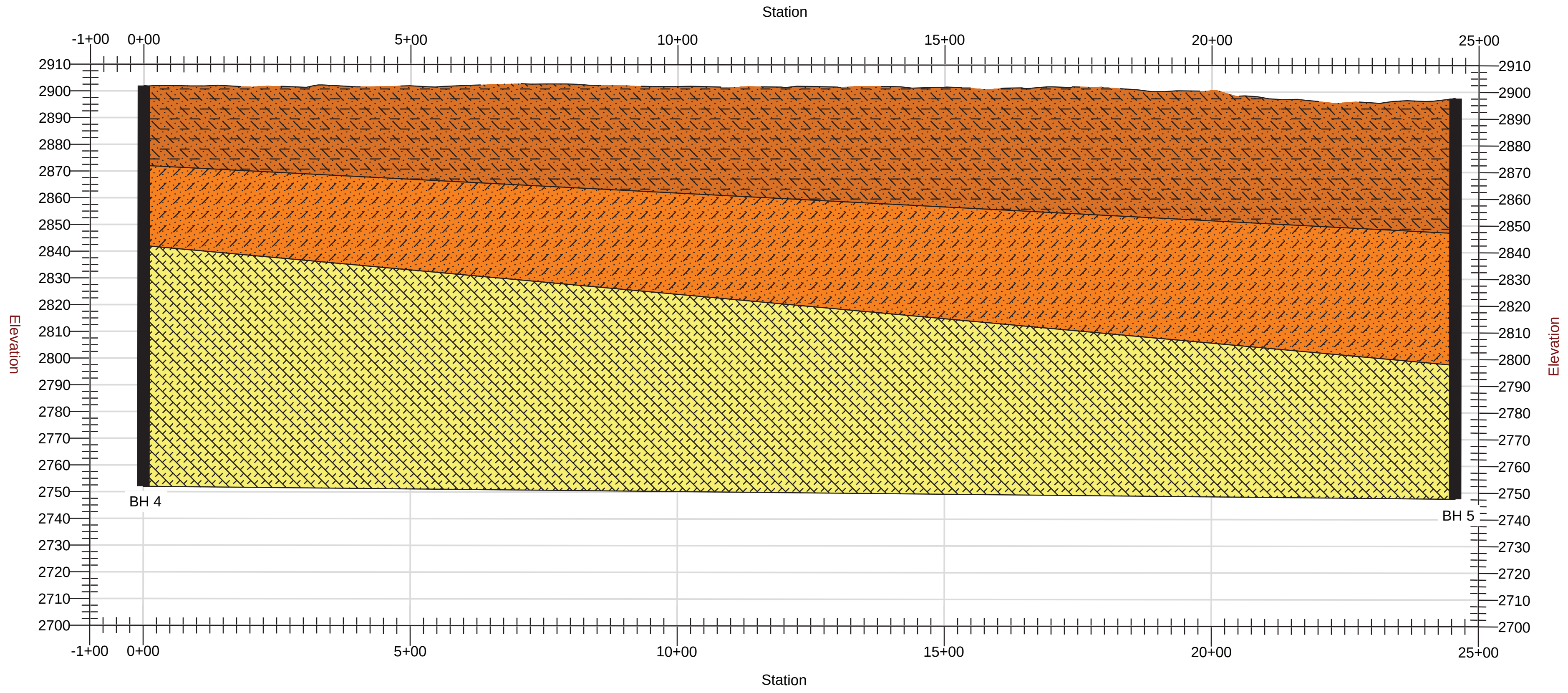


ALIGN - A-A'

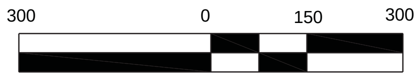
SECTION A 11A



ALIGN - B-B'

SECTION B 11A

SCALES:
1" = 300' (HORIZONTAL)
1" = 60' (VERTICAL)
VERTICAL EXAGGERATION = x 5



SCALE IN FEET

- ▨ Silty Sand with Interbedded Caliche
- ▨ Clayey Sand
- ▨ Caliche
- ▨ Poorly Graded Sand with Silt
- ▨ Poorly Graded Sand with Silt and Interbedded Caliche
- ▨ Silty Sand
- ▨ Sandstone
- ▮ BH # Bore Hole

REV.	DATE	BY	DESCRIPTION

GEOLOGICAL CROSS-SECTION A-A' AND B-B'

SOUTH RANCH SURFACE WASTE MANAGEMENT FACILITY
NGL WASTE SERVICES, LLC
PERMIT APPLICATION DRAWING
LEA COUNTY
NEW MEXICO

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BRYANT, AR 72022
PH. (501) 847-9292
FAX. (501) 847-9210

FIGURE 11A

DESIGNED BY:	MPB
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APPVD. BY:	MPB
SCALE:	SEE SCALEBAR
DATE:	JUNE 2019
JOB NO.	35187378
ACAD NO.	572-002
SHEET NO.:	OF

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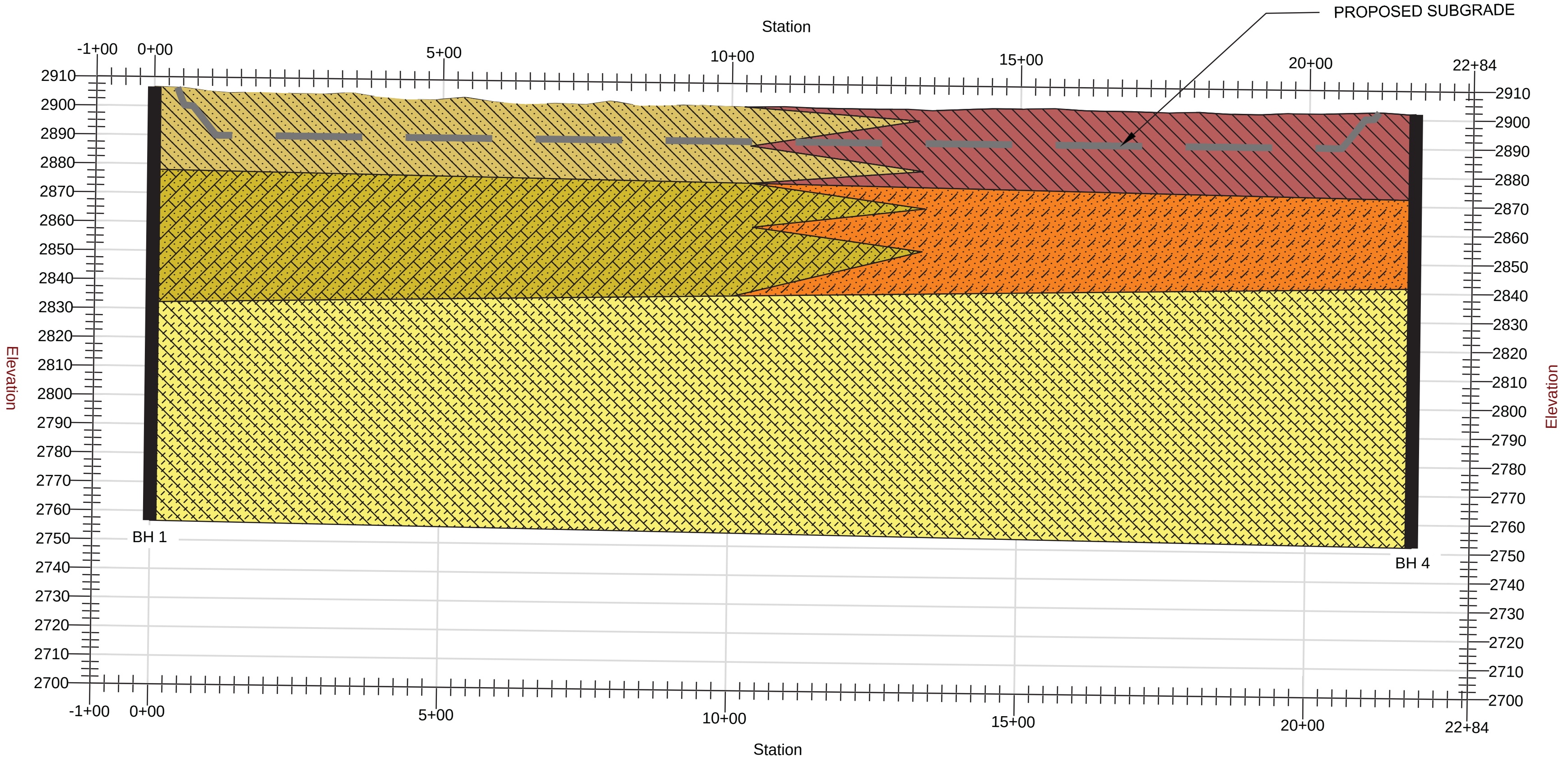
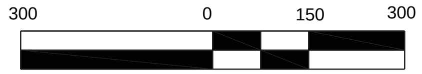


ALIGN - C-C'

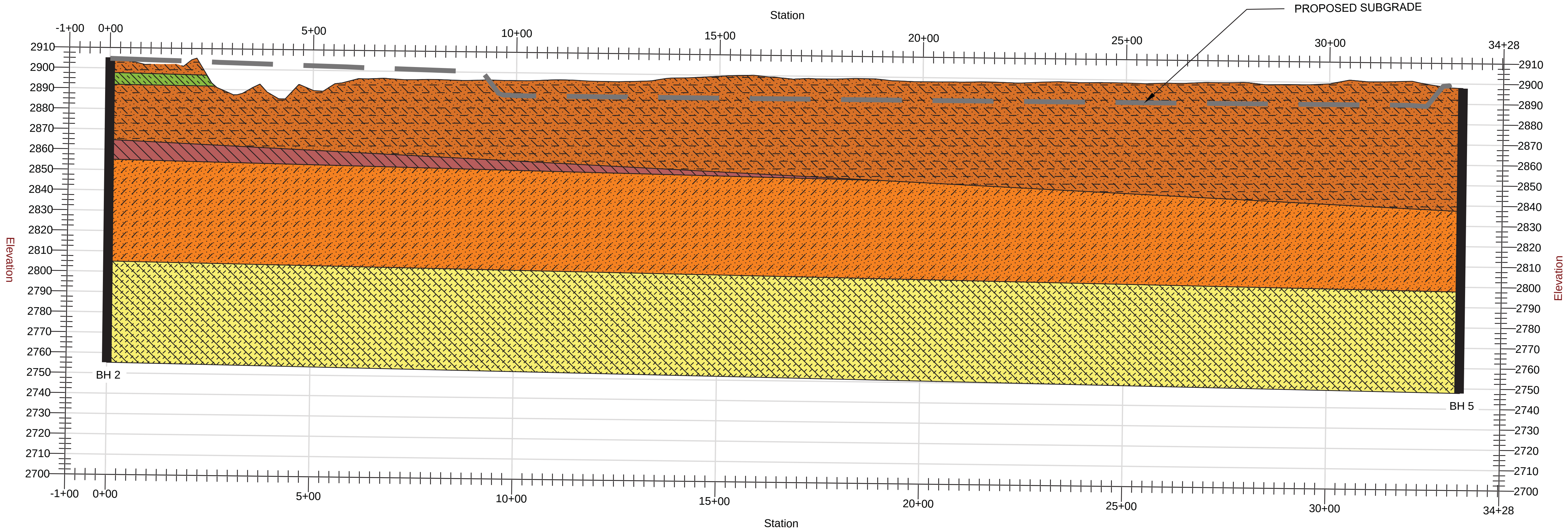
SECTION C / 11B

SCALES:
1" = 300' (HORIZONTAL)
1" = 60' (VERTICAL)
VERTICAL EXAGGERATION = x 5



SCALE IN FEET

▨	Silty Sand with Interbedded Caliche
▨	Clayey Sand
▨	Caliche
▨	Poorly Graded Sand with Silt
▨	Poorly Graded Sand with Silt and Interbedded Caliche
▨	Silty Sand
▨	Sandstone
▮ BH #	Bore Hole



ALIGN - D-D'

SECTION D / 11B

FOR PERMITTING PURPOSES ONLY

REV.	DATE	BY	DESCRIPTION

GEOLOGICAL CROSS-SECTION C-C' AND D-D'

SOUTH RANCH SURFACE WASTE MANAGEMENT FACILITY
NGL WASTE SERVICES, LLC
PERMIT APPLICATION DRAWING
LEA COUNTY
NEW MEXICO

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Consulting Engineers and Scientists
25809 I-30 SOUTH
BRYANT, AR 72022
PH. (501) 847-9292
FAX. (501) 847-9210

FIGURE 11B

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APPVD. BY:	MPB
SCALE:	SEE SCALEBAR
DATE:	JUNE 2019
JOB NO.	35187378
ACAD NO.	572-002
SHEET NO.:	OF

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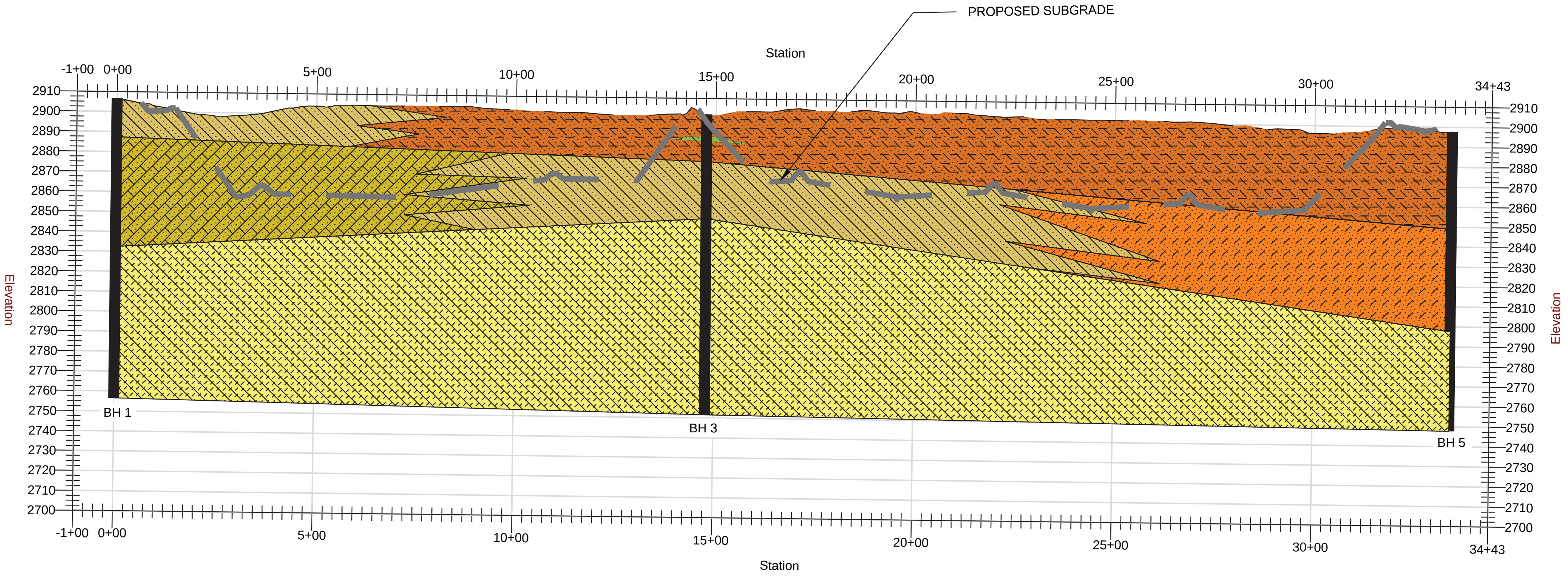
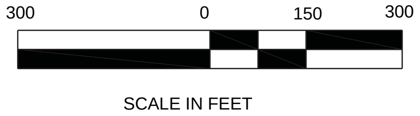


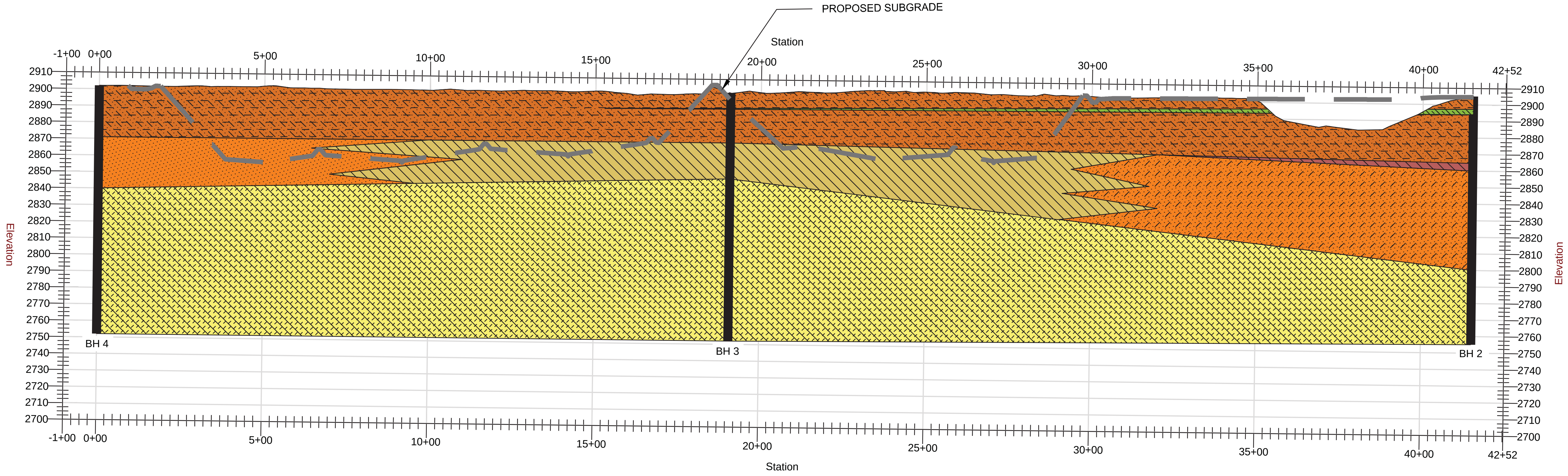
ALIGN - E-E'

SECTION E 11C

SCALES:
1" = 350' (HORIZONTAL)
1" = 70' (VERTICAL)
VERTICAL EXAGGERATION = x 5



▨ Silty Sand with Interbedded Caliche
▨ Clayey Sand
▨ Caliche
▨ Poorly Graded Sand with Silt
▨ Poorly Graded Sand with Silt and Interbedded Caliche
▨ Silty Sand
▨ Sandstone
▮ Bore Hole
BH #



ALIGN - F-F'

SECTION F 11C

FOR PERMITTING PURPOSES ONLY

REV.	DATE	BY	DESCRIPTION

GEOLOGICAL CROSS-SECTION E-E' AND F-F'
SOUTH RANCH SURFACE WASTE MANAGEMENT FACILITY
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LEA COUNTY
NEW MEXICO

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FIGURE 11C

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SCALE:	SEE SCALEBAR
DATE:	JUNE 2019
JOB NO.	35187378
ACAD NO.	572-002
SHEET NO.:	OF

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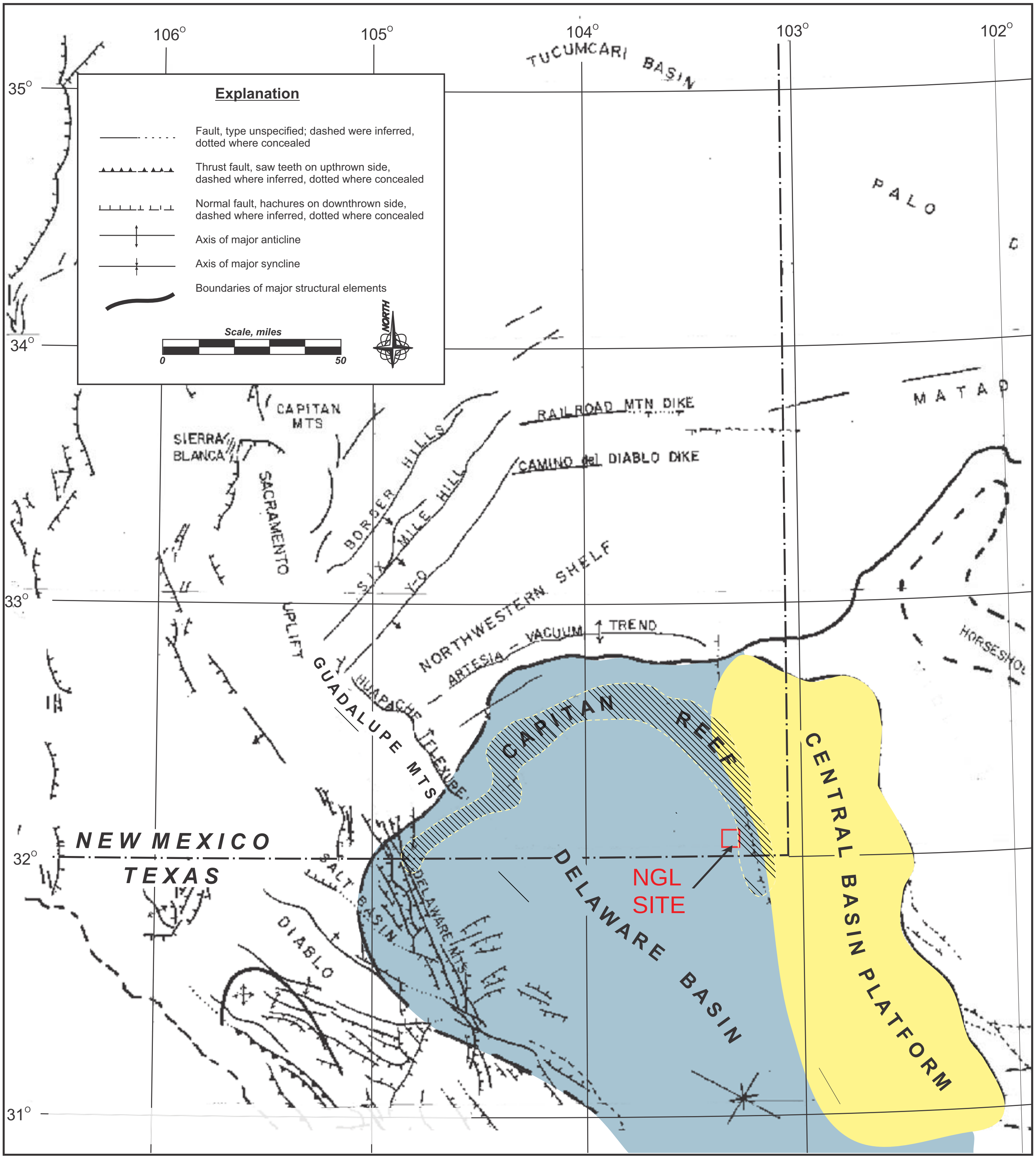


Fig 12

NGL South Ranch SWMF, Lea County, NM

Structures of the Delaware Basin,
Southeastern New Mexico and West Texas

Major Regional Structural Features of Southeastern New Mexico
Modified from Powers, 1978

Attachment A

Geotechnical Engineering Report (Terracon - January 2019, Non-technical Revision May 2019)

Geotechnical Engineering Report

Beckham Ranch Landfill

Jal, Lea County, New Mexico

May 6, 2019

Terracon Project No. A4187129

Prepared for:

Trammco Environmental Solutions, LLC
Fernandina Beach, FL

Prepared by:

Terracon Consultants, Inc.
Midland, Texas

Terracon
GeoReport

January 25, 2019

Trammco Environmental Solutions, LLC
P.O. Box 2283
Fernandina Beach, FL 79760

Attn: Mr. Matthew Trammell
E: matt@trammco.com

Re: Geotechnical Engineering Report
Beckham Ranch Landfill
Jal, Lea County, New Mexico
Terracon Project No. A4187129

Dear Mr. Trammell:

We have completed the Hydrogeological/Geotechnical investigations for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P35187312 dated October 17, 2018. This report presents the findings of the subsurface exploration and provides hydrological/geotechnical recommendations for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

JAMES D. COSPER, II
14477
1-25-19

Naga Velpuri
Staff Geotechnical Engineer

J. Dan Cosper, P.E.
Senior Associate/Office Manager

Copy: file

REPORT TOPICS

Note: This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
SITE LOCATION AND EXPLORATION PLANS
SUBSURFACE PROFILE (5 profiles)
EXPLORATION RESULTS (Boring Logs and Laboratory Data)
SUPPORTING INFORMATION (General Notes and Unified Soil Classification System and Description of Rock Properties)

REPORT SUMMARY

Topic [1]	Overview Statement [2]
Project Description	Landfill facility will be constructed on a 190-acre surface waste disposal facility within Section 27 of, T26S, R36E approximately 7 miles southwest of the City of Jal in Lea County, New Mexico.
Geotechnical Characterization	■ Based on the field exploration, we classified the soils we encountered into three soil strata, first stratum with depths ranging between 26 feet to 47 feet below grade surface (bgs) consisting of clayey sand, silty sand, silty sand with interbedded layers of caliche, poorly graded sand with silt and interbedded layers of caliche. The second stratum was penetrated at depths ranging between 50 feet to 100 feet bgs consisting of silty sand, poorly graded sand, interbedded caliche layers classified as, silty sand, poorly graded sand. The third stratum was penetrated at depths ranging between 100 feet to 150 feet bgs and consisted of fine-grain, poorly to moderately compacted sandstone. ■ Very dense/hard calcareous materials with varying degrees of cementation, or locally called "caliche" materials, which are typically classified as silty sand, poorly graded sand, were encountered in all the borings ranging from the upper approximately 7 to 100 feet of existing grades. Caliche interval thicknesses ranged from 1 inch to over 10 feet. The overburden materials are underlain by medium to finely weathered sandstone extending to boring-termination depths of 150 feet below existing grades. On-site subsurface soils are not expected to experience substantial volumetric changes (shrink/swell) with fluctuations in moisture content. Potential vertical rise (PVR) of on-site soils is estimated to be less than 1 inch. On-site soils are generally suitable for use as structural fill. ■ Caliche bears a strong resemblance to rock and is therefore difficult to excavate. Based on the conditions encountered, we believe landfill excavations in the upper 7 to 50 feet of existing grades will require a hoe ram, a heavy dozer equipped with a ripper, a rock saw or a jack hammer. Bedrock was encountered beneath caliche materials, thus rock excavation by means of ripping and blasting is expected. Recommendations regarding excavation conditions of on-site subsurface materials and definitions of rock in various conditions are included in section Excavations Conditions of this report. ■ The 2012 International Building Code (Section 1613.3.2) seismic site classification for this site is estimated to be C. ■ No groundwater was encountered in any of the borings within the drilling depths of 150 feet below existing grades at the time of drilling. Based on these data, we do not expect groundwater would impact the landfill development. ■ Laboratory permeability were measured on samples. Results of laboratory permeability measurements on samples collected from B-1, B-3 and B-5 were in a range of $1.63x10^{-5}$ to $9.46x10^{-7}$ cm/sec. Detailed permeability measurement results are presented in Geotechnical Characterization section of this report. ■ Bedrocks (sandstone) were encountered at depths of 50 to 150 feet below existing grades. Please refer to boring logs and subsurface profiles provided in the Appendices.

Topic [1]	Overview Statement [2]
Below Grade Structures	The landfill development itself is considered a below grade structure.
General Comments	This section contains important information about the limitations of this geotechnical engineering report.

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

Geotechnical Engineering Report

Beckham Ranch Landfill
IH-20 and FM-866
Jal, Lea County, New Mexico
Terracon Project No. A4187129
May 6, 2019

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Landfill to be located within Section 27 of, T26S, R36E approximately 7 miles southwest of the City of Jal in Lea County, New Mexico. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil (and rock) conditions
- Groundwater conditions
- Seismic site classification per IBC
- Site preparation and earthwork
- Excavation considerations

The geotechnical engineering scope of services for this project included the advancement of four test borings (B-1 to B-4) to depths approximately 150 feet and one boring (B-5) to a depth of 100 feet below existing site grades. **Please note that boring B-5 was terminated prior to proposed depth due to soil caving, after discussions with the client.** Although the original scope consists a total of fourteen soil testing samples, due to the homogeneity of soils and based on the project coordination with the client during the site exploration, only a total of three samples were collected for lab testing.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and as separate graphs in the **Exploration Results** section of this report.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project site is located within Section 27 of, T26S, R36E approximately 7 miles southwest of the City of Jal in Lea County, New Mexico. See **Site Location** for site location information.
Existing Improvements	Undeveloped ranch covered with creosote and mesquite trees. The site formerly was improved with 3 oil well production pads and a caliche/sand barrow pit.
Current Ground Cover	Site covered with sparse vegetation and mesquite trees
Existing Topography	The site slopes down towards the east.
Geology	■ Expected Geologic Conditions: o Pecos alluvium overlying Dockum Group ■ Geologic Map Details: o Unconsolidated, interlayered eolian sands and piedmont-slope deposits: ▪ Unconsolidated, interlayered eolian sands • Sands, loesses ▪ Piedmont-slope deposits • Includes deposits of higher gradient tributaries bordering major stream valleys, alluvial veneers of the piedmont slope, and alluvial fans. May locally include uppermost Pliocene deposits. ■ Underlying Upper Chinle Group, Garita Creek through Redonda Formations, undivided (Upper Triassic) ▪ Major mudstone, sandstone and minor conglomerate

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed in the project planning stage. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Project Description	One recycling and landfill facility will be constructed on a 190-acre tract of land.
Finished Floor Elevation	Elevation of deepest excavation is expected to be 50 feet below existing grade.
Below Grade Structures	Landfill

DRILLING PROCEDURES

▪ FIELD SUBSURFACE BORING INVESTIGATION WORK PLAN

Five boring locations were identified for drilling within the property. The boring program was designed to evaluate the lithology and subsurface conditions throughout the property. Terracon mobilized a sonic drilling unit to the site. However, due to drilling requirements, rock coring and/or air rotary drilling was required to advance the borings to final depth.

The drilling activities at this location was completed by a State of New Mexico licensed well driller. Oversight of the drilling program and the logging of the lithology was conducted by a field geologist.

▪ Drilling Methodology

Soil borings were performed using sonic drilling methods to the proposed maximum depth of the landfill (50 ft bgs) in accordance with ASTM D-6914/D6914M-16. The drilling rig was equipped with coring tools capable of providing a minimum borehole diameter of 6 inches with a core barrel 4 inches, 5 or 10 feet in length as drilling depth dictates. Borings B-1, B-2, B-3, and B-4 were advance to a total depth of 150 feet bgs. Boring B-5 was advanced to a depth of 100 feet bgs, due to the continual collapsing of the hole as noted above. Continuous cores were collected from boring B-2 to a depth of 150 feet bgs. Borings B-1, B-3, B-4 and B-5 were advanced from 50 to boring terminus using compressed air-rotary drilling after receiving approval from the State of New Mexico.

▪ Soil Boring Advancement

Each soil boring was advanced to a depth of 150 feet bgs, except boring B-5 which advanced to 100 feet bgs. This is over 100 feet below the proposed maximum depth of the landfill, if a landfill cell were to be located in the area of the soil boring. If a potential groundwater bearing zone (moist to saturated soils) was visible in any of the core samples, the depth was noted and the drill casing would be raised to a depth of 2 feet above the potential groundwater bearing zone. The boring would be gauged every hour for 3 hours. If no measurable amount of water had accumulated as measured with a water level meter (less than 0.01 feet) drilling would continue past this zone until either another potential groundwater bearing zone was encountered or the total depth of the boring was reached.

GEOTECHNICAL CHARACTERIZATION

Subsurface Profile

Subsurface conditions encountered at the boring locations are described on the boring logs. Stratification boundaries on the boring logs represent the approximate locations of changes in soil types; in-situ, the transition between materials may be gradual. Details for the boring locations can be found on the boring logs of this report. Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

As noted in **General Comments**, the characterization is based upon field descriptions of cores and cuttings by the field geologist, and variations in stratum are likely due to the widely spaced exploration points across the site.

Stratum	Approximate Depth to Bottom of Stratum (feet)	Material Encountered[1]	Consistency/Density
Stratum I	26 to 47	silty sand, poorly graded sand; brown	Loose to medium
Stratum II	50 to 100	silty sand, poorly graded sand, CALICHE classified as, silty sand, poorly graded sand; brown, light brown, reddish brown	Medium dense to very dense
Stratum III	>100 to 150	Sandstone, light brown, brown, tannish brown, to tan, reddish brown	Fine to medium, poorly to well Cemented

Conditions encountered at each boring location are indicated on the individual boring logs shown in the **Exploration Results** section and are attached to this report. Stratification boundaries on the boring logs represent the approximate location of changes in native soil types; in situ, the transition between materials may be gradual.

Groundwater Conditions

Groundwater was not identified in the 5 borings during boring advancement. In addition, each boring was allowed to recharge for a period of 24 hours to determine if groundwater was present. Prior to plugging each boring, the boring was gauged with a water level probe to evaluate the boring for the presence of groundwater. No measurable groundwater infiltration (greater than 0.01 feet) was present; therefore, the installation of monitoring wells was not required.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

Laboratory Permeability Tests

Terracon conducted 3 laboratory permeability tests on cored stratum samples, the results are tabulated in the following table:

Test Number	Boring Number	Sample Depth (feet)	Permeability, K (cm/sec)
1	B-1	0 to 26	$2.17x10^{-5}$
2	B-3	27 to 50	$9.46x10^{-7}$
3	B-5	0 to 50	$1.63x10^{-5}$

Laboratory Direct Shear Tests

Terracon conducted three laboratory direct shear tests on samples, the results are tabulated in the following table:

Test Number	Boring Number	Sample Depth (feet)	Strain rate, (in./min.)	Cohesion (psi)	Friction Angle (degrees)
1	B-1	0 to 26	0.003	0.35	31.9
2	B-3	27 to 50	0.002	0.01	34
3	B-5	0 to 50	0.003	3.77	29.2

GEOTECHNICAL OVERVIEW

On-site soils generally consist of fine to medium sandy soils and strongly cemented, with calcareous interbedded caliche materials in the upper approximately 7 to 100 feet of existing grades, underlain by sandstone extending to boring termination depths of 150 feet bgs. On-site subsurface soils are not expected to experience substantial volumetric changes (shrink/swell) with fluctuations in moisture content. Potential vertical rise (PVR) of on-site soils is estimated to be less than 1 inch. On-site soils are generally suitable for use as structural fill.

The 2012 International Building Code (Section 1613.3.2) seismic site classification for this site is C.

Groundwater was not encountered in any of the borings within the drilling depths at the time of boring advancements. Based on site exploration, we do not expect groundwater would impact the landfill development, provided excavation depth is kept at ~50 feet below existing grades.

The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Earthwork will include clearing and grubbing, excavations and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria as necessary to render the site in the state considered in our geotechnical engineering evaluation for landfill construction.

Site Preparation

Any topsoil or vegetation within areas to receive new fill or structures foundation footprint should be stripped and grubbed and removed. Subsequently, the exposed subgrade should be proof-rolled prior to the placement of any fill or base materials. The proof-rolling should be performed with a fully loaded, tandem-axle dump truck or other equipment providing an equivalent subgrade loading. A minimum gross weight of 20 tons is recommended for the proof-rolling equipment. The proof-rolling should consist of several overlapping passes in mutually perpendicular directions over a given area. Any soft or pumping areas should be excavated to firm ground. Excavated areas should be backfilled with properly placed and compacted fill as discussed in Section **Fill Compaction Requirements**.

Fill Material Types

The on-site subsurface materials, which are free of vegetation, debris, and rocks greater than 4 inches in maximum dimension, are generally suitable to be used for structural fill. Cemented caliche materials that look like rock are present on the project site. Caliche materials need to be crushed into sizes less than 4 inches in maximum dimension and thoroughly mixed with soils before they can be used for structural fill. Structural fill should be clean soil with a Liquid Limit (LL) of less than 35 and a Plasticity Index (PI) less than 15.

Fill Compaction Requirements

Recommendations for compaction are presented in the following table. We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.

Item	Description
General subgrade preparation to receive fill	Surface scarified to a minimum depth of 6 inches, moisture conditioned and compacted
Lift thickness	9 inches or less loose lift thickness
Compaction	At least 95% maximum standard Proctor dry density (ASTM D 698) in the range of ±2 percentage points of optimum moisture

Utilities

Care should be taken that utility trenches are properly backfilled. Backfilling should be accomplished with properly compacted engineered fill with loose lift thickness of generally 9 inches except for the first lift above the utility pipes that can be relaxed to 12 inches. Compaction should be accomplished with a hand-held compaction device inside utility trenches. Engineered fill should be compacted to at least 95% maximum standard Proctor dry density (ASTM D 698) in the range of ±2 percentage points of optimum moisture for the engineered fill.

Excavation Conditions and Construction Slopes

We understand that EDE in landfill is expected to be 50 feet below ground surface and construction of the proposed waste facility will involve mass excavation of subsurface materials. For this reason, we aim to determine the expected excavation conditions and rippability of the on-site subsurface materials within 50 feet bgs. We note that actual rippability will depend heavily on the equipment and tools used as well as the skill and experience of operators, among other factors. There is no method more effective to determine material rippability than a field production test with equipment similar or identical to that planned for use in project construction.

Caliche materials were encountered from existing grade to depths of about 7 to 100 feet bgs. Interbedded caliche layer underlain by sandstone bedrock extending to the borings termination depths of 150 feet bgs in all borings except B-5. Caliche bears a strong resemblance to rock and is therefore difficult to excavate. Based on the conditions encountered, we believe excavation of caliche may require a hoe ram, a heavy dozer equipped with a ripper, a rock saw or a jack hammer or with rock-excavation or blasting equipment. Excavation of rock, sandstone, will likely require controlled blasting.

Soils can generally be excavated by conventional scrapers and loaders. Caliche, partially weathered rock (PWR) or heavily fractured rock typically requires loosening by ripping with large dozers pulling single tooth rippers in mass excavation or blasting in confined (trench) excavation. Relatively sound, massive, rock typically requires blasting for removal in mass or trench excavation.

All excavations must comply with the applicable Federal, State, and local safety regulations and codes, and especially with the excavation standards of the Occupational Safety and Health Administration (OSHA). According to the OSHA soil classification, the on-site materials are generally classified as Type B soils. Temporary slopes of 1H:1V and permanent slopes of 3H:1V may be used. Construction site safety, including excavation safety, is the sole responsibility of the Contractor as part of its overall responsibility for the mean, methods, and sequencing of construction operations.

These descriptions are a guide to conditions generally encountered. Excavation techniques will vary based on the weathering of the materials, fracturing and jointing in the rock, and the overall stratigraphy of the feature. Actual field conditions usually display a gradual weathering progression with poorly defined and uneven boundaries between layers of different materials.

We recommend that the following definitions for rock in earthwork excavation construction be included in bid documents:

Mass Excavation:	Any material occupying an original volume of more than 1 cubic yard which cannot be excavated with a single-toothed ripper drawn by a crawler tractor having a minimum draw bar pull rating of not less than 80,000 pounds (Caterpillar D-8 or larger).
Trench Excavation:	Any material occupying an original volume of more than 1/2 cubic yard which cannot be excavated with a backhoe having a bucket curling rate of not less than 40,000 pounds, using a rock bucket and rock teeth (a John Deere 790 or larger).

In applicable areas, we recommend that soils which can be excavated with conventional equipment be removed first. Then, if necessary, heavy-duty or oversized equipment can be used to excavate cemented caliche by ripping. Blasting should only be conducted where materials cannot be excavated by other trench excavation techniques such as ripping.

Grading and Drainage

All grades must provide effective drainage away from structures during and after construction and should be maintained throughout the life of the structures. Water retained next to structures can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from structures

Exposed ground should be sloped and maintained at a minimum 5 percent away from structures for at least 10 feet beyond the perimeter of the structures. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After construction and landscaping, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted as necessary as part of the structure's maintenance program. Where paving or flatwork abuts the structure a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations, for the landfill structures and buildings, are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of floor slabs. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over, or adjacent to, construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted, prior to floor slab construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local, and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation and top soil, proof-rolling and mitigation of areas delineated by the proof-roll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked as necessary until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. One density and water content test for every 50 linear feet of compacted utility trench backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. In the event that unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

SEISMIC CONSIDERATIONS

Description	Value
2012 International Building Code Site Classification	C [1, 2]
Site Latitude	32.011149°
Site Longitude	- 103.2572°
S_{DS} Spectral Acceleration for a Short Period [3]	0.164g
S_{D1} Spectral Acceleration for a 1-Second Period [3]	0.053g

1. Seismic site classification in general accordance with the *2012 International Building Code*, which refers to ASCE 7-10.
2. The 2012 International Building Code (IBC) uses a site profile extending to a depth of 100 feet for seismic site classification. Borings at this site were extended to a maximum depth of 165 feet.
3. These values were obtained using online seismic design maps and tools provided by the USGS (http://earthquake.usgs.gov/hazards/designmaps/).

GENERAL COMMENTS

As the project progresses, we address assumptions by incorporating information provided by the design team, if any. Revised project information that reflects actual conditions important to our services is reflected in the final report. The design team should collaborate with Terracon to confirm these assumptions and to prepare the final design plans and specifications. This facilitates the incorporation of our opinions related to implementation of our geotechnical recommendations. Any information conveyed prior to the final report is for informational purposes only and should not be considered or used for decision-making purposes.

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in the final report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our scope of services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third party beneficiaries intended. Any third party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Borings

As client requested, Terracon conducted a total of five (5) soil borings as tabulated in the following table:

Boring Location	Number of Borings	Boring Depth (feet)[1]	Drilling Footage (feet)[1]
Beckham Ranch Landfill	B-1 through B-4	150	600
Beckham Ranch Landfill	1 (B-5)	100	100

[1] The borings at the proposed center were extended to auger refusal/rock depths, and then rock coring was conducted.

Boring Layout and Elevations: Location of soil borings are provided on our **Site Location and Exploration Plans**. Location is established in the field by Terracon's exploration team using a measuring wheel/tape and/or a hand-held GPS unit to establish boring location with reference to known points. The accuracy of the exploration points is usually within 10 feet of the noted location.

Subsurface Exploration Procedures: All borings were advanced using sonic drilling methods to the minimum depth of 50 feet bgs in accordance with ASTM D-6914/D6914M-16. Boring B-5 was advanced using sonic drilling methods to a depth of 150 feet bgs. The sonic drilling rig was equipped with coring tools capable of providing a minimum borehole diameter of 6 inches with a core barrel 4 inches, 5 or 10 feet in length as drilling depth dictates. The drill casing and coring barrel was advanced into the subsurface to collect an undisturbed soil core. Prior to placing an additional core casing section onto the drill stem, the soil core was removed from the core barrel and the undisturbed soil core was extracted, characterized for geological lithology, and logged. The empty coring barrel was replaced inside the drill casing, and the drilling continued. This process was continued until either a boring depth of 50 feet bgs (150 feet bgs for B-5) was achieved or until groundwater was encountered. Compressed air-rotary drillingand plain water was utilized to remove the cores and/or cuttings and speed up the operation further, depending on subsurface conditions.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a geotechnical engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs include visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the geotechnical engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

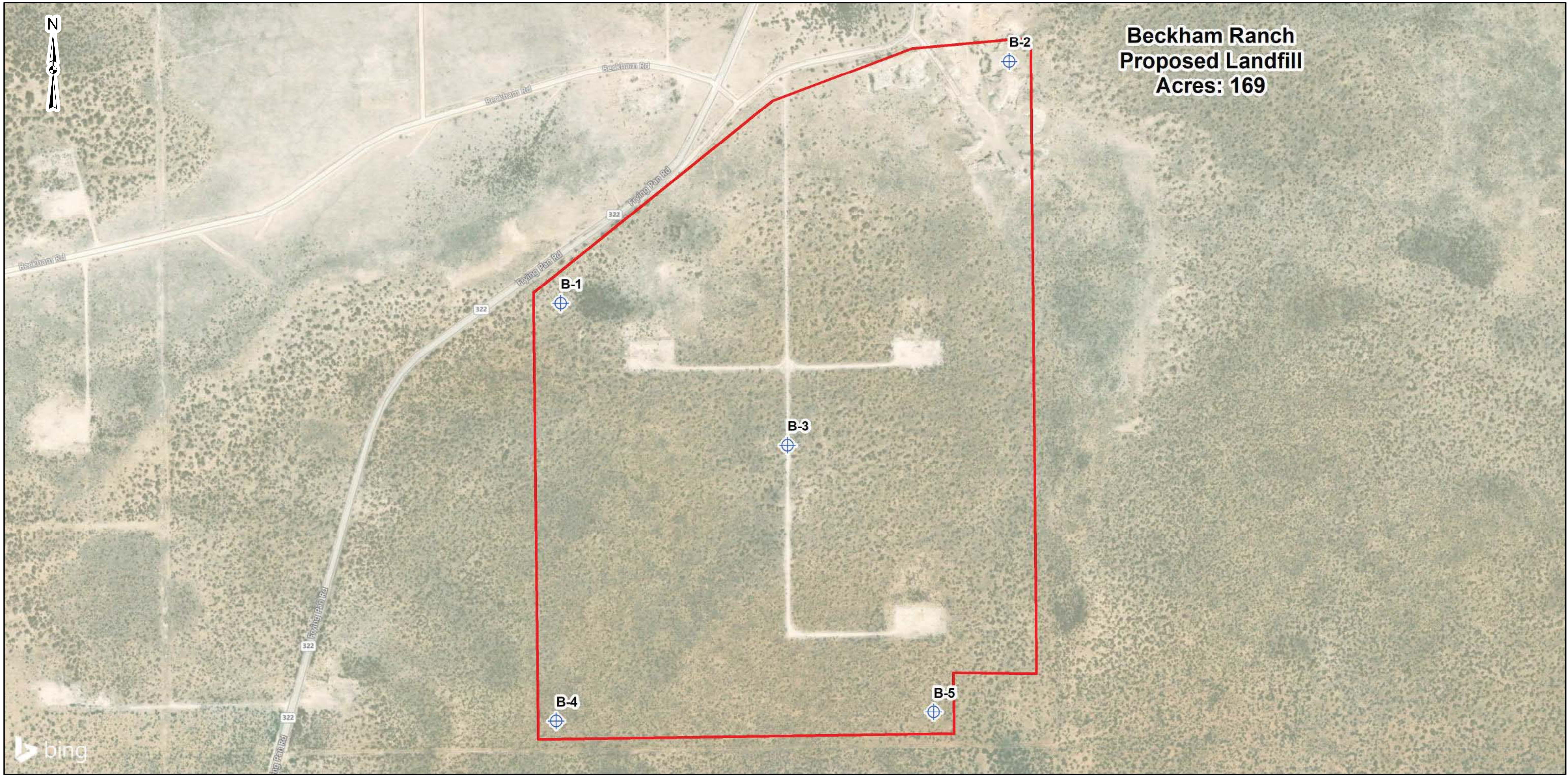
The project engineer reviews the field data and assigns various laboratory tests to better understand the engineering properties of the various soil and rock strata as necessary for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods are applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- Moisture Content (ASTM D854)
- Particle Size (ASTM D1140, D422)
- Atterberg Limits (ASTM D4318)
- Laboratory Compaction (ASTM D698)
- ASTM D5084 Standard Test Method for Permeability Tests
- Direct Sheer of Soil (ASTM D3080)

The laboratory testing program often includes examination of soil samples by an engineer. Based on the material's texture and plasticity, we describe and classify the soil samples in accordance with the Unified Soil Classification System (USCS).

Rock classification is conducted using locally accepted practices for engineering purposes; petrographic analysis may reveal other rock types. Rock core samples typically provide an improved specimen for this classification. Boring log rock classification is determined using the Description of Rock Properties.

SITE LOCATION AND EXPLORATION PLANS



Proposed Landfill

⊕ Soil Boring (B)

🟥 Proposed Landfill

Notes:
-Exhibit is for general location only, is not indended for construction purposes, and should not be used seperatedly from original report.

Feet
0 375 750 1,500

Fractional Scale: 1:5,814

DATA SOURCES:
Bing Maps - Aerial Imagery, World Street Map

Project No.:	A4187129
Date:	Jan 2019
Drawn By:	SW
Reviewed By:	DC

10400 Highway 191 Midland, TX 79707
PH. (432) 684-9600 terracon.com

Proposed Landfill Map

Trammco Environmental Solutions
Beckham Ranch - Proposed Landfill
Project Address
Lea County, New Mexico
GPS: 32.011219°, -103.257025°

Exhibit

1

C:\Users\swagner\Desktop\GIS_Midland_Projects\LSI GIS Projects\A41870##_NM_BeckhamRanch_GIS\A41870##_NM_BeckhamRanch_Ex2_SampleLocMap.mxd

EXPLORATION RESULTS

BORING LOG NO. B-1

PROJECT: **Beckham Ranch Landfill**

CLIENT: **Trammco Environmental Solutions LLC**
Fermandina Beach, Florida

SITE: **Section 27 of, T26S, R36E**
Jal, Lea County, New Mexico

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 32.0133° Longitude: -103.2615° Approximate Surface Elev.: 2903 (Ft.) +/- DEPTH / ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
▨	**CLAYEY SAND (SC)**, brown to light brown, dry, -Loose to very dense						
		5					
		10		✋	3	29-15-14	48
		15					
		20					
	26.0 / 2877+/-	25					
▨	**POORLY GRADED SAND WITH SILT, with interbedded CALICHE (SP-SM)**, reddish brown to light brown, dry, -Medium dense to very dense						
		30					
		35					
		40					
		45					
		50					
		55					
		60					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Sonic/Coring

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered during drilling

Dry after 24 hours of drilling

Terracon
10400 State Highway 191
Midland, TX

Boring Started: 12-03-2018	Boring Completed: 12-11-2018
Drill Rig: CME 75	Driller: Alec
Project No.: A4187129	

BORING LOG NO. B-1

PROJECT: Beckham Ranch Landfill

CLIENT: Trammco Environmental Solutions LLC
Fermandina Beach, Florida

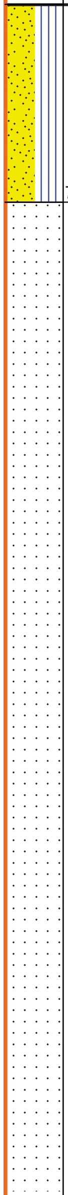
SITE: **Section 27 of, T26S, R36E**
Jal, Lea County, New Mexico

LOCATION See Exploration Plan

Latitude: 32.0133° Longitude: -103.2615°

Approximate Surface Elev.: 2903 (Ft.) +/-

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		POORLY GRADED SAND WITH SILT, with interbedded CALICHE (SP-SM), reddish brown to light brown, dry, -Medium dense to very dense *(continued)*		65					
	70.0		2833+/-	70					
		SANDSTONE, reddish brown, dry, -Moderately to highly weathered		75 80 85 90 95 100 105 110 115 120					



Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Sonic/Coring

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered during drilling

Dry after 24 hours of drilling

Terracon
10400 State Highway 191
Midland, TX

Boring Started: 12-03-2018	Boring Completed: 12-11-2018
Drill Rig: CME 75	Driller: Alec
Project No.: A4187129	

BORING LOG NO. B-1

PROJECT: Beckham Ranch Landfill

CLIENT: Trammco Environmental Solutions LLC
Fermandina Beach, Florida

SITE: Section 27 of, T26S, R36E
Jal, Lea County, New Mexico

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 32.0133° Longitude: -103.2615° Approximate Surface Elev.: 2903 (Ft.) +/- DEPTH / ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
· · ·	**SANDSTONE**, reddish brown, dry, -Moderately to highly weathered *(continued)*	125 130 135 140 145					
	150.0 / 2753+/-	150					
	Boring Terminated at 150 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Sonic/Coring

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered during drilling

Dry after 24 hours of drilling

Terracon
10400 State Highway 191
Midland, TX

Boring Started: 12-03-2018	Boring Completed: 12-11-2018
Drill Rig: CME 75	Driller: Alec
Project No.: A4187129	

BORING LOG NO. B-2

PROJECT: **Beckham Ranch Landfill**

CLIENT: **Trammco Environmental Solutions LLC**
Fermandina Beach, Florida

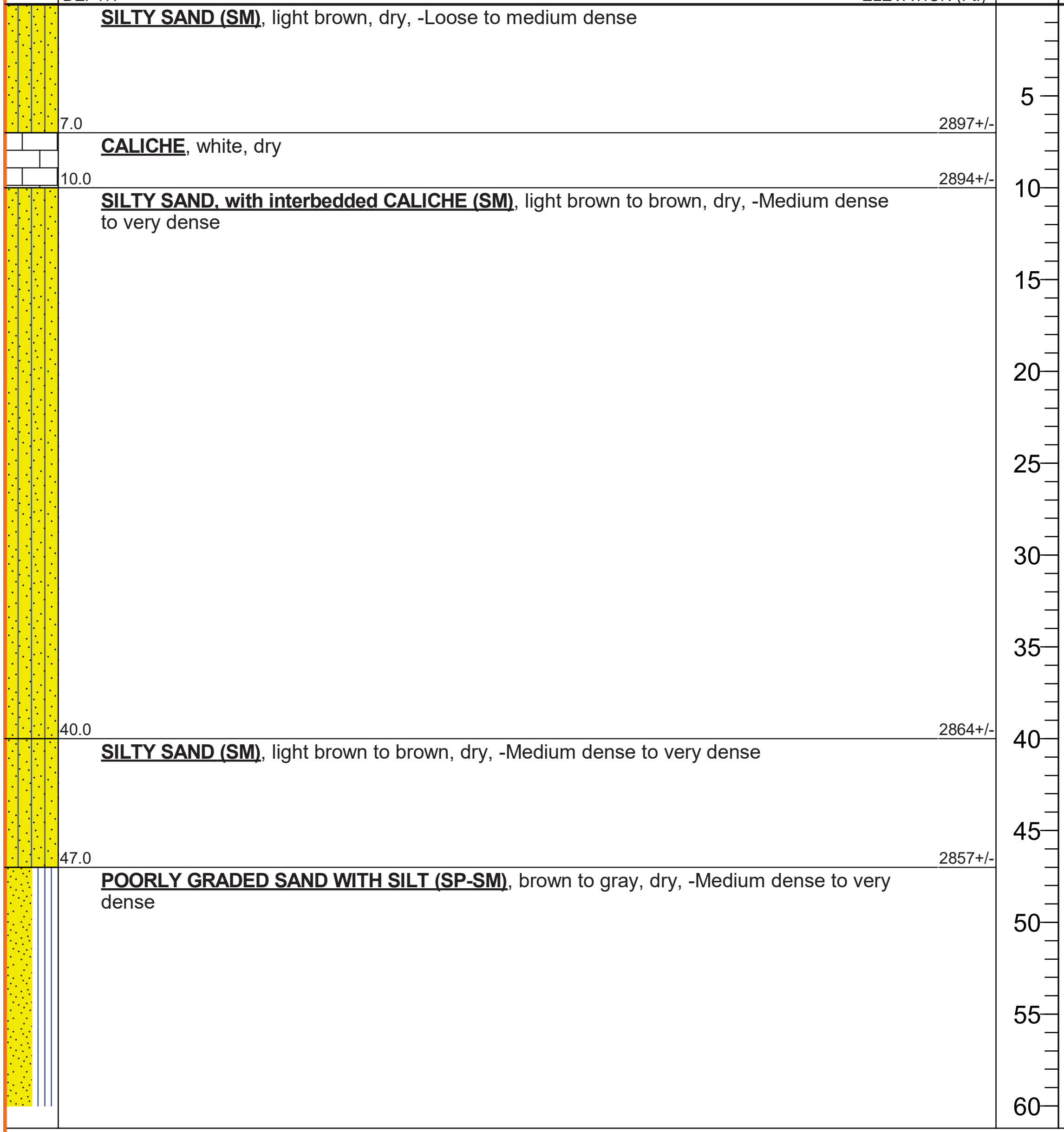
SITE: **Section 27 of, T26S, R36E**
Jal, Lea County, New Mexico

LOCATION See Exploration Plan

Latitude: 32.0166° Longitude: -103.2531°

Approximate Surface Elev.: 2904 (Ft.) +/-

GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		SILTY SAND (SM), light brown, dry, -Loose to medium dense							
	7.0		2897+/-						
		CALICHE, white, dry							
	10.0		2894+/-						
		SILTY SAND, with interbedded CALICHE (SM), light brown to brown, dry, -Medium dense to very dense							
	40.0		2864+/-						
		SILTY SAND (SM), light brown to brown, dry, -Medium dense to very dense							
	47.0		2857+/-						
		POORLY GRADED SAND WITH SILT (SP-SM), brown to gray, dry, -Medium dense to very dense							



Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Sonic/Coring

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered during drilling

Dry after 24 hours of drilling

Terracon
10400 State Highway 191
Midland, TX

Boring Started: 11-30-2018	Boring Completed: 11-30-2018
Drill Rig: CME 75	Driller: Alec
Project No.: A4187129	

BORING LOG NO. B-2

PROJECT: Beckham Ranch Landfill

CLIENT: Trammco Environmental Solutions LLC
Fermandina Beach, Florida

SITE: Section 27 of, T26S, R36E
Jal, Lea County, New Mexico

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 32.0166° Longitude: -103.2531° Approximate Surface Elev.: 2904 (Ft.) +/- DEPTH / ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	POORLY GRADED SAND WITH SILT (SP-SM), brown to gray, dry, -Medium dense to very dense *(continued)*	65 70 75 80 85 90 95					
	100.0 / 2804+/-	100					
	SANDSTONE, reddish brown, dry, -Moderately to highly weathered	105 110 115 120					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Sonic/Coring

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered during drilling

Dry after 24 hours of drilling

Terracon
10400 State Highway 191
Midland, TX

Boring Started: 11-30-2018	Boring Completed: 11-30-2018
Drill Rig: CME 75	Driller: Alec
Project No.: A4187129	

BORING LOG NO. B-2

PROJECT: Beckham Ranch Landfill

CLIENT: Trammco Environmental Solutions LLC
Fermandina Beach, Florida

SITE: Section 27 of, T26S, R36E
Jal, Lea County, New Mexico

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 32.0166° Longitude: -103.2531° Approximate Surface Elev.: 2904 (Ft.) +/- DEPTH / ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDSTONE, reddish brown, dry, -Moderately to highly weathered *(continued)*	125 130 135 140 145					
	150.0 2754+/-	150					
	Boring Terminated at 150 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Sonic/Coring

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered during drilling

Dry after 24 hours of drilling

Terracon
10400 State Highway 191
Midland, TX

Boring Started: 11-30-2018	Boring Completed: 11-30-2018
Drill Rig: CME 75	Driller: Alec
Project No.: A4187129	

BORING LOG NO. B-3

PROJECT: **Beckham Ranch Landfill**

CLIENT: **Trammco Environmental Solutions LLC**
Fermandina Beach, Florida

SITE: **Section 27 of, T26S, R36E**
Jal, Lea County, New Mexico

LOCATION See Exploration Plan

Latitude: 32.0111° Longitude: -103.2572°

Approximate Surface Elev.: 2900 (Ft.) +/-

DEPTH	Material Description	ELEVATION (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
8.0	**SILTY SAND (SM)**, light brown, dry, -Loose to medium dense	2892+/-					
10.0	**CALICHE**, white, dry	2890+/-					
27.0	**SILTY SAND, with interbedded CALICHE (SM)**, light brown to brown, dry, -Loose to medium dense	2873+/-					
50.0	**CLAYEY SAND (SC)**, brown, dry, -Medium dense to very dense	2850+/-		✋	11	27-18-9	35
	SANDSTONE, brown to reddish brown, dry, -Moderately to highly weathered						

DEPTH (Ft.): 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Sonic/Coring

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered during drilling

Dry after 24 hours of drilling

Terracon
10400 State Highway 191
Midland, TX

Boring Started: 11-29-2018	Boring Completed: 12-06-2018
Drill Rig: CME 75	Driller: Alec
Project No.: A4187129	

BORING LOG NO. B-3

PROJECT: **Beckham Ranch Landfill**

CLIENT: **Trammco Environmental Solutions LLC**
Fermandina Beach, Florida

SITE: **Section 27 of, T26S, R36E**
Jal, Lea County, New Mexico

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 32.0111° Longitude: -103.2572° Approximate Surface Elev.: 2900 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDSTONE, brown to reddish brown, dry, -Moderately to highly weathered *(continued)*	65 70 75 80 85 90 95 100 105 110 115 120					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Sonic/Coring

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered during drilling

Dry after 24 hours of drilling

Terracon
10400 State Highway 191
Midland, TX

Boring Started: 11-29-2018	Boring Completed: 12-06-2018
Drill Rig: CME 75	Driller: Alec
Project No.: A4187129	

BORING LOG NO. B-3

PROJECT: Beckham Ranch Landfill

CLIENT: Trammco Environmental Solutions LLC
Fermandina Beach, Florida

SITE: **Section 27 of, T26S, R36E**
Jal, Lea County, New Mexico

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 32.0111° Longitude: -103.2572° Approximate Surface Elev.: 2900 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDSTONE, brown to reddish brown, dry, -Moderately to highly weathered *(continued)*	125 130 135 140 145					
	150.0 2750+/-	150					
	Boring Terminated at 150 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Sonic/Coring

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered during drilling

Dry after 24 hours of drilling

Terracon
10400 State Highway 191
Midland, TX

Boring Started: 11-29-2018	Boring Completed: 12-06-2018
Drill Rig: CME 75	Driller: Alec
Project No.: A4187129	

BORING LOG NO. B-4

PROJECT: Beckham Ranch Landfill

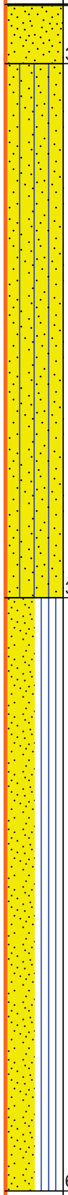
CLIENT: Trammco Environmental Solutions LLC
Fermandina Beach, Florida

SITE: **Section 27 of, T26S, R36E**
Jal, Lea County, New Mexico

LOCATION See Exploration Plan

Latitude: 32.007° Longitude: -103.2615°

Approximate Surface Elev.: 2902 (Ft.) +/-



GRAPHIC LOG	DEPTH		ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
		POORLY GRADED SAND (SP), dark brown, dry, -Loose							
	3.0		2899+/-						
		SILTY SAND, with interbedded CALICHE (SM), light brown to brown, dry, -Loose to medium dense		5 10 15 20 25					
	30.0		2872+/-	30					
		POORLY GRADED SAND WITH SILT (SP-SM), light brown to gray, dry, -Medium dense to very dense		35 40 45 50 55					
	60.0		2842+/-	60					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Sonic/Coring

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered during drilling

Dry after 24 hours of drilling

Terracon
10400 State Highway 191
Midland, TX

Boring Started: 12-03-2018	Boring Completed: 12-07-2018
Drill Rig: CME 75	Driller: Alec
Project No.: A4187129	

BORING LOG NO. B-4

PROJECT: **Beckham Ranch Landfill**

CLIENT: **Trammco Environmental Solutions LLC**
Fermandina Beach, Florida

SITE: **Section 27 of, T26S, R36E**
Jal, Lea County, New Mexico

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 32.007° Longitude: -103.2615° Approximate Surface Elev.: 2902 (Ft.) +/- DEPTH ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDSTONE, light brown to reddish brown, dry, -Moderately to highly weathered						
		65					
		70					
		75					
		80					
		85					
		90					
		95					
		100					
		105					
		110					
		115					
		120					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Sonic/Coring

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered during drilling

Dry after 24 hours of drilling

Terracon
10400 State Highway 191
Midland, TX

Boring Started: 12-03-2018	Boring Completed: 12-07-2018
Drill Rig: CME 75	Driller: Alec
Project No.: A4187129	

BORING LOG NO. B-4

PROJECT: **Beckham Ranch Landfill**

CLIENT: **Trammco Environmental Solutions LLC**
Fermandina Beach, Florida

SITE: **Section 27 of, T26S, R36E**
Jal, Lea County, New Mexico

GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 32.007° Longitude: -103.2615° Approximate Surface Elev.: 2902 (Ft.) +/- DEPTH / ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SANDSTONE, light brown to reddish brown, dry, -Moderately to highly weathered *(continued)*	125 130 135 140 145					
	150.0 / 2752+/-	150					
	Boring Terminated at 150 Feet						

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Sonic/Coring

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered during drilling

Dry after 24 hours of drilling

Terracon
10400 State Highway 191
Midland, TX

Boring Started: 12-03-2018	Boring Completed: 12-07-2018
Drill Rig: CME 75	Driller: Alec
Project No.: A4187129	

BORING LOG NO. B-5

PROJECT: Beckham Ranch Landfill

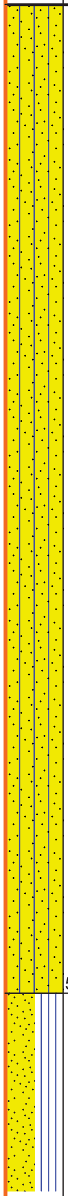
CLIENT: Trammco Environmental Solutions LLC
Fermandina Beach, Florida

SITE: Section 27 of, T26S, R36E
Jal, Lea County, New Mexico

LOCATION See Exploration Plan

Latitude: 32.007° Longitude: -103.2531°

Approximate Surface Elev.: 2898 (Ft.) +/-



GRAPHIC LOG	DEPTH / ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	SILTY SAND, with interbedded CALICHE (SM), light brown to brown, dry, -Loose to very dense						
		25		✋	5	20-17-3	29
	50.0 / 2848+/-	50					
	POORLY GRADED SAND WITH SILT (SP-SM), light brown to gray, dry, -Medium dense to very dense						
		60					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Sonic/Coring

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered during drilling

Dry after 24 hours of drilling

Terracon
10400 State Highway 191
Midland, TX

Boring Started: 12-01-2018	Boring Completed: 12-12-2018
Drill Rig: CME 75	Driller: Alec
Project No.: A4187129	

BORING LOG NO. B-5

PROJECT: **Beckham Ranch Landfill**

CLIENT: **Trammco Environmental Solutions LLC**
Fermandina Beach, Florida

SITE: **Section 27 of, T26S, R36E**
Jal, Lea County, New Mexico

LOCATION See Exploration Plan

Latitude: 32.007° Longitude: -103.2531°

Approximate Surface Elev.: 2898 (Ft.) +/-

GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
	POORLY GRADED SAND WITH SILT (SP-SM), light brown to gray, dry, -Medium dense to very dense *(continued)*		65 70 75 80 85 90 95					
	100.0	2798+/-	100					
	Boring Terminated at 100 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Sonic/Coring

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No groundwater encountered during drilling

Dry after 24 hours of drilling

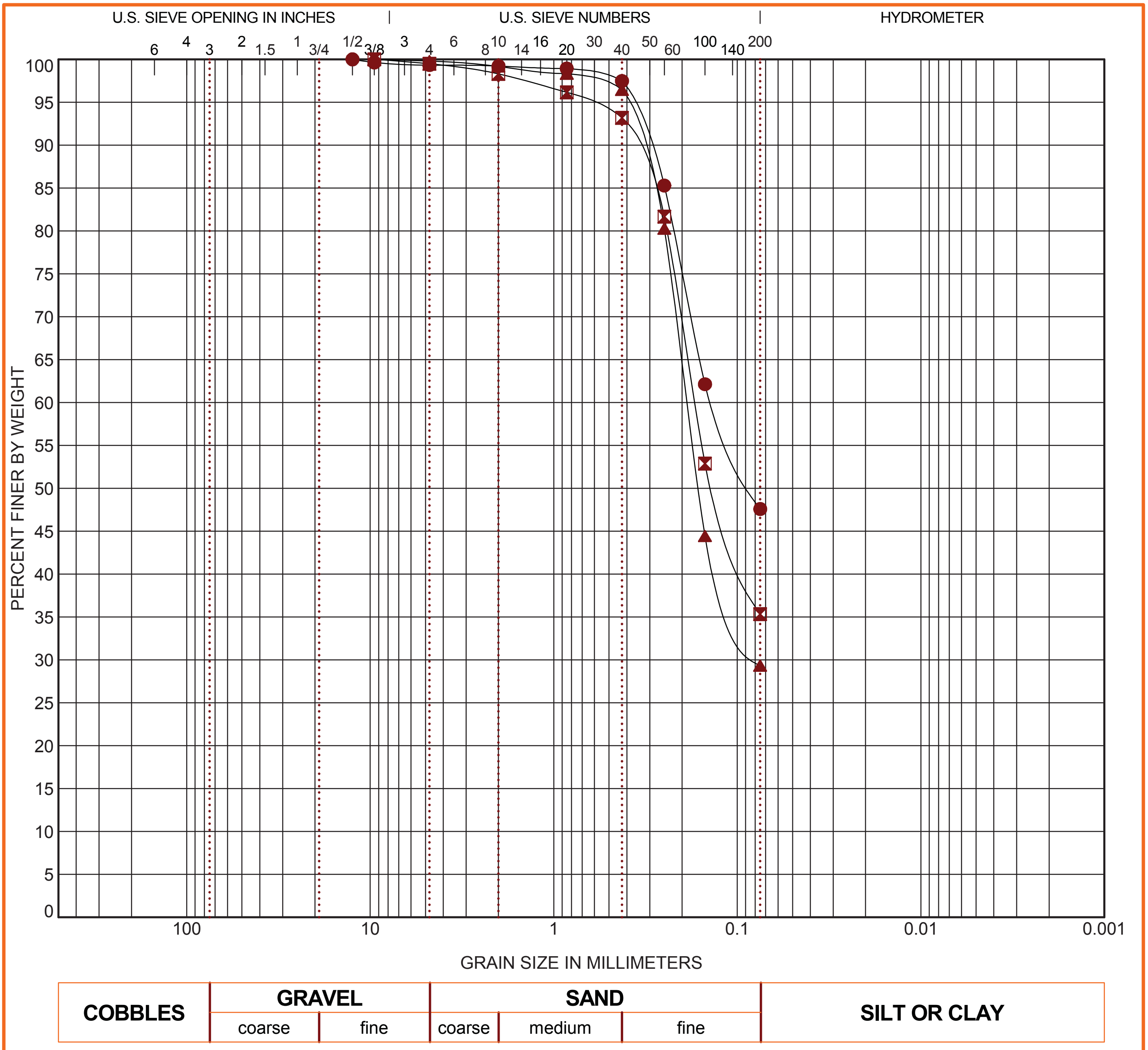
Terracon
10400 State Highway 191
Midland, TX

Boring Started: 12-01-2018	Boring Completed: 12-12-2018
Drill Rig: CME 75	Driller: Alec
Project No.: A4187129	

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL A4187129- BECKHAM SITE.GPJ MODELLAYER.GPJ 5/6/19

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-1	0 - 26	CLAYEY SAND (SC)	3	29	15	14		
☒	B-3	27 - 50	CLAYEY SAND (SC)	11	27	18	9		
▲	B-5	0 - 50	SILTY SAND (SM)	5	20	17	3		

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-1	0 - 26	12.5	0.136			0.7	51.8		47.6	
☒	B-3	27 - 50	9.5	0.17			0.5	64.2		35.3	
▲	B-5	0 - 50	9.5	0.187	0.077		0.2	70.5		29.3	

PROJECT: Beckham Ranch Landfill

SITE: Section 27, T26S, R36E
Jal, Lea County, New Mexico

Terracon
10400 State Highway 191
Midland, TX

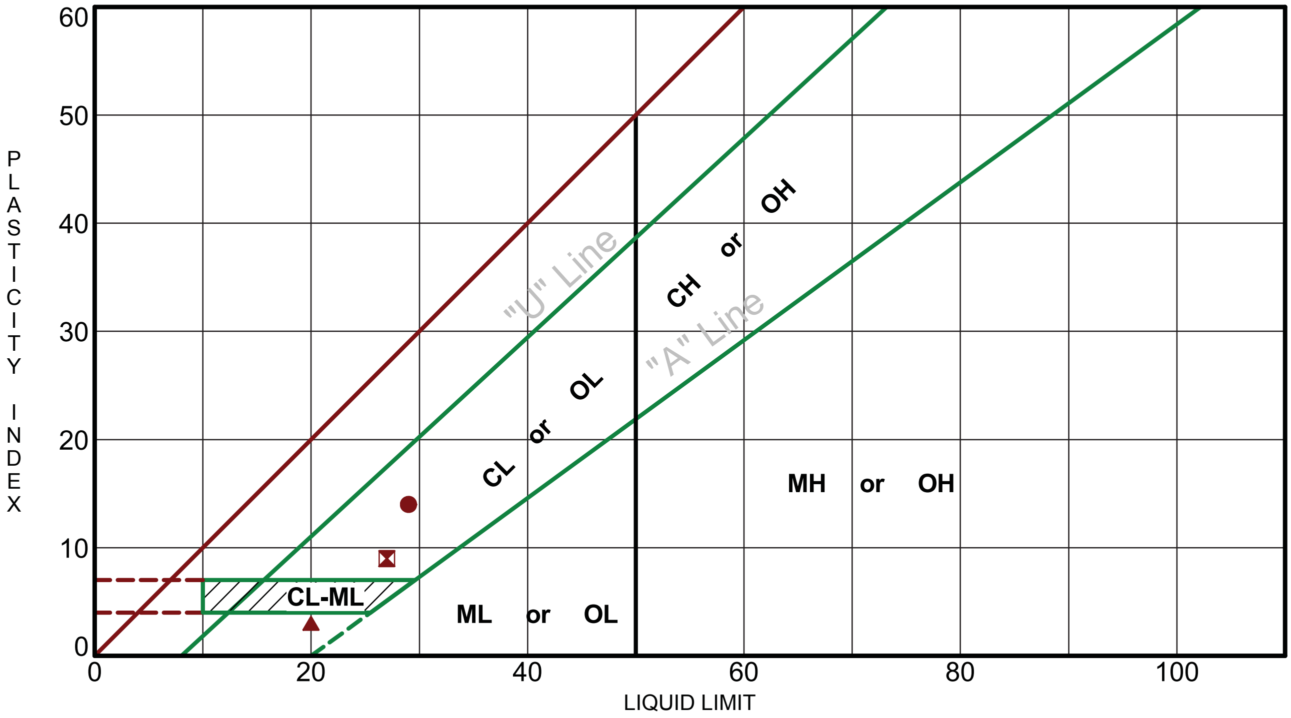
PROJECT NUMBER: A4187129

CLIENT: Trammco Environmental Solutions LLC
Fernandina Beach, Florida

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 A4187129- BECKHAM SITE.GPJ TERRACON_DATATEMPLATE.GDT 1/16/19

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth	LL	PL	PI	Fines	USCS	Description
●	B-1	0 - 26	29	15	14	48	SC	CLAYEY SAND
☒	B-3	27 - 50	27	18	9	35	SC	CLAYEY SAND
▲	B-5	0 - 50	20	17	3	29	SM	SILTY SAND

PROJECT: Beckham Ranch Landfill

SITE: Section 27, T26S, R36E
Jal, Lea County, New Mexico

Terracon
10400 State Highway 191
Midland, TX

PROJECT NUMBER: A4187129

CLIENT: Trammco Environmental Solutions LLC
Fermandina Beach, Florida

HYDRAULIC CONDUCTIVITY DETERMINATION
FLEXIBLE WALL PERMEAMETER - CONSTANT VOLUME
(Mercury Permometer Test)

Project : Beckham and McCloy Landfill
Date: 12/21/2018 Panel Number : P-1
Project No. : A4187129 Permometer Data

Boring No.:	B-1	a_p =	0.031416 cm^2		**Set Mercury to Pipet Rp at beginning**	Equilibrium	1.6	cm^3
Sample:	composite	a_a =	0.767120 cm^2			Pipet **Rp**	**16.8**	cm^3
Depth (ft):	0.0-26.0	M_1 =	0.030180	C =	0.0004288	Annulus **Ra**	1.0	cm^3
Other Location:	Beckham Site	M_2 =	1.040953	T =	0.0658646			

Material Description : light brown sandy clay

SAMPLE DATA

Wet Wt. sample + ring or tare :			568.83	g
Tare or ring Wt. :			0.0	g
Wet Wt: of Sample :			568.83	g
Diameter :	2.80	in	7.11	cm^2
Length :	2.80	in	7.11	cm
Area:	6.16	in^2	39.73	cm^2
Volume :	17.24	in^3	282.53	cm^3
Unit Wt.(wet):	**125.63**	pcf	**2.01**	g/cm$^{\wedge3}$
Unit Wt.(dry):	**109.91**	pcf	**1.76**	g/cm$^{\wedge3}$

	Before Test		After Test
Tare No.:	101	Tare No.:	N/A
Wet Wt.+tare:	114.30	Wet Wt.+tare:	581.29
Dry Wt.+tare:	100.00	Dry Wt.+tare:	486.00
Tare Wt:	0.00	Tare Wt:	0.00
Dry Wt.:	100	Dry Wt.:	486
Water Wt.:	14.3	Water Wt.:	95.29
% moist.:	**14.3**	% moist.:	**19.6**

Assumed Specific Gravity: **2.70** Max Dry Density(pcf) = 115.7 OMC = 12.3
% of max = 95.0 +/- OMC = 2.00
Calculated % saturation: 99.22 Void ratio (e) = **0.53** Porosity (n)= **0.35**

Test Pressures During Hydraulic Conductivity Test

Cell Pressure (psi) = 55.00 Back Pressure (psi) = 50.00 Confining Pressure = 5.00 psi

Note: The above value is Effective Confining Pressure

TEST READINGS

Z_1(Mercury Height Difference @ t_1): 15.8 cm Hydraulic Gradient = 28.00

Date	elapsed t (seconds)	Z (pipet @ t)	ΔZp (cm)	temp (deg C)	α (temp corr)	k (cm/sec)	k (ft./day)	Reset = *
1/3/2019	2	15.4	1.382666	21	0.977	2.00E-05	5.67E-02	
1/3/2019	4	14	2.782666	21	0.977	2.12E-05	6.01E-02	
1/3/2019	6	12.5	4.282666	21	0.977	2.31E-05	6.56E-02	
1/3/2019	8	11.5	5.282666	21	0.977	2.24E-05	6.35E-02	

SUMMARY

ka = 2.17E-05 cm/sec Acceptance criteria = 50 %

ki			Vm	
k1 =	2.00E-05	cm/sec	7.8	%
k2 =	2.12E-05	cm/sec	2.2	%
k3 =	2.31E-05	cm/sec	6.7	%
k4 =	2.24E-05	cm/sec	3.3	%

$$Vm = \frac{|ka-ki|}{ka} \times 100$$

Hydraulic conductivity	k =	**2.17E-05**	cm/sec	**6.15E-02**	ft/day
Void Ratio	e =	**0.53**			
Porosity	n =	**0.35**			
Bulk Density	γ =	**2.01**	g/cm^3	**125.6**	pcf
Water Content	W =	**0.25**	cm^3/cm^3	(at 20 deg C)	
Intrinsic Permeability	k_{int} =	**2.22E-10**	cm^2	(at 20 deg C)	

HYDRAULIC CONDUCTIVITY DETERMINATION
FLEXIBLE WALL PERMEAMETER - CONSTANT VOLUME
(Mercury Permometer Test)

Project : Beckham and McCloy Landfill

Date: 12/21/2018 Panel Number : P-1

Project No. : A4187129

Permometer Data

Boring No.: B-3	a_p =	0.031416	cm^2	Set Mercury to Pipet Rp at beginning		Equilibrium	1.6 cm^3
Sample: composite	a_a =	0.767120	cm^2			Pipet **Rp**	**16.8** cm^3
Depth (ft): 27.0-50.0	M_1 =	0.030180		C =	0.0004288	Annulus **Ra**	1.0 cm^3
Other Location: Beckham Site	M_2 =	1.040953		T =	0.0658646		

Material Description : light reddish brown sandy silt

SAMPLE DATA

Wet Wt. sample + ring or tare : 566.51 g

Tare or ring Wt. : 0.0 g

Wet Wt: of Sample : 566.51 g

Diameter :	2.80	in	7.11	cm^2
Length :	2.80	in	7.11	cm
Area:	6.16	in^2	39.73	cm^2
Volume :	17.24	in^3	282.53	cm^3
Unit Wt.(wet):	**125.12**	pcf	**2.01**	g/cm^3
Unit Wt.(dry):	**106.30**	pcf	**1.70**	g/cm^3

Before Test		After Test	
Tare No.:	102	Tare No.:	N/A
Wet Wt.+tare:	117.70	Wet Wt.+tare:	573.66
Dry Wt.+tare:	100.00	Dry Wt.+tare:	472.66
Tare Wt:	0.00	Tare Wt:	0.00
Dry Wt.:	100	Dry Wt.:	472.66
Water Wt.:	17.7	Water Wt.:	101
% moist.:	**17.7**	% moist.:	**21.4**

Assumed Specific Gravity: **2.70** Max Dry Density(pcf) = 111.9 OMC = 15.7

% of max = 95.0 +/- OMC = 2.00

Calculated % saturation: 98.51 Void ratio (e) = **0.59** Porosity (n)= **0.37**

Test Pressures During Hydraulic Conductivity Test

Cell Pressure (psi) = 55.00 Back Pressure (psi) = 50.00 Confining Pressure = 5.00 psi

Note: The above value is Effective Confining Pressure

TEST READINGS

Z_1(Mercury Height Difference @ t_1): 15.8 cm Hydraulic Gradient = 28.00

Date	elapsed t (seconds)	Z (pipet @ t)	ΔZp (cm)	temp (deg C)	α (temp corr)	k (cm/sec)	k (ft./day)
1/3/2019	10	16.5	0.282666	21	0.977	7.87E-07	2.23E-03
1/3/2019	20	16.1	0.682666	21	0.977	9.63E-07	2.73E-03
1/3/2019	30	15.7	1.082666	21	0.977	1.03E-06	2.93E-03
1/3/2019	40	15.4	1.382666	21	0.977	1.00E-06	2.83E-03

Reset = *

SUMMARY

ka = 9.46E-07 cm/sec Acceptance criteria = 50 %

ki			Vm	
k1 =	7.87E-07	cm/sec	16.8	%
k2 =	9.63E-07	cm/sec	1.9	%
k3 =	1.03E-06	cm/sec	9.2	%
k4 =	1.00E-06	cm/sec	5.7	%

$$Vm = \frac{|ka-ki|}{ka} \times 100$$

Hydraulic conductivity	k =	**9.46E-07**	cm/sec	**2.68E-03**	ft/day
Void Ratio	e =	**0.59**			
Porosity	n =	**0.37**			
Bulk Density	γ =	**2.01**	g/cm^3	**125.1**	pcf
Water Content	W =	**0.30**	cm^3/cm^3	(at 20 deg C)	
Intrinsic Permeability	k_{int} =	**9.69E-12**	cm^2	(at 20 deg C)	

Terracon

HYDRAULIC CONDUCTIVITY DETERMINATION
FLEXIBLE WALL PERMEAMETER - CONSTANT VOLUME
(Mercury Permometer Test)

Project : Beckham and McCloy Landfill
Date: 12/21/2018 Panel Number : P-1
Project No. : A4187129 Permometer Data

Boring No.:	B-5	a_p =	0.031416 cm^2		**Set Mercury to Pipet Rp at beginning**	Equilibrium	1.6	cm^3
Sample:	composite	a_a =	0.767120 cm^2			Pipet **Rp**	**16.8**	cm^3
Depth (ft):	0.0-50.0	M_1 =	0.030180	C = 0.0004288		Annulus **Ra**	1.0	cm^3
Other Location:	Beckham Site	M_2 =	1.040953	T = 0.0658646				

Material Description : light brown sandy silt

SAMPLE DATA

Wet Wt. sample + ring or tare :			587.33	g
Tare or ring Wt. :			0.0	g
Wet Wt: of Sample :			587.33	g
Diameter :	2.80	in	7.11	cm^2
Length :	2.80	in	7.11	cm
Area:	6.16	in^2	39.73	cm^2
Volume :	17.24	in^3	282.53	cm^3
Unit Wt.(wet):	**129.72**	pcf	**2.08**	g/cm$^{\wedge 3}$
Unit Wt.(dry):	**114.19**	pcf	**1.83**	g/cm$^{\wedge 3}$

Before Test		After Test	
Tare No.:	103	Tare No.:	N/A
Wet Wt.+tare:	113.60	Wet Wt.+tare:	594.70
Dry Wt.+tare:	100.00	Dry Wt.+tare:	506.48
Tare Wt:	0.00	Tare Wt:	0.00
Dry Wt.:	100	Dry Wt.:	506.48
Water Wt.:	13.6	Water Wt.:	88.22
% moist.:	**13.6**	% moist.:	**17.4**

Assumed Specific Gravity: **2.70** Max Dry Density(pcf) = 120.2 OMC = 11.6
% of max = 95.0 +/- OMC = 2.00
Calculated % saturation: 98.77 Void ratio (e) = **0.48** Porosity (n)= **0.32**

Test Pressures During Hydraulic Conductivity Test

Cell Pressure (psi) = 55.00 Back Pressure (psi) = 50.00 Confining Pressure = 5.00 psi

Note: The above value is Effective Confining Pressure

TEST READINGS

Z_1(Mercury Height Difference @ t_1): 15.8 cm Hydraulic Gradient = 28.00

Date	elapsed t (seconds)	Z (pipet @ t)	ΔZp (cm)	temp (deg C)	α (temp corr)	k (cm/sec)	k (ft./day)	Reset = *
1/3/2019	2	16	0.782666	21	0.977	1.11E-05	3.14E-02	
1/3/2019	4	14.8	1.982666	21	0.977	1.47E-05	4.15E-02	
1/3/2019	6	13.4	3.382666	21	0.977	1.76E-05	4.99E-02	
1/3/2019	8	11.6	5.182666	21	0.977	2.19E-05	6.20E-02	

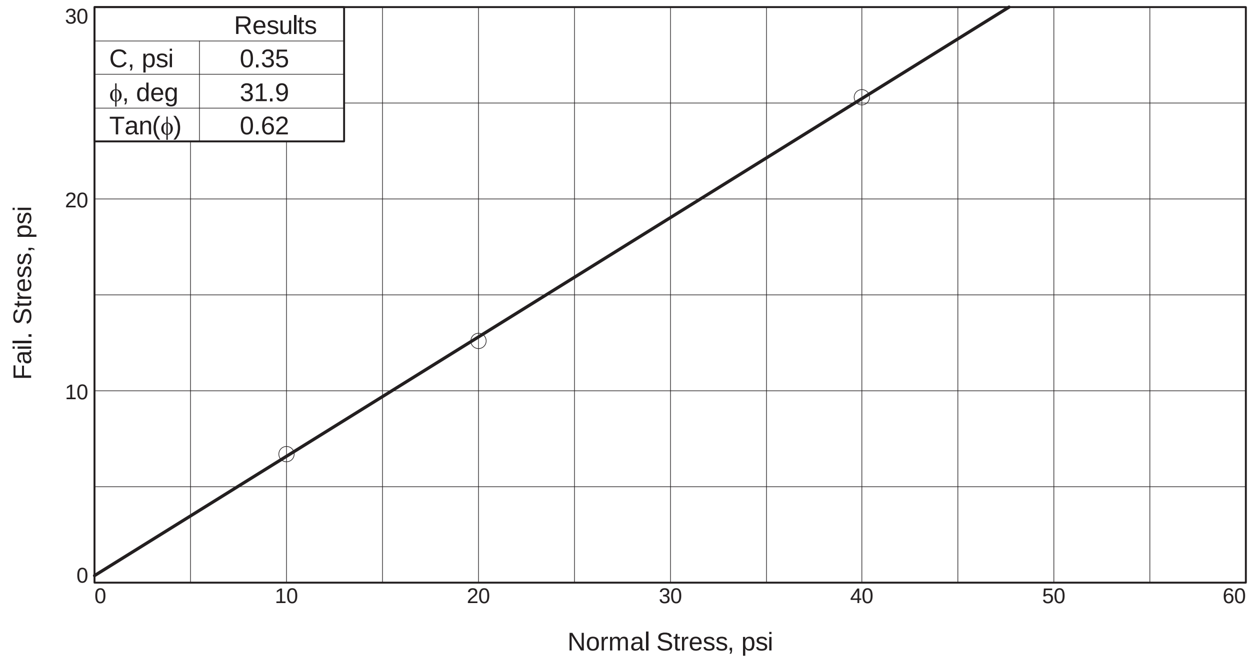
SUMMARY

ka = 1.63E-05 cm/sec Acceptance criteria = 50 %

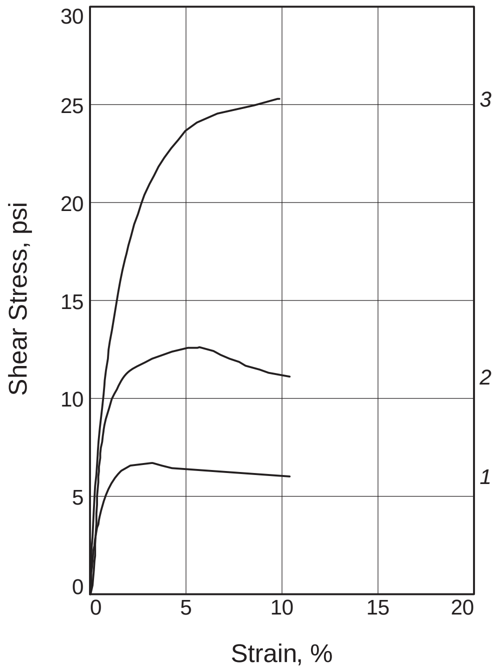
ki			Vm	
k1 =	1.11E-05	cm/sec	32.0	%
k2 =	1.47E-05	cm/sec	10.1	%
k3 =	1.76E-05	cm/sec	8.0	%
k4 =	2.19E-05	cm/sec	34.1	%

$$Vm = \frac{|\,ka-ki\,|}{ka} \times 100$$

Hydraulic conductivity	k =	**1.63E-05**	cm/sec	**4.62E-02**	ft/day
Void Ratio	e =	**0.48**			
Porosity	n =	**0.32**			
Bulk Density	γ =	**2.08**	g/cm^3	**129.7**	pcf
Water Content	W =	**0.25**	cm^3/cm^3	(at 20 deg C)	
Intrinsic Permeability	k_{int} =	**1.67E-10**	cm^2	(at 20 deg C)	



	Results
C, psi	0.35
ϕ, deg	31.9
Tan(ϕ)	0.62



	Sample No.	1	2	3
Initial	Water Content, %	14.3	14.3	14.3
	Dry Density, pcf	109.9	109.9	109.9
	Saturation, %	72.4	72.4	72.4
	Void Ratio	0.5333	0.5333	0.5333
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	18.3	18.0	16.2
	Dry Density, pcf	112.7	112.4	116.4
	Saturation, %	99.5	97.3	97.7
	Void Ratio	0.4956	0.4993	0.4476
	Diameter, in.	2.500	2.500	2.500
	Height, in.	0.975	0.978	0.944
	Normal Stress, psi	10.00	20.00	40.00
	Fail. Stress, psi	6.70	12.60	25.30
	Strain, %	3.2	5.7	9.8
	Ult. Stress, psi			
	Strain, %			
	Strain rate, in./min.	0.003	0.003	0.003

Sample Type: Remold

Description: clayey sand (SC)

LL= 29 **PL=** 15 **PI=** 14

Assumed Specific Gravity= 2.7

Remarks: Compaction based on D698 efforts. Specimens compacted to 95% maximum dry density at +2% of optimum moisture.

Client: Trammco Environmental Solutions LLC

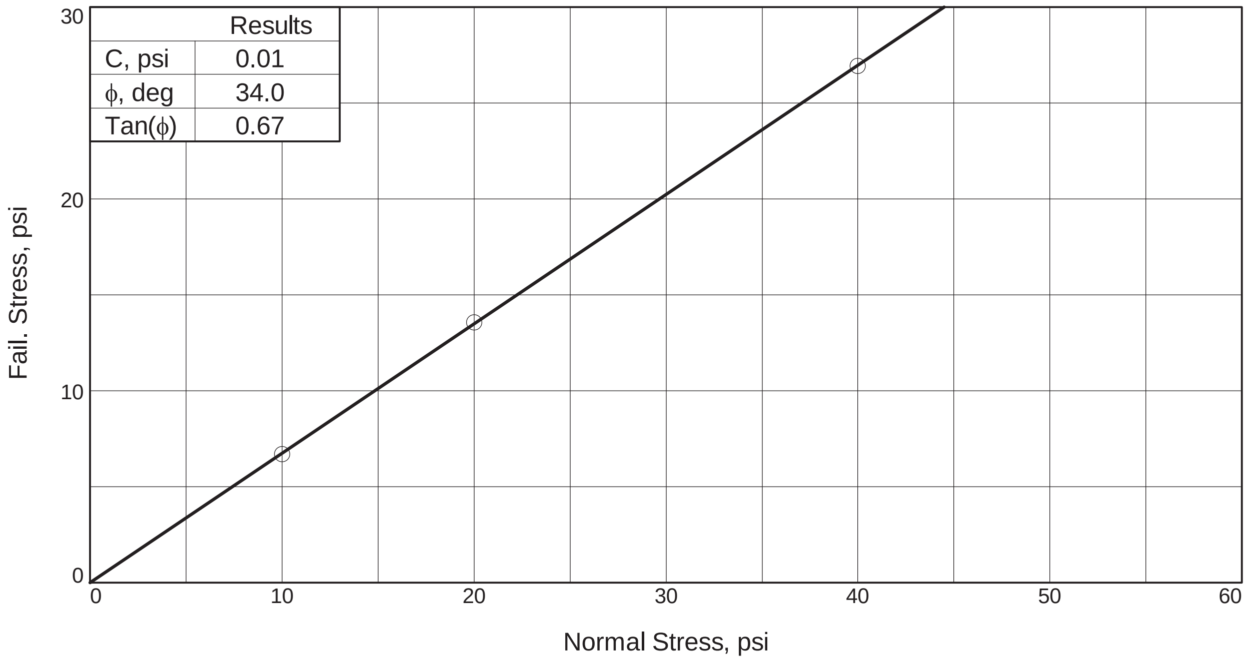
Project: McCloy and Beckham Landfill

Source of Sample: B-1 **Depth:** 0.0-26.0 ft

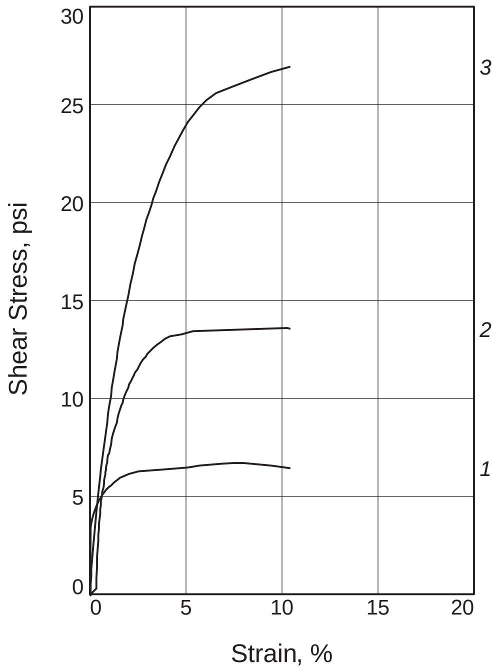
Sample Number: composite

Proj. No.: A4187129 **Date Sampled:** N/A

DIRECT SHEAR TEST REPORT
Terracon Consultants, Inc.
Chattanooga, TN



	Results
C, psi	0.01
ϕ, deg	34.0
Tan(ϕ)	0.67



	Sample No.	1	2	3
Initial	Water Content, %	17.7	17.7	17.7
	Dry Density, pcf	106.3	106.3	106.3
	Saturation, %	81.6	81.6	81.6
	Void Ratio	0.5858	0.5858	0.5858
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	20.1	19.2	17.5
	Dry Density, pcf	108.8	110.4	113.9
	Saturation, %	98.9	98.1	98.6
	Void Ratio	0.5493	0.5273	0.4792
	Diameter, in.	2.500	2.500	2.500
	Height, in.	0.977	0.963	0.933
	Normal Stress, psi	10.00	20.00	40.00
	Fail. Stress, psi	6.69	13.57	26.94
	Strain, %	7.5	10.3	10.4
	Ult. Stress, psi			
	Strain, %			
	Strain rate, in./min.	0.002	0.002	0.002

Sample Type: Remold

Description: clayey sand (SC)

LL= 27 **PL=** 18 **PI=** 9

Assumed Specific Gravity= 2.7

Remarks: Compaction based on D698 efforts. Specimens compacted to 95% maximum dry density at +2% of optimum moisture.

Client: Trammco Environmental Solutions LLC

Project: McCloy and Beckham Landfill

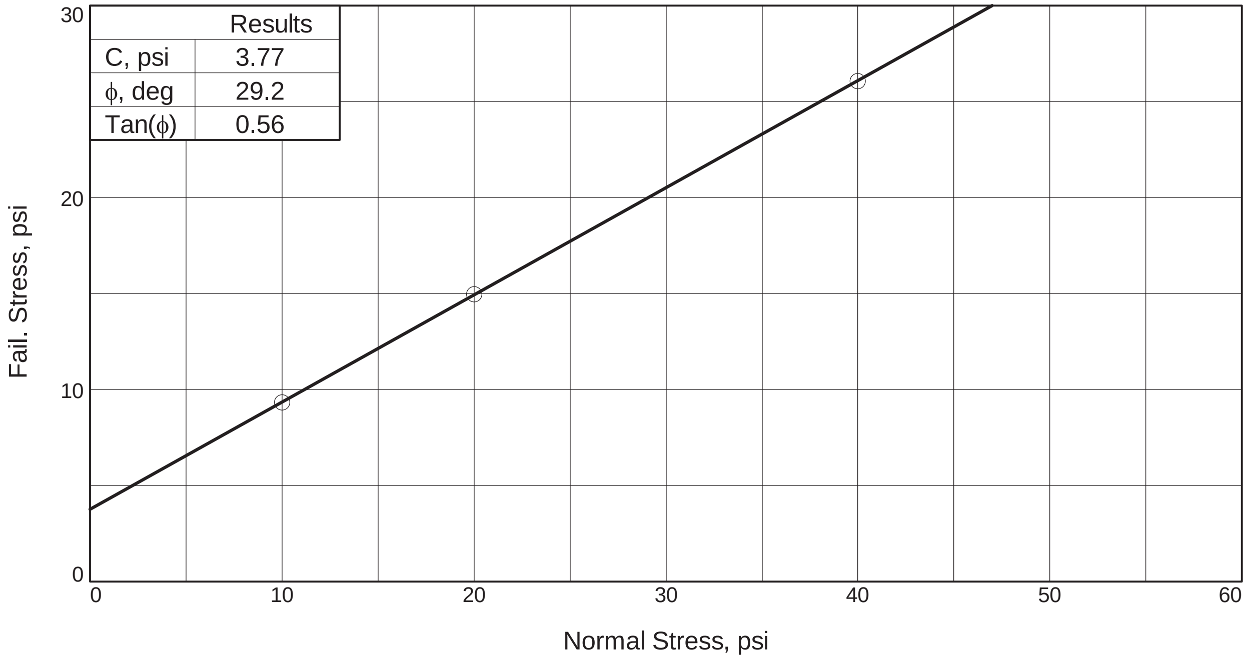
Source of Sample: B-3 **Depth:** 27.0-50.0 ft

Sample Number: composite

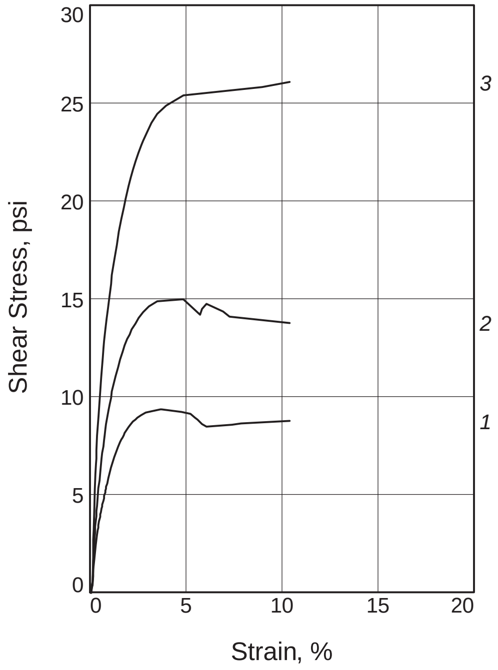
Proj. No.: A4187129 **Date Sampled:** N/A

DIRECT SHEAR TEST REPORT

Terracon Consultants, Inc.
Chattanooga, TN



	Results
C, psi	3.77
ϕ, deg	29.2
Tan(ϕ)	0.56



	Sample No.	1	2	3
Initial	Water Content, %	13.6	13.6	13.6
	Dry Density, pcf	114.2	114.2	114.2
	Saturation, %	77.1	77.1	77.1
	Void Ratio	0.4765	0.4765	0.4765
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	15.5	14.3	14.2
	Dry Density, pcf	118.8	120.7	121.1
	Saturation, %	99.7	97.5	97.9
	Void Ratio	0.4194	0.3962	0.3922
	Diameter, in.	2.500	2.500	2.500
	Height, in.	0.961	0.946	0.943
	Normal Stress, psi	10.00	20.00	40.00
	Fail. Stress, psi	9.33	14.96	26.08
	Strain, %	3.7	4.8	10.4
	Ult. Stress, psi			
	Strain, %			
	Strain rate, in./min.	0.003	0.003	0.003

Sample Type: Remold
Description: silty sand (SM)

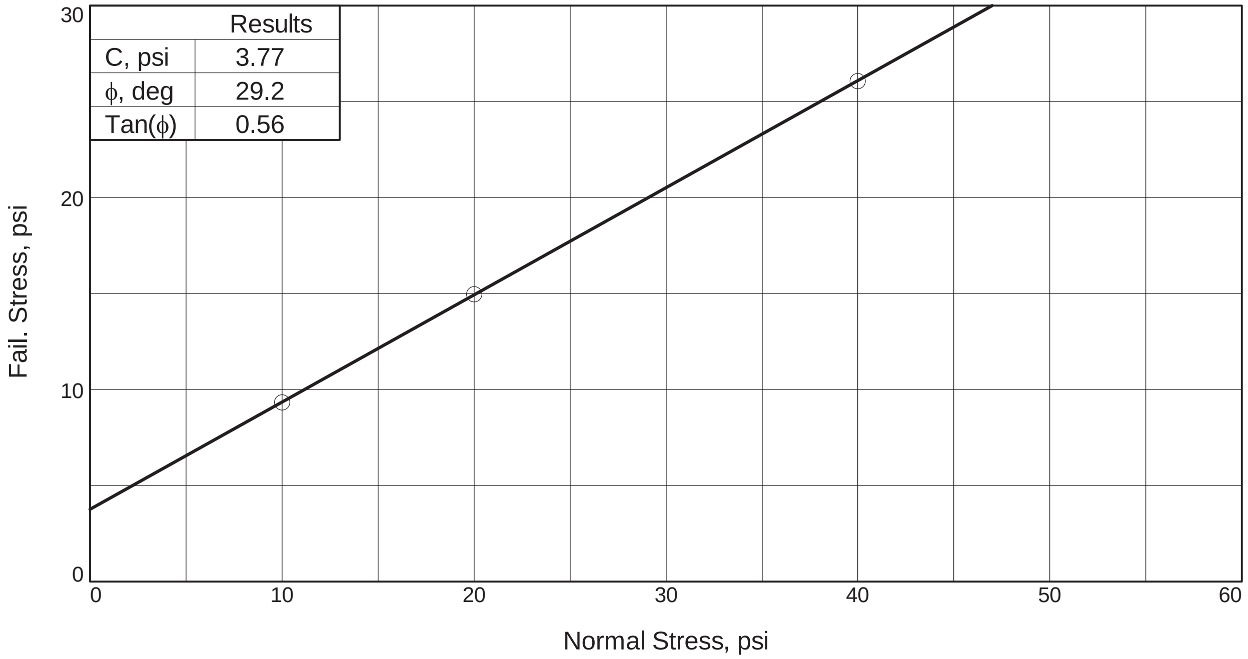
LL= 20 **PL=** 17 **PI=** 3
Assumed Specific Gravity= 2.7
Remarks: Compaction based on D698 efforts. Specimens compacted to 95% maximum dry density and +2% of optimum moisture.

Client: Trammco Environmental Solutions LLC

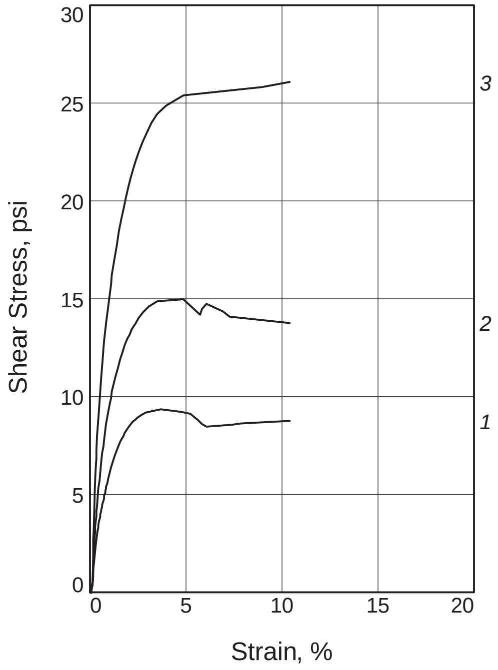
Project: McCloy and Beckham Landfill

Source of Sample: B-5 **Depth:** 0.0-50.0 ft
Sample Number: composite
Proj. No.: A4187129 **Date Sampled:** N/A

DIRECT SHEAR TEST REPORT
Terracon Consultants, Inc.
Chattanooga, TN



	Results
C, psi	3.77
ϕ, deg	29.2
Tan(ϕ)	0.56



	Sample No.	1	2	3
Initial	Water Content, %	13.6	13.6	13.6
	Dry Density, pcf	114.2	114.2	114.2
	Saturation, %	77.1	77.1	77.1
	Void Ratio	0.4765	0.4765	0.4765
	Diameter, in.	2.500	2.500	2.500
	Height, in.	1.000	1.000	1.000
At Test	Water Content, %	15.5	14.3	14.2
	Dry Density, pcf	118.8	120.7	121.1
	Saturation, %	99.7	97.5	97.9
	Void Ratio	0.4194	0.3962	0.3922
	Diameter, in.	2.500	2.500	2.500
	Height, in.	0.961	0.946	0.943
	Normal Stress, psi	10.00	20.00	40.00
	Fail. Stress, psi	9.33	14.96	26.08
	Strain, %	3.7	4.8	10.4
	Ult. Stress, psi			
	Strain, %			
	Strain rate, in./min.	0.003	0.003	0.003

Sample Type: Remold
Description: silty sand (SM)

LL= 20 **PL=** 17 **PI=** 3
Assumed Specific Gravity= 2.7
Remarks: Compaction based on D698 efforts. Specimens compacted to 95% maximum dry density and +2% of optimum moisture.

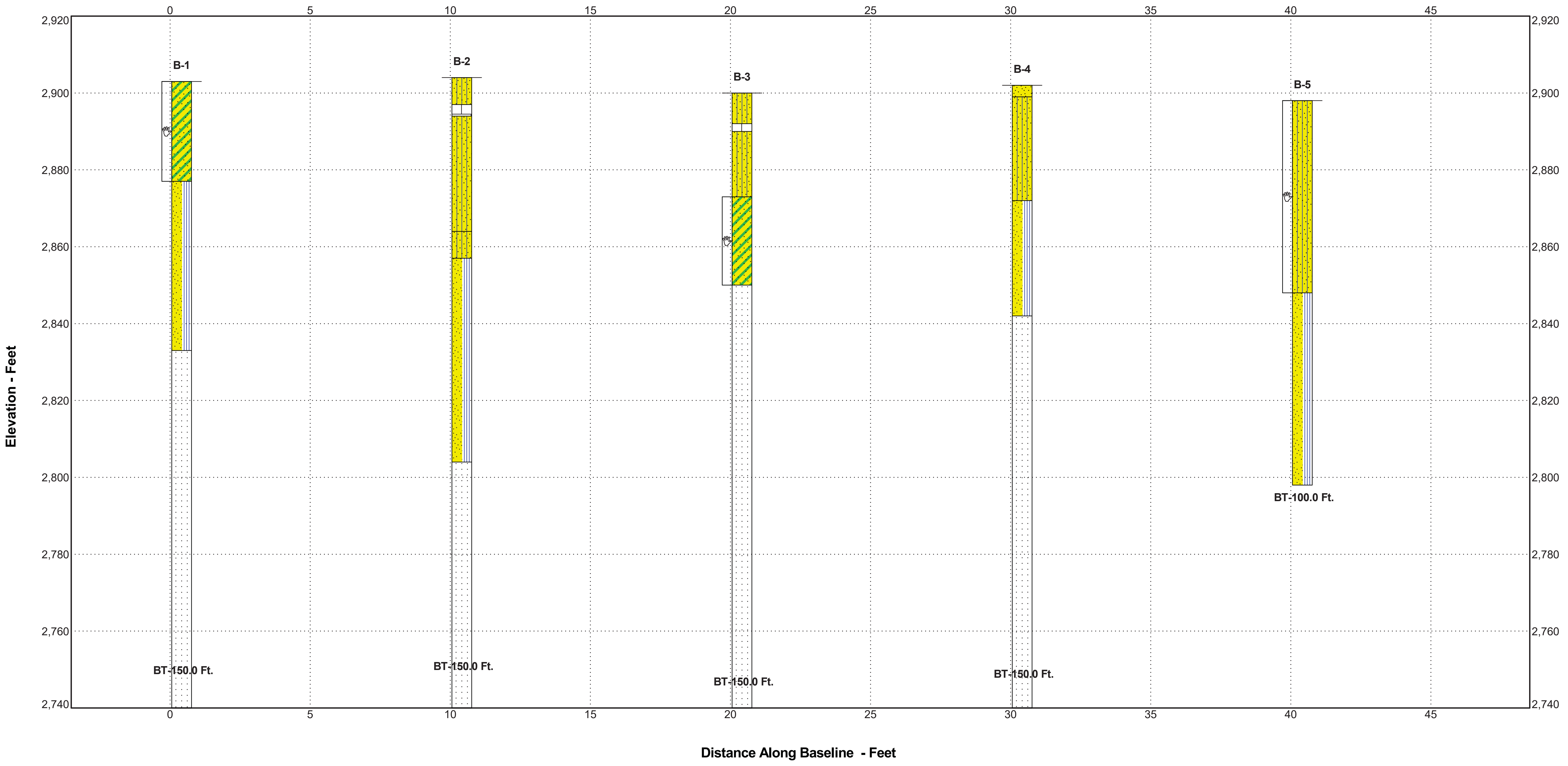
Client: Trammco Environmental Solutions LLC

Project: McCloy and Beckham Landfill

Source of Sample: B-5 **Depth:** 0.0-50.0 ft
Sample Number: composite
Proj. No.: A4187129 **Date Sampled:** N/A

DIRECT SHEAR TEST REPORT

Terracon Consultants, Inc.
Chattanooga, TN



- ▨ Clayey Sand
- ▨ Poorly-graded Sand with Silt
- ▨ Sandstone
- ▨ Silty Sand
- ▨ CALICHE - USGS Standard
- ▨ Poorly-graded Sand

Explanation

B-1 —— Borehole Number
Moisture Content —— %w
LL PL —— Liquid and Plastic Limits
Sampling (See General Notes) ——
Borehole Lithology
AR BT —— Borehole Termination Type
∇ Water Level Reading at time of drilling.
▼ Water Level Reading after drilling.

NOTES:
See Exploration Plan for orientation of soil profile.
See General Notes in Supporting Information for symbols and soil classifications.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project No.: A4187129
Date: 5/6/2019
Scale: N.T.S

Terracon
10400 State Highway 191
Midland, TX

SUBSURFACE PROFILE

BECKHAM RANCH LANDFILL
SECTION 27 OF, T26S, R36E JAL,
LEA COUNTY, NEW MEXICO

SUPPORTING INFORMATION

UNIFIED SOIL CLASSIFICATION SYSTEM

Beckham Ranch Landfill ■ Jal, Lea County, New Mexico
May 6, 2019 ■ Terracon Project No. A4187129

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above “A”		CL	Lean clay [K, L, M]
			$PI < 4$ or plots below “A” line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above “A” line		CH	Fat clay [K, L, M]
			PI plots below “A” line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq$ 15% sand, add “with sand” to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add “with organic fines” to group name.

[I] If soil contains $\geq$ 15% gravel, add “with gravel” to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add “with sand” or “with gravel,” whichever is predominant.

[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add “sandy” to group name.

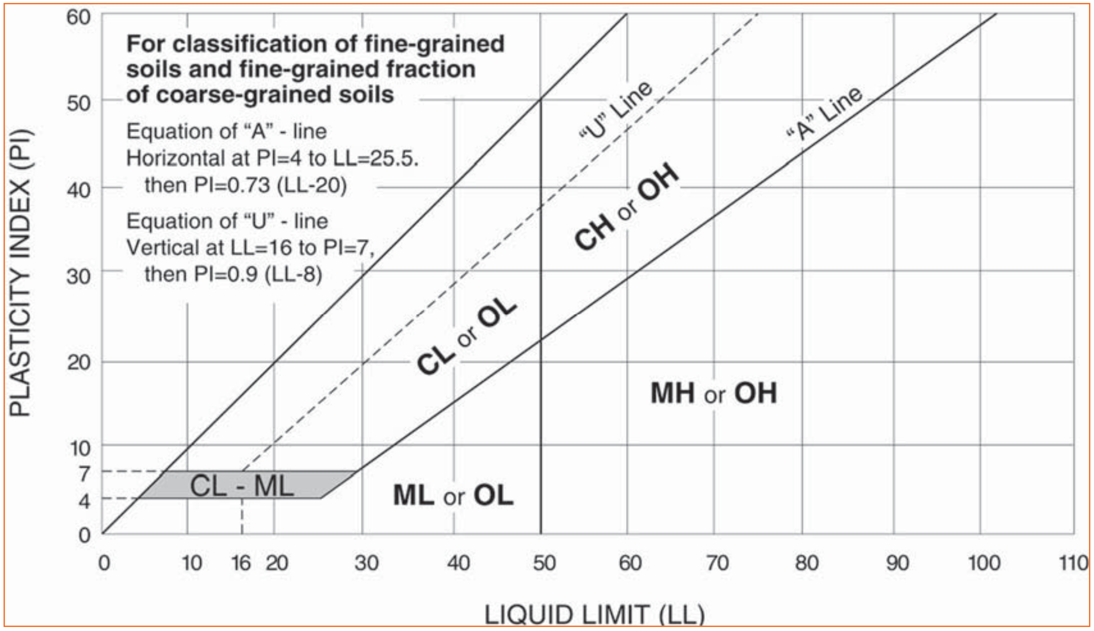
[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

[N] $PI \geq 4$ and plots on or above “A” line.

[O] $PI < 4$ or plots below “A” line.

[P] PI plots on or above “A” line.

[Q] PI plots below “A” line.



DESCRIPTION OF ROCK PROPERTIES

Beckham Ranch Landfill ■ Jal, Lea County, New Mexico
May 6, 2019 ■ Terracon Project No. A4187129

WEATHERING

Term	Description
Unweathered	No visible sign of rock material weathering, perhaps slight discoloration on major discontinuity surfaces.
Slightly weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally than in its fresh condition.
Moderately weathered	Less than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as corestones.
Highly weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.
Residual soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

STRENGTH OR HARDNESS

Description	Field Identification	Uniaxial Compressive Strength, psi (MPa)
Extremely weak	Indented by thumbnail	40-150 (0.3-1)
Very weak	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife	150-700 (1-5)
Weak rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	700-4,000 (5-30)
Medium strong	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with single firm blow of geological hammer	4,000-7,000 (30-50)
Strong rock	Specimen requires more than one blow of geological hammer to fracture it	7,000-15,000 (50-100)
Very strong	Specimen requires many blows of geological hammer to fracture it	15,000-36,000 (100-250)
Extremely strong	Specimen can only be chipped with geological hammer	>36,000 (>250)

DISCONTINUITY DESCRIPTION

Fracture Spacing (Joints, Faults, Other Fractures)		Bedding Spacing (May Include Foliation or Banding)	
Description	**Spacing**	**Description**	**Spacing**
Extremely close	< ¾ in (<19 mm)	**Laminated**	< ½ in (<12 mm)
Very close	¾ in – 2-1/2 in (19 - 60 mm)	**Very thin**	½ in – 2 in (12 – 50 mm)
Close	2-1/2 in – 8 in (60 – 200 mm)	**Thin**	2 in – 1 ft. (50 – 300 mm)
Moderate	8 in – 2 ft. (200 – 600 mm)	**Medium**	1 ft. – 3 ft. (300 – 900 mm)
Wide	2 ft. – 6 ft. (600 mm – 2.0 m)	**Thick**	3 ft. – 10 ft. (900 mm – 3 m)
Very Wide	6 ft. – 20 ft. (2.0 – 6 m)	**Massive**	> 10 ft. (3 m)

Discontinuity Orientation (Angle): Measure the angle of discontinuity relative to a plane perpendicular to the longitudinal axis of the core. (For most cases, the core axis is vertical; therefore, the plane perpendicular to the core axis is horizontal.) For example, a horizontal bedding plane would have a 0-degree angle.

ROCK QUALITY DESIGNATION (RQD) [1]

Description	RQD Value (%)
Very Poor	0 - 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 - 100

1. The combined length of all sound and intact core segments equal to or greater than 4 inches in length, expressed as a percentage of the total core run length.

Reference: U.S. Department of Transportation, Federal Highway Administration, Publication No FHWA-NHI-10-034, December 2009 Technical Manual for Design and Construction of Road Tunnels – Civil Elements

DESCRIPTION OF ROCK PROPERTIES

Beckham Ranch Landfill ■ Jal, Lea County, New Mexico

May 6, 2019 ■ Terracon Project No. A4187129

WEATHERING

Fresh	Rock fresh, crystals bright, few joints may show slight staining. Rock rings under hammer if crystalline.
Very slight	Rock generally fresh, joints stained, some joints may show thin clay coatings, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Rock generally fresh, joints stained, and discoloration extends into rock up to 1 in. Joints may contain clay. In granitoid rocks some occasional feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granitoid rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer and shows significant loss of strength as compared with fresh rock.
Moderately severe	All rock except quartz discolored or stained. In granitoid rocks, all feldspars dull and discolored and majority show kaolinization. Rock shows severe loss of strength and can be excavated with geologist's pick.
Severe	All rock except quartz discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granitoid rocks, all feldspars kaolinized to some extent. Some fragments of strong rock usually left.
Very severe	All rock except quartz discolored or stained. Rock "fabric" discernible, but mass effectively reduced to "soil" with only fragments of strong rock remaining.
Complete	Rock reduced to "soil". Rock "fabric" no discernible or discernible only in small, scattered locations. Quartz may be present as dikes or stringers.

HARDNESS (for engineering description of rock – not to be confused with Moh's scale for minerals)

Very hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows of geologist's pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately hard	Can be scratched with knife or pick. Gouges or grooves to ¼ in. deep can be excavated by hard blow of point of a geologist's pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16 in. deep by firm pressure on knife or pick point. Can be excavated in small chips to pieces about 1-in. maximum size by hard blows of the point of a geologist's pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips to pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.

Joint, Bedding, and Foliation Spacing in Rock [1]

Spacing	Joints	Bedding/Foliation
Less than 2 in.	Very close	Very thin
2 in. – 1 ft.	Close	Thin
1 ft. – 3 ft.	Moderately close	Medium
3 ft. – 10 ft.	Wide	Thick
More than 10 ft.	Very wide	Very thick

1. Spacing refers to the distance normal to the planes, of the described feature, which are parallel to each other or nearly so.

Rock Quality Designator (RQD) [1]

RQD, as a percentage	Diagnostic description
Exceeding 90	Excellent
90 – 75	Good
75 – 50	Fair
50 – 25	Poor
Less than 25	Very poor

1. RQD (given as a percentage) = length of core in pieces 4 inches and longer / length of run

Joint Openness Descriptors

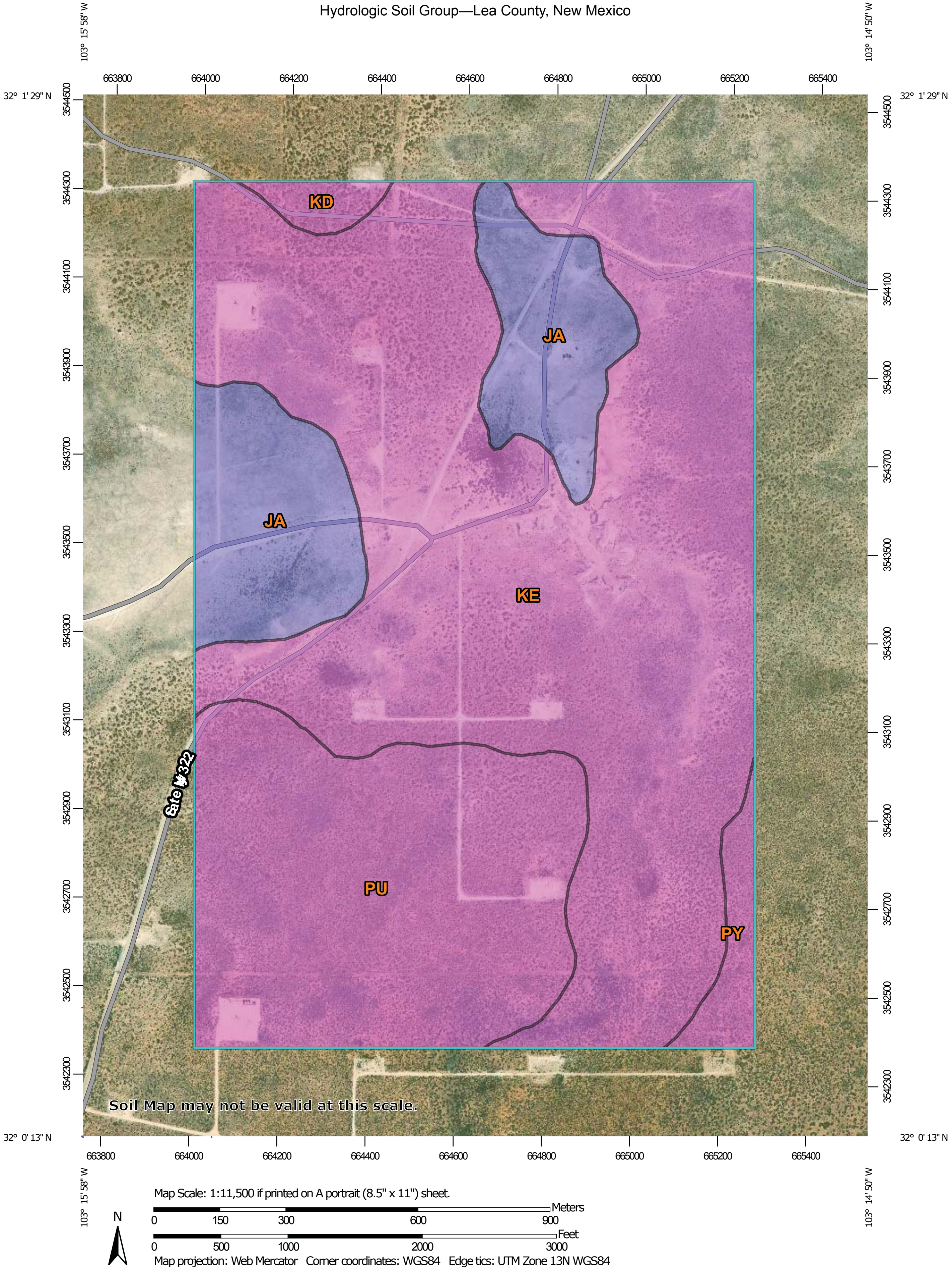
Openness	Descriptor
No Visible Separation	Tight
Less than 1/32 in.	Slightly Open
1/32 to 1/8 in.	Moderately Open
1/8 to 3/8 in.	Open
3/8 in. to 0.1 ft.	Moderately Wide
Greater than 0.1 ft.	Wide

References: American Society of Civil Engineers. Manuals and Reports on Engineering Practice - No. 56. Subsurface Investigation for Design and Construction of Foundations of Buildings. New York: American Society of Civil Engineers, 1976. U.S. Department of the Interior, Bureau of Reclamation, Engineering Geology Field Manual.

Attachment B

Soils Report

Hydrologic Soil Group—Lea County, New Mexico



Map Scale: 1:11,500 if printed on A portrait (8.5" x 11") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

⬜	Area of Interest (AOI)

Soils

Soil Rating Polygons

🟪	A
🟩	A/D
🟪	B
🟫	B/D
🟦	C
🟫	C/D
🟥	D
⬜	Not rated or not available

Soil Rating Lines

〰	A
〰	A/D
〰	B
〰	B/D
〰	C
〰	C/D
〰	D
〰	Not rated or not available

Soil Rating Points

■	A
■	A/D
■	B
■	B/D
■	C
■	C/D
■	D
□	Not rated or not available

Water Features

〰	Streams and Canals

Transportation

┼┼┼	Rails
〰	Interstate Highways
〰	US Routes
〰	Major Roads
〰	Local Roads

Background

▩	Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lea County, New Mexico
Survey Area Data: Version 15, Sep 12, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Sep 19, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
JA	Jal association	B	85.6	13.9%
KD	Kermit-Palomas fine sands, 0 to 12 percent slopes	A	6.6	1.1%
KE	Kermit-Wink complex, 0 to 3 percent slopes	A	364.8	59.1%
PU	Pyote and maljamar fine sands	A	148.0	24.0%
PY	Pyote soils and dune land	A	12.4	2.0%
Totals for Area of Interest			**617.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix J

Design and Construction Plan

Engineering Design Report

South Ranch Surface Waste Management Facility
Lea County, New Mexico

October 2019
Project No. 35187378

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

Prepared for:
NGL Waste Services, LLC
3773 Cherry Creek Dr., Suite 1000
Denver, CO 80209
303-815-1010

Prepared by:
Terracon Consultants, Inc.
25809 Interstate 30 South
Bryant, Arkansas 72022
(501) 847-9292

terracon.com

Terracon

Environmental ■ Facilities ■ Geotechnical ■ Materials

Table of Contents

Tables

Attachments

1.0 INTRODUCTION

This engineering design report (EDR) was prepared by Terracon Consultants, Inc. (Terracon) for NGL Waste Services, LLC (NGL) to support the Permit Application for the proposed South Ranch Surface Waste Management Facility (Facility) located near Bennett, Lea County, New Mexico. The following sections and appendices provide backup engineering calculations and documentation for the proposed landfill configuration as presented on the permit drawings in **Appendix K** of the Permit Application (PA).

1.1 Regulatory Oversight

Due to its function the Facility will be regulated by New Mexico Administrative Code, Title 19 – Natural Resources and Wildlife, Chapter 15 – Oil and Gas, Part 36 – Surface Waste Management Facilities, or 19.15.36. The Facility is defined as a commercial landfill facility by **19.15.36.7.A(2)** and **(4)** accepting exempt oil field waste from nearby oil field development customers. In general, this EDR will focus on providing the engineering calculations and documentation to satisfy design requirements specified in **19.15.36.14.C** – **19.15.36.14.F**. In addition, NGL proposes to manage and dispose of the Facility's leachate with an evaporation pond. Therefore, this EDR will also provide engineering calculations for the proposed evaporation pond in compliance with **19.15.36.17.A** and **19.15.36.17.B**.

1.2 General Facility Description

The Facility consists of approximately (~) 187 acres of which ~111 acres will be dedicated for lined landfill disposal cells. The remaining ~76 acres consists of a ~43-acre entrance and waste acceptance area including an ~2.2-acre leachate evaporation pond; ~13 acres making up two stormwater retention ponds; and ~18 acres of ancillary space for perimeter roadways, drainage channels and landfill structural berms.

The landfill area will be subdivided in to two phases. Phase 1 will have six disposal cells ranging in size from 8.4 acres to 9.7 acres for a total disposal area of ~55 acres. Phase 2 will have six disposal cells ranging in size from 7.6 acres, to 9.6 acres for a total disposal area ~56 acres. Phase 1 and 2 have maximum depths below existing grade of ~50-feet. Phase 1 and 2 are separated by approximately 10 feet and the base liner system for Phase 2 will overlap and tie directly to the Phase 1 liner system.

Each of the Phase 1 and 2 disposal cells will be separated by a 4-foot tall soil divider berm. All disposal areas will be lined with a multilayered geosynthetic liner system with both leachate collection and recovery and leak detection systems. Final waste surfaces will be covered with a geosynthetic and soil based final cover system. Full descriptions of the liner and cover systems are provided in this EDR. Ultimately the proposed configuration of the landfill area will result in a total design operational capacity (waste and routine soil) of ~21,481,852 Cubic Yards (CY).

Detailed design of the Facility is presented within this EDR and attached including supporting calculations and analyses.

2.0 PROPOSED FACILITY DESIGN

2.1 Landfill Geometry

In general compliance with **19.15.36.14.C** and **19.15.36.14.D**, all landfill cells have been designed with 3H:1V side slopes. Each cell floor will be graded at a minimum of 2% laterally to a center leachate collection pipeline which is sloped at 2% towards a central leachate collection sump. The liner system and leachate collection lines will be protected with 2-feet of protective soil, see Section 2.7 for greater details regarding the liner system design. Cell depths ranging from 41 feet at the high end of the cell to ~50 feet, the maximum excavation depth below existing grade is ~51.6 feet at the leachate collection sump.

Note that maximum depth of waste placement is approximately 4-feet above maximum excavation depth, or approximately 48.6 feet below grade. Based on information provided in **Appendix I** of the **PA this will provide,** investigatory drilling of five-test pits explored to a depth of 150-feet below grade and did not encounter groundwater. Therefore, the proposed cell depths are in compliance with **19.15.36.13.A.(1).**

The intermediate, final waste and final cover slopes will be nominally 4H:1V and the top deck will have a minimum grade of 4%. The final cover system will include 2.5 feet of soil over the liner system. The landfill will have a maximum final waste grade of 3,108 feet above mean sea level (AMSL), and maximum final cover grade will be 3,110.5 feet AMSL. See **Permit Drawings** in **Appendix K** of the PA for visual representation of the proposed geometry.

2.2 Landfill Design Capacity

The following Table 2.1 provides the design operational capacity (waste and routine and intermediate soil cover), routine and intermediate soil cover volume assuming 15% soil to waste ratio, and waste capacity of each disposal cell, phase and overall landfill. Per-cell capacities assume an intermediate waste fill slope of 4V:1H and that fill sequencing occurs as shown on **Drawing 24** of **Appendix K** of the PA. Operational capacities were calculated using AutoDesk© Civil3D® 2019 (Civil 3D) software.

Table 2.1 Design Capacity Summary

Cell	**Operational Capacity** (CY)	**Routine and Intermediate Soil Cover** [10% of Operational Waste Capacity] (CY)	**Waste Capacity** [90% of Operational Capacity] (CY)
PHASE 1			
E-1	153,411	15,341	138,070
E-2	678,499	67,850	610,649
E-3	1,326,046,	132,605	1,193,441
E-4	1,466,944	146,694	1,320,250
E-5	1,498,142	149,814	1,348,328
E-6	2,618,937	261,894	2,357,043
PHASE 1	**7,741,979**	**774,198**	**6,967,781**
PHASE 2			
W-1	5,306,309	530,631	4,775,678
W-2	3,312,342	331,234	2,981,108
W-3	2,297,090	229,709	2,067,381
W-4	1,634,192	163,419	1,470,773
W-5	899,263	89,926	809,337
W-6	290,677	29,068	261,609
PHASE 2	**13,739,873**	**1,373,992**	**12,365,891**
TOTAL	**21,481,852**	**2,148,185**	**19,333,667**

2.3 Site Soil Balance

Landfill cell construction, routine operations, and closure will require large quantities of soil over the life of the landfill. The proposed Facility-wide grading plan shown in the **Permit Drawings** in **Appendix K** of the PA, which includes all grading activities for landfill cells, roads, stormwater infrastructure (channels and ponds), and the leachate evaporation pond, will generate soils for these activities. Table 2.2 below summarizes the soil balance for known operational and construction activities through buildout of the Facility. All cut and fill volumes provided in Table 2.2 are calculated using Civil 3D.

Table 2.2 Soil Balance Summary

Area	Cut (CY)	Fill (CY)
Facility Wide Grading	6,229,031	304,612
Base Liner Protective Cover	0	368,612
Operational Cover (Routine and Intermediate, From Table 2.1)	0	3,321,676
Final Cover System	0	617,556
TOTALS	**6,229,031**	**4,612,456**
FACILITY SOIL BALANCE = +1,616,575 CY EXCESS SOIL		

2.4 Stormwater Management System

The proposed surface-water management system for both run-on and run-off for the Facility is shown on the **Permit Drawings** in **Appendix K** of the PA. The proposed configuration of the run-off management system was modeled in AutoDesk© Storm and Sanitary Analysis® 2019 (SSA) software. The run-on management system has been sized using the USDA, NRCS, Technical Release 55 (TR-55) method. Both the SAA and TR-55 simulated the 25-year, 24-hour storm (design storm) event for the Lea County, New Mexico area.

Facility Storm Run-off Management System Design

All proposed stormwater run-off conveyance structures (channels, berms, letdowns, culverts) have been designed to handle the peak flow from the design storm. The two (see section 1.2 narrative) stormwater ponds have been designed to retain at least the total run-off volume from the design storm. The Facility also has a 2-foot earth berm at the permit boundary to retain onsite any potential storm pond over flow during greater storm events. In short, the Facility has been designed to be a non-discharging facility. **Attachment A** provides a detailed report of the SSA, including figures and modeling results.

Facility Run-on Management System Design

Review of regional topographic maps from various sources indicate that the topography surrounding the Facility is a essentially flat with very slight gradient of 0.2% from north to south.

There is negligible gradient east to west. Further, a qualified professional engineer from Terracon performed an engineering site reconnaissance visit to the proposed facility. In this visit and it was observed that Highway J-3 (Frying Pan Road) and Beckham Road which immediately parallel the northern and western Facility boundary are set lower than the site and effectively cut-off and manage any stormwater drainage approaching the Facility's northern and western boundaries. Terracon observed no evidence of stormwater drainage towards the Facility from the East, South, or West directions, which verifies the topographic map review. Although there is no evidence of drainage towards the eastern boundary, a natural gully was observed to run along the east property boundary on the adjacent property and would effectively cut-off and manage any stormwater run-on from the east, if any. Therefore, no stormwater run-on management system is necessary. However, to ensure surface run-on water, if any, is effectively cut-off and prevented from entering the facility, a 2-foot tall earth berm will be constructed along the entire perimeter of the facility. In general, surface water will be prevented from entering the active disposal area via a berm around the perimeter of the disposal area and all perimeter roads and drainage will be tipped away from the active areas. Berms and drainage are detailed in the permit drawings provided in **Appendix K** of the permit application. See **Figure A-1** in **Attachment A** for a map of regional topography illustrating and confirming the information provided above.

2.5 Erosion Loss

The purpose of the erosion calculation is to determine potential soil losses due to rainfall erosion under closure conditions. Using the Revised Universal Soil Loss Equation (RUSLE), projected soil loss from rainfall is approximately 1.3 tons/acre/year (t/a/y), which is below the NRCS established criterion of 2 t/a/y maximum for landfills. Detailed RUSLE calculations are provided in **Attachment B**. Wind erosion is considered negligible at this facility. Prevailing wind directions based on windrose data is North-to-South at an average of 3 miles per hour, thus only effecting the northern slope. At these speeds the effective wind erosion is considered negligible compared to surface water erosion. All erosion will be monitored routinely and repaired during operations and in post-closure. See **Appendix D** and **Appendix H** of the Permit Narrative for detailed discussions of erosion monitoring and repair.

2.6 Leachate Evaporation Pond Geometry and Sizing

Geometry

A proposed leachate evaporation pond (LEP) is to be located near the site entrance in the northeast portion of the Facility. In general, the LEP geometry is in compliance with **19.15.36.17.A** and **19.15.36.17.B** having 3H:1V side slopes and a floor sloped laterally at 2% towards a central leak detection sump. In addition, the LEP has a 2-3-foot-high perimeter berm to prevent external surface water intrusion. The LEP plan footprint is approximately 2.25 acres with depths varying from 3.25 feet – 13.3 feet, with a 2-foot deep leak detection sump at the lowest point.

The LEP was sized assuming a worst-case condition defined as follows:

- Assumes the Facility will only construct and operate one disposal cell at a time. In this case:
- The largest Cell (W-2, 9.61 acres) has been constructed and hasn't received waste.
- Run-off from the intermediate 4H:1V waste slope from the previous Cells (W-1, E-5 and E-6) are draining into the new cell (W-2) leachate collection system.
- Little to no waste has been placed over the new cell's liner system.

Under this condition leachate generation is governed by incidental precipitation, thus two calculation methods to determine the require storage in the LEP are considered:

- 25-year, 24-hour precipitation volume incidental to the open area defined above, which totals to 25.7 acres.
- Leachate generation from the open cell (28.2 acres).

To be conservative, the LEP is sized to fully contain the greater of the volumes generated from the two sources. **Attachment C** provides a TR-55 run-off volume calculation from the 25.7 acre area indicating that 5.6 acre-feet of storage is required to contain incidental precipitation volume. A Hydraulic Evaluation of Landfill Performance (HELP) analysis was performed to determine the leachate generation rate from the open cell. The HELP analysis indicated that ~0.1 acre-feet annually of leachate is collected over the liner and would be required to contain the leachate generation volume from the largest cell (Cell E-3) when it is open with no waste over the liner. This required capacity diminishes as waste thickness is increased over the liner system. A HELP analysis summary memo and results are provided in **Attachment D**. In either case, the LEP must also provide storage for incidental precipitation over the 2-acre pond footprint, requiring an additional 0.77 acre-feet.

Therefore, the LEP has a design storage capacity of 9.3 acre-feet. The LEP will also have three feet of freeboard above the design waterline which is not included in the design capacity. This complies with **19.15.36.17.B(12)** requiring three feet of freeboard and **19.15.36.17.B(12)** limiting the maximum size of evaporation ponds to 10 acre-feet.

2.7 Base Liner System

The Facility is proposing two base liner systems one for the landfill cells and one for the leachate evaporation pond. Details showing the bottom liner systems can be found in the **Permit Drawings** in **Appendix K** of the PA.

The typical landfill liner system will consist of (from bottom to top):

- A prepared subgrade layer on the cell floor and on the side slopes to provide a smooth surface for geosynthetic deployment;

- Low Permeability Clay Base Layer. The field geologic/hydrogeological investigation (See **Appendix I** of the PA) generally characterized the potential excavated soil as sandy with permeabilities ranging from 1.09x10^{-6} cm/sec to 6.5x10^{-5} cm/s. Thus, this soil is not favorable for a compacted clay liner. In addition, groundwater was not encountered within 100 feet of the lowest proposed landfill cell elevation. Therefore, NGL proposes to install a geosynthetic clay liner (GCL) in lieu of the prescriptive base layer (**19.15.36.14.C(1)**) two-feet of compacted clay with hydraulic conductivity of 1x10^{-7} cm/s or less. GCLs are commonly installed in landfill liner systems as an alternative to compacted clay in similar conditions, and have hydraulic conductivities as low as 1x10^{-8} – 1x10^{-10} cm/s (Daniel 1993)
- A secondary 60-mil thick textured high-density polyethylene (HDPE) geomembrane liner, in compliance with **19.15.36.14.C(2)**;
- Leak detection drainage layer. For ease of construction and to maximize potential landfill airspace, NGL proposes using a 200-mil HDPE bi-planar geonet composite (Geocomposite) leak detection drainage layer in lieu of the prescriptive (**19.15.36.14.C(3)**) two feet of compacted soil with a hydraulic conductivity of 1x10^{-5} cm/s or greater. Drainage geocomposites consist of a biplanar geonet with geotextile filters heat bonded to both sides and are commonly installed in landfill liner leak detection systems as an alternative to a soil drainage layer due to their superior hydraulic performance obtaining hydraulic conductivities of up to 10 cm/s. The geocomposite, in conjunction with the textured geomembrane, also provides additional friction for greater slope stability;
- A primary 60-mil thick textured HDPE geomembrane liner in compliance with **19.15.36.14.C(4)**);
- Leachate collection and removal system. For ease of construction and to maximize potential landfill airspace, NGL proposes 200-mil HDPE bi-planar geocomposite leachate drainage layer in lieu of the prescriptive (**19.15.36.14.C(5)**) two-feet of compacted soil with a hydraulic conductivity of 1x10^{-2} cm/s or greater. This concept provides a high transmissivity (K up to 10 cm/s) blanket over the entire cell rather than intermittent collection laterals, giving greater leachate collection coverage;
- 2-feet of highly permeable protective cover soil, 1x10^{-2} cm/s or greater, in compliance with (**19.15.36.14.C(6)**).

The typical leachate evaporation pond liner system will consist of (from bottom to top):

- A prepared subgrade layer on the cell floor and on the side slopes to provide a smooth surface for geosynthetic deployment;
- Secondary 60-mil thick HDPE geomembrane liner, in compliance with **19.15.36.17.B(8)**.

- Leak detection drainage layer. For ease of construction, NGL proposes a 200-mil Geocomposite leak detection drainage layer in lieu of the prescriptive (**19.15.36.17.B(9)**) two-feet of compacted soil with a hydraulic conductivity of 1x10^{-5} cm/s or greater. Geocomposites are commonly installed in leak detection systems as an alternative to soil drainage layers due to their superior hydraulic performance obtaining hydraulic conductivities of up to 1-5 cm/s;
- Primary 60-mil thick textured HDPE geomembrane liner in compliance with **19.15.36.17.B(7)**).

See **Attachment D** for a HELP model demonstrating equivalent performance to the prescriptive base line system defined in **19.15.36.14.C**. The modeling was performed in two tiers as directed by the New Mexico Environmental Department guidance document; *Performance Demonstration for an Alternative Cover Design Under Section 502.A.2 of the New Mexico Solid Waste Regulations (20 NMAC 9.1) Using HELP Modeling.* Tier 1 of the modeling first demonstrates the alternative liner's equivalent performance to the prescriptive liner and compliance with maintaining no more than 12-inches over the liner under open cell conditions. Tier 2 of the modeling demonstrates the alternative liner's performance under four operational conditions: open, partially filled, completely filled and closed with no established vegetation, and completely filled and closed with established vegetation. Tier 2 demonstrates that in all conditions no liquids will percolate through the liner and into the subsurface, thus protective of groundwater.

See **Attachment E** for liner design calculations of the following:

- E1 - Foundation and Waste Settlement and resulting tensile stresses on the base liner and final cover systems
- E2 - Tensile Stress due to equipment loading
- E3 - Anchor trench pullout
- E4 - Geocomposite performance under overburden compression

2.8 Leachate and Leak Detection Collection and Recovery System

Landfill

The leachate and leak detection collection and recovery systems follow identical flow paths. Leachate generated from each landfill cell and leaks (if any) through the primary liner will flow through the associated lateral geocomposite drainage layer sloped at a minimum of 2% and directed towards a leachate and leak detection collection sump. The leachate collection system incorporates a perforated six-inch HDPE SDR-11 collection pipe embedded in a gravel trench one foot deep, generally along the cell centerline, with flow towards and terminating in the leachate collection sump.

The leachate collection sumps have a top dimension of 35 feet by 35 feet and are two feet deep with 3H:1V side slopes. The leak detection sumps sit directly below the leachate collection sumps and are a continuation of the leachate sump geometry another two feet deeper. The leachate sump and leak detection sump are separated by the 60-mil HDPE primary geomembrane. Each sump is equipped with an 18-inch HDPE SDR-17 leachate pump side-slope riser pipe, a 6-inch HDPE SDR-11 collection line cleanout riser, and a 12-inch HDPE SDR-17 leak detection witness riser. The riser pipes will be embedded into a side-slope trench for protection of the pipes and the liner system. The risers will daylight at the top of landfill cell slope and be protected by a concrete headwall and capped with blind flanges. The 18-inch riser will be equipped with a submersible pump that will transfer the liquids collected in the sump via a flexible hose to a 4-inch force main/carrier pipe. The force 4-inch main/carrier pipe will transfer the liquids to the on-site leachate evaporation pond. A typical pump cycle stroke that the operator may use is ON at 6-inches, OFF at 20-inches, HIGH ALARM at 22-inchs, and HIGH-HIGH ALARM at 24-inchs. The operator may alter this pump stroke as needed by operations. The HIGH ALARM typically will illuminate a beacon and/or sound an audible alarm until the level drops. The HIGH-HIGH ALARM will be equipped with an auto dialer that will notify the site manager so that the liquid level can be managed and reduced.

Leachate Evaporation Pond

The leak detection collection and recovery system for the leachate evaporation pond will collect leaks (if any) through the primary liner. Liquids collected will flow through the associated lateral geocomposite drainage layer sloped at a minimum of 2% and directly towards a leachate and leak detection collection sump.

The leak detection collection sump has a top dimension of 20-feet by 20-feet and is 2-feet deep with 3H:1V side slopes. The sump is equipped with a 12-inch HDPE SDR-17 leak detection witness riser.

Details I-O of the Permit Drawings in **Appendix K** of the PA depict the general configuration of the leachate and leak detection systems for both the landfill cells and the leachate evaporation pond.

See **Attachment E** for pipe design calculations of the following:

- Leachate Pipe Size and Perforation Design
- Drainage Rock sizing and Bedding Strain
- Pipe Ring Deflection
- HDPE pipe wall buckling under waste compression
- HDPE pipe wall crushing under waste compression

2.9 Final Cover System

Final waste slopes will be no steeper than 4H:1V. A final cover system will be installed over the final waste surface which will include surface-water control berms that will be constructed on the final cover system with approximately 25 ft. of vertical spacing between benches. While the interior of the berms will be 4H:1V, the exterior bench slope will be 3H:1V. The berms will be directed to rip-rap lined let-down structures built into the final cover system. The typical final cover system for the landfill will consist of (from top to bottom):

- A soil erosion/vegetation layer composed of at least 12-inches of vegetated soil. A 70% coverage of at least two native grasses shall be maintained in accordance with the post closure provisions of 19.15.36.18.C.2.b. The seed list shall conform to the most recent list from NMDOT Revegetation Zone 5 – Southern Desertic Basins, Plains, and Mountains.
- A compacted soil infiltration barrier layer composed of at least 26-inches of soil with a permeability of 1x10-5 cm/s or less.
- A compacted soil intermediate cover layer composed of at least 12-inches of soil with a permeability of 1x10 5 cm/s or less.

See **Attachment D** for a HELP model demonstrating equivalent performance to the prescriptive base line system defined in **19.15.36.14.C**. The modeling was performed in two tiers as directed by the New Mexico Environmental Department guidance document; *Performance Demonstration for an Alternative Cover Design Under Section 502.A.2 of the New Mexico Solid Waste Regulations (20 NMAC 9.1) Using HELP Modeling.* Tier 1 of the modeling first demonstrates the alternative liner's equivalent performance to the prescriptive liner and compliance with maintaining no more than 12-inches over the liner under open cell conditions. Tier 2 of the modeling demonstrates the alternative liner's performance under four operational conditions: open, partially filled, completely filled and closed with no established vegetation, and completely filled and closed with established vegetation. Tier 2 demonstrates that in all conditions no liquids will percolate through the liner and into the subsurface, thus protective of groundwater. All HELP model simulations assumed that native soils can achieve a compacted hydraulic conductivity of at least $1x10^{-5}$ cm/s based on the permeability testing results of onsite soils presented in **Attachment A of Appendix I** of the Permit Narrative. When approaching a closure selected stockpiles or borrow areas to be used for closure material will be sampled and tested. If testing results in a permeability greater than $1x10^{-5}$ cm/s the alternative cap thickness shall be adjusted accordingly at that time to maintain equivalent performance.

2.10 Slope Stability Analysis

Terracon has performed a comprehensive slope stability analysis of the cell excavation side slopes, base liner configuration, final waste slopes, and final cover system configuration as defined in previous sections. This analysis was performed using Geo-Slope International SLOPE-W® software. In summary, the 3H:1V excavation slope is stable upon placement of the base liner system with a minimum factor of safety of 1.6 in the Phase 2 critical slope. The 4H:1V waste fill slopes and final cover system are stable with a minimum factor of safety of 2.3

on the Phase 2 critical slope. Please see **Attachment G** for a comprehensive slope stability report and summary of modeling results.

3.0 19.15.36 DESIGN COMPLIANCE SUMMARY

The New Mexico design criteria for surface waste management landfills are contained in **19.15.36.14** and the design criteria for leachate evaporation ponds are contained in **19.15.36.17**. The following discussion lists the design criteria contained in these regulations and how the proposed Facility design complies.

Landfill Base Liner Design Requirements:

19.15.36.14.C Landfill Design Specification

As discussed in Sections 2.7 – 2.9, the proposed landfill has been designed with the required components.

19.15.36.14.C(1) Base Layer

As discussed in Section 2.7, due to the absence of suitable clayey materials onsite, and the groundwater setting, NGL proposes an alternative base layer consisting of a reinforced geosynthetic clay liner. Typical GCLs specified for landfill liner systems have hydraulic conductivities less than $1x10^{-9}$ cm/s (EPA 2001).

19.15.36.14.C(2) Lower Geomembrane

As discussed in Section 2.7, the lower membrane shall consist of 60-mil HDPE, in compliance with this regulation.

19.15.36.14.C(3) Leak Detection System

As discussed in Sections 2.6 - 2.8 NGL proposes to install an alternative leak detection system comprised of a 200-mil HDPE geocomposite blanket drainage collection system in lieu of soil and piping as prescribed. HDPE has high chemical resistance to oil field wastes and the leak detection system is sloped at 2% in the lateral direction compliant with this regulation.

19.15.36.14.C(4) Upper Geomembrane

As discussed in Sections 2.7 the upper membrane shall consist of 60-mil HDPE, in compliance with this regulation.

19.15.36.14.C(5) Leachate Collection and Removal System

As discussed in Sections 2.6 - 2.8 NGL proposes to install an alternative leachate collection and removal system comprised of a 200-mil HDPE Geocomposite blanket drainage collection system in lieu of soil and piping as prescribed.

In compliance with this regulation, HDPE is the material proposed for geomembrane and piping, which has high chemical resistance and is proven to withstand attack from oil field wastes. The leachate collection and removal systems are sloped at 2% in the lateral direction. The central collection trench pipe is a perforated 6-inch HDPE pipe, which will be protected by a drainage rock backfill and equipped with a solid cleanout riser embedded into a side slope riser trench. The leachate is collected in a centralized sump and conveyed to a leachate evaporation pond outside of landfill perimeter within a 4-inch double-walled HDPE force main.

19.15.36.14.C(6) Liner Protection Layer

As discussed Section 2.7 the liner system will be overlain with two-feet of protective soil cover with a saturated hydraulic conductivity of 1x10^{-2} cm/s or greater, in compliance with this regulation.

Landfill Final Cover System Design Requirements:

19.15.36.14.C(8) Final Cover System

As discussed in Section 2.6, 2.7, and 2.9, the final waste slopes shall not exceed 4H:1V or be less than 4% in compliance with this regulation. The final cover system shall include an alternative final cover system as defined in **Section 2.**

19.15.36.14.C(9) Alternative materials

NGL is proposing the use of reinforced GCL as the base foundation layer in place of two feet of compacted clay and 200-mil HDPE geocomposite in place of high permeability soils for drainage. **Attachment E** provides a demonstration of geocomposite hydraulic performance under these conditions.

19.15.36.14.C(10) External Piping

All leachate and leak detection riser piping will be installed along the side slopes of the cells in compliance with this regulation. Liner penetrations are not proposed.

19.15.36.14.D(1) Liner Specifications and Requirements - Geomembranes

(a) In compliance with this regulation, all geomembranes are specified as 60-mil textured HDPE. HDPE geomembranes have published permeabilities as low as $1x10^{-15}$ cm/s (Webber 2005) and have high chemical resistance with proven resistance to hydrocarbons, salts, acidic and alkaline solutions. HDPE also has a high UV resistance when exposed to sunlight.

(b) As provided in **Attachment E,** the membrane is designed to withstand projected stresses and settling from overlying waste and equipment operations.

(c) As designed, the base liner system maintains a minimum 2% lateral slope to promote positive drainage and to facilitate leachate collection and leak detection.

19.15.36.14.D(2) Liner Specifications and Requirements – Additional Geomembrane Requirements

(a) HDPE geomembranes have published and field proven high chemical resistance with resistance to chemical attack from oil field waste and resulting leachate.

(b) The base liner system has a maximum slope of 3H:1V which has been shown to be stable in the slope stability analysis in **Attachment G,** which considers the soil-geosynthetic and geosynthetic-geosynthetic interface friction angles.

(c) In general, all HDPE liner systems will be installed in compliance with this regulation as specified in the Construction Quality Assurance Plan provided in **Attachment H**.

19.15.36.14.E Requirements for Soil Components

(1) The prepared subgrade for the base liner system will be compacted to at least 90% standard Proctor (ASTM D-698), see **Attachment H**.

(2) All soil surfaces to receive geosynthetics will be prepared in compliance with this regulation, See **Attachment H.**

(3) As previously discussed, NGL proposes to replace the compacted clay foundation layer with a reinforced GCL, thus this regulation in not applicable.

19.15.36.14.F Soil Material Requirements for the Leachate Collection and Recovery System and Leak Detection System

(1) As previously discussed, NGL proposes to replace the prescribed soil drainage materials with a 200-mil HDPE geocomposite, thus this regulation in not applicable.

19.15.36.14.G Landfill Gas Control System

NGL is not required to, nor is proposing to install a landfill gas control system for this landfill at this time.

Leachate Evaporation Pond (LEP) Construction Standards:

19.15.36.17.A Engineering Design Plan

This EDR includes design information for the LEP and its liner system, which is certified by Michael Bradford, P.E. The overall PA for the Facility incorporates and integrates the LEP operation and maintenance procedures (**Appendices D** and **E** of the PA), closure planning (**Appendix G** of the PA), and hydrologic information (**Appendix I** of the PA). Thus, the overall PA demonstrates compliance with this regulation.

19.15.36.17.B Construction Standards

(1) The LEP has been designed as prescribed in the Regulations, thus protective of fresh water, public health, and the environment.

(2) The proposed LEP is designed with a primary and secondary 60-mil HDPE geomembrane with a leak detection layer between them.

(3) In compliance with this regulation, the primary and secondary liners are specified as 60-mil textured HDPE. HDPE geomembranes have published permeabilities as low as $1x10^{-15}$ cm/s (Webber 2005) and have high chemical resistance with proven resistance to hydrocarbons, salts, acidic and alkaline solutions. HDPE with carbon black also has a high UV resistance when exposed to sunlight.

(4) NGL is proposing to use 200-mil HDPE geocomposite in place of high permeability soils for drainage. **Attachment E** provides a demonstration of geocomposite hydraulic performance under these conditions.

(5) As discussed in Section 2.6 and **Attachment H,** the pond has been designed and will be constructed in compliance with this regulation.

(6) The discharge point of the leachate force main into the pond will be reinforced to protect the liner system from excessive hydrostatic force. No liner penetrations are proposed.

(7) As discussed in Section 2.7 the primary liner shall consist of 60-mil HDPE, in compliance with this regulation.

(8) As discussed in Section 2.7 the secondary liner shall consist of 60-mil HDPE, in compliance with this regulation.

(9) As discussed in Sections 2.6 - 2.8 NGL proposes to install an alternative leak detection system comprised of a 200-mil HDPE geocomposite blanket drainage collection system in lieu of soil and piping as prescribed. HDPE has high chemical resistance to oil field wastes and the leak detection system is sloped at 2% in the lateral direction, compliant with this regulation. Discharge from this pond is not proposed.

(10) Not applicable

(11) The LEP has been designed with 3-feet of freeboard under the worst-case leachate generation condition, See **Attachment C.**

(12) The LEP has a leachate storage capacity of approximately 9.3 acre-feet, in compliance with this regulation which limits the capacity of evaporation ponds to 10 acre-feet.

4.0 REFERENCES

Daniel, D.E. and Estornell P. (1991) “Hydraulic Conductivity of Three Geosynthetic Clay Liners” *Journal of Civil Engineering* 118(10) 2605.

U.S. EPA. 2001. **Geosynthetic Clay Liners Used in Municipal Solid Waste Landfills**. EPA530-F-97-002. Solid Waste and Emergency Response. December.

Weber, C.T., and Zornberg, J.G. (2005). Leakage through Liners under High Hydraulic Heads." Geosynthetics Research and Development in Progress, Eighteenth Geosynthetic Research Institute Conference (GRI-18), Austin, Texas, January 26

Attachment A

Run-on and Run-off Surface Water Management Report

PROJECT: South Ranch Surface Waste Management Permit Application– Run-on and Run-off Surface Water Management

PAGE: 1 of 5

JOB NO.: 35187378 **DATE:** October 2019 **COMP. BY:** MPB **CHECKED BY:** FOC

CALCULATIONS BY: Michael P. Bradford, P.E. – Senior Project Manager
Terracon Consultants, Inc.
25809 Interstate 30 South
Bryant, Arkansas 72022
(501) 847-9292

I. RUN OFF SURFACE WATER MODELING

MODELING METHOD

Autodesk Storm and Sanitary Analysis 2019 (SSA)

ANALYSIS

A detailed engineering analysis was performed on the components that comprise the stormwater management system for surface water runoff within the facility boundaries. The components analyzed for this permit modification include:

1. Stormwater Letdown Structures
2. Slope Integrated diversion channels
3. Perimeter Ditches
4. Stormwater Ponds

As required by ***NMAC 19.15.36***, the hydrologic analysis was performed utilizing a 25-year, 24-hour rainfall event. SSA was utilized to perform the engineering analysis to assure compliance with the above regulations. The analysis was performed for the post development conditions of the Facility. This is considered to be a conservative approach for the design capacity of the stormwater pond and other conveyance features.

SSA was utilized to illustrate the capacity of the stormwater letdown structures, slope integrated berms, and perimeter ditches. These results were generated to assure that the conveyance parameters of stormwater design elements are adequate.

PARAMETERS USED IN THE ANALYSES

The following are the lists of parameters that were considered for stormwater management:

Based on ***NMAC 19.15.36,*** a 25-year, 24-hour rainfall event, with a cumulative precipitation depth of 4.88 inches, was considered for design of the proposed landfill permit area. A time series rain gauge for Lea County, New Mexico was generated using the SSA databases, which are derived from NOAA information. The proposed disposal area was first segregated into 60 sub-basins, 95 nodes, and 93 links, then the areas were determined. It was concluded that the Landfill would fall into the Type II rainfall distribution as published by the Nation Resource Conservation Service (NRCS). The 25-year, 24- rainfall data for Lea County was available within the SSA. The EPA SWMM hydrology method was used due to its flexibility, such as allowances for existing soil moisture and evaporation.

For each element in the design, the following parameters, if applicable, were input or calculated using the SSA software and dialogue box selections, typical values or site design information:

- Runoff Curve Number
  - Data gathered from NRCS Web Soil Survey and TR-55 Tables
    - Kermit-Wink Fine Sandy Loams and Kermit-Palomas Fine Sands.
      - Hydraulic Soil Group A.
    - CN = 76 from Table 2-2a of the TR-55 Manual for “Newly Graded, Pervious Areas, No Vegetation”
- Area (Ac);
  - Automatically calculated based on site design
- Impervious Area (%);
  - 0% assumed globally this site is not expected to have significant areas of pavement
- Drying Time (days);
  - 2 days assumed globally
- Average Slope (%);
  - 1.0% for side slope berms
  - 0.5% min for perimeter channels
  - 4 horizontal to 1 Vertical for waste side slopes
  - 4% waste top deck
  - 0.5% for entrance/admin/staging area
- Equivalent Width (ft)
  - Critical flow path as determined by site design
- Pervious Area Manning’s Roughness, taken from SSA databases;
  - 0.027 for Landfill – “poor grass cover, moderately rough surface”
  - 0.015 for Entrance/Admin/Staging area – “Gravel”
  - 0.035 for Let Down Structures, “rip-rap”
  - 0.011 for Culverts – “concrete”
- Link Invert Information (elevation)
  - Taken from site design
- Link Cross Section
  - V-ditch for all side slope diversion channels
    - Manning’s n = 0.027
  - Trapezoidal ditch for all perimeter ditches
    - Manning’s n = 0.027

- Circular for all culverts
  - Manning's n = 0.011

SUMMARY OF RESULTS

Stormwater Letdown Structures

Four (4) stormwater letdown structures are planned for the final landfill configuration, beginning with letdown structure 1 in the north landfill face of the finished landfill and distributed clockwise around the landfill to letdown structure 4 on the west face of the landfill. Each of these letdown structures has been designed with a 10-foot bottom width, 2' depth, 3:1 side slopes, and 25% traverse slope. The flow capacity of these let down structures is approximately 950 cubic feet per second (cfs). The SSA calculated maximum peak flow values from a 25-year, 24-hour rainfall event for lower most design segments of the letdown structures range from 70 CFS to 100 cfs. The SSA generated output tables for the stormwater analysis can be found in **Exhibit A.1, also see Figures depicting links, junctions, basins, and storage nodes for visual reference** .

Slope Integrated Berms

The landfill slope integrated berms were designed assuming that the berms would collect and transfer the entire area of each letdown sub-basin runoff volume. With this assumption, the maximum flow to be carried in a slope integrated berm is ~34 cubic feet per second (cfs). Each letdown has at least six slope integrated berms with contributing drainage areas varying in size. The slope integrated berms will be sloped at 1.0 percent and have a depth of 1.5-feet, providing a maximum flow capacity of approximately ~42 cfs. The side slopes of the berms will be 4:1 (using the 4:1 final cover system of the landfill for one side).

Perimeter Ditches

The perimeter channels along the west, south, and north sides have been designed with a 10-foot bottom width, 3-foot depth, 4:1 side slopes, and a traverse slope of 1.5% minimum. The perimeter channel along the east side has been designed with a 6-foot bottom width, 3-foot depth and 4:1 side slope.

- North-to-West Ditch (Link 74)
  - Design Capacity ~117 cfs
  - Peak Flow during design storm ~66 cfs
- North-to-East Ditch – 1 (Link 21)
  - Design Capacity ~131cfs
  - Peak Flow during design storm ~72 cfs
- South-to-West Ditch – 2 (Link 68)
  - Design Capacity ~320 cfs
  - Peak Flow during design storm ~44 cfs
- South-to-East Ditch (Link 18 and Link 59)
  - Design Capacity ~228 cfs

    - Peak Flow during design storm ~43 cfs

See **Exhibit A.1** for results

Culverts

Each of the perimeter ditches must transition through a culvert below the main access/haul roads prior to entering one of the two retention ponds. Culverts are size to flow approximately half full at peak discharge. To minimize entrance losses and surcharging, the culverts will be installed with approximately half of the pipe installed below the flow line of the channel. The following is a summary of the culverts proposed:

- Northwest Culvert (Link 93)
    - 2 barrel, 24-inch concrete pipe
    - Design Flow = 128 cfs
    - Peak Flow during design storm = 67 cfs
- Northeast Culvert (Link 102)
    - 1 barrel, 36-inch concrete pipe
    - Design Flow = 194 cfs
    - Peak Flow during design storm = 118 cfs
- East Letdown Culvert (Link 32)
    - 3 barrel, 18-inch concrete pipe
    - Design Flow = 134 cfs
    - Peak Flow during design storm = 82 cfs
- East Perimeter Road Culvert (Link 98)
    - 1 barrel, 24-inch concrete pipe
    - Design Flow = 141 cfs
    - Peak Flow during design storm = 82 cfs
- Southeast Culvert (Link 25)
    - 1 barrel, 24-inch concrete pipe
    - Design Flow = 78 cfs
    - Peak Flow during design storm = 43 cfs
- Southwest Culvert (Link 94)
    - 1 barrel, 24-inch concrete pipe
    - Design Flow = 53 cfs
    - Peak Flow during design storm = 44 cfs
- West Letdown Culvert (Link 91)
    - 1 barrel, 30-inch concrete pipe
    - Design Flow = 178 cfs
    - Peak Flow during design storm = 77 cfs

Stormwater culvert sizing is presented in **Exhibit A.1, also see Figures depicting links, junctions, basins, and storage nodes for visual reference**.

Stormwater/Sedimentation Pond

The facility will be required to hold the run-off from a 25-year, 24-hour storm. As shown in **Exhibit A.1,** the three proposed ponds will provide sufficient capacity to retain the entire runoff volume from their associated contributing basins from the 25-year, 24-hour storm event. Each pond has been size to be 10-feet deep with 4:1 side slopes in order to maximize borrow soil generation. These ponds will each have a minimum of 3' freeboard, and some additional capacity in the case that the pond is retaining some liquids already at the time of the design storm event.

I. RUN-ON SURFACE WATER MODELING

ANALYSIS

Review of regional topographic maps from various sources indicate that the topography surrounding the Facility is a essentially flat with very slight gradient of 0.2% from north to south. There is negligible gradient east to west. Further, a qualified professional engineer from Terracon performed an engineering site reconnaissance visit to the proposed facility. In this visit and it was observed that Highway J-3 (Frying Pan Road) and Beckham Road which immediately parallel the northern and western Facility boundary are set lower than the site and effectively cut-off and manage any stormwater drainage approaching the Facility's northern and western boundaries. Terracon observed no evidence of stormwater drainage towards the Facility from the East, South, or West directions, which verifies the topographic map review. Although there is no evidence of drainage towards the eastern boundary, a natural gully was observed to run along the east property boundary on the adjacent property and would effectively cut-off and manage any stormwater run-on from the east, if any. Therefore, no stormwater run-on management system is necessary. However, to ensure surface run-on water, if any, is effectively cut-off and prevented from entering the facility, a 2-foot tall earth berm will be constructed along the entire perimeter of the facility. In general, surface water will be prevented from entering the active disposal area via a berm around the perimeter of the disposal area and all perimeter roads and drainage will be tipped away from the active areas. Berms and drainage are detailed in the permit drawings provided in **Appendix K** of the permit application. See **Figure A-1** for a map of regional topography illustrating and confirming the information provided above.

PROJECT: South Ranch Surface Waste Management Permit Application– Run-on and Run-off Surface Water Management

PAGE: A of 7

JOB NO.: 35187378 **DATE:** October 2019 **COMP. BY:** MPB **CHECKED BY:** FOC

FIGURE A-1
Regional Drainage Basin Map

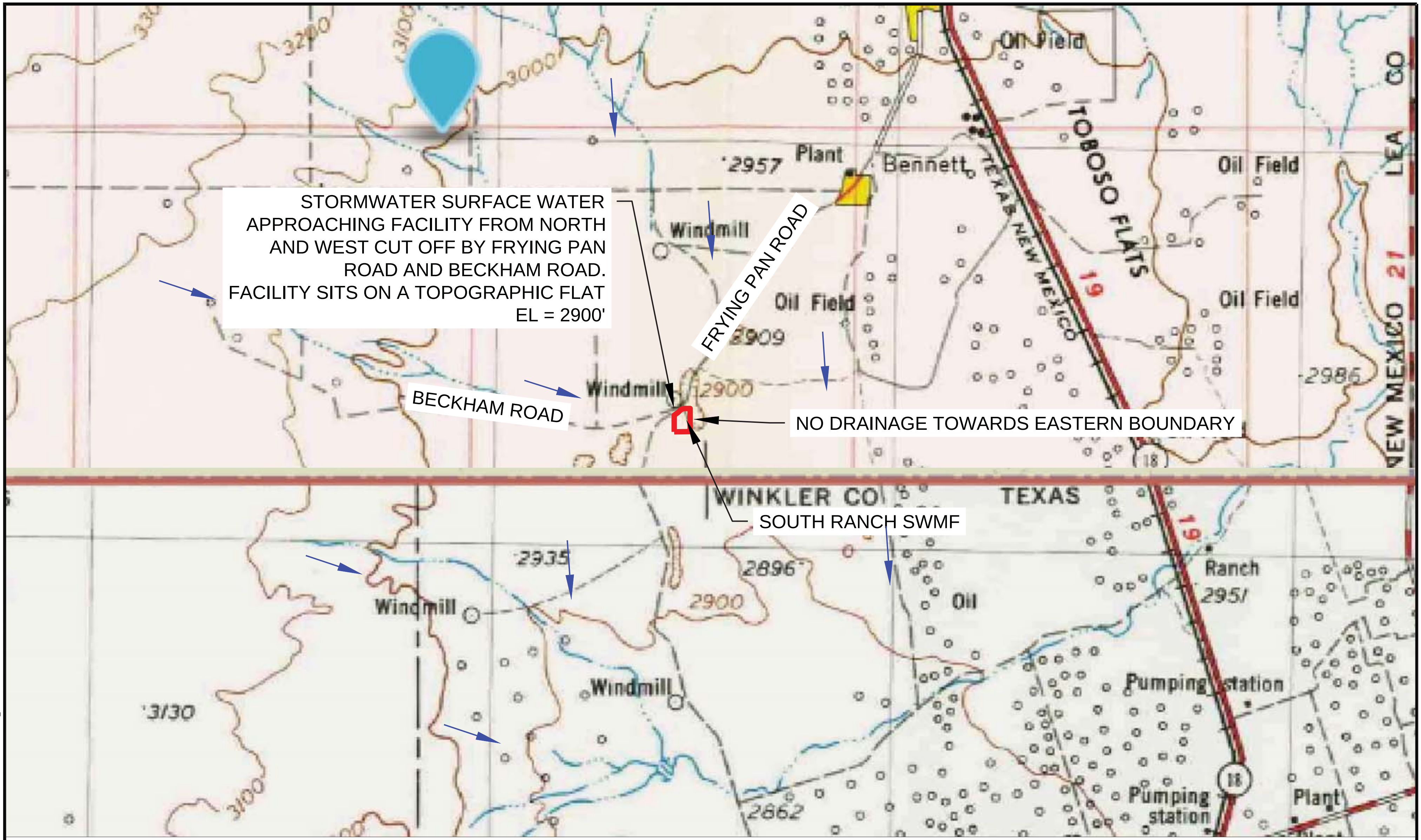


IMAGE SOURCE: UNITED STATES GEOLOGICAL SURVEY (USGS) QUADRANGLE TOPOGRAPHIC MAPS FOR LEA COUNTY, NEW MEXICO AND WINKLER COUNTY, TEXAS TAKEN FROM THE USGS NATIONAL GEOLOGIC MAP DATABASE TOPOVIEW GIS VIEWER.

REV.	DATE	BY	DESCRIPTION

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9292 FAX. (501) 847-9210

REGIONAL DRAINAGE MAP
PERMIT APPLICATION FIGURE
SURFACE WASTE MANAGEMENT FACILITY
SOUTH RANCH
LEA COUNTY NEW MEXICO

FIG. A-1

DESIGNED BY:	-
DRAWN BY:	DEW
APPVD. BY:	MPB
SCALE:	1" = 100'
DATE:	SEPTEMBER 2019
JOB NO.	35187378
ACAD NO.	572/002
SHEET NO.:	1 OF 1

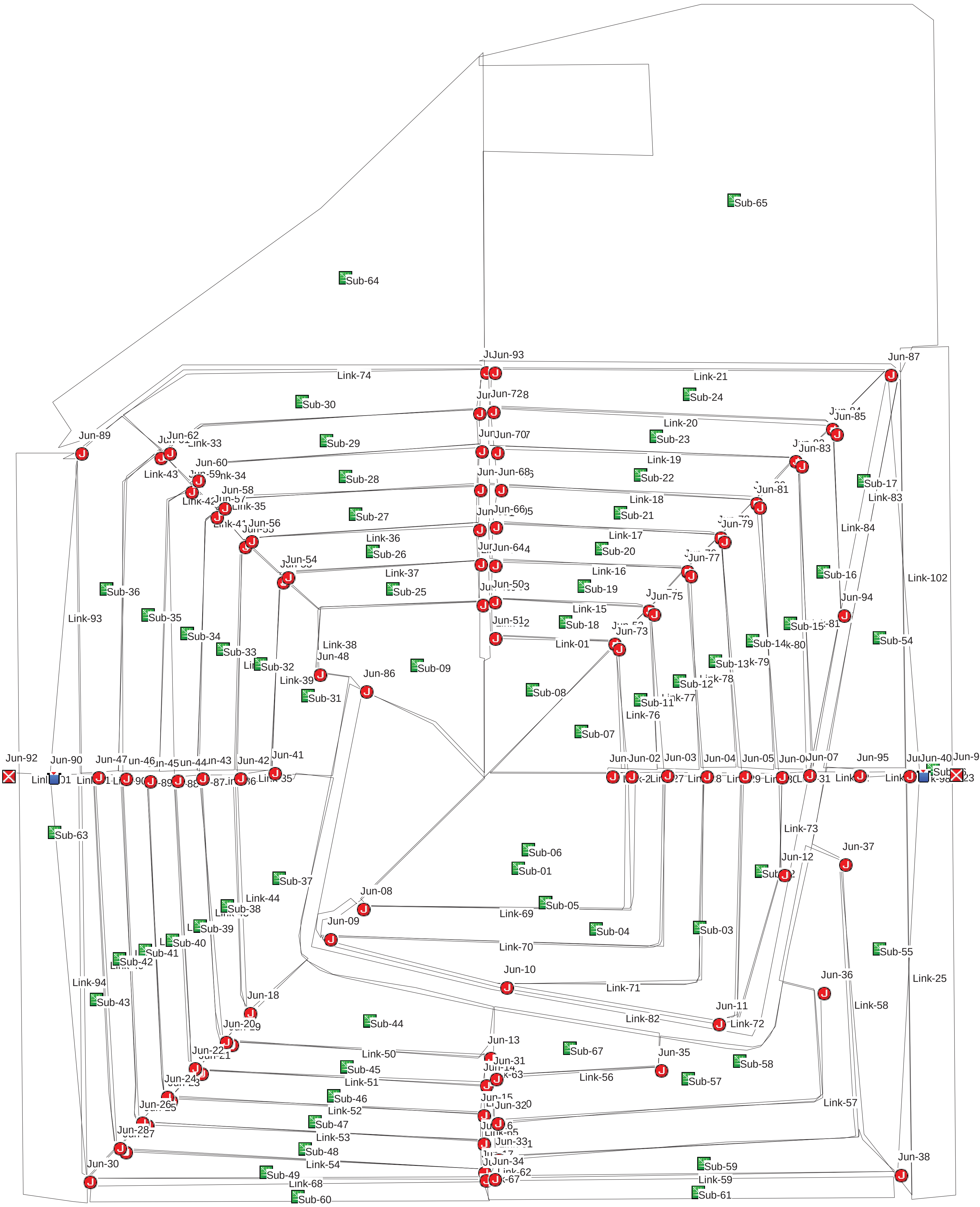
N:\GECARCHIVE\CAD\572\002\BECKHAM\35187378 DESIGN PERMITTING\PERMIT DRAWINGS_FIGURES\PERMIT FIGURES\APP J\ATT A\FIG 1 - SITE LOCATION MAP.DWG

PROJECT: South Ranch Surface Waste Management Permit Application– Run-on and Run-off Surface Water Management

PAGE: A of 7

JOB NO.: 35187378 **DATE:** October 2019 **COMP. BY:** MPB **CHECKED BY:** FOC

Exhibit A.1
Run-off Design Figures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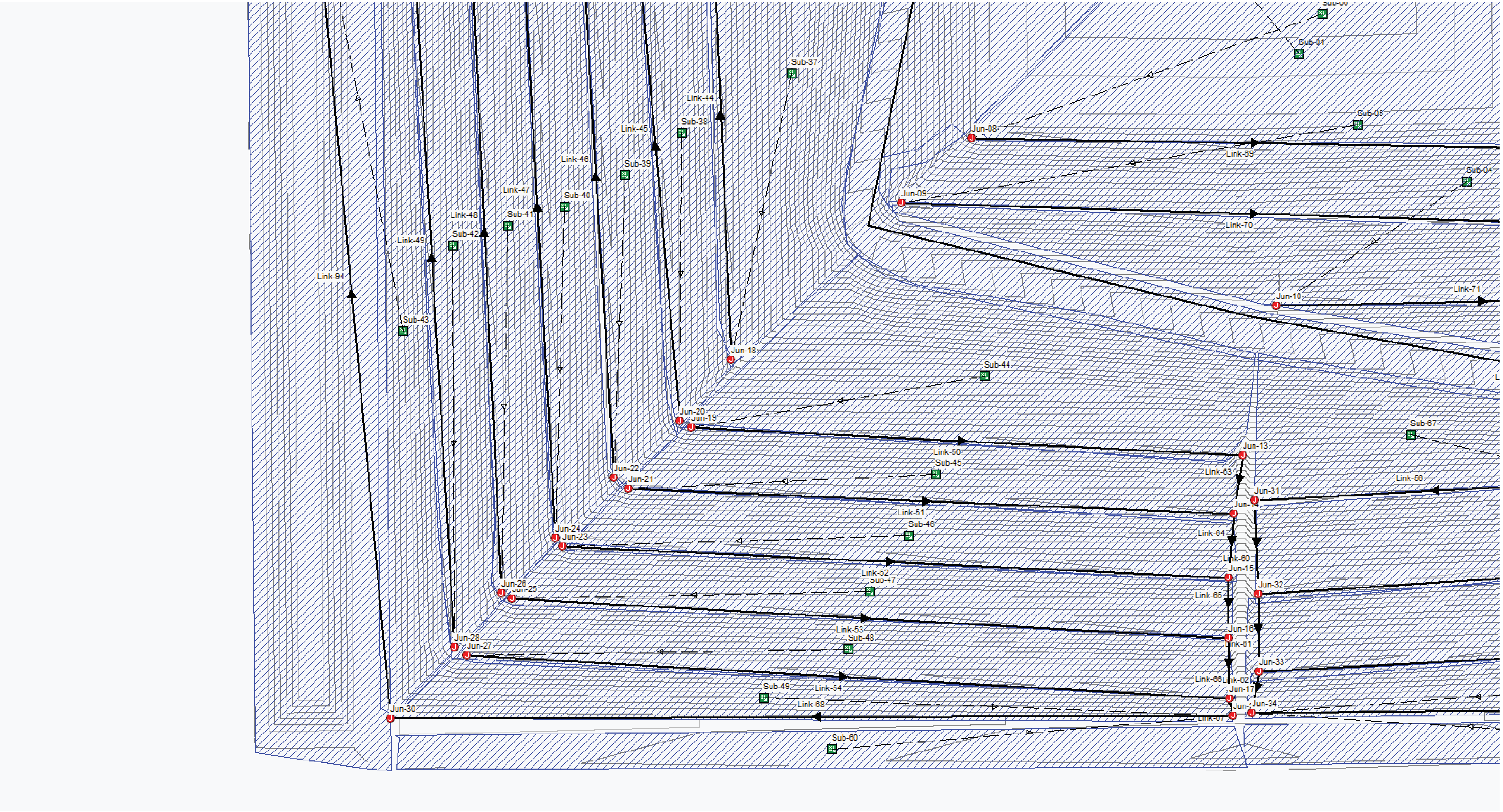


FIGURE 2 - SOUTHWEST

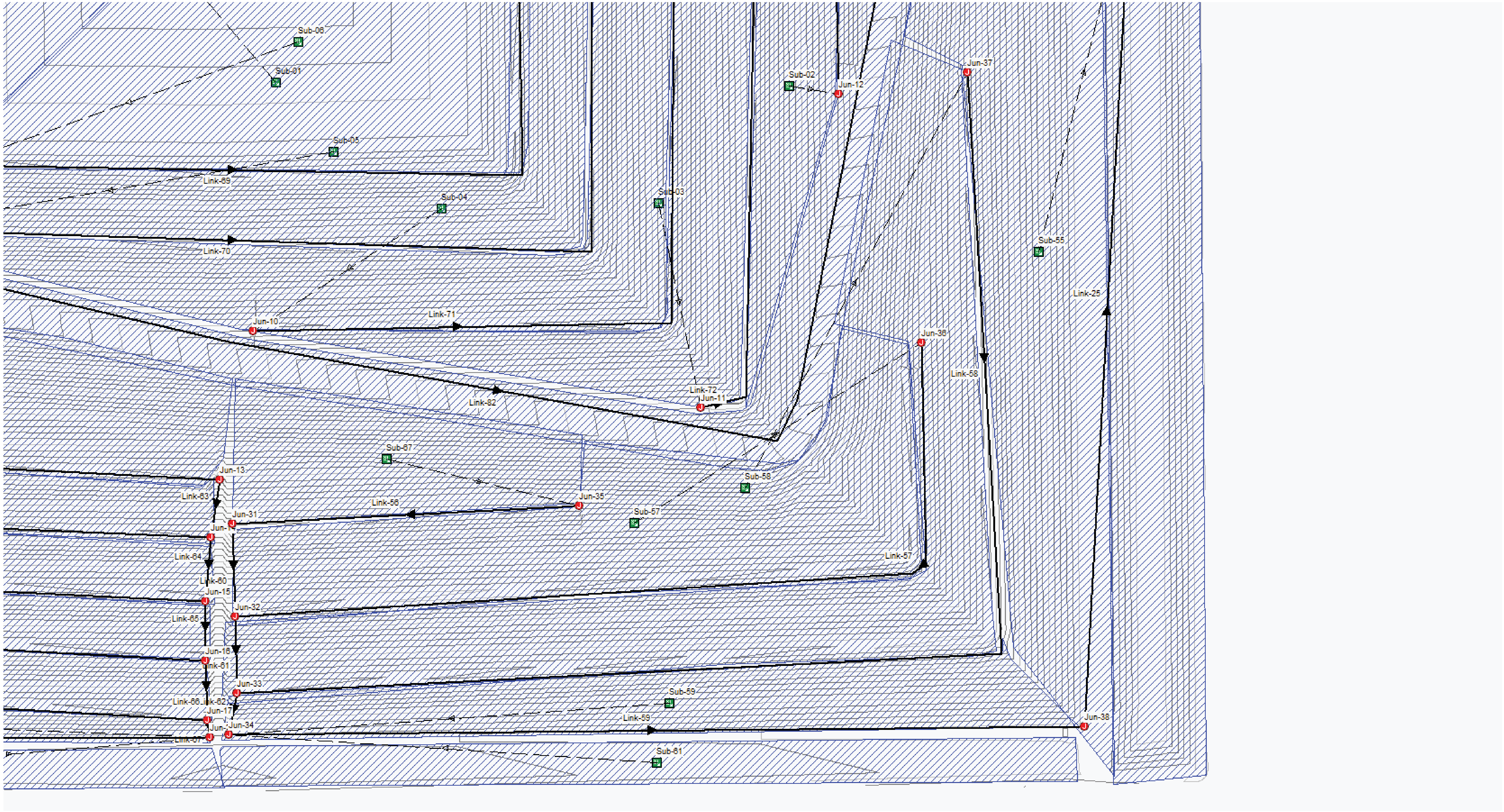
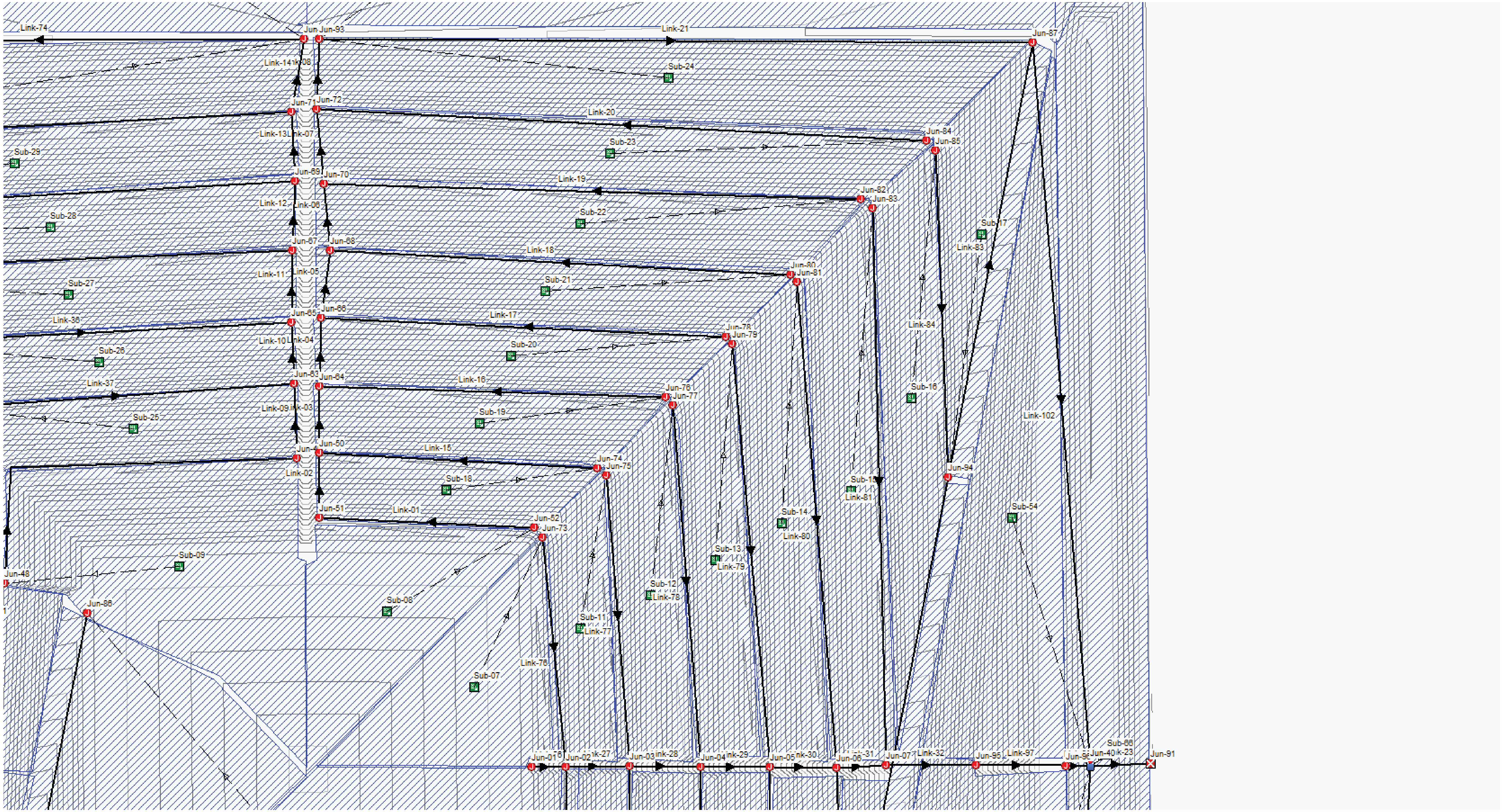


FIGURE 3 - SOUTHEAST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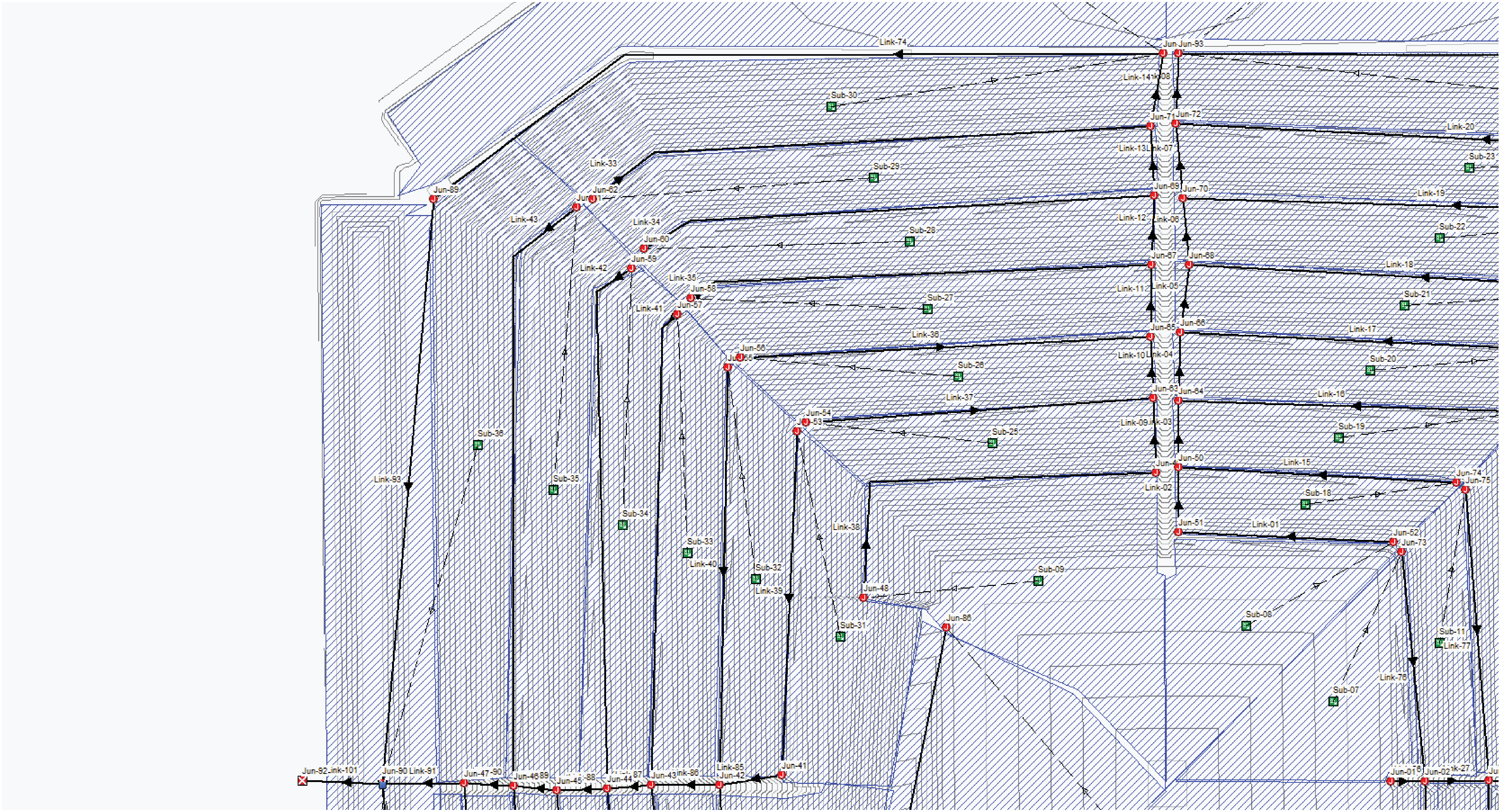
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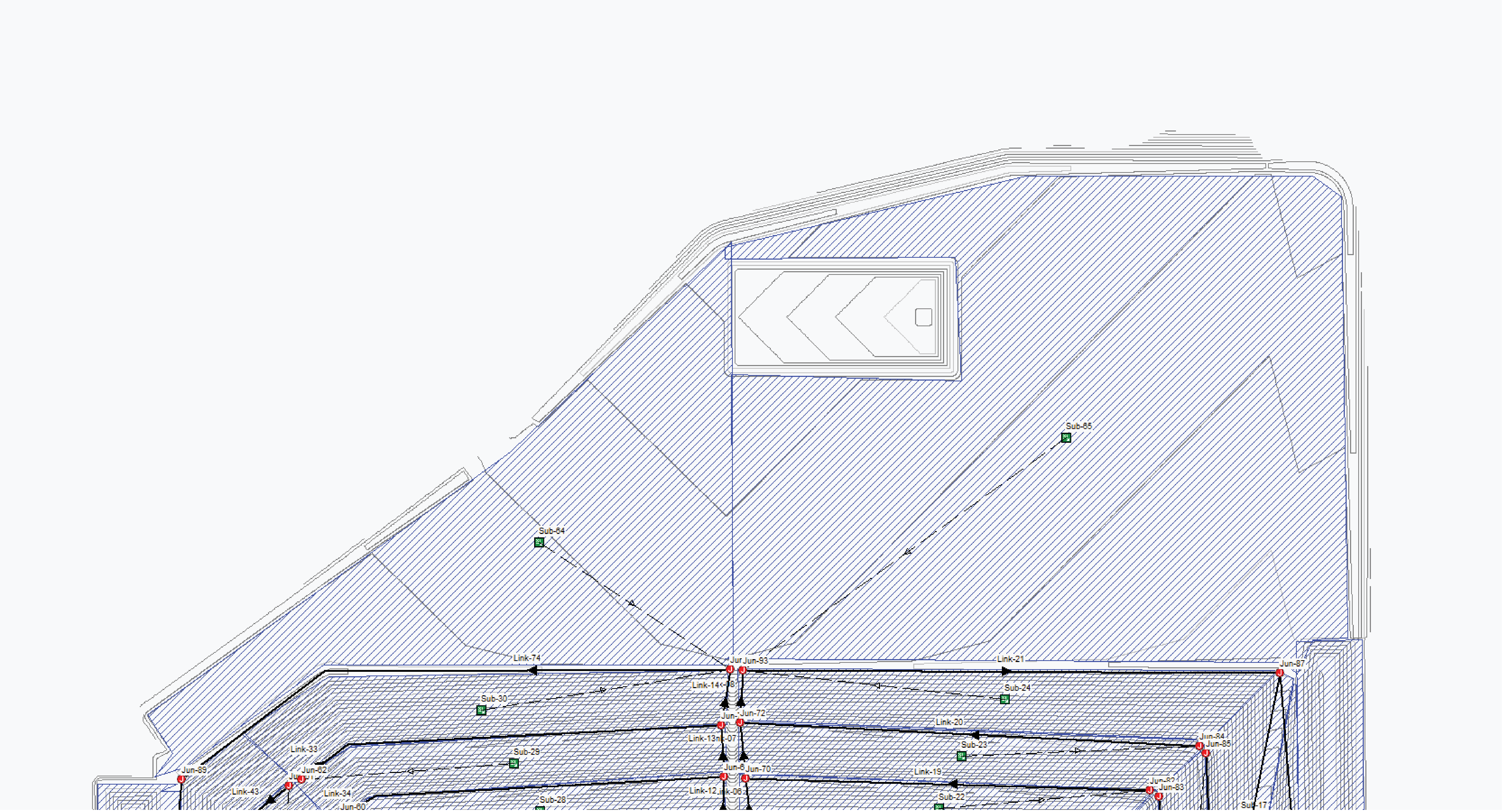

FIGURE 6 - NORTH AREA

PROJECT: South Ranch Surface Waste Management Permit Application– Run-on and Run-off Surface Water Management

PAGE: A of 7

JOB NO.: 35187378 **DATE:** October 2019 **COMP. BY:** MPB **CHECKED BY:** FOC

Exhibit A.2

Run-off Design Results

Storm and Sanitary Analysis Results

South Ranch Surface Waste Management Facility

SSA RESULTS

10/17/2019

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Inlet Invert Offset	Outlet Invert Elevation	Outlet Invert Offset	Total Drop	Average Slope	Pipe Shape	Pipe Diameter or Height	Pipe Width	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow	Flap Gate	Lengthening Factor	Peak Flow	Time of Peak Flow Occurrence	Max Flow Velocity	Travel Time	Design Flow Capacity	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged	Max Flow Depth	Reported Condition
					(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(%)		(inches)	(inches)					(cfs)			(cfs)	(days hh:mm)	(ft/sec)	(min)	(cfs)			(min)	(ft)	
1	Link-102		64	64	100.00	2895.30	-2.00	2889.24	0.24	6.06	6.0600	CIRCULAR	36.000	36.00	0.0110	0.5000	0.5000	0.0000	0.00	NO	1.00	105.70	0 12:09	31.21	0.05	223.79	0.47	0.48	0.00	1.45	Calculated
2	Link-25		64	64	1114.55	2898.05	0.00	2889.24	0.24	8.81	0.7900	CIRCULAR	30.000	30.00	0.0110	0.5000	0.5000	0.0000	0.00	NO	1.00	42.14	0 12:11	8.90	2.09	86.20	0.49	0.49	0.00	1.23	Calculated
3	Link-32		64	64	139.61	2956.11	0.00	2922.50	0.00	33.61	24.0700	CIRCULAR	18.000	18.00	0.0150	0.5000	0.5000	0.0000	0.00	NO	1.00	81.54	0 12:07	26.50	0.09	134.00	0.61	0.56	0.00	0.84	Calculated
4	Link-91		64	64	126.70	2907.19	0.00	2890.00	0.00	17.19	13.5700	CIRCULAR	30.000	30.00	0.0110	0.5000	0.5000	0.0000	0.00	NO	1.00	76.93	0 12:03	35.02	0.06	178.55	0.43	0.46	0.00	1.14	Calculated
5	Link-93		64	64	909.05	2896.02	-2.00	2890.00	0.00	6.02	0.6600	CIRCULAR	30.000	30.00	0.0110	0.5000	0.5000	0.0000	0.00	NO	1.00	66.06	0 12:11	10.22	1.48	91.06	0.73	0.63	0.00	1.57	Calculated
6	Link-94		64	64	1131.28	2897.78	8.03	2890.00	0.00	7.78	0.6900	CIRCULAR	30.000	30.00	0.0150	0.5000	0.5000	0.0000	0.00	NO	1.00	44.18	0 12:10	6.90	2.73	58.96	0.75	0.64	0.00	1.59	Calculated
7	Link-98		64	64	37.79	2900.28	0.00	2889.63	0.63	10.65	28.1800	CIRCULAR	24.000	24.00	0.0110	0.5000	0.5000	0.0000	0.00	NO	1.00	81.47	0 12:07	46.70	0.01	141.93	0.57	0.54	0.00	1.08	Calculated

South Ranch Surface Waste Management Facility
SSA RESULTS

05/17/2019

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Channel Type	Channel Height (ft)	Channel Width (ft)	Left Overbank Manning's Roughness	Channel Manning's Roughness	Right Overbank Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	Lengthening Factor	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Max Flow Velocity (ft/sec)	Travel Time (min)	Design Flow Capacity (cfs)	Max Flow / Design Flow Ratio	Max Flow Depth / Total Depth Ratio	Total Time Surcharged (min)	Max Flow Depth (ft)	Reported Condition
1	Link-01		64	64	333.05	3096.93	0.00	3091.97	0.00	4.96	1.4900	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	6.02	0 12:02	3.31	1.68	48.90	0.12	0.46	0.00	0.68	Calculated
2	Link-02		64	64	100.76	3091.97	0.00	3065.40	0.00	26.57	26.3700	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	6.02	0 12:02	5.04	0.33	878.45	0.01	0.06	0.00	0.11	Calculated
3	Link-03		64	64	102.56	3065.40	0.00	3040.00	0.00	25.40	24.7700	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	10.26	0 12:02	6.06	0.28	851.32	0.01	0.08	0.00	0.16	Calculated
4	Link-04		64	64	106.24	3040.00	0.00	3012.79	0.00	27.21	25.6100	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	15.57	0 12:02	7.16	0.25	865.74	0.02	0.10	0.00	0.20	Calculated
5	Link-05		64	64	105.15	3012.79	0.00	2986.69	0.00	26.10	24.8200	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	21.43	0 12:02	7.98	0.22	852.28	0.03	0.12	0.00	0.24	Calculated
6	Link-06		64	64	104.65	2986.69	0.00	2959.92	0.00	26.77	25.5800	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	28.33	0 12:03	8.93	0.20	865.21	0.03	0.15	0.00	0.29	Calculated
7	Link-07		64	64	115.01	2959.92	0.00	2933.66	0.00	26.26	22.8300	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	36.45	0 12:03	9.43	0.20	817.42	0.04	0.18	0.00	0.34	Calculated
8	Link-08		64	64	109.01	2933.66	0.00	2902.69	0.00	30.97	28.4100	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	44.88	0 12:03	10.89	0.17	911.81	0.05	0.19	0.00	0.37	Calculated
9	Link-09		64	64	115.03	3065.93	0.00	3039.99	0.00	25.94	22.5500	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	10.04	0 12:07	5.84	0.33	812.36	0.01	0.08	0.00	0.16	Calculated
10	Link-10		64	64	95.89	3039.99	0.00	3012.73	0.00	27.26	28.4300	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	14.94	0 12:07	7.29	0.22	912.10	0.02	0.10	0.00	0.19	Calculated
11	Link-101		64	64	124.64	2890.00	0.00	2887.00	2887.00	3.00	2.4100	Trapezoidal	10.000	92.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	179.18	0 12:12	6.82	0.30	18456.24	0.01	0.08	0.00	0.76	Calculated
12	Link-11		64	64	110.40	3012.73	0.00	2985.81	0.00	26.92	24.3800	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	20.41	0 12:07	7.80	0.24	844.73	0.02	0.12	0.00	0.24	Calculated
13	Link-12		64	64	108.37	2985.81	0.00	2959.64	0.00	26.17	24.1500	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	27.17	0 12:04	8.63	0.21	840.65	0.03	0.14	0.00	0.29	Calculated
14	Link-13		64	64	106.39	2959.64	0.00	2933.89	0.00	25.75	24.2000	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	34.72	0 12:04	9.44	0.19	841.60	0.04	0.17	0.00	0.33	Calculated
15	Link-14		64	64	115.38	2933.89	0.00	2902.69	0.00	31.20	27.0400	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	42.55	0 12:04	10.52	0.18	889.57	0.05	0.18	0.00	0.36	Calculated
16	Link-15		64	64	430.85	3074.34	0.00	3065.40	0.00	8.94	2.0700	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	4.29	0 12:01	3.42	2.10	57.72	0.07	0.38	0.00	0.56	Calculated
17	Link-16		64	64	536.26	3044.49	0.00	3040.00	0.00	4.49	0.8400	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	5.32	0 12:02	2.88	3.10	36.67	0.15	0.48	0.00	0.71	Calculated
18	Link-17		64	64	628.31	3019.32	0.00	3012.79	0.00	6.53	1.0400	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	5.87	0 12:03	3.22	3.25	40.85	0.14	0.48	0.00	0.71	Calculated
19	Link-18		64	64	713.60	2994.25	0.00	2986.69	0.00	7.56	1.0600	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	6.92	0 12:03	3.41	3.49	41.24	0.17	0.51	0.00	0.75	Calculated
20	Link-19		64	64	832.36	2969.37	0.00	2959.92	0.00	9.45	1.1400	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	8.18	0 12:04	3.68	3.77	42.70	0.19	0.54	0.00	0.79	Calculated
21	Link-20		64	64	945.57	2942.80	0.00	2933.66	0.00	9.14	0.9700	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	8.56	0 12:07	3.62	4.35	39.40	0.22	0.56	0.00	0.84	Calculated
22	Link-21		64	64	1105.08	2902.69	0.00	2897.30	0.00	5.39	0.4900	Trapezoidal	2.000	26.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	72.36	0 12:09	3.34	5.51	130.96	0.55	0.73	0.00	1.43	Calculated
23	Link-23		64	64	92.52	2888.56	-0.44	2885.56	2885.56	3.00	3.2400	Trapezoidal	10.000	92.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	241.51	0 12:11	8.73	0.18	22938.91	0.01	0.08	0.00	0.80	Calculated
24	Link-26		64	64	53.08	3096.42	0.00	3081.70	0.00	14.72	27.7300	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	0.00	0 00:00	0.00		900.86	0.00	0.00	0.00	0.00	Calculated
25	Link-27		64	64	99.93	3081.70	0.00	3060.94	0.00	20.76	20.7700	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	19.29	0 12:07	7.26	0.23	779.71	0.02	0.12	0.00	0.24	Calculated
26	Link-28		64	64	109.30	3060.94	0.00	3035.63	0.00	25.31	23.1600	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	33.03	0 12:07	9.14	0.20	823.19	0.04	0.16	0.00	0.32	Calculated
27	Link-29		64	64	107.73	3035.63	0.00	3007.60	0.00	28.03	26.0200	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	49.75	0 12:07	10.98	0.16	872.59	0.06	0.20	0.00	0.39	Calculated
28	Link-30		64	64	103.06	3007.60	0.00	2982.83	4.83	24.77	24.0300	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	63.23	0 12:07	11.63	0.15	838.66	0.08	0.24	0.00	0.47	Calculated
29	Link-31		64	64	76.64	2982.83	4.83	2956.11	0.00	26.72	34.8600	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	73.89	0 12:07	13.87	0.09	1010.08	0.07	0.23	0.00	0.46	Calculated
30	Link-33		64	64	888.73	2941.05	0.00	2933.89	0.00	7.16	0.8100	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	7.84	0 12:07	3.36	4.41	35.97	0.22	0.56	0.00	0.84	Calculated
31	Link-34		64	64	803.01	2968.95	0.00	2959.64	0.00	9.31	1.1600	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	7.59	0 12:03	3.64	3.68	43.15	0.18	0.52	0.00	0.77	Calculated
32	Link-35		64	64	721.12	2994.05	0.00	2985.81	0.00	8.24	1.1400	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	7.08	0 12:03	3.50	3.43	42.83	0.17	0.51	0.00	0.75	Calculated
33	Link-36		64	64	636.17	3018.95	0.00	3012.73	0.00	6.22	0.9800	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	5.98	0 12:03	3.18	3.33	39.62	0.15	0.49	0.00	0.72	Calculated
34	Link-37		64	64	538.88	3043.85	0.00	3039.99	0.00	3.86	0.7200	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	5.43	0 12:02	2.77	3.24	33.91	0.16	0.50	0.00	0.74	Calculated
35	Link-38		64	64	622.26	3068.71	0.00	3065.93	0.00	2.78	0.4500	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	10.05	0 12:07	2.52	4.12	26.78	0.38	0.69	0.00	1.02	Calculated
36	Link-39		64	64	533.52	3044.64	0.00	3040.27	0.00	4.37	0.8200	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	7.34	0 12:02	2.98	2.98	36.27	0.20	0.55	0.00	0.81	Calculated
37	Link-40		64	64	646.12	3018.95	0.00	3010.54	0.00	8.41	1.3000	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	5.92	0 12:02	3.46	3.11	45.72	0.13	0.46	0.00	0.68	Calculated
38	Link-41		64	64	739.57	2993.67	0.00	2984.94	0.00	8.73	1.1800	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	6.57	0 12:03	3.52	3.50	43.54	0.15	0.49	0.00	0.72	Calculated
39	Link-42		64	64	835.39	2968.54	0.00	2955.99	0.00	12.55	1.5000	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	7.56	0 12:03	3.95	3.52	49.11	0.15	0.49	0.00	0.73	Calculated
40	Link-43		64	64	944.17	2942.84	0.00	2930.04	0.00	12.80	1.3600	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	9.05	0 12:04	4.03	3.90	46.66	0.19	0.54	0.00	0.80	Calculated
41	Link-44		64	64	655.74	3018.23	0.00	3010.54	0.00	7.69	1.1700	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	10.67	0 12:03	3.67	2.98	43.39	0.25	0.59	0.00	0.87	Calculated
42	Link-45		64	64	738.07	2997.91	0.00	2984.94	0.00	12.97	1.7600	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	5.35	0 12:02	3.85	3.20	53.12	0.10	0.42	0.00	0.62	Calculated
43	Link-46		64	64	804.68	2979.20	0.00	2955.99	0.00	23.21	2.8800	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	5.56	0 12:02	4.54	2.95	68.05	0.08	0.39	0.00	0.58	Calculated
44	Link-47		64	64	881.19	2960.06	0.00	2947.19	0.00	12.87	1.4600	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	5.99	0 12:03	3.86	3.80	48.43	0.12	0.45	0.00	0.67	Calculated
45	Link-48		64	64	959.63	2942.18	0.00	2930.04	0.00	12.14	1.2700	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	6.20	0 12:04	3.80	4.21	45.07	0.14	0.47	0.00	0.70	Calculated
46	Link-49		64	64	1036.15	2923.00	0.00	2907.19	0.00	15.81	1.5300	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	6.87	0 12:04	4.12	4.19	49.50	0.14	0.47	0.00	0.70	Calculated
47	Link-50		64	64	723.72	2998.96	0.00	2991.31	0.00	7.65	1.0600	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	10.75	0 12:03	3.63	3.32	41.20	0.26	0.60	0.00	0.89	Calculated
48	Link-51		64	64	794.68	2979.95	0.00	2971.70	0.00	8.25	1.0400	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	5.84	0 12:03	3.41	3.88	40.83	0.14	0.48	0.00	0.70	Calculated
49	Link-52		64	64	874.47	2960.06	0.00	2948.18	0.00	11.88	1.3600	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	6.35	0 12:03	3.80	3.84	46.71	0.14	0.47	0.00	0.69	Calculated
50	Link-53		64	64	941.01	2942.18	0.00	2932.22	0.00	9.96	1.0600	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	6.49	0 12:04	3.61	4.34	41.23	0.16	0.50	0.00	0.74	Calculated
51	Link-54		64	64	1002.26	2923.00	0.00	2913.89	0.00	9.11	0.9100	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	7.18	0 12:07	3.53	4.73	38.20	0.19	0.53	0.00	0.79	Calculated
52	Link-56		64	64	460.10	2979.07	0.00	2974.37	0.00	4.70	1.0200	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	6.29	0 12:02	3.00	2.56	40.50	0.16	0.50	0.00	0.74	Calculated
53	Link-57		64	64	1213.95	2959.22	0.00	2946.81	0.00	12.41	1.0200	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	13.00	0 12:07	4.03	5.02	40.51	0.32	0.64	0.00	0.96	Calculated
54	Link-58		64	64	1785.84	2937.79	0.00	2920.66	0.00	17.13	0.9600	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	14.97	0 12:09	4.19	7.10	39.25	0.38	0.68	0.00	1.02	Calculated
55	Link-59		64	64	1133.21	2908.02	0.00	2898.05	0.00	9.97	0.8800	Trapezoidal	2.000	26.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	42.51	0 12:09	4.13	4.57	228.00	0.19	0.41	0.00	0.80	Calculated
56	Link-60		64	64	123.28	2974.37	0.00	2946.81	0.00	27.56	22.3600	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	6.28	0 12:02	4.88	0.42	808.83	0.01	0.06	0.00	0.12	Calculated
57	Link-61		64	64	101.57	2946.81	0.00	2920.66	0.00	26.15	25.7500	Trapezoidal	2.000	22.00	0.0000	0.0330	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	18.49	0 12:07	7.94	0.21	920.61	0.02	0.11	0.00	0.22	Calculated
58	Link-62		64	64	55.63	2920.66	0.00	2908.02	0.00	12.64	22.7200	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	33.15	0 12:08	9.10	0.10	815.43	0.04	0.17	0.00	0.32	Calculated
59	Link-63		64	64	76.84	2991.31	0.00	2971.70	0.00	19.61	25.5200	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	10.75	0 12:03	6.23	0.21	864.19	0.01	0.08	0.00	0.16	Calculated
60	Link-64		64	64	84.67	2971.70	0.00	2948.18	0.00	23.52	27.7800	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	16.58	0 12:04	7.52	0.19	901.61	0.02	0.10	0.00	0.21	Calculated
61	Link-65		64	64	79.10	2948.18	0.00	2932.22	0.00	15.96	20.1800	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	22.93	0 12:04	7.66	0.17	768.41	0.03	0.14	0.00	0.27	Calculated
62	Link-66		64	64	79.12	2932.22	0.00	2913.89	0.00	18.33	23.1700	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	29.41	0 12:04	8.77	0.15	823.39	0.04	0.15	0.00	0.31	Calculated
63	Link-67		64	64	23.27	2913.89	0.00	2908.98	0.00	4.91	21.1000	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	36.48	0 12:04	9.19	0.04	785.79	0.05	0.18	0.00	0.36	Calculated
64	Link-68		64	64	1105.50	2908.98	0.00	2889.75	0.00	19.23	1.7400	Trapezoidal	2.000	26.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	44.39	0 12:06	5.20	3.54	320.59	0.14	0.35	0.00	0.70	Calculated
65	Link-69		64	64	1139.17	3095.62	0.00	3081.70	0.00	13.92	1.2200	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	14.06	0 12:08	3.94	4.82	44.29	0.32	0.65	0.00	0.95	Calculated
66	Link-70		64	64	1425.34	3070.95	0.00	3060.94	0.00	10.01	0.7000	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	10.69	0 12:08	3.57	6.65	33.58	0.32	0.64	0.00	0.95	Calculated

67	Link-71	64	64	1131.67	3042.70	0.00	3035.63	0.00	7.07	0.6200	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	11.83	0	12:08	3.38	5.58	31.67	0.37	0.68	0.00	1.02	Calculated
68	Link-72	64	64	737.77	3010.69	0.00	3007.60	0.00	3.09	0.4200	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	8.35	0	12:07	2.67	4.61	25.93	0.32	0.65	0.00	0.97	Calculated
69	Link-73	64	64	273.57	2979.45	0.00	2978.00	0.00	1.45	0.5300	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	5.02	0	12:01	2.13	2.14	29.17	0.17	0.52	0.00	0.77	Calculated
70	Link-74	64	64	1204.45	2902.69	0.00	2898.02	0.00	4.67	0.3900	Trapezoidal	2.000	26.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	66.30	0	12:10	3.06	6.56	116.76	0.57	0.74	0.00	1.45	Calculated
71	Link-76	64	64	357.23	3096.93	0.00	3081.70	0.00	15.23	4.2600	Triangular	1.500	12.00	0.0000	0.0320	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	5.85	0	12:02	4.25	1.40	69.81	0.08	0.39	0.00	0.59	Calculated
72	Link-77	64	64	451.48	3074.34	0.00	3060.94	0.00	13.40	2.9700	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	4.08	0	12:01	3.85	1.95	69.03	0.06	0.35	0.00	0.52	Calculated
73	Link-78	64	64	560.95	3044.49	0.00	3035.63	0.00	8.86	1.5800	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	5.72	0	12:02	3.52	2.66	50.36	0.11	0.44	0.00	0.66	Calculated
74	Link-79	64	64	656.78	3019.32	0.00	3007.60	0.00	11.72	1.7800	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	5.87	0	12:02	3.80	2.88	53.53	0.11	0.44	0.00	0.64	Calculated
75	Link-80	64	64	754.35	2994.25	0.00	2982.83	4.83	11.42	1.5100	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	7.18	0	12:03	3.84	3.27	49.30	0.15	0.48	0.00	0.71	Calculated
76	Link-81	64	64	862.17	2969.37	0.00	2956.11	0.00	13.26	1.5400	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	7.96	0	12:03	4.04	3.56	49.69	0.16	0.50	0.00	0.74	Calculated
77	Link-82	64	64	3202.50	3096.16	0.00	2937.42	0.00	158.74	4.9600	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	24.51	0	12:09	8.14	6.56	89.21	0.27	0.61	0.00	0.90	Calculated
78	Link-83	64	64	684.44	2937.42	0.00	2897.30	0.00	40.12	5.8600	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	33.79	0	12:08	8.36	1.36	97.02	0.35	0.67	0.00	0.99	Calculated
79	Link-84	64	64	505.74	2942.80	0.00	2937.42	0.00	5.38	1.0600	Triangular	1.500	12.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	6.62	0	12:02	3.13	2.69	41.33	0.16	0.50	0.00	0.74	Calculated
80	Link-85	64	64	96.90	3040.27	0.00	3010.54	0.00	29.73	30.6800	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	7.33	0	12:03	5.70	0.28	947.55	0.01	0.06	0.00	0.12	Calculated
81	Link-86	64	64	106.20	3010.54	0.00	2984.94	0.00	25.60	24.1100	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	23.92	0	12:03	8.23	0.22	839.89	0.03	0.13	0.00	0.26	Calculated
82	Link-87	64	64	69.01	2984.94	0.00	2955.99	0.00	28.95	41.9500	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	35.83	0	12:03	11.38	0.10	1107.99	0.03	0.14	0.00	0.28	Calculated
83	Link-88	64	64	77.08	2955.99	0.00	2947.19	0.00	8.80	11.4200	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	48.91	0	12:03	8.34	0.15	578.01	0.08	0.25	0.00	0.50	Calculated
84	Link-89	64	64	68.13	2947.19	0.00	2930.04	0.00	17.15	25.1700	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	54.86	0	12:03	11.24	0.10	858.28	0.06	0.22	0.00	0.43	Calculated
85	Link-90	64	64	76.29	2930.04	0.00	2907.19	0.00	22.85	29.9500	Trapezoidal	2.000	22.00	0.0000	0.0350	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	70.06	0	12:03	12.95	0.10	936.22	0.07	0.24	0.00	0.47	Calculated
86	Link-97	64	64	140.25	2922.50	0.00	2900.28	0.00	22.22	15.8400	Trapezoidal	2.000	22.00	0.0000	0.0270	0.0000	0.5000	0.5000	0.0000	0.00	NO	1.00	81.48	0	12:07	13.12	0.18	882.66	0.09	0.27	0.00	0.53	Calculated

South Ranch Surface Waste Management Facility

10/17/2019

SSA RESULTS

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (ft)	Boundary Type	Flap Gate	Fixed Water Elevation (ft)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Depth Attained (ft)	Maximum HGL Elevation Attained (ft)
1	64	876169.79	369257.07		0.00	NORMAL	NO		241.51	0.00	2886.36	2886.36
2	64	873526.22	369253.36		0.00	NORMAL	NO		179.18	0.00	2887.77	2887.77

South Ranch Surface Waste Management Facility

SSA RESULTS

10/17/2019

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (ft)	Max (Rim) Elevation (ft)	Max (Rim) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Ponded Area (ft^2)	Evaporation Loss	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Peak Outflow (cfs)	Peak Exfiltration Flow Rate (cfm)	Maximum HGL Elevation Attained (ft)	Maximum HGL Depth Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Maximum HGL Occurrence (days hh:mm)	Total Exfiltration Volume (1000-ft^3)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)	Total Retention Time (seconds)
1	64	876077.37	369252.68		2889.00	2900.00	11.00	0.00	-2889.00	0.00	0.00	256.90	38.66	241.50	0.00	2889.80	0.80	2889.09	0.09	0 12:11	0.00	0.00	0.00	0.00
2	64	873650.72	369247.46		2890.00	2900.00	10.00	0.00	-2890.00	0.00	0.00	199.32	29.56	179.18	0.00	2890.77	0.77	2890.08	0.08	0 12:11	0.00	0.00	0.00	0.00

South Ranch Surface Waste Management Facility

SSA RESULTS

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft²)	Minimum Pipe Cover (inches)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Elevation Attained (ft)	Maximum HGL Depth Attained (ft)	Maximum Surcharge Depth Attained (ft)	Minimum Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Maximum HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
1	64	875211.35	369252.03		3096.42	3097.92	1.50	0.00	-3096.42	0.00	-3097.92	0.00	0.00	0.00	0.00	3096.42	0.00	0.00	2.00	3096.42	0.00	0 00:00	0 00:00	0.00	0.00
2	64	875264.43	369252.03		3081.70	3083.20	1.50	0.00	-3081.70	0.00	-3083.20	0.00	0.00	19.29	0.00	3082.68	0.98	0.00	1.02	3081.87	0.17	0 12:08	0 00:00	0.00	0.00
3	64	875364.35	369253.59		3060.94	3062.44	1.50	0.00	-3060.94	0.00	-3062.44	0.00	0.00	33.03	0.00	3061.92	0.98	0.00	1.02	3061.09	0.15	0 12:08	0 00:00	0.00	0.00
4	64	875473.64	369252.03		3035.63	3037.13	1.50	0.00	-3035.63	0.00	-3037.13	0.00	0.00	49.75	0.00	3036.67	1.04	0.00	0.96	3035.79	0.16	0 12:08	0 00:00	0.00	0.00
5	64	875581.37	369252.03		3007.60	3009.10	1.50	0.00	-3007.60	0.00	-3009.10	0.00	0.00	63.22	0.00	3008.58	0.98	0.00	1.02	3007.75	0.15	0 12:07	0 00:00	0.00	0.00
6	64	875684.42	369250.47		2978.00	2979.50	1.50	0.00	-2978.00	0.00	-2979.50	0.00	0.00	73.86	0.00	2983.56	5.56	0.00	1.27	2982.94	4.94	0 12:03	0 00:00	0.00	0.00
7	64	875760.92	369255.15		2956.11	2957.61	1.50	0.00	-2956.11	0.00	-2957.61	0.00	0.00	81.45	0.00	2956.95	0.84	0.00	1.16	2956.23	0.12	0 12:07	0 00:00	0.00	0.00
8	64	874516.16	368882.13		3095.62	3097.12	1.50	0.00	-3095.62	0.00	-3097.12	0.00	0.00	14.69	14.69	3096.61	0.99	0.00	0.51	3095.79	0.17	0 12:06	0 00:00	0.00	0.00
9	64	874423.64	368797.81		3070.95	3072.45	1.50	0.00	-3070.95	0.00	-3072.45	0.00	0.00	11.57	11.57	3071.96	1.01	0.00	0.49	3071.11	0.16	0 12:00	0 00:00	0.00	0.00
10	64	874915.50	368663.13		3042.70	3044.20	1.50	0.00	-3042.70	0.00	-3044.20	0.00	0.00	12.53	12.53	3043.76	1.06	0.00	0.44	3042.87	0.17	0 12:00	0 00:00	0.00	0.00
11	64	875508.08	368561.25		3010.69	3012.19	1.50	0.00	-3010.69	0.00	-3012.19	0.00	0.00	9.13	9.13	3011.70	1.01	0.00	0.49	3010.84	0.15	0 12:00	0 00:00	0.00	0.00
12	64	875691.36	368976.99		2979.45	2980.95	1.50	0.00	-2979.45	0.00	-2980.95	0.00	0.00	5.20	5.20	2980.24	0.79	0.00	0.71	2979.57	0.12	0 12:00	0 00:00	0.00	0.00
13	64	874871.35	368465.93		2991.31	2992.81	1.50	0.00	-2991.31	0.00	-2992.81	0.00	0.00	10.75	0.00	2992.22	0.91	0.00	1.09	2991.45	0.14	0 12:03	0 00:00	0.00	0.00
14	64	874859.15	368390.06		2971.70	2973.20	1.50	0.00	-2971.70	0.00	-2973.20	0.00	0.00	16.59	0.00	2972.42	0.72	0.00	1.28	2971.81	0.11	0 12:03	0 00:00	0.00	0.00
15	64	874852.12	368305.68		2948.18	2949.68	1.50	0.00	-2948.18	0.00	-2949.68	0.00	0.00	22.93	0.00	2948.89	0.71	0.00	1.29	2948.29	0.11	0 12:03	0 00:00	0.00	0.00
16	64	874852.12	368226.58		2932.22	2933.72	1.50	0.00	-2932.22	0.00	-2933.72	0.00	0.00	29.41	0.00	2932.97	0.75	0.00	1.25	2932.34	0.12	0 12:04	0 00:00	0.00	0.00
17	64	874853.88	368147.48		2913.89	2915.39	1.50	0.00	-2913.89	0.00	-2915.39	0.00	0.00	36.49	0.00	2914.69	0.80	0.00	1.20	2914.01	0.12	0 12:07	0 00:00	0.00	0.00
18	64	874199.55	368591.16		3018.23	3018.23	0.00	0.00	-3018.23	0.00	-3018.23	0.00	0.00	11.20	11.20	3019.13	0.90	0.00	0.60	3018.37	0.14	0 12:00	0 00:00	0.00	0.00
19	64	874148.60	368503.33		2998.96	3000.46	1.50	0.00	-2998.96	0.00	-3000.46	0.00	0.00	11.37	11.37	2999.89	0.93	0.00	0.57	2999.10	0.14	0 12:00	0 00:00	0.00	0.00
20	64	874132.79	368511.23		2997.91	2999.41	1.50	0.00	-2997.91	0.00	-2999.41	0.00	0.00	5.72	5.72	2998.56	0.65	0.00	0.85	2998.01	0.10	0 12:00	0 00:00	0.00	0.00
21	64	874065.15	368422.81		2979.95	2981.45	1.50	0.00	-2979.95	0.00	-2981.45	0.00	0.00	6.38	6.38	2980.70	0.75	0.00	0.75	2980.06	0.11	0 12:00	0 00:00	0.00	0.00
22	64	874045.83	368436.86		2979.20	2980.70	1.50	0.00	-2979.20	0.00	-2980.70	0.00	0.00	5.89	5.89	2979.80	0.60	0.00	0.90	2979.29	0.09	0 12:00	0 00:00	0.00	0.00
23	64	873978.63	368346.97		2960.06	2961.56	1.50	0.00	-2960.06	0.00	-2961.56	0.00	0.00	6.91	6.91	2960.79	0.73	0.00	0.77	2960.17	0.11	0 12:00	0 00:00	0.00	0.00
24	64	873969.40	368358.17		2960.06	2961.56	1.50	0.00	-2960.06	0.00	-2961.56	0.00	0.00	6.52	6.52	2960.77	0.71	0.00	0.79	2960.17	0.11	0 12:00	0 00:00	0.00	0.00
25	64	873912.52	368278.09		2942.18	2943.68	1.50	0.00	-2942.18	0.00	-2943.68	0.00	0.00	7.18	7.18	2942.96	0.78	0.00	0.72	2942.30	0.12	0 12:00	0 00:00	0.00	0.00
26	64	873898.69	368285.99		2942.18	2943.68	1.50	0.00	-2942.18	0.00	-2943.68	0.00	0.00	6.84	6.84	2942.92	0.74	0.00	0.76	2942.29	0.11	0 12:00	0 00:00	0.00	0.00
27	64	873853.23	368204.30		2923.00	2924.50	1.50	0.00	-2923.00	0.00	-2924.50	0.00	0.00	7.95	7.95	2923.83	0.83	0.00	0.67	2923.13	0.13	0 12:00	0 00:00	0.00	0.00
28	64	873837.41	368214.84		2923.00	2924.50	1.50	0.00	-2923.00	0.00	-2924.50	0.00	0.00	7.55	7.55	2923.74	0.74	0.00	0.76	2923.11	0.11	0 12:00	0 00:00	0.00	0.00
29	64	874858.28	368124.63		2908.98	2910.48	1.50	0.00	-2908.98	0.00	-2910.48	0.00	0.00	45.33	9.55	2909.69	0.71	0.00	1.29	2909.04	0.06	0 12:04	0 00:00	0.00	0.00
30	64	873752.79	368120.79		2889.75	2891.25	1.50	0.00	-2889.75	0.00	-2891.25	0.00	0.00	44.39	0.00	2899.40	9.65	0.00	0.88	2897.94	8.19	0 12:06	0 00:00	0.00	0.00
31	64	874887.18	368407.60		2974.37	2975.87	1.50	0.00	-2974.37	0.00	-2975.87	0.00	0.00	6.29	0.00	2975.12	0.75	0.00	1.25	2974.48	0.11	0 12:02	0 00:00	0.00	0.00
32	64	874891.48	368284.40		2946.81	2948.31	1.50	0.00	-2946.81	0.00	-2948.31	0.00	0.00	18.52	0.00	2947.79	0.98	0.00	1.02	2946.96	0.15	0 12:07	0 00:00	0.00	0.00
33	64	874893.04	368182.84		2920.66	2922.16	1.50	0.00	-2920.66	0.00	-2922.16	0.00	0.00	33.14	0.00	2921.71	1.05	0.00	0.95	2920.83	0.17	0 12:09	0 00:00	0.00	0.00
34	64	874882.89	368128.14		2908.02	2909.52	1.50	0.00	-2908.02	0.00	-2909.52	0.00	0.00	43.11	12.31	2908.85	0.83	0.00	1.17	2908.10	0.08	0 12:07	0 00:00	0.00	0.00
35	64	875346.62	368432.18		2979.07	2980.57	1.50	0.00	-2979.07	0.00	-2980.57	0.00	0.00	6.59	6.59	2979.83	0.76	0.00	0.74	2979.18	0.11	0 12:00	0 00:00	0.00	0.00
36	64	875800.97	368648.08		2959.22	2960.72	1.50	0.00	-2959.22	0.00	-2960.72	0.00	0.00	13.54	13.54	2960.21	0.99	0.00	0.51	2959.38	0.16	0 12:00	0 00:00	0.00	0.00
37	64	875861.43	369005.56		2937.79	2939.29	1.50	0.00	-2937.79	0.00	-2939.29	0.00	0.00	15.68	15.68	2938.85	1.06	0.00	0.44	2937.96	0.17	0 12:00	0 00:00	0.00	0.00
38	64	876016.04	368139.82		2898.05	2899.55	1.50	0.00	-2898.05	0.00	-2899.55	0.00	0.00	42.51	0.00	2899.29	1.24	0.00	1.26	2898.19	0.14	0 12:09	0 00:00	0.00	0.00
39	64	874269.16	369260.96		3040.27	3041.77	1.50	0.00	-3040.27	0.00	-3041.77	0.00	0.00	7.34	0.00	3041.09	0.82	0.00	1.18	3040.40	0.13	0 12:02	0 00:00	0.00	0.00
40	64	874173.36	369246.38		3010.54	3012.04	1.50	0.00	-3010.54	0.00	-3012.04	0.00	0.00	23.91	0.00	3011.43	0.89	0.00	1.11	3010.68	0.14	0 12:03	0 00:00	0.00	0.00
41	64	874067.16	369246.38		2984.94	2986.44	1.50	0.00	-2984.94	0.00	-2986.44	0.00	0.00	35.83	0.00	2985.68	0.74	0.00	1.26	2985.05	0.11	0 12:03	0 00:00	0.00	0.00
42	64	873998.43	369240.14		2955.99	2957.49	1.50	0.00	-2955.99	0.00	-2957.49	0.00	0.00	48.92	0.00	2956.73	0.74	0.00	1.26	2956.10	0.11	0 12:03	0 00:00	0.00	0.00
43	64	873921.38	369238.05		2947.19	2948.69	1.50	0.00	-2947.19	0.00	-2948.69	0.00	0.00	54.88	0.00	2947.87	0.68	0.00	1.32	2947.29	0.10	0 12:03	0 00:00	0.00	0.00
44	64	873853.56	369244.56		2930.04	2931.54	1.50	0.00	-2930.04	0.00	-2931.54	0.00	0.00	70.05	0.00	2930.85	0.81	0.00	1.19	2930.17	0.13	0 12:04	0 00:00	0.00	0.00
45	64	873777.41	369249.25		2907.19	2908.69	1.50	0.00	-2907.19	0.00	-2908.69	0.00	0.00	76.91	0.00	2908.34	1.15	0.00	1.35	2907.31	0.12	0 12:03	0 00:00	0.00	0.00
46	64	874395.41	369536.25		3068.71	3070.21	1.50	0.00	-3068.71	0.00	-3070.21	0.00	0.00	10.16	10.16	3069.75	1.04	0.00	0.46	3068.88	0.17	0 12:06	0 00:00	0.00	0.00
47	64	874848.77	369729.55		3065.93	3067.43	1.50	0.00	-3065.93	0.00	-3067.43	0.00	0.00	10.05	0.00	3066.97	1.04	0.00	0.96	3066.10	0.17	0 12:07	0 00:00	0.00	0.00
48	64	874882.74	369737.75		3065.40	3066.90	1.50	0.00	-3065.40	0.00	-3066.90	0.00	0.00	10.26	0.00	3065.97	0.57	0.00	1.43	3065.48	0.08	0 12:01	0 00:00	0.00	0.00
49	64	874883.91	369637.00		3091.97	3093.47	1.50	0.00	-3091.97	0.00	-3093.47	0.00	0.00	6.02	0.00	3092.65	0.68	0.00	1.32	3092.08	0.11	0 12:02	0 00:00	0.00	0.00
50	64	875216.61	369621.77		3096.93	3098.43	1.50	0.00	-3096.93	0.00	-3098.43	0.00	0.00	6.11	6.11	3097.62	0.69	0.00	0.81	3097.04	0.11	0 12:00	0 00:00	0.00	0.00
51	64	874292.32	369793.98		3044.64	3046.14	1.50	0.00	-3044.64	0.00	-3046.14	0.00	0.00	7.77	7.77	3045.48	0.84	0.00	0.66	3044.77	0.13	0 12:00	0 00:00	0.00	0.00
52	64	874306.38	369806.86		3043.85	3045.33	1.48	0.00	-3043.85	0.00	-3045.33	0.00	0.00	5.82	5.82	3044.62	0.77	0.00	0.73	3043.97	0.12	0 12:00	0 00:00	0.00	0.00
53	64	874185.72	369892.38		3018.95	3020.45	1.50	0.00	-3018.95	0.00	-3020.45	0.00	0.00	6.31	6.31	3019.66	0.71	0.00	0.79	3019.06	0.11	0 12:00	0 00:00	0.00	0.00
54	64	874204.46	369907.61		3018.95	3020.45	1.50	0.00	-3018.95	0.00	-3020.45	0.00	0.00	6.41	6.41	3019.71	0.76	0.00	0.74	3019.06	0.11	0 12:00	0 00:00	0.00	0.00
55	64	874107.23	369975.16		2993.67	2935.17	-58.50	0.00	-2993.67	0.00	-2935.17	0.00	0.00	7.07	7.07	2994.43	0.76	0.00	0.74	2993.78	0.11	0 12:00	0 00:00	0.00	0.00
56	64	874129.10	370000.15		2994.05	2995.55	1.50	0.00	-2994.05	0.00	-2995.55	0.00	0.00	7.60	7.60	2994.83	0.78	0.00	0.72	2994.17	0.12	0 12:00	0 00:00	0.00	0.00
57	64	874036.94	370045.45		2968.54	2970.04	1.50	0.00	-2968.54	0.00	-2970.04	0.00	0.00	8.13	8.13	2969.30	0.76	0.00	0.74	2968.66	0.12	0 12:00	0 00:00	0.00	0.00
58	64	874055.69	370076.69		2968.95	2970.45	1.50	0.00	-2968.95	0.00	-2970.45	0.00	0.00	8.19	8.19	2969.75	0.80	0.00	0.70	2969.07	0.12	0 12:00	0 00:00	0.00	0.00

South Ranch Surface Waste Management Facility

SSA RESULTS

59	64	873951.04	370140.73	2942.84	2944.34	1.50	0.00	-2942.84	0.00	-2944.34	0.00	0.00	0.00	9.78	9.78	2943.67	0.83	0.00	0.67	2942.97	0.13	0	12:00	0	00:00	0.00	0.00
60	64	873976.03	370153.22	2941.05	2942.55	1.50	0.00	-2941.05	0.00	-2942.55	0.00	0.00	0.00	8.62	8.62	2941.93	0.88	0.00	0.62	2941.18	0.13	0	12:00	0	00:00	0.00	0.00
61	64	874843.95	369844.48	3039.99	3041.49	1.50	0.00	-3039.99	0.00	-3041.49	0.00	0.00	0.00	14.93	0.00	3040.74	0.75	0.00	1.25	3040.10	0.11	0	12:02	0	00:00	0.00	0.00
62	64	874883.52	369840.31	3040.00	3041.50	1.50	0.00	-3040.00	0.00	-3041.50	0.00	0.00	0.00	15.56	0.00	3040.73	0.73	0.00	1.27	3040.11	0.11	0	12:02	0	00:00	0.00	0.00
63	64	874839.79	369940.28	3012.73	3014.23	1.50	0.00	-3012.73	0.00	-3014.23	0.00	0.00	0.00	20.42	0.00	3013.47	0.74	0.00	1.26	3012.84	0.11	0	12:03	0	00:00	0.00	0.00
64	64	874885.60	369946.53	3012.79	3014.29	1.50	0.00	-3012.79	0.00	-3014.29	0.00	0.00	0.00	21.43	0.00	3013.51	0.72	0.00	1.28	3012.90	0.11	0	12:03	0	00:00	0.00	0.00
65	64	874841.87	370050.66	2985.81	2987.31	1.50	0.00	-2985.81	0.00	-2987.31	0.00	0.00	0.00	27.17	0.00	2986.57	0.76	0.00	1.24	2985.93	0.12	0	12:03	0	00:00	0.00	0.00
66	64	874900.18	370050.66	2986.69	2988.19	1.50	0.00	-2986.69	0.00	-2988.19	0.00	0.00	0.00	28.32	0.00	2987.46	0.77	0.00	1.23	2986.81	0.12	0	12:03	0	00:00	0.00	0.00
67	64	874846.03	370158.95	2959.64	2961.14	1.50	0.00	-2959.64	0.00	-2961.14	0.00	0.00	0.00	34.72	0.00	2960.42	0.78	0.00	1.22	2959.76	0.12	0	12:03	0	00:00	0.00	0.00
68	64	874889.77	370154.79	2959.92	2961.42	1.50	0.00	-2959.92	0.00	-2961.42	0.00	0.00	0.00	36.47	0.00	2960.73	0.81	0.00	1.19	2960.04	0.12	0	12:04	0	00:00	0.00	0.00
69	64	874839.79	370265.16	2933.89	2935.34	1.45	0.00	-2933.89	0.00	-2935.34	0.00	0.00	0.00	42.55	0.00	2934.74	0.85	0.00	1.15	2934.02	0.13	0	12:07	0	00:00	0.00	0.00
70	64	874879.36	370269.33	2933.66	2935.16	1.50	0.00	-2933.66	0.00	-2935.16	0.00	0.00	0.00	44.88	0.00	2934.51	0.85	0.00	1.15	2933.79	0.13	0	12:07	0	00:00	0.00	0.00
71	64	875228.59	369607.46	3096.93	3097.83	0.90	0.00	-3096.93	0.00	-3097.83	0.00	0.00	0.00	5.93	5.93	3097.53	0.60	0.00	0.90	3097.02	0.09	0	12:00	0	00:00	0.00	0.00
72	64	875312.94	369714.06	3074.34	3075.84	1.50	0.00	-3074.34	0.00	-3075.84	0.00	0.00	0.00	4.44	4.44	3074.91	0.57	0.00	0.93	3074.42	0.08	0	12:00	0	00:00	0.00	0.00
73	64	875327.00	369703.52	3074.34	3075.84	1.50	0.00	-3074.34	0.00	-3075.84	0.00	0.00	0.00	4.21	4.21	3074.87	0.53	0.00	0.97	3074.42	0.08	0	12:00	0	00:00	0.00	0.00
74	64	875419.54	369824.18	3044.49	3045.99	1.50	0.00	-3044.49	0.00	-3045.99	0.00	0.00	0.00	5.68	5.68	3045.24	0.75	0.00	0.75	3044.60	0.11	0	12:00	0	00:00	0.00	0.00
75	64	875430.09	369811.29	3044.49	3045.99	1.50	0.00	-3044.49	0.00	-3045.99	0.00	0.00	0.00	6.01	6.01	3045.17	0.68	0.00	0.82	3044.59	0.10	0	12:00	0	00:00	0.00	0.00
76	64	875513.26	369917.90	3019.32	3020.82	1.50	0.00	-3019.32	0.00	-3020.82	0.00	0.00	0.00	6.28	6.28	3020.06	0.74	0.00	0.76	3019.43	0.11	0	12:00	0	00:00	0.00	0.00
77	64	875522.63	369906.18	3019.32	3020.82	1.50	0.00	-3019.32	0.00	-3020.82	0.00	0.00	0.00	6.21	6.21	3019.99	0.67	0.00	0.83	3019.42	0.10	0	12:00	0	00:00	0.00	0.00
78	64	875612.84	370013.96	2994.25	2995.75	1.50	0.00	-2994.25	0.00	-2995.75	0.00	0.00	0.00	7.44	7.44	2995.04	0.79	0.00	0.71	2994.37	0.12	0	12:00	0	00:00	0.00	0.00
79	64	875622.21	370002.25	2994.25	2995.75	1.50	0.00	-2994.25	0.00	-2995.75	0.00	0.00	0.00	7.66	7.66	2995.00	0.75	0.00	0.75	2994.36	0.11	0	12:00	0	00:00	0.00	0.00
80	64	875721.79	370131.11	2969.37	2970.87	1.50	0.00	-2969.37	0.00	-2970.87	0.00	0.00	0.00	8.84	8.84	2970.20	0.83	0.00	0.67	2969.50	0.13	0	12:00	0	00:00	0.00	0.00
81	64	875739.36	370117.05	2969.37	2970.87	1.50	0.00	-2969.37	0.00	-2970.87	0.00	0.00	0.00	8.55	8.55	2970.15	0.78	0.00	0.72	2969.49	0.12	0	12:00	0	00:00	0.00	0.00
82	64	875823.71	370221.31	2942.80	2944.30	1.50	0.00	-2942.80	0.00	-2944.30	0.00	0.00	0.00	9.34	9.34	2943.67	0.87	0.00	0.63	2942.93	0.13	0	12:00	0	00:00	0.00	0.00
83	64	875836.59	370206.08	2942.80	2944.30	1.50	0.00	-2942.80	0.00	-2944.30	0.00	0.00	0.00	6.96	6.96	2943.57	0.77	0.00	0.73	2942.92	0.12	0	12:00	0	00:00	0.00	0.00
84	64	874524.27	369489.40	3096.16	3097.66	1.50	0.00	-3096.16	0.00	-3097.66	0.00	0.00	0.00	25.65	25.65	3097.10	0.94	0.00	0.56	3096.32	0.16	0	12:06	0	00:00	0.00	0.00
85	64	875988.36	370372.44	2897.30	2898.80	1.50	0.00	-2897.30	0.00	-2898.80	0.00	0.00	0.00	105.80	0.00	2898.78	1.48	0.00	1.52	2897.52	0.22	0	12:09	0	00:00	0.00	0.00
86	64	874859.11	370378.91	2902.69	2904.19	1.50	0.00	-2902.69	0.00	-2904.19	0.00	0.00	0.00	69.02	27.19	2904.22	1.53	0.00	0.47	2902.86	0.17	0	12:05	0	00:00	0.00	0.00
87	64	873729.85	370153.06	2898.02	2899.52	1.50	0.00	-2898.02	0.00	-2899.52	0.00	0.00	0.00	66.30	0.00	2899.60	1.58	0.00	0.92	2898.21	0.19	0	12:10	0	00:00	0.00	0.00
88	64	874883.30	370378.27	2902.69	2904.19	1.50	0.00	-2902.69	0.00	-2904.19	0.00	0.00	0.00	74.15	31.04	2904.19	1.50	0.00	0.50	2902.90	0.21	0	12:05	0	00:00	0.00	0.00
89	64	875856.86	369700.75	2937.42	2938.92	1.50	0.00	-2937.42	0.00	-2938.92	0.00	0.00	0.00	33.94	6.54	2938.43	1.01	0.00	0.49	2937.59	0.17	0	12:07	0	00:00	0.00	0.00
90	64	875900.53	369253.98	2922.50	2924.00	1.50	0.00	-2922.50	0.00	-2924.00	0.00	0.00	0.00	81.54	0.00	2923.35	0.85	0.00	1.15	2922.59	0.09	0	12:07	0	00:00	0.00	0.00
91	64	876039.58	369253.20	2900.28	2901.78	1.50	0.00	-2900.28	0.00	-2901.78	0.00	0.00	0.00	81.48	0.00	2901.37	1.09	0.00	0.91	2900.40	0.12	0	12:07	0	00:00	0.00	0.00

South Ranch Surface Waste Management Facility

10/17/2019

SSA RESULTS

SN	Element ID	Description	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	NewMexico		Time Series	NEW MEXICO, LEA COUNTY 25-year 24-hour	Cumulative	inches				0	

South Ranch Surface Management Facility

SSA RESULTS

10/17/2019

SN	Element ID	Description	Area (acres)	Drainage Node ID	Weighted Curve Number	Conductivity (inches/hr)	Drying Time (days)	Average Slope (%)	Equivalent Width (ft)	Impervious Area (%)	Impervious Area No Depression (%)	Impervious Area Depression Depth (inches)	Impervious Area Manning's Roughness	Pervious Area Depression Depth (inches)	Pervious Area Manning's Roughness	Curb & Gutter Length (ft)	Rain Gage ID	Total Precipitation (inches)	Total Runon (inches)	Total Evaporation (inches)	Total Infiltration (inches)	Total Runoff (inches)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	Sub-01		7.89	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.72	25.65	0 00:36:07
2	Sub-02		1.16	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.76	5.20	0 00:11:24
3	Sub-03		2.17	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	9.13	0 00:16:39
4	Sub-04		3.20	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.74	12.53	0 00:21:00
5	Sub-05		2.89	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.74	11.57	0 00:19:46
6	Sub-06		5.14	64	76.00	0.1500	7.00	4.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.70	14.69	0 00:48:23
7	Sub-07		1.59	64	76.00	0.1500	7.00	4.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.74	5.93	0 00:23:57
8	Sub-08		1.66	64	76.00	0.1500	7.00	4.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.74	6.11	0 00:24:33
9	Sub-09		3.12	64	76.00	0.1500	7.00	4.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.72	10.16	0 00:35:51
10	Sub-11		0.92	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.76	4.21	0 00:09:58
11	Sub-12		1.35	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	6.01	0 00:12:32
12	Sub-13		1.40	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	6.21	0 00:12:49
13	Sub-14		1.77	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	7.66	0 00:14:45
14	Sub-15		2.01	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	8.55	0 00:15:55
15	Sub-16		1.59	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	6.96	0 00:13:49
16	Sub-17		1.48	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	6.54	0 00:13:15
17	Sub-18		0.98	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.76	4.44	0 00:10:18
18	Sub-19		1.27	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	5.68	0 00:12:04
19	Sub-20		1.42	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	6.28	0 00:12:54
20	Sub-21		1.72	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	7.44	0 00:14:28
21	Sub-22		2.09	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	8.84	0 00:16:17
22	Sub-23		2.23	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	9.34	0 00:16:56
23	Sub-24		3.00	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.74	11.92	0 00:20:13
24	Sub-25		1.31	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	5.82	0 00:12:16
25	Sub-26		1.45	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	6.41	0 00:13:05
26	Sub-27		1.76	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	7.60	0 00:14:40
27	Sub-28		1.92	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	8.19	0 00:15:27
28	Sub-29		2.03	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	8.62	0 00:16:00
29	Sub-30		2.90	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.74	11.58	0 00:19:47
30	Sub-31		1.80	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	7.77	0 00:14:53
31	Sub-32		1.43	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	6.31	0 00:12:56
32	Sub-33		1.62	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	7.07	0 00:13:58
33	Sub-34		1.90	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	8.13	0 00:15:22
34	Sub-35		2.36	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	9.78	0 00:17:29
35	Sub-36		2.85	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.74	11.44	0 00:19:36
36	Sub-37		2.78	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.74	11.20	0 00:19:18
37	Sub-38		1.28	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	5.72	0 00:12:08
38	Sub-39		1.32	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	5.89	0 00:12:22
39	Sub-40		1.48	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	6.52	0 00:13:13
40	Sub-41		1.56	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	6.84	0 00:13:39
41	Sub-42		1.75	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	7.55	0 00:14:36
42	Sub-43		1.64	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	7.16	0 00:14:05
43	Sub-44		2.83	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.74	11.37	0 00:19:31
44	Sub-45		1.45	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	6.38	0 00:13:02
45	Sub-46		1.58	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	6.91	0 00:13:45
46	Sub-47		1.65	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	7.18	0 00:14:07
47	Sub-48		1.85	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	7.95	0 00:15:07
48	Sub-49		1.36	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	6.03	0 00:12:33
49	Sub-54		2.92	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.74	11.67	0 00:19:54
50	Sub-55		4.42	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.73	16.03	0 00:25:31
51	Sub-57		3.53	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.74	13.54	0 00:22:17
52	Sub-58		4.29	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.73	15.68	0 00:25:03
53	Sub-59		1.98	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	8.45	0 00:15:46

54	Sub-60	1.23	64	76.00	0.1500	7.00	0.5000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.71	3.91	0 00:38:15
55	Sub-61	1.45	64	76.00	0.1500	7.00	0.5000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.71	4.43	0 00:42:13
56	Sub-63	8.34	64	76.00	0.1500	7.00	0.5000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0150	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.63	13.54	0 01:35:57
57	Sub-64	10.72	64	76.00	0.1500	7.00	0.7500	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0150	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.62	16.86	0 01:38:48
58	Sub-65	25.17	64	76.00	0.1500	7.00	0.7100	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0150	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.50	20.34	0 02:47:35
59	Sub-66	7.04	64	76.00	0.1500	7.00	0.5000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0150	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.64	12.72	0 01:26:41
60	Sub-67	1.50	64	76.00	0.1500	7.00	25.0000	100.00	0.00	0.00	0.0800	0.0150	0.2000	0.0220	0.00	NewMexico	4.88	0.00	0.0000	1.9170	2.75	6.59	0 00:13:19

Attachment B

Revised Universal Soil Loss Equation (RUSLE) Calculation

SOUTH RANCH SURFACE WASTE MANAGEMENT FACILITY
REVISED UNIVERSAL SOIL LOSS EVALUATION (RUSLE)

ASSUMPTIONS:
- 2 areas or basin types to consider top deck of landfill and side slope of landfill between collection at diversion berms
- There is 1 top deck area and 11 areas between letdowns subdivided by side slope diversion berms

Basin Type Definition

Basin	Description	Slope (%)	Slope Length (ft)
1	Top Deck	4	350
2	Side Slope Area Between Diversion Berms and Letdowns	25	240
3	Side Slope Area Between Diversion Berms and Letdowns	25	100

C - Factor Calculation

C	=	$C_{PLU}*C_{CC}*C_{SC}*C_{SR}*C_{SM}$		
C_{PLU}	-	Prior Land Use Subfactor		
	=	1	For Rangeland	
C_{CC}	-	Canopy Cover Subfactor		
	=	1-FC*exp(-0.1*H)		Equation 5-11, NRCS Agricultural Handbook #703
		F_C = Fraction Land Covered by Canopy		
		F_C = 0.5	Conservative Estimate	
		H = Canopy Cover Height		
		H = 0	Conservative Estimate	
	=	0.5		
C_{SC}	-	Surface Cover Subfactor		
	=	$\exp[-b*S_P(0.24/R_U)^{.08}]$		Equation 5-12, NRCS Agricultural Handbook #703
		b = 0.39	Simanton et. al (1984)	
		$S_P = [1-\exp(-\alpha*B_S)]*100$		Equation 5-13, NRCS Agricultural Handbook #703
		α = 0.00055	Table 5-1, NRCS Agricultural Handbook #703	
		B_S = 5 ton/acre^{-1}		
		S_P = 93.61		
		R_U = 0.8	Short Grass, Desert	Table 5-6, NRCS Agricultural Handbook #703
	=	0.036		
C_{SR}	-	Surface Roughness Subfactor		
	=	$\exp[-0.66*(R_U-0.24)]$		Equation 5-23, NRCS Agricultural Handbook #703
	=	0.691		
C_{SM}	-	Soil Moisture Subfactor		
	=	0.3	Assuming an initial soil moisture of 30% in historically wet years	
C	=	0.0037314		

RUSLE Equation Calculation

R	-	Rainfall Value Factor		
	=	45		Fig 2-1 & 2-2, NRCS Agricultural Handbook #703
K	-	Soil Erodibility Factor		
	=	0.13		Soil Type Poorly Graded Silty Sand
LS	-	Slope Length Factor		
	=	Basin	LS	Table 4-3, NRCS Agricultural Handbook #703
		1	1.06	
		2	9.00	
		3	4.59	
C	-	Covering Management Factor		
	=	0.0037314		see C factor calculation sheet
P	-	Support Practices Factor		
	=	1		Conservative Estimate
A	-	Calculated Soils Loss in tons/acre-year		
		Basin	A (tons/acrea-year)	
		1	0.02	
		2	0.20	
		3	0.10	

Total Soil Loss

Basin Type	Calculated Soil Loss A per Basin Type (tons/acre-year)	Number of Basins Types	Total Soil Loss (tons/acre-year)
1	0.02	1	**0.02**
2	0.20	3	**0.59**
3	0.10	7	**0.70**
Total Soil Loss			**1.31**

Attachment C

Leachate Evaporation Pond Sizing – Incidental Precipitation Volume

SOUTH RANCH SURFACE WASTE MANAGEMENT FACILITY
LEACHATE EVAPORATION POND SIZING - INCIDENTAL PRECIPITATION VOLUME

ASSUMPTIONS:
- Area Assumes Largest Cell Open, Cell E-6, and Waste Slope in from Cell C-2
- Incidental precipitation from 25-year, 24-hour storm event

HYDROLOGY PARAMETERS SCS METHOD	**VALUE**	**SOURCE**
Precipitation (25-YEAR/24-HOUR EVENT, INCHES)	4.56	NOAA Atlas 14, Volume 1, Version 5. Jal, New Mexico, USA
Curve Number (unitless)	77	TR-55 Manual, Table 2-2a for "Streets/Roads-Dirt" for Hydraulic Soil Group B
Direct Runoff (inches)	2.25	TR-55 Manual, Figure 2-1 using CN and P above.
RUNOFF VOLUME		
Area (acres)	25.7	CALCULATED IN CAD
Runoff Volume (Ac-ft^3)	4.8	calculated
Runoff Volume (CY)	7774.3	calculated
INCIDENTAL RAINFALL OVER POND		
- Area From Site Development Design		
HYDROLOGY PARAMETERS SCS METHOD	VALUE	SOURCE
Precipitation (25-YEAR/24-HOUR EVENT, INCHES)	4.56	NOAA Atlas 14, Volume 1, Version 5. Jal, New Mexico, USA
Curve Number (unitless)	100	Exposed HDPE Impervious Surface
Direct Runoff (inches)	4.60	TR-55 Manual, Figure 2-1 using CN and P above.
RUNOFF VOLUME		
Area (acres)	2	CALCULATED IN CAD
Runoff Volume (Ac-ft^3)	0.77	calculated
Runoff Volume (CY)	1236.89	calculated
TOTAL Runoff Volume (Ac-ft3)	5.6	
TOTAL Runoff Volume (CY)	9011.1	
TOTAL Runoff Volume (CF)	243300.8	

PROJECT: South Ranch Surface Waste Management Facility
HELP Calculations Summary

PAGE: 1 of 5

JOB NO.: 35187378 **DATE:** October 2019 **COMP. BY:** KJ **CHECKED BY:** MPB

CALCULATIONS BY: Kyle Jackson – Staff Engineer
Michael P. Bradford, P.E. – Senior Project Manager

SOFTWARE: HELP Version 3.07 (November 1, 1997),
Hydrologic Evaluation of the Landfill Performance – A model for predicting landfill hydrologic and infiltration processes and testing of effectiveness of landfill designs that was recompiled for Windows by Institute of Soil Science, University of Hamburg, Germany dated August 9, 2012.

METHODOLOGY: *Guidance Document for Performance for an Alternate Cover/Liner Design Under Section 502.A.2 of the New Mexico Solid Waste Management Regulations (20 NMAC 9.1) Using HELP Modeling, New Mexico Environmental Department Solid Waste Bureau Permit Section, April 1, 1998 (Guidance)*
Provided in Exhibit I.

INTRODUCTION:

The following document comprises the HELP modeling for the NGL Water Solutions Permian, LLC (NGL) South Ranch Surface Waste Management Facility (Facility). The site is located 7 miles southwest of Jal, New Mexico and is approximately 187 acres in size. The primary waste accepted by the Facility will be oil field waste.

The applicant proposes to permit, construct and operate the Facility and associated leachate evaporation pond and appurtenances. The facility design is split into Phase 1 and Phase 2. Each phase is divided into cells ranging from 7.6 acres to 9.7 acres in size with a total waste disposal size of 112 acres. The proposed disposal area design is expected to yield approximately 21,481,573 cubic yards of airspace. The weather data was synthetically derived from HELP model database.

ANALYSIS:

The HELP Model version 3.07 was used to calculate approximate leachate flow rates and liquid heads above the liner system under eight different scenarios. The scenarios were to compare the alternate cover/liner systems proposed by Terracon and the prescriptive cover/liner system defined by NMAC 19.15.36.14.

Final Cover Demonstration – Tier 1 Analysis

- Scenario 1 portrays the prescriptive final cover system outlined in NMAC 19.15.36.14. See **Table D.1,** and **Exhibit A** for modeling results.
- Scenario 2 portrays the alternate final cover system designed by Terracon. See **Table D.2,** and **Exhibit B** for modeling results.

Base Liner Demonstration – Tier 1 Analysis

- Scenario 3 portrays the prescriptive liner system set forth by NMAC 19.15.36.14 of the largest cell in the disposal area. See **Table D.3,** and **Exhibit C** for modeling results.
- Scenario 4 portrays the alternate liner system designed by Terracon of the largest cell in the disposal area prior to waste being placed over the cell. See **Table D.4,** and **Exhibit D** for modeling results.

Base Liner Demonstration – Tier 2 Analysis

- Scenario 5 portrays the alternate liner system designed by Terracon of the largest cell in the disposal area prior to waste being placed over the cell. See **Table D.4,** and **Exhibit E** for modeling results.

- Scenario 6 portrays the alternate liner system of the entire disposal area with 20’ of waste placed. See **Table D.5,** and **Exhibit F** for modeling results.
- Scenario 7 portrays the alternate liner system of the entire disposal area completely filled with alternative final cover placed but with no vegetation developed. See **Table D.6,** and **Exhibit G** for modeling results.
- Scenario 8 portrays the alternate liner system of the entire disposal area completely filled with alternative final cover placed with vegetation developed. See **Table D.7,** and **Exhibit H** for modeling results.

The layers for each scenario analyzed using the HELP Model are described below in **the following tables.**

Table D.1 Scenario 1 - Prescriptive Final Cover Design

Layer	Description	Thickness	K_{sat} (cm/se)
1	Erosion Layer	12-in	3.3×10^{-5}
2	Final Cover	12-in	1×10^{-5}
3	Drainage Sand	12-in	1×10^{-2}
4	Geomembrane	60-mil	2×10^{-13}
5	Drainage Sand	12-in	1×10^{-2}

Table D.2 Scenario 2 - Alternate Final Cover

Layer	Description	Thickness	K_{sat} (cm/se)
1	Erosion Layer	12-in	5.2×10^{-4}
2	Final Cover	26-in	1.9×10^{-4}
3	Intermediate Cover	12-in	1.9×10^{-4}

Table D.3 Scenario 3 - Prescriptive Liner

Layer	Description	Thickness	K_{sat} (cm/se)
1	Protective/Drainage Soil	24-in	1×10^{-2}
2	Geomembrane	60-mil	2×10^{-13}
3	On-Site Soil	24-in	1×10^{-5}
4	Geomembrane	60-mil	2×10^{-13}
5	Compacted Clay Liner	24-in	1×10^{-7}

Table D.4 Scenario 4 and 5 - Alternate Liner System Design

Layer	Description	Thickness	K_{sat} (cm/se)
1	Protective/Drainage Soil	24-in	1.9 x 10^{-4}
2	Geocomposite	200-mil	10
3	Geomembrane	60-mil	2 x 10^{-13}
4	Geocomposite Leak Detection	200-mil	10
5	Geomembrane	60-mil	2 x 10^{-13}
6	Geosynthetic Clay Liner	240-mil	3 x 10^{-9}

Table D.5 Scenario 6 - Alternate Liner - 20' Filled

Layer	Description	Thickness	K_{sat} (cm/se)
1	Waste	20-ft	1 x 10^{-3}
2	Protective/Drainage Soil	24-in	1.9 x 10^{-4}
3	Geocomposite	200-mil	10
4	Geomembrane	60-mil	2 x 10^{-13}
5	Geocomposite Leak Detection	200-mil	10
6	Geomembrane	60-mil	2 x 10^{-13}
7	Geosynthetic Clay Liner	240-mil	3 x 10^{-9}

Table D.6 Scenario 7 - Alternate Liner - Filled with Final Cover No Vegetation

Layer	Description	Thickness	K_{sat} (cm/se)
1	Erosion Layer	12-in	5.2 x 10^{-4}
2	Final Cover	26-in	1.9 x 10^{-4}
3	Intermediate Cover	12-in	1.9 x 10^{-4}
4	Waste	227-ft	1 x 10^{-3}
5	Protective/Drainage Soil	24-in	1 x 10^{-5}
6	Geocomposite	200-mil	10
7	Geomembrane	60-mil	2 x 10^{-13}
8	Geocomposite Leak Detection	200-mil	10
9	Geomembrane	60-mil	2 x 10^{-13}
10	Geosynthetic Clay Liner	240-mil	3 x 10^{-9}

Table D.7 Scenario 8 - Alternate Liner - Filled Established Vegetation

Layer	Description	Thickness	K_{sat} (cm/se)
1	Erosion Layer	12-in	5.2×10^{-4}
2	Final Cover	26-in	1.9×10^{-4}
3	Intermediate Cover	12-in	1.9×10^{-4}
4	Waste	227-ft	1×10^{-3}
5	Protective/Drainage Soil	24-in	1×10^{-5}
6	Geocomposite	200-mil	10
7	Geomembrane	60-mil	2×10^{-13}
8	Geocomposite Leak Detection	200-mil	10
9	Geomembrane	60-mil	2×10^{-13}
10	Geosynthetic Clay Liner	240-mil	3×10^{-9}

Site specific soil and climate conditions and parameters are established using HELP Model predefined input data. The cell floor is modeled assuming a 250 ft maximum lateral drainage length at 2% grade. The final cover is modeled with a maximum lateral drainage length of 350 ft at 4% grade. Initial moisture of soil components is calculated using the 25% rule stated in the Guidance. The individual HELP Model evaluation results stating the various conditions of the different scenarios can be found in **Exhibit A-H**.

SUMMARY OF RESULTS:

The following **Table D.8** is a summary of the HELP modeling results as related to the Guidance and NMAC requirements.

Table D.8 Summary of HELP Modeling Results

Scenario	Critical Layer	Percolation Through Critical Layer (inches)	Maximum Head on Primary Liner (Inches)	Comments
Tier I - Alternative Final Cover Equivalency Demonstration				
1 - Prescriptive Final Cover (NMAC 19.15.36.14.C(8))	Layer 4	0.00001	n/a	none
2 – Alternative Final Cover	Layer 3	0.00001	n/a	Effectively 0.0 inches.

Scenario	**Critical Layer**	**Percolation Through Critical Layer (inches)**	**Maximum Head on Primary Liner (Inches)**	**Comments**
Tier I – Alternative Base Liner Equivalency Demonstration				
3 – Prescriptive Liner Over Largest Cell (NMAC 19.15.26.14.C)	Layer 5	0.00000	0.911	none
4 – Alternative Liner Over Largest Cell	Layer 6	0.00000	0.0	Performance exceeds performance of the prescriptive line system. Is in compliance with NMAC 19.15.36.14.F as head over the liner does not exceed 1-ft.
Tier II – Alternative Base Liner Groundwater Protection Demonstration				
5 – Alternative Liner Over Entire Landfill, Prior to Waste Placement	Layer 6	0.0	0.0	No percolation through the clay barrier, thus protective of groundwater.
6 – Alternative Liner Over Entire Landfill, with 20' of Waste Placement	Layer 7	0.0	0.0	No percolation through the clay barrier, thus protective of groundwater.
7 – Alternative Liner Over Entire Landfill, Filled to Final Grade with Alternative Final Cover with no vegetation established	Layer 10	0.0	0.0	No percolation through the clay barrier, thus protective of groundwater.
8 – Alternative Liner Over Entire Landfill, Filled to Final Grade with Alternative Final Cover with poor cover vegetation established	Layer 10	0.0	0.0	No percolation through the clay barrier, thus protective of groundwater.

In conclusion, the proposed alternative final cover and base liner systems have demonstrated equivalent or better hydraulic performance to that of the NMAC prescriptive systems. In addition, as shown there is no percolation anticipated through the proposed alternative final cover system. The cap is designed to remove moisture from the cap by either evaporation or plant transpiration before moving through the cap's thickness. Therefore, the final cover system effectively prevents the "bathtub effect" and is in compliance with NMAC 19.15.39.14.C.(9).

Exhibit A

SCENARIO 1 HELP MODEL RESULTS

```
******************************************************************************
 ******************************************************************************
 **                                                                          **
 **                                                                          **
 **              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
 **                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
 **                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
 **                    USAE WATERWAYS EXPERIMENT STATION                     **
 **             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
 **                                                                          **
 **             Recompiled for Windows (32/64-bit) (09 Aug 2012)             **
 **        Institute of Soil Science, University of Hamburg, Germany         **
 **                                                                          **
 **                                                                          **
 ******************************************************************************
 ******************************************************************************



 PRECIPITATION DATA FILE:      N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Final to OCD\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRprecco.d4
 TEMPERATURE DATA FILE:        N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Final to OCD\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRtempco.d7
 SOLAR RADIATION DATA FILE:   N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Final to OCD\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRsolcov.d13
 EVAPOTRANSPIRATION DATA:      N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Final to OCD\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRevapco.d11
 SOIL AND DESIGN DATA FILE:   N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Final to OCD\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRPRCOEH (1).D10
 OUTPUT DATA FILE:             N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Final to OCD\VOL 2\App J - Engineering
Report\Attachment D - HELP\Exhibits\ExA - PrescriptiveFC\Summary Output Files.out


 TIME:  14:35     DATE:  10/14/2019



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

      TITLE:  Prescriptive Final Cover

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



      NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.



                                   LAYER  1
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  13
           THICKNESS                   =     12.00   INCHES
           POROSITY                    =      0.4300 VOL/VOL
           FIELD CAPACITY              =      0.3210 VOL/VOL
           WILTING POINT               =      0.2210 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.2540 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.330000002577E-04 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  2.01
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

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

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4750 VOL/VOL
FIELD CAPACITY              =      0.3780 VOL/VOL
WILTING POINT               =      0.2650 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2930 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999974738E-05 CM/SEC



                        LAYER  3
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   1
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4170 VOL/VOL
FIELD CAPACITY              =      0.0450 VOL/VOL
WILTING POINT               =      0.0180 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0250 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999977648E-02 CM/SEC
SLOPE                       =      4.00   PERCENT
DRAINAGE LENGTH             =    350.0    FEET



                        LAYER  4
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996490E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD



                        LAYER  5
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   1
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4170 VOL/VOL
FIELD CAPACITY              =      0.0450 VOL/VOL
WILTING POINT               =      0.0180 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.1720 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999977648E-02 CM/SEC



        GENERAL DESIGN AND EVAPORATIVE ZONE DATA
```

```
              ----------------------------------------

    NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
             SOIL DATA BASE USING SOIL TEXTURE #13 WITH A
             POOR STAND OF GRASS, A SURFACE SLOPE OF  4.%
             AND A SLOPE LENGTH OF  350. FEET.

   SCS RUNOFF CURVE NUMBER             =     91.90
   FRACTION OF AREA ALLOWING RUNOFF    =    100.0    PERCENT
   AREA PROJECTED ON HORIZONTAL PLANE  =    112.000  ACRES
   EVAPORATIVE ZONE DEPTH              =     24.0    INCHES
   INITIAL WATER IN EVAPORATIVE ZONE   =      6.564  INCHES
   UPPER LIMIT OF EVAPORATIVE STORAGE  =     10.860  INCHES
   LOWER LIMIT OF EVAPORATIVE STORAGE  =      5.832  INCHES
   INITIAL SNOW WATER                  =      0.000  INCHES
   INITIAL WATER IN LAYER MATERIALS    =      8.928  INCHES
   TOTAL INITIAL WATER                 =      8.928  INCHES
   TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR




               EVAPOTRANSPIRATION AND WEATHER DATA
               -----------------------------------

    NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
             ROSWELL             NEW MEXICO

        STATION LATITUDE                       =  33.24 DEGREES
        MAXIMUM LEAF AREA INDEX                =   1.20
        START OF GROWING SEASON (JULIAN DATE)  =     76
        END OF GROWING SEASON (JULIAN DATE)    =    310
        EVAPORATIVE ZONE DEPTH                 =  24.0  INCHES
        AVERAGE ANNUAL WIND SPEED              =   8.70 MPH
        AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  49.00 %
        AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  40.00 %
        AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  53.00 %
        AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  52.00 %



    NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    ROSWELL             NEW MEXICO

             NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
  0.24        0.28        0.27        0.37        0.77        0.91
  1.38        2.17        1.72        0.99        0.33        0.27



    NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    ROSWELL             NEW MEXICO

        NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
 41.40       45.90       52.80       61.90       70.30       79.00
 81.40       79.20       72.30       61.70       49.10       42.50



    NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    ROSWELL             NEW MEXICO
               AND STATION LATITUDE  =  33.24 DEGREES
```

```
*******************************************************************************

                          ANNUAL TOTALS FOR YEAR    1
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            8.70        3537072.250    100.00

  RUNOFF                                   0.272        110437.602      3.12

  EVAPOTRANSPIRATION                       8.355       3396726.000     96.03

  DRAINAGE COLLECTED FROM LAYER  3         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  PERC./LEAKAGE THROUGH LAYER  5           1.329588     540557.312     15.28

  CHANGE IN WATER STORAGE                 -1.256       -510649.656    -14.44

  SOIL WATER AT START OF YEAR              9.228       3751732.000

  SOIL WATER AT END OF YEAR                7.972       3241082.750

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            1.163      0.00

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


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

                          ANNUAL TOTALS FOR YEAR    2
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.35        4207896.500    100.00

  RUNOFF                                   0.225         91675.133      2.18

  EVAPOTRANSPIRATION                      10.359       4211456.000    100.08

  DRAINAGE COLLECTED FROM LAYER  3         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  PERC./LEAKAGE THROUGH LAYER  5           0.063230      25706.773      0.61

  CHANGE IN WATER STORAGE                 -0.297       -120940.219     -2.87

  SOIL WATER AT START OF YEAR              7.972       3241082.750

  SOIL WATER AT END OF YEAR                7.674       3120142.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000           -0.939      0.00

*******************************************************************************
```

```
*******************************************************************************

                          ANNUAL TOTALS FOR YEAR    3
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.33        4199764.500    100.00

  RUNOFF                                   0.105         42824.523      1.02

  EVAPOTRANSPIRATION                       9.732       3956590.250     94.21

  DRAINAGE COLLECTED FROM LAYER  3         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  PERC./LEAKAGE THROUGH LAYER  5           0.033718      13708.370      0.33

  CHANGE IN WATER STORAGE                  0.459        186642.688      4.44

  SOIL WATER AT START OF YEAR              7.674       3120142.000

  SOIL WATER AT END OF YEAR                8.134       3306784.750

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000           -1.874      0.00

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


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

                          ANNUAL TOTALS FOR YEAR    4
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            9.25        3760681.000    100.00

  RUNOFF                                   0.413        167886.625      4.46

  EVAPOTRANSPIRATION                       9.192       3737089.750     99.37

  DRAINAGE COLLECTED FROM LAYER  3         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  PERC./LEAKAGE THROUGH LAYER  5           0.022618       9195.696      0.24

  CHANGE IN WATER STORAGE                 -0.378       -153493.094     -4.08

  SOIL WATER AT START OF YEAR              8.134       3306784.750

  SOIL WATER AT END OF YEAR                7.756       3153291.750

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00
```

```
  ANNUAL WATER BUDGET BALANCE              0.0000            2.518      0.00

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




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

                          ANNUAL TOTALS FOR YEAR    5
-------------------------------------------------------------------------------
                                          INCHES          CU. FEET     PERCENT
                                         --------        ----------    -------
  PRECIPITATION                            9.68        3935501.000    100.00

  RUNOFF                                   0.098         39697.879      1.01

  EVAPOTRANSPIRATION                       9.571       3891196.250     98.87

  DRAINAGE COLLECTED FROM LAYER  3         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  PERC./LEAKAGE THROUGH LAYER  5           0.016754       6811.320      0.17

  CHANGE IN WATER STORAGE                 -0.005         -2204.609     -0.06

  SOIL WATER AT START OF YEAR              7.756       3153291.750

  SOIL WATER AT END OF YEAR                7.751       3151087.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            0.247      0.00

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




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

         AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH    5
-------------------------------------------------------------------------------

                         JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                         -------  -------  -------  -------  -------  -------
  PRECIPITATION
  -------------
    TOTALS                 0.18     0.17     0.29     0.26     0.78     0.63
                           1.66     1.91     1.64     0.79     0.84     0.49

    STD. DEVIATIONS        0.19     0.04     0.26     0.21     0.74     0.77
                           0.78     1.32     1.04     0.91     1.02     0.34

  RUNOFF
  ------
    TOTALS                 0.000    0.000    0.000    0.000    0.011    0.017
                           0.046    0.060    0.039    0.044    0.004    0.000

    STD. DEVIATIONS        0.000    0.000    0.000    0.000    0.024    0.034
                           0.044    0.058    0.084    0.097    0.006    0.000

  EVAPOTRANSPIRATION
  ------------------
```

```
    TOTALS                 0.412    0.297    0.276    0.269    0.965    0.719
                           1.448    2.074    1.329    0.613    0.582    0.457

    STD. DEVIATIONS        0.212    0.106    0.089    0.109    0.502    0.910
                           0.809    1.530    0.993    0.482    0.276    0.156

  LATERAL DRAINAGE COLLECTED FROM LAYER  3
  ----------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  PERCOLATION/LEAKAGE THROUGH LAYER  4
  ------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  PERCOLATION/LEAKAGE THROUGH LAYER  5
  ------------------------------------
    TOTALS                 0.2103   0.0202   0.0133   0.0093   0.0077   0.0062
                           0.0056   0.0050   0.0043   0.0041   0.0037   0.0035

    STD. DEVIATIONS        0.4617   0.0380   0.0223   0.0140   0.0105   0.0078
                           0.0065   0.0054   0.0044   0.0039   0.0033   0.0030


-------------------------------------------------------------------------------
               AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
-------------------------------------------------------------------------------


  DAILY AVERAGE HEAD ON TOP OF LAYER  4
  -------------------------------------
    AVERAGES               0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

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


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

     AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH    5
-------------------------------------------------------------------------------
                                     INCHES          CU. FEET      PERCENT
                               -------------------   -------------   ---------
 PRECIPITATION                   9.66    (   0.710)    3928183.0     100.00

 RUNOFF                          0.223   (  0.1304)      90504.35      2.304

 EVAPOTRANSPIRATION              9.442   (  0.7392)    3838611.75     97.720

 LATERAL DRAINAGE COLLECTED      0.00000 (  0.00000)        0.000    0.00000
   FROM LAYER  3

 PERCOLATION/LEAKAGE THROUGH     0.00000 (  0.00000)        0.000     0.00000
   LAYER  4

 AVERAGE HEAD ON TOP             0.000 (    0.000)
   OF LAYER  4

 PERCOLATION/LEAKAGE THROUGH     0.29318 (  0.57965)    119195.883     3.03438
   LAYER  5
```

```
 CHANGE IN WATER STORAGE        -0.295   (  0.6291)    -120128.97     -3.058
*******************************************************************************
```

```
******************************************************************************

              PEAK DAILY VALUES FOR YEARS    1 THROUGH    5
   ------------------------------------------------------------------------
                                            (INCHES)      (CU. FT.)
                                           ----------   -------------
      PRECIPITATION                          1.17        475675.156

      RUNOFF                                 0.179        72936.5312

      DRAINAGE COLLECTED FROM LAYER  3       0.00000          0.00000

      PERCOLATION/LEAKAGE THROUGH LAYER  4   0.000000         0.00000

      AVERAGE HEAD ON TOP OF LAYER  4        0.000

      MAXIMUM HEAD ON TOP OF LAYER  4        0.000

      LOCATION OF MAXIMUM HEAD IN LAYER  3
            (DISTANCE FROM DRAIN)            0.0 FEET

      PERCOLATION/LEAKAGE THROUGH LAYER  5   0.439320    178610.04688

      SNOW WATER                             0.61        248784.4219


      MAXIMUM VEG. SOIL WATER (VOL/VOL)                0.3158

      MINIMUM VEG. SOIL WATER (VOL/VOL)                0.2430


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

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

******************************************************************************
```

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

                   FINAL WATER STORAGE AT END OF YEAR    5
    ----------------------------------------------------------------------
                    LAYER        (INCHES)       (VOL/VOL)
                    -----        --------       ---------
                      1            3.3616         0.2801

                      2            3.1802         0.2650

                      3            0.3107         0.0259

                      4            0.0000         0.0000

                      5            0.5981         0.0498

                  SNOW WATER       0.000

******************************************************************************
******************************************************************************
```

Exhibit B

SCENARIO 2 HELP MODEL RESULTS

```
******************************************************************************
 ******************************************************************************
 **                                                                          **
 **                                                                          **
 **              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
 **                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
 **                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
 **                    USAE WATERWAYS EXPERIMENT STATION                     **
 **             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
 **                                                                          **
 **             Recompiled for Windows (32/64-bit) (09 Aug 2012)             **
 **        Institute of Soil Science, University of Hamburg, Germany         **
 **                                                                          **
 **                                                                          **
 ******************************************************************************
 ******************************************************************************




 PRECIPITATION  DATA  FILE:      N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Final  to  OCD\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRprecco.d4
 TEMPERATURE  DATA  FILE:        N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Final  to  OCD\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRtempco.d7
 SOLAR  RADIATION  DATA  FILE:   N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Final  to  OCD\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRsolcov.d13
 EVAPOTRANSPIRATION  DATA:       N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Final  to  OCD\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRevapco.d11
 SOIL  AND  DESIGN  DATA  FILE:  N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Final  to  OCD\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\Exhibits\ExB - AltFC\SRALCO50.D10
 OUTPUT  DATA  FILE:             N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Final  to  OCD\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\Exhibits\ExB - AltFC\Summary Output Files.out



 TIME:  14:38     DATE:  10/14/2019




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

      TITLE:  Alternate Final Cover 50" high K

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




      NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.




                                    LAYER  1
                                    --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   7
            THICKNESS                   =     12.00   INCHES
            POROSITY                    =      0.4730 VOL/VOL
            FIELD CAPACITY              =      0.2220 VOL/VOL
            WILTING POINT               =      0.1040 VOL/VOL
            INITIAL SOIL WATER CONTENT  =      0.1340 VOL/VOL
            EFFECTIVE SAT. HYD. COND.   =  0.520000001416E-03 CM/SEC
          NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  2.01
                   FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

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

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   9
   THICKNESS                   =     26.00   INCHES
   POROSITY                    =      0.5010 VOL/VOL
   FIELD CAPACITY              =      0.2840 VOL/VOL
   WILTING POINT               =      0.1350 VOL/VOL
   INITIAL SOIL WATER CONTENT  =      0.1720 VOL/VOL
   EFFECTIVE SAT. HYD. COND.   =  0.190000006114E-03 CM/SEC




                           LAYER  3
                           --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   9
   THICKNESS                   =     12.00   INCHES
   POROSITY                    =      0.5010 VOL/VOL
   FIELD CAPACITY              =      0.2840 VOL/VOL
   WILTING POINT               =      0.1350 VOL/VOL
   INITIAL SOIL WATER CONTENT  =      0.1720 VOL/VOL
   EFFECTIVE SAT. HYD. COND.   =  0.190000006114E-03 CM/SEC





           GENERAL DESIGN AND EVAPORATIVE ZONE DATA
           ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
          SOIL DATA BASE USING SOIL TEXTURE # 9 WITH BARE
          GROUND CONDITIONS, A SURFACE SLOPE OF  4.% AND
          A SLOPE LENGTH OF  350. FEET.

SCS RUNOFF CURVE NUMBER              =     91.79
FRACTION OF AREA ALLOWING RUNOFF     =    100.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =    112.000  ACRES
EVAPORATIVE ZONE DEPTH               =     24.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      3.672  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =     11.688  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      2.868  INCHES
INITIAL SNOW WATER                   =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =      8.144  INCHES
TOTAL INITIAL WATER                  =      8.144  INCHES
TOTAL SUBSURFACE INFLOW              =      0.00   INCHES/YEAR




            EVAPOTRANSPIRATION AND WEATHER DATA
            -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          ROSWELL             NEW MEXICO

     STATION LATITUDE                       =  33.24 DEGREES
     MAXIMUM LEAF AREA INDEX                =   1.20
     START OF GROWING SEASON (JULIAN DATE)  =     76
     END OF GROWING SEASON (JULIAN DATE)    =    310
     EVAPORATIVE ZONE DEPTH                 =  24.0  INCHES
     AVERAGE ANNUAL WIND SPEED              =   8.70 MPH
     AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  49.00 %
```

```
             AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  40.00 %
             AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  53.00 %
             AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  52.00 %


         NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    ROSWELL             NEW MEXICO

                  NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

     JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
     -------     -------     -------     -------     -------     -------
       0.24        0.28        0.27        0.37        0.77        0.91
       1.38        2.17        1.72        0.99        0.33        0.27


         NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    ROSWELL             NEW MEXICO

             NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

     JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
     -------     -------     -------     -------     -------     -------
      41.40       45.90       52.80       61.90       70.30       79.00
      81.40       79.20       72.30       61.70       49.10       42.50


         NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    ROSWELL             NEW MEXICO
                    AND STATION LATITUDE  =  33.24 DEGREES



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

                          ANNUAL TOTALS FOR YEAR    1
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            8.70        3537072.250    100.00

  RUNOFF                                   0.193         78473.523      2.22

  EVAPOTRANSPIRATION                       9.274       3770304.000    106.59

  PERC./LEAKAGE THROUGH LAYER  3           0.000002          0.647      0.00

  CHANGE IN WATER STORAGE                 -0.767       -311707.906     -8.81

  SOIL WATER AT START OF YEAR              8.144       3311010.750

  SOIL WATER AT END OF YEAR                7.377       2999302.750

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            2.067      0.00
*******************************************************************************



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

                          ANNUAL TOTALS FOR YEAR    2
```

```
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.35        4207896.500    100.00

  RUNOFF                                   0.216         87740.531      2.09

  EVAPOTRANSPIRATION                      10.127       4117098.750     97.84

  PERC./LEAKAGE THROUGH LAYER  3           0.000003          1.185      0.00

  CHANGE IN WATER STORAGE                  0.008          3055.667      0.07

  SOIL WATER AT START OF YEAR              7.377       2999302.750

  SOIL WATER AT END OF YEAR                7.385       3002358.250

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            0.753      0.00

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



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

                          ANNUAL TOTALS FOR YEAR    3
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.33        4199764.500    100.00

  RUNOFF                                   0.078         31795.930      0.76

  EVAPOTRANSPIRATION                      10.232       4160023.250     99.05

  PERC./LEAKAGE THROUGH LAYER  3           0.000003          1.354      0.00

  CHANGE IN WATER STORAGE                  0.020          7944.502      0.19

  SOIL WATER AT START OF YEAR              7.385       3002358.250

  SOIL WATER AT END OF YEAR                7.404       3010303.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000           -0.579      0.00

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



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                          ANNUAL TOTALS FOR YEAR    4
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            9.25        3760681.000    100.00

  RUNOFF                                   0.368        149601.609      3.98

  EVAPOTRANSPIRATION                       8.581       3488494.750     92.76
```

```
  PERC./LEAKAGE THROUGH LAYER  3           0.000014          5.687      0.00

  CHANGE IN WATER STORAGE                  0.301        122577.383      3.26

  SOIL WATER AT START OF YEAR              7.404       3010303.000

  SOIL WATER AT END OF YEAR                7.706       3132880.250

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            1.873      0.00

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



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

                          ANNUAL TOTALS FOR YEAR    5
-------------------------------------------------------------------------------
                                         INCHES         CU. FEET     PERCENT
                                        --------       ----------    -------
  PRECIPITATION                            9.68        3935501.000    100.00

  RUNOFF                                   0.085         34740.293      0.88

  EVAPOTRANSPIRATION                       9.935       4039235.000    102.64

  PERC./LEAKAGE THROUGH LAYER  3           0.000010          3.994      0.00

  CHANGE IN WATER STORAGE                 -0.341       -138477.828     -3.52

  SOIL WATER AT START OF YEAR              7.706       3132880.250

  SOIL WATER AT END OF YEAR                7.365       2994402.750

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000           -0.505      0.00

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




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

         AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH    5
-------------------------------------------------------------------------------

                         JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                         -------  -------  -------  -------  -------  -------
  PRECIPITATION
  -------------
    TOTALS                 0.18     0.17     0.29     0.26     0.78     0.63
                           1.66     1.91     1.64     0.79     0.84     0.49

    STD. DEVIATIONS        0.19     0.04     0.26     0.21     0.74     0.77
                           0.78     1.32     1.04     0.91     1.02     0.34

  RUNOFF
  ------
    TOTALS                 0.000    0.000    0.000    0.000    0.010    0.016
                           0.042    0.054    0.024    0.041    0.001    0.000
```

```
    STD. DEVIATIONS        0.000    0.000    0.000    0.000    0.022    0.032
                           0.040    0.054    0.052    0.090    0.002    0.000

  EVAPOTRANSPIRATION
  ------------------
    TOTALS                 0.326    0.182    0.287    0.205    0.845    0.631
                           1.579    1.926    1.465    0.749    0.852    0.582

    STD. DEVIATIONS        0.169    0.086    0.246    0.112    0.607    0.762
                           0.842    1.323    1.000    0.692    0.629    0.370

  PERCOLATION/LEAKAGE THROUGH LAYER  3
  ------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

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


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

     AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH    5
-------------------------------------------------------------------------------
                                    INCHES           CU. FEET      PERCENT
                               -------------------  -------------  ---------
 PRECIPITATION                   9.66    (   0.710)    3928183.0    100.00

 RUNOFF                          0.188   (  0.1181)      76470.38      1.947

 EVAPOTRANSPIRATION              9.630   (  0.6948)    3915031.25     99.665

 PERCOLATION/LEAKAGE THROUGH     0.00001 (  0.00001)         2.574     0.00007
   LAYER  3

 CHANGE IN WATER STORAGE        -0.156   (  0.4105)     -63321.64     -1.612

*******************************************************************************
```

```
******************************************************************************

                PEAK DAILY VALUES FOR YEARS    1 THROUGH    5
   ------------------------------------------------------------------------
                                                (INCHES)      (CU. FT.)
                                               ----------   -------------
      PRECIPITATION                              1.17        475675.156

      RUNOFF                                     0.179        72865.4922

      PERCOLATION/LEAKAGE THROUGH LAYER  3       0.000006         2.45296

      SNOW WATER                                 0.61        248784.4219


      MAXIMUM VEG. SOIL WATER (VOL/VOL)                  0.1861

      MINIMUM VEG. SOIL WATER (VOL/VOL)                  0.1195

******************************************************************************
```

```
******************************************************************************

                  FINAL WATER STORAGE AT END OF YEAR    5
    ----------------------------------------------------------------------
                   LAYER        (INCHES)       (VOL/VOL)
                   -----        --------       ---------
                     1            1.2480         0.1040

                     2            4.0419         0.1555

                     3            2.0753         0.1729

                  SNOW WATER      0.000

******************************************************************************
******************************************************************************
```

Exhibit C

SCENARIO 3 HELP MODEL RESULTS

```
******************************************************************************
 ******************************************************************************
 **                                                                          **
 **                                                                          **
 **              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
 **                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
 **                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
 **                    USAE WATERWAYS EXPERIMENT STATION                     **
 **             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
 **                                                                          **
 **             Recompiled for Windows (32/64-bit) (09 Aug 2012)             **
 **        Institute of Soil Science, University of Hamburg, Germany         **
 **                                                                          **
 **                                                                          **
 ******************************************************************************
 ******************************************************************************




 PRECIPITATION DATA FILE:      N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRprecl.d4
 TEMPERATURE DATA FILE:        N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRtempl.d7
 SOLAR RADIATION DATA FILE:   N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRsoll.d13
 EVAPOTRANSPIRATION DATA:      N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRevapl.d11
 SOIL AND DESIGN DATA FILE:   N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRPRELEH.D10
 OUTPUT DATA FILE:             N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRPRELEH.OUT



 TIME:  11: 0     DATE:  10/14/2019




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

      TITLE:  Prescriptive Liner

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




      NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.




                                    LAYER  1
                                    --------

                        TYPE 2 - LATERAL DRAINAGE LAYER
                          MATERIAL TEXTURE NUMBER   1
            THICKNESS                   =     24.00   INCHES
            POROSITY                    =      0.4170 VOL/VOL
            FIELD CAPACITY              =      0.0450 VOL/VOL
            WILTING POINT               =      0.0180 VOL/VOL
            INITIAL SOIL WATER CONTENT  =      0.0250 VOL/VOL
            EFFECTIVE SAT. HYD. COND.   =  0.999999977648E-02 CM/SEC
            SLOPE                       =      2.00   PERCENT
            DRAINAGE LENGTH             =    250.0    FEET
```

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

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996490E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD




                        LAYER  3
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4750 VOL/VOL
FIELD CAPACITY              =      0.3780 VOL/VOL
WILTING POINT               =      0.2650 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2930 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.999999974738E-05 CM/SEC




                        LAYER  4
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996490E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD




                        LAYER  5
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  16
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4270 VOL/VOL
FIELD CAPACITY              =      0.4180 VOL/VOL
WILTING POINT               =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3800 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000001169E-06 CM/SEC
```

```
              GENERAL DESIGN AND EVAPORATIVE ZONE DATA
              ----------------------------------------

    NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
             SOIL DATA BASE USING SOIL TEXTURE # 1 WITH BARE
             GROUND CONDITIONS, A SURFACE SLOPE OF  2.% AND
             A SLOPE LENGTH OF  250. FEET.

   SCS RUNOFF CURVE NUMBER             =     73.20
   FRACTION OF AREA ALLOWING RUNOFF    =      0.0    PERCENT
   AREA PROJECTED ON HORIZONTAL PLANE  =      9.680  ACRES
   EVAPORATIVE ZONE DEPTH              =     14.0    INCHES
   INITIAL WATER IN EVAPORATIVE ZONE   =      0.350  INCHES
   UPPER LIMIT OF EVAPORATIVE STORAGE  =      5.838  INCHES
   LOWER LIMIT OF EVAPORATIVE STORAGE  =      0.252  INCHES
   INITIAL SNOW WATER                  =      0.000  INCHES
   INITIAL WATER IN LAYER MATERIALS    =     16.752  INCHES
   TOTAL INITIAL WATER                 =     16.752  INCHES
   TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR




               EVAPOTRANSPIRATION AND WEATHER DATA
               -----------------------------------

    NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
             ROSWELL             NEW MEXICO

        STATION LATITUDE                        =  33.24 DEGREES
        MAXIMUM LEAF AREA INDEX                 =   0.00
        START OF GROWING SEASON (JULIAN DATE)   =     76
        END OF GROWING SEASON (JULIAN DATE)     =    310
        EVAPORATIVE ZONE DEPTH                  =  14.0  INCHES
        AVERAGE ANNUAL WIND SPEED               =   8.70 MPH
        AVERAGE 1ST QUARTER RELATIVE HUMIDITY   =  49.00 %
        AVERAGE 2ND QUARTER RELATIVE HUMIDITY   =  40.00 %
        AVERAGE 3RD QUARTER RELATIVE HUMIDITY   =  53.00 %
        AVERAGE 4TH QUARTER RELATIVE HUMIDITY   =  52.00 %



    NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    ROSWELL             NEW MEXICO

             NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
  0.24        0.28        0.27        0.37        0.77        0.91
  1.38        2.17        1.72        0.99        0.33        0.27


    NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    ROSWELL             NEW MEXICO

        NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
 41.40       45.90       52.80       61.90       70.30       79.00
 81.40       79.20       72.30       61.70       49.10       42.50


    NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    ROSWELL             NEW MEXICO
               AND STATION LATITUDE  =  33.24 DEGREES
```

```
*******************************************************************************

                          ANNUAL TOTALS FOR YEAR    1
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            8.70         305704.125    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       6.914        242963.359     79.48

  DRAINAGE COLLECTED FROM LAYER  1         1.1312        39748.344     13.00

  PERC./LEAKAGE THROUGH LAYER  2           0.019310        678.535      0.22

  AVG. HEAD ON TOP OF LAYER  2             0.6810

  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  PERC./LEAKAGE THROUGH LAYER  5           0.000000          0.000      0.00

  CHANGE IN WATER STORAGE                  0.654         22992.420      7.52

  SOIL WATER AT START OF YEAR             24.828        872416.062

  SOIL WATER AT END OF YEAR               25.482        895408.500

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000           -0.008      0.00

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


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

                          ANNUAL TOTALS FOR YEAR    2
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.35         363682.500    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       8.641        303634.875     83.49

  DRAINAGE COLLECTED FROM LAYER  1         1.3892        48812.684     13.42

  PERC./LEAKAGE THROUGH LAYER  2           0.024977        877.661      0.24

  AVG. HEAD ON TOP OF LAYER  2             0.8399

  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  PERC./LEAKAGE THROUGH LAYER  5           0.000000          0.000      0.00

  CHANGE IN WATER STORAGE                  0.320         11235.028      3.09

  SOIL WATER AT START OF YEAR             25.482        895408.500
```

```
  SOIL WATER AT END OF YEAR               25.802        906643.562

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000           -0.084      0.00

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


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

                          ANNUAL TOTALS FOR YEAR    3
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.33         362979.656    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       9.228        324250.250     89.33

  DRAINAGE COLLECTED FROM LAYER  1         1.4365        50476.234     13.91

  PERC./LEAKAGE THROUGH LAYER  2           0.025692        902.792      0.25

  AVG. HEAD ON TOP OF LAYER  2             0.8663

  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  PERC./LEAKAGE THROUGH LAYER  5           0.000000          0.000      0.00

  CHANGE IN WATER STORAGE                 -0.334        -11746.602     -3.24

  SOIL WATER AT START OF YEAR             25.802        906643.562

  SOIL WATER AT END OF YEAR               25.468        894896.812

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000           -0.235      0.00

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


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

                          ANNUAL TOTALS FOR YEAR    4
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            9.25         325030.312    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       6.502        228476.328     70.29

  DRAINAGE COLLECTED FROM LAYER  1         2.1089        74104.992     22.80

  PERC./LEAKAGE THROUGH LAYER  2           0.035918       1262.089      0.39

  AVG. HEAD ON TOP OF LAYER  2             1.2694
```

```
  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  PERC./LEAKAGE THROUGH LAYER  5           0.000000          0.000      0.00

  CHANGE IN WATER STORAGE                  0.639         22448.877      6.91

  SOIL WATER AT START OF YEAR             25.468        894896.812

  SOIL WATER AT END OF YEAR               26.107        917345.812

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            0.109      0.00

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



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

                          ANNUAL TOTALS FOR YEAR    5
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            9.68         340139.719    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       8.699        305660.406     89.86

  DRAINAGE COLLECTED FROM LAYER  1         1.4838        52139.438     15.33

  PERC./LEAKAGE THROUGH LAYER  2           0.026541        932.619      0.27

  AVG. HEAD ON TOP OF LAYER  2             0.8984

  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  PERC./LEAKAGE THROUGH LAYER  5           0.000000          0.000      0.00

  CHANGE IN WATER STORAGE                 -0.503        -17660.080     -5.19

  SOIL WATER AT START OF YEAR             26.107        917345.812

  SOIL WATER AT END OF YEAR               25.604        899685.750

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000           -0.042      0.00

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




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

         AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH    5
-------------------------------------------------------------------------------
```

```
                         JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                         -------  -------  -------  -------  -------  -------
  PRECIPITATION
  -------------
    TOTALS                 0.18     0.17     0.29     0.26     0.78     0.63
                           1.66     1.91     1.64     0.79     0.84     0.49

    STD. DEVIATIONS        0.19     0.04     0.26     0.21     0.74     0.77
                           0.78     1.32     1.04     0.91     1.02     0.34

  RUNOFF
  ------
    TOTALS                 0.000    0.000    0.000    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

    STD. DEVIATIONS        0.000    0.000    0.000    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

  EVAPOTRANSPIRATION
  ------------------
    TOTALS                 0.132    0.134    0.169    0.159    0.794    0.481
                           1.180    1.914    1.097    0.863    0.685    0.390

    STD. DEVIATIONS        0.075    0.040    0.183    0.126    0.625    0.624
                           0.816    1.251    0.673    0.577    0.754    0.225

  LATERAL DRAINAGE COLLECTED FROM LAYER  1
  ----------------------------------------
    TOTALS                 0.1225   0.0877   0.0777   0.0616   0.0593   0.0761
                           0.0881   0.1634   0.1980   0.1993   0.1982   0.1780

    STD. DEVIATIONS        0.0800   0.0547   0.0471   0.0395   0.0412   0.0581
                           0.0388   0.1036   0.0846   0.0908   0.1123   0.0737

  PERCOLATION/LEAKAGE THROUGH LAYER  2
  ------------------------------------
    TOTALS                 0.0022   0.0016   0.0014   0.0011   0.0011   0.0014
                           0.0016   0.0028   0.0034   0.0034   0.0034   0.0031

    STD. DEVIATIONS        0.0014   0.0010   0.0009   0.0007   0.0007   0.0010
                           0.0007   0.0016   0.0013   0.0014   0.0017   0.0012

  PERCOLATION/LEAKAGE THROUGH LAYER  4
  ------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  PERCOLATION/LEAKAGE THROUGH LAYER  5
  ------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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


-------------------------------------------------------------------------------
               AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
-------------------------------------------------------------------------------


  DAILY AVERAGE HEAD ON TOP OF LAYER  2
  -------------------------------------
    AVERAGES               0.8716   0.6859   0.5532   0.4528   0.4220   0.5596
                           0.6269   1.1624   1.4557   1.4183   1.4575   1.2663

    STD. DEVIATIONS        0.5689   0.4307   0.3353   0.2906   0.2932   0.4270
```

```
                           0.2757   0.7373   0.6218   0.6462   0.8259   0.5244

  DAILY AVERAGE HEAD ON TOP OF LAYER  4
  -------------------------------------
    AVERAGES               0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

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


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

     AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH    5
-------------------------------------------------------------------------------
                                     INCHES          CU. FEET      PERCENT
                               -------------------  -------------  ---------
 PRECIPITATION                   9.66    (   0.710)     339507.2     100.00

 RUNOFF                          0.000   (  0.0000)         0.00      0.000

 EVAPOTRANSPIRATION              7.997   (  1.2071)    280997.03     82.766

 LATERAL DRAINAGE COLLECTED      1.50992 (  0.36157)     53056.340   15.62745
   FROM LAYER  1

 PERCOLATION/LEAKAGE THROUGH     0.02649 (  0.00599)       930.739    0.27414
   LAYER  2

 AVERAGE HEAD ON TOP             0.911 (    0.217)
   OF LAYER  2

 PERCOLATION/LEAKAGE THROUGH     0.00000 (  0.00000)         0.000    0.00000
   LAYER  4

 AVERAGE HEAD ON TOP             0.000 (    0.000)
   OF LAYER  4

 PERCOLATION/LEAKAGE THROUGH     0.00000 (  0.00000)         0.000    0.00000
   LAYER  5

 CHANGE IN WATER STORAGE         0.155   (  0.5437)      5453.93      1.606
*******************************************************************************
```

```
******************************************************************************

                PEAK DAILY VALUES FOR YEARS    1 THROUGH    5
   ------------------------------------------------------------------------
                                                (INCHES)      (CU. FT.)
                                               ----------   -------------
      PRECIPITATION                              1.17         41111.926

      RUNOFF                                     0.000            0.0000

      DRAINAGE COLLECTED FROM LAYER  1           0.01424        500.24167

      PERCOLATION/LEAKAGE THROUGH LAYER  2       0.000230         8.06791

      AVERAGE HEAD ON TOP OF LAYER  2            3.140

      MAXIMUM HEAD ON TOP OF LAYER  2            5.216

      LOCATION OF MAXIMUM HEAD IN LAYER  1
            (DISTANCE FROM DRAIN)               42.3 FEET

      PERCOLATION/LEAKAGE THROUGH LAYER  4       0.000000         0.00000

      AVERAGE HEAD ON TOP OF LAYER  4            0.000

      PERCOLATION/LEAKAGE THROUGH LAYER  5       0.000000         0.00000

      SNOW WATER                                 0.61         21502.0840


      MAXIMUM VEG. SOIL WATER (VOL/VOL)                  0.1530

      MINIMUM VEG. SOIL WATER (VOL/VOL)                  0.0180


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

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

******************************************************************************
```

```
*******************************************************************************

                   FINAL WATER STORAGE AT END OF YEAR    5
    -----------------------------------------------------------------------
                    LAYER        (INCHES)       (VOL/VOL)
                    -----        --------       ---------
                      1            1.2436         0.0518

                      2            0.0000         0.0000

                      3            7.1644         0.2985

                      4            0.0000         0.0000

                      5            9.1200         0.3800

                  SNOW WATER       0.000

*******************************************************************************
*******************************************************************************
```

Exhibit D

SCENARIO 4 HELP MODEL RESULTS

```
******************************************************************************
 ******************************************************************************
 **                                                                          **
 **                                                                          **
 **              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
 **                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
 **                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
 **                    USAE WATERWAYS EXPERIMENT STATION                     **
 **             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
 **                                                                          **
 **             Recompiled for Windows (32/64-bit) (09 Aug 2012)             **
 **        Institute of Soil Science, University of Hamburg, Germany         **
 **                                                                          **
 **                                                                          **
 ******************************************************************************
 ******************************************************************************



 PRECIPITATION  DATA  FILE:      N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRprecl.d4
 TEMPERATURE  DATA  FILE:        N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRtempl.d7
 SOLAR  RADIATION  DATA  FILE:   N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRsoll.d13
 EVAPOTRANSPIRATION  DATA:      N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRevapl.d11
 SOIL  AND  DESIGN  DATA  FILE:   N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRALLIEH.D10
 OUTPUT  DATA  FILE:             N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRALLIEH.OUT


 TIME:  11: 5     DATE:  10/14/2019



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

      TITLE:  Alternate Liner

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



      NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.



                                   LAYER  1
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   9
            THICKNESS                   =     24.00   INCHES
            POROSITY                    =      0.5010 VOL/VOL
            FIELD CAPACITY              =      0.2840 VOL/VOL
            WILTING POINT               =      0.1350 VOL/VOL
            INITIAL SOIL WATER CONTENT  =      0.1720 VOL/VOL
            EFFECTIVE SAT. HYD. COND.   =  0.190000006114E-03 CM/SEC
```

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

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.20   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0060 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET



                        LAYER  3
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996490E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD



                        LAYER  4
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.20   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0060 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET



                        LAYER  5
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996490E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

```
                              LAYER  6
                              --------

                    TYPE 3 - BARRIER SOIL LINER
                    MATERIAL TEXTURE NUMBER  17
      THICKNESS                  =      0.24   INCHES
      POROSITY                   =      0.7500 VOL/VOL
      FIELD CAPACITY             =      0.7470 VOL/VOL
      WILTING POINT              =      0.4000 VOL/VOL
      INITIAL SOIL WATER CONTENT =      0.7500 VOL/VOL
      EFFECTIVE SAT. HYD. COND.  =  0.300000002618E-08 CM/SEC




              GENERAL DESIGN AND EVAPORATIVE ZONE DATA
              ----------------------------------------

    NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
             SOIL DATA BASE USING SOIL TEXTURE # 9 WITH BARE
             GROUND CONDITIONS, A SURFACE SLOPE OF  2.% AND
             A SLOPE LENGTH OF  250. FEET.

   SCS RUNOFF CURVE NUMBER             =     91.80
   FRACTION OF AREA ALLOWING RUNOFF    =      0.0    PERCENT
   AREA PROJECTED ON HORIZONTAL PLANE  =      9.680  ACRES
   EVAPORATIVE ZONE DEPTH              =     14.0    INCHES
   INITIAL WATER IN EVAPORATIVE ZONE   =      2.408  INCHES
   UPPER LIMIT OF EVAPORATIVE STORAGE  =      7.014  INCHES
   LOWER LIMIT OF EVAPORATIVE STORAGE  =      1.890  INCHES
   INITIAL SNOW WATER                  =      0.000  INCHES
   INITIAL WATER IN LAYER MATERIALS    =      4.310  INCHES
   TOTAL INITIAL WATER                 =      4.310  INCHES
   TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR



               EVAPOTRANSPIRATION AND WEATHER DATA
               -----------------------------------

    NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
             ROSWELL             NEW MEXICO

        STATION LATITUDE                       =  33.24 DEGREES
        MAXIMUM LEAF AREA INDEX                =   0.00
        START OF GROWING SEASON (JULIAN DATE)  =     76
        END OF GROWING SEASON (JULIAN DATE)    =    310
        EVAPORATIVE ZONE DEPTH                 =  14.0  INCHES
        AVERAGE ANNUAL WIND SPEED              =   8.70 MPH
        AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  49.00 %
        AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  40.00 %
        AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  53.00 %
        AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  52.00 %



    NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    ROSWELL             NEW MEXICO

             NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
  0.24        0.28        0.27        0.37        0.77        0.91
  1.38        2.17        1.72        0.99        0.33        0.27
```

```
         NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    ROSWELL             NEW MEXICO

             NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

     JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
     -------     -------     -------     -------     -------     -------
      41.40       45.90       52.80       61.90       70.30       79.00
      81.40       79.20       72.30       61.70       49.10       42.50


         NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    ROSWELL             NEW MEXICO
                    AND STATION LATITUDE  =  33.24 DEGREES



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

                          ANNUAL TOTALS FOR YEAR    1
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            8.70         305704.125    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       8.136        285874.031     93.51

  DRAINAGE COLLECTED FROM LAYER  2         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  3           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  3             0.0000

  DRAINAGE COLLECTED FROM LAYER  4         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  6           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  5             0.0000

  CHANGE IN WATER STORAGE                  0.564         19830.025      6.49

  SOIL WATER AT START OF YEAR              4.312        151501.531

  SOIL WATER AT END OF YEAR                4.876        171331.547

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            0.067      0.00

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



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

                          ANNUAL TOTALS FOR YEAR    2
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.35         363682.500    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       9.712        341256.750     93.83
```

```
  DRAINAGE COLLECTED FROM LAYER  2         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  3           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  3             0.0000

  DRAINAGE COLLECTED FROM LAYER  4         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  6           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  5             0.0000

  CHANGE IN WATER STORAGE                  0.638         22425.705      6.17

  SOIL WATER AT START OF YEAR              4.876        171331.547

  SOIL WATER AT END OF YEAR                5.514        193757.266

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            0.050      0.00

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



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

                          ANNUAL TOTALS FOR YEAR    3
--------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.33         362979.656    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                      10.923        383824.406    105.74

  DRAINAGE COLLECTED FROM LAYER  2         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  3           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  3             0.0000

  DRAINAGE COLLECTED FROM LAYER  4         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  6           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  5             0.0000

  CHANGE IN WATER STORAGE                 -0.593        -20844.727     -5.74

  SOIL WATER AT START OF YEAR              5.514        193757.266

  SOIL WATER AT END OF YEAR                4.921        172912.531

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000           -0.034      0.00

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                          ANNUAL TOTALS FOR YEAR    4
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            9.25         325030.312    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       8.498        298602.031     91.87

  DRAINAGE COLLECTED FROM LAYER  2         0.0000            0.005      0.00

  PERC./LEAKAGE THROUGH LAYER  3           0.000003          0.089      0.00

  AVG. HEAD ON TOP OF LAYER  3             0.0000

  DRAINAGE COLLECTED FROM LAYER  4         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  6           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  5             0.0000

  CHANGE IN WATER STORAGE                  0.752         26428.078      8.13

  SOIL WATER AT START OF YEAR              4.921        172912.531

  SOIL WATER AT END OF YEAR                5.673        199340.609

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            0.180      0.00

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


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

                          ANNUAL TOTALS FOR YEAR    5
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            9.68         340139.719    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       9.097        319666.469     93.98

  DRAINAGE COLLECTED FROM LAYER  2         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  3           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  3             0.0000

  DRAINAGE COLLECTED FROM LAYER  4         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  6           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  5             0.0000

  CHANGE IN WATER STORAGE                  0.583         20473.211      6.02

  SOIL WATER AT START OF YEAR              5.673        199340.609

  SOIL WATER AT END OF YEAR                6.256        219813.828
```

```
  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            0.050      0.00

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




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

         AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH    5
-------------------------------------------------------------------------------

                         JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                         -------  -------  -------  -------  -------  -------
  PRECIPITATION
  -------------
    TOTALS                 0.18     0.17     0.29     0.26     0.78     0.63
                           1.66     1.91     1.64     0.79     0.84     0.49

    STD. DEVIATIONS        0.19     0.04     0.26     0.21     0.74     0.77
                           0.78     1.32     1.04     0.91     1.02     0.34

  RUNOFF
  ------
    TOTALS                 0.000    0.000    0.000    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

    STD. DEVIATIONS        0.000    0.000    0.000    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

  EVAPOTRANSPIRATION
  ------------------
    TOTALS                 0.328    0.226    0.222    0.165    0.676    0.780
                           0.972    1.922    1.666    0.990    0.671    0.656

    STD. DEVIATIONS        0.086    0.045    0.140    0.065    0.679    0.792
                           0.874    1.372    0.944    0.561    0.492    0.338

  LATERAL DRAINAGE COLLECTED FROM LAYER  2
  ----------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  PERCOLATION/LEAKAGE THROUGH LAYER  3
  ------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  LATERAL DRAINAGE COLLECTED FROM LAYER  4
  ----------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  PERCOLATION/LEAKAGE THROUGH LAYER  6
  ------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
```

```
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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


-------------------------------------------------------------------------------
               AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
-------------------------------------------------------------------------------


  DAILY AVERAGE HEAD ON TOP OF LAYER  3
  -------------------------------------
    AVERAGES               0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  DAILY AVERAGE HEAD ON TOP OF LAYER  5
  -------------------------------------
    AVERAGES               0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

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



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

     AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH    5
-------------------------------------------------------------------------------
                                     INCHES           CU. FEET      PERCENT
                               -------------------   -------------   ---------
 PRECIPITATION                   9.66    (   0.710)     339507.2     100.00

 RUNOFF                          0.000   (  0.0000)          0.00      0.000

 EVAPOTRANSPIRATION              9.273   (  1.1001)     325844.72     95.976

 LATERAL DRAINAGE COLLECTED      0.00000 (  0.00000)         0.001    0.00000
   FROM LAYER  2

 PERCOLATION/LEAKAGE THROUGH     0.00000 (  0.00000)         0.018     0.00001
   LAYER  3

 AVERAGE HEAD ON TOP             0.000 (    0.000)
   OF LAYER  3

 LATERAL DRAINAGE COLLECTED      0.00000 (  0.00000)         0.000    0.00000
   FROM LAYER  4

 PERCOLATION/LEAKAGE THROUGH     0.00000 (  0.00000)         0.000     0.00000
   LAYER  6

 AVERAGE HEAD ON TOP             0.000 (    0.000)
   OF LAYER  5

 CHANGE IN WATER STORAGE         0.389   (  0.5538)      13662.46      4.024
*******************************************************************************
```

```
******************************************************************************

               PEAK DAILY VALUES FOR YEARS    1 THROUGH    5
   ------------------------------------------------------------------------
                                               (INCHES)      (CU. FT.)
                                              ----------   -------------
      PRECIPITATION                             1.17        41111.926

      RUNOFF                                    0.000           0.0000

      DRAINAGE COLLECTED FROM LAYER  2          0.00000         0.00504

      PERCOLATION/LEAKAGE THROUGH LAYER  3      0.000003        0.08874

      AVERAGE HEAD ON TOP OF LAYER  3           0.000

      MAXIMUM HEAD ON TOP OF LAYER  3           0.000

      LOCATION OF MAXIMUM HEAD IN LAYER  2
            (DISTANCE FROM DRAIN)               0.0 FEET

      DRAINAGE COLLECTED FROM LAYER  4          0.00000         0.00000

      PERCOLATION/LEAKAGE THROUGH LAYER  6      0.000000        0.00000

      AVERAGE HEAD ON TOP OF LAYER  5           0.000

      MAXIMUM HEAD ON TOP OF LAYER  5           0.000

      LOCATION OF MAXIMUM HEAD IN LAYER  4
            (DISTANCE FROM DRAIN)               0.0 FEET

      SNOW WATER                                0.61        21502.0840


      MAXIMUM VEG. SOIL WATER (VOL/VOL)                 0.3427

      MINIMUM VEG. SOIL WATER (VOL/VOL)                 0.1350


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

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

******************************************************************************
```

```
******************************************************************************

                   FINAL WATER STORAGE AT END OF YEAR    5
    ----------------------------------------------------------------------
                    LAYER        (INCHES)       (VOL/VOL)
                    -----        --------       ---------
                      1            6.0713         0.2530

                      2            0.0020         0.0100

                      3            0.0000         0.0000

                      4            0.0012         0.0060

                      5            0.0000         0.0000

                      6            0.1800         0.7500

                  SNOW WATER       0.000

******************************************************************************
******************************************************************************
```

Exhibit E

SCENARIO 5 HELP MODEL RESULTS

```
******************************************************************************
 ******************************************************************************
 **                                                                          **
 **                                                                          **
 **              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
 **                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
 **                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
 **                    USAE WATERWAYS EXPERIMENT STATION                     **
 **              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
 **                                                                          **
 **              Recompiled for Windows (32/64-bit) (09 Aug 2012)            **
 **         Institute of Soil Science, University of Hamburg, Germany        **
 **                                                                          **
 **                                                                          **
 ******************************************************************************
 ******************************************************************************



 PRECIPITATION  DATA  FILE:      N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRprecl.d4
 TEMPERATURE  DATA  FILE:        N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRtempl.d7
 SOLAR  RADIATION  DATA  FILE:   N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRsoll.d13
 EVAPOTRANSPIRATION  DATA:      N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRevapl.d11
 SOIL  AND  DESIGN  DATA  FILE:  N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\Exhibits\ExE - AltLin - Open\SRALLIEH.D10
 OUTPUT  DATA  FILE:             N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\Exhibits\ExE - AltLin - Open\Summary Output.out


 TIME:  11:14     DATE:  10/14/2019



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

      TITLE:  Alternate Liner

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



      NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.



                                  LAYER  1
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   9
            THICKNESS                   =     24.00   INCHES
            POROSITY                    =      0.5010 VOL/VOL
            FIELD CAPACITY              =      0.2840 VOL/VOL
            WILTING POINT               =      0.1350 VOL/VOL
            INITIAL SOIL WATER CONTENT  =      0.1720 VOL/VOL
            EFFECTIVE SAT. HYD. COND.   =  0.190000006114E-03 CM/SEC
```

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

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.20   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0060 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET



                        LAYER  3
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996490E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD



                        LAYER  4
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.20   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0060 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET



                        LAYER  5
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996490E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD
```

```
                              LAYER  6
                              --------

                    TYPE 3 - BARRIER SOIL LINER
                    MATERIAL TEXTURE NUMBER  17
      THICKNESS                  =      0.24   INCHES
      POROSITY                   =      0.7500 VOL/VOL
      FIELD CAPACITY             =      0.7470 VOL/VOL
      WILTING POINT              =      0.4000 VOL/VOL
      INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
      EFFECTIVE SAT. HYD. COND.   =  0.300000002618E-08 CM/SEC




              GENERAL DESIGN AND EVAPORATIVE ZONE DATA
              ----------------------------------------

    NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
             SOIL DATA BASE USING SOIL TEXTURE # 9 WITH BARE
             GROUND CONDITIONS, A SURFACE SLOPE OF  2.% AND
             A SLOPE LENGTH OF  250. FEET.

   SCS RUNOFF CURVE NUMBER             =     91.80
   FRACTION OF AREA ALLOWING RUNOFF    =      0.0    PERCENT
   AREA PROJECTED ON HORIZONTAL PLANE  =    112.000  ACRES
   EVAPORATIVE ZONE DEPTH              =     14.0    INCHES
   INITIAL WATER IN EVAPORATIVE ZONE   =      2.408  INCHES
   UPPER LIMIT OF EVAPORATIVE STORAGE  =      7.014  INCHES
   LOWER LIMIT OF EVAPORATIVE STORAGE  =      1.890  INCHES
   INITIAL SNOW WATER                  =      0.000  INCHES
   INITIAL WATER IN LAYER MATERIALS    =      4.310  INCHES
   TOTAL INITIAL WATER                 =      4.310  INCHES
   TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR




               EVAPOTRANSPIRATION AND WEATHER DATA
               -----------------------------------

    NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
             ROSWELL             NEW MEXICO

        STATION LATITUDE                       =  33.24 DEGREES
        MAXIMUM LEAF AREA INDEX                =   0.00
        START OF GROWING SEASON (JULIAN DATE)  =     76
        END OF GROWING SEASON (JULIAN DATE)    =    310
        EVAPORATIVE ZONE DEPTH                 =  14.0  INCHES
        AVERAGE ANNUAL WIND SPEED              =   8.70 MPH
        AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  49.00 %
        AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  40.00 %
        AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  53.00 %
        AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  52.00 %



    NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    ROSWELL             NEW MEXICO

             NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
  0.24        0.28        0.27        0.37        0.77        0.91
  1.38        2.17        1.72        0.99        0.33        0.27
```

```
         NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    ROSWELL             NEW MEXICO

             NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

     JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
     -------     -------     -------     -------     -------     -------
      41.40       45.90       52.80       61.90       70.30       79.00
      81.40       79.20       72.30       61.70       49.10       42.50


         NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    ROSWELL             NEW MEXICO
                    AND STATION LATITUDE  =  33.24 DEGREES


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

                          ANNUAL TOTALS FOR YEAR    1
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            8.70        3537072.250    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       8.136       3307633.250     93.51

  DRAINAGE COLLECTED FROM LAYER  2         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  3           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  3             0.0000

  DRAINAGE COLLECTED FROM LAYER  4         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  6           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  5             0.0000

  CHANGE IN WATER STORAGE                  0.564        229438.312      6.49

  SOIL WATER AT START OF YEAR              4.312       1752910.375

  SOIL WATER AT END OF YEAR                4.876       1982348.500

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            0.775      0.00

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


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

                          ANNUAL TOTALS FOR YEAR    2
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.35        4207896.500    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       9.712       3948425.000     93.83
```

```
  DRAINAGE COLLECTED FROM LAYER  2          0.0000            0.000      0.00
  PERC./LEAKAGE THROUGH LAYER  3            0.000000          0.000      0.00
  AVG. HEAD ON TOP OF LAYER  3              0.0000
  DRAINAGE COLLECTED FROM LAYER  4          0.0000            0.000      0.00
  PERC./LEAKAGE THROUGH LAYER  6            0.000000          0.000      0.00
  AVG. HEAD ON TOP OF LAYER  5              0.0000
  CHANGE IN WATER STORAGE                   0.638        259470.984      6.17
  SOIL WATER AT START OF YEAR               4.876       1982348.500
  SOIL WATER AT END OF YEAR                 5.514       2241819.500
  SNOW WATER AT START OF YEAR               0.000             0.000      0.00
  SNOW WATER AT END OF YEAR                 0.000             0.000      0.00
  ANNUAL WATER BUDGET BALANCE               0.0000            0.582      0.00
********************************************************************************


********************************************************************************
                          ANNUAL TOTALS FOR YEAR    3
--------------------------------------------------------------------------------
                                          INCHES          CU. FEET     PERCENT
                                         --------        ----------    -------
  PRECIPITATION                            10.33        4199764.500    100.00
  RUNOFF                                    0.000             0.000      0.00
  EVAPOTRANSPIRATION                       10.923       4440943.500    105.74
  DRAINAGE COLLECTED FROM LAYER  2          0.0000            0.000      0.00
  PERC./LEAKAGE THROUGH LAYER  3            0.000000          0.000      0.00
  AVG. HEAD ON TOP OF LAYER  3              0.0000
  DRAINAGE COLLECTED FROM LAYER  4          0.0000            0.000      0.00
  PERC./LEAKAGE THROUGH LAYER  6            0.000000          0.000      0.00
  AVG. HEAD ON TOP OF LAYER  5              0.0000
  CHANGE IN WATER STORAGE                  -0.593       -241178.641     -5.74
  SOIL WATER AT START OF YEAR               5.514       2241819.500
  SOIL WATER AT END OF YEAR                 4.921       2000640.875
  SNOW WATER AT START OF YEAR               0.000             0.000      0.00
  SNOW WATER AT END OF YEAR                 0.000             0.000      0.00
  ANNUAL WATER BUDGET BALANCE               0.0000           -0.388      0.00
********************************************************************************
```

```
*******************************************************************************

                          ANNUAL TOTALS FOR YEAR    4
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            9.25        3760681.000    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       8.498       3454899.750     91.87

  DRAINAGE COLLECTED FROM LAYER  2         0.0000            0.058      0.00

  PERC./LEAKAGE THROUGH LAYER  3           0.000003          1.027      0.00

  AVG. HEAD ON TOP OF LAYER  3             0.0000

  DRAINAGE COLLECTED FROM LAYER  4         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  6           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  5             0.0000

  CHANGE IN WATER STORAGE                  0.752        305779.406      8.13

  SOIL WATER AT START OF YEAR              4.921       2000640.875

  SOIL WATER AT END OF YEAR                5.673       2306420.250

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            2.084      0.00

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


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

                          ANNUAL TOTALS FOR YEAR    5
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            9.68        3935501.000    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       9.097       3698620.250     93.98

  DRAINAGE COLLECTED FROM LAYER  2         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  3           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  3             0.0000

  DRAINAGE COLLECTED FROM LAYER  4         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  6           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  5             0.0000

  CHANGE IN WATER STORAGE                  0.583        236880.125      6.02

  SOIL WATER AT START OF YEAR              5.673       2306420.250

  SOIL WATER AT END OF YEAR                6.256       2543300.250
```

```
  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            0.582      0.00

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




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

         AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH    5
--------------------------------------------------------------------------------

                         JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                         -------  -------  -------  -------  -------  -------
  PRECIPITATION
  -------------
    TOTALS                 0.18     0.17     0.29     0.26     0.78     0.63
                           1.66     1.91     1.64     0.79     0.84     0.49

    STD. DEVIATIONS        0.19     0.04     0.26     0.21     0.74     0.77
                           0.78     1.32     1.04     0.91     1.02     0.34

  RUNOFF
  ------
    TOTALS                 0.000    0.000    0.000    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

    STD. DEVIATIONS        0.000    0.000    0.000    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

  EVAPOTRANSPIRATION
  ------------------
    TOTALS                 0.328    0.226    0.222    0.165    0.676    0.780
                           0.972    1.922    1.666    0.990    0.671    0.656

    STD. DEVIATIONS        0.086    0.045    0.140    0.065    0.679    0.792
                           0.874    1.372    0.944    0.561    0.492    0.338

  LATERAL DRAINAGE COLLECTED FROM LAYER  2
  ----------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  PERCOLATION/LEAKAGE THROUGH LAYER  3
  ------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  LATERAL DRAINAGE COLLECTED FROM LAYER  4
  ----------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  PERCOLATION/LEAKAGE THROUGH LAYER  6
  ------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
```

```
                          0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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


-------------------------------------------------------------------------------
               AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
-------------------------------------------------------------------------------


  DAILY AVERAGE HEAD ON TOP OF LAYER  3
  -------------------------------------
    AVERAGES              0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                          0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  DAILY AVERAGE HEAD ON TOP OF LAYER  5
  -------------------------------------
    AVERAGES              0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                          0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

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



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

     AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH    5
-------------------------------------------------------------------------------
                                     INCHES           CU. FEET      PERCENT
                               -------------------   -------------   ---------
 PRECIPITATION                   9.66    (   0.710)    3928183.0     100.00

 RUNOFF                          0.000   (  0.0000)         0.00      0.000

 EVAPOTRANSPIRATION              9.273   (  1.1001)    3770104.00     95.976

 LATERAL DRAINAGE COLLECTED      0.00000 (  0.00000)        0.012    0.00000
   FROM LAYER  2

 PERCOLATION/LEAKAGE THROUGH     0.00000 (  0.00000)        0.205     0.00001
   LAYER  3

 AVERAGE HEAD ON TOP             0.000 (    0.000)
   OF LAYER  3

 LATERAL DRAINAGE COLLECTED      0.00000 (  0.00000)        0.000    0.00000
   FROM LAYER  4

 PERCOLATION/LEAKAGE THROUGH     0.00000 (  0.00000)        0.000     0.00000
   LAYER  6

 AVERAGE HEAD ON TOP             0.000 (    0.000)
   OF LAYER  5

 CHANGE IN WATER STORAGE         0.389   (  0.5538)     158078.03      4.024

*******************************************************************************
```

```
******************************************************************************

               PEAK DAILY VALUES FOR YEARS    1 THROUGH    5
   ------------------------------------------------------------------------
                                              (INCHES)      (CU. FT.)
                                             ----------   -------------
       PRECIPITATION                           1.17        475675.156

       RUNOFF                                  0.000            0.0000

       DRAINAGE COLLECTED FROM LAYER  2        0.00000          0.05826

       PERCOLATION/LEAKAGE THROUGH LAYER  3    0.000003         1.02676

       AVERAGE HEAD ON TOP OF LAYER  3         0.000

       MAXIMUM HEAD ON TOP OF LAYER  3         0.000

       LOCATION OF MAXIMUM HEAD IN LAYER  2
             (DISTANCE FROM DRAIN)             0.0 FEET

       DRAINAGE COLLECTED FROM LAYER  4        0.00000          0.00000

       PERCOLATION/LEAKAGE THROUGH LAYER  6    0.000000         0.00000

       AVERAGE HEAD ON TOP OF LAYER  5         0.000

       MAXIMUM HEAD ON TOP OF LAYER  5         0.000

       LOCATION OF MAXIMUM HEAD IN LAYER  4
             (DISTANCE FROM DRAIN)             0.0 FEET

       SNOW WATER                              0.61        248784.4219


       MAXIMUM VEG. SOIL WATER (VOL/VOL)               0.3427

       MINIMUM VEG. SOIL WATER (VOL/VOL)               0.1350


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

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


******************************************************************************
```

```
******************************************************************************

                  FINAL WATER STORAGE AT END OF YEAR    5
    ----------------------------------------------------------------------
                   LAYER        (INCHES)       (VOL/VOL)
                   -----        --------       ---------
                     1            6.0713         0.2530

                     2            0.0020         0.0100

                     3            0.0000         0.0000

                     4            0.0012         0.0060

                     5            0.0000         0.0000

                     6            0.1800         0.7500

                  SNOW WATER      0.000

******************************************************************************
******************************************************************************
```

Exhibit F

SCENARIO 6 HELP MODEL RESULTS

```
******************************************************************************
 ******************************************************************************
 **                                                                          **
 **                                                                          **
 **              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
 **                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
 **                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
 **                    USAE WATERWAYS EXPERIMENT STATION                     **
 **              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
 **                                                                          **
 **              Recompiled for Windows (32/64-bit) (09 Aug 2012)            **
 **         Institute of Soil Science, University of Hamburg, Germany        **
 **                                                                          **
 **                                                                          **
 ******************************************************************************
 ******************************************************************************



 PRECIPITATION DATA FILE:      N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRprecco.d4
 TEMPERATURE DATA FILE:        N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRtempco.d7
 SOLAR RADIATION DATA FILE:   N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRsolcov.d13
 EVAPOTRANSPIRATION DATA:      N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRevapco.d11
 SOIL AND DESIGN DATA FILE:   N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\Exhibits\ExF - AltLin - 20' Filled\SRALLIEH.D10
 OUTPUT DATA FILE:             N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\Exhibits\ExF - AltLin - 20' Filled\Summary Output.out


 TIME:   9:44     DATE:  10/15/2019



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

      TITLE:  Alternate Liner

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



      NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.



                                    LAYER  1
                                    --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER  18
            THICKNESS                   =    240.00   INCHES
            POROSITY                    =      0.6710 VOL/VOL
            FIELD CAPACITY              =      0.2920 VOL/VOL
            WILTING POINT               =      0.0770 VOL/VOL
            INITIAL SOIL WATER CONTENT  =      0.2000 VOL/VOL
            EFFECTIVE SAT. HYD. COND.   =  0.100000004750E-02 CM/SEC
          NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  2.01
                   FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

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

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   9
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.5010 VOL/VOL
FIELD CAPACITY              =      0.2840 VOL/VOL
WILTING POINT               =      0.1350 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2530 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.190000006114E-03 CM/SEC



                        LAYER  3
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.20   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET



                        LAYER  4
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996490E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD



                        LAYER  5
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.20   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0060 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET
```

```
                           LAYER  6
                           --------

               TYPE 4 - FLEXIBLE MEMBRANE LINER
                 MATERIAL TEXTURE NUMBER  35
   THICKNESS                   =      0.06   INCHES
   POROSITY                    =      0.0000 VOL/VOL
   FIELD CAPACITY              =      0.0000 VOL/VOL
   WILTING POINT               =      0.0000 VOL/VOL
   INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
   EFFECTIVE SAT. HYD. COND.   =  0.199999996490E-12 CM/SEC
   FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
   FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
   FML PLACEMENT QUALITY       =  3 - GOOD



                           LAYER  7
                           --------

                 TYPE 3 - BARRIER SOIL LINER
                 MATERIAL TEXTURE NUMBER  17
   THICKNESS                   =      0.24   INCHES
   POROSITY                    =      0.7500 VOL/VOL
   FIELD CAPACITY              =      0.7470 VOL/VOL
   WILTING POINT               =      0.4000 VOL/VOL
   INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
   EFFECTIVE SAT. HYD. COND.   =  0.300000002618E-08 CM/SEC




           GENERAL DESIGN AND EVAPORATIVE ZONE DATA
           ----------------------------------------

 NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
          SOIL DATA BASE USING SOIL TEXTURE #18 WITH BARE
          GROUND CONDITIONS, A SURFACE SLOPE OF  4.% AND
          A SLOPE LENGTH OF  350. FEET.

SCS RUNOFF CURVE NUMBER             =     80.06
FRACTION OF AREA ALLOWING RUNOFF    =      0.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =    112.000  ACRES
EVAPORATIVE ZONE DEPTH              =     24.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =      4.800  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =     16.104  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =      1.848  INCHES
INITIAL SNOW WATER                  =      0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =     54.255  INCHES
TOTAL INITIAL WATER                 =     54.255  INCHES
TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR



            EVAPOTRANSPIRATION AND WEATHER DATA
            -----------------------------------

 NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
          ROSWELL             NEW MEXICO

     STATION LATITUDE                       =  33.24 DEGREES
     MAXIMUM LEAF AREA INDEX                =   1.20
     START OF GROWING SEASON (JULIAN DATE)  =     76
     END OF GROWING SEASON (JULIAN DATE)    =    310
     EVAPORATIVE ZONE DEPTH                 =  24.0  INCHES
     AVERAGE ANNUAL WIND SPEED              =   8.70 MPH
     AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  49.00 %
     AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  40.00 %
```

```
             AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  53.00 %
             AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  52.00 %


         NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    ROSWELL             NEW MEXICO

                  NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

     JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
     -------     -------     -------     -------     -------     -------
       0.24        0.28        0.27        0.37        0.77        0.91
       1.38        2.17        1.72        0.99        0.33        0.27


         NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    ROSWELL             NEW MEXICO

             NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

     JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
     -------     -------     -------     -------     -------     -------
      41.40       45.90       52.80       61.90       70.30       79.00
      81.40       79.20       72.30       61.70       49.10       42.50


         NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    ROSWELL             NEW MEXICO
                    AND STATION LATITUDE  =  33.24 DEGREES


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

                          ANNUAL TOTALS FOR YEAR    1
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            8.70         3537072.250   100.00

  RUNOFF                                   0.000              0.000     0.00

  EVAPOTRANSPIRATION                      11.581        4708398.000   133.12

  DRAINAGE COLLECTED FROM LAYER  3         0.0000             0.000     0.00

  PERC./LEAKAGE THROUGH LAYER  4           0.000000           0.000     0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  DRAINAGE COLLECTED FROM LAYER  5         0.0000             0.000     0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000           0.000     0.00

  AVG. HEAD ON TOP OF LAYER  6             0.0000

  CHANGE IN WATER STORAGE                 -2.881       -1171324.375   -33.12

  SOIL WATER AT START OF YEAR             54.257       22058790.000

  SOIL WATER AT END OF YEAR               51.376       20887466.000

  SNOW WATER AT START OF YEAR              0.000              0.000     0.00

  SNOW WATER AT END OF YEAR                0.000              0.000     0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            -1.163     0.00
```

```
*******************************************************************************



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                          ANNUAL TOTALS FOR YEAR    2
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.35        4207896.500    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                      10.179       4138192.750     98.34

  DRAINAGE COLLECTED FROM LAYER  3         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  DRAINAGE COLLECTED FROM LAYER  5         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  6             0.0000

  CHANGE IN WATER STORAGE                  0.171         69702.250      1.66

  SOIL WATER AT START OF YEAR             51.376      20887466.000

  SOIL WATER AT END OF YEAR               51.548      20957166.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            1.551      0.00

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



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

                          ANNUAL TOTALS FOR YEAR    3
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.33        4199764.500    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                      10.441       4244980.500    101.08

  DRAINAGE COLLECTED FROM LAYER  3         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  DRAINAGE COLLECTED FROM LAYER  5         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  6             0.0000
```

```
  CHANGE IN WATER STORAGE                 -0.111        -45215.035     -1.08

  SOIL WATER AT START OF YEAR             51.548      20957166.000

  SOIL WATER AT END OF YEAR               51.436      20911952.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000           -1.163      0.00

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



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

                          ANNUAL TOTALS FOR YEAR    4
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            9.25        3760681.000    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       8.965       3644957.000     96.92

  DRAINAGE COLLECTED FROM LAYER  3         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  DRAINAGE COLLECTED FROM LAYER  5         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  6             0.0000

  CHANGE IN WATER STORAGE                  0.285        115722.195      3.08

  SOIL WATER AT START OF YEAR             51.436      20911952.000

  SOIL WATER AT END OF YEAR               51.721      21027676.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            1.939      0.00

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



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

                          ANNUAL TOTALS FOR YEAR    5
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            9.68        3935501.000    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                      10.004       4067200.000    103.35

  DRAINAGE COLLECTED FROM LAYER  3         0.0000            0.000      0.00
```

```
  PERC./LEAKAGE THROUGH LAYER  4           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  4             0.0000

  DRAINAGE COLLECTED FROM LAYER  5         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  6             0.0000

  CHANGE IN WATER STORAGE                 -0.324       -131698.047     -3.35

  SOIL WATER AT START OF YEAR             51.721      21027676.000

  SOIL WATER AT END OF YEAR               51.397      20895976.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000           -1.163      0.00

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




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         AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH    5
-------------------------------------------------------------------------------

                         JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                         -------  -------  -------  -------  -------  -------
  PRECIPITATION
  -------------
    TOTALS                 0.18     0.17     0.29     0.26     0.78     0.63
                           1.66     1.91     1.64     0.79     0.84     0.49

    STD. DEVIATIONS        0.19     0.04     0.26     0.21     0.74     0.77
                           0.78     1.32     1.04     0.91     1.02     0.34

  RUNOFF
  ------
    TOTALS                 0.000    0.000    0.000    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

    STD. DEVIATIONS        0.000    0.000    0.000    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

  EVAPOTRANSPIRATION
  ------------------
    TOTALS                 0.349    0.201    0.333    0.202    1.091    0.734
                           1.628    1.984    1.485    0.713    0.893    0.620

    STD. DEVIATIONS        0.177    0.104    0.214    0.139    0.542    0.748
                           0.873    1.347    1.039    0.669    0.493    0.435

  LATERAL DRAINAGE COLLECTED FROM LAYER  3
  ----------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  PERCOLATION/LEAKAGE THROUGH LAYER  4
  ------------------------------------
```

```
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  LATERAL DRAINAGE COLLECTED FROM LAYER  5
  ----------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  PERCOLATION/LEAKAGE THROUGH LAYER  7
  ------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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


-------------------------------------------------------------------------------
               AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
-------------------------------------------------------------------------------


  DAILY AVERAGE HEAD ON TOP OF LAYER  4
  -------------------------------------
    AVERAGES               0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  DAILY AVERAGE HEAD ON TOP OF LAYER  6
  -------------------------------------
    AVERAGES               0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

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


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

     AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS     1 THROUGH    5
-------------------------------------------------------------------------------
                                     INCHES            CU. FEET       PERCENT
                               -------------------    -------------   ---------
 PRECIPITATION                   9.66    (   0.710)    3928183.0     100.00

 RUNOFF                          0.000   (  0.0000)          0.00      0.000

 EVAPOTRANSPIRATION             10.234   (  0.9385)    4160746.00    105.920

 LATERAL DRAINAGE COLLECTED      0.00000 (  0.00000)        0.000    0.00000
   FROM LAYER  3

 PERCOLATION/LEAKAGE THROUGH     0.00000 (  0.00000)        0.000     0.00000
   LAYER  4

 AVERAGE HEAD ON TOP             0.000 (    0.000)
   OF LAYER  4

 LATERAL DRAINAGE COLLECTED      0.00000 (  0.00000)        0.000    0.00000
   FROM LAYER  5
```

```
 PERCOLATION/LEAKAGE THROUGH     0.00000 (  0.00000)         0.000     0.00000
   LAYER  7

 AVERAGE HEAD ON TOP             0.000 (    0.000)
   OF LAYER  6

 CHANGE IN WATER STORAGE        -0.572   (  1.3126)    -232562.61     -5.920

*******************************************************************************
```

```
******************************************************************************

                PEAK DAILY VALUES FOR YEARS    1 THROUGH    5
   ------------------------------------------------------------------------
                                               (INCHES)      (CU. FT.)
                                               ----------   -------------
      PRECIPITATION                              1.17        475675.156

      RUNOFF                                     0.000            0.0000

      DRAINAGE COLLECTED FROM LAYER  3           0.00000          0.00000

      PERCOLATION/LEAKAGE THROUGH LAYER  4       0.000000         0.00000

      AVERAGE HEAD ON TOP OF LAYER  4            0.000

      MAXIMUM HEAD ON TOP OF LAYER  4            0.000

      LOCATION OF MAXIMUM HEAD IN LAYER  3
            (DISTANCE FROM DRAIN)                0.0 FEET

      DRAINAGE COLLECTED FROM LAYER  5           0.00000          0.00000

      PERCOLATION/LEAKAGE THROUGH LAYER  7       0.000000         0.00000

      AVERAGE HEAD ON TOP OF LAYER  6            0.000

      MAXIMUM HEAD ON TOP OF LAYER  6            0.000

      LOCATION OF MAXIMUM HEAD IN LAYER  5
            (DISTANCE FROM DRAIN)                0.0 FEET

      SNOW WATER                                 0.61        248784.4219


      MAXIMUM VEG. SOIL WATER (VOL/VOL)                  0.2000

      MINIMUM VEG. SOIL WATER (VOL/VOL)                  0.0770


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

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

******************************************************************************
```

```
******************************************************************************

                   FINAL WATER STORAGE AT END OF YEAR    5
    ----------------------------------------------------------------------
                    LAYER        (INCHES)       (VOL/VOL)
                    -----        --------       ---------
                      1          45.1398          0.1881

                      2           6.0720          0.2530

                      3           0.0020          0.0100

                      4           0.0000          0.0000

                      5           0.0012          0.0060

                      6           0.0000          0.0000

                      7           0.1800          0.7500

                  SNOW WATER      0.000

******************************************************************************
******************************************************************************
```

Exhibit G

SCENARIO 7 HELP MODEL RESULTS

```
******************************************************************************
 ******************************************************************************
 **                                                                          **
 **                                                                          **
 **              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
 **                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
 **                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
 **                    USAE WATERWAYS EXPERIMENT STATION                     **
 **              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
 **                                                                          **
 **              Recompiled for Windows (32/64-bit) (09 Aug 2012)            **
 **         Institute of Soil Science, University of Hamburg, Germany        **
 **                                                                          **
 **                                                                          **
 ******************************************************************************
 ******************************************************************************




 PRECIPITATION DATA FILE:      N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRprecco.d4
 TEMPERATURE DATA FILE:        N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRtempco.d7
 SOLAR RADIATION DATA FILE:   N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRsolcov.d13
 EVAPOTRANSPIRATION DATA:      N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\From Edward 2.0\SRevapco.d11
 SOIL AND DESIGN DATA FILE:   N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\Exhibits\ExG - AltLin - Filled Bare\SRALLIEH.D10
 OUTPUT DATA FILE:             N:\Projects\2018\35187378\Working Files\DRAFTS (Proposal-Reports-
Communications)\Beckham Permit Narrative\S.R. - Rev 092319 to JJ\VOL 2\App J - Engineering
Report\Attachment D - HELP\Exhibits\ExG - AltLin - Filled Bare\Summary Output.out


 TIME:   9:49     DATE:  10/15/2019



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

      TITLE:  Alternate Liner

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



      NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.



                                    LAYER  1
                                    --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER   7
            THICKNESS                   =     12.00   INCHES
            POROSITY                    =      0.4730 VOL/VOL
            FIELD CAPACITY              =      0.2220 VOL/VOL
            WILTING POINT               =      0.1040 VOL/VOL
            INITIAL SOIL WATER CONTENT  =      0.1340 VOL/VOL
            EFFECTIVE SAT. HYD. COND.   =  0.520000001416E-03 CM/SEC
          NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  2.01
                   FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

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

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   9
THICKNESS                    =     26.00   INCHES
POROSITY                     =      0.5010 VOL/VOL
FIELD CAPACITY               =      0.2840 VOL/VOL
WILTING POINT                =      0.1350 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.1720 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.190000006114E-03 CM/SEC




                        LAYER  3
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   9
THICKNESS                    =     12.00   INCHES
POROSITY                     =      0.5010 VOL/VOL
FIELD CAPACITY               =      0.2840 VOL/VOL
WILTING POINT                =      0.1350 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.1720 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.190000006114E-03 CM/SEC




                        LAYER  4
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  18
THICKNESS                    =   2820.00   INCHES
POROSITY                     =      0.6710 VOL/VOL
FIELD CAPACITY               =      0.2920 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.1881 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000004750E-02 CM/SEC




                        LAYER  5
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   9
THICKNESS                    =     24.00   INCHES
POROSITY                     =      0.5010 VOL/VOL
FIELD CAPACITY               =      0.2840 VOL/VOL
WILTING POINT                =      0.1350 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2530 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.190000006114E-03 CM/SEC




                        LAYER  6
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                    =      0.20   INCHES
POROSITY                     =      0.8500 VOL/VOL
```

```
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET


                        LAYER  7
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996490E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD


                        LAYER  8
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.20   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0060 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET


                        LAYER  9
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996490E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD


                        LAYER 10
                        --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.24   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
```

```
      WILTING POINT               =      0.4000 VOL/VOL
      INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
      EFFECTIVE SAT. HYD. COND.   =  0.300000002618E-08 CM/SEC




              GENERAL DESIGN AND EVAPORATIVE ZONE DATA
              ----------------------------------------

    NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
             SOIL DATA BASE USING SOIL TEXTURE # 7 WITH BARE
             GROUND CONDITIONS, A SURFACE SLOPE OF  4.% AND
             A SLOPE LENGTH OF  350. FEET.

   SCS RUNOFF CURVE NUMBER             =     88.35
   FRACTION OF AREA ALLOWING RUNOFF    =      0.0    PERCENT
   AREA PROJECTED ON HORIZONTAL PLANE  =    112.000  ACRES
   EVAPORATIVE ZONE DEPTH              =     24.0    INCHES
   INITIAL WATER IN EVAPORATIVE ZONE   =      3.672  INCHES
   UPPER LIMIT OF EVAPORATIVE STORAGE  =     11.688  INCHES
   LOWER LIMIT OF EVAPORATIVE STORAGE  =      2.868  INCHES
   INITIAL SNOW WATER                  =      0.000  INCHES
   INITIAL WATER IN LAYER MATERIALS    =    544.841  INCHES
   TOTAL INITIAL WATER                 =    544.841  INCHES
   TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR



               EVAPOTRANSPIRATION AND WEATHER DATA
               -----------------------------------

    NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
             ROSWELL             NEW MEXICO

        STATION LATITUDE                       =  33.24 DEGREES
        MAXIMUM LEAF AREA INDEX                =   1.20
        START OF GROWING SEASON (JULIAN DATE)  =     76
        END OF GROWING SEASON (JULIAN DATE)    =    310
        EVAPORATIVE ZONE DEPTH                 =  24.0  INCHES
        AVERAGE ANNUAL WIND SPEED              =   8.70 MPH
        AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  49.00 %
        AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  40.00 %
        AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  53.00 %
        AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  52.00 %


    NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    ROSWELL             NEW MEXICO

             NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
  0.24        0.28        0.27        0.37        0.77        0.91
  1.38        2.17        1.72        0.99        0.33        0.27


    NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    ROSWELL             NEW MEXICO

        NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
 41.40       45.90       52.80       61.90       70.30       79.00
 81.40       79.20       72.30       61.70       49.10       42.50
```

```
         NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    ROSWELL             NEW MEXICO
                    AND STATION LATITUDE  =  33.24 DEGREES


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

                          ANNUAL TOTALS FOR YEAR    1
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            8.70        3537072.250    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       9.478       3853473.750    108.95

  DRAINAGE COLLECTED FROM LAYER  6         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  7             0.0000

  DRAINAGE COLLECTED FROM LAYER  8         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER 10           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  9             0.0000

  CHANGE IN WATER STORAGE                 -0.778       -316359.469     -8.94

  SOIL WATER AT START OF YEAR            544.843     221511424.000

  SOIL WATER AT END OF YEAR              544.065     221195072.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE             -0.0001          -41.874      0.00

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



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

                          ANNUAL TOTALS FOR YEAR    2
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.35        4207896.500    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                      10.335       4201727.500     99.85

  DRAINAGE COLLECTED FROM LAYER  6         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  7             0.0000

  DRAINAGE COLLECTED FROM LAYER  8         0.0000            0.000      0.00
```

```
  PERC./LEAKAGE THROUGH LAYER 10           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  9             0.0000

  CHANGE IN WATER STORAGE                  0.015          6129.170      0.15

  SOIL WATER AT START OF YEAR            544.065     221195072.000

  SOIL WATER AT END OF YEAR              544.080     221201200.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0001           39.936      0.00
********************************************************************************


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

                          ANNUAL TOTALS FOR YEAR    3
--------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.33        4199764.500    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                      10.319       4195265.500     99.89

  DRAINAGE COLLECTED FROM LAYER  6         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  7             0.0000

  DRAINAGE COLLECTED FROM LAYER  8         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER 10           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  9             0.0000

  CHANGE IN WATER STORAGE                  0.011          4541.045      0.11

  SOIL WATER AT START OF YEAR            544.080     221201200.000

  SOIL WATER AT END OF YEAR              544.091     221205744.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE             -0.0001          -41.874      0.00
********************************************************************************


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

                          ANNUAL TOTALS FOR YEAR    4
--------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            9.25        3760681.000    100.00

  RUNOFF                                   0.000             0.000      0.00
```

```
  EVAPOTRANSPIRATION                       8.901       3618900.000     96.23

  DRAINAGE COLLECTED FROM LAYER  6         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  7             0.0000

  DRAINAGE COLLECTED FROM LAYER  8         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER 10           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  9             0.0000

  CHANGE IN WATER STORAGE                  0.349        141764.969      3.77

  SOIL WATER AT START OF YEAR            544.091     221205744.000

  SOIL WATER AT END OF YEAR              544.440     221347504.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000           16.284      0.00

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



*******************************************************************************
                          ANNUAL TOTALS FOR YEAR    5
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            9.68        3935501.000    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                      10.067       4092961.250    104.00

  DRAINAGE COLLECTED FROM LAYER  6         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  7             0.0000

  DRAINAGE COLLECTED FROM LAYER  8         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER 10           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  9             0.0000

  CHANGE IN WATER STORAGE                 -0.387       -157447.703     -4.00

  SOIL WATER AT START OF YEAR            544.440     221347504.000

  SOIL WATER AT END OF YEAR              544.053     221190064.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000          -12.795      0.00

*******************************************************************************
```

```
*******************************************************************************

         AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH    5
-------------------------------------------------------------------------------

                         JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                         -------  -------  -------  -------  -------  -------
  PRECIPITATION
  -------------
    TOTALS                 0.18     0.17     0.29     0.26     0.78     0.63
                           1.66     1.91     1.64     0.79     0.84     0.49

    STD. DEVIATIONS        0.19     0.04     0.26     0.21     0.74     0.77
                           0.78     1.32     1.04     0.91     1.02     0.34

  RUNOFF
  ------
    TOTALS                 0.000    0.000    0.000    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

    STD. DEVIATIONS        0.000    0.000    0.000    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

  EVAPOTRANSPIRATION
  ------------------
    TOTALS                 0.313    0.189    0.305    0.184    0.870    0.637
                           1.633    1.982    1.496    0.743    0.901    0.567

    STD. DEVIATIONS        0.166    0.092    0.253    0.115    0.642    0.819
                           0.860    1.345    1.026    0.688    0.561    0.374

  LATERAL DRAINAGE COLLECTED FROM LAYER  6
  ----------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  PERCOLATION/LEAKAGE THROUGH LAYER  7
  ------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  LATERAL DRAINAGE COLLECTED FROM LAYER  8
  ----------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  PERCOLATION/LEAKAGE THROUGH LAYER 10
  ------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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


-------------------------------------------------------------------------------
               AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
-------------------------------------------------------------------------------
```

```
  DAILY AVERAGE HEAD ON TOP OF LAYER  7
  -------------------------------------
    AVERAGES              0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                          0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  DAILY AVERAGE HEAD ON TOP OF LAYER  9
  -------------------------------------
    AVERAGES              0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                          0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

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


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

     AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH    5
-------------------------------------------------------------------------------
                                     INCHES          CU. FEET       PERCENT
                               -------------------   -------------   ---------
 PRECIPITATION                    9.66    (   0.710)    3928183.0     100.00

 RUNOFF                           0.000   (  0.0000)         0.00      0.000

 EVAPOTRANSPIRATION               9.820   (  0.6197)    3992465.25    101.636

 LATERAL DRAINAGE COLLECTED       0.00000 (  0.00000)        0.000    0.00000
   FROM LAYER  6

 PERCOLATION/LEAKAGE THROUGH      0.00000 (  0.00000)        0.000     0.00000
   LAYER  7

 AVERAGE HEAD ON TOP              0.000 (    0.000)
   OF LAYER  7

 LATERAL DRAINAGE COLLECTED       0.00000 (  0.00000)        0.000    0.00000
   FROM LAYER  8

 PERCOLATION/LEAKAGE THROUGH      0.00000 (  0.00000)        0.000     0.00000
   LAYER 10

 AVERAGE HEAD ON TOP              0.000 (    0.000)
   OF LAYER  9

 CHANGE IN WATER STORAGE         -0.158   (  0.4337)     -64274.39     -1.636

*******************************************************************************
```

```
******************************************************************************

              PEAK DAILY VALUES FOR YEARS    1 THROUGH    5
   ------------------------------------------------------------------------
                                             (INCHES)      (CU. FT.)
                                            ----------   -------------
      PRECIPITATION                            1.17        475675.156

      RUNOFF                                   0.000            0.0000

      DRAINAGE COLLECTED FROM LAYER  6         0.00000          0.00000

      PERCOLATION/LEAKAGE THROUGH LAYER  7     0.000000         0.00000

      AVERAGE HEAD ON TOP OF LAYER  7          0.000

      MAXIMUM HEAD ON TOP OF LAYER  7          0.000

      LOCATION OF MAXIMUM HEAD IN LAYER  6
            (DISTANCE FROM DRAIN)              0.0 FEET

      DRAINAGE COLLECTED FROM LAYER  8         0.00000          0.00000

      PERCOLATION/LEAKAGE THROUGH LAYER 10     0.000000         0.00000

      AVERAGE HEAD ON TOP OF LAYER  9          0.000

      MAXIMUM HEAD ON TOP OF LAYER  9          0.000

      LOCATION OF MAXIMUM HEAD IN LAYER  8
            (DISTANCE FROM DRAIN)              0.0 FEET

      SNOW WATER                               0.61        248784.4219


      MAXIMUM VEG. SOIL WATER (VOL/VOL)                0.1945

      MINIMUM VEG. SOIL WATER (VOL/VOL)                0.1195


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

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

******************************************************************************
```

```
******************************************************************************

                  FINAL WATER STORAGE AT END OF YEAR    5
    ----------------------------------------------------------------------
                   LAYER        (INCHES)       (VOL/VOL)
                   -----        --------       ---------
                     1            1.2480         0.1040

                     2            4.0357         0.1552

                     3            2.0697         0.1725

                     4          530.4420         0.1881

                     5            6.0720         0.2530

                     6            0.0020         0.0100

                     7            0.0000         0.0000

                     8            0.0012         0.0060

                     9            0.0000         0.0000

                    10            0.1800         0.7500

                  SNOW WATER      0.000

******************************************************************************
******************************************************************************
```

Exhibit H

SCENARIO 8 HELP MODEL RESULTS

```
*******************************************************************************
 ******************************************************************************
 **                                                                          **
 **                                                                          **
 **              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
 **                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
 **                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
 **                    USAE WATERWAYS EXPERIMENT STATION                     **
 **              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
 **                                                                          **
 **              Recompiled for Windows (32/64-bit) (09 Aug 2012)            **
 **         Institute of Soil Science, University of Hamburg, Germany        **
 **                                                                          **
 **                                                                          **
 ******************************************************************************
 ******************************************************************************



 PRECIPITATION  DATA  FILE:      N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRprecco.d4
 TEMPERATURE  DATA  FILE:        N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRtempco.d7
 SOLAR  RADIATION  DATA  FILE:   N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRsolcov.d13
 EVAPOTRANSPIRATION  DATA:       N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\From Edward 2.0\SRevapco.d11
 SOIL  AND  DESIGN  DATA  FILE:  N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\Exhibits\ExH - AltLin - Filled Poor\SRALLIEH.D10
 OUTPUT  DATA  FILE:             N:\Projects\2018\35187378\Working  Files\DRAFTS  (Proposal-Reports-
Communications)\Beckham  Permit  Narrative\S.R.  -  Rev  092319  to  JJ\VOL  2\App  J  -  Engineering
Report\Attachment D - HELP\Exhibits\ExH - AltLin - Filled Poor\Summary Output.out


 TIME:   9:53     DATE:  10/15/2019



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

      TITLE:  Alternate Liner

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



      NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.



                                   LAYER  1
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   7
            THICKNESS                   =     12.00   INCHES
            POROSITY                    =      0.4730 VOL/VOL
            FIELD CAPACITY              =      0.2220 VOL/VOL
            WILTING POINT               =      0.1040 VOL/VOL
            INITIAL SOIL WATER CONTENT  =      0.1040 VOL/VOL
            EFFECTIVE SAT. HYD. COND.   =  0.520000001416E-03 CM/SEC
          NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  2.01
                   FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.
```

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

              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   9
THICKNESS                   =     26.00   INCHES
POROSITY                    =      0.5010 VOL/VOL
FIELD CAPACITY              =      0.2840 VOL/VOL
WILTING POINT               =      0.1350 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.1552 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.190000006114E-03 CM/SEC


                        LAYER  3
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   9
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.5010 VOL/VOL
FIELD CAPACITY              =      0.2840 VOL/VOL
WILTING POINT               =      0.1350 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.1725 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.190000006114E-03 CM/SEC


                        LAYER  4
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER  18
THICKNESS                   =   2820.00   INCHES
POROSITY                    =      0.6710 VOL/VOL
FIELD CAPACITY              =      0.2920 VOL/VOL
WILTING POINT               =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.1881 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000004750E-02 CM/SEC


                        LAYER  5
                        --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   9
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.5010 VOL/VOL
FIELD CAPACITY              =      0.2840 VOL/VOL
WILTING POINT               =      0.1350 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2530 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.190000006114E-03 CM/SEC


                        LAYER  6
                        --------

                TYPE 2 - LATERAL DRAINAGE LAYER
                  MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.20   INCHES
POROSITY                    =      0.8500 VOL/VOL
```

```
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET



                        LAYER  7
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996490E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD



                        LAYER  8
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER  20
THICKNESS                   =      0.20   INCHES
POROSITY                    =      0.8500 VOL/VOL
FIELD CAPACITY              =      0.0100 VOL/VOL
WILTING POINT               =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0060 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =   10.0000000000     CM/SEC
SLOPE                       =      2.00   PERCENT
DRAINAGE LENGTH             =    250.0    FEET



                        LAYER  9
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                   =      0.06   INCHES
POROSITY                    =      0.0000 VOL/VOL
FIELD CAPACITY              =      0.0000 VOL/VOL
WILTING POINT               =      0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.199999996490E-12 CM/SEC
FML PINHOLE DENSITY         =      1.00   HOLES/ACRE
FML INSTALLATION DEFECTS    =      4.00   HOLES/ACRE
FML PLACEMENT QUALITY       =  3 - GOOD



                        LAYER 10
                        --------

              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  17
THICKNESS                   =      0.24   INCHES
POROSITY                    =      0.7500 VOL/VOL
FIELD CAPACITY              =      0.7470 VOL/VOL
```

```
      WILTING POINT                =      0.4000 VOL/VOL
      INITIAL SOIL WATER CONTENT  =      0.7500 VOL/VOL
      EFFECTIVE SAT. HYD. COND.   =  0.300000002618E-08 CM/SEC




              GENERAL DESIGN AND EVAPORATIVE ZONE DATA
              ----------------------------------------

    NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
             SOIL DATA BASE USING SOIL TEXTURE #13 WITH A
             POOR STAND OF GRASS, A SURFACE SLOPE OF  4.%
             AND A SLOPE LENGTH OF  350. FEET.

   SCS RUNOFF CURVE NUMBER             =     91.90
   FRACTION OF AREA ALLOWING RUNOFF    =      0.0    PERCENT
   AREA PROJECTED ON HORIZONTAL PLANE  =    112.000  ACRES
   EVAPORATIVE ZONE DEPTH              =     24.0    INCHES
   INITIAL WATER IN EVAPORATIVE ZONE   =      3.110  INCHES
   UPPER LIMIT OF EVAPORATIVE STORAGE  =     11.688  INCHES
   LOWER LIMIT OF EVAPORATIVE STORAGE  =      2.868  INCHES
   INITIAL SNOW WATER                  =      0.000  INCHES
   INITIAL WATER IN LAYER MATERIALS    =    544.050  INCHES
   TOTAL INITIAL WATER                 =    544.050  INCHES
   TOTAL SUBSURFACE INFLOW             =      0.00   INCHES/YEAR




               EVAPOTRANSPIRATION AND WEATHER DATA
               -----------------------------------

    NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
             ROSWELL             NEW MEXICO

        STATION LATITUDE                       =  33.24 DEGREES
        MAXIMUM LEAF AREA INDEX                =   1.20
        START OF GROWING SEASON (JULIAN DATE)  =     76
        END OF GROWING SEASON (JULIAN DATE)    =    310
        EVAPORATIVE ZONE DEPTH                 =  24.0  INCHES
        AVERAGE ANNUAL WIND SPEED              =   8.70 MPH
        AVERAGE 1ST QUARTER RELATIVE HUMIDITY  =  49.00 %
        AVERAGE 2ND QUARTER RELATIVE HUMIDITY  =  40.00 %
        AVERAGE 3RD QUARTER RELATIVE HUMIDITY  =  53.00 %
        AVERAGE 4TH QUARTER RELATIVE HUMIDITY  =  52.00 %



    NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    ROSWELL             NEW MEXICO

             NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
  0.24        0.28        0.27        0.37        0.77        0.91
  1.38        2.17        1.72        0.99        0.33        0.27



    NOTE:  TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
             COEFFICIENTS FOR    ROSWELL             NEW MEXICO

        NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL     FEB/AUG     MAR/SEP     APR/OCT     MAY/NOV     JUN/DEC
-------     -------     -------     -------     -------     -------
 41.40       45.90       52.80       61.90       70.30       79.00
 81.40       79.20       72.30       61.70       49.10       42.50
```

```
         NOTE:  SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
                  COEFFICIENTS FOR    ROSWELL             NEW MEXICO
                    AND STATION LATITUDE  =  33.24 DEGREES


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

                          ANNUAL TOTALS FOR YEAR    1
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            8.70        3537072.250    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                       8.922       3627413.250    102.55

  DRAINAGE COLLECTED FROM LAYER  6         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  7             0.0000

  DRAINAGE COLLECTED FROM LAYER  8         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER 10           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  9             0.0000

  CHANGE IN WATER STORAGE                 -0.222        -90349.430     -2.55

  SOIL WATER AT START OF YEAR            544.052     221189952.000

  SOIL WATER AT END OF YEAR              543.830     221099600.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000            8.530      0.00

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



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

                          ANNUAL TOTALS FOR YEAR    2
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.35        4207896.500    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                      10.350       4207930.000    100.00

  DRAINAGE COLLECTED FROM LAYER  6         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  7             0.0000

  DRAINAGE COLLECTED FROM LAYER  8         0.0000            0.000      0.00
```

```
  PERC./LEAKAGE THROUGH LAYER 10           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  9             0.0000

  CHANGE IN WATER STORAGE                  0.000           -24.814      0.00

  SOIL WATER AT START OF YEAR            543.830     221099600.000

  SOIL WATER AT END OF YEAR              543.830     221099568.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000           -8.530      0.00
*******************************************************************************



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

                          ANNUAL TOTALS FOR YEAR    3
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                           10.33        4199764.500    100.00

  RUNOFF                                   0.000             0.000      0.00

  EVAPOTRANSPIRATION                      10.304       4189203.000     99.75

  DRAINAGE COLLECTED FROM LAYER  6         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  7             0.0000

  DRAINAGE COLLECTED FROM LAYER  8         0.0000            0.000      0.00

  PERC./LEAKAGE THROUGH LAYER 10           0.000000          0.000      0.00

  AVG. HEAD ON TOP OF LAYER  9             0.0000

  CHANGE IN WATER STORAGE                  0.026         10546.143      0.25

  SOIL WATER AT START OF YEAR            543.830     221099568.000

  SOIL WATER AT END OF YEAR              543.856     221110128.000

  SNOW WATER AT START OF YEAR              0.000             0.000      0.00

  SNOW WATER AT END OF YEAR                0.000             0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000           15.121      0.00
*******************************************************************************



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

                          ANNUAL TOTALS FOR YEAR    4
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            9.25        3760681.000    100.00

  RUNOFF                                   0.000             0.000      0.00
```

```
  EVAPOTRANSPIRATION                       8.897      3617042.000     96.18

  DRAINAGE COLLECTED FROM LAYER  6         0.0000           0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000         0.000      0.00

  AVG. HEAD ON TOP OF LAYER  7             0.0000

  DRAINAGE COLLECTED FROM LAYER  8         0.0000           0.000      0.00

  PERC./LEAKAGE THROUGH LAYER 10           0.000000         0.000      0.00

  AVG. HEAD ON TOP OF LAYER  9             0.0000

  CHANGE IN WATER STORAGE                  0.353        143650.859      3.82

  SOIL WATER AT START OF YEAR            543.856     221110128.000

  SOIL WATER AT END OF YEAR              544.209     221253776.000

  SNOW WATER AT START OF YEAR              0.000            0.000      0.00

  SNOW WATER AT END OF YEAR                0.000            0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000         -11.632      0.00
*******************************************************************************


*******************************************************************************
                          ANNUAL TOTALS FOR YEAR    5
-------------------------------------------------------------------------------
                                         INCHES          CU. FEET     PERCENT
                                        --------        ----------    -------
  PRECIPITATION                            9.68       3935501.000    100.00

  RUNOFF                                   0.000            0.000      0.00

  EVAPOTRANSPIRATION                      10.072      4094873.000    104.05

  DRAINAGE COLLECTED FROM LAYER  6         0.0000           0.000      0.00

  PERC./LEAKAGE THROUGH LAYER  7           0.000000         0.000      0.00

  AVG. HEAD ON TOP OF LAYER  7             0.0000

  DRAINAGE COLLECTED FROM LAYER  8         0.0000           0.000      0.00

  PERC./LEAKAGE THROUGH LAYER 10           0.000000         0.000      0.00

  AVG. HEAD ON TOP OF LAYER  9             0.0000

  CHANGE IN WATER STORAGE                 -0.392      -159383.234     -4.05

  SOIL WATER AT START OF YEAR            544.209     221253776.000

  SOIL WATER AT END OF YEAR              543.817     221094400.000

  SNOW WATER AT START OF YEAR              0.000            0.000      0.00

  SNOW WATER AT END OF YEAR                0.000            0.000      0.00

  ANNUAL WATER BUDGET BALANCE              0.0000          11.244      0.00
*******************************************************************************
```

```
*******************************************************************************

        AVERAGE MONTHLY VALUES IN INCHES FOR YEARS    1 THROUGH    5
-------------------------------------------------------------------------------

                         JAN/JUL  FEB/AUG  MAR/SEP  APR/OCT  MAY/NOV  JUN/DEC
                         -------  -------  -------  -------  -------  -------
  PRECIPITATION
  -------------
    TOTALS                 0.18     0.17     0.29     0.26     0.78     0.63
                           1.66     1.91     1.64     0.79     0.84     0.49

    STD. DEVIATIONS        0.19     0.04     0.26     0.21     0.74     0.77
                           0.78     1.32     1.04     0.91     1.02     0.34

  RUNOFF
  ------
    TOTALS                 0.000    0.000    0.000    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

    STD. DEVIATIONS        0.000    0.000    0.000    0.000    0.000    0.000
                           0.000    0.000    0.000    0.000    0.000    0.000

  EVAPOTRANSPIRATION
  ------------------
    TOTALS                 0.258    0.162    0.274    0.176    0.896    0.621
                           1.617    2.002    1.491    0.735    0.916    0.561

    STD. DEVIATIONS        0.162    0.066    0.265    0.123    0.675    0.828
                           0.855    1.383    1.033    0.705    0.584    0.367

  LATERAL DRAINAGE COLLECTED FROM LAYER  6
  ----------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  PERCOLATION/LEAKAGE THROUGH LAYER  7
  ------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  LATERAL DRAINAGE COLLECTED FROM LAYER  8
  ----------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  PERCOLATION/LEAKAGE THROUGH LAYER 10
  ------------------------------------
    TOTALS                 0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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


-------------------------------------------------------------------------------
               AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)
-------------------------------------------------------------------------------
```

```
  DAILY AVERAGE HEAD ON TOP OF LAYER  7
  -------------------------------------
    AVERAGES               0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

  DAILY AVERAGE HEAD ON TOP OF LAYER  9
  -------------------------------------
    AVERAGES               0.0000   0.0000   0.0000   0.0000   0.0000   0.0000
                           0.0000   0.0000   0.0000   0.0000   0.0000   0.0000

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

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


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

     AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS    1 THROUGH    5
-------------------------------------------------------------------------------
                                     INCHES            CU. FEET       PERCENT
                               -------------------   -------------   ---------
 PRECIPITATION                   9.66    (   0.710)    3928183.0     100.00

 RUNOFF                          0.000   (  0.0000)         0.00      0.000

 EVAPOTRANSPIRATION              9.709   (  0.7375)    3947292.25    100.486

 LATERAL DRAINAGE COLLECTED      0.00000 (  0.00000)        0.000    0.00000
   FROM LAYER  6

 PERCOLATION/LEAKAGE THROUGH     0.00000 (  0.00000)        0.000     0.00000
   LAYER  7

 AVERAGE HEAD ON TOP             0.000 (    0.000)
   OF LAYER  7

 LATERAL DRAINAGE COLLECTED      0.00000 (  0.00000)        0.000    0.00000
   FROM LAYER  8

 PERCOLATION/LEAKAGE THROUGH     0.00000 (  0.00000)        0.000     0.00000
   LAYER 10

 AVERAGE HEAD ON TOP             0.000 (    0.000)
   OF LAYER  9

 CHANGE IN WATER STORAGE        -0.047   (  0.2818)     -19112.09     -0.487

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              PEAK DAILY VALUES FOR YEARS    1 THROUGH    5
   ------------------------------------------------------------------------
                                            (INCHES)      (CU. FT.)
                                           ----------   -------------
      PRECIPITATION                          1.17        475675.156

      RUNOFF                                 0.000            0.0000

      DRAINAGE COLLECTED FROM LAYER  6       0.00000          0.00000

      PERCOLATION/LEAKAGE THROUGH LAYER  7   0.000000         0.00000

      AVERAGE HEAD ON TOP OF LAYER  7        0.000

      MAXIMUM HEAD ON TOP OF LAYER  7        0.000

      LOCATION OF MAXIMUM HEAD IN LAYER  6
            (DISTANCE FROM DRAIN)            0.0 FEET

      DRAINAGE COLLECTED FROM LAYER  8       0.00000          0.00000

      PERCOLATION/LEAKAGE THROUGH LAYER 10   0.000000         0.00000

      AVERAGE HEAD ON TOP OF LAYER  9        0.000

      MAXIMUM HEAD ON TOP OF LAYER  9        0.000

      LOCATION OF MAXIMUM HEAD IN LAYER  8
            (DISTANCE FROM DRAIN)            0.0 FEET

      SNOW WATER                             0.61        248784.4219


      MAXIMUM VEG. SOIL WATER (VOL/VOL)              0.1945

      MINIMUM VEG. SOIL WATER (VOL/VOL)              0.1195


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

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

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

                   FINAL WATER STORAGE AT END OF YEAR    5
    ----------------------------------------------------------------------
                    LAYER        (INCHES)       (VOL/VOL)
                    -----        --------       ---------
                      1           1.2480         0.1040

                      2           3.8002         0.1462

                      3           2.0700         0.1725

                      4         530.4420         0.1881

                      5           6.0720         0.2530

                      6           0.0020         0.0100

                      7           0.0000         0.0000

                      8           0.0012         0.0060

                      9           0.0000         0.0000

                     10           0.1800         0.7500

                  SNOW WATER      0.000

******************************************************************************
******************************************************************************
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Exhibit I

HELP MODEL GUIDANCE DOCUMENT

Guidance Document

for

Performance Demonstration for an Alternate Cover Design under Section 502.A.2 of the New Mexico Solid Waste Management Regulations (20 NMAC 9.1) Using HELP Modeling

and

Performance Demonstration for an Alternate Liner Design under Section 306.A.2 of the New Mexico Solid Waste Management Regulations (20 NMAC 9.1) Using HELP Modeling

This document is for guidance only and is subject to change. However, any deviations from this document must be fully justified to the satisfaction of the Department.

Prepared by the
New Mexico Environment Department
Solid Waste Bureau
Permit Section
April 1, 1998

Performance Demonstration for an Alternative Cover Design under Section 502.A.2 of the New Mexico Solid Waste Management Regulations (20 NMAC 9.1) Using HELP Modeling

1. Existing Solid Waste Landfills without a Liner System:

A prescriptive landfill cover system must, in accordance with Section 502.A.1, consist of an infiltration layer comprised of a minimum of 18 inches of earthen material with the required hydraulic conductivity (K) and a minimum of 6 inches of soil that is capable of sustaining native plant growth as an erosion layer (Figure 1). The cover component of 18 inches of earthen material must be equivalent to the least hydraulically conductive natural subsoils or a saturated hydraulic conductivity of no greater than 1×10^{-5} cm/sec. For example, if the hydraulic conductivity of the natural subsoils is 5×10^{-6} cm/sec, then the K of the infiltration layer material must be equivalent to these soils. *However, this example is for modeling purposes only. If the K of the underlying subsoils is less than 1×10^{-5} cm/sec (e.g., 5×10^{-6} cm/sec), then an alternative cover design must be proposed since 1×10^{-5} cm/sec is the lowest acceptable actual K for soils used in covers due to desiccation and root penetration (see example below).* If the hydraulic conductivity of the natural subsoils is greater than 1×10^{-5} cm/sec (e.g., 1×10^{-4} cm/sec), the K of the infiltration layer material must equate to the 1×10^{-5} cm/sec requirement.

If the infiltration layer meets the minimum hydraulic conductivity of 1×10^{-5} cm/sec or that of the natural subsoils and the minimum 18 inch condition then a Hydrologic Evaluation of Landfill Performance (HELP) Model simulation is not required. If an alternative cover design is proposed, it must achieve an equivalent reduction in infiltration as the infiltration layer specified in Section 502.A.1.a. Therefore, a HELP Model simulation is required to demonstrate that the design of such a cover provides equivalent reduction in infiltration as the prescriptive cover design. If the natural subsoils have a hydraulic conductivity of less than 1×10^{-5} cm/sec (e.g., 5×10^{-6} cm/sec), then the cover must achieve equivalent reduction in infiltration as that of the prescriptive cover but with an 18 inch infiltration layer with a hydraulic conductivity of 5×10^{-6} cm/sec.

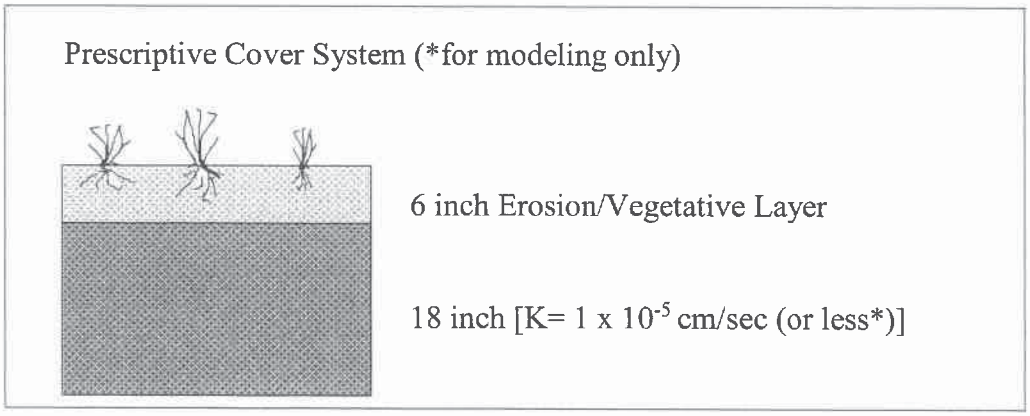

Figure 1. Prescriptive Cover System

A demonstration of equivalent reduction in infiltration is determined by using the EPA HELP Model. The HELP Model simulations need to compare the prescriptive cover and the alternative cover design (Figure 2). The simulation for the prescriptive cover must include the erosion, infiltration and intermediate cover layers. The alternative cover design simulation includes the intermediate and alternative cover layers. The two designs are to be simulated for years 1 through 5 with "poor" vegetation during the post-closure care period to demonstrate equivalency (Simulations #1 & #2). In New Mexico, it is assumed for a conservative value that the vegetation will be between "bare ground" and "fair vegetation" designated as "poor vegetation". Precipitation (wettest 5 consecutive year period using Climatedata CD or NOAA data files: discs or manual entry), evapotranspiration, temperature (use values associated with wettest 5 consecutive years of precipitation), and solar radiation data must be site specific and identical for both alternative and prescriptive cover designs simulations. Provide justification for all input parameters in the model utilizing the attached forms. Indicate characteristics of on-site or other sources of soil proposed for the construction of cover and the parameter values in the model. It is anticipated that the entire area of the landfill or cell will be modeled. The Department recommends initializing the soil moisture content to be the value of the wilting point plus 25% of the difference between the wilting point and the field capacity [i.e., (field capacity - wilting point) x 0.25 + wilting point]. Other values deviating from this range may be used but must be fully justified. The leaf area index may be between 0.8 and 1.6 depending on the site location. The evaporative zone depth may be between 18" and 28" depending on the site location.

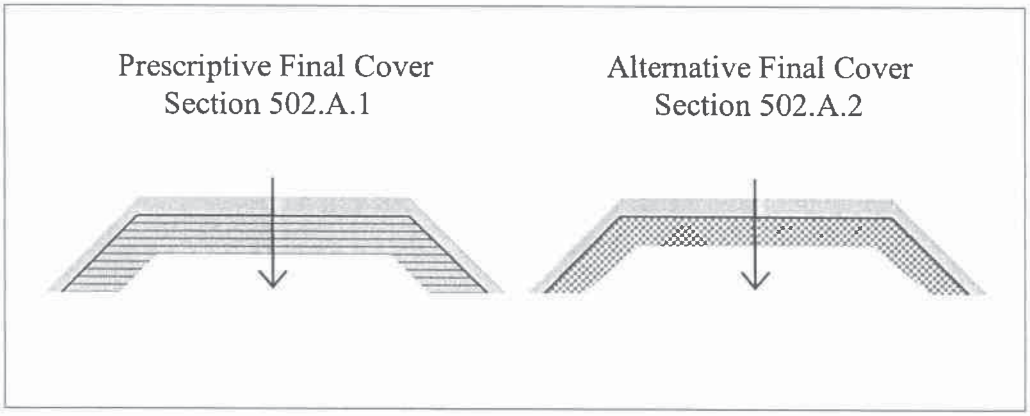

Figure 2

For example, comparing the prescriptive cover of:

1) 6 inches of topsoil
2) 18 inches of compacted soil (K = 5 x 10^{-6} cm/sec* - to meet natural subsoils K = 5 x 10^{-6})
3) Intermediate cover layer (optional* for modeling purposes) [*unless an intermediate cover layer is used for modeling purposes with a proposed alternative cover system (see below), then an intermediate cover layer must be used for modeling purposes]

with a proposed alternative cover system of:

1) 6 inches of topsoil
2) 30 inches of compacted (K = 1 x 10^{-5} cm/sec*)
3) Intermediate cover layer (optional for modeling purposes)

* $K = 5 \times 10^{-6}$ cm/sec is for modeling purposes only since 1×10^{-5} cm/sec is the lowest acceptable actual K for soils used in covers. Even if soils with $K = 5 \times 10^{-6}$ cm/sec are available for use in the cover, over time the K will increase to 1×10^{-5} cm/sec due to desiccation and root penetration.

Input Parameters for HELP Simulation #1 (Prescriptive Cover)

Weather data

City/State: The weather data should be from the nearest reporting station that has at least 40 years of data.

Latitude: The latitude must be specific for the site to use in synthesizing solar radiation data.

Evaporative zone depth: 18" to 28" corresponding with "poor" vegetation (see EPA Engineering Documentation for Version 3, Figure 5 - e.g., Clovis would be 20"; Santa Fe and Roswell would be 24"; Las Cruces, Albuquerque, and Farmington would be 28")

Maximum leaf area index: 0.8 to 1.6 corresponding with "poor" vegetation (see EPA Engineering Documentation for Version 3, Figure 3 - e.g., Clovis would be 1.6; Santa Fe and Roswell would be 1.2; Farmington would be 1.0; Las Cruces and Albuquerque would be 0.8)

Growing season start and end day: from solar radiation data (default)

Average wind speed: from solar radiation data (default)

Relative humidity: from solar radiation data (default)

Precipitation: daily precipitation from the wettest 5 consecutive years for the appropriate weather reporting station

Temperature: daily* minimum and maximum temperatures corresponding with the wettest 5 consecutive years for the appropriate weather reporting station
(*may be monthly averages if manual entry is used)

Solar radiation data: synthetically generated using coefficients for the appropriate* default (HELP) weather reporting station (*should be the closest by distance or latitude - consult with the Department if the appropriate station is not obvious)

Landfill Cover Data

Type of vegetation: Type 2 for "poor"

SCS Runoff curve #: may be generated from HELP or user specified* (*must be justified)

% of area allowing runoff: 100%; "closed"

Surface area: entire disposal area of landfill

Soil and Design Data

Source of soil characteristics: geotechnical data should be obtained from the source material.

Number of layers: There should be a layer for each type of material used (or compacted v. non-compacted)

Layer Number: (There should be a justification sheet for each layer.)

Thickness: 6" of topsoil, 18" of infiltration layer, 12" of intermediate cover layer* [*optional for modeling purposes (unless an intermediate cover layer is used for modeling purposes with a proposed alternative cover system in Simulation #2, then an intermediate cover layer must be used for modeling purposes)]

Layer type: "1" vertical percolation layer for all cover materials

Soil texture: The texture # should approximate the geotechnical characteristics (see EPA HELP User's Guide for Version 3, Table 4).

Total porosity: If the actual porosity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Field capacity: If the actual field capacity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Wilting point: If the actual wilting point is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Moisture content: The moisture content should be initialized to be the value of the wilting point plus 25% of the difference between the wilting point and the field capacity [i.e., (field capacity - wilting point) x 0.25 + wilting point].

Saturated hydraulic conductivity (K): The K of the infiltration layer must be the greatest actual value (unless greater than 1x 10^{-5} cm/sec*) of the underlying soil [e.g., If the actual (two tested samples - different locations) K of the underlying soil = 1x 10^{-6} cm/sec and 2 x 10^{-6}, then model 18" of 2 x 10^{-6} cm/sec for the infiltration layer; *If the K of the underlying soil = 5 x 10^{-5} cm/sec, then model 18" of 1x 10^{-5} cm/sec].

Input Parameters for HELP Simulation #2 (Proposed Alternate Cover)

Weather data (must be the same as Simulation #1)

City/State: The weather data should be from the nearest reporting station that has at least 40 years of data.

Latitude: The latitude must be specific for the site to use in synthesizing solar radiation data.

Evaporative zone depth: 18" to 28" corresponding with "poor" vegetation (see EPA Engineering Documentation for Version 3, Figure 5 - e.g., Clovis would be 20"; Santa Fe and Roswell would be 24"; Las Cruces, Albuquerque, and Farmington would be 28")

Maximum leaf area index: 0.8 to 1.6 corresponding with "poor" vegetation (see EPA Engineering Documentation for Version 3, Figure 3 - e.g., Clovis would be 1.6; Santa Fe and Roswell would be 1.2; Farmington would be 1.0; Las Cruces and Albuquerque would be 0.8)

Growing season start and end day: from solar radiation data (default)

Average wind speed: from solar radiation data (default)

Relative humidity: from solar radiation data (default)

Precipitation: daily precipitation from the wettest 5 consecutive years for the appropriate weather reporting station

Temperature: daily* minimum and maximum temperatures corresponding with the wettest 5 consecutive years for the appropriate weather reporting station
(*may be monthly averages if manual entry is used)

Solar radiation data: synthetically generated using coefficients for the appropriate* default (HELP) weather reporting station (*should be the closest by distance or latitude - consult with the Department if the appropriate station is not obvious)

Landfill Cover Data

Type of vegetation: Type 2 for "poor"

SCS Runoff curve #: may be generated from HELP or user specified* (*must be justified)

% of area allowing runoff: 100%; "closed"

Surface area: entire disposal area of landfill

Soil and Design Data

Source of soil characteristics: geotechnical data should be obtained from the source material.

Number of layers: There should be a layer for each type of material used (or compacted v. non-compacted)

Layer Number: (There should be a justification sheet for each layer.)

Thickness: 6" of topsoil, 18" to proposed thickness of infiltration layer, 12" of intermediate cover layer* (*optional for modeling purposes)

Layer type: "1" vertical percolation layer for all* cover materials including GCLs used (*consult with the Department if a FML is proposed to be used in the cover)

Soil texture: The texture # should approximate the geotechnical characteristics (see EPA HELP User's Guide for Version 3, Table 4).

Total porosity: If the actual porosity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Field capacity: If the actual field capacity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Wilting point: If the actual wilting point is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Moisture content: The moisture content should be initialized to be the value of the wilting point plus 25% of the difference between the wilting point and the field capacity [i.e., (field capacity - wilting point) x 0.25 + wilting point].

Saturated hydraulic conductivity (K): The K must be tested for the actual value unless the K is less than 1×10^{-5} cm/sec* (e.g., If the tested K is 5×10^{-5} cm/sec, then model the proposed thickness of the infiltration layer at 5×10^{-5} cm/sec. However, if the tested K is 2×10^{-6}, the lowest value to be modeled would be 1×10^{-5} cm/sec). *1×10^{-5} cm/sec is the lowest acceptable K for soils used in covers due to desiccation and root penetration; unless a GCL is proposed, then the actual K may be modeled for the GCL layer (i.e., 0.24" at 3×10^{-9} cm/sec).

2. New Solid Waste Landfills:

As in the above case, the cover for the proposed landfill with a prescriptive or alternative liner must achieve an equivalent protection as the liner. If an alternative final cover is proposed for the landfill, then a demonstration must be submitted to the Bureau for approval pursuant to Section 502.A. It must be determined by this demonstration that the proposed final cover design includes an infiltration layer that achieves an equivalent reduction in infiltration as the bottom liner (Figure 3). A HELP Model simulation comparison is acceptable for this demonstration for a 5 year period with vegetation. Precipitation (wettest 5 consecutive year period using Climatedata CD or NOAA data files: discs or manual entry), evapotranspiration, temperature (use values associated with wettest 5 consecutive years of precipitation) , and solar radiation data must be site specific and identical for both liner and cover design simulations. Provide justification for all input parameters in the model utilizing the attached forms. Demonstrate the relationship of the characteristics of on-site or other sources of soil proposed for the construction of cover or liner and the parameter values in the model. It is anticipated that the entire area of the landfill or cell will be modeled. The Department recommends initializing the soil moisture content to be at least the value of the wilting point plus 25% of the difference between the wilting point and the field capacity [i.e., (field capacity - wilting point) x 0.25 + wilting point]. Other values deviating from this range may be used but must be fully justified.

For example, the comparison must include a HELP Model simulation for the liner and the proposed final cover systems as below (see Simulations #4 & #3, respectively).

The simulation for an alternative liner system* could include:

1) the drainage/protective layer of the liner with leachate collection system,
2) the 60-mil HDPE FML,
3) the 0.25 inch ($K = 3 \times 10^{-9}$) GCL (geosynthetic clay liner),
4) the 6 inches of compacted in situ soil used as the prepared subgrade, and
5) with the solid waste cell open and no runoff.

*Any alternative liner system must meet the demonstration as described in the "Performance Demonstration For An Alternative <u>Liner</u> Design under Section 306.A.2 of the New Mexico Solid Waste Management Regulations (20 NMAC 9.1) Using HELP Modeling".

A liner system is compared with a HELP Model simulation for a proposed final cover:

1) 18 inches non-compacted material (6 inches of topsoil with poor grass and 12 inches of non-compacted soil),
2) the 0.25 inch GCL ($K = 3 \times 10^{-9}$),
3) 12 inches of intermediate cover (6 inches of compacted soil and 6 inches of non-compacted soil), and
4) with the solid waste cell closed and final placement of the cover to include runoff.

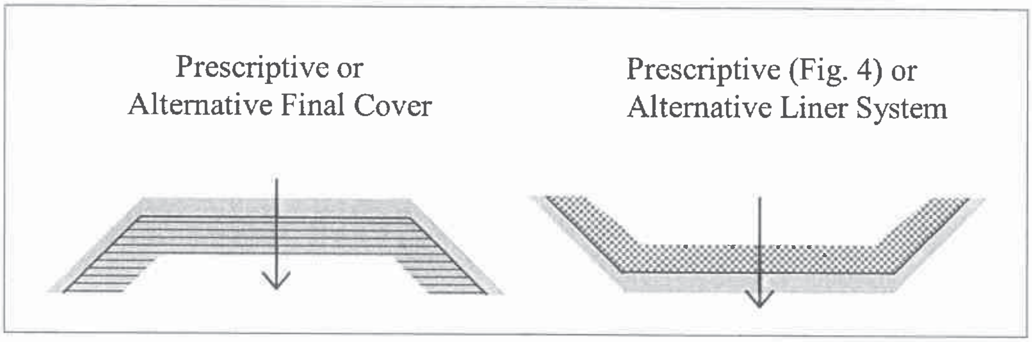

Figure 3

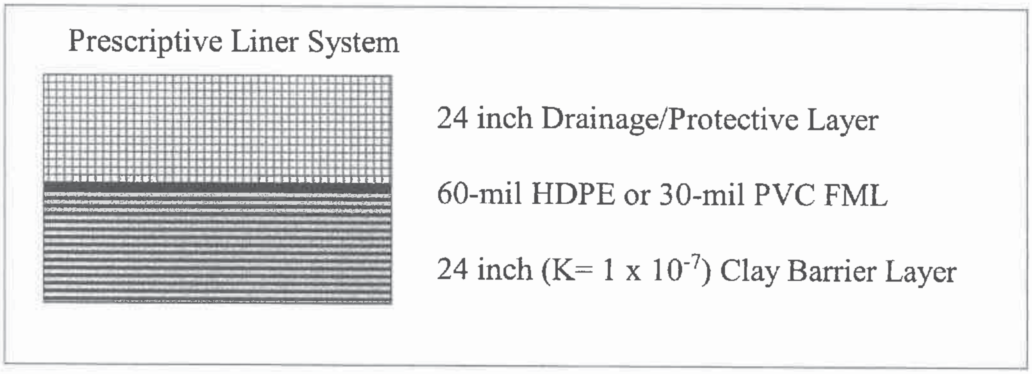

Figure 4

Input Parameters for HELP Simulation #3 (Proposed Alternate Cover)

Weather data

City/State: The weather data should be from the nearest reporting station that has at least 40 years of data.

Latitude: The latitude must be specific for the site to use in synthesizing solar radiation data.

Evaporative zone depth: 18" to 28" corresponding with "poor" vegetation (see EPA Engineering Documentation for Version 3, Figure 5 - e.g., Clovis would be 20"; Santa Fe and Roswell would be 24"; Las Cruces, Albuquerque, and Farmington would be 28")

Maximum leaf area index: 0.8 to 1.6 corresponding with "poor" vegetation (see EPA Engineering Documentation for Version 3, Figure 3 - e.g., Clovis would be 1.6; Santa Fe and Roswell would be 1.2; Farmington would be 1.0; Las Cruces and Albuquerque would be 0.8)

Growing season start and end day: from solar radiation data (default)

Average wind speed: from solar radiation data (default)

Relative humidity: from solar radiation data (default)

Precipitation: daily precipitation from the wettest 5 consecutive years for the appropriate weather reporting station

Temperature: daily* minimum and maximum temperatures corresponding with the wettest 5 consecutive years for the appropriate weather reporting station
(*may be monthly averages if manual entry is used)

Solar radiation data: synthetically generated using coefficients for the appropriate* default (HELP) weather reporting station (*should be the closest by distance or latitude - consult with the Department if the appropriate station is not obvious)

Landfill Cover Data

Type of vegetation: Type 2 for "poor"

SCS Runoff curve #: may be generated from HELP or user specified* (*must be justified)

% of area allowing runoff: 100%; "closed"

Surface area: entire disposal area of landfill or cell (leachate collection basin)

Soil and Design Data

Source of soil characteristics: geotechnical data should be obtained from the source material.

Number of layers: There should be a layer for each type of material used (or compacted v. non-compacted)

Layer Number: (There should be a justification sheet for each layer.)

Thickness: 6" of topsoil, Proposed thickness of infiltration layer or rooting medium or drainage layer, Possible GCL (0.24") or FML, subgrade thickness for GCL or FML (minimum of 6"), 12" of intermediate cover layer* (*optional for modeling purposes)

Layer type: Type "1" - vertical percolation layer for all* cover materials including GCLs used (*consult with the Department if a FML is proposed to be used in the cover)

Soil texture: The texture # should approximate the geotechnical characteristics (see EPA HELP User's Guide for Version 3, Table 4).

Total porosity: If the actual porosity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Field capacity: If the actual field capacity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Wilting point: If the actual wilting point is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Moisture content: The moisture content should be initialized to be the value of the wilting point plus 25% of the difference between the wilting point and the field capacity [i.e., (field capacity - wilting point) x 0.25 + wilting point].

Saturated hydraulic conductivity (K): The K must be tested for the actual value unless the K is less than 1 x 10^{-5} cm/sec* (e.g., If the tested K is 5 x 10^{-5} cm/sec, then model the proposed thickness of the infiltration layer at 5 x 10^{-5} cm/sec. However, if the tested K is 2 x 10^{-6}, the lowest value to be modeled would be 1 x 10^{-5} cm/sec). *1 x 10^{-5} cm/sec is the lowest acceptable K for soils used in covers due to desiccation and root penetration; unless a GCL is proposed, then the actual K may be modeled for the GCL layer (i.e., 0.24" at 3 x 10^{-9} cm/sec).

Input Parameters for HELP Simulation #4 (Prescriptive Liner or Proposed Alternate Liner - Tier I)

Weather data (must be the same as Simulation #3)

City/State: The weather data should be from the nearest reporting station that has at least 40 years of data.

Latitude: The latitude must be specific for the site to use in synthesizing solar radiation data.

Evaporative zone depth: 12" to 18" corresponding with bare ground (see EPA Engineering Documentation for Version 3, Figure 5 - e.g., Santa Fe and Roswell would be 14"; Las Cruces, Albuquerque, and Farmington would be 18")

Maximum leaf area index: 0.0 corresponding with bare ground

Growing season start and end day: from solar radiation data (default)

Average wind speed: from solar radiation data (default)

Relative humidity: from solar radiation data (default)

Precipitation: daily precipitation from the wettest 5 consecutive years for the appropriate weather reporting station

Temperature: daily* minimum and maximum temperatures corresponding with the wettest 5 consecutive years for the appropriate weather reporting station
(*may be monthly averages if manual entry is used)

Solar radiation data: synthetically generated using coefficients for the appropriate* default (HELP) weather reporting station (*should be the closest by distance or latitude - consult with the Department if the appropriate station is not obvious)

Landfill Cover Data

Type of vegetation: Type 1 for "bare ground"

SCS Runoff curve #: may be generated from HELP or user specified* (*must be justified)

% of area allowing runoff: 0%; "open"

Surface area: entire disposal area of landfill or cell (leachate collection basin)

Soil and Design Data

Source of soil characteristics: geotechnical data should be obtained from the source material.

Number of layers: There should be a layer for each type of material used (or compacted v. non-compacted)

Layer Number: (There should be a justification sheet for each layer.)

Thickness: 24" of drainage/protection layer, possible geonet*, FML, 24" of 1 x 10^{-7} cm/sec clay barrier layer for prescriptive liner or GCL or other proposed thickness of clay barrier layer for an alternate liner. (*A demonstration that no more than one foot of head will be on the liner must be made for this simulation. Therefore, a geonet may be necessary if the 24" drainage layer material is incapable of transmitting leachate so 12" of head is not on the liner.)

Layer type: Type "2" for lateral drainage layer - slope (minimum of 2%) and drainage length must be designated (consult with the Department if leachate recirculation is proposed); Type "4" for geomembrane liners - geomembrane pinhole density of 1/acre, geomembrane installation defects of 4/acre and liner installation quality of "good"; Type "3" for barrier soil layers including GCLs (any soil layer underlying a geomembrane must be considered to be a barrier soil layer)

Soil texture: The texture # should approximate the geotechnical characteristics (see EPA HELP User's Guide for Version 3, Table 4).

Total porosity: If the actual porosity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Field capacity: If the actual field capacity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Wilting point: If the actual wilting point is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Moisture content: The moisture content should be initialized to be the value of the wilting point plus 25% of the difference between the wilting point and the field capacity [i.e., (field capacity - wilting point) x 0.25 + wilting point].

Saturated hydraulic conductivity (K): For the 24" of drainage/protection layer use the tested K* for modeling the prescriptive liner design and for a proposed alternate liner design; for a possible geonet use the lowest value from the manufacture's specifications; for the FML use a K* value which is the greatest value from the manufacture's specifications; 24" of 1 x 10^{-7} cm/sec clay barrier layer for prescriptive liner or GCL (3 x 10^{-9} cm/sec) or other proposed soil barrier layer for an alternate liner. (*must be the same value in both Simulation #5 & #6)

Performance Demonstration for an Alternate Liner Design under Section 306.A.2 of the New Mexico Solid Waste Management Regulations (20 NMAC 9.1) Using HELP Modeling

1. Permit applicants proposing an alternate liner in accordance with Section 306.A.2 must demonstrate the liner "... provides equivalent protection as the composite liner ... and ensures concentration values listed in Section 1110 will not be exceeded in the uppermost aquifer ... ". This requires that a two tier demonstration be made:

Tier 1 - the alternative liner provides equivalent protection, and
Tier 2 - the alternate liner ensures the uppermost aquifer will be protected.

The first tier of this demonstration may be satisfied through mathematical modeling using the EPA Hydrologic Evaluation of Landfill Performance (HELP) model. Two computer modeling analyses must be performed - (1) an analysis of the composite liner as specified in Section 306.A.1 and (2) an analysis of the proposed alternate liner as specified in Section 306.A.2. Each of these analyses must be performed under identical hydrologic and climatologic loading conditions of five years with no solid waste in the landfill (see Simulations #5 & 6). This time period is necessary to adequately evaluate the performance of the two liners. A successful demonstration of equivalent protection has been made when the analyses show equal or less percolation/leakage through the bottom layer of the proposed alternate liner than the percolation/leakage through the bottom layer of the Section 306.A.1 composite liner (Figure 5).

annual average

The second tier of the demonstration must include HELP modeling of the actual design conditions and the entire operational development of the landfill as closely as possible by doing a succession of model simulations which consider the factors in Section 306.A.2.a. To aid in accomplishing this, each successive computer simulation must use the previous simulation's moisture content output as the input for the following simulation (Figure 6). The modeling design method must be fully described. If no leakage is indicated at the end of the second simulation (#8) and subsequent simulations (#9 & #10) continue to indicate no leakage, then a successful demonstration has been made that the uppermost aquifer will be protected as required by Section 306.A.2 and it will not be necessary to perform a fate and transport modeling.

2. Justification for all input parameters in the HELP modeling must be provided utilizing the attached forms. Demonstrate the relationship of the characteristics of the soil proposed for the construction and operation of the landfill and the parameter values used in the model. Show justification for the soil and waste moisture content parameters as well as geomembrane liner data and storm water runoff fractions. The initial moisture content of the soil should be initialized by the use in the HELP model. The Department recommends initializing the soil moisture content to be the value of the wilting point plus 25% of the difference between the wilting point and the field capacity [i.e., (field capacity - wilting point) x 0.25 + wilting point]. Other values deviating from this range may be used but must be fully justified.

3(1) First Tier of the Demonstration

Two simulations must be made, one of the Section 306.A.1 specified liner and one of the proposed alternate liner, both using the same precipitation (wettest 5 consecutive year period using Climatedata or NOAA tapes), temperature (use values associated with 5 wettest consecutive years), solar radiation, and evapotranspiration data (see Simulations #5 & #6). Current historic NOAA weather data from the nearest representative weather station as published by the National Climatic Data Center in Asheville, North Carolina must be used for the precipitation and temperature files. Both simulations must be made for the landfill in the open condition with no run-off and a Leaf Area Index of zero. *Simulations:*

#5 A simulation for the specified liner design must be performed using a 24 inch protective layer, a lateral drainage layer (which may be integral with the protective layer), an FML, and a 24 inch barrier layer of soil with a saturated hydraulic conductivity of 1×10^{-7} cm/sec. This simulation must be performed using no solid waste and for a five year period.

#6 A simulation for the proposed alternate liner design must be performed using a 24 inch protective layer, a lateral drainage layer (which may be integral with the protective layer), and the other proposed liner layer (the bottom layer must be modeled as a barrier layer). This simulation must be performed using no solid waste and for a five year period.

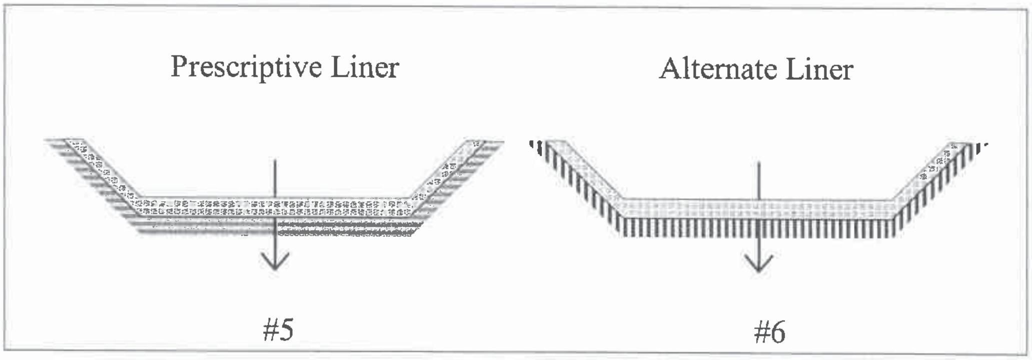

Figure 5

Compare the average annual percolation from the bottom layer of the two simulations. If the percolation is equivalent, a successful demonstration has been made for the first tier.

Input Parameters for HELP Simulation #5* (Prescriptive Liner - Tier I)

same as Simulation #4 with prescriptive liner design

Input Parameters for HELP Simulation #6* (Proposed Alternate Liner - Tier I)

same as Simulation #4 with proposed alternate liner design

*One of these simulations will also serve for the alternate cover design equivalency demonstration.

3(2) Second Tier of the Demonstration

Four simulations encompassing the entire life cycle of the facility to model actual design conditions and operational development as closely as possible must be performed (see Simulations #7, #8, #9 & #10). This is accomplished through a succession of four model simulations: one simulation of the open landfill, a second with the landfill partially filled with solid waste, a third with the landfill in the closed condition with bare ground, and a fourth with the landfill in the closed condition with "poor" vegetation. *Simulations:*

#7 The initial simulation must model the open landfill at start-up when the landfill contains no solid waste. The time period should extend for the anticipated duration of this condition (a minimum of two years).

#8 A succeeding simulation to model conditions of the partially filled landfill for a five year period*. This would incorporate daily and intermediate covers. (*This period may vary in accordance with anticipated operations.)

#9 Model the landfill in the closed condition with bare ground (a minimum of a two years).

#10 Finally, perform a simulation to model the landfill in the closed condition with poor vegetation for remainder of the post-closure care period (a minimum of 28 years).

If the simulations indicate no leakage after the third simulation (#9) and the subsequent simulation (#10), then the simulations have served to demonstrate the concentration values delineated in Section 1110 of the Regulations will not be exceeded in the uppermost aquifer at the relative point of compliance. Therefore, a successful demonstration has been made for the second tier.

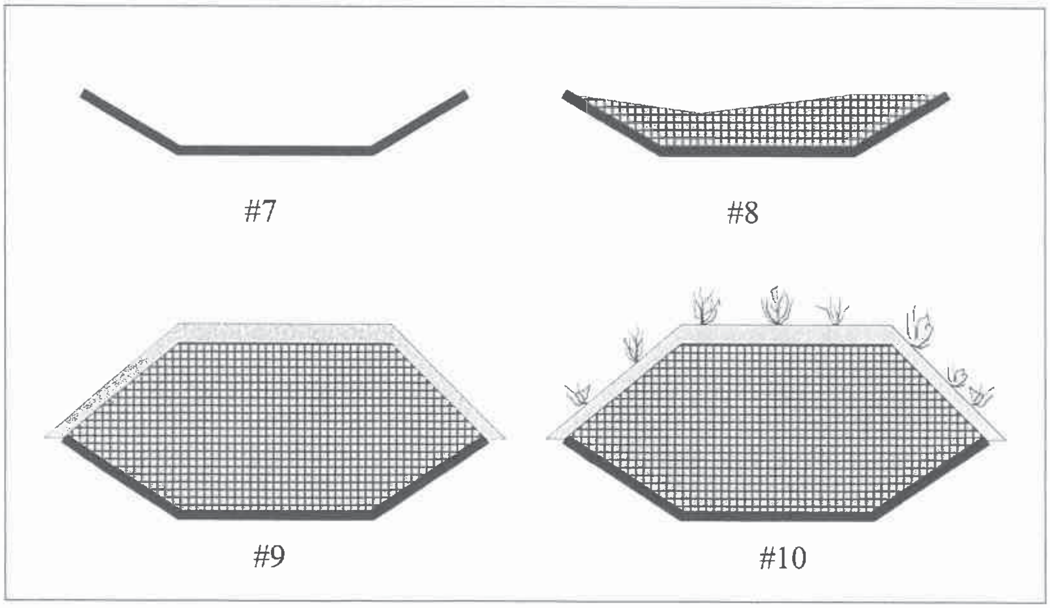

Figure 6

Input Parameters for HELP Simulation #7 (Proposed Alternate Liner - Tier II)

Weather data (must be the same as Simulation #3)

City/State: The weather data should be from the nearest reporting station that has at least 40 years of data.

Latitude: The latitude must be specific for the site to use in synthesizing solar radiation data.

Evaporative zone depth: 12" to 18" corresponding with bare ground (see EPA Engineering Documentation for Version 3, Figure 5 - e.g., Santa Fe and Roswell would be 14"; Las Cruces, Albuquerque, and Farmington would be 18")

Maximum leaf area index: 0.0 corresponding with bare ground

Growing season start and end day: from solar radiation data (default)

Average wind speed: from solar radiation data (default)

Relative humidity: from solar radiation data (default)

Precipitation: daily precipitation from 2 consecutive years for the appropriate weather reporting station

Temperature: daily* minimum and maximum temperatures corresponding with 2 consecutive years for the appropriate weather reporting station
(*may be monthly averages if manual entry is used)

Solar radiation data: synthetically generated using coefficients for the appropriate* default (HELP) weather reporting station (*should be the closest by distance or latitude - consult with the Department if the appropriate station is not obvious)

Landfill Cover Data

Type of vegetation: Type 1 for "bare ground"

SCS Runoff curve #: may be generated from HELP or user specified* (*must be justified)

% of area allowing runoff: 0%; "open"

Surface area: entire disposal area of landfill or cell (leachate collection basin)

Soil and Design Data

Source of soil characteristics: geotechnical data should be obtained from the source material.

Number of layers: There should be a layer for each type of material used (or compacted v. non-compacted)

Layer Number: (There should be a justification sheet for each layer.)

Thickness: 24" of drainage/protection layer, possible geonet, FML, 24" of 1 x 10^{-7} cm/sec clay barrier layer for prescriptive liner or GCL or other proposed thickness of clay barrier layer for an alternate liner.

Layer type: Type "2" for lateral drainage layer - slope (minimum of 2%) and drainage length must be designated (consult with the Department if leachate recirculation is proposed); Type "4" for geomembrane liners - geomembrane pinhole density of 1/acre, geomembrane installation defects of 4/acre and liner installation quality of "good"; Type "3" for barrier soil layers including GCLs (any soil layer underlying a geomembrane must be considered to be a barrier soil layer)

Soil texture: The texture # should approximate the geotechnical characteristics (see EPA HELP User's Guide for Version 3, Table 4).

Total porosity: If the actual porosity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Field capacity: If the actual field capacity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Wilting point: If the actual wilting point is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Moisture content: The moisture content should be initialized to be the value of the wilting point plus 25% of the difference between the wilting point and the field capacity [i.e., (field capacity - wilting point) x 0.25 + wilting point].

Saturated hydraulic conductivity (K): For the 24" of drainage/protection layer use the tested K for modeling the proposed alternate liner design; for a possible geonet use the lowest value from the manufacture's specifications; for the FML use a K value which is the greatest value from the manufacture's specifications; GCL (3 x 10^{-9} cm/sec) or other proposed soil barrier layer for an alternate liner.

Input Parameters for HELP Simulation #8 (Proposed Alternate Liner - Tier II)

Weather data (must be the same as Simulation #3)

City/State: The weather data should be from the nearest reporting station that has at least 40 years of data.

Latitude: The latitude must be specific for the site to use in synthesizing solar radiation data.

Evaporative zone depth: 12" to 18" corresponding with bare ground (see EPA Engineering Documentation for Version 3, Figure 5 - e.g., Santa Fe and Roswell would be 14"; Las Cruces, Albuquerque, and Farmington would be 18")

Maximum leaf area index: 0.0 corresponding with bare ground

Growing season start and end day: from solar radiation data (default)

Average wind speed: from solar radiation data (default)

Relative humidity: from solar radiation data (default)

Precipitation: daily precipitation from 2 to 5* consecutive years for the appropriate weather reporting station (*may vary with landfill operations)

Temperature: daily* minimum and maximum temperatures corresponding with 2 to 5 years (same years as precipitation) for the appropriate weather reporting station
(*may be monthly averages if manual entry is used)

Solar radiation data: synthetically generated using coefficients for the appropriate* default (HELP) weather reporting station (*should be the closest by distance or latitude - consult with the Department if the appropriate station is not obvious)

Landfill Cover Data

Type of vegetation: bare ground

SCS Runoff curve #: may be generated from HELP or user specified* (*must be justified)

% of area allowing runoff: 0%; "open"

Surface area: entire disposal area of landfill or cell (leachate collection basin)

Soil and Design Data

Source of soil characteristics: geotechnical data should be obtained from the source material.

Number of layers: There should be a layer for each type of material used (or compacted v. non-compacted)

Layer Number: (There should be a justification sheet for each layer.)

Thickness: 240" of solid waste (this thickness may vary depending on landfill operations); 24" of drainage/protection layer; possible geonet*; FML; 24" of 1 x 10^{-7} cm/sec clay barrier layer for prescriptive liner or GCL or other proposed thickness of clay barrier layer for an alternate liner.

Layer type: Type "1", vertical percolation layer, must be used for solid waste. Type "2" for lateral drainage layer - slope (minimum of 2%) and drainage length must be designated (consult with the Department if leachate recirculation is proposed); Type "4" for geomembrane liners - geomembrane pinhole density of 1/acre, geomembrane installation defects of 4/acre and liner installation quality of "good"; Type "3" for barrier soil layers including GCLs (any soil layer underlying a geomembrane must be considered to be a barrier soil layer)

Soil texture: The texture # should approximate the geotechnical characteristics (see EPA HELP User's Guide for Version 3, Table 4).

Total porosity: If the actual porosity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Field capacity: If the actual field capacity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Wilting point: If the actual wilting point is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Moisture content: The moisture content must be initialized to be the value of the previous simulation's (from Simulation #7) moisture content output as the input for the following simulation (Simulation #8). For compacted municipal solid waste with a HELP soil texture number of "18" use 20%* by volume/volume (which is greater than per mass basis - see EPA HELP User's Guide for Version 3 for conversion) (*a lower value may be used if justified)

Saturated hydraulic conductivity (K): For compacted municipal solid waste with a HELP soil texture number of "18" will have a K of 1 x 10^{-3} cm/sec. For the 24" of drainage/protection layer use the tested K for modeling the proposed alternate liner design; for a possible geonet use the lowest value from the manufacture's specifications; for the FML use a K value which is the greatest value from the manufacture's specifications; GCL (3 x 10^{-9} cm/sec) or other proposed soil barrier layer for an alternate liner.

Input Parameters for HELP Simulation #9 (Proposed Alternate Liner - Tier II)

Weather data

City/State: The weather data should be from the nearest reporting station that has at least 40 years of data.

Latitude: The latitude must be specific for the site to use in synthesizing solar radiation data.

Evaporative zone depth: 12" to 18" corresponding with bare ground (see EPA Engineering Documentation for Version 3, Figure 5 - e.g., Santa Fe and Roswell would be 14"; Las Cruces, Albuquerque, and Farmington would be 18")

Maximum leaf area index: 0.0 corresponding with bare ground

Growing season start and end day: from solar radiation data (default)

Average wind speed: from solar radiation data (default)

Relative humidity: from solar radiation data (default)

Precipitation: daily precipitation from 2 consecutive years for the appropriate weather reporting station

Temperature: daily* minimum and maximum temperatures corresponding with 2 consecutive years for the appropriate weather reporting station
(*may be monthly averages if manual entry is used)

Solar radiation data: synthetically generated using coefficients for the appropriate* default (HELP) weather reporting station (*should be the closest by distance or latitude - consult with the Department if the appropriate station is not obvious)

Landfill Cover Data

Type of vegetation: Type 1 for "bare ground"

SCS Runoff curve #: may be generated from HELP or user specified* (*must be justified)

% of area allowing runoff: 100%; "closed"

Surface area: entire disposal area of landfill or cell (leachate collection basin)

3710
3490
220

Soil and Design Data

Source of soil characteristics: geotechnical data should be obtained from the source material.

Number of layers: There should be a layer for each type of material used (or compacted v. non-compacted)

Layer Number: (There should be a justification sheet for each layer.)

Thickness: 6" of topsoil, Proposed thickness of infiltration layer or rooting medium or drainage layer, Possible GCL (0.24") or FML, subgrade thickness for GCL or FML (minimum of 6"), 12" of intermediate cover layer* (*optional for modeling); Proposed thickness of solid waste (this thickness will vary depending on landfill design); 24" of drainage/protection layer; possible geonet*; FML; 24" of 1 x 10^{-7} cm/sec clay barrier layer for prescriptive liner or GCL or other proposed thickness of clay barrier layer for an alternate liner.

Layer type: Type "1" - vertical percolation layer for all* cover materials including GCLs used in the cover (*consult with the Department if a FML is proposed to be used in the cover).Type "1", vertical percolation layer, must be used for solid waste. Type "2" for lateral drainage layer - slope (minimum of 2%) and drainage length must be designated (consult with the Department if leachate recirculation is proposed); Type "4" for geomembrane liners - geomembrane pinhole density of 1/acre, geomembrane installation defects of 4/acre and liner installation quality of "good"; Type "3" for barrier soil layers including GCLs (any soil layer underlying a geomembrane must be considered to be a barrier soil layer)

Soil texture: The texture # should approximate the geotechnical characteristics (see EPA HELP User's Guide for Version 3, Table 4).

Total porosity: If the actual porosity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Field capacity: If the actual field capacity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Wilting point: If the actual wilting point is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Moisture content: The moisture content must be initialized to be the value of the previous simulation's (from Simulation #8) moisture content output as the input for the following simulation (Simulation #9).

Saturated hydraulic conductivity (K): The K must be tested for the actual value unless the K is less than 1 x 10^{-5} cm/sec* (e.g., If the tested K is 5 x 10^{-5} cm/sec, then model the proposed thickness of the infiltration layer at 5 x 10^{-5} cm/sec. However, if the tested K is 2 x 10^{-6}, the lowest value to be modeled would be 1 x 10^{-5} cm/sec). *1 x 10^{-5} cm/sec is the lowest acceptable K for soils used in covers due to desiccation and root penetration; unless a GCL is proposed, then the actual K may be modeled for the GCL layer (i.e., 0.24" at 3 x 10^{-9} cm/sec). For compacted municipal solid waste with a HELP soil texture number of "18" will have a K of 1 x 10^{-3} cm/sec. For the 24" of drainage/protection layer use the tested K for modeling the proposed alternate liner design; for a possible geonet use the lowest value from the manufacture's specifications; for the FML use a K value which is the greatest value from the manufacture's specifications; GCL (3 x 10^{-9} cm/sec) or other proposed soil barrier layer for an alternate liner.

Input Parameters for HELP Simulation #10 (Proposed Alternate Liner - Tier II)

Weather data

City/State: The weather data should be from the nearest reporting station that has at least 40 years of data.

Latitude: The latitude must be specific for the site to use in synthesizing solar radiation data.

Evaporative zone depth: 18" to 28" corresponding with "poor" vegetation (see EPA Engineering Documentation for Version 3, Figure 5 - e.g., Clovis would be 20"; Santa Fe and Roswell would be 24"; Las Cruces, Albuquerque, and Farmington would be 28")

Maximum leaf area index: 0.8 to 1.6 corresponding with "poor" vegetation (see EPA Engineering Documentation for Version 3, Figure 3 - e.g., Clovis would be 1.6; Santa Fe and Roswell would be 1.2; Farmington would be 1.0; Las Cruces and Albuquerque would be 0.8)

Growing season start and end day: from solar radiation data (default)

Average wind speed: from solar radiation data (default)

Relative humidity: from solar radiation data (default)

Precipitation: daily precipitation from 28 consecutive years for the appropriate weather reporting station

Temperature: daily* minimum and maximum temperatures corresponding with 28 consecutive years for the appropriate weather reporting station
(*may be monthly averages if manual entry is used)

Solar radiation data: synthetically generated using coefficients for the appropriate* default (HELP) weather reporting station (*should be the closest by distance or latitude - consult with the Department if the appropriate station is not obvious)

Landfill Cover Data

Type of vegetation: Type 2 for "poor"

SCS Runoff curve #: may be generated from HELP or user specified* (*must be justified)

% of area allowing runoff: 100%; "closed"

Surface area: entire disposal area of landfill or cell (leachate collection basin)

Soil and Design Data

Source of soil characteristics: geotechnical data should be obtained from the source material.

Number of layers: There should be a layer for each type of material used (or compacted v. non-compacted)

Layer Number: (There should be a justification sheet for each layer.)

Thickness: 6" of topsoil, Proposed thickness of infiltration layer or rooting medium or drainage layer, Possible GCL (0.24") or FML, subgrade thickness for GCL or FML (minimum of 6"), 12" of intermediate cover layer* (*optional for modeling); Proposed thickness of solid waste (this thickness will vary depending on landfill design); 24" of drainage/protection layer; possible geonet*; FML; 24" of 1 x 10^{-7} cm/sec clay barrier layer for prescriptive liner or GCL or other proposed thickness of clay barrier layer for an alternate liner.

Layer type: Type "1" - vertical percolation layer for all* cover materials including GCLs used (*consult with the Department if a FML is proposed to be used in the cover). Type "1", vertical percolation layer, must be used for solid waste. Type "2" for lateral drainage layer - slope (minimum of 2%) and drainage length must be designated (consult with the Department if leachate recirculation is proposed); Type "4" for geomembrane liners - geomembrane pinhole density of 1/acre, geomembrane installation defects of 4/acre and liner installation quality of "good"; Type "3" for barrier soil layers including GCLs (any soil layer underlying a geomembrane must be considered to be a barrier soil layer)

Soil texture: The texture # should approximate the geotechnical characteristics (see EPA HELP User's Guide for Version 3, Table 4).

Total porosity: If the actual porosity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Field capacity: If the actual field capacity is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Wilting point: If the actual wilting point is not known, then the default value may be used that most closely approximates the geotechnical characteristics.

Moisture content: The moisture content must be initialized to be the value of the previous simulation's (from Simulation #9) moisture content output as the input for the following simulation (Simulation #10).

Saturated hydraulic conductivity (K): The K must be tested for the actual value unless the K is less than 1 x 10^{-5} cm/sec* (e.g., If the tested K is 5 x 10^{-5} cm/sec, then model the proposed thickness of the infiltration layer at 5 x 10^{-5} cm/sec. However, if the tested K is 2 x 10^{-6}, the lowest value to be modeled would be 1 x 10^{-5} cm/sec). *1 x 10^{-5} cm/sec is the lowest acceptable K for soils used in covers due to desiccation and root penetration; unless a GCL is proposed, then the actual K may be modeled for the GCL layer (i.e., 0.24" at 3 x 10^{-9} cm/sec). For compacted municipal solid waste with a HELP soil texture number of "18" will have a K of 1 x 10^{-3} cm/sec. For the 24" of drainage/protection layer use the tested K for modeling the proposed alternate liner design; for a possible geonet use the lowest value from the manufacture's specifications; for the FML use a K value which is the greatest value from the manufacture's specifications; GCL (3 x 10^{-9} cm/sec) or other proposed soil barrier layer for an alternate liner.

Equivalency Demonstrations

Typical "New" Landfill:

Alternate Cover Design Equivalency Demonstration (two simulations)

Simulation #3 & (either Simulation #5 or #6)

Average Annual Percolation from bottom layer of Simulation #3 must be less than or equal to (equivalent*) the Average Annual Percolation from the bottom layer of Simulation #5 or #6 (depending on the proposed liner design).

Alternate Liner Design Equivalency Demonstration

Tier I (two simulations) - Simulation #5 & Simulation #6

Average Annual Percolation from bottom layer of Simulation #6 must be less than or equal to (equivalent*) the Average Annual Percolation from the bottom layer of Simulation #5.

Tier II (four simulations) - Simulations #7, #8, #9, #10

Average Annual Percolation from bottom layer of Simulation #7 must decrease to zero for Simulations #9 & #10.

For closing an "old" (no liner system) landfill:

Alternate Cover Design Equivalency Demonstration (two simulations)

Simulation #1 & Simulation #2

Average Annual Percolation from bottom layer of Simulation #2 must be less than or equal to (equivalent*) the Average Annual Percolation from the bottom layer of Simulation #1

Submit hardcopies of all output files and submit all input files on 3.5" diskette.

*If the two Average Annual Percolation values are within 0.00001" of each other, then the demonstration is successful since these values are practically equal (the definition of equivalent) and well within modeling uncertainty.

Attachment E

Liner System Design Calculations

Attachment E1

Settlement and Liner Stress Calculations

PROJECT: South Ranch SWMF – Settlement Analysis **PAGE:** 1 of 16

JOB NO.: A4187129 **DATE:** October 2019 **COMP. BY:** DKK **CHECKED BY:** FOC

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PURPOSE

This calculation package includes settlement analyses for the proposed South Ranch (formerly Beckham Ranch) landfill to be located within Section 27 of T26S, R36E approximately 7 miles southwest of the City of Jal in Lea County, New Mexico. The settlement analyses include both soil foundation and waste settlements. The settlement analyses were performed to determine that the final cover slope, liner, and leachate collection system (after settlement) are consistent with the performance specifications of the project. The following calculations show the anticipated strains on the geosynthetic materials are less the allowable strains and the designed grades for final cover and leachate collection system will allow adequate drainage even after settlement.

METHOD OF ANALYSIS

The methodology for estimating settlements involves calculating settlements at multiple points and evaluating the resultant change in the designed grade and its impact on the landfill elements. Points were conservatively selected from a cross-section based on the thickness of waste material. The critical cross-section of the landfill was selected based the waste height and is shown on the Top of Protective Plan (see Figure 1). The cross-section drawing and settlement location points are shown in Figure 2.

Foundation Soil Settlement

On-site (native) soils predominately consist of granular soils, medium to very dense sandy soils and varying degrees of cementation, calcareous interbedded caliche materials in the upper approximately 7 to 100 feet of existing grades, underlain by medium to finely weathered sandstone extending to boring-termination depths of 150 feet below existing grade. For granular soils, settlement is caused by the compression of the soil skeleton as the particles rearrange due to the applied loads. The immediate (elastic) settlement of the foundation soils was calculated using the following equation:

$$S = \Delta\sigma / M_s * H$$

where: S = elastic settlement of soil layer
H = thickness of soil layer
$\Delta\sigma$ = applied Stress
M_s = constrained modulus of soils

Waste Material Settlements

The compression settlement of oil field wastes can be analyzed using the one-dimensional consolidation theory, commonly used for cohesive soils. Based on this theory, waste settlement has two components: settlement due to primary consolidation and settlement due to secondary consolidation. The primary settlement component of waste material is related to the increase in effective vertical stresses resulting from the additional waste material and landfill final cover system. The secondary settlement component is typically related to compression of the waste structure (skeleton) and is time-dependent.

Settlements resulting from primary consolidation of the waste were calculated using the general form of the 1-D consolidation theory settlement equation as given below [Holtz and Kovacs, 1981]:

$$Sp = Cer * H * log(\sigma'p/\sigma'vo) + Cec * H * log(\sigma'f\ /\sigma'p)$$

where: Sp = primary settlement
C_{ec} = primary compression index ratio
C_{er} = recompression index ratio
H = initial thickness of the waste layer before settlement
σ'_{vo} = initial effective pressure in the waste layer
σ'_{p} = effective pressure in the waste layer
σ'_{p} = pre-consolidation stress
σ'_{f} = final overburden pressure applied at the mid-level of the waste layer

The mechanisms for secondary settlement are mechanical creep, chemical reactions, and biodegradation. This type of compression is dependent on time, not applied loads. Settlements resulting from secondary settlement of the waste may be calculated according to the following equation [Qian, Koerner, and Gray, 2002]:

$$\Delta H_\alpha = C'_\alpha * H_o * log\frac{t_2}{t_1}$$

where: ΔH_α = long-term secondary settlement
C'_α = modified secondary compression index
t_2 = ending time of the time period for which long-term settlement of the layer is desired
t_1 = starting time of the time period for which long-term settlement of the layer is desire

However, from the best available information and discussions with the project team members, it is considered that waste materials for this landfill will typically be granular soils, contaminated silty sands/sands. Therefore, a secondary settlement of the waste material was neglected in our analyses.

Final Cover Settlement

Since (1) the waste material and foundation soils are permeable and will experience an immediate primary consolidation settlement under applied load, and (2) foundation soil settlement resulting from the final cover will be minimal, the total final cover settlement will be due to the primary compression of the waste material only with the increase in effective vertical stresses resulting from the final cover system. The settlement equation presented above for the waste material settlement calculation was used for the final cover settlement estimates.

Tensile Strains

The effects of waste settlement on the final cover and foundation settlement on the liner system were evaluated as described below.

Tensile strains in the final cover and the liner were estimated by the following general equation:

$$\varepsilon_{tens} = L_o - \frac{L_f}{L_o}$$

where: ε_{tens} = strain in the cover/liner (tension is negative)

L_o = initial length of cover/liner between adjacent points

L_f = length of cover/liner between adjacent points after settlement

MATERIAL PARAMETERS

The waste materials for this landfill are assumed to be granular soils, contaminated silty sands/sands. Based on the available typical compression parameters for sandy soils and our experience for similar waste materials and project, a compression index ratio C_{ec} of 0.012, a recompression index ratio Cer of about one-third of Cec, the total unit weight of 120 pcf, and a pre-consolidation pressure σ'_p of 1,000 psf were selected for the presented analyses. Based on the available typical compression parameters for native silty sands/sands and our experience for similar materials, a constrained modulus Ms of about 850 ksf was used for the foundation settlement estimate.

Table 1. Material Properties

Cover System		γ, pcf	120
Waste		γ, pcf	120
		$C_{c\varepsilon}$	0.012
		$C_{r\varepsilon}$	0.004
		σ'_p, psf	1,000
Foundation Soils-Silty Sands/Sands	Loose to Medium Dense	Ms, ksf	350
	Medium to Very Dense		850

RESULTS

The foundation soil, waste, and final cover settlement estimates are presented in Tables 2, 3, and 4, respectively. The spreadsheet output that details settlement estimates for the foundation soil, waste, and final cover settlement are also included in Tables 2, 3, and 4, respectively.

SUMMARY AND CONCLUSIONS

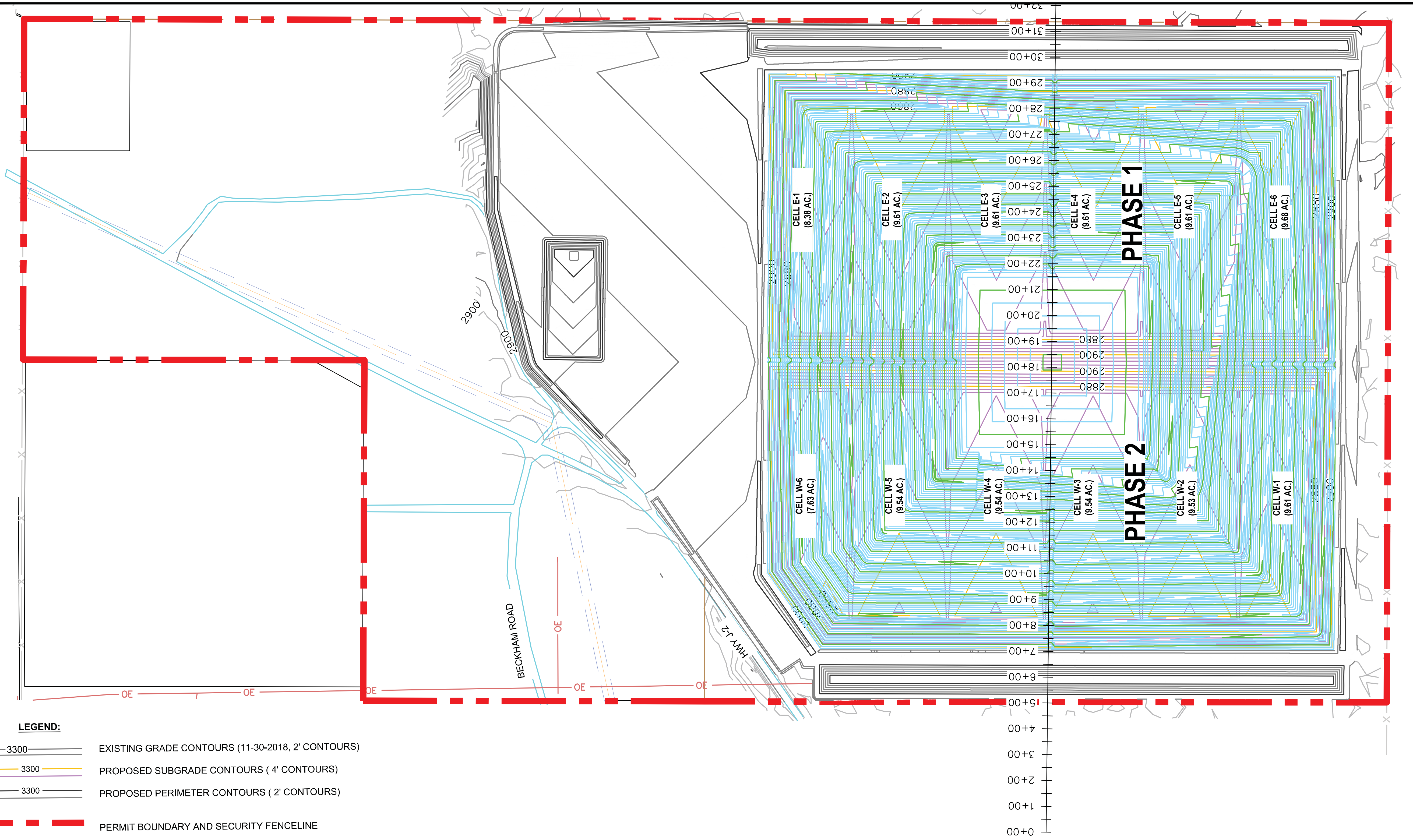
Based on our calculations, the foundation soils will settle about 3.0 feet (max.) near area (Station 18+15) where foundation (native) soil is thick (no excavation was planned near this area) and about 1.3 feet (max.) for the remaining area. The estimated settlements resulted in a maximum grade change of 2% near Station 18+15 and minimal grade change for the remaining area. The required 2% slope of the leachate collection system will not adversely be affected by the foundation settlements. Additionally, a maximum tensile stress on the liner was estimated to be 0.1%, which was less than the allowable strain on the geosynthetic liner system.

The final cover will settle on the order of 1 inch due to compression of waste material, resulting from the increase in effective stress due to the placement of the final cover system. Grade changes induced by differential waste settlement were estimated to be minimal and the final cover system will maintain positive drainage on the side slopes. Additionally, negligible tensile strains are expected to develop in the final cover system due to waste settlement.

REFERENCES

Holtz, R. D., and Kovacs, W. D. (1981) An Introduction to Geotechnical Engineering, Prentice-Hall Inc., Englewood Cliffs, N.J.

Qian, X., Koerner, R. M., and Gray, D. H. (2002) “Geotechnical Aspects of Landfill Design and Construction” Prentice Hall, Upper Saddle River, NJ



LEGEND:

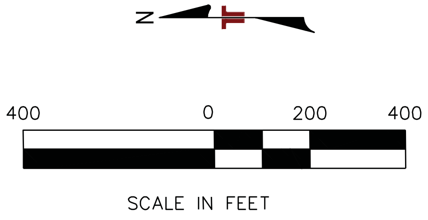
3300	EXISTING GRADE CONTOURS (11-30-2018, 2' CONTOURS)
3300	PROPOSED SUBGRADE CONTOURS (4' CONTOURS)
3300	PROPOSED PERIMETER CONTOURS (2' CONTOURS)
▬ ▬ ▬	PERMIT BOUNDARY AND SECURITY FENCELINE
OE	OVERHEAD ELECTRIC
G G G	EXISTING GAS LINES / GAS EASEMENT
X X	EXISTING WATER LINE
	EXISTING CENTERLINE
BH ⊕ #	BOREHOLE LOCATIONS
	NGL PROPERTY LINE
℄	SURVEY SECTION LINE
	CELL BOUNDARIES
	PHASE BOUNDARIES
	SITE ROAD

NOTES:

1. EXISTING TOPOGRAPHY WAS PERFORMED NOVEMBER 30, 2018 AND VERTICAL ELEVATIONS ARE BASED ON THE NAVD 88 NM_E.

2. GAS AND OVERHEAD ELECTRIC TO BE RELOCATED BY OWNER PRIOR TO CELL CONSTRUCTION IN THIS AREA

3. PHASE 3 WILL BE A VALLEY "PIGGY BACK" FILL BETWEEN COMPLETED PHASE 1 & 2 INCLUDING THE ADDITIONAL FILL HEIGHT CAPACITY AND PHASE 1 & 2.



FOR PERMITTING PURPOSES ONLY

REV.	DATE	BY	DESCRIPTION

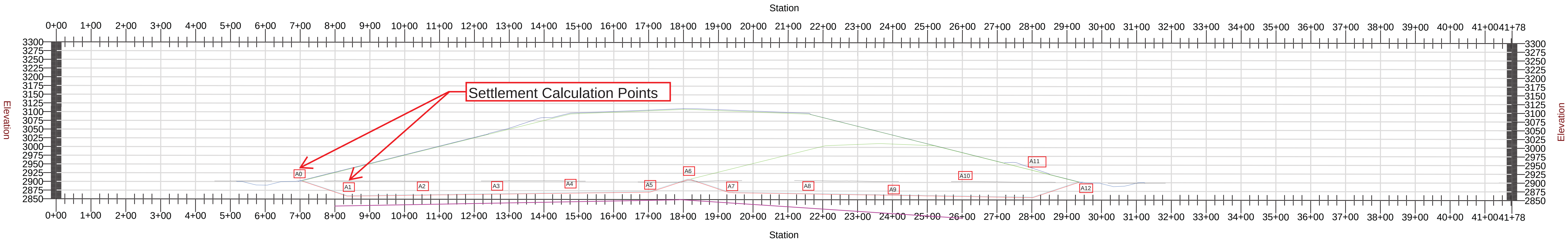
TOP OF PROTECTIVE PLAN
SOUTH RANCH SURFACE WASTE MANAGEMENT FACILITY
NGL WATER SOLUTIONS PERMIAN, LLC
PERMIT APPLICATION DRAWING
LEA COUNTY NEW MEXICO

Terracon
Consulting Engineers and Scientists
25809 I-30 SOUTH BRYANT, AR 72022
PH. (501) 847-9292 FAX. (501) 847-9210

FIGURE 1

DESIGNED BY:	MPB
DRAWN BY:	DEW
APPVD. BY:	MPB
SCALE:	SEE SCALEBAR
DATE:	JUNE 2019
JOB NO.	35187378
ACAD NO.	572-002
SHEET NO.:	18 OF 39

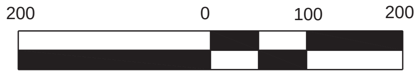
N:\GECARCHIVE\CAD\572\002\BECKHAM\35187378 DESIGN PERMITTING\PERMIT DRAWINGS\DEEP KHATRI SETTLEMENT ANALYSIS.DWG



LEGEND:

PROPOSED TOP OF FINAL COVER
PROPOSED TOP OF WASTE
PROPOSED TOP OF PROTECTIVE COVER
PROPOSED TOP OF SUBGRADE
PROPOSED PERIMETER INFRASTRUCTURE
EXISTING GRADE (11/30/2018)

SCALES:
1" = 300' (HORIZONTAL)
1" = 300' (VERTICAL)
VERTICAL EXAGGERATION = x 1



SCALE IN FEET

FOR PERMITTING PURPOSES ONLY

REV.	DATE	BY	DESCRIPTION

CROSS-SECTION FOR SETTLMENET ANALYSIS
SOUTH RANCH SURFACE WASTE MANAGEMENT FACILITY
NGL WATER SOLUTIONS PERMIAN, LLC
PERMIT APPLICATION DRAWING
LEA COUNTY
NEW MEXICO

Consulting Engineers and Scientists
25809 I-30 SOUTH
BRYANT, AR 72022
PH. (501) 847-9292
FAX. (501) 847-9210

FIGURE 2

DESIGNED BY:	MPB
DRAWN BY:	DEW
APPVD. BY:	MPB
SCALE:	SEE SCALEBAR
DATE:	JUNE 2019
JOB NO.	35187378
ACAD NO.	572-002
SHEET NO.:	- OF 39

N:\GECARCHIVE\CAD\572\002\BECKHAM\35187378 DESIGN PERMITTING\PERMIT DRAWINGS\DEEP KHATRI SETTLEMENT ANALYSIS.DWG

TABLE 2 FOUNDATION SOIL SETTLEMENT CALCULATIONS

Point	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
Station	7+00	8+35	10+50	12+50	14+75	17+00	18+15	19+25	21+50	24+00	26+00	28+00	29+40
Linear Horizontal Distance From 0+00 (ft.)	700	835	1050	1250	1475	1700	1815	1925	2150	2400	2600	2800	2940
Final Cover Elevation (ft.)	2900	2934	2988	3036	3095	3100	3106	3100	3093	3029	2980	2936	2900
Final Cover Above Waste (ft.)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Final Waste Elevation (ft.)	2896.5	2930.5	2984.5	3032.5	3091.5	3096.5	3102.5	3096.5	3089.5	3025.5	2976.5	2932.5	2896.5
Clay Liner Thickness (ft.)	1	1	1	1	1	1	1	1	1	1	1	1	1
Top of Clay Liner Elevation (ft.)	2896.5	2859	2861	2863	2866	2869	2906	2870	2868	2864	2860	2856	2896.5
Waste Thickness (ft.)	0.0	71.5	123.5	169.5	225.5	227.5	196.5	226.5	221.5	161.5	116.5	76.5	0.0
Unit Weight of Final Cover (pcf)	120	120	120	120	120	120	120	120	120	120	120	120	120
Unit Weight of Waste (pcf)	120	120	120	120	120	120	120	120	120	120	120	120	120
Applied Pressure (psf)	540	9120	15360	20880	27600	27840	24120	27720	27120	19920	14520	9720	540
Founfation Surficial Sand Bottom El (ft.)-Loose to Medium Dense	2872	2872	2872	2872	2872	2872	2872	2872	2872	2872	2872	2872	2872
Foundation-Surficial Sand Thickness (ft.)-Loose to Medium Dense	24	0	0	0	0	0	33	0	0	0	0	0	24
Foundation- Surficial Sand Constrained Modulus (ksf)-Loose to Medium Dense	350						350						350
Founfation Bedrock Elevation (ft.)	2830	2830	2835	2838	2842	2847	2848	2840	2825	2812	2800	2800	2800
Foundation-Lower Sand Thickness (ft.)-Medium to Very Dense	42.0	28.0	25.0	24.0	23.0	21.0	24.0	29.0	42.0	51.0	59.0	55.0	72.0
Foundation- Lower Sand Constrained Modulus (ksf)-Medium to Very Dense	850.0	850.0	850.0	850.0	850.0	850.0	850.0	850.0	850.0	850.0	850.0	850.0	850.0
SETTLEMENT													
Settlement (ft.)	0.1	0.3	0.5	0.6	0.7	0.7	3.0	0.9	1.3	1.2	1.0	0.6	0.1
Settlement (in.)	0.8	3.6	5.4	7.1	9.0	8.3	35.5	11.3	16.1	14.3	12.1	7.5	1.0
Differential Settlement (ft.)		0.2	0.2	0.1	0.2	-0.1	2.3	-2.0	0.4	-0.1	-0.2	-0.4	-0.5
GRADES AND STRAINS													
Bottom of Clay Liner Elevation Prior to Settlement (ft.)	2895.5	2858.0	2860.0	2862.0	2865.0	2868.0	2905.0	2869.0	2867.0	2863.0	2859.0	2855.0	2895.5
Bottom of Clay Liner Elevation After settlement (ft.)	2895.4	2857.7	2859.5	2861.4	2864.3	2867.3	2902.0	2868.1	2865.7	2861.8	2858.0	2854.4	2895.4
Initial Liner Cover GeoMembrane Segment Length (ft.)		140.1	215.0	200.0	225.0	225.0	120.8	115.7	225.0	250.0	200.0	200.0	145.7
PostSettlement Final Cover GeoMemberane Segment Length (ft.)		140.2	215.0	200.0	225.0	225.0	120.1	115.1	225.0	250.0	200.0	200.0	145.9
Strain (+ Compression/- Tension)		0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.5%	0.0%	0.0%	0.0%	0.0%	-0.1%
PreSettlement Slope (+ up/- down)		-27.8%	0.9%	1.0%	1.3%	1.3%	32.2%	-32.7%	-0.9%	-1.6%	-2.0%	-2.0%	28.9%
Post Settlement Slope (+ up/- down)		-28.0%	0.9%	0.9%	1.3%	1.4%	30.2%	-30.9%	-1.1%	-1.5%	-1.9%	-1.8%	29.3%
Grade Change (+ Steeper/- Milder)		0.2%	-0.1%	-0.1%	-0.1%	0.0%	-2.0%	-1.8%	0.2%	-0.1%	-0.1%	-0.2%	0.4%

TABLE 3 WASTE SETTLEMENT CALCULATIONS

Point	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12				
Station	7+00	8+35	10+50	12+50	14+75	17+00	18+15	19+25	21+50	24+00	26+00	28+00	29+40				
Linear Horizontal Distance (ft.)	700	835	1050	1250	1475	1700	1815	1925	2150	2400	2600	2800	2940				
Final Cover Elevation (ft.)	2900	2934	2988	3036	3095	3100	3106	3100	3093	3029	2980	2936	2900				
Final Cover Above Waste (ft.)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5				
Final Waste Elevation (ft.)	2896.5	2930.5	2984.5	3032.5	3091.5	3096.5	3102.5	3096.5	3089.5	3025.5	2976.5	2932.5	2896.5				
Top of Clay Liner (ft.)	2896.5	2859	2861	2863	2866	2869	2906	2870	2868	2864	2860	2856	2896.5				
Waste Thickness (ft.)	0.0	71.5	123.5	169.5	225.5	227.5	196.5	226.5	221.5	161.5	116.5	76.5	0.0				
Number of Layers	0	7	12	17	20	20	20	20	20	16	12	8	0				
Layer Thickness (ft.)	0	10	10	10	11	11	10	11	11	10	10	10	0				
Unit Weight of Final Cover (pcf)	120	120	120	120	120	120	120	120	120	120	120	120	120				
Unit Weight of Waste (pcf)	120	120	120	120	120	120	120	120	120	120	120	120	120				
Pre Consolidation Pressure (psf)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000				
Modified Primary Compression Index	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012				
Modified Recompression Index	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004				
Modified Secondary Compression Index	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
SUB LAYER	1																
Top of Layer Elevation (ft.)		2930.5	2984.5	3032.5	3091.5	3096.5	3102.5	3096.5	3089.5	3025.5	2976.5	2932.5					
Bottom of Layer Elevation (ft.)		2920.3	2974.2	3022.5	3080.2	3085.1	3092.7	3085.2	3078.4	3015.4	2966.8	2922.9					
Layer Midpoint Elevation (ft.)		2925.4	2979.4	3027.5	3085.9	3090.8	3097.6	3090.8	3084.0	3020.5	2971.6	2927.7					
Initial Effective Stress (psf)		612.9	617.5	598.2	676.5	682.5	589.5	679.5	664.5	605.6	582.5	573.8					
Final Effective Stress (psf)		1032.9	1037.5	1018.2	1096.5	1102.5	1009.5	1099.5	1084.5	1025.6	1002.5	993.8					
Primary Settlement (ft.)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
Primary Settlement (in.)		0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.1					
SUB LAYER	2																
Top of Layer Elevation (ft.)		2920.3	2974.2	3022.5	3080.2	3085.1	3092.7	3085.2	3078.4	3015.4	2966.8	2922.9					
Bottom of Layer Elevation (ft.)		2910.1	2963.9	3012.6	3069.0	3073.8	3082.9	3073.9	3067.4	3005.3	2957.1	2913.4					
Layer Midpoint Elevation (ft.)		2915.2	2969.1	3017.5	3074.6	3079.4	3087.8	3079.5	3072.9	3010.4	2961.9	2918.2					
Initial Effective Stress (psf)		612.9	617.5	598.2	676.5	682.5	589.5	679.5	664.5	605.6	582.5	573.8					
Final Effective Stress (psf)		2258.6	2272.5	2214.7	2449.5	2467.5	2188.5	2458.5	2413.5	2236.9	2167.5	2141.3					
Primary Settlement (ft.)		0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.0					
Primary Settlement (in.)		0.6	0.6	0.6	0.7	0.7	0.6	0.7	0.7	0.6	0.6	0.6					
SUB LAYER	3																
Top of Layer Elevation (ft.)		2910.1	2963.9	3012.6	3069.0	3073.8	3082.9	3073.9	3067.4	3005.3	2957.1	2913.4					
Bottom of Layer Elevation (ft.)		2899.9	2953.6	3002.6	3057.7	3062.4	3073.0	3062.5	3056.3	2995.2	2947.4	2903.8					
Layer Midpoint Elevation (ft.)		2905.0	2958.8	3007.6	3063.3	3068.1	3077.9	3068.2	3061.8	3000.3	2952.2	2908.6					
Initial Effective Stress (psf)		612.9	617.5	598.2	676.5	682.5	589.5	679.5	664.5	605.6	582.5	573.8					
Final Effective Stress (psf)		3484.3	3507.5	3411.2	3802.5	3832.5	3367.5	3817.5	3742.5	3448.1	3332.5	3288.8					
Primary Settlement (ft.)		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1					
Primary Settlement (in.)		0.9	0.9	0.9	1.0	1.0	0.9	1.0	1.0	0.9	0.8	0.8					
SUB LAYER	4																
Top of Layer Elevation (ft.)		2899.9	2953.6	3002.6	3057.7	3062.4	3073.0	3062.5	3056.3	2995.2	2947.4	2903.8					
Bottom of Layer Elevation (ft.)		2889.6	2943.3	2992.6	3046.4	3051.0	3063.2	3051.2	3045.2	2985.1	2937.7	2894.3					
Layer Midpoint Elevation (ft.)		2894.8	2948.5	2997.6	3052.0	3056.7	3068.1	3056.9	3050.7	2990.2	2942.5	2899.0					
Initial Effective Stress (psf)		612.9	617.5	598.2	676.5	682.5	589.5	679.5	664.5	605.6	582.5	573.8					
Final Effective Stress (psf)		4710.0	4742.5	4607.6	5155.5	5197.5	4546.5	5176.5	5071.5	4659.4	4497.5	4436.3					
Primary Settlement (ft.)		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1					
Primary Settlement (in.)		1.1	1.1	1.1	1.2	1.3	1.0	1.3	1.2	1.1	1.0	1.0					

TABLE 3 WASTE SETTLEMENT CALCULATIONS (CONTINUED)

Point	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12				
Station	7+00	8+35	10+50	12+50	14+75	17+00	18+15	19+25	21+50	24+00	26+00	28+00	29+40				
SUB LAYER	**5**																
Top of Layer Elevation (ft.)		2889.64	2943.3	2992.6	3046.4	3051.0	3063.2	3051.2	3045.2	2985.1	2937.7	2894.3					
Bottom of Layer Elevation (ft.)		2879.43	2933.0	2982.6	3035.1	3039.6	3053.4	3039.9	3034.1	2975.0	2928.0	2884.7					
Layer Midpoint Elevation (ft.)		2884.54	2938.2	2987.6	3040.8	3045.3	3058.3	3045.5	3039.7	2980.1	2932.8	2889.5					
Initial Effective Stress (psf)		612.9	617.5	598.2	676.5	682.5	589.5	679.5	664.5	605.6	582.5	573.8					
Final Effective Stress (psf)		5935.7	5977.5	5804.1	6508.5	6562.5	5725.5	6535.5	6400.5	5870.6	5662.5	5583.8					
Primary Settlement (ft.)		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1					
Primary Settlement (in.)		1.2	1.3	1.2	1.4	1.4	1.2	1.4	1.4	1.2	1.2	1.1					
SUB LAYER	**6**																
Top of Layer Elevation (ft.)		2879.43	2933.0	2982.6	3035.1	3039.6	3053.4	3039.9	3034.1	2975.0	2928.0	2884.7					
Bottom of Layer Elevation (ft.)		2869.21	2922.8	2972.7	3023.9	3028.3	3043.6	3028.6	3023.1	2964.9	2918.3	2875.1					
Layer Midpoint Elevation (ft.)		2874.32	2927.9	2977.7	3029.5	3033.9	3048.5	3034.2	3028.6	2970.0	2923.1	2879.9					
Initial Effective Stress (psf)		612.9	617.5	598.2	676.5	682.5	589.5	679.5	664.5	605.6	582.5	573.8					
Final Effective Stress (psf)		7161.4	7212.5	7000.6	7861.5	7927.5	6904.5	7894.5	7729.5	7081.9	6827.5	6731.3					
Primary Settlement (ft.)		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1					
Primary Settlement (in.)		1.4	1.4	1.3	1.5	1.6	1.3	1.6	1.5	1.3	1.3	1.3					
SUB LAYER	**7**																
Top of Layer Elevation (ft.)		2869.21	2922.8	2972.7	3023.9	3028.3	3043.6	3028.6	3023.1	2964.9	2918.3	2875.1					
Bottom of Layer Elevation (ft.)		2859	2912.5	2962.7	3012.6	3016.9	3033.7	3017.2	3012.0	2954.8	2908.5	2865.6					
Layer Midpoint Elevation (ft.)		2864.11	2917.6	2967.7	3018.2	3022.6	3038.6	3022.9	3017.5	2959.9	2913.4	2870.3					
Initial Effective Stress (psf)		612.9	617.5	598.2	676.5	682.5	589.5	679.5	664.5	605.6	582.5	573.8					
Final Effective Stress (psf)		8387.1	8447.5	8197.1	9214.5	9292.5	8083.5	9253.5	9058.5	8293.1	7992.5	7878.8					
Primary Settlement (ft.)		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1					
Primary Settlement (in.)		1.5	1.5	1.4	1.7	1.7	1.4	1.7	1.6	1.4	1.4	1.3					
SUB LAYER	**8**																
Top of Layer Elevation (ft.)			2912.5	2962.7	3012.6	3016.9	3033.7	3017.2	3012.0	2954.8	2908.5	2865.6					
Bottom of Layer Elevation (ft.)			2902.2	2952.7	3001.3	3005.5	3023.9	3005.9	3000.9	2944.8	2898.8	2856.0					
Layer Midpoint Elevation (ft.)			2907.3	2957.7	3006.9	3011.2	3028.8	3011.6	3006.4	2949.8	2903.7	2860.8					
Initial Effective Stress (psf)			617.5	598.2	676.5	682.5	589.5	679.5	664.5	605.6	582.5	573.8					
Final Effective Stress (psf)			9682.5	9393.5	10567.5	10657.5	9262.5	10612.5	10387.5	9504.4	9157.5	9026.3					
Primary Settlement (ft.)			0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1					
Primary Settlement (in.)			1.6	1.5	1.8	1.8	1.5	1.8	1.7	1.5	1.5	1.4					
SUB LAYER	**9**																
Top of Layer Elevation (ft.)			2902.167	2952.7	3001.3	3005.5	3023.9	3005.9	3000.9	2944.8	2898.8						
Bottom of Layer Elevation (ft.)			2891.875	2942.8	2990.0	2994.1	3014.1	2994.6	2989.8	2934.7	2889.1						
Layer Midpoint Elevation (ft.)			2897.021	2947.8	2995.7	2999.8	3019.0	3000.2	2995.4	2939.7	2894.0						
Initial Effective Stress (psf)			617.5	598.2	676.5	682.5	589.5	679.5	664.5	605.6	582.5						
Final Effective Stress (psf)			10917.5	10590.0	11920.5	12022.5	10441.5	11971.5	11716.5	10715.6	10322.5						
Primary Settlement (ft.)			0.1	0.1	0.2	0.2	0.1	0.2	0.1	0.1	0.1						
Primary Settlement (in.)			1.6	1.6	1.8	1.9	1.5	1.8	1.8	1.6	1.5						
SUB LAYER	**10**																
Top of Layer Elevation (ft.)			2891.875	2942.8	2990.0	2994.1	3014.1	2994.6	2989.8	2934.7	2889.1						
Bottom of Layer Elevation (ft.)			2881.583	2932.8	2978.8	2982.8	3004.3	2983.3	2978.8	2924.6	2879.4						
Layer Midpoint Elevation (ft.)			2886.729	2937.8	2984.4	2988.4	3009.2	2988.9	2984.3	2929.6	2884.3						
Initial Effective Stress (psf)			617.5	598.2	676.5	682.5	589.5	679.5	664.5	605.6	582.5						
Final Effective Stress (psf)			12152.5	11786.5	13273.5	13387.5	11620.5	13330.5	13045.5	11926.9	11487.5						
Primary Settlement (ft.)			0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.1						
Primary Settlement (in.)			1.7	1.6	1.9	1.9	1.6	1.9	1.9	1.7	1.6						

TABLE 3 WASTE SETTLEMENT CALCULATIONS (CONTINUED)

Point	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12				
Station	7+00	8+35	10+50	12+50	14+75	17+00	18+15	19+25	21+50	24+00	26+00	28+00	29+40				
SUB LAYER	11																
Top of Layer Elevation (ft.)			2881.583	2932.8	2978.8	2982.8	3004.3	2983.3	2978.8	2924.6	2879.4						
Bottom of Layer Elevation (ft.)			2871.292	2922.8	2967.5	2971.4	2994.4	2971.9	2967.7	2914.5	2869.7						
Layer Midpoint Elevation (ft.)			2876.438	2927.8	2973.1	2977.1	2999.3	2977.6	2973.2	2919.5	2874.6						
Initial Effective Stress (psf)			617.5	598.2	676.5	682.5	589.5	679.5	664.5	605.6	582.5						
Final Effective Stress (psf)			13387.5	12982.9	14626.5	14752.5	12799.5	14689.5	14374.5	13138.1	12652.5						
Primary Settlement (ft.)			0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.1						
Primary Settlement (in.)			1.8	1.7	2.0	2.0	1.7	2.0	1.9	1.7	1.7						
SUB LAYER	12																
Top of Layer Elevation (ft.)			2871.292	2922.824	2967.5	2971.4	2994.4	2971.9	2967.7	2914.5	2869.7						
Bottom of Layer Elevation (ft.)			2861	2912.853	2956.2	2960.0	2984.6	2960.6	2956.6	2904.4	2860.0						
Layer Midpoint Elevation (ft.)			2866.146	2917.838	2961.8	2965.7	2989.5	2966.3	2962.1	2909.4	2864.9						
Initial Effective Stress (psf)			617.5	598.2	676.5	682.5	589.5	679.5	664.5	605.6	582.5						
Final Effective Stress (psf)			14622.5	14179.4	15979.5	16117.5	13978.5	16048.5	15703.5	14349.4	13817.5						
Primary Settlement (ft.)			0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.1						
Primary Settlement (in.)			1.8	1.8	2.0	2.1	1.7	2.1	2.0	1.8	1.7						
SUB LAYER	13																
Top of Layer Elevation (ft.)				2912.853	2956.2	2960.0	2984.6	2960.6	2956.6	2904.4							
Bottom of Layer Elevation (ft.)				2902.882	2944.9	2948.6	2974.8	2949.3	2945.5	2894.3							
Layer Midpoint Elevation (ft.)				2907.868	2950.6	2954.3	2979.7	2954.9	2951.1	2899.3							
Initial Effective Stress (psf)				598.2	676.5	682.5	589.5	679.5	664.5	605.6							
Final Effective Stress (psf)				15375.9	17332.5	17482.5	15157.5	17407.5	17032.5	15560.6							
Primary Settlement (ft.)				0.2	0.2	0.2	0.1	0.2	0.2	0.2							
Primary Settlement (in.)				1.8	2.1	2.1	1.8	2.1	2.1	1.8							
SUB LAYER	14																
Top of Layer Elevation (ft.)				2902.882	2944.9	2948.6	2974.8	2949.3	2945.5	2894.3							
Bottom of Layer Elevation (ft.)				2892.912	2933.7	2937.3	2965.0	2938.0	2934.5	2884.2							
Layer Midpoint Elevation (ft.)				2897.897	2939.3	2942.9	2969.9	2943.6	2940.0	2889.2							
Initial Effective Stress (psf)				598.2	676.5	682.5	589.5	679.5	664.5	605.6							
Final Effective Stress (psf)				16572.4	18685.5	18847.5	16336.5	18766.5	18361.5	16771.9							
Primary Settlement (ft.)				0.2	0.2	0.2	0.2	0.2	0.2	0.2							
Primary Settlement (in.)				1.9	2.2	2.2	1.8	2.2	2.1	1.9							
SUB LAYER	15																
Top of Layer Elevation (ft.)				2892.912	2933.7	2937.3	2965.0	2938.0	2934.5	2884.2							
Bottom of Layer Elevation (ft.)				2882.941	2922.4	2925.9	2955.1	2926.6	2923.4	2874.1							
Layer Midpoint Elevation (ft.)				2887.926	2928.0	2931.6	2960.0	2932.3	2928.9	2879.1							
Initial Effective Stress (psf)				598.2	676.5	682.5	589.5	679.5	664.5	605.6							
Final Effective Stress (psf)				17768.8	20038.5	20212.5	17515.5	20125.5	19690.5	17983.1							
Primary Settlement (ft.)				0.2	0.2	0.2	0.2	0.2	0.2	0.2							
Primary Settlement (in.)				1.9	2.2	2.2	1.9	2.2	2.2	1.9							
SUB LAYER	16																
Top of Layer Elevation (ft.)				2882.941	2922.375	2925.875	2955.1	2926.6	2923.4	2874.1							
Bottom of Layer Elevation (ft.)				2872.971	2911.1	2914.5	2945.3	2915.3	2912.3	2864.0							
Layer Midpoint Elevation (ft.)				2877.956	2916.738	2920.188	2950.2	2921.0	2917.8	2869.0							
Initial Effective Stress (psf)				598.2	676.5	682.5	589.5	679.5	664.5	605.6							
Final Effective Stress (psf)				18965.3	21391.5	21577.5	18694.5	21484.5	21019.5	19194.4							
Primary Settlement (ft.)				0.2	0.2	0.2	0.2	0.2	0.2	0.2							
Primary Settlement (in.)				1.9	2.3	2.3	1.9	2.3	2.2	2.0							

TABLE 3 WASTE SETTLEMENT CALCULATIONS (CONTINUED)

Point	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12				
Station	7+00	8+35	10+50	12+50	14+75	17+00	18+15	19+25	21+50	24+00	26+00	28+00	29+40				
SUB LAYER	17																
Top of Layer Elevation (ft.)				2872.971	2911.1	2914.5	2945.3	2915.3	2912.3								
Bottom of Layer Elevation (ft.)				2863	2899.825	2903.125	2935.5	2904.0	2901.2								
Layer Midpoint Elevation (ft.)				2867.985	2905.463	2908.813	2940.4	2909.6	2906.8								
Initial Effective Stress (psf)				598.2	676.5	682.5	589.5	679.5	664.5								
Final Effective Stress (psf)				20161.8	22744.5	22942.5	19873.5	22843.5	22348.5								
Primary Settlement (ft.)				0.2	0.2	0.2	0.2	0.2	0.2								
Primary Settlement (in.)				2.0	2.3	2.3	1.9	2.3	2.2								
SUB LAYER	18																
Top of Layer Elevation (ft.)					2899.825	2903.125	2935.5	2904.0	2901.2								
Bottom of Layer Elevation (ft.)					2888.55	2891.75	2925.7	2892.7	2890.2								
Layer Midpoint Elevation (ft.)					2894.188	2897.438	2930.6	2898.3	2895.7								
Initial Effective Stress (psf)					676.5	682.5	589.5	679.5	664.5								
Final Effective Stress (psf)					24097.5	24307.5	21052.5	24202.5	23677.5								
Primary Settlement (ft.)					0.2	0.2	0.2	0.2	0.2								
Primary Settlement (in.)					2.3	2.4	2.0	2.3	2.3								
SUB LAYER	19																
Top of Layer Elevation (ft.)					2888.55	2891.75	2925.65	2892.7	2890.2								
Bottom of Layer Elevation (ft.)					2877.275	2880.375	2915.825	2881.3	2879.1								
Layer Midpoint Elevation (ft.)					2882.913	2886.063	2920.738	2887.0	2884.6								
Initial Effective Stress (psf)					676.5	682.5	589.5	679.5	664.5								
Final Effective Stress (psf)					25450.5	25672.5	22231.5	25561.5	25006.5								
Primary Settlement (ft.)					0.2	0.2	0.2	0.2	0.2								
Primary Settlement (in.)					2.4	2.4	2.0	2.4	2.3								
SUB LAYER	20																
Top of Layer Elevation (ft.)					2877.275	2880.375	2915.825	2881.3	2879.1								
Bottom of Layer Elevation (ft.)					2866	2869	2906	2870.0	2868.0								
Layer Midpoint Elevation (ft.)					2871.638	2874.688	2910.913	2875.7	2873.5								
Initial Effective Stress (psf)					676.5	682.5	589.5	679.5	664.5								
Final Effective Stress (psf)					26803.5	27037.5	23410.5	26920.5	26335.5								
Primary Settlement (ft.)					0.2	0.2	0.2	0.2	0.2								
Primary Settlement (in.)					2.4	2.4	2.0	2.4	2.4								
SETTLEMENT																	
Total Primary Settlement (in.)	0.0	6.8	15.4	24.3	35.4	35.8	29.9	35.6	34.7	22.6	14.3	7.7	0.0				
Total Secondary Settlement (in.)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Total Settlement (in.)	0.0	6.8	15.4	24.3	35.4	35.8	29.9	35.6	34.7	22.6	14.3	7.7	0.0				
Total Settlement (ft.)	0.0	0.6	1.3	2.0	3.0	3.0	2.5	3.0	2.9	1.9	1.2	0.6	0.0				

TABLE 4 FINAL COVER SETTLEMENT CALCULATIONS

Point	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12				
Station	7+00	8+35	10+50	12+50	14+75	17+00	18+15	19+25	21+50	24+00	26+00	28+00	29+40				
Linear Horizontal Distance (ft.)	700	835	1050	1250	1475	1700	1815	1925	2150	2400	2600	2800	2940				
Final Cover Elevation (ft.)	2900	2934	2988	3036	3095	3100	3106	3100	3093	3029	2980	2936	2900				
Final Cover Above Waste (ft.)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5				
Final Waste Elevation (ft.)	2896.5	2930.5	2984.5	3032.5	3091.5	3096.5	3102.5	3096.5	3089.5	3025.5	2976.5	2932.5	2896.5				
Top of Clay Liner (ft.)	2896.5	2859	2861	2863	2866	2869	2906	2870	2868	2864	2860	2856	2896.5				
Waste Thickness (ft.)	0.0	71.5	123.5	169.5	225.5	227.5	196.5	226.5	221.5	161.5	116.5	76.5	0.0				
Number of Layers	0	7	12	17	20	20	20	20	20	16	12	8	0				
Layer Thickness (ft.)	0	10	10	10	11	11	10	11	11	10	10	10	0				
Unit Weight of Final Cover (pcf)	120	120	120	120	120	120	120	120	120	120	120	120	120				
Unit Weight of Waste (pcf)	120	120	120	120	120	120	120	120	120	120	120	120	120				
Pre Consolidation Pressure (psf)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000				
Modified Primary Compression Index	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012				
Modified Recompression Index	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004				
Modified Secondary Compression Index	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
SUB LAYER	**1**																
Top of Layer Elevation (ft.)		2930.5	2984.5	3032.5	3091.5	3096.5	3102.5	3096.5	3089.5	3025.5	2976.5	2932.5					
Bottom of Layer Elevation (ft.)		2920.3	2974.2	3022.5	3080.2	3085.1	3092.7	3085.2	3078.4	3015.4	2966.8	2922.9					
Layer Midpoint Elevation (ft.)		2925.4	2979.4	3027.5	3085.9	3090.8	3097.6	3090.8	3084.0	3020.5	2971.6	2927.7					
Initial Effective Stress (psf)		612.9	617.5	598.2	676.5	682.5	589.5	679.5	664.5	605.6	582.5	573.8					
Final Effective Stress (psf)		1032.9	1037.5	1018.2	1096.5	1102.5	1009.5	1099.5	1084.5	1025.6	1002.5	993.8					
Primary Settlement (ft.)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
Primary Settlement (in.)		0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.1					
SUB LAYER	**2**																
Top of Layer Elevation (ft.)		2920.3	2974.2	3022.5	3080.2	3085.1	3092.7	3085.2	3078.4	3015.4	2966.8	2922.9					
Bottom of Layer Elevation (ft.)		2910.1	2963.9	3012.6	3069.0	3073.8	3082.9	3073.9	3067.4	3005.3	2957.1	2913.4					
Layer Midpoint Elevation (ft.)		2915.2	2969.1	3017.5	3074.6	3079.4	3087.8	3079.5	3072.9	3010.4	2961.9	2918.2					
Initial Effective Stress (psf)		1838.6	1852.5	1794.7	2029.5	2047.5	1768.5	2038.5	1993.5	1816.9	1747.5	1721.3					
Final Effective Stress (psf)		2258.6	2272.5	2214.7	2449.5	2467.5	2188.5	2458.5	2413.5	2236.9	2167.5	2141.3					
Primary Settlement (ft.)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
Primary Settlement (in.)		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1					
SUB LAYER	**3**																
Top of Layer Elevation (ft.)		2910.1	2963.9	3012.6	3069.0	3073.8	3082.9	3073.9	3067.4	3005.3	2957.1	2913.4					
Bottom of Layer Elevation (ft.)		2899.9	2953.6	3002.6	3057.7	3062.4	3073.0	3062.5	3056.3	2995.2	2947.4	2903.8					
Layer Midpoint Elevation (ft.)		2905.0	2958.8	3007.6	3063.3	3068.1	3077.9	3068.2	3061.8	3000.3	2952.2	2908.6					
Initial Effective Stress (psf)		3064.3	3087.5	2991.2	3382.5	3412.5	2947.5	3397.5	3322.5	3028.1	2912.5	2868.8					
Final Effective Stress (psf)		3484.3	3507.5	3411.2	3802.5	3832.5	3367.5	3817.5	3742.5	3448.1	3332.5	3288.8					
Primary Settlement (ft.)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
Primary Settlement (in.)		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1					

TABLE 4 FINAL COVER SETTLEMENT CALCULATIONS (CONTINUED)

Point	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12				
Station	7+00	8+35	10+50	12+50	14+75	17+00	18+15	19+25	21+50	24+00	26+00	28+00	29+40				
SUB LAYER	4																
Top of Layer Elevation (ft.)		2899.9	2953.6	3002.6	3057.7	3062.4	3073.0	3062.5	3056.3	2995.2	2947.4	2903.8					
Bottom of Layer Elevation (ft.)		2889.6	2943.3	2992.6	3046.4	3051.0	3063.2	3051.2	3045.2	2985.1	2937.7	2894.3					
Layer Midpoint Elevation (ft.)		2894.8	2948.5	2997.6	3052.0	3056.7	3068.1	3056.9	3050.7	2990.2	2942.5	2899.0					
Initial Effective Stress (psf)		4290.0	4322.5	4187.6	4735.5	4777.5	4126.5	4756.5	4651.5	4239.4	4077.5	4016.3					
Final Effective Stress (psf)		4710.0	4742.5	4607.6	5155.5	5197.5	4546.5	5176.5	5071.5	4659.4	4497.5	4436.3					
Primary Settlement (ft.)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
Primary Settlement (in.)		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1					
SUB LAYER	5																
Top of Layer Elevation (ft.)		2889.64	2943.3	2992.6	3046.4	3051.0	3063.2	3051.2	3045.2	2985.1	2937.7	2894.3					
Bottom of Layer Elevation (ft.)		2879.43	2933.0	2982.6	3035.1	3039.6	3053.4	3039.9	3034.1	2975.0	2928.0	2884.7					
Layer Midpoint Elevation (ft.)		2884.54	2938.2	2987.6	3040.8	3045.3	3058.3	3045.5	3039.7	2980.1	2932.8	2889.5					
Initial Effective Stress (psf)		5515.71	5557.5	5384.1	6088.5	6142.5	5305.5	6115.5	5980.5	5450.6	5242.5	5163.8					
Final Effective Stress (psf)		5935.71	5977.5	5804.1	6508.5	6562.5	5725.5	6535.5	6400.5	5870.6	5662.5	5583.8					
Primary Settlement (ft.)		0.00391	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
Primary Settlement (in.)		0.04688	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
SUB LAYER	6																
Top of Layer Elevation (ft.)		2879.43	2933.0	2982.6	3035.1	3039.6	3053.4	3039.9	3034.1	2975.0	2928.0	2884.7					
Bottom of Layer Elevation (ft.)		2869.21	2922.8	2972.7	3023.9	3028.3	3043.6	3028.6	3023.1	2964.9	2918.3	2875.1					
Layer Midpoint Elevation (ft.)		2874.32	2927.9	2977.7	3029.5	3033.9	3048.5	3034.2	3028.6	2970.0	2923.1	2879.9					
Initial Effective Stress (psf)		6741.43	6792.5	6580.6	7441.5	7507.5	6484.5	7474.5	7309.5	6661.9	6407.5	6311.3					
Final Effective Stress (psf)		7161.43	7212.5	7000.6	7861.5	7927.5	6904.5	7894.5	7729.5	7081.9	6827.5	6731.3					
Primary Settlement (ft.)		0.00322	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
Primary Settlement (in.)		0.03861	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
SUB LAYER	7																
Top of Layer Elevation (ft.)		2869.21	2922.8	2972.7	3023.9	3028.3	3043.6	3028.6	3023.1	2964.9	2918.3	2875.1					
Bottom of Layer Elevation (ft.)		2859	2912.5	2962.7	3012.6	3016.9	3033.7	3017.2	3012.0	2954.8	2908.5	2865.6					
Layer Midpoint Elevation (ft.)		2864.11	2917.6	2967.7	3018.2	3022.6	3038.6	3022.9	3017.5	2959.9	2913.4	2870.3					
Initial Effective Stress (psf)		7967.14	8027.5	7777.1	8794.5	8872.5	7663.5	8833.5	8638.5	7873.1	7572.5	7458.8					
Final Effective Stress (psf)		8387.14	8447.5	8197.1	9214.5	9292.5	8083.5	9253.5	9058.5	8293.1	7992.5	7878.8					
Primary Settlement (ft.)		0.00273	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
Primary Settlement (in.)		0.03282	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
SUB LAYER	8																
Top of Layer Elevation (ft.)			2912.5	2962.7	3012.6	3016.9	3033.7	3017.2	3012.0	2954.8	2908.5	2865.6					
Bottom of Layer Elevation (ft.)			2902.2	2952.7	3001.3	3005.5	3023.9	3005.9	3000.9	2944.8	2898.8	2856.0					
Layer Midpoint Elevation (ft.)			2907.3	2957.7	3006.9	3011.2	3028.8	3011.6	3006.4	2949.8	2903.7	2860.8					
Initial Effective Stress (psf)			9262.5	8973.5	10147.5	10237.5	8842.5	10192.5	9967.5	9084.4	8737.5	8606.3					
Final Effective Stress (psf)			9682.5	9393.5	10567.5	10657.5	9262.5	10612.5	10387.5	9504.4	9157.5	9026.3					
Primary Settlement (ft.)			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					
Primary Settlement (in.)			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0					

TABLE 4 FINAL COVER SETTLEMENT CALCULATIONS (CONTINUED)

Point	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12				
Station	7+00	8+35	10+50	12+50	14+75	17+00	18+15	19+25	21+50	24+00	26+00	28+00	29+40				
SUB LAYER	**9**																
Top of Layer Elevation (ft.)			2902.167	2952.7	3001.3	3005.5	3023.9	3005.9	3000.9	2944.8	2898.8						
Bottom of Layer Elevation (ft.)			2891.875	2942.8	2990.0	2994.1	3014.1	2994.6	2989.8	2934.7	2889.1						
Layer Midpoint Elevation (ft.)			2897.021	2947.8	2995.7	2999.8	3019.0	3000.2	2995.4	2939.7	2894.0						
Initial Effective Stress (psf)			10497.5	10170.0	11500.5	11602.5	10021.5	11551.5	11296.5	10295.6	9902.5						
Final Effective Stress (psf)			10917.5	10590.0	11920.5	12022.5	10441.5	11971.5	11716.5	10715.6	10322.5						
Primary Settlement (ft.)			0.002104	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
Primary Settlement (in.)			0.025249	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
SUB LAYER	**10**																
Top of Layer Elevation (ft.)			2891.875	2942.8	2990.0	2994.1	3014.1	2994.6	2989.8	2934.7	2889.1						
Bottom of Layer Elevation (ft.)			2881.583	2932.8	2978.8	2982.8	3004.3	2983.3	2978.8	2924.6	2879.4						
Layer Midpoint Elevation (ft.)			2886.729	2937.8	2984.4	2988.4	3009.2	2988.9	2984.3	2929.6	2884.3						
Initial Effective Stress (psf)			11732.5	11366.5	12853.5	12967.5	11200.5	12910.5	12625.5	11506.9	11067.5						
Final Effective Stress (psf)			12152.5	11786.5	13273.5	13387.5	11620.5	13330.5	13045.5	11926.9	11487.5						
Primary Settlement (ft.)			0.001886	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
Primary Settlement (in.)			0.022638	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
SUB LAYER	**11**																
Top of Layer Elevation (ft.)			2881.583	2932.8	2978.8	2982.8	3004.3	2983.3	2978.8	2924.6	2879.4						
Bottom of Layer Elevation (ft.)			2871.292	2922.8	2967.5	2971.4	2994.4	2971.9	2967.7	2914.5	2869.7						
Layer Midpoint Elevation (ft.)			2876.438	2927.8	2973.1	2977.1	2999.3	2977.6	2973.2	2919.5	2874.6						
Initial Effective Stress (psf)			12967.5	12562.9	14206.5	14332.5	12379.5	14269.5	13954.5	12718.1	12232.5						
Final Effective Stress (psf)			13387.5	12982.9	14626.5	14752.5	12799.5	14689.5	14374.5	13138.1	12652.5						
Primary Settlement (ft.)			0.00171	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
Primary Settlement (in.)			0.020516	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
SUB LAYER	**12**																
Top of Layer Elevation (ft.)			2871.292	2922.824	2967.5	2971.4	2994.4	2971.9	2967.7	2914.5	2869.7						
Bottom of Layer Elevation (ft.)			2861	2912.853	2956.2	2960.0	2984.6	2960.6	2956.6	2904.4	2860.0						
Layer Midpoint Elevation (ft.)			2866.146	2917.838	2961.8	2965.7	2989.5	2966.3	2962.1	2909.4	2864.9						
Initial Effective Stress (psf)			14202.5	13759.41	15559.5	15697.5	13558.5	15628.5	15283.5	13929.4	13397.5						
Final Effective Stress (psf)			14622.5	14179.41	15979.5	16117.5	13978.5	16048.5	15703.5	14349.4	13817.5						
Primary Settlement (ft.)			0.001563	0.001562	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
Primary Settlement (in.)			0.018757	0.018749	0.0	0.0	0.0	0.0	0.0	0.0	0.0						
SUB LAYER	**13**																
Top of Layer Elevation (ft.)				2912.853	2956.2	2960.0	2984.6	2960.6	2956.6	2904.4							
Bottom of Layer Elevation (ft.)				2902.882	2944.9	2948.6	2974.8	2949.3	2945.5	2894.3							
Layer Midpoint Elevation (ft.)				2907.868	2950.6	2954.3	2979.7	2954.9	2951.1	2899.3							
Initial Effective Stress (psf)				14955.88	16912.5	17062.5	14737.5	16987.5	16612.5	15140.6							
Final Effective Stress (psf)				15375.88	17332.5	17482.5	15157.5	17407.5	17032.5	15560.6							
Primary Settlement (ft.)				0.001439	0.0	0.0	0.0	0.0	0.0	0.0							
Primary Settlement (in.)				0.017269	0.0	0.0	0.0	0.0	0.0	0.0							
SUB LAYER	**14**																
Top of Layer Elevation (ft.)				2902.882	2944.9	2948.6	2974.8	2949.3	2945.5	2894.3							
Bottom of Layer Elevation (ft.)				2892.912	2933.7	2937.3	2965.0	2938.0	2934.5	2884.2							
Layer Midpoint Elevation (ft.)				2897.897	2939.3	2942.9	2969.9	2943.6	2940.0	2889.2							
Initial Effective Stress (psf)				16152.35	18265.5	18427.5	15916.5	18346.5	17941.5	16351.9							
Final Effective Stress (psf)				16572.35	18685.5	18847.5	16336.5	18766.5	18361.5	16771.9							
Primary Settlement (ft.)				0.001334	0.0	0.0	0.0	0.0	0.0	0.0							
Primary Settlement (in.)				0.016006	0.0	0.0	0.0	0.0	0.0	0.0							

TABLE 4 FINAL COVER SETTLEMENT CALCULATIONS (CONTINUED)

Point	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12				
Station	7+00	8+35	10+50	12+50	14+75	17+00	18+15	19+25	21+50	24+00	26+00	28+00	29+40				
SUB LAYER	15																
Top of Layer Elevation (ft.)				2892.912	2933.7	2937.3	2965.0	2938.0	2934.5	2884.2							
Bottom of Layer Elevation (ft.)				2882.941	2922.4	2925.9	2955.1	2926.6	2923.4	2874.1							
Layer Midpoint Elevation (ft.)				2887.926	2928.0	2931.6	2960.0	2932.3	2928.9	2879.1							
Initial Effective Stress (psf)				17348.82	19618.5	19792.5	17095.5	19705.5	19270.5	17563.1							
Final Effective Stress (psf)				17768.82	20038.5	20212.5	17515.5	20125.5	19690.5	17983.1							
Primary Settlement (ft.)				0.001243	0.0	0.0	0.0	0.0	0.0	0.0							
Primary Settlement (in.)				0.014916	0.0	0.0	0.0	0.0	0.0	0.0							
SUB LAYER	16																
Top of Layer Elevation (ft.)				2882.941	2922.375	2925.875	2955.1	2926.6	2923.4	2874.1							
Bottom of Layer Elevation (ft.)				2872.971	2911.1	2914.5	2945.3	2915.3	2912.3	2864.0							
Layer Midpoint Elevation (ft.)				2877.956	2916.738	2920.188	2950.2	2921.0	2917.8	2869.0							
Initial Effective Stress (psf)				18545.29	20971.5	21157.5	18274.5	21064.5	20599.5	18774.4							
Final Effective Stress (psf)				18965.29	21391.5	21577.5	18694.5	21484.5	21019.5	19194.4							
Primary Settlement (ft.)				0.001164	0.001165	0.001165	0.0	0.0	0.0	0.0							
Primary Settlement (in.)				0.013964	0.013982	0.013983	0.0	0.0	0.0	0.0							
SUB LAYER	17																
Top of Layer Elevation (ft.)				2872.971	2911.1	2914.5	2945.3	2915.3	2912.3								
Bottom of Layer Elevation (ft.)				2863	2899.825	2903.125	2935.5	2904.0	2901.2								
Layer Midpoint Elevation (ft.)				2867.985	2905.463	2908.813	2940.4	2909.6	2906.8								
Initial Effective Stress (psf)				19741.76	22324.5	22522.5	19453.5	22423.5	21928.5								
Final Effective Stress (psf)				20161.76	22744.5	22942.5	19873.5	22843.5	22348.5								
Primary Settlement (ft.)				0.001094	0.001095	0.001095	0.0	0.0	0.0								
Primary Settlement (in.)				0.013127	0.013142	0.013144	0.0	0.0	0.0								
SUB LAYER	18																
Top of Layer Elevation (ft.)					2899.825	2903.125	2935.5	2904.0	2901.2								
Bottom of Layer Elevation (ft.)					2888.55	2891.75	2925.7	2892.7	2890.2								
Layer Midpoint Elevation (ft.)					2894.188	2897.438	2930.6	2898.3	2895.7								
Initial Effective Stress (psf)					23677.5	23887.5	20632.5	23782.5	23257.5								
Final Effective Stress (psf)					24097.5	24307.5	21052.5	24202.5	23677.5								
Primary Settlement (ft.)					0.001033	0.001033	0.0	0.0	0.0								
Primary Settlement (in.)					0.012398	0.012399	0.0	0.0	0.0								
SUB LAYER	19																
Top of Layer Elevation (ft.)					2888.55	2891.75	2925.65	2892.7	2890.2								
Bottom of Layer Elevation (ft.)					2877.275	2880.375	2915.825	2881.3	2879.1								
Layer Midpoint Elevation (ft.)					2882.913	2886.063	2920.738	2887.0	2884.6								
Initial Effective Stress (psf)					25030.5	25252.5	21811.5	25141.5	24586.5								
Final Effective Stress (psf)					25450.5	25672.5	22231.5	25561.5	25006.5								
Primary Settlement (ft.)					0.000978	0.000978	0.000977	0.0	0.0								
Primary Settlement (in.)					0.011733	0.011734	0.011719	0.0	0.0								

TABLE 4 FINAL COVER SETTLEMENT CALCULATIONS (CONTINUED)

Point	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12				
Station	7+00	8+35	10+50	12+50	14+75	17+00	18+15	19+25	21+50	24+00	26+00	28+00	29+40				
SUB LAYER	**20**																
Top of Layer Elevation (ft.)					2877.275	2880.375	2915.825	2881.3	2879.1								
Bottom of Layer Elevation (ft.)					2866	2869	2906	2870.0	2868.0								
Layer Midpoint Elevation (ft.)					2871.638	2874.688	2910.913	2875.7	2873.5								
Initial Effective Stress (psf)					26383.5	26617.5	22990.5	26500.5	25915.5								
Final Effective Stress (psf)					26803.5	27037.5	23410.5	26920.5	26335.5								
Primary Settlement (ft.)					0.000928	0.000928	0.000927	0.0	0.0								
Primary Settlement (in.)					0.011136	0.011137	0.011124	0.0	0.0								
SETTLEMENT																	
Total Primary Settlement (in.)	0.0	0.5	0.6	0.7	0.8	0.8	0.7	0.8	0.8	0.7	0.6	0.5	0.0				
Total Secondary Settlement (in.)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Total Settlement (in.)	0.0	0.5	0.6	0.7	0.8	0.8	0.7	0.8	0.8	0.7	0.6	0.5	0.0				
Total Settlement (ft.)	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0				
Differential Settlement (ft.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
GRADES AND STRAINS																	
Final Waste Elevation Prior to Settlement (ft.)	2896.5	2930.5	2984.5	3032.5	3091.5	3096.5	3102.5	3096.5	3089.5	3025.5	2976.5	2932.5	2896.5				
Final Waste Elevation After settlement (ft.)	2896.5	2930.5	2984.4	3032.4	3091.4	3096.4	3102.4	3096.4	3089.4	3025.4	2976.4	2932.5	2896.5				
Initial Final Cover GeoMembrane Segment Length (ft.)	0.0	139.2	221.7	205.7	232.6	225.1	115.2	110.2	225.1	258.1	205.9	204.8	144.6				
PostSettlement Final Cover GeoMemberane Segment	0.0	139.2	221.7	205.7	232.6	225.1	115.2	110.2	225.1	258.1	205.9	204.8	144.5				
Strain (+ Compression/- Tension)		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%				
PreSettlement Slope (+ up/- down)		25.2%	25.1%	24.0%	26.2%	2.2%	5.2%	-5.5%	-3.1%	-25.6%	-24.5%	-22.0%	-25.7%				
Post Settlement Slope (+ up/- down)		25.2%	25.1%	24.0%	26.2%	2.2%	5.2%	-5.5%	-3.1%	-25.6%	-24.5%	-22.0%	-25.7%				
Grade Change (+ Steeper/- Milder)		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%				

Attachment E2

Liner Stress Due to Equipment Loads

South Ranch Surface Waste Management Facility
PROJECT: Tensile Stresses in Geosynthetics due to Equipment Loads

JOB NO.: 35187378 **DATE:** October 2019 **COMP. BY:** MPB

CALCULATIONS BY:

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Terracon Consultants, Inc.
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Bryant, Arkansas 72022
(501) 847-9292

PURPOSE

In this calculation, tensile stresses exerted onto the base liner system by operational equipment is evaluated. This evaluation considers the worst case tensile stress condition to be exerted onto the uppermost geosynthetic layer, 200-mil geocomposite leachate drainage layer just below the 2-foot protective cover layer. This condition considers the during protective cover placement on the side slope walls. Once waste material begins being filled into a cell the tensile stresses on the geosynthetics becomes less. Stress below the uppermost geosynthetic will be distributed. In this scenario, a Caterpillar 657 scraper or equivalent is used to place protective soil layer up the side slope at a constant speed and a sufficient distance to accommodate an approximate 10-foot lift of waste placed on the landfill floor, or an unsupported slope (3:1) length of ~70-feet. Although it is highly unlikely and not recommended to allow scrapers on a slope for any reason due to its immense size and weight, it is being used to demonstrate a very conservative worst-case condition of liner performance.

METHOD OF ANALYSIS

Assumptions:

- Unit weight of protective soil = 120 lbs/ft^3 dry density
    - h_{lift} = 2 feet
    - Distribution Distance 70-ft
        - Unit Weight Distribution = W_s = 120 lbs/ft^3 x 2ft x 70 ft = 16,800 lb/ft

- Internal friction angle of protective soil = B = 23°

- Slope Angle = A = 18° (3:1)

- Equipment loading assuming a fully loaded Standard Tandem 657 Scraper:
    - Governing Front Axle Weight = 128,246 lbs (published by CAT)
    - Distributed weight per tire = 64,123 lbs

PROJECT: South Ranch Surface Waste Management Facility
Tensile Stresses in Geosynthetics due to Equipment Loads

JOB NO.: 35187378 **DATE:** October 2019 **COMP. BY:** MPB

  - Tire width = 36 in = 3 feet
    - Unit Weight Distribution = W_b = 64,123 lbs / 3 ft = 23,374 lb/ft

- Tensile forces acting on geomembrane = $F_{soil} + F_{scraper}$:
  - Protective soil layer, F_{soil}
  - 657 scraper, $F_{scraper}$

- Total resisting forces = $F_{geomembrane}$
  - Geomembrane interface friction, $F_{geomembrane}$

Tensile forces acting on geomembrane:

F_{soil} = h_{lift} (2) x (unit weight of protective soil) x (sin(slope angle))

F_{soil} = (2 ft) x (70 ft) x (120 lbs/ft^3) (sin(18°))

F_{soil} = 5,191 lbs/ft

$F_{Scraper}$ = [(scraperweight) / (width acting on geocomposite)] (sin(18°))

$F_{Scraper}$ = [(64,123lbs) / 3 ft] (sin(18°))

$F_{Scraper}$ = 6,605 lbs/ft

Total tensile force acting on geomembrane due to equipment and soil:

$F_{tensile}$= 5,191 lbs/ft + 1390 lbs/ft

$F_{membrane}$= 11,796 lbs/ft

Total resisting forces acting due to friction from geomembrane:

F_{resist} = (weight of protective soil + weight of scraper) (cos(slope angle)) (tan(interface friction angle))

PROJECT: South Ranch Surface Waste Management Facility
Tensile Stresses in Geosynthetics due to Equipment Loads

JOB NO.: 35187378 **DATE:** October 2019 **COMP. BY:** MPB

F_{resist} = [(2 ft)(70 ft)(120 lbs/ft3) + (64,123 lbs / 3 ft)] (cos 18°) (tan 23°)

F_{resist} = [(16,800 lb/ft) + (21,374 lbs/ft)] (cos 18°) (tan 21°)

F_{resist} = 13,936 lbs/ft

To summarize,

tensile force acting on the liner = 11,796 lbs/ft
resisting force acting on the liner = 13,936 lbs/ft.

See Diagram 1 below which represents the various forces acting on the liner in this scenario:

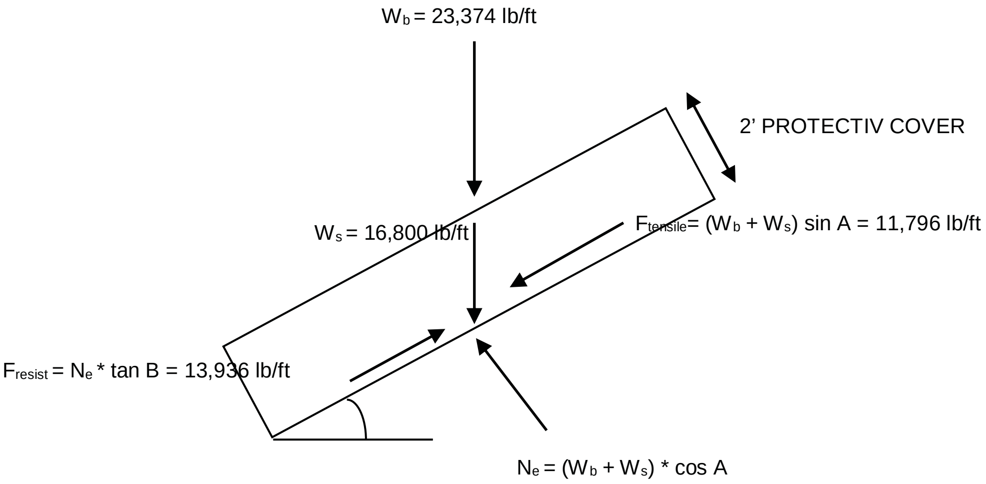


DIAGRAM 1. TENSILE FORCE DIAGRAM

As the resisting forces are greater than the tensile forces this indicates that the friction strength from the geomembrane is sufficient to counter tensile forces from the soil and equipment with a factor of safety of 1.2.

PROJECT: South Ranch Surface Waste Management Facility
Tensile Stresses in Geosynthetics due to Equipment Loads

JOB NO.: 35187378 **DATE:** October 2019 **COMP. BY:** MPB

Reference:

Sangeeta, Lewis P., and Hari D. Sharma, Waste Containment Systems, Waste Stabilization and Landfills: Design and Evaluation. New York: John Wiley and Sons. 1994. Print.

Gray, Donald, Robert M. Koerner, and Xian Quede, Geotechnical Aspects of Landfill Design and Construction. New York: Prentice Hall, 2002. Print.

Attachment E3

Anchor Trench Pullout

Made By:	MPB	Date:	17-May	Sheet No.:	1 of 2
Checked By:	FOC	Date:	17-May	Job No.:	35187378
Calculations for:	Anchor Trench Stability Analysis				
	SOUTH RANCH LANDFILL				

Objective:

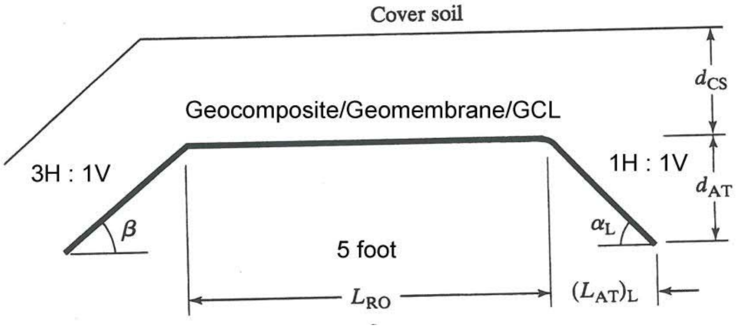
Determine the ability of the anchor trench to resist the weight of the geosynthetic components and to verify that the material will pull out of the anchor trench prior to geomembrane failure.

Assumptions:

- the anchor trench will have a 2 foot runout length
- anchor trench will be 2 foot deep
- the interior slope will be 3H : 1V or flatter
- the exterior slope will be 1H : 1V or flatter
- the deepest slope is approximately 62 foot deep (Phase 1, Cell E3)
- the composite liner system of future cells will consist of in-situ subgrade, a geosynthetic clay liner (GCL), a 60 mil HDPE geomembrane that is textured on both sides, a geocomposite with textile bonded on both sides, 60-mil HDPE geomembrane that is textured on both sides, a geocomposite with textile bonded on both sides, and a 2-foot soil protection layer.

Approach:

Calculations were performed in accordance with the procedures outline in the textbook "Geotechnical Aspects of Landfill Design and Construction" by Xued Qian, Robert Koerner, and Donald Gray, 2002, pp. 104-119.



Equation

$$T = \frac{\gamma_s \cdot d_{CS} \cdot L_{RO} \cdot \tan\delta_C + \gamma_s \cdot (d_{CS} + 0.5 \cdot d_{AT}) \cdot d_{AT} \cdot (\tan\delta_C + \tan\delta_F) \cdot (\cot\alpha_L + \cot\alpha_R)}{\cos\beta - \sin\beta \cdot \tan\delta_C}$$

T = geomembrane tensile force (i.e, anchor trench resistance force)
γ_s = unit weight of the cover and the backfill soil
d_{CS} = depth of cover soil
L_{RO} = runout length
$\tan\delta_C$ = tangent of the friction angle between the geosynthetic layers and the underlying soil
d_{AT} = anchor trench depth
$\tan\delta_F$ = tangent of the friction angle between the geosynthetic layers and the backfill soil
$\cot\alpha_L$ = cotangent of the left bottom angle of V-shaped anchor trench
$\cot\alpha_R$ = cotangent of the right bottom angle of V-shaped anchor trench
$\cos\beta$ = cosine of the sideslope angle
$\sin\beta$ = sine of the sideslope angle
L_t = Liner thickness

Terracon

Made By: MPB	Date: 19-Apr	Sheet No.: 2 of 2
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Calculations for: Anchor Trench Stability Analysis

SOUTH RANCH LANDFILL

γ_s = 120 pcf
d_{CS} = 2 foot
L_{RO} = 2 foot
$\tan\delta_C$ = Tan (18^o) = 0.3249
d_{AT} = 2.0 foot
$\tan\delta_F$ = Tan (18^o) = 0.3249
$\cot\alpha_L$ = cot (45^o) = 1
$\cot\alpha_R$ = Assume 0 to be conservative 0
$\cos\beta$ = cos (18.4^o) = 0.9489
$\sin\beta$ = sine (18.4^o) = 0.3156
L_t = 0.06 inches

Calculations:

$$T = \frac{\gamma_s \cdot d_{CS} \cdot L_{RO} \cdot \tan\delta_C + \gamma_s \cdot (d_{CS} + 0.5 \cdot d_{AT}) \cdot d_{AT} \cdot (\tan\delta_C + \tan\delta_F) \cdot (\cot\alpha_L + \cot\alpha_R)}{\cos\beta - \sin\beta \cdot \tan\delta_C}$$

T = 737.0 lb./ft.

T = 1023.7 lb./in.^{2}

Ultimate Strength (lb./in.^{2})	>	Anchor Trench Resistance Capacity (lb./in.^{2})	>	Allowable Strength (lb./in.^{2})
2100		1023.7		840

Note:
The ultimate strength is based off of material properties for standard 60 mil HDPE material. The allowable strength was calculated by dividing the ultimate strength by a 2.5 safety factor.

Summary

The results of the calculations indicate that the design anchor resistance capacity between the yield stress and the allowable stress of the geosynthetic layer system. Therefore, the anchor trench dimensions are acceptable. This assumes that the protective cover is being properly placed on the slopes using low groundpressure equipment and the equipment is backfilling up the slope.

Attachment E4

Geocomposite Compression and Hydraulic Performance

PROJECT: South Ranch Surface Waste Management Facility
Geocomposite Performance Under Overburden Compression

JOB NO.: 35187378 **DATE:** October 2019 **COMP. BY:** MPB

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PURPOSE

In this calculation, the compression under the waste overburden and the resulting transmissivity of the geocomposite leachate drainage and leak detection layers are evaluated. A 200-mil geonet composite will be used in the base liner system for both leachate collection and leak detection. The site's leachate collection was modeled using the HELP Model in Attachment D of Appendix J of the Facility Permit Application. The HELP Model uses a hydraulic conductivity of 10 cm/sec for the estimated geocomposite flow rate. The geocomposite will compress under the immense weight of the overlying waste.

METHOD OF ANALYSIS

Assumptions:

- 200-mil geonet or 0.2 inches thick
- Unit weight of waste y_w = 74 pcf, assuming a nominal operational density of 2000 lb/cubic yard
- Unit weight of soil y_s = 120 pcf
- Maximum height of waste over geocomposite = 235 feet, assume 2' protective cover, and 5' final cover soils
- 50% compressibility at 20,000 psf

<u>Thickness (t)</u>

$t_o = t_i + (t_c – t_i)((P_o-P_i)/(P_t-P_i))$

Where:

to = thickness after loading
tc = thickness of geonet at 20,000 psf = 0.1 inch
t_i = initial thickness = 0.2 inch
P_O = loading on geocomposite
= (235 ft)(74 pcf)+(7ft)(120 pcf) = 18,230 lbs/ft2
P_i = initial loading
P_t = total compressibility

$t_o = t_i + (t_c – t_i)((P_o-P_i)/(P_t-P_i))$

t_o = 0.2 + (0.1 – 0.2)*((18,230 – 0) / (20,000 – 0))

t_o = 0.11 inch or 0.28 cm

A factor of safety was assumed to be 1.5 to account for geotextile intrusion, creep deformation, chemical clogging, and biological clogging.

Transmissivity (T)

T_{FS} = T/FS

Where:

T_{FS} = transmissivity with factor of safety (m^2/s)

T = transmissivity of geocomposite (m^2/s), *$1x10^{-4}$ m^2/s as published by GSE for 200-mil FabriNet*

FS = 1.5

T_{FS} = ($1x10^{-4}$ m^2/s) / (1.5)

T_{FS} = $6.67x10^{-5}$ m^2/s or .667 $cm^{2/}s$

Applying the estimated compressed thickness from above to the geocomposite's transmissivity, a new hydraulic conductivity valve is calculated.

K = TFS / t

K = (.667 $cm^{2/}s$) / (0.28 cm)

K = 2.38 cm/s

Summary

NMAC 19.15.36.14.C(3) requires that the leak detection layer have a minimum hydraulic conductivity of $1x10^{-5}$ cm/s and NMAC 19.15.36.14.C(3) requires that the leachate collection and recovery system have a minimum hydraulic conductivity of $1x10^{-2}$ cm/s. Therefore even under full height waste compression, the proposed 200-mil geocomposite alternative layers will have hydraulic conductivity of 2.38 cm/s far exceeding the required minimum performance criteria. To be conservative, the HELP modeling provided in **Attachment D of Appendix J of the Facility Permit Application** has assumed a hydraulic conductivity of 1 cm/s for the geocomposite components of the base liner system.

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Geocomposite Performance Under Overburden Compression

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Reference:

Bachus, Robert, Mengjia Li, Dhani Narejo, Richard Thiel, and Te-Yang Soong, GSE Drainage Design Manual. GSE Environmental, June 2007. Web. 3 May 2016. <https://www.gseworld.com/content/documents/product-sheets/Drainage_Design_Manual.pdf>