Prepared for Applicant:

Waste Management of Texas, Inc.
1000 Kohlenberg Lane
P.O. Box 311657
New Braunfels, Texas 78130
(830) 625-7894

PERMIT AMENDMENT APPLICATION
PARTS I AND II

MESQUITE CREEK LANDFILL
NEW BRAUNFELS,
COMAL AND GUADALUPE COUNTIES, TEXAS
MSW PERMIT NO. 66B

Prepared by:

Geosyntec consultants
Texas Board of Professional Engineers Firm Registration No. F-1182
8217 Shoal Creek Blvd, Suite 200
Austin, Texas 78757
(512) 451-4003

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED
PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

Initial Application Submittal – 18 November 2005
Response to NOD 1 – 28 March 2006
Response to NOD 2 – 15 May 2006
Supplemental Information – 3 July 2006
Technically Complete – 14 July 2006
Revised – 24 February 2021

TABLE OF CONTENTS

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED
PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
Texas Board of Professional Engineers
Firm Registration No. F-1182

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED
PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
Texas Board of Professional Engineers
Firm Registration No. F-1182

TABLES

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED
PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
Texas Board of Professional Engineers
Firm Registration No. F-1182

FIGURES

APPENDICES

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED
PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
Texas Board of Professional Engineers
Firm Registration No. F-1182

1.2 Proposed Amendment

Permit Amendment Application No. MSW-66B (this application) has been prepared to laterally expand the facility southward, as described below. This proposed lateral expansion will extend the facility permit boundary to into Guadalupe County, as shown on Figures I/II-1 and I/II-2.

This application does not propose to change the facility's currently permitted maximum vertical elevation of 798 feet above mean sea level (ft, MSL). The vertical height of the lateral expansion will be 790 ft, MSL, and thus is lower than the maximum permitted height of the current landfill. The expansion will provide approximately 13,963,090 yd^3 of additional landfill capacity, for a total maximum landfill waste inventory of 20,190,090 yd^3. The permit boundary of the facility will be increased from 96.07 acres to 244.12 acres by incorporating approximately 148.05 acres of additional property located south of the currently permitted area (Figure I/II-2). Approximately 84.9 acres will be designated for disposal in the expansion area (Figure I/II-3), resulting in a total area of 157.2 acres of waste disposal footprint at the facility. The remaining acreage will be used for buffer zones, perimeter access roads, scales, office buildings, storm-water management features, miscellaneous equipment/supplies storage, and soil stockpiles. Details of the landfill design layout are provided in Part III – Site Development Plan of this application (see Part III, Attachment 1, Site Layout Plans).

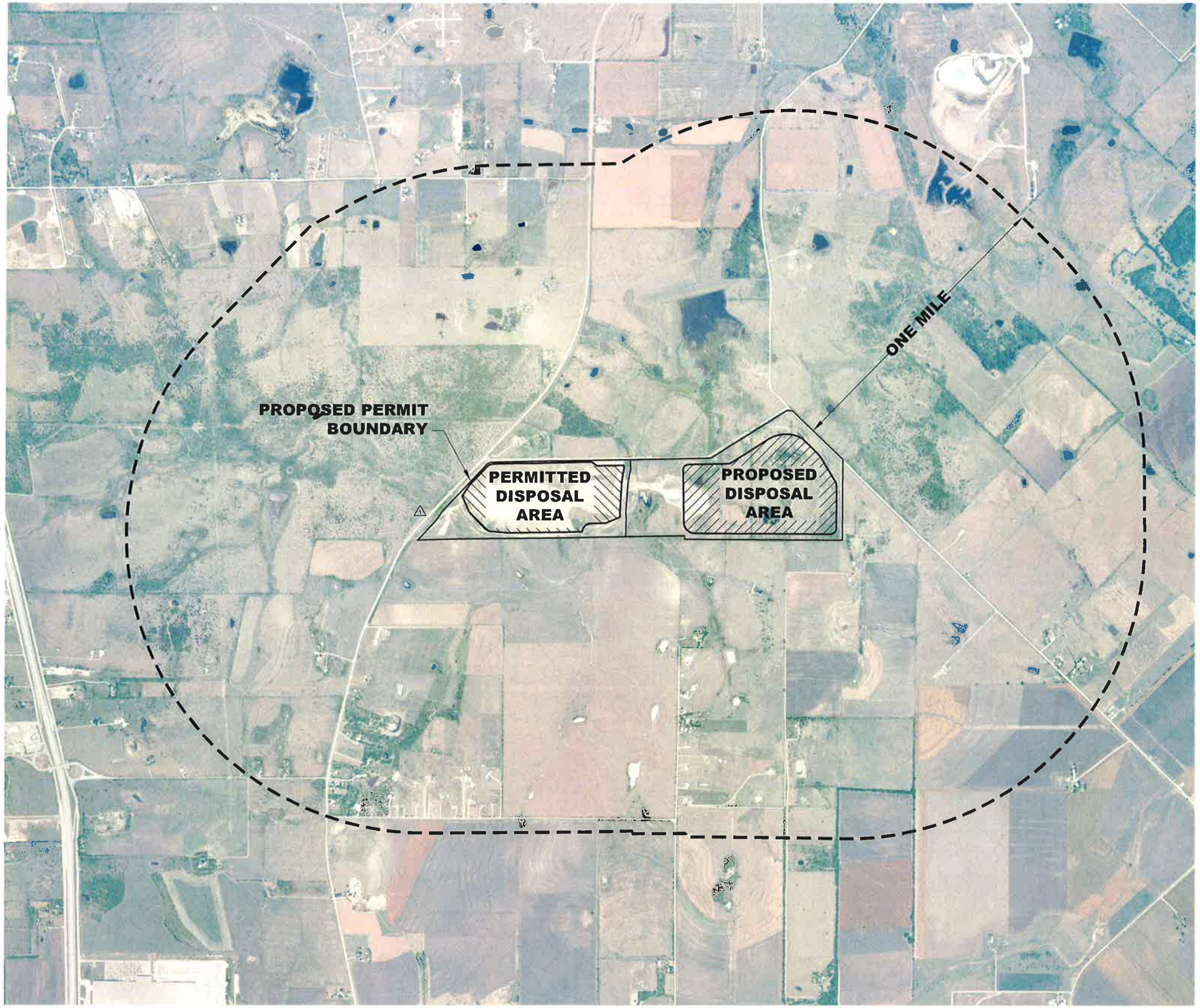
1.3 Report Organization

This report contains Parts I and II of Permit Amendment Application No. MSW-66B. These parts of the application present the technical information required to address the existing conditions and character of the site and surrounding land, general land use, authorization, appointments, and financial and competency demonstrations in accordance with 30 TAC §330.51 to §330.53. As discussed in this report, no site-specific conditions that require special design considerations have been identified.

The remainder of this report is organized as follows:

- information on waste disposal at the facility is presented in Section 2;
- land use in the vicinity of the facility is discussed in Section 3;
- the potential impact of the expansion on transportation in the vicinity of the facility is discussed in Section 4;
- a geology and soils statement for the facility is presented in Section 5;
- a ground and surface-water statement for the facility is presented in Section 6;
- a floodplains and wetland statement for the facility is presented in Section 7;

FIGURES



1000 500 0 1000 2000
SCALE IN FEET

MAP SOURCE: AERIAL PHOTOGRAPH TAKEN ON 05 MAY 2004 BY SAM SURVEYING INC.

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED
PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

MARK	DATE	REVISION	BY	APPROVED
1	02/24/2021	ELIMINATE UNIT 3	JJV	SMG
–	07/14/2006	TECHNICALLY COMPLETE	SMG	SMG
–	11/18/2005	INITIAL SUBMITTAL TO TCEQ	SMG	SMG

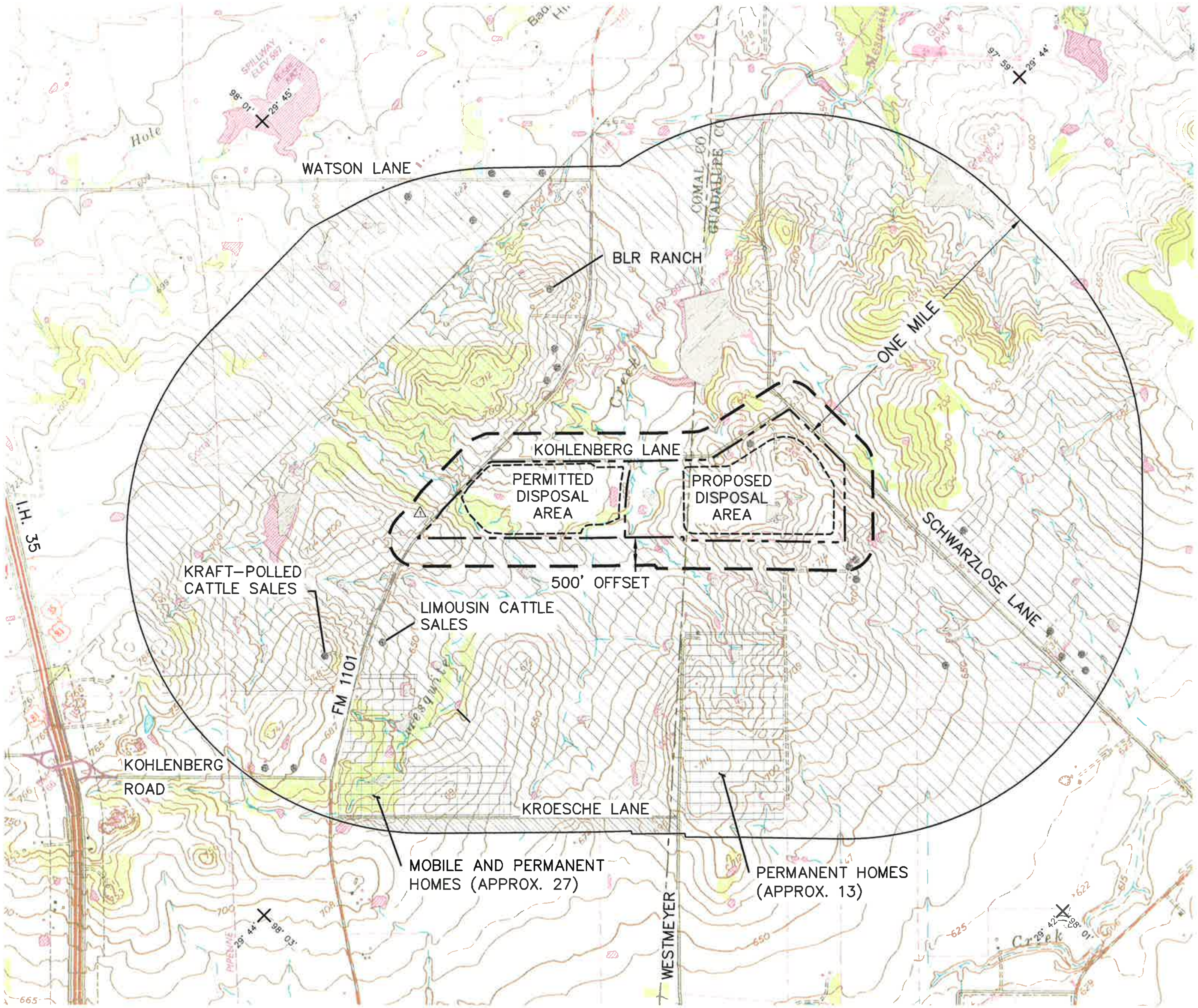
OWNER / SITE ADDRESS:
WASTE MANAGEMENT OF TEXAS, INC.
1000 KOHLENBERG LANE
P.O. BOX 311657
NEW BRAUNFELS, TEXAS 78130
(830) 685-7894

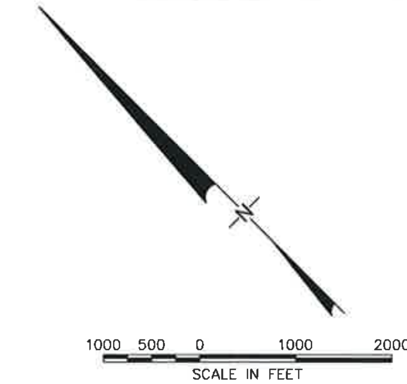
ENGINEER:
Geosyntec consultants
GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NO. 1182
8217 SHOAL CREEK BLVD., SUITE 200
AUSTIN, TEXAS 78757
(512) 451-4003

PROJECT: MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

TITLE: AERIAL PHOTOGRAPH

PROJECT NO.: GT3435-03	DRAWN BY: JJV	REVIEWED BY: BAG	PART NO.	FIGURE NO:
FILE NO.: 3435F003	CHECKED BY: SMG	APPROVED BY: SMG	I / II	3





LEGEND

- PROPERTY BOUNDARY (PERMIT BOUNDARY)
- LIMIT OF WASTE
- SURFACE WATER POND FROM AERIAL PHOTOGRAPH
- AGRICULTURAL
- RESIDENTIAL (MULTIPLE RESIDENCES)
- RESIDENCE

ROAD CLASSIFICATION

- Primary highway, hard surface
- Light-duty road, hard or improved surface
- Secondary highway, hard surface
- Unimproved road
- Interstate Route
- U S Route
- State Route

NOTES:

1. THERE ARE NO SCHOOLS, LICENSED DAY CARE FACILITIES, CHURCHES, HOSPITALS, CEMETERIES, OR DESIGNATED RECREATION AREAS LOCATED WITHIN ONE MILE OF THE SITE.
2. THERE ARE NO ARCHEOLOGICAL SITES, HISTORICAL SITES, OR SITES WITH EXCEPTIONAL QUALITIES ADJACENT TO THE SITE.
3. FOR CLARITY, EASEMENTS ARE SHOWN SEPARATELY ON FIGURE I / II–4.
4. THE SITE AND SURROUNDING AREAS ARE LOCATED IN AN UNZONED AREA WITHIN THE EXTRA–TERRITORIAL JURISDICTION OF NEW BRAUNFELS.
5. THE PROPOSED FACILITY IS MUNICIPAL SOLID WASTE LANDFILL AND HAS NO INTAKE OR DISCHARGE STRUCTURES.
6. LAND USE INFORMATION TAKEN FROM AERIAL PHOTOGRAPHY (MAY 2004), FIELD INSPECTION (JANUARY 2005), AND USGS QUADRANGLES.
7. MAP SOURCE: UNITED STATES DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY, 7 1/2 MINUTE SERIES QUADRANGLE (TOPOGRAPHIC) MAPS OF:
   NEW BRAUNFELS EAST, TEX. DATED 1958 REVISED 1994
   SAN MARCOS SOUTH, TEX. DATED 1964 REVISED 1994
   HUNTER, TEX. DATED 1964 REVISED 1994
   GERONIMO, TEX. DATED 1964 REVISED 1994

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

MARK	DATE	REVISION	BY	APPROVED
1	02/24/2021	ELIMINATE UNIT 3	SMG	SMG
–	07/14/2006	TECHNICALLY COMPLETE	SMG	SMG
–	11/18/2005	INITIAL SUBMITTAL TO TCEQ	SMG	SMG

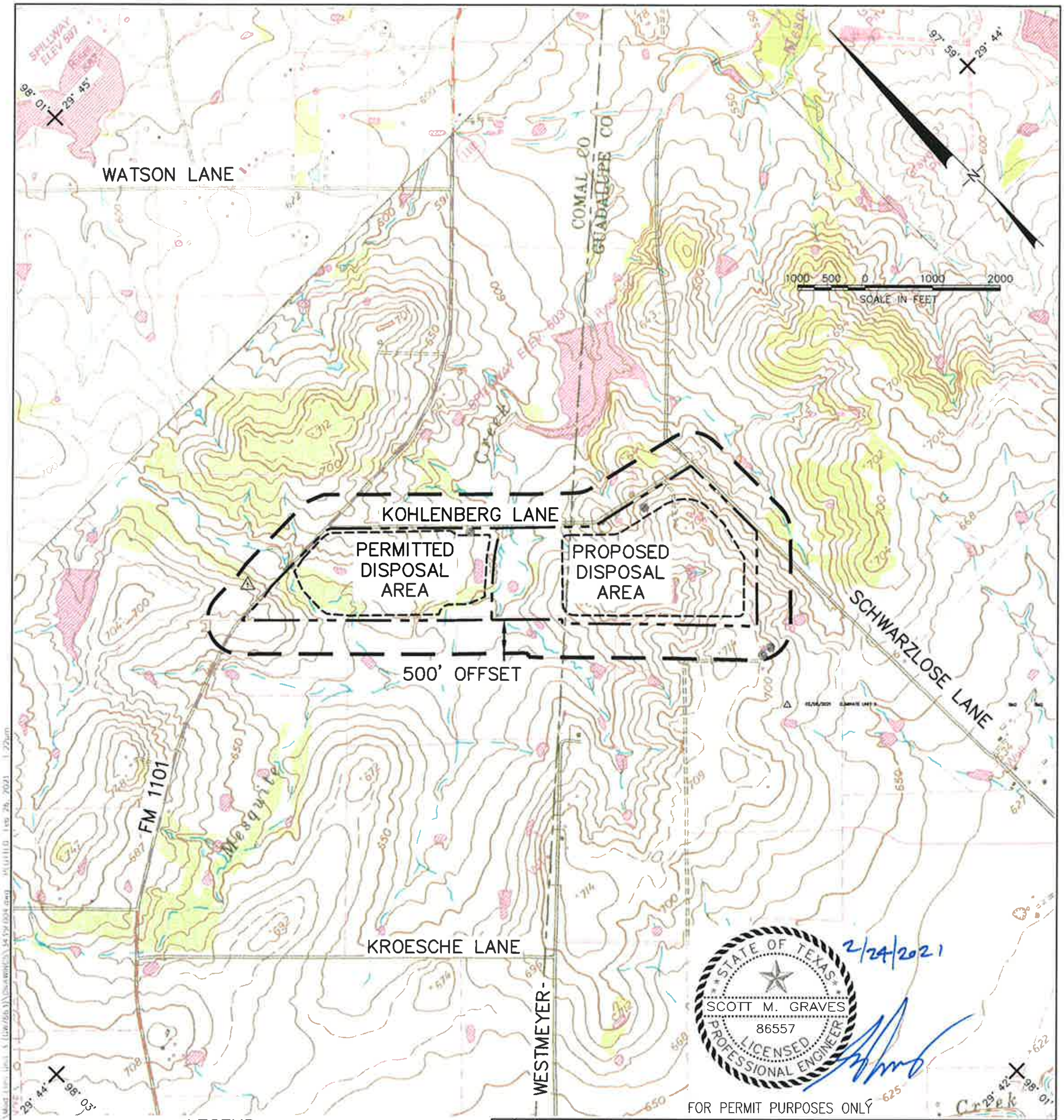
OWNER / SITE ADDRESS:
WASTE MANAGEMENT OF TEXAS, INC.
1000 KOHLENBERG LANE
P.O. BOX 311657
NEW BRAUNFELS, TEXAS 78130
(830) 685–7894

ENGINEER:
Geosyntec consultants
GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NO. 1182
8217 SHOAL CREEK BLVD., SUITE 200
AUSTIN, TEXAS 78757
(512) 451–4003

PROJECT: MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

TITLE: **LAND USE MAP**

PROJECT NO.: GT3435–03	DRAWN BY: JJV	REVIEWED BY: BAG	PART NO. I / II	FIGURE NO: 5
FILE NO.: 3435F006	CHECKED BY: SMG	APPROVED BY: SMG		



LEGEND

- PROPERTY BOUNDARY (PERMIT BOUNDARY)
- LIMIT OF WASTE
- 500-FT OFFSET
- STRUCTURES AND INHABITABLE BUILDINGS

NOTES:

1. INFORMATION ON THIS MAP TAKEN FROM AERIAL PHOTOGRAPHY (MAY 2004), FIELD INSPECTION (JANUARY 2005) AND USGS QUADRANGLES.
2. MAP SOURCE: UNITED STATES DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY, 7 1/2 MINUTE SERIES QUADRANGLE (TOPOGRAPHIC) MAPS OF:
NEW BRAUNFELS EAST, TEX. DATED 1958 REVISED 1994
SAN MARCOS SOUTH, TEX. DATED 1964 REVISED 1994
HUNTER, TEX. DATED 1964 REVISED 1994
GERONIMO, TEX. DATED 1964 REVISED 1994

MARK	DATE	REVISION	BY	APPROVED
1	02/24/2021	ELIMINATE UNIT 3	SMG	SMG
–	07/14/2006	TECHNICALLY COMPLETE	SMG	SMG
–	11/18/2005	INITIAL SUBMITTAL TO TCEQ	SMG	SMG

OWNER / SITE ADDRESS:

WM WASTE MANAGEMENT

WASTE MANAGEMENT OF TEXAS, INC.
1000 KOHLENBERG LANE
P.O. BOX 311657
NEW BRAUNFELS, TEXAS 78130
(830) 685-7894

ENGINEER:

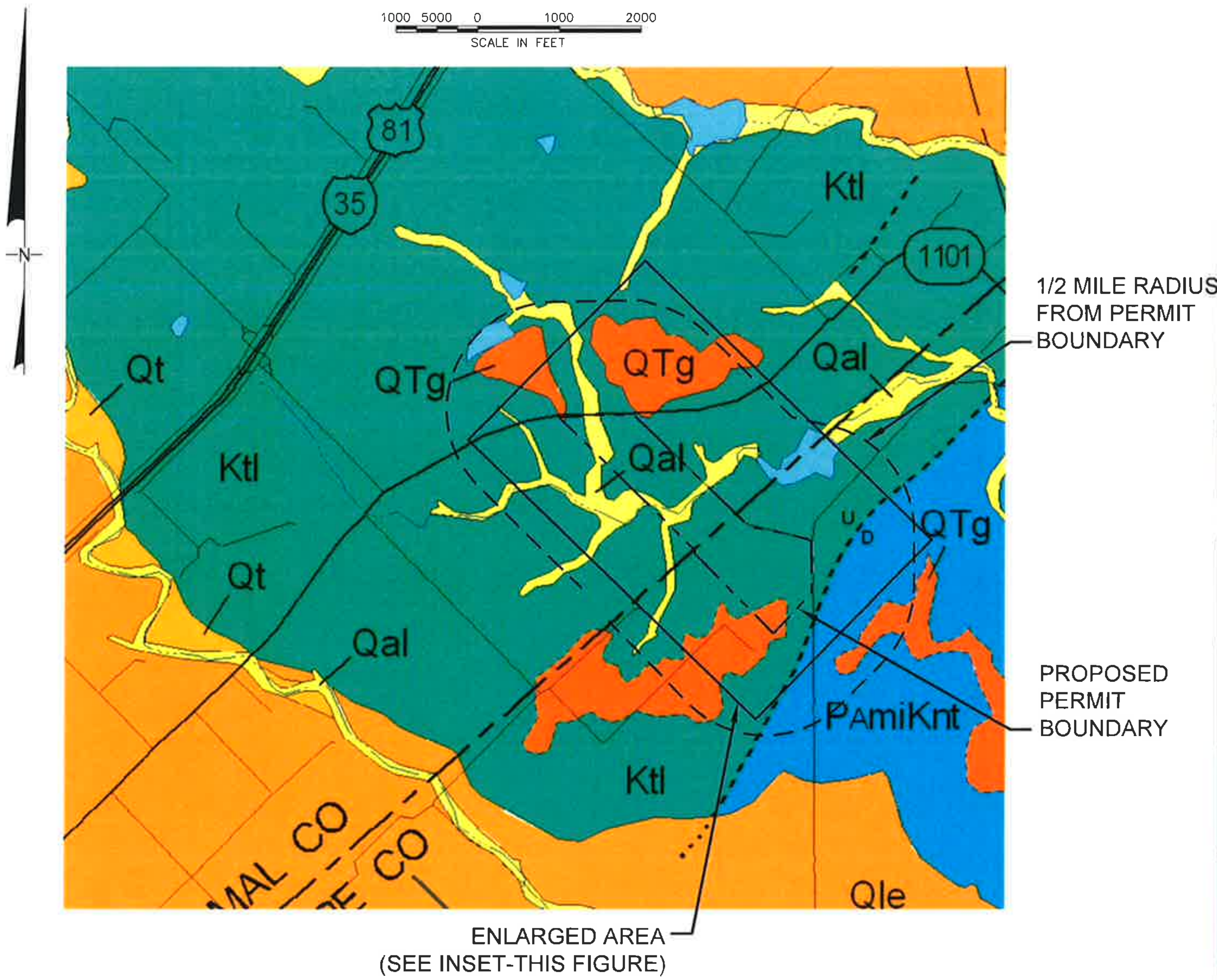
Geosyntec consultants

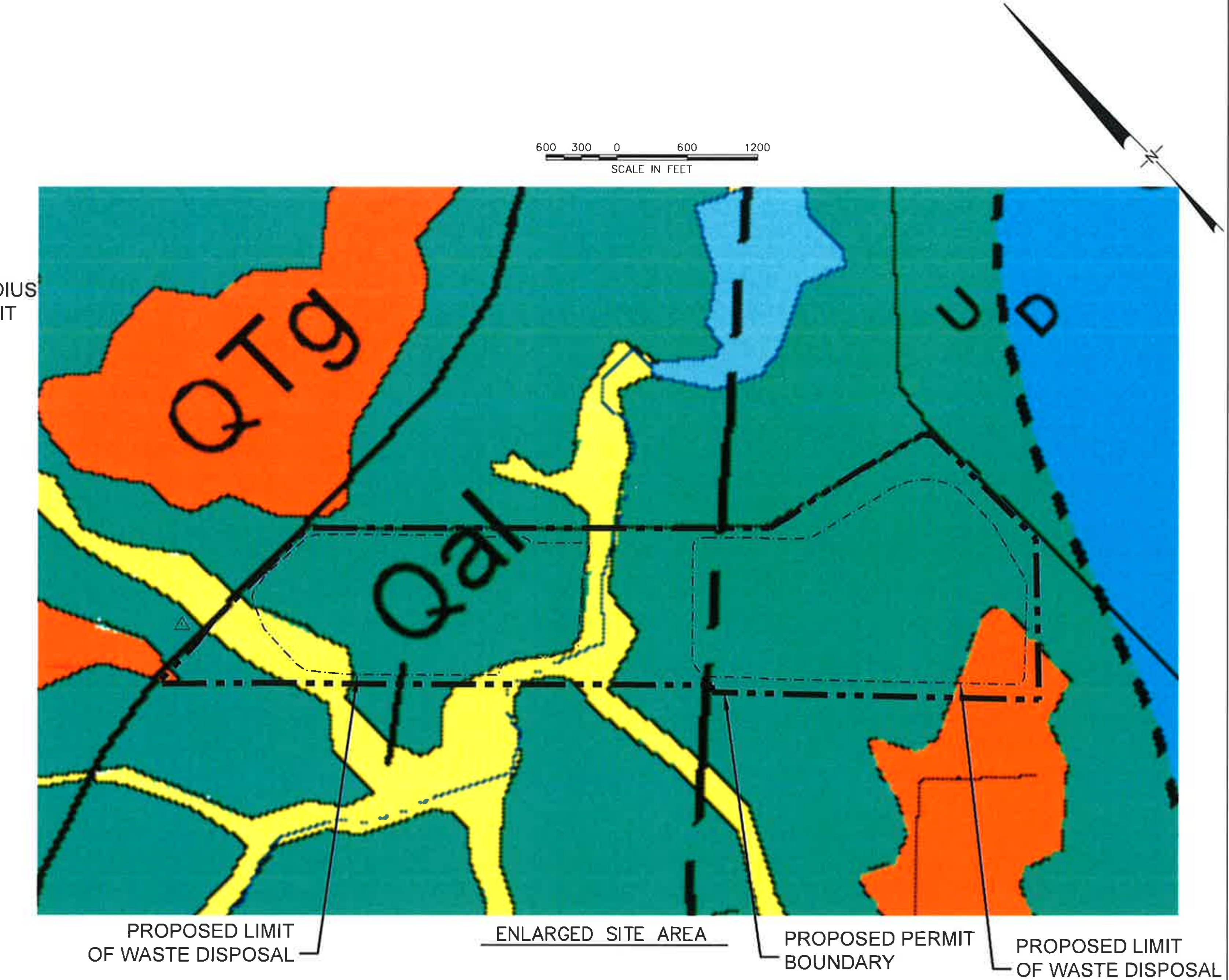
GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NO. 1182
8217 SHOAL CREEK BLVD., SUITE 200
AUSTIN, TEXAS 78757
(512) 451-4003

PROJECT: MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

TITLE: **STRUCTURES AND INHABITABLE BUILDINGS WITHIN 500 FEET OF SITE**

PROJECT NO.: GT3435-03	DRAWN BY: JJV	REVIEWED BY: BAG	PART NO. I / II	DRAWING NO: 6
FILE NO.: 3435F004	CHECKED BY: SMG	APPROVED BY: SMG		





LEGEND

Qal — ALLUVIUM; GRAVEL, SAND, SILT, AND MUD; MOSTLY MODERN DRAINAGEWAY DEPOSITS; INCLUDES SOME UNDIVIDED THIN, LOCAL TERRACE DEPOSITS AND LOCAL BEDROCK OUTCROPS

Qt — TERRACE ALLUVIUM; GRAVEL, SAND, SILT, AND MUD

Qle — LEONA FORMATION; SAND, SILT, AND GRAVEL

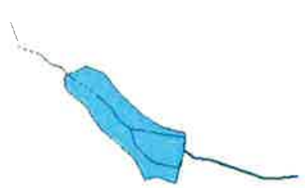
PAmiKnt — UNDIVIDED CRETACEOUS UPPER TAYLOR AND NAVARRO GROUPS AND PALEOCENE MIDWAY GROUP; UPPER TAYLOR GROUP: CLAY–CLAYSTONE TO MUD–MUDSTONE AND MARI; NAVARRO GROUP; CLAY–CLAYSTONE TO MUD–MUDSTONE, MARL, SILTSTONE, AND SANDSTONE; MIDWAY GROUP; CLAY–CLAYSTONE TO MUD–MUDSTONE, SILTSTONE, AND SANDSTONE

QTg — OLDER GRAVELLY ALLUVIUM; GRAVEL AND SAND; POSSIBLY EQUIVALENT TO UVALDE GRAVEL

Ktl — LOWER TAYLOR GROUP; MARI, ARGILLACEOUS LIMESTONE, LIMESTONE, AND SOME CLAY–CLAYSTONE TO MUD–MUDSTONE; INCLUDES UNDIVIDED PECAN GAP AND ANACACHO FORMATIONS

U / D — NORMAL FAULT; U=UPTHROWN BLOCK, D=DOWNTHROWN BLOCK

FAULTS DRAWN AS SOLID LINES ARE RELATIVELY MORE DISTINCT IN THE FIELD AND ON AERIAL PHOTOGRAPHS THAN WHERE THEY ARE DRAWN AS DASHED LINES; DOTTED LINES SHOW WHERE FAULTS ARE COVERED BY UNFAULTED DEPOSITS; QUESTION MARKS (?) INDICATE WHERE FAULTS ARE UNCERTAIN



STREAM, LAKE; PERENNIAL WHERE SOLID; INTERMITTENT STREAMS WHERE PARTLY DOTTED; HATCHED AREA SUBJECT TO INUNDATION

BASE MAP SOURCE: MISCELLANEOUS MAP NO. 39, "GEOLOGIC MAP OF THE NEW BRAUNFELS, TEXAS, 30 X 60 MINUTE QUADRANGLE: GEOLOGIC FRAMEWORK OF AN URBAN–GROWTH CORRIDOR ALONG THE EDWARDS AQUIFER, SOUTH–CENTRAL TEXAS" BY EDWARD W. COLLINS, 2000. BUREAU OF ECONOMIC GEOLOGY.

2/24/2021

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED
PROFESSIONAL ENGINEER

FOR PERMIT PURPOSES ONLY

MARK	DATE	REVISION	BY	APPROVED
1	02/24/2021	ELIMINATE UNIT 3	SMG	SMG
–	07/14/2006	TECHNICALLY COMPLETE	SMG	SMG
–	03/28/2006	RESPONSE TO NOD 1	SMG	SMG
–	11/18/2005	INITIAL SUBMITTAL TO TCEQ	SMG	SMG

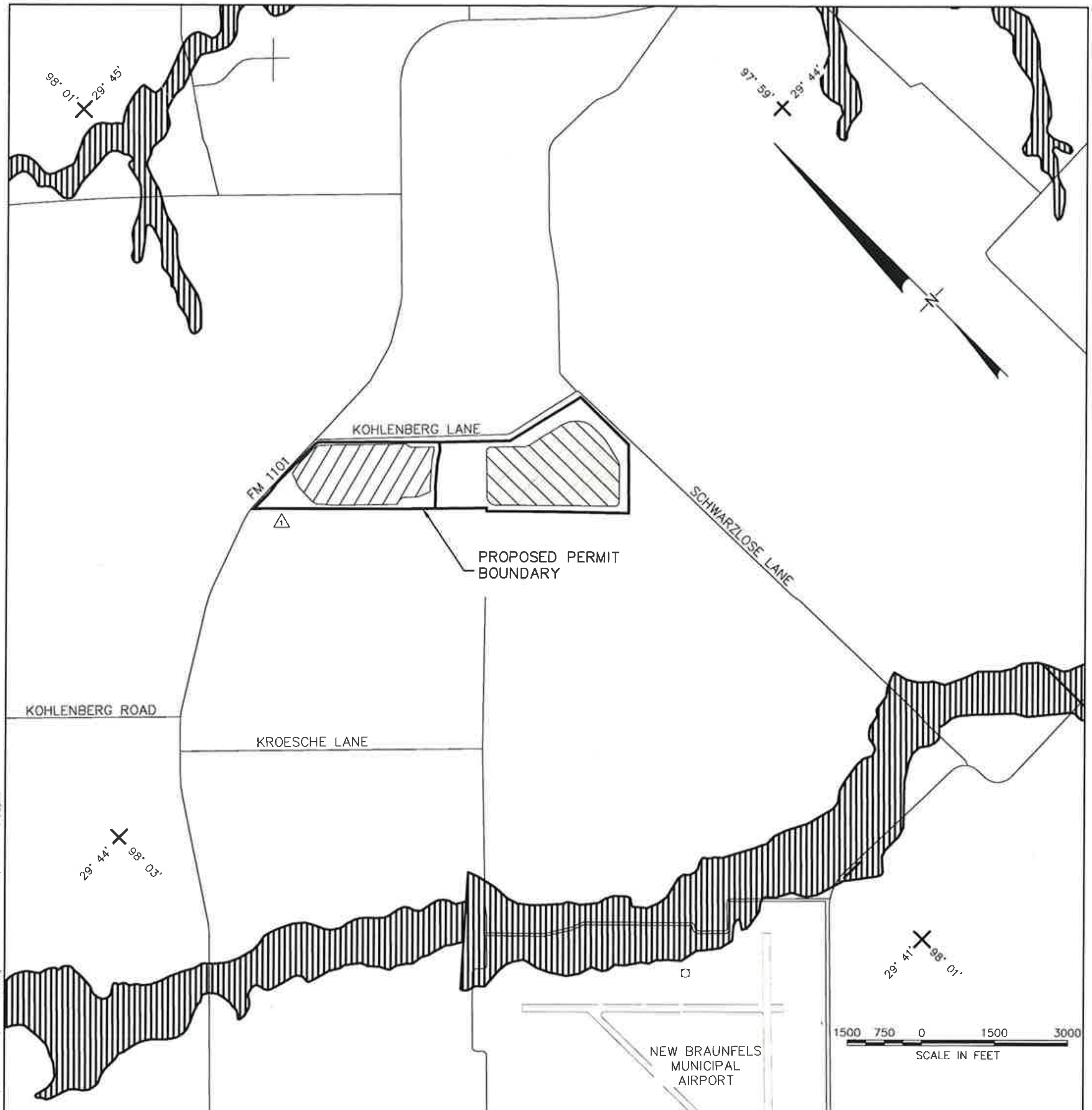
OWNER / SITE ADDRESS:
WASTE MANAGEMENT
WASTE MANAGEMENT OF TEXAS, INC.
1000 KOHLENBERG LANE
P.O. BOX 311657
NEW BRAUNFELS, TEXAS 78130
(830) 685–7894

ENGINEER:
Geosyntec consultants
GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NO. 1182
8217 SHOAL CREEK BLVD., SUITE 200
AUSTIN, TEXAS 78757
(512) 451–4003

PROJECT: MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

TITLE: GEOLOGIC MAP

PROJECT NO.: GT3435–03	DRAWN BY: JJV	REVIEWED BY: BAG	PART NO. I / II	FIGURE NO: 11
FILE NO.: 3435F005	CHECKED BY: SMG	APPROVED BY: SMG		



LEGEND

EXISTING PERMITTED AREA

PROPOSED EXPANSION AREA

100–YEAR FLOODPLAIN

BASE MAP SOURCE: FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA), Q3 FLOOD DATA, GUADALUPE COUNTY FILE (C48187.DLG) AND COMAL COUNTY FILE (C48091.DLG), SEPTEMBER 1998. DATA CORRESPONDS TO FLOOD INSURANCE RATE MAP (FIRM) COMMUNITY PANEL NUMBERS 4802660050B AND 4854630130C. FEMA MAP OVERLAYED WITH TXDOT HIGHWAY MAP FOR REFERENCE.

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

MARK	DATE	REVISION	BY	APPROVED
1	02/24/2021	ELIMINATE UNIT 3	SMG	SMG
–	07/14/2006	TECHNICALLY COMPLETE	SMG	SMG
–	11/18/2005	INITIAL SUBMITTAL TO TCEQ	SMG	SMG

OWNER / SITE ADDRESS:
WASTE MANAGEMENT
WASTE MANAGEMENT OF TEXAS, INC.
1000 KOHLENBERG LANE
P.O. BOX 311657
NEW BRAUNFELS, TEXAS 78130
(830) 685–7894

ENGINEER:
Geosyntec consultants
GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NO. 1182
8217 SHOAL CREEK BLVD., SUITE 200
AUSTIN, TEXAS 78757
(512) 451–4003

PROJECT: MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

TITLE: **FLOODPLAIN MAP**

PROJECT NO.: GT3435–03	DRAWN BY: JJV	REVIEWED BY: BAG	PART NO.	FIGURE NO:
FILE NO.: 3435F015	CHECKED BY: SMG	APPROVED BY: SMG	I / II	13

DRAWING: P:\CADD\Projects\WM\Mesquite Creek Landfill\Permit\Mud Elm Unit 3 (GW/663)\DRAWINGS\3435F015.dwg PLOTTED: Feb 26, 2021 1:23pm

WASTE MANAGEMENT

Prepared for Applicant:

Waste Management of Texas, Inc.
1000 Kohlenberg Road
P.O. Box 311657
New Braunfels, Texas 78130
(830) 625-7894

PERMIT AMENDMENT APPLICATION
PART III, SITE DEVELOPMENT PLAN

MESQUITE CREEK LANDFILL
NEW BRAUNFELS,
COMAL AND GUADALUPE COUNTIES, TEXAS
MSW PERMIT NO. 66B

Prepared by:

Geosyntec consultants
Texas Board of Professional Engineers Firm Registration No. F-1182
8217 Shoal Creek Blvd, Suite 200
Austin, Texas 78757
(512) 451-4003

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED
PROFESSIONAL ENGINEER

2/24/2021

FOR PERMIT PURPOSES ONLY

Initial Application Submittal – 18 November 2005
Response to NOD 1 – 28 March 2006
Response to NOD 2 – 15 May 2006
Supplemental Information – 3 July 2006
Technically Complete – 14 July 2006
Revised – 24 February 2021

TABLE OF CONTENTS – PART III

SITE DEVELOPMENT PLAN NARRATIVE REPORT

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
Texas Board of Professional Engineers
Firm Registration No. F-1182

APPENDIX

ATTACHMENTS

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED
PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

GEOSYNTEC CONSULTANTS, INC.
Texas Board of Professional Engineers
Firm Registration No. F-1182

SITE DEVELOPMENT PLAN NARRATIVE REPORT

1. INTRODUCTION

1.1 Facility History and Existing Conditions

Waste Management of Texas, Inc. (WMTX), a Texas corporation and wholly-owned subsidiary of Waste Management, Inc., owns and operates the facility currently permitted as the "Comal County Landfill," a Type I municipal solid waste facility located in Comal County, Texas. The lateral expansion of the facility as proposed in this application would extend the permit boundary of the facility into Guadalupe County, as further discussed herein. Accordingly, WMTX proposes to change the name of the facility to "Mesquite Creek Landfill." A TCEQ Core Data Form is included with this application to indicate the name change.

The facility is located at the southwest intersection of Farm-to-Market Road (FM) 1101 and Kohlenberg Lane, approximately 5 miles north of the intersection of State Highway 46 and FM 1101. The site is approximately two miles east of the I-35 Kohlenberg Road exit, north of the city of New Braunfels. Maps showing the site location and surrounding vicinity were previously presented in Parts I/II (see Figures I/II-1 and I/II-2).

The facility was initially owned and operated by Comal County and received Permit No. 66 on 27 May 1975, and began operating shortly thereafter. WMTX acquired the facility from Comal County in 1988. Subtitle D modifications for the site were approved on 28 November 1994. Then, on 24 October 2003, the facility received approval for a major permit amendment (Permit No. 66A) for a vertical expansion. The current permitted facility occupies 96.07 acres, with approximately 79 acres designated for disposal. The facility currently is composed of Phases I through V. Phases I and II are existing pre-Subtitle D areas. Phases III and V are existing and are Subtitle D compliant, using an approved Subtitle D-equivalent alternate liner system. At this time, Phase IV has not been constructed. Thus, at the time of this initial permit amendment application submittal, approximately 72.3 acres of the existing permitted disposal are constructed, with the remaining acreage (approximately 6.3 acres) yet to be constructed and filled.

1.2 Proposed Amendment

Permit Amendment Application No. MSW-66B (this application) has been prepared to laterally expand the landfill southward, as described herein. This proposed lateral expansion will extend the facility permit boundary to into Guadalupe County. The permitted acreage will be increased from 96.07 acres to 244.12 acres by incorporating approximately 148.05 acres of additional property located south of the currently permitted area. Approximately 84.9 acres will be designated for disposal in the expansion area, resulting in a total area of 157.2 acres designated for waste disposal at the facility. The remaining acreage to be used for buffer zones, perimeter access roads, scales, office

2. LANDFILL METHOD

The facility currently operates, and proposes to continue operating as an area fill landfill with below-grade excavation followed by aerial filling to the proposed final landfill completion height above-grade. The general site layout and sequencing plan is shown in Attachment 1 on Drawing 1-1. Attachment 1, Drawings 1-2 and 1-3 show the liner system base grades and final cover system grades, respectively.

Excavation, liner construction, and waste filling operations will progress sequentially according to the numerical units and phases shown on the drawings in Attachment 1. As shown on Drawing 1-1 and 1-2, the existing landfill (with Phases I – III and Phase V already constructed) is being renamed as "Unit 1". The proposed expansion area is being named "Unit 2," and is composed of Phase I through Phase VI. The existing permitted Phase IV (subsequently named "Unit 3", and not yet constructed) is being removed. Thus, there will be no Unit 1, Phase IV (a.k.a., Unit 3).

The excavation side slopes will be configured at 3 horizontal:1 vertical (3H:1V) down to the cell floor areas which are sloped at between two percent and five percent, as shown on Drawing 1-2. The aerial fill side slopes will be configured at 3H:1V slopes between drainage benches (resulting in an average cover sideslope inclination of approximately 3.5H:1V) , up to a landfill top deck area sloped upward at five percent to a peak or ridgeline, as shown on Drawing 1-3. The final cover system will be installed incrementally with the landfill development progression as fill areas reach their maximum final waste grade elevations.

3. ALL WEATHER OPERATIONS ACCESS

All-weather roadways will be used to provide access during wet weather from the site entrance at Kohlenberg Lane (public roadway) to the waste unloading area being used during wet weather. An all-weather road will also be provided around the landfill perimeter. Unit 1 (existing unit) will be accessed by its existing all-weather asphalt-paved entrance road from Kohlenberg Lane to approximately 200-ft beyond the scale area, where the road then transitions to an all-weather gravel surface that continues as an internal access road on the landfill to the waste unloading area being used during wet weather. The entrance road also connects to an existing gravel, all-weather landfill perimeter road that extends around the southwest portion of Unit 1. Unit 2 (proposed expansion area) will be accessed from a new site entrance that will be constructed just prior to the start of Unit 2. The new site entrance will have an all-weather asphalt or concrete paved entrance road from Kohlenberg Lane to approximately 200-ft beyond the scale area, where the road will transition to an all-weather gravel surface that will continue as an internal access road on the landfill to the Unit 2 waste unloading area. The entrance road will also connect to a gravel, all-weather landfill perimeter road that will be extended around Unit 2 as development progresses. The location of these site access roads are shown on the site layout plan (Attachment 1, Drawing 1-1). The existing and proposed site entrance area and engineering details of the proposed roadway cross sections and all-weather surfacing materials are shown on Attachment 1, Drawing 1-4.

Additional internal roads on the landfill needed to access waste unloading areas will be established by the facility to provide waste vehicle access and facilitate site operations as waste filling progresses. These internal roads will be accessed from the facility entrance road described above. Internal roads that will be used by waste vehicles and landfill operations vehicles during wet weather conditions will be surfaced with all-weather material, such as gravel, so that continuous access to waste disposal areas is provided during both wet and dry weather.

The rough gravel road surfacing on the internal roads used to access the active working face will reduce the amount of mud tracked from the disposal area by shaking and pulling mud off the vehicle tires as they exit the disposal area. Then, the paved entrance roads will further minimize tracking of mud from the site onto public roads. In particular with the new access road for Unit 2, the relatively long length of the on-site paved road prior to exiting to the public road is expected to help minimize tracking of mud off-site (see Attachment 1, Drawing 1-1).

Access road maintenance requirements, including specific provisions addressing control of mud tracking, dust control, and general road cleaning and safety, are provided in Part IV – Site Operating Plan of this permit amendment application (in accordance with 30 TAC §330.127).

5. SOLID WASTE DEPOSITION AND SITE OPERATING LIFE

5.1 Type and Source of Waste

As discussed in Part I/II, Section 2.3, the facility currently accepts and proposes to continue accepting municipal solid waste, Class 2 and 3 industrial solid wastes, Class 1 industrial waste only because of asbestos content, and special waste, as defined by 30 TAC §330.2. The facility is located in Comal and Guadalupe counties, both of which are part of the Alamo Area Council of Government Regional Solid Waste Management Plan (AACOG RSWMP) 20-yr planning area. Currently approximately 90% of the waste disposed of in the facility comes from Comal, Guadalupe, and Bexar counties, and this trend is anticipated to continue in a similar manner.

5.2 Waste Disposal Rate

Based on a review of 2003 through 2005 waste receipt records for the site, the current waste disposal rate at the facility is approximately 1,316 tons/day using 282 normal operating days per year. The in-place waste density is approximately 1,500 lbs/yd^3. Assuming a unit disposal rate of 5 lbs/person/day (30 TAC §330.55(a)(4)) for 365 days/year, this equates to an equivalent population served of 406,600 persons based on current waste receipts.

As discussed in Part I/II, Section 2.3 of this permit amendment application, assuming the waste receipts increase proportional to the projected population growth of Comal and Guadalupe counties (whose residents and businesses are the major source of waste), the facility is estimated to receive approximately 595,000 tons during the final year of operation before closure (i.e., approximately 2,110 tons/day x 282 normal operating days/yr). Using the same unit disposal rate assumed above, this equates to an equivalent population served of 652,000 persons during the final year of operation. These projections are based on long-term estimates of population growth and an assessment of market conditions that suggest waste receipts could increase proportionally to population; actual tonnages may vary as market conditions, waste disposal habits, and population changes. Refer to Part IV- Site Operating Plan for additional details on the waste acceptance rate with respect to site operations requirements.

5.2 Site Operating Life

A calculation of the site capacity and estimated operating life is presented in Appendix III-A of this Site Development Plan. In summary, the calculated landfill volumes are as follows:

- Currently Permitted Waste Disposal Volume (Permit 66A) = 6,227,000 yd^3.
- Waste Disposal Volume Gained by This Permit Amendment = 13,963,090 yd^3.
- Total Waste Disposal Volume (Maximum Waste Inventory) = 20,190,090 yd^3.

- Available Waste Disposal Volume Resulting From This Permit Amendment (as of most recent aerial flyover topography on 8 March 2005) = 17,074,090 yd^3.

The in-place waste density is currently approximately 1,500 lbs/yd^3 based on recent site data for this facility, and this value is used to calculate the site operating life. Using the above available waste disposal airspace, the assumed in-place density, and the growth rate of waste receipts, the calculated site operating life is estimated as:

- Site Operating Life = 26.6 years from 3/8/2005 topography, or approximately November 2031.

percent. The leachate collection corridors are then sloped at one percent towards sumps. The proposed layout of the liner system base grades is shown on Attachment 1, Drawing 1-2.

A composite liner system will be constructed in all remaining proposed disposal areas of the landfill. Engineering details of the proposed liner system are shown in Attachment 6 – Groundwater and Surface Water Protection Plan and Drainage Plan. In summary, for Unit 2 (the expansion area), the proposed liner system consists of a 2-ft thick (minimum) layer of compacted soil liner with a hydraulic conductivity of no more than 1×10^{-7} cm/s, overlain by a 60-mil high-density polyethylene (HDPE) geomembrane, a leachate drainage layer of either geocomposite (geonet bonded to geotextiles) or geotextile, and 2-ft thick (minimum) of protective soil. An alternate liner design demonstration for the existing facility (i.e., Unit 1) is provided as Appendix III-B to this Site Development Plan.

These proposed liner systems meet the groundwater protection design and operation requirements of 30 TAC §330.200 through §330.206. Stability of the liner system and overall landfill foundation and waste slopes against sliding (i.e., slope stability) and settlement is addressed in Attachment 4. Material and construction specifications and construction quality assurance/quality control requirements for the liner system components are presented in Attachment 10 – Soils and Liner Quality Control Plan.

6.2.2 Leachate Collection System

As part of groundwater protection for the landfill, a leachate collection and drainage system has been designed to drain, collect, and allow leachate removal from the landfill during the active life, scheduled closure, and the post-closure period of the landfill. As described above, the proposed liner system includes a drainage layer above the composite liner for leachate collection. Leachate percolating through the waste will be collected in the drainage layer and will flow by gravity towards the leachate collection corridor or a sideslope toe drain, which in turn conveys leachate to collection sumps at the low point of the liner system floor grades for each phase. Submersible pumps in each sump will be used to remove collected leachate from the landfill, which will then be conveyed to leachate evaporation ponds using a leachate transmission system of piping.

The layout of the liner system base grades is shown in Attachment 1, Drawing 1-2. The selected leachate collection system materials are expected to be chemically resistant to the anticipated leachate. Engineering details of the leachate collection system are provided in Attachment 6 – Groundwater and Surface Water Protection Plan and Drainage Plan. Material and construction specifications and construction quality assurance/quality control requirements for the leachate collection system components of the liner are presented in Attachment 10 – Soils and Liner Quality Control Plan. The calculated leachate generation rates and resulting sizing of leachate collection

8. PROTECTION FROM FLOODING

As described and documented in Part I/II, Section 7 of this permit amendment application, the waste disposal limits of the existing facility and for the proposed expansion facility area are located in an area not known to flood and that is not within the 100-yr floodplain (see Part I/II, Figure I/II-13). The central portion of the site, where Mesquite Creek flows, is within the flood pool of the downstream Freedom Lake (see Part I/II, Figure I/II-13). According to the York Creek Watershed Management District, Freedom Lake has a spillway elevation of 603.1 ft, MSL, and the flood pool elevation at the site is 605.1 ft, MSL. The existing landfill waste disposal limits do not extend into this flood pool. Neither the waste disposal areas, nor any perimeter roads or berms of the proposed expansion will extend into this flood pool area. Two storm water ponds, one existing and one part of the proposed expansion area, are partially within the upper elevations of this flood pool; however, they are designed to allow backflow into the ponds during a flood event through their principal spillway pipes, thus not changing the flood storage capacity of Freedom Lake. Also, as discussed further in Attachment 6 of the Site Development Plan, these ponds do not change the 100-yr, 24-hr flood flow pattern and the flood storage capacity of Freedom Lake.

Since neither the existing nor the proposed disposal areas are located in floodplains, the floodplain location restriction criterion (30 TAC §330.301) is satisfied, as presented in Parts I/II. Also, the Unit 1 (existing landfill) perimeter berm is designed to have a minimum elevation of 608.1 ft, MSL, which provides at least 3 ft of freeboard above the Freedom Lake flood pool. Unit 2 (expansion area) has a perimeter berm with a minimum elevation of 615 ft, MSL, which provides at least 10 ft of freeboard above the Freedom Lake flood pool. Since the landfill areas are not located within the 100-year floodplain and since post-development discharge flow volumes and rates are designed to be less than pre-development (natural) conditions, the requirements of 30 TAC §330.55(b)(7)(C) are met because the flow and storage capacity of a 100-year frequency flood are not expected to be restricted.

APPENDIX III-A

VOLUME AND SITE LIFE ESTIMATE

TABLE III-A-1

SUMMARY COMPARISON OF CURRENT PERMIT AND PROPOSED EXPANSION MESQUITE CREEK LANDFILL (formerly the Comal County Landfill)

Item	Units	As Currently Permitted	Proposed Increase due to Lateral Expansion	Total New Quantity - Overall Proposed Facility
Permit Boundary/Property Boundary	(acres)	96.07	148.05	244.12
Waste Disposal Footprint	(acres)	78.6	78.6	157.2
Total Waste Disposal Volume (Airspace)	(cubic yards)	6,227,000	13,963,090	20,190,090
Remaining Volume as of 8 March 2005 Aerial Flyover	(cubic yards)	3,111,000	13,963,090	17,074,090
Projected Remaining Site Life from Date of Aerial Flyover	(years)	6.0	20.6	26.6

Waste disposal volume (a.k.a. airspace) refers to volume available for waste disposal (i.e., from top of liner protective soil to bottom of final cover system, including waste + daily/int cover). Volumes calculated by CADD-based grid volume methods using digital terrain models (DTMs) of top of final cover and top of clay liner surfaces, and subtracting out the volume of the liner protective cover and the final cover.

TABLE III-A-2
SITE LIFE CALCULATIONS - MESQUITE CREEK LANDFILL

Site life calculation assumptions:		
Assumed year 2005 tonnage:	371,000	tons/yr
Assumed in-place waste density:	0.75	tons/cubic yard
In-place waste density conversion:	1500	lbs/cubic yard
Assumed tonnage growth over life of facility:	60.4%	Source: Part I/II Permit Amendment Application (using average of AACOG 2000-2040 population growth trend predictions, extrapolated to life of expansion).

Year	Year number	Waste Receipts at Gate (tons)	Average Daily Tonnage (using 282 normal working days/yr) (tons/day)	Airspace Consumed (cubic yards)	Total Airspace Remaining at End of Year (cubic yards)	
Partial year - adjust from flyover date to end of Dec 2005	0	278,250		371,000	16,703,090	
2006	1	378,714	1,343	504,952	16,198,138	
2007	2	386,556	1,371	515,408	15,682,730	
2008	3	394,571	1,399	526,094	15,156,635	
2009	4	402,731	1,428	536,975	14,619,661	
2010	5	411,009	1,457	548,012	14,071,649	
2011	6	419,396	1,487	559,194	13,512,454	
2012	7	427,962	1,518	570,616	12,941,839	
2013	8	436,626	1,548	582,169	12,359,670	
2014	9	445,363	1,579	593,817	11,765,853	
2015	10	454,211	1,611	605,615	11,160,238	
2016	11	463,196	1,643	617,594	10,542,643	
2017	12	472,188	1,674	629,584	9,913,059	
2018	13	481,255	1,707	641,673	9,271,386	
2019	14	490,313	1,739	653,751	8,617,634	
2020	15	499,416	1,771	665,888	7,951,746	
2021	16	508,461	1,803	677,947	7,273,799	
2022	17	517,471	1,835	689,961	6,583,838	
2023	18	526,428	1,867	701,903	5,881,934	
2024	19	535,350	1,898	713,800	5,168,134	
2025	20	544,155	1,930	725,539	4,442,595	
2026	21	552,877	1,961	737,169	3,705,425	
2027	22	561,507	1,991	748,677	2,956,749	
2028	23	570,106	2,022	760,141	2,196,608	
2029	24	578,528	2,052	771,371	1,425,237	
2030	25	586,820	2,081	782,427	642,809	
2031	26	594,989	2,110	793,318	-150,509	Essentially Depleted Nov 2031

APPENDIX III-B

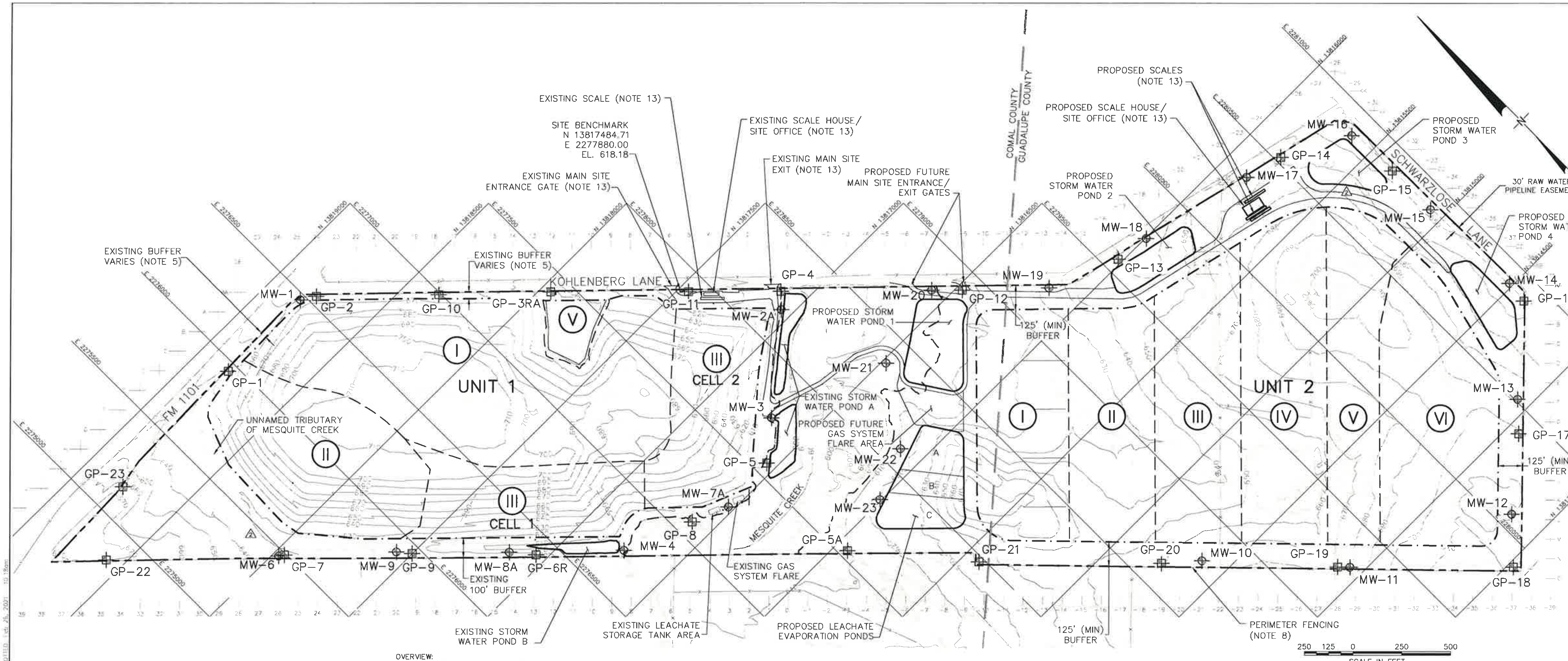
ALTERNATE LINER SYSTEM DEMONSTRATION, EXISTING PERMITTED LANDFILL AREAS

The attached demonstration was prepared by RUST for the 1994 Subtitle D upgrade and was part of approved permits MSW-66 and MSW-66A. The demonstration is for the existing permitted area. No changes have been made to the design of the existing facility for this permit amendment application; therefore, this demonstration remains applicable.

ATTACHMENT 1

SITE LAYOUT PLANS

- Drawing 1-1 General Site Layout and Sequencing Plan
- Drawing 1-2 Overall Base Grading Plan
- Drawing 1-3 Overall Final Cover Grading Plan
- Drawing 1-4 Landfill Entrance Plan and Road Details
- Drawing 1-5 Existing & Proposed Perimeter Screening Plan



OVERVIEW:

UNIT 1 (PHASES I–III AND V) IS ALREADY CONSTRUCTED AND FILLING IS IN PROGRESS. THERE IS NO UNIT 1, PHASE IV. NO CHANGES TO UNIT 1 ARE PROPOSED FOR THIS PERMIT AMENDMENT. UNIT 2 IS THE PROPOSED LATERAL EXPANSION AREA. (2)

LEGEND

- 650 — EXISTING GROUND ELEVATION (FT, MSL)
- EXISTING WATER LINE
- EXISTING SITE FENCE
- EXISTING TREE LINE
- EXISTING BUILDING
- PROPERTY BOUNDARY (NOTE 4)
- LIMIT OF WASTE
- PHASE BOUNDARY
- FREEDOM LAKE FLOOD POOL (NOTE 7)
- (I) PHASE DESIGNATION (NOTE 11)
- N 13,674,000 E 2,080,000 STATE PLANE COORDINATES
- SITE GRID
- SITE ACCESS ROAD
- MW-7 GROUNDWATER MONITORING WELL (NOTE 9)
- GP-1 GAS MONITORING PROBE (NOTE 10)

NOTES:

1. THE EXISTING CONTOUR MAP SHOWN ON THIS DRAWING WAS COMPILED USING PHOTOGRAMMETRIC METHODS BASED ON AERIAL PHOTOGRAPHY PERFORMED ON 08 MARCH 2005 BY SURVEYING AND MAPPING, INC. OF AUSTIN, TEXAS.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL) AS DEFINED BY THE USGS NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929. STATE PLANE COORDINATE GRID CORRESPONDS TO TEXAS COORDINATE SYSTEM, SOUTH CENTRAL ZONE, NORTH AMERICAN DATUM (NAD) 1983.
3. PROPERTY BOUNDARY AND EASEMENT INFORMATION PROVIDED BY SURVEYING AND MAPPING INC., AUSTIN, TEXAS, DATED 23 MAY 2005.
4. PERMIT BOUNDARY AND PROPERTY BOUNDARY COINCIDE.
5. BUFFER DISTANCES REFER TO DISTANCE FROM PROPERTY LINE TO LIMIT OF WASTE. THE NORTH AND EAST SIDES OF UNIT 1 ALONG FM 1101 AND KOHLENBERG LANE ARE ALREADY PERMITTED WITH A BUFFER THAT VARIES FROM 13 TO 36 FT THROUGH PREVIOUSLY GRANTED BUFFER RULE WAIVERS TO PERMITS 66 AND 66A. THESE AREAS ARE ALREADY FILLED, AND NO CHANGES ARE PROPOSED. ALL PROPOSED LATERAL EXPANSION AREAS (UNIT 2) ARE DESIGNED WITH A MINIMUM OF 125 FT BUFFER. (2)
6. REFER TO DRAWING 1–2 FOR A SUMMARY OF THE PLAN AREA (ACREAGE) AND CURRENT STATUS (E.G., CONSTRUCTED, FUTURE, ETC.) OF EACH UNIT AND PHASE.
7. THERE ARE NO FEMA-DESIGNATED 100–YEAR FLOODPLAIN AREAS WITHIN THE PERMITTED FACILITY AS DOCUMENTED IN PARTS I/II, FIGURE I/II–13. HOWEVER, THE DOWNSTREAM FREEDOM LAKE FLOOD POOL ELEVATION IS 605.1 FT, MSL ACCORDING TO THE YORK CREEK WATERSHED CONSERVATION DISTRICT. AS SHOWN, NEITHER THE EXISTING NOR THE PROPOSED LANDFILL ENCROACHES ON THE FREEDOM LAKE FLOOD POOL AREAS. STORM WATER PONDS IN THE FLOOD POOL AREA DO NOT ADVERSELY ALTER THE FLOOD POOL BECAUSE STORM WATER WILL BACKFLOW THROUGH THE PRINCIPAL SPILLWAY PIPES DURING A FLOOD EVENT.
8. PERIMETER FENCING SHALL FOLLOW THE PERMIT BOUNDARY AROUND THE ENTIRE SITE.
9. GROUNDWATER MONITORING WELLS MW–1 THROUGH MW–4 AND MW–6 ARE EXISTING, THE REMAINDER ARE PROPOSED. REFER TO PART III, ATTACHMENT 5 FOR ADDITIONAL DETAILS ON THE LOCATION AND TIMING OF THE GROUNDWATER MONITORING SYSTEM.
10. GAS MONITORING PROBES GP–1 THROUGH GP–7 ARE EXISTING, THE REMAINDER ARE PROPOSED. REFER TO PART III, ATTACHMENT 14 FOR ADDITIONAL DETAILS ON THE LOCATION AND TIMING OF THE GAS MONITORING PHASE NETWORK.
11. LANDFILL DEVELOPMENT (EXCAVATION, LINING, AND FILLING) SEQUENCE WILL BE IN THE ORDER OF THE NUMERICAL UNITS AND PHASES SHOWN. PHASES MAY BE FURTHER SUBDIVIDED AT THE FACILITY'S DISCRETION. NOTE–THERE IS NO PHASE IV OF UNIT 1.
12. REFER TO PART III, ATTACHMENT 6, DRAWING 6–1 FOR TIMING OF STORM WATER POND CONSTRUCTION.
13. REFER TO DRAWING 1–4 FOR FURTHER DETAIL OF EXISTING AND PROPOSED SITE ENTRANCE/EXIT AREAS. EXISTING ENTRANCE, EXIT, AND FACILITIES (SCALE, SCALE HOUSE/OFFICE) WILL REMAIN IN SERVICE UNTIL UNIT 1 IS FILLED TO CAPACITY. THE PROPOSED NEW ENTRANCE/EXIT AREA AND FACILITIES WILL BE CONSTRUCTED IN CONJUNCTION WITH THE START OF UNIT 2 OPERATIONS.
14. REFER TO DRAWING 1–2 FOR INFORMATION ON TYPES OF WASTE DISPOSAL AND THEIR DESIGNATED LOCATIONS.

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

MARK	DATE	REVISION	BY	APPROVED
2	02/24/2021	ELIMINATE UNIT 3	JJV	SMG
1	08/08/2008	REVISED SITE ENTRANCE	SMG	SMG
–	07/14/2006	TECHNICALLY COMPLETE	SMG	SMG
–	05/15/2006	RESPONSE TO NOD 2	SMG	SMG
–	03/28/2006	RESPONSE TO NOD 1	SMG	SMG
–	11/18/2005	INITIAL SUBMITTAL TO TCEQ	SMG	SMG

OWNER / SITE ADDRESS:
WASTE MANAGEMENT
WASTE MANAGEMENT OF TEXAS, INC.
1000 KOHLENBERG LANE
P.O. BOX 311657
NEW BRAUNFELS, TEXAS 78130
(830) 685-7894

ENGINEER:
Geosyntec consultants
GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NO. 1182
8217 SHOAL CREEK BLVD., SUITE 200
AUSTIN, TEXAS 78757
(512) 451-4003

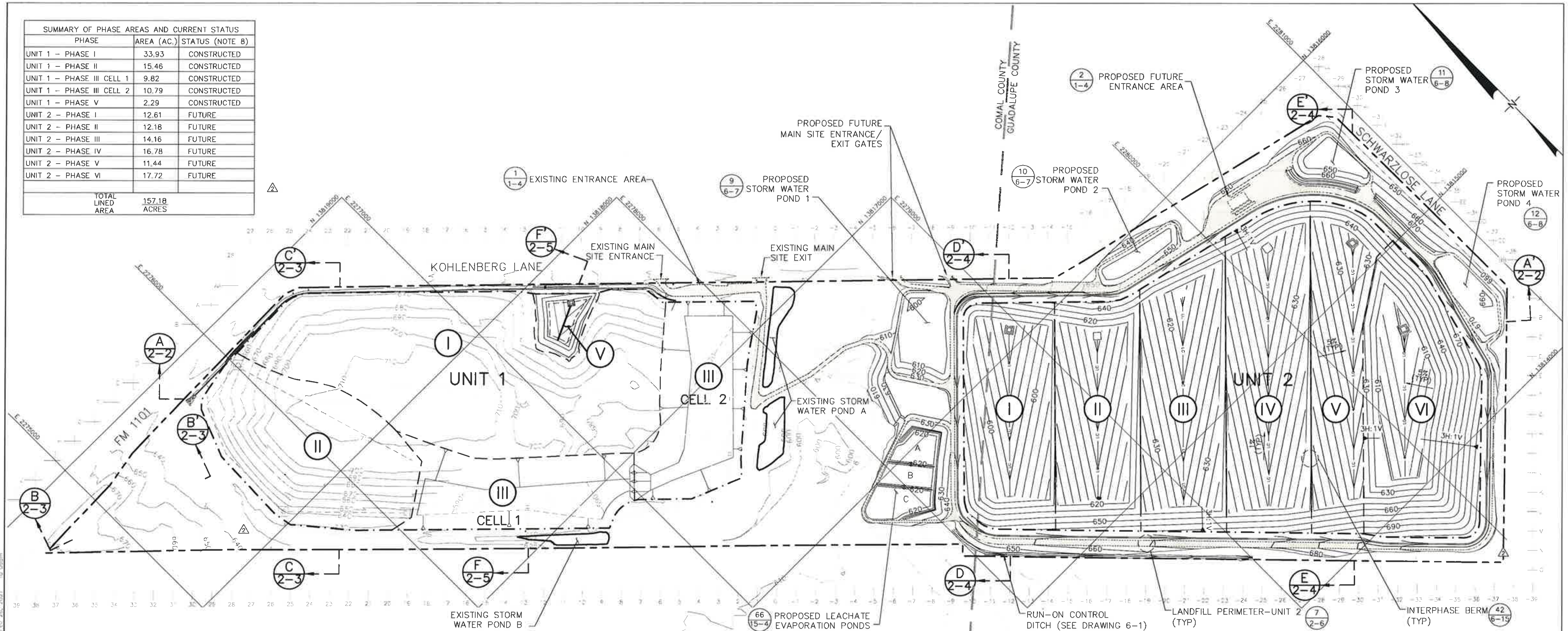
PROJECT: MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

TITLE:

GENERAL SITE LAYOUT AND SEQUENCING PLAN

PROJECT NO.: GT3435-03	DRAWN BY: JJV	REVIEWED BY: BAG	PART NO.	FIGURE NO:
FILE NO.: 3435-002	CHECKED BY: SMG	APPROVED BY: SMG	III	1–1

SUMMARY OF PHASE AREAS AND CURRENT STATUS		
PHASE	AREA (AC.)	STATUS (NOTE 8)
UNIT 1 – PHASE I	33.93	CONSTRUCTED
UNIT 1 – PHASE II	15.46	CONSTRUCTED
UNIT 1 – PHASE III CELL 1	9.82	CONSTRUCTED
UNIT 1 – PHASE III CELL 2	10.79	CONSTRUCTED
UNIT 1 – PHASE V	2.29	CONSTRUCTED
UNIT 2 – PHASE I	12.61	FUTURE
UNIT 2 – PHASE II	12.18	FUTURE
UNIT 2 – PHASE III	14.16	FUTURE
UNIT 2 – PHASE IV	16.78	FUTURE
UNIT 2 – PHASE V	11.44	FUTURE
UNIT 2 – PHASE VI	17.72	FUTURE
TOTAL LINED AREA	157.18 ACRES	



250 125 0 250 500
SCALE IN FEET

LEGEND

—— 610 ——	EXISTING GROUND ELEVATION (FT, MSL)
– – 630 – –	EXISTING (AS-CONSTRUCTED) TOP OF LINER ELEVATION (FT, MSL)
	EXISTING ROAD
	EXISTING BUILDING
	PROPERTY BOUNDARY (NOTE 4)
	LIMIT OF WASTE
	PHASE BOUNDARY
(I)	PHASE DESIGNATION
N 13,674,000 E 2,080,000	STATE PLANE COORDINATES
A 27	SITE GRID
	SITE ACCESS ROAD
—— 650 ——	PROPOSED TOP OF LINER ELEVATION (FT, MSL)
	LEACHATE COLLECTION SYSTEM CORRIDOR
	LEACHATE COLLECTION SUMP AND RISER PIPE
1/1-4	DETAIL OR SECTION NUMBER; PART III DRAWING NUMBER ON WHICH ABOVE DETAIL NUMBER IS SHOWN

OVERVIEW:

UNIT 1 BASE GRADES ARE ALREADY CONSTRUCTED. NO CHANGES ARE PROPOSED. UNIT 1, PHASES I AND II HAVE PRE-SUBTITLE D CLAY LINERS. THERE IS NO UNIT 1, PHASE IV. ALL OTHER UNIT 1 AND 2 PHASES ARE SUBTITLE D OR EQUIVALENT. CONFIGURATION OF UNIT 1, PHASES I AND II BASE GRADES IS NOT AVAILABLE, THEREFORE EXISTING TOPOGRAPHY IS SHOWN IN THESE AREAS. UNIT 2 (LATERAL EXPANSION AREA) BASE GRADES ARE PROPOSED.

NOTES:

1. THE EXISTING CONTOUR MAP SHOWN ON THIS DRAWING WAS COMPILED USING PHOTOGRAMMETRIC METHODS BASED ON AERIAL PHOTOGRAPHY PERFORMED ON 08 MARCH 2005 BY SURVEYING AND MAPPING, INC. OF AUSTIN, TEXAS.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL) AS DEFINED BY THE USGS NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929. STATE PLANE COORDINATE GRID CORRESPONDS TO TEXAS COORDINATE SYSTEM, SOUTH CENTRAL ZONE, NORTH AMERICAN DATUM (NAD) 1983.
3. PROPERTY BOUNDARY AND EASEMENT INFORMATION PROVIDED BY SURVEYING AND MAPPING INC., AUSTIN, TEXAS, 23 MAY 2005.
4. PERMIT BOUNDARY AND PROPERTY BOUNDARY COINCIDE.
5. ALL PREVIOUS AND PROPOSED PHASES ARE APPROVED OR PROPOSED FOR TYPE I MUNICIPAL SOLID WASTE (MSW) DISPOSAL. IN ADDITION THE ENTIRE LANDFILL FOOTPRINT IS PROPOSED AS ALLOWABLE FOR REGULATED ASBESTOS CONTAINING MATERIAL DISPOSAL, AS DESCRIBED IN PART IV (SITE OPERATING PLAN).
6. TOP OF LINER CONTOURS REFER TO TOP OF COMPACTED CLAY LINER (I.E. SURFACE ON WHICH THE GEOMEMBRANE LINER WILL BE INSTALLED). FOR CLARITY, ONLY 10-FT CONTOURS ARE SHOWN ON LINER SIDESLOPES OF PROPOSED PHASES THAT ARE NOT YET BUILT. 2-FT CONTOURS ARE SHOWN ON LINER BASE (FLOOR) AREAS.
7. THE BASE GRADE ELEVATIONS SHOWN ON THIS DRAWING REPRESENT THE DEEPEST ALLOWABLE BASE GRADES. AT THE FACILITY'S DISCRETION, PORTIONS OF PHASES MAY BE CONSTRUCTED WITH HIGHER BASE GRADES THAN THOSE ORIGINALLY PERMITTED ON THIS DRAWING AS LONG AS THE LEACHATE COLLECTION SYSTEM LAYOUT REMAINS CONSISTENT, AND A REVISION TO THIS DRAWING (PREPARED AND CERTIFIED BY A TEXAS PROFESSIONAL ENGINEER) IS SUBMITTED TO TCEQ PRIOR TO CONSTRUCTION OF THE REVISED GRADES.
8. STATUS REFERS TO TIME OF INITIAL MSW – 66B APPLICATION SUBMITTAL.
9. PROPOSED LINER SYSTEM DETAILS ARE PRESENTED ON DRAWING 6-15 IN ATTACHMENT 6.
10. AT FACILITY'S DISCRETION, PHASES MAY BE SUBDIVIDED INTO SMALLER AREAS. IF THE UP-GRADIENT (HIGHER FLOOR ELEVATIONS) PORTION OF A PHASE IS DEVELOPED PRIOR TO THE DOWN-GRADIENT PORTION (LOWER FLOOR ELEVATIONS WITH LEACHATE SUMP), A TEMPORARY LEACHATE SUMP SHALL BE USED.
11. REFER TO PART III, ATTACHMENT 15, DRAWING 15-1 FOR ADDITIONAL DETAILS OF LEACHATE MANAGEMENT SYSTEM INCLUDING SIDESLOPE CHIMNEY DRAIN LOCATIONS.

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

MARK	DATE	REVISION	BY	APPROVED
2	02/24/2021	ELIMINATE UNIT 3	JJV	SMG
1	06/06/2006	REVISED SITE ENTRANCE	SMG	SMG
–	07/14/2006	TECHNICALLY COMPLETE	SMG	SMG
–	03/26/2006	RESPONSE TO NOD 1	SMG	SMG
–	11/18/2005	INITIAL SUBMITTAL TO TCEQ	SMG	SMG

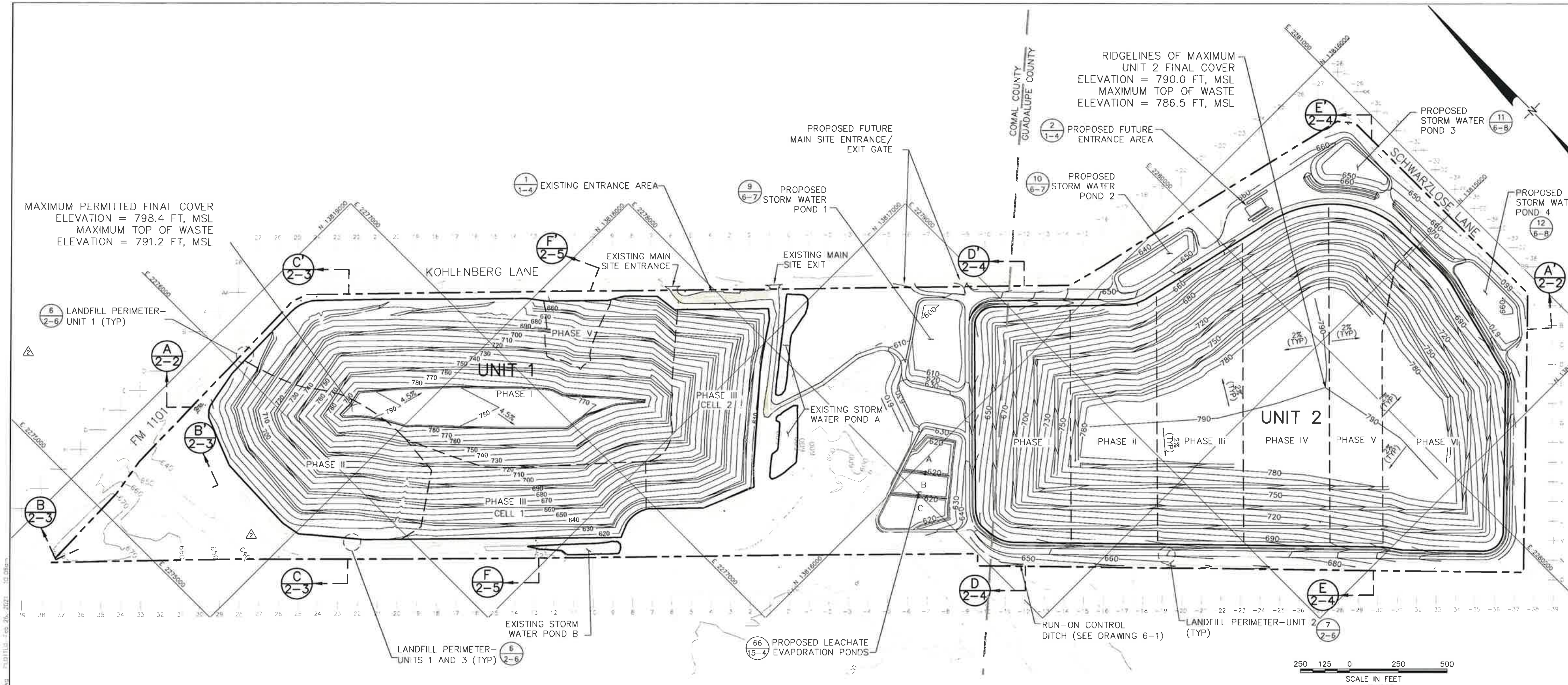
OWNER / SITE ADDRESS:
WASTE MANAGEMENT OF TEXAS, INC.
1000 KOHLENBERG LANE
P.O. BOX 311657
NEW BRAUNFELS, TEXAS 78130
(830) 685-7894

ENGINEER:
GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NO. 1182
8217 SHOAL CREEK BLVD., SUITE 200
AUSTIN, TEXAS 78757
(512) 451-4003

PROJECT: MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

TITLE: OVERALL BASE GRADING PLAN

PROJECT NO.: GT3435-03	DRAWN BY: JJV	REVIEWED BY: BAG	PART NO. III	FIGURE NO: 1-2
FILE NO.: 3435-002	CHECKED BY: SMG	APPROVED BY: SMG		



LEGEND

- EXISTING GROUND ELEVATION (FT, MSL)
- EXISTING ROAD
- EXISTING BUILDING
- PROPERTY BOUNDARY (NOTE 4)
- LIMIT OF WASTE
- PHASE BOUNDARY
- N 13,674,000 E 2,080,000 — STATE PLANE COORDINATES
- SITE GRID
- SITE ACCESS ROAD
- 650 — PROPOSED TOP OF FINAL COVER SYSTEM (FT, MSL)
- PROPOSED LIMIT OF FINAL COVER
- DETAIL OR SECTION NUMBER / PART III DRAWING NUMBER ON WHICH ABOVE DETAIL NUMBER IS SHOWN

OVERVIEW:

UNIT 1 WASTE FILLING IS IN PROGRESS. NO CHANGES ARE PROPOSED TO THE PERMITTED UNIT 1 FINAL COVER GRADING PLAN DESIGN. UNIT 2 (LATERAL EXPANSION AREA) FINAL COVER GRADES ARE PROPOSED.

NOTES:

1. THE EXISTING CONTOUR MAP SHOWN ON THIS DRAWING WAS COMPILED USING PHOTOGRAMMETRIC METHODS BASED ON AERIAL PHOTOGRAPHY PERFORMED ON 08 MARCH 2005 BY SURVEYING AND MAPPING, INC. OF AUSTIN, TEXAS.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL) AS DEFINED BY THE USGS NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929. STATE PLANE COORDINATE GRID CORRESPONDS TO TEXAS COORDINATE SYSTEM, SOUTH CENTRAL ZONE, NORTH AMERICAN DATUM (NAD) 1983.
3. PROPERTY BOUNDARY AND EASEMENT INFORMATION PROVIDED BY SURVEYING AND MAPPING INC., AUSTIN, TEXAS, DATED 23 MAY 2005.
4. PERMIT BOUNDARY AND PROPERTY BOUNDARY COINCIDE.
5. TOP OF FINAL COVER CONTOURS REFER TO PROPOSED FINISHED GRADE (TOP OF VEGETATIVE SOIL COMPONENT OF FINAL COVER SYSTEM). LIMIT OF FINAL COVER SYSTEM REFERS TO PERIMETER TOE OF SLOPE OF VEGETATIVE LAYER.
6. REFER TO ATTACHMENT 6, DRAWING 6-1 FOR SURFACE WATER MANAGEMENT SYSTEM FEATURES ON FINAL COVER (NOT SHOWN ON THIS DRAWING FOR CLARITY), AND FOR TIMING OF STORM WATER POND CONSTRUCTION.
7. REFER TO ATTACHMENT 14, DRAWING 14-4 FOR CONCEPTUAL LANDFILL GAS COLLECTION AND CONTROL SYSTEM DESIGN (NOT SHOWN ON THIS DRAWING FOR CLARITY).

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

MARK	DATE	REVISION	BY	APPROVED
2	02/24/2021	ELIMINATE UNIT 3	JJV	SMG
1	06/06/2006	REVISED SITE ENTRANCE	SMG	SMG
–	07/14/2006	TECHNICALLY COMPLETE	SMG	SMG
–	03/26/2006	RESPONSE TO NOD 1	SMG	SMG
–	11/18/2005	INITIAL SUBMITTAL TO TCEQ	SMG	SMG

OWNER / SITE ADDRESS:

WASTE MANAGEMENT OF TEXAS, INC.
1000 KOHLENBERG LANE
P.O. BOX 311657
NEW BRAUNFELS, TEXAS 78130
(830) 685-7894

ENGINEER:

Geosyntec consultants
GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NO. 1182
8217 SHOAL CREEK BLVD., SUITE 200
AUSTIN, TEXAS 78757
(512) 451-4003

PROJECT: MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

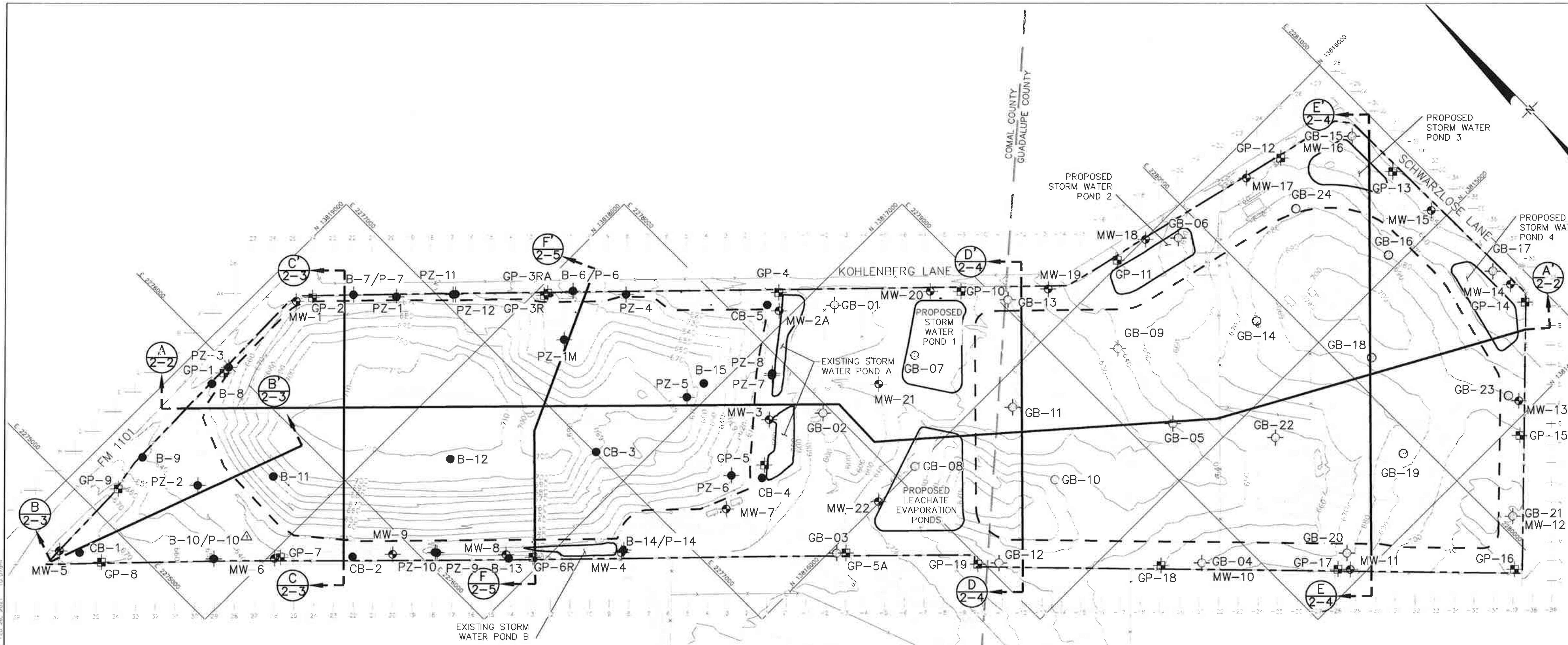
TITLE: **OVERALL FINAL COVER GRADING PLAN**

PROJECT NO.: GT3435-03	DRAWN BY: JJV	REVIEWED BY: BAG	PART NO. III	FIGURE NO: 1-3
FILE NO.: 3435-003	CHECKED BY: SMG	APPROVED BY: SMG		

ATTACHMENT 2

FILL CROSS SECTIONS

- Drawing 2-1 Landfill Cross-Section Location Map
- Drawing 2-2 Landfill Cross-Section A-A’
- Drawing 2-3 Landfill Cross-Section B-B’
  Landfill Cross-Section C-C’
- Drawing 2-4 Landfill Cross Section D-D’
  Landfill Cross Section E-E’
- Drawing 2-5 Landfill Cross Section F-F'
- Drawing 2-6 Landfill Perimeter Detail



LEGEND

—— 650 ——	EXISTING GROUND ELEVATION (FT, MSL)
	EXISTING WATER LINE
—x—x—	EXISTING SITE FENCE
	EXISTING ROAD
	EXISTING BUILDING
—·—·—	PROPOSED LIMIT OF WASTE
—— — ——	PROPERTY BOUNDARY (NOTE 4)
N 13,674,000 E 2,080,000	STATE PLANE COORDINATES
A—20	SITE GRID
● B-11, CB-1	PREVIOUS BORING
● B-7/P-7, PZ-11	PREVIOUS BORING COMPLETED AS PIEZOMETER
○ GB-08	GEOSYNTEC CONSULTANTS BORING
GB-21	GEOSYNTEC CONSULTANTS BORING COMPLETED AS PIEZOMETER
MW-7	GROUNDWATER MONITORING WELL (NOTE 7)
GP-1	GAS MONITORING PROBE (NOTE 8)

NOTES:

1. THE EXISTING CONTOUR MAP SHOWN ON THIS DRAWING WAS COMPILED USING PHOTOGRAMMETRIC METHODS BASED ON AERIAL PHOTOGRAPHY PERFORMED ON 08 MARCH 2005 BY SURVEYING AND MAPPING, INC. OF AUSTIN, TEXAS.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL) AS DEFINED BY THE USGS NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929. STATE PLANE COORDINATE GRID CORRESPONDS TO TEXAS COORDINATE SYSTEM, SOUTH CENTRAL ZONE, NORTH AMERICAN DATUM (NAD) 1983.
3. PROPERTY BOUNDARY AND EASEMENT INFORMATION PROVIDED BY SURVEYING AND MAPPING INC., AUSTIN, TEXAS, DATED 23 MAY 2005.
4. PERMIT BOUNDARY AND PROPERTY BOUNDARY COINCIDE.
5. SEE DRAWING 1-2 FOR PROPOSED BASE GRADING PLAN.
6. SEE DRAWING 1-3 FOR PROPOSED FINAL COVER GRADING PLAN.
7. GROUNDWATER MONITORING WELLS MW-1, MW-2, MW-3, MW-4, AND MW-6 ARE EXISTING. MW-5 IS NO LONGER USED AND HAS BEEN PLUGGED AND ABANDONED. THE REMAINDER ARE PROPOSED. REFER TO PART III, ATTACHMENT 5 FOR ADDITIONAL DETAILS ON THE LOCATION AND TIMING OF THE GROUNDWATER MONITORING NETWORK.
8. GAS MONITORING PROBES GP-1, GP-2, GP-3RA, GP-4, GP-5, GP-6R, AND GP-7 ARE EXISTING. GP-8 AND HIGHER ARE PROPOSED. REFER TO PART III, ATTACHMENT 14 FOR ADDITIONAL DETAILS ON THE LOCATION AND TIMING OF THE GAS MONITORING NETWORK.

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

MARK	DATE	REVISION	BY	APPROVED
⚠	02/24/2021	ELIMINATE UNIT 3	JJV	SMG
–	07/14/2006	TECHNICALLY COMPLETE	SMG	SMG
–	03/28/2006	RESPONSE TO NOD 1	SMG	SMG
–	11/18/2005	INITIAL SUBMITTAL TO TCEQ	SMG	SMG

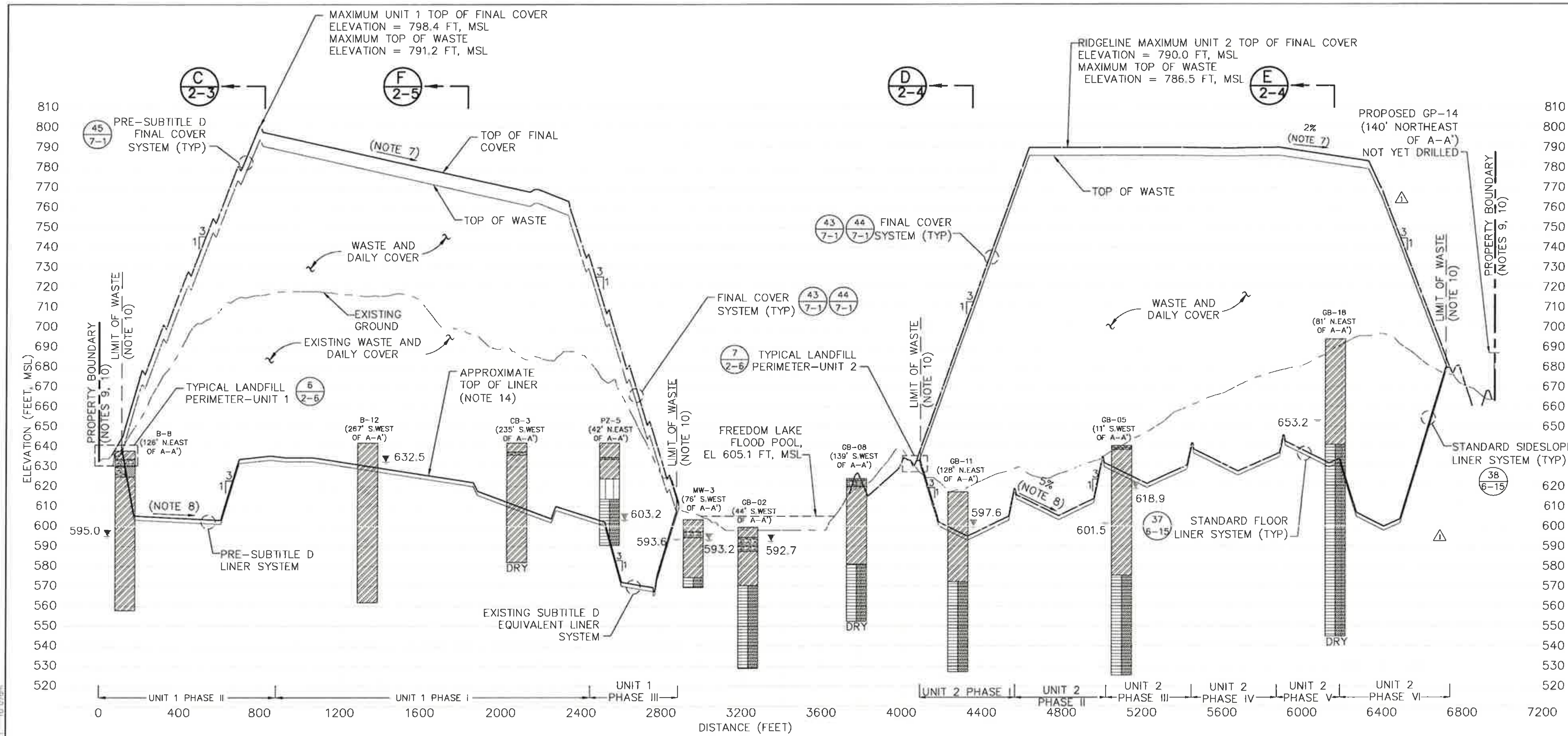
OWNER / SITE ADDRESS:
WM WASTE MANAGEMENT
WASTE MANAGEMENT OF TEXAS, INC.
1000 KOHLENBERG LANE
P.O. BOX 311657
NEW BRAUNFELS, TEXAS 78130
(830) 685-7894

ENGINEER:
Geosyntec consultants
GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NO. 11182
8217 SHOAL CREEK BLVD., SUITE 200
AUSTIN, TEXAS 78757
(512) 451-4003

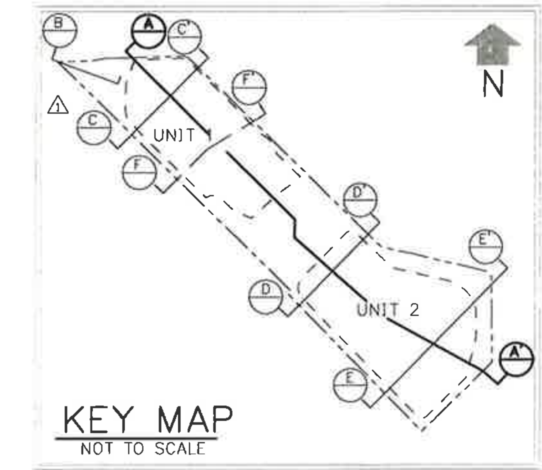
PROJECT: MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

TITLE: LANDFILL CROSS-SECTION LOCATION MAP

PROJECT NO.: GT3435-03	DRAWN BY: JJV	REVIEWED BY: BAG	PART NO. III	FIGURE NO. 2-1
FILE NO.: 3435-005	CHECKED BY: SMG	APPROVED BY: SMG		



CROSS SECTION A-A'

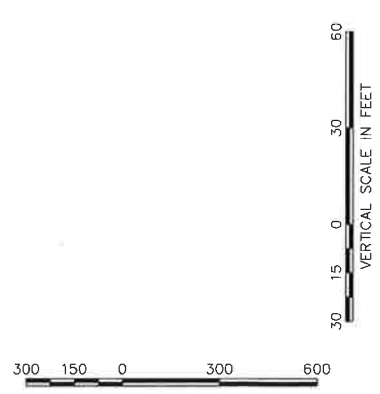


LEGEND OF SOIL/ROCK CLASSIFICATIONS

- (CL-CH) LEAN OR FAT CLAY
- (GW) WELL GRADED GRAVEL
- (GC) CLAYEY GRAVEL
- SILTSTONE
- CLAYSTONE
- INITIAL GROUNDWATER ELEVATION
- FINAL MEASUREMENT OF GROUNDWATER ELEVATION

NOTES:

1. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL).
2. EXISTING GROUND TAKEN FROM A PHOTOGRAMMETRIC METHODS BASED ON AERIAL PHOTOGRAPHY PERFORMED ON 08 MARCH 2005 BY SURVEYING AND MAPPING, INC. OF AUSTIN, TEXAS.
3. TOP OF LINER TAKEN FROM OVERALL BASE GRADING PLAN (ATTACHMENT 1, DRAWING 1-2).
4. TOP OF FINAL COVER TAKEN FROM OVERALL FINAL COVER GRADING PLAN (ATTACHMENT 1, DRAWING 1-3).
5. WATER LEVELS ENCOUNTERED IN BORINGS ARE SHOWN WHERE REPORTED ON BORING LOGS. MANY BORINGS WERE REPORTED DRY. REFER TO ATTACHMENTS 4 AND 5 FOR HYDROGEOLOGIC INTERPRETATIONS AND POTENTIOMETRIC SURFACE.
6. REFER TO ATTACHMENT 4 FOR DETAILED SUBSURFACE INFORMATION, CHARACTERIZATION, CROSS SECTIONS, AND BORING LOGS.
7. PROPOSED TOP OF FINAL COVER IS SLOPED AT 3H:1V ON THE LANDFILL SIDESLOPES BETWEEN DRAINAGE BENCHES AND 2% TO 4.5% ON THE LANDFILL TOP AREAS. SLOPES AND FINAL COVER SYSTEM LAYER THICKNESS MAY APPEAR DISTORTED ON THESE CROSS SECTIONS DUE TO THE EXAGGERATED VERTICAL SCALE AND THE SKEWED ANGLE AT WHICH THE SECTIONS WERE CUT COMPARED TO THE THREE-DIMENSIONAL SLOPE DIRECTIONS.
8. PROPOSED TOP OF CLAY LINER IS SLOPED AT 3H:1V (SEE ATTACHMENT 1, DRAWING 1-2) ON THE LINER SIDESLOPES, AT TWO TO FIVE PERCENT ON LINER BASE (FLOOR) AREAS, AND AT ONE PERCENT ALONG THE LEACHATE COLLECTION CORRIDORS. SLOPES AND LINER SYSTEM THICKNESS MAY APPEAR DISTORTED ON THESE CROSS SECTIONS DUE TO EXAGGERATED VERTICAL SCALE AND THE SKEWED ANGLE AT WHICH THE SECTIONS WERE CUT COMPARED TO THE THREE-DIMENSIONAL SLOPE DIRECTIONS.
9. PROPERTY BOUNDARY COINCIDES WITH PERMIT BOUNDARY.
10. BUFFER ZONES TO LIMIT OF WASTE ARE AS SHOWN ON ATTACHMENT 1, DRAWING 1-1. THE NORTH AND EAST SIDES OF UNIT 1 ALONG FM 1101 AND KOHLENBERG LANE ARE ALREADY PERMITTED WITH A BUFFER THAT VARIES FROM 13 TO 36 FT THROUGH PREVIOUSLY GRANTED BUFFER RULE WAIVERS TO PERMITS 66 AND 66A. THESE AREAS ARE ALREADY FILLED, AND NO CHANGES ARE PROPOSED. ALL PROPOSED LATERAL EXPANSION AREAS (UNIT 2) ARE DESIGNED WITH A MINIMUM OF 125 FT BUFFER.
11. CROSS SECTION DOES NOT GO THROUGH GAS EXTRACTION WELLS. CROSS SECTION PASSES NEAR GAS MONITORING PROBE(S) (GPs) AS SHOWN. SEE ATTACHMENT 14 FOR LANDFILL GAS MANAGEMENT PLAN, INCLUDING LOCATION OF THESE FEATURES.
12. CROSS SECTION PASSES NEAR GROUNDWATER MONITORING WELLS AS SHOWN. SEE ATTACHMENT 5 FOR LOCATION OF THESE FEATURES.
13. PER THE APPROVED SOIL BORING PLAN, THE ELEVATION OF DEEPEST EXCAVATION (EDE) ALLOWABLE FOR THE FACILITY, INCLUDING SUMPS SHALL BE 560 FT, MSL.
14. TOP OF LINER IN PRE-SUBTITLE D AREAS IS APPROXIMATE, AND WAS TAKEN FROM LANDFILL CROSS SECTIONS PRESENTED IN PREVIOUS PERMIT PREPARED BY METROPLEX INC. FOR PERMIT MSW-66A, JULY, 2002.



STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

MARK	DATE	REVISION	BY	APPROVED
⚠	02/24/2021	ELIMINATE UNIT 3	JJV	SMG
–	07/14/2006	TECHNICALLY COMPLETE	SMG	SMG
–	03/28/2006	RESPONSE TO NOD 1	SMG	SMG
–	11/18/2005	INITIAL SUBMITTAL TO TCEQ	SMG	SMG

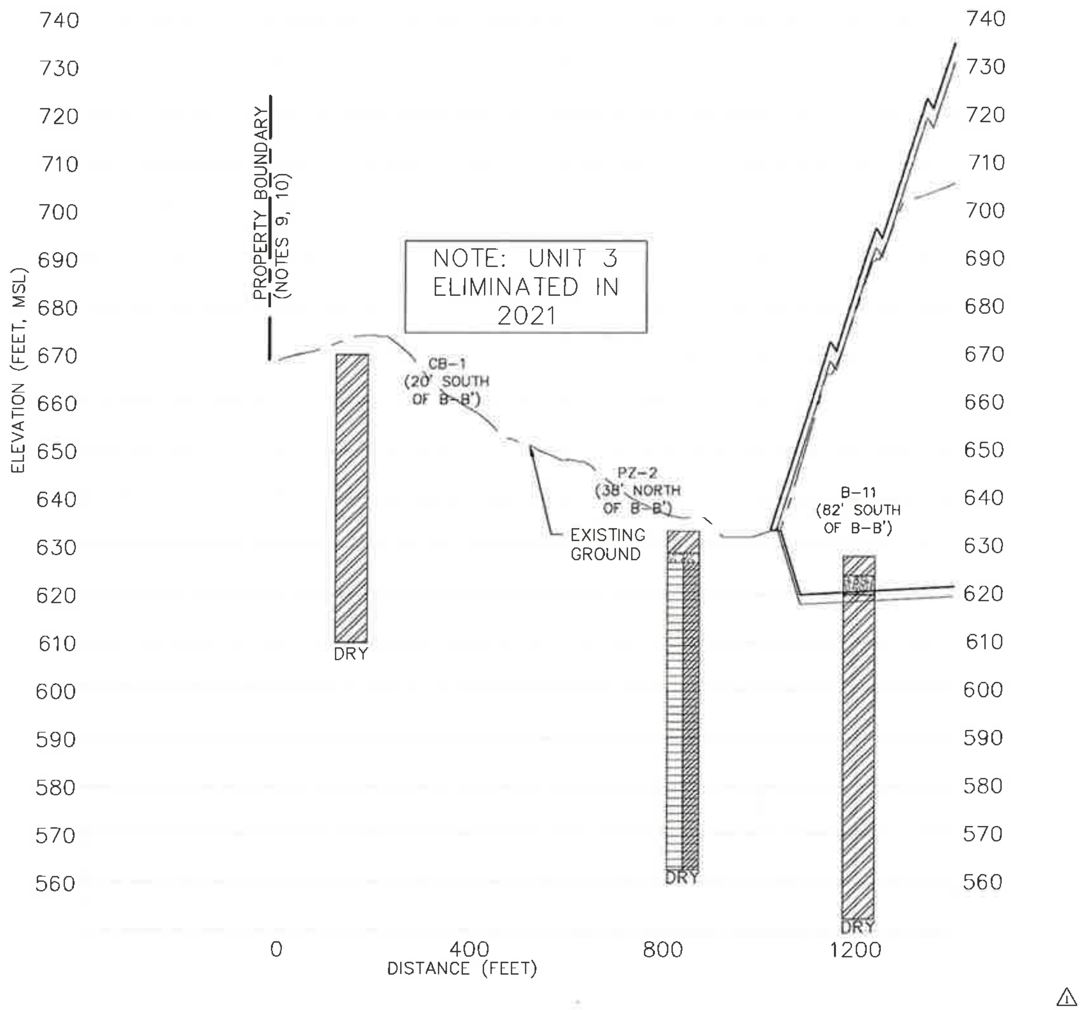
OWNER / SITE ADDRESS:
WASTE MANAGEMENT OF TEXAS, INC.
1000 KOHLENBERG LANE
P.O. BOX 311657
NEW BRAUNFELS, TEXAS 78130
(830) 685-7894

ENGINEER:
Geosyntec consultants
GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NO. 11862
8217 SHOAL CREEK BLVD., SUITE 200
AUSTIN, TEXAS 78757
(512) 451-4003

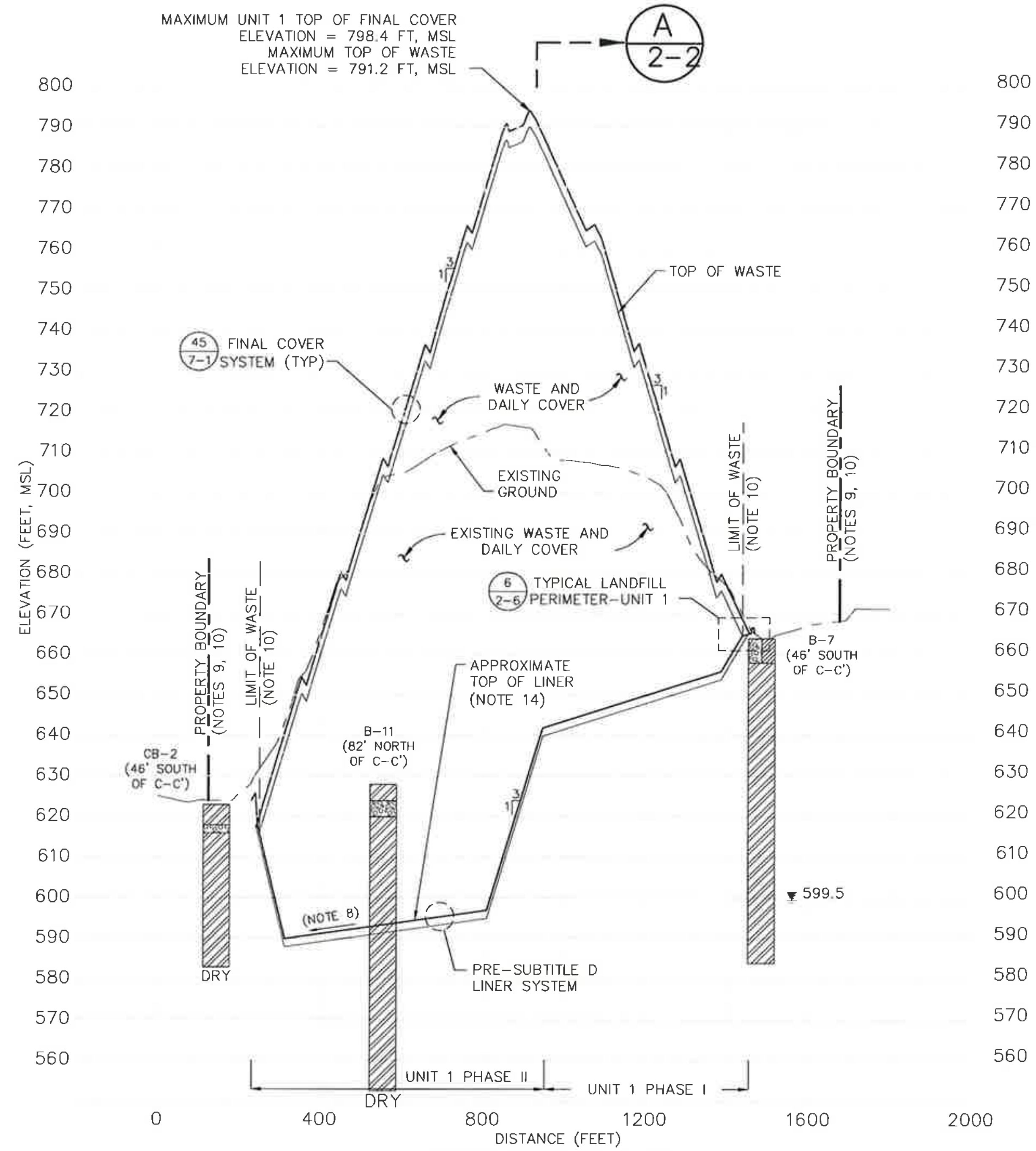
PROJECT: MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

TITLE: LANDFILL CROSS-SECTION A-A'

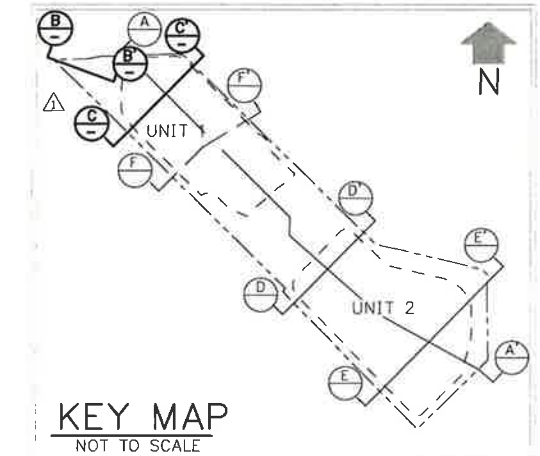
PROJECT NO.: GT3435-03	DRAWN BY: JJV	REVIEWED BY: BAG	PART NO. III	FIGURE NO: 2-2
FILE NO.: 3435-006	CHECKED BY: SMG	APPROVED BY: SMG		



CROSS SECTION B-B'

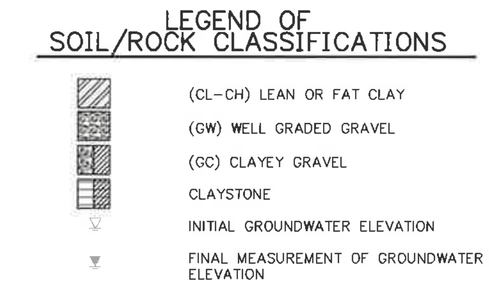


CROSS SECTION C-C'



KEY MAP

NOT TO SCALE



NOTES:

1. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL).
2. EXISTING GROUND TAKEN FROM A PHOTOGRAMMETRIC METHODS BASED ON AERIAL PHOTOGRAPHY PERFORMED ON 08 MARCH 2005 BY SURVEYING AND MAPPING, INC. OF AUSTIN, TEXAS.
3. TOP OF LINER TAKEN FROM OVERALL BASE GRADING PLAN (ATTACHMENT 1, DRAWING 1-2).
4. TOP OF FINAL COVER TAKEN FROM OVERALL FINAL COVER GRADING PLAN (ATTACHMENT 1, DRAWING 1-3).
5. WATER LEVELS ENCOUNTERED IN BORINGS ARE SHOWN WHERE REPORTED ON BORING LOGS. MANY BORINGS WERE REPORTED DRY. REFER TO ATTACHMENTS 4 AND 5 FOR HYDROGEOLOGIC INTERPRETATIONS AND POTENTIOMETRIC SURFACE.
6. REFER TO ATTACHMENT 4 FOR DETAILED SUBSURFACE INFORMATION, CHARACTERIZATION, CROSS SECTIONS, AND BORING LOGS.
7. PROPOSED TOP OF FINAL COVER IS SLOPED AT 3H:1V ON THE LANDFILL SIDESLOPES BETWEEN DRAINAGE BENCHES AND 2% TO 4.5% ON THE LANDFILL TOP AREAS. SLOPES AND FINAL COVER SYSTEM LAYER THICKNESS MAY APPEAR DISTORTED ON THESE CROSS SECTIONS DUE TO THE EXAGGERATED VERTICAL SCALE AND THE SKEWED ANGLE AT WHICH THE SECTIONS WERE CUT COMPARED TO THE THREE-DIMENSIONAL SLOPE DIRECTIONS.
8. PROPOSED TOP OF CLAY LINER IS SLOPED AT 3H:1V (SEE ATTACHMENT 1, DRAWING 1-2) ON THE LINER SIDESLOPES, AT TWO TO FIVE PERCENT ON LINER BASE (FLOOR) AREAS, AND AT ONE PERCENT ALONG THE LEACHATE COLLECTION CORRIDORS. SLOPES AND LINER SYSTEM THICKNESS MAY APPEAR DISTORTED ON THESE CROSS SECTIONS DUE TO EXAGGERATED VERTICAL SCALE AND THE SKEWED ANGLE AT WHICH THE SECTIONS WERE CUT COMPARED TO THE THREE-DIMENSIONAL SLOPE DIRECTIONS.
9. PROPERTY BOUNDARY COINCIDES WITH PERMIT BOUNDARY.
10. BUFFER ZONES TO LIMIT OF WASTE ARE AS SHOWN ON ATTACHMENT 1, DRAWING 1-1. THE NORTH AND EAST SIDES OF UNIT 1 ALONG FM 1101 AND KOHLENBERG LANE ARE ALREADY PERMITTED WITH A BUFFER THAT VARIES FROM 13 TO 36 FT THROUGH PREVIOUSLY GRANTED BUFFER RULE WAIVERS TO PERMITS 66 AND 66A. THESE AREAS ARE ALREADY FILLED, AND NO CHANGES ARE PROPOSED. ALL PROPOSED LATERAL EXPANSION AREAS (UNIT 2) ARE DESIGNED WITH A MINIMUM OF 125 FT BUFFER.
11. CROSS SECTION DOES NOT GO THROUGH GAS EXTRACTION WELLS. CROSS SECTION PASSES NEAR GAS MONITORING PROBE(S) (GPs) AS SHOWN. SEE ATTACHMENT 14 FOR LANDFILL GAS MANAGEMENT PLAN, INCLUDING LOCATION OF THESE FEATURES.
12. CROSS SECTION PASSES NEAR GROUNDWATER MONITORING WELLS AS SHOWN. SEE ATTACHMENT 5 FOR LOCATION OF THESE FEATURES.
13. PER THE APPROVED SOIL BORING PLAN, THE ELEVATION OF DEEPEST EXCAVATION (EDE) ALLOWABLE FOR THE FACILITY, INCLUDING SUMPS SHALL BE 560 FT, MSL.
14. TOP OF LINER IN PRE-SUBTITLE D AREAS IS APPROXIMATE, AND WAS TAKEN FROM LANDFILL CROSS SECTIONS PRESENTED IN PREVIOUS PERMIT PREPARED BY METROPLEX INC. FOR PERMIT MSW-66A, JULY, 2002.

FOR PERMIT PURPOSES ONLY

MARK	DATE	REVISION	BY	APPROVED
1	02/24/2021	ELIMINATE UNIT 3	JJV	SMG
-	07/14/2006	TECHNICALLY COMPLETE	SMG	SMG
-	03/28/2006	RESPONSE TO NOD 1	SMG	SMG
-	11/18/2005	INITIAL SUBMITTAL TO TCEQ	SMG	SMG

OWNER / SITE ADDRESS:

WASTE MANAGEMENT

WASTE MANAGEMENT OF TEXAS, INC.
1000 KOHLENBERG LANE
P.O. BOX 311657
NEW BRAUNFELS, TEXAS 78130
(830) 685-7894

ENGINEER:

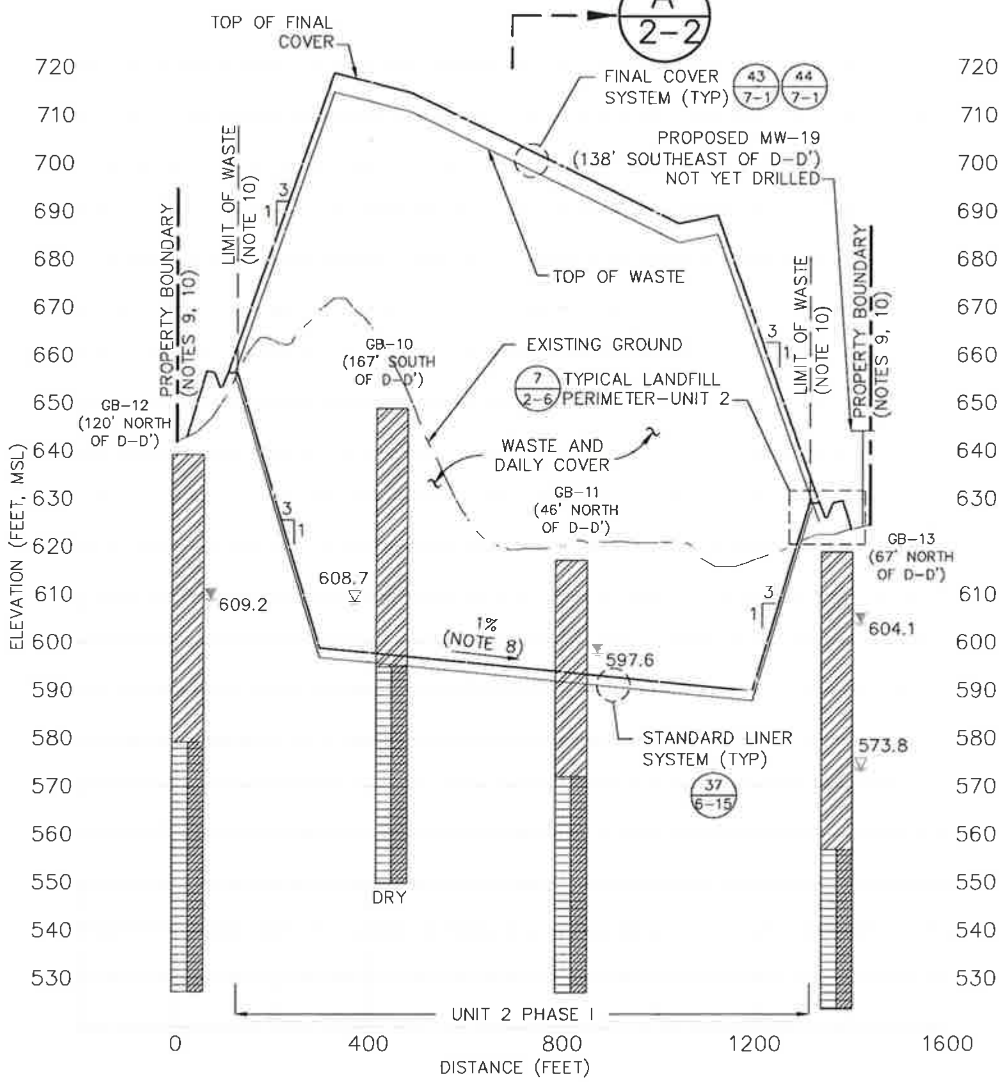
Geosyntec consultants

GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NO. 1182
8217 SHOAL CREEK BLVD., SUITE 200
AUSTIN, TEXAS 78757
(512) 451-4003

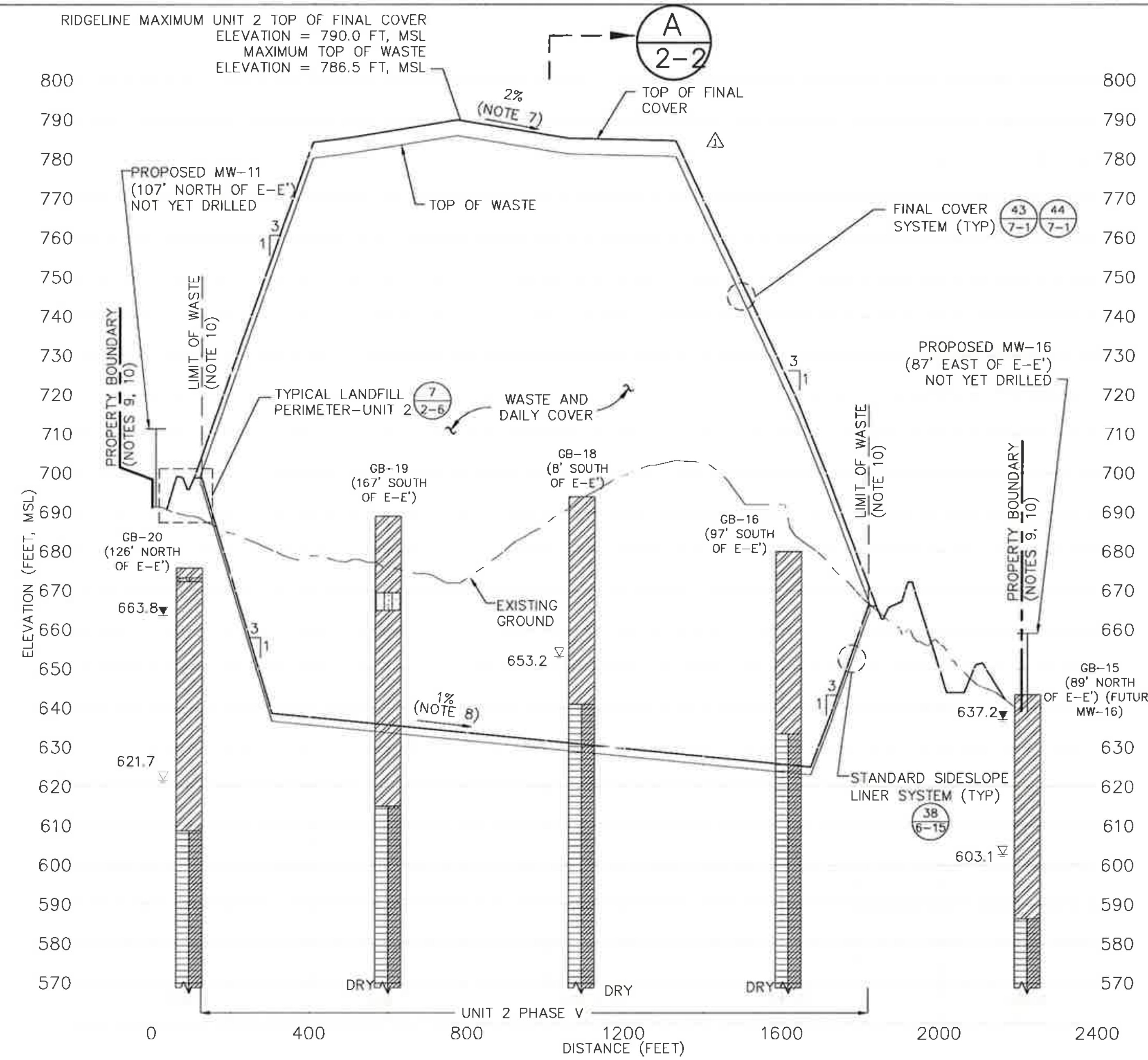
PROJECT: MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

TITLE: LANDFILL CROSS-SECTIONS B-B' AND C-C'

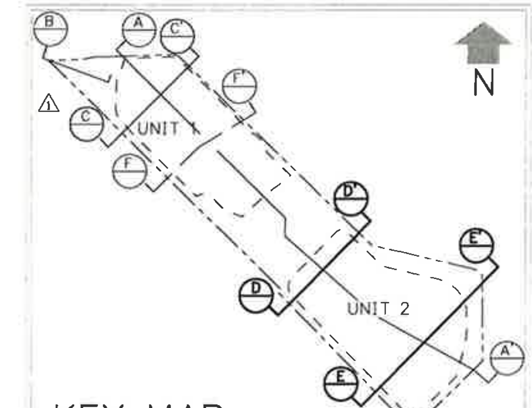
PROJECT NO.: GT3435-03	DRAWN BY: JJV	REVIEWED BY: BAG	PART NO.	FIGURE NO:
FILE NO.: 3435-007	CHECKED BY: SMG	APPROVED BY: SMG	III	2-3



CROSS SECTION D-D'



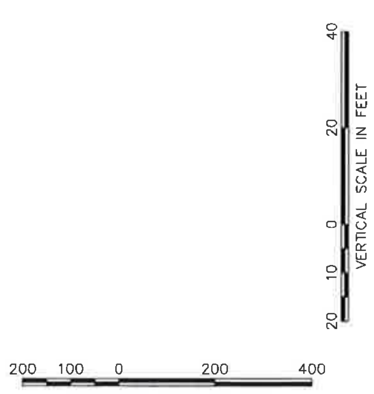
CROSS SECTION E-E'



KEY MAP
NOT TO SCALE

LEGEND OF SOIL/ROCK CLASSIFICATIONS

- (CL-CH) LEAN OR FAT CLAY
- (GC) CLAYEY GRAVEL
- (SM) SILTY SAND
- CLAYSTONE
- INITIAL GROUNDWATER ELEVATION
- FINAL MEASUREMENT OF GROUNDWATER ELEVATION
- INDICATES BORING CONTINUES WITH SAME MATERIAL TO BOTTOM OF BORING ELEVATION SHOWN



NOTES:

1. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL).
2. EXISTING GROUND TAKEN FROM A PHOTOGRAMMETRIC METHODS BASED ON AERIAL PHOTOGRAPHY PERFORMED ON 08 MARCH 2005 BY SURVEYING AND MAPPING, INC. OF AUSTIN, TEXAS.
3. TOP OF LINER TAKEN FROM OVERALL BASE GRADING PLAN (ATTACHMENT 1, DRAWING 1-2).
4. TOP OF FINAL COVER TAKEN FROM OVERALL FINAL COVER GRADING PLAN (ATTACHMENT 1, DRAWING 1-3).
5. WATER LEVELS ENCOUNTERED IN BORINGS ARE SHOWN WHERE REPORTED ON BORING LOGS. MANY BORINGS WERE REPORTED DRY. REFER TO ATTACHMENTS 4 AND 5 FOR HYDROGEOLOGIC INTERPRETATIONS AND POTENTIOMETRIC SURFACE.
6. REFER TO ATTACHMENT 4 FOR DETAILED SUBSURFACE INFORMATION, CHARACTERIZATION, CROSS SECTIONS, AND BORING LOGS.
7. PROPOSED TOP OF FINAL COVER IS SLOPED AT 3H:1V ON THE LANDFILL SIDESLOPES BETWEEN DRAINAGE BENCHES AND 2% TO 4.5% ON THE LANDFILL TOP AREAS. SLOPES AND FINAL COVER SYSTEM LAYER THICKNESS MAY APPEAR DISTORTED ON THESE CROSS SECTIONS DUE TO THE EXAGGERATED VERTICAL SCALE AND THE SKEWED ANGLE AT WHICH THE SECTIONS WERE CUT COMPARED TO THE THREE-DIMENSIONAL SLOPE DIRECTIONS. ⚠
8. PROPOSED TOP OF CLAY LINER IS SLOPED AT 3H:1V (SEE ATTACHMENT 1, DRAWING 1-2) ON THE LINER SIDESLOPES, AT TWO TO FIVE PERCENT ON LINER BASE (FLOOR) AREAS, AND AT ONE PERCENT ALONG THE LEACHATE COLLECTION CORRIDORS. SLOPES AND LINER SYSTEM THICKNESS MAY APPEAR DISTORTED ON THESE CROSS SECTIONS DUE TO EXAGGERATED VERTICAL SCALE AND THE SKEWED ANGLE AT WHICH THE SECTIONS WERE CUT COMPARED TO THE THREE-DIMENSIONAL SLOPE DIRECTIONS.
9. PROPERTY BOUNDARY COINCIDES WITH PERMIT BOUNDARY.
10. BUFFER ZONES TO LIMIT OF WASTE ARE AS SHOWN ON ATTACHMENT 1, DRAWING 1-1. THE NORTH AND EAST SIDES OF UNIT 1 ALONG FM 1101 AND KOHLENBERG LANE ARE ALREADY PERMITTED WITH A BUFFER THAT VARIES FROM 13 TO 36 FT THROUGH PREVIOUSLY GRANTED BUFFER RULE WAIVERS TO PERMITS 66 AND 66A. THESE AREAS ARE ALREADY FILLED, AND NO CHANGES ARE PROPOSED. ALL PROPOSED LATERAL EXPANSION AREAS (UNIT 2) ARE DESIGNED WITH A MINIMUM OF 125 FT BUFFER. ⚠
11. CROSS SECTION DOES NOT GO THROUGH GAS EXTRACTION WELLS. CROSS SECTION PASSES NEAR GAS MONITORING PROBE(S) (GPs) AS SHOWN. SEE ATTACHMENT 14 FOR LANDFILL GAS MANAGEMENT PLAN, INCLUDING LOCATION OF THESE FEATURES.
12. CROSS SECTION PASSES NEAR GROUNDWATER MONITORING WELLS AS SHOWN. SEE ATTACHMENT 5 FOR LOCATION OF THESE FEATURES.
13. PER THE APPROVED SOIL BORING PLAN, THE ELEVATION OF DEEPEST EXCAVATION (EDE) ALLOWABLE FOR THE FACILITY, INCLUDING SUMPS SHALL BE 560 FT, MSL.
14. TOP OF LINER IN PRE-SUBTITLE D AREAS IS APPROXIMATE, AND WAS TAKEN FROM LANDFILL CROSS SECTIONS PRESENTED IN PREVIOUS PERMIT PREPARED BY METROPLEX INC. FOR PERMIT MSW-66A, JULY, 2002.

FOR PERMIT PURPOSES ONLY

MARK	DATE	REVISION	BY	APPROVED
⚠	02/24/2021	ELEMINATE UNIT 3	JJV	SMG
–	07/14/2006	TECHNICALLY COMPLETE	SMG	SMG
–	03/28/2006	RESPONSE TO NOD 1	SMG	SMG
–	11/18/2005	INITIAL SUBMITTAL TO TCEQ	SMG	SMG

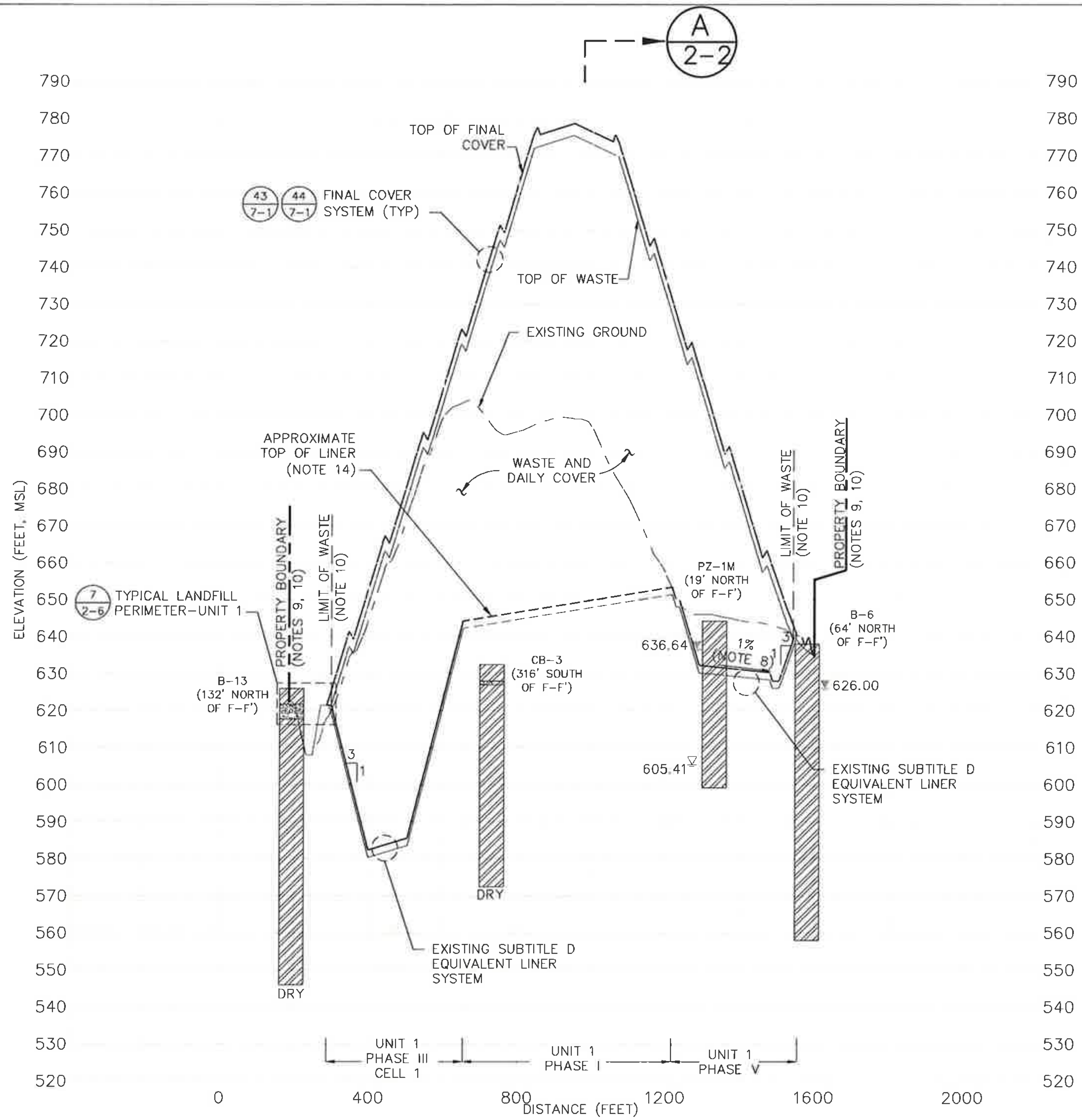
OWNER / SITE ADDRESS: WASTE MANAGEMENT OF TEXAS, INC. 1000 KOHLENBERG LANE P.O. BOX 311657 NEW BRAUNFELS, TEXAS 78130 (830) 685-7894

ENGINEER: Geosyntec consultants — GEOSYNTEC CONSULTANTS, INC. TEXAS ENG. FIRM REGISTRATION NO. 1182 8217 SHOAL CREEK BLVD., SUITE 200 AUSTIN, TEXAS 78757 (512) 451-4003

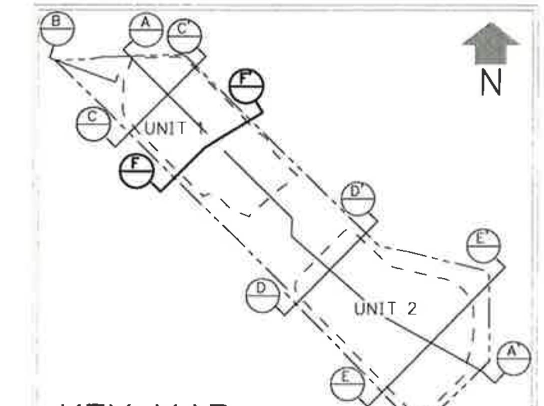
PROJECT: MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

TITLE: LANDFILL CROSS-SECTIONS D-D' AND E-E'

PROJECT NO.: GT3435-03	DRAWN BY: JJV	REVIEWED BY: BAG	PART NO. III	FIGURE NO. 2-4
FILE NO.: 3435-008	CHECKED BY: SMG	APPROVED BY: SMG		



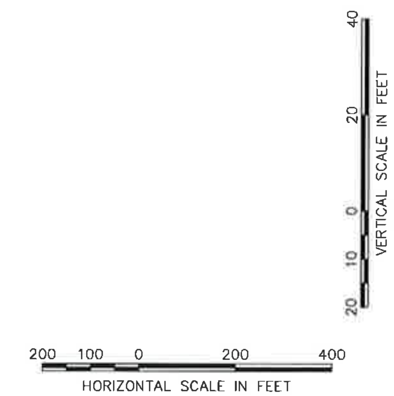
CROSS SECTION F-F'



KEY MAP
NOT TO SCALE

LEGEND OF SOIL/ROCK CLASSIFICATIONS

- (CL-CH) LEAN OR FAT CLAY
- (GC) CLAYEY GRAVEL
- (GW) WELL GRADED GRAVEL
- INITIAL GROUNDWATER ELEVATION
- FINAL MEASUREMENT OF GROUNDWATER ELEVATION



NOTES:

1. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL (FT, MSL).
2. EXISTING GROUND TAKEN FROM A PHOTOGRAMMETRIC METHODS BASED ON AERIAL PHOTOGRAPHY PERFORMED ON 08 MARCH 2005 BY SURVEYING AND MAPPING, INC. OF AUSTIN, TEXAS.
3. TOP OF LINER TAKEN FROM OVERALL BASE GRADING PLAN (ATTACHMENT 1, DRAWING 1-2).
4. TOP OF FINAL COVER TAKEN FROM OVERALL FINAL COVER GRADING PLAN (ATTACHMENT 1, DRAWING 1-3).
5. WATER LEVELS ENCOUNTERED IN BORINGS ARE SHOWN WHERE REPORTED ON BORING LOGS. MANY BORINGS WERE REPORTED DRY. REFER TO ATTACHMENTS 4 AND 5 FOR HYDROGEOLOGIC INTERPRETATIONS AND POTENTIOMETRIC SURFACE.
6. REFER TO ATTACHMENT 4 FOR DETAILED SUBSURFACE INFORMATION, CHARACTERIZATION, CROSS SECTIONS, AND BORING LOGS.
7. PROPOSED TOP OF FINAL COVER IS SLOPED AT 3H:1V ON THE LANDFILL SIDESLOPES BETWEEN DRAINAGE BENCHES AND 2% TO 4.5% ON THE LANDFILL TOP AREAS. SLOPES AND FINAL COVER SYSTEM LAYER THICKNESS MAY APPEAR DISTORTED ON THESE CROSS SECTIONS DUE TO THE EXAGGERATED VERTICAL SCALE AND THE SKEWED ANGLE AT WHICH THE SECTIONS WERE CUT COMPARED TO THE THREE-DIMENSIONAL SLOPE DIRECTIONS.
8. PROPOSED TOP OF CLAY LINER IS SLOPED AT 3H:1V (SEE ATTACHMENT 1, DRAWING 1-2) ON THE LINER SIDESLOPES, AT TWO TO FIVE PERCENT ON LINER BASE (FLOOR) AREAS, AND AT ONE PERCENT ALONG THE LEACHATE COLLECTION CORRIDORS. SLOPES AND LINER SYSTEM THICKNESS MAY APPEAR DISTORTED ON THESE CROSS SECTIONS DUE TO EXAGGERATED VERTICAL SCALE AND THE SKEWED ANGLE AT WHICH THE SECTIONS WERE CUT COMPARED TO THE THREE-DIMENSIONAL SLOPE DIRECTIONS.
9. PROPERTY BOUNDARY COINCIDES WITH PERMIT BOUNDARY.
10. BUFFER ZONES TO LIMIT OF WASTE ARE AS SHOWN ON ATTACHMENT 1, DRAWING 1-1. THE NORTH AND EAST SIDES OF UNIT 1 ALONG FM 1101 AND KOHLENBERG LANE ARE ALREADY PERMITTED WITH A BUFFER THAT VARIES FROM 13 TO 36 FT THROUGH PREVIOUSLY GRANTED BUFFER RULE WAIVERS TO PERMITS 66 AND 66A. THESE AREAS ARE ALREADY FILLED, AND NO CHANGES ARE PROPOSED. ALL PROPOSED LATERAL EXPANSION AREAS (UNIT 2) ARE DESIGNED WITH A MINIMUM OF 125 FT BUFFER.
11. CROSS SECTION DOES NOT GO THROUGH GAS EXTRACTION WELLS. CROSS SECTION PASSES NEAR GAS MONITORING PROBE(S) (GPs) AS SHOWN. SEE ATTACHMENT 14 FOR LANDFILL GAS MANAGEMENT PLAN, INCLUDING LOCATION OF THESE FEATURES.
12. CROSS SECTION PASSES NEAR GROUNDWATER MONITORING WELLS AS SHOWN. SEE ATTACHMENT 5 FOR LOCATION OF THESE FEATURES.
13. PER THE APPROVED SOIL BORING PLAN, THE ELEVATION OF DEEPEST EXCAVATION (EDE) ALLOWABLE FOR THE FACILITY, INCLUDING SUMPS SHALL BE 560 FT, MSL.
14. TOP OF LINER IN PRE-SUBTITLE D AREAS IS APPROXIMATE, AND WAS ESTIMATED FROM INFORMATION PRESENTED IN PREVIOUS PERMIT PREPARED BY METROPLEX INC. FOR PERMIT MSW-66A, JULY, 2002.

STATE OF TEXAS — SCOTT M. GRAVES — 86557 — LICENSED PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

MARK	DATE	REVISION	BY	APPROVED
1	02/24/2021	ELIMINATE UNIT 3	JJV	SMG
–	07/14/2006	TECHNICALLY COMPLETE	SMG	SMG
–	03/28/2006	RESPONSE TO NOD 1	SMG	SMG
–	11/18/2005	INITIAL SUBMITTAL TO TCEQ	SMG	SMG

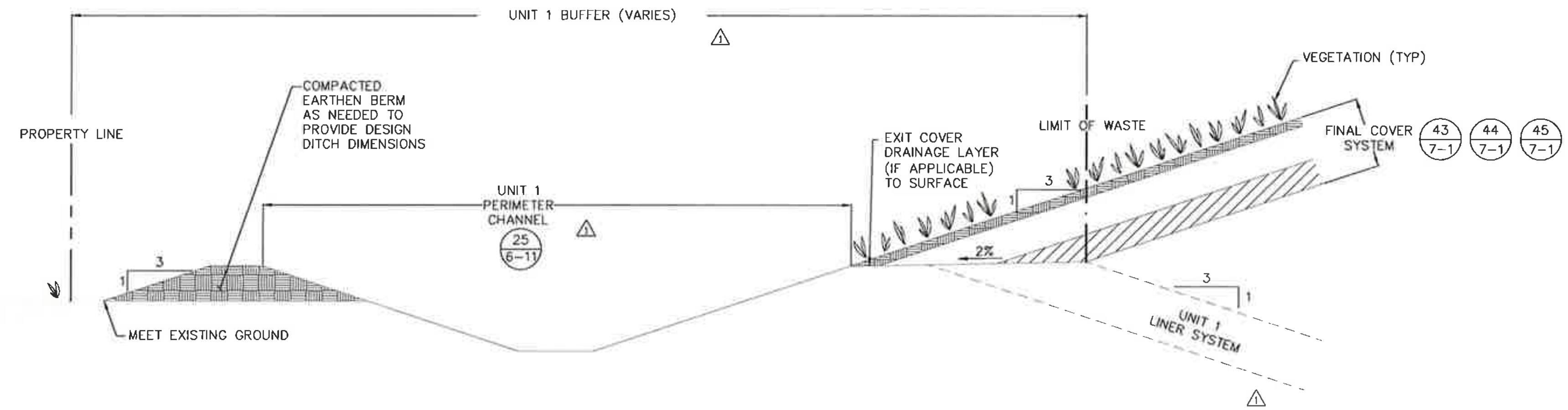
OWNER / SITE ADDRESS: WASTE MANAGEMENT OF TEXAS, INC. 1000 KOHLENBERG LANE P.O. BOX 311657 NEW BRAUNFELS, TEXAS 78130 (830) 685-7894

ENGINEER: Geosyntec consultants — GEOSYNTEC CONSULTANTS, INC. TEXAS ENG. FIRM REGISTRATION NO. 1182 8217 SHOAL CREEK BLVD., SUITE 200 AUSTIN, TEXAS 78757 (512) 451-4003

PROJECT: MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

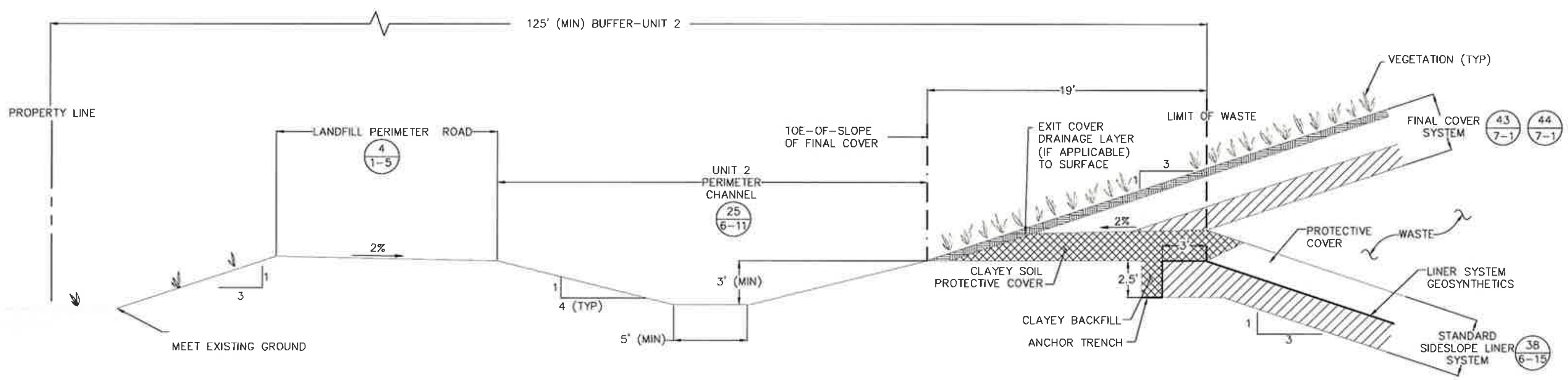
TITLE: LANDFILL CROSS SECTION F-F'

PROJECT NO.: GT3435-03	DRAWN BY: JJV	REVIEWED BY: BAG	PART NO. III	FIGURE NO: 2-5
FILE NO.: 3435-010	CHECKED BY: SMG	APPROVED BY: SMG		



6
1-3
DETAIL
TYPICAL LANDFILL PERIMETER–UNIT 1
XREF: 3435X099.DWG

0 5 10
SCALE IN FEET



7
1-2
DETAIL
TYPICAL LANDFILL PERIMETER–UNIT 2
XREF: 3435X100.DWG

0 5 10
SCALE IN FEET

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY

MARK	DATE	REVISION	BY	APPROVED
⚠	02/24/2021	ELIMINATE UNIT 3	JJV	SMG
–	07/14/2006	TECHNICALLY COMPLETE	SMG	SMG
–	03/28/2006	RESPONSE TO NOD 1	SMG	SMG
–	11/18/2005	INITIAL SUBMITTAL TO TCEQ	SMG	SMG

OWNER / SITE ADDRESS:
WASTE MANAGEMENT
WASTE MANAGEMENT OF TEXAS, INC.
1000 KOHLENBERG LANE
P.O. BOX 311657
NEW BRAUNFELS, TEXAS 78130
(830) 685-7894

ENGINEER:
Geosyntec consultants
GEOSYNTEC CONSULTANTS, INC.
TEXAS ENG. FIRM REGISTRATION NO. 1182
8217 SHOAL CREEK BLVD., SUITE 200
AUSTIN, TEXAS 78757
(512) 451-4003

PROJECT:
MESQUITE CREEK LANDFILL
PERMIT APPLICATION – PERMIT NO. MSW – 66 B

TITLE:
LANDFILL PERIMETER DETAIL

PROJECT NO.: GT3435-04	DRAWN BY: JJV	REVIEWED BY: BAG	PART NO. III	FIGURE NO: 2-6
FILE NO.: 3435-009	CHECKED BY: SMG	APPROVED BY: SMG		

Prepared for Applicant:
Waste Management of Texas, Inc.
1000 Kohlenberg Lane
P.O. Box 311657
New Braunfels, Texas 78130
(830) 625-7894

PERMIT AMENDMENT APPLICATION
PART III – SITE DEVELOPMENT PLAN
ATTACHMENT 4

GEOLOGY REPORT

MESQUITE CREEK LANDFILL
NEW BRAUNFELS, COMAL AND GUADALUPE COUNTIES, TEXAS
MSW PERMIT NO. 66B

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED
PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY.
SEALED FOR FEBRUARY 2021
REVISIONS TO SECTION 7 ONLY.

STATE OF TEXAS
JANET L. RASHKES MEAUX
GEOLOGY
1462
LICENSED
PROFESSIONAL GEOSCIENTIST
2/12/07

FOR PERMIT PURPOSES ONLY

GEOLOGY REPORT,
EXCLUDING SECTION 7 AND
APPENDICES 4-F AND 4-G.

THE ABOVE P.G. IMAGE IS A COPY.
THERE ARE NO FEBRUARY 2021
REVISIONS TO THE P.G-SEALED
SECTIONS.

Prepared by:
Geosyntec consultants
Texas Board of Professional Engineers Firm Registration No. F-1182
Texas Board of Professional Geoscientists Firm Registration No. 50256
8217 Shoal Creek Blvd, Suite 200
Austin, Texas 78757
(512) 451-4003

Initial Application Submittal – 18 November 2005
Response to NOD 1 – 28 March 2006
Response to NOD 2 – 15 May 2006
Supplemental Information – 30 June 2006
Technically Complete – 14 July 2006
Revised – 20 October 2006, 12 February 2007, 24 February 2021

TABLE OF CONTENTS

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED
PROFESSIONAL ENGINEER
2/24/2021

FOR PERMIT PURPOSES ONLY.
SEALED FOR FEBRUARY 2021
REVISIONS TO SECTION 7 ONLY.

GEOSYNTEC CONSULTANTS, INC.
Texas Board of Professional Engineers
Firm Registration No. F-1182

STATE OF TEXAS
JANET L. RASHKES MEAUX
GEOLOGY
1462
LICENSED
PROFESSIONAL GEOSCIENTIST
Janet L. Rashkes Meaux
2/12/07

FOR PERMIT PURPOSES ONLY

GEOLOGY REPORT,
EXCLUDING SECTION 7 AND
APPENDICES 4-F AND 4-G.

STATE OF TEXAS
JANET L. RASHKES MEAUX
GEOLOGY
1462
LICENSED
PROFESSIONAL GEOSCIENTIST
Janet L. Rashkes Meaux 2/12/07
FOR PERMIT PURPOSES ONLY
GEOLOGY REPORT,
EXCLUDING SECTION 7 AND
APPENDICES 4-F AND 4-G.

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED
PROFESSIONAL ENGINEER
2/24/2021
FOR PERMIT PURPOSES ONLY
SEALED FOR FEBRUARY 2021
REVISIONS TO SECTION 7 ONLY.

GEOSYNTEC CONSULTANTS, INC.
Texas Board of Professional Engineers
Firm Registration No. F-1182

STATE OF TEXAS
JANET L. RASHKES MEAUX
GEOLOGY
1462
LICENSED
PROFESSIONAL GEOSCIENTIST
2/12/07
FOR PERMIT PURPOSES ONLY

TABLES

GEOLOGY REPORT, EXCLUDING SECTION 7 AND APPENDICES 4-F AND 4-G.

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED
PROFESSIONAL ENGINEER
2/24/2021
FOR PERMIT PURPOSES ONLY
SEALED FOR FEBRUARY 2021 REVISIONS
TO SECTION 7 ONLY

GEOSYNTEC CONSULTANTS, INC.
Texas Board of Professional Engineers Firm
Registration No. F-1182

DRAWINGS

2/24/2021

STATE OF TEXAS
SCOTT M. GRAVES
86557
LICENSED
PROFESSIONAL ENGINEER

FOR PERMIT PURPOSES ONLY.
SEALED FOR FEBRUARY 2021
REVISIONS TO SECTION 7 ONLY.

GEOSYNTEC CONSULTANTS, INC.
Texas Board of Professional Engineers
Firm Registration No. F-1182

APPENDICES

STATE OF TEXAS
JANET L. RASHKES MEAUX
GEOLOGY
1482
LICENSED
PROFESSIONAL GEOSCIENTIST

Janet L. Rashkes Meaux
2/12/07

FOR PERMIT PURPOSES ONLY

GEOLOGY REPORT,
EXCLUDING SECTION 7 AND
APPENDICES 4-F AND 4-G.

Metroplex (2002) also conducted slope stability and foundation settlement analyses for Units 1 and 3. The slope stability analysis included the following:

- a method of slices analysis of the stability of a 47-ft high, 3 horizontal: 1 vertical (3H:1V) excavation slopes prior to liner system construction, which demonstrated that the calculated minimum factor of safety for circular shear surfaces through the excavation slopes is 8.0;
- a force equilibrium analysis of liner system stability prior to waste placement, which demonstrated that the calculated minimum factor of safety for liner system stability is approximately 1.25;
- a method of slices analysis of the stability of the final landfill configuration, which demonstrated that the calculated minimum factor of safety for circular shear surfaces through the final landfill slopes is 1.6; and
- a force equilibrium analysis of final cover system stability, which demonstrated that the calculated minimum factor of safety for final cover system stability is approximately 1.5.

The calculated slope stability factors of safety were considered adequate.

For the settlement analysis, Metroplex (2002) performed an elastic settlement analysis of the foundation soils beneath Units 1 and 3 and evaluated the effect of the settlements on the post-settlement grades of the leachate collection system. Metroplex (2002) found the calculated settlements to be acceptable as the leachate collection maintained positive drainage.

It is noted that Unit 3 in this section refers to a previously permitted landfill disposal area that was never constructed and is being removed from the permit.

7.4 <u>Recent Geotechnical Evaluation</u>

7.4.1 Results of GeoSyntec Investigation

The findings of the geotechnical investigation of the Unit 2 area (i.e., the landfill expansion area, as shown on Drawing 1-2) are generally consistent with those presented by Metroplex (2002) for the existing facility. Unit 2 is underlain by Stratum I to Stratum IV materials. The Stratum I soils are typified by a medium to high plasticity clay that is stiff to hard in consistency. The Stratum II soils are clayey gravel to gravelly clay. Stratum III is a very stiff to hard oxidized clay or claystone. Stratum IV is a very hard primarily unoxidized clay to claystone. The clay in Strata I through III is primarily classified as CL to CH in accordance with the Unified Soil Classification System.

7.4.2 Suitability of On-Site Soils for Soil Liner and Infiltration Layer

Based on the successful construction over a portion of the existing facility of cover system infiltration layer having a hydraulic conductivity less than 1×10^{-7} cm/s, the Stratum I soil is suitable for soil liner and infiltration layer material. From laboratory permeability tests on remolded samples of the Strata III and IV soils, these soils should also be suitable for use in liner system and final cover system construction. As shown in Table 4-7, the hydraulic conductivities of samples of the Strata III and IV soils ranged from 2.8×10^{-9} to 3.5×10^{-8} cm/s when the soils were remolded to 95 percent of their maximum dry density and optimum moisture content as determined from the standard Proctor compaction test (ASTM D 698). It is noted that the Strata III and IV soils are generally moderately hard to very hard and are drier than optimum moisture content. If used as soil liner or infiltration layer material, these soils will require the addition of water and processing to distribute moisture and reduce clod size.

7.4.3 Excavation Considerations

Based on the previous cell construction at the site, the Strata I, II, and III soils can be excavated with conventional earth moving equipment. The Stratum IV claystone requires more effort to excavate, but could likely be ripped using a bulldozer or excavator with rock excavating teeth, if needed.

7.4.4 Slope Stability Analysis

A slope stability analysis for the landfill was performed by GeoSyntec and supersedes the previous analyses conducted by Metroplex (2002). The analysis was performed to verify the stability of the permitted and constructed landfill area (Unit 1) and the proposed expansion area (Unit 2). The slope stability analysis presented in Appendix 4-F includes figures showing the locations of the critical cross sections within each unit.

The target factor of safety for short-term interim conditions (i.e., foundation slopes prior to liner system construction, liner system slopes prior to waste placement, and interim landfill slopes during operation) is 1.25, and the target calculated factor of safety for long-term conditions (i.e., final landfill slopes at the end of operation and final cover system slopes) is 1.5. An exception to this is for the analysis of the final, long-term condition for Unit 1. For that unit, a factor of safety of 1.25 for the final landfill slopes was considered acceptable because project-specific liner testing was performed and measured strength parameters were used in the slope stability analysis. For all cases considered herein with shear surfaces that pass along a liner or final cover system interface, the target minimum calculated factor of safety using large-displacement strengths is 1.0 for short-term conditions and 1.15 for long-term conditions.

With the exception of the analysis performed for Unit 1, the approach generally taken was to back-calculate the minimum secant effective-stress friction angle that yields the target calculated factor of safety for slope stability for shear surfaces that pass through the liner system or final cover system,. The back-calculated minimum strength values for the liner system and final cover system are incorporated into the SLQCP (Attachment 10 of the Site Development Plan (SDP)) and the FCQCP (Attachment 12 to the SDP), respectively.

The analyses performed by GeoSyntec are presented in Appendix 4-F and include the following:

<u>Unit 1</u>

- a method of slices analysis of the global stability of the final landfill configuration for a critical section in Unit 1, which demonstrated that the calculated minimum factor of safety is 1.35 for the interface friction angle parameters obtained from tests performed during construction of the liner system.

<u>Unit 2</u>

- a method of slices analysis of the stability of a 60-ft high, 3H:1V excavation slope prior to liner system construction, which demonstrated that the calculated minimum factor of safety for excavation stability is 1.26;

- a force equilibrium analysis of liner system stability prior to waste placement, which demonstrated that, for 3H:1V side slopes, the calculated minimum factor of safety for liner system stability is 1.25 if the minimum peak secant effective-stress friction angle of the liner system interfaces is 21.1° and 1.00 if the minimum large-displacement secant effective-stress friction angle of the liner system interfaces is 16.8°;

- a force equilibrium analysis of final cover system stability, which demonstrated that the calculated minimum factor of safety for final cover system stability is approximately 1.51 if the minimum peak secant effective-stress friction angle of the final cover system interfaces is 21.3° and 1.20 if the minimum large-displacement secant effective-stress friction angle of the liner system interfaces is 16°;

- a method of slices analysis of the global stability of the worst-case interim landfill configuration, which demonstrated that the calculated minimum factors of safety of 1.26

and 1.0, respectively if the minimum peak and large-displacement secant effective-stress friction angles for the floor liner system are 9.4º and 5.7º, respectively; and

- a method of slices analysis of the global stability of the final landfill configuration, which demonstrated that the calculated minimum factors of safety are 1.5 and 1.15, respectively, if the minimum peak and large-displacement secant effective-stress friction angles for floor liner system are 12° and 6.8°, respectively.

7.4.5 Foundation Settlement Analysis

A settlement analysis for the landfill was performed by GeoSyntec and supersedes the previous analyses conducted by Metroplex (2002). The settlement analysis was performed to evaluate the effect of compression of the foundation materials on the post-settlement grades of the leachate collection system in Units 1 and 2. If the differential settlements of these materials are too great, the leachate collection system may not maintain positive drainage. The analyses performed by GeoSyntec are presented in Appendix 4-G and summarized below.

The minimum slope of the leachate collection system is 1% in each phase of Units 1 and 2 and occurs along the leachate collection corridor. The highest differential settlements along the leachate collection corridor will occur where the corridor is underlain by the thickest, most compressible materials (the Stratum III clays) and the differential loads along the corridor are the greatest. From a review of the hydrogeologic sections (Drawings 4-7 to 4-11), the overall base grading plan (Drawing 1-2), and the overall final grading plan (Drawing 1-3), the critical cross sections for differential settlement occur along the leachate collection corridor of Phase V of Unit 1 and the leachate collection corridors of Phases II, III, and IV of Unit 2. These critical cross sections have relatively thick layers of Stratum III clays below the proposed base grades. Additionally, at final grades, the leachate collection corridors of these phases will be subject to relatively high differential loads.

Differential settlements along the leachate collection corridors were calculated, and the effect of the settlements on the corridor slopes was evaluated. As shown in Appendix 4-G, the minimum calculated post-settlement slope for the evaluated sections in Units 1 and 2 is 0.4%. Since positive drainage is maintained, calculated foundation settlements beneath the landfill are considered acceptable.

APPENDIX 4-F

SLOPE STABILITY ANALYSIS

Written by:	J. Lang/ L. Peve	Date:	05/10/11 21/01/18 (YY/MM/DD)	Reviewed by:	B. Gross/ S. Graves
		Date:	05/11/11 21/02/24 (YY/MM/DD)		
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435
Task No:	03				

SLOPE STABILITY ANALYSIS

FOR PERMIT PURPOSES ONLY.
SEALED FOR FEBRUARY 2021 REVISIONS ONLY.

INTRODUCTION

The purpose of this calculation package is to present the slope stability analysis for the proposed expansion of the Waste Management of Texas (WMTX) Mesquite Creek Landfill. An analysis was performed to verify the stability of the final slopes of the currently permitted and constructed landfill area (Unit 1). The base grades of Unit 1 have been constructed, the first increment of final cover system has been installed over this unit, and the remainder of the unit is currently being filled. Both stability of the final landfill slopes and stability of the final cover system slopes of Unit 1 were considered. A slope stability analysis was also performed for the proposed expansion area (Unit 2).

The components of the landfill for which the static slope stability analysis were performed are:

- foundation slopes prior to liner system construction;
- liner system slopes prior to waste placement (i.e., liner system veneer);
- interim landfill slopes during operation;
- final cover system slopes (i.e., final cover system veneer); and
- final landfill slopes at the end of operation.

The slope stability factor of safety (FS) is evaluated herein for cross sections that represent critical combinations of geometry and shear strength. For shear surfaces that pass through the liner system or final cover system, the approach generally taken is to back-calculate the minimum secant effective-stress friction angle for the liner system or final cover system that yields the target calculated factor of safety for slope stability. The back-calculated minimum strength values for the liner system and final cover system are incorporated into the SLQCP (Attachment 10 of the Site Development Plan (SDP)) and the Final Cover Quality Control Plan (Attachment 12 to the SDP), respectively.

Minimum acceptable factors of safety for landfill slope stability depend on project-specific conditions and uncertainties. The target calculated factor of safety for short-term interim conditions (i.e., foundation slopes prior to liner system construction, liner system veneer, and interim landfill slopes during operation) is 1.25. The target calculated factor of safety for long-term conditions (i.e., final cover veneer and final landfill slopes at the end of operation) is 1.5. An exception to this is for the analysis of the final landfill slopes for Unit 1. For that unit, a factor of safety of 1.25 for the final landfill slopes was considered acceptable because project-specific liner testing was performed and measured strength parameters were used in the slope stability analysis. To provide additional confidence in the reliability of the design, for all cases considered herein with shear surfaces that pass along a liner or final cover system interface, target factors of safety using large-displacement strengths are also set. The target minimum calculated factor of safety using large-displacement strengths is 1.0 for short-term conditions and 1.15 for long-term conditions. It is noted that the minimum large-displacement strength back-calculated to achieve target factors of safety applies to the critical interface that had the lowest peak strength, which may not always be the interface with the lowest large-displacement strength.

METHOD

Liner system and final cover system veneer stability was evaluated using the force equilibrium method presented by Giroud et al. (1995). The veneer stability analysis is presented in Appendix 4F-1.

The slope stability of all other landfill components was analyzed using a method of slices coded in the computer program SLIDE [Rocscience, 2004], which has been updated since the initial submittal of this calculation package and is now referred to as Slide2 [Rocscience, 2020]. The computer program was used to generate circular and non-circular (block-type) shear surfaces and calculate the factors of safety of these surfaces using the simplified Bishop's (1955) and Spencer's (1967) methods, respectively.

CRITICAL CROSS SECTIONS

The slope stability analysis was performed for several cross sections to evaluate the different critical configurations of the various components of the landfill. The overall base grading plan (Drawing 1-2 in Attachment 1), overall final grading plan (Drawing 1-3 in Attachment 1), hydrogeologic sections (Drawings 4-7 to 4-11 in Attachment 4), top of Stratum IV elevation map (Drawing 4-12 in Attachment 4), and liner system and final cover system materials for the different phases of the landfill were considered when selecting the geometry of the critical cross sections.

The base grading plan and final grading plan for the landfill are shown in Figures 4F-1 and 4F-2, respectively.

Foundation Slopes

The critical cross sections for foundation slope stability occur along the longest and steepest excavation slopes. The overall base grading plan (Figure 4F-1) incorporates 3 horizontal: 1 vertical (3H:1V) foundation slopes in the lateral expansion areas incorporated in this permit amendment application (Unit 2, Phases I to VI).
The 3H:1V foundation slope in Unit 2 that incorporates the greatest Stratum I/II thickness of approximately 32 ft is located on the southeast side of Phase I (Figure 4F-1). This slope, as represented by A-A' on Figure 4F-1, was considered in the foundation slope stability analysis for Phases I-V.

The 3H:1V foundation slope in Unit 2 that incorporates the critical excavation slope is located along the southeast side of Phase VI (Figure 4F-1). This slope, as represented by F-F' on Figure 4F-1, was considered in the foundation slope stability analysis for Phase VI.

Liner System and Final Cover System Veneer

The cross sections considered for the veneer stability analysis are described in Appendix 4F-1.

Interim Landfill Slopes

The critical case for stability of the 3H:1V interim landfill slopes occurs during the tallest waste filling slope. The critical cross section for Unit 2, Phase III is shown as B-B' in Figures 4F-1 and 4F-2. If 3H:1V interim waste slopes are maintained in the vicinity of this phase and waste is piggy-backed onto existing waste in Phase II, the construction increment could be filled to a maximum elevation of approximately 790 ft msl, the final waste grades for the landfill.

The critical cross section for Unit 2, Phase VI is shown as F-F' in Figures 4F-1 and 4F-2, depicting a condition which occurs after the excavation of Unit 2, Phase VI and during the filling of Phase V. If 3H:1V interim waste slopes are maintained in the vicinity of this phase and waste is piggy-backed onto existing waste in Phase V, the construction increment could be filled to a maximum elevation of approximately 790 ft msl, the final waste grades for the landfill; hence the inclusion of this cross section for analysis.

Final Landfill Slopes

Phases III and V of the Unit 1 area were constructed with Subtitle D liner systems that incorporate a geomembrane/geosynthetic clay liner (GCL) composite liner and are active landfilling areas. However, the drainage layer in the liner system for Unit I, Phase V is different from the drainage layer for Unit 1, Phase III, which could lead to different critical interface surfaces in the stability analysis. Therefore, two different cross sections with a geomembrane/GCL liner were evaluated, one for Unit 1, Phase III, and one for Unit 1, Phase V. Two additional cross sections were used to evaluate the standard geomembrane/compacted clay composite liner of Unit 2.

The critical case for stability of the landfill at final grades for the geomembrane/GCL composite liner of Unit 1, Phase V occurs at section C-C' in Unit 1, Phase V (Figures 4F-1 and 4F-2). The section intersects Phase V parallel to the leachate collection corridor (in the general northeast-southwest direction). The section has relatively tall final cover system slopes (approximately 125 ft high) and relatively short liner system slopes (approximately 15 ft high).

The critical case for stability of the landfill at final grades for the geomembrane/GCL composite liner of Unit 1, Phase III occurs at section D-D' (Figures 4F-1 and 4F-2). The section intersects Phase III perpendicular to the leachate collection corridor (in the general southeast-northwest direction). The section has relatively tall final cover system slopes (approximately 123 ft high) and approximately 58-ft high liner system side slopes.

The critical case for stability of Unit 2 at final grades with a standard liner system and at final grades occurs for a cross section that intersects Unit 2, Phase I perpendicular to the leachate collection corridor (in the general northeast-southwest direction). The section has relatively tall final cover system slopes (approximately 163 ft high) and relatively short liner system slopes (approximately 25 ft high). This cross section is shown as E-E' in Figures 4F-1 and 4F-2. Cross section F-F' has a shallower final landfill slope (approximately 73 ft high) compared to cross section E-E' and is therefore less critical; however, because it has a taller liner system slope, cross section F-F' was also analyzed for completeness.

LINER SYSTEM AND FINAL COVER SYSTEM MATERIALS

Liner System

The liner system for all of Unit 1 has been constructed. Unit 1, Phases I and II were constructed with a pre-subtitle D liner system. Unit 1, Phases III and V were constructed with a Subtitle D liner system consisting of the following:

- 2-ft thick protective cover;
- leachate collection system:
  - on side slope of Phase V, double-sided geocomposite (i.e., geonet with geotextile bonded to its top and bottom surfaces) and
  - on side slope and floor of Phase III and on floor of Phase V, 8 or 16-oz/sy needlepunched nonwoven geotextile filter layer over geonet drainage layer;
- 60-mil thick high density polyethylene (HDPE) geomembrane liner (smooth on floor and textured on side slopes);
- GCL; and
- 0.5-ft thick prepared subgrade.

For Unit 2, the liner system consists of the following components, from top to bottom:

- 2-ft thick protective cover;
- leachate collection system:
  - on side slope, double-sided geocomposite OR 16-oz/sy needlepunched nonwoven geotextile drainage/filter layer and
  - on floor, 8-oz/sy needlepunched nonwoven geotextile filter layer over geonet drainage layer OR double-sided geocomposite;
- 60-mil thick HDPE geomembrane liner (smooth or textured on floor and textured on side slopes); and
- 2-ft thick compacted soil liner.

Final Cover System

The standard final cover system cross section, as shown on Drawing 7-1 in Attachment 7 to the SDP, consists of the following components from top to bottom:

- 2.0-ft thick vegetative soil/cover soil;
- double-sided geocomposite drainage layer;
- 40-mil thick textured polyethylene (PE) geomembrane liner; and
- 1.5-ft thick compacted soil liner.

The alternative final cover system shown on Drawing 7-1 only uses soils components. The soil components in the alternative final cover system have higher strengths than the weakest interface in the standard final cover system, which incorporates geosynthetics. Therefore, only the standard final cover system will be considered herein.

MATERIAL PARAMETERS

Foundation Soils

Unit Weight

Based on the results of moisture content and dry unit weight tests for the Strata III/IV soils, the representative moist unit weight of the Strata III/IV soils are assumed to be 133 pcf. The representative moist unit weight of Stratum I/II soils is assumed to be 120 pcf.

Shear Strength

When the foundation slopes are excavated, excess negative pore pressures build up in the fine-grained overconsolidated soils as the soils attempt to expand. This increases the effective stress in the soils and hence increases the mobilized frictional shearing resistance. Over time as the excess negative pore pressures dissipate, the strength of the soils will decrease and approach their long-term drained values. The short-term undrained strength of the foundation soils will be considered in the evaluation of foundation slope stability. The long-term drained strength of the foundation soils will be considered in the evaluation of interim and final landfill slopes.

The undrained strengths of the clayey foundation soils at the Mesquite Creek Landfill were estimated using a correlation between undrained strength and Standard Penetration Test (SPT) blow counts. Based on results of SPT blow counts for soil borings performed in the Unit 2 lateral expansion area and the general relationship between SPT blow count and undrained shear strength (Das, 1990), the representative undrained cohesion (c) for the in-situ Strata I/II and III soils are assumed to be 500 and 1,600 psf, respectively. Stratum IV was assigned a representative undrained cohesion of 7,000 psf; it is noted that in some analysis cases, Stratum IV was conservatively assigned the same strength as Stratum III even though it is substantially harder and stronger rock-like clay-shale material. It should also be noted that the undrained shear strength values for the Strata III and IV soils determined from laboratory testing (Tables 4-4 and 4-7 of Attachment 4) are considerably higher than the undrained strength values used in the stability analyses. Any compacted site fill that is used to replace the stiff Stratum I/II soils beneath the liner system was assumed to have an undrained cohesion of 400 psf, the same value assumed for the liner system protective cover. The rationale for selecting a value of 400 psf for the protective cover is presented in Appendix 4F-1.

The long-term large-displacement drained strength of the Stratum I/II and III/IV soils was estimated from the torsional shear strength data presented by Stark and Eid (1994) for clays and shales. Stark and Eid found that the drained residual strength of a clay or shale is related to the material liquid limit, fraction of clay-sized particles (< 0.002 mm), and effective normal stress. From the geotechnical data for the Stratum I/II soils presented in Tables 4-3 and 4-6 of Attachment 4, the liquid limit of the surficial soils generally range from 43 to 77% and averages 62%. The fraction of clay-sized particles ranges from 37 to 68%. Similarly, for Stratum III/IV soils, the liquid limit of the soil generally ranges from 33 to 104% and averages 60%. The fraction of clay-sized particles ranges from 53 to 86%. Using the average liquid limit values and the residual friction angle relationship presented by Stark and Eid, the long-term large-displacement drained strength of the Stratum I/II and III/IV material was assumed to be represented by an effective-stress friction angle of 14°. In the evaluation of the interim landfill slopes for Unit 2, Phase VI, the drained shear strength of Stratum IV was assumed to be represented by an effective-stress friction angle of 26 degrees based on the geotechnical investigation included in Attachment 4.

Liner System and Final Cover System

The liner system and final cover system have soil components and geosynthetic components. Tables 4F-1 and 4F-2 in Appendix 4F-1 presents typical strength properties for compacted soils. Table 4F-3 in Appendix 4F-1 presents typical interface friction values for common interfaces used in preliminary design. A discussion of the selection of the unit weight and shear strength values for the slope stability analysis is provided below.

Soil Unit Weight

On-site soil (generally classified as CL or CH material) will be used as cover soil and compacted soil liner for the liner system and final cover system. The moist unit weight of these soil layers was assumed to be 120 pcf.

Soil and Interface Shear Strength

The liner system and final cover system strength parameters used in the veneer stability analysis are presented in Appendix 4F-1.

Site-specific interface shear testing results obtained during construction of Unit 1, Phase V and results of interface shear tests obtained during construction at nearby landfill facility operated by WMTX were used for the slope stability analysis of the Unit 1 slopes at final grades (Appendix 4F-3). Interface testing determined that the critical interface for the floor liner system of Unit 1, Phases III and V was the smooth geomembrane/geonet interface. For the side slope liner system of Unit 1, Phase V, interface tests indicated that slippage occurs between the GCL and the overlying textured geomembrane at low stresses and between the GCL and the underlying soil at higher stresses. For the side slope liner system of Unit 1, Phase III, tests on the geonet/textured geomembrane interface resulted in lower secant angles of interface friction than those measured for the geomembrane/GCL and GCL/soil interfaces. Therefore, the critical liner system interface for the Unit 1, Phase III side slopes occurs between the geonet and underlying textured geomembrane. The interface parameters that are used in the stability analyses of Unit 1 are listed below.

Because the liner system configuration for Unit 2 is different from Unit 1, the interface testing described above was not applicable. Instead, published values for interface friction angles were used in the Unit 2 stability analyses. Based on the data in Table 4F-2 in Appendix 4F-1, it is anticipated that the critical side slope liner system interface for the interim and final landfill scenarios of Unit 2 would occur between the geocomposite and textured geomembrane, or textured geomembrane and compacted soil liner. The minimum secant friction angle of these interfaces under large-displacement conditions is assumed to be 13° for the calculations herein.

The critical liner system interface on the floor of Unit 2 is anticipated to occur between the geonet and smooth geomembrane, or smooth geomembrane and compacted soil liner. The minimum secant friction angle of this interface under peak-displacement conditions may range from approximately 7° to 15°. The value required to achieve the target calculated factors of safety for the interim and final landfill scenarios is back-calculated herein. For the scenario with the landfill at final grades, the minimum peak secant interface friction angle for the floor liner system in Unit 2 is back-calculated for target factors of safety of 1.5. The value determined for the floor liner system final landfill scenario is then used to verify that the calculated factor of safety for the interim scenario is greater than 1.25.

<u>Waste</u>

Municipal solid waste will be placed in the Mesquite Creek Landfill. Properties assumed for municipal solid waste are discussed below.

Unit Weight

The average unit weight of the waste was assumed to be 80 pcf.

Shear Strength

The shear strength parameters of the waste were selected based on published information on the shear strength of municipal solid waste (Kavazanjian et al., 1995). A bilinear effective-stress shear strength envelope was used to model the waste. This envelope is defined as: (i) a cohesion of 500 psf and a friction angle of zero degrees for normal stresses up to 770 psf; and (ii) a cohesion of zero and a friction angle of 33° for normal stresses greater than 770 psf.

<u>Summary of Material Parameters Used in Stability Analysis</u>

Note: γ = moist unit weight; c = cohesion; σ' = effective stress; ϕ' = effective-stress friction angle; and δ = secant effective-stress interface friction angle.

- Foundation
  - Stratum I/II
    - γ = 120 pcf
    - Undrained strength (used in evaluation of foundation slopes): c = 500 psf
    - Drained strength (used in evaluation of interim and final landfill slopes): ϕ' = 14°
  - Stratum III
    - γ = 133 pcf
    - Undrained strength (used in evaluation of foundation slopes): c = 1600 psf
    - Drained strength (used in evaluation of interim and final landfill slopes): ϕ' = 14°
  - Stratum IV
    - γ = 133 pcf
    - Undrained strength (used in evaluation of Unit 2, Phase VI foundation slopes): c = 7000 psf
    - Drained strength (used in evaluation of Unit 2, Phase VI interim and final landfill slopes): ϕ' = 26°

- Liner System
  - Protective cover soil
    - γ = 120 pcf
    - Undrained strength (used in evaluation of liner system veneer): c = 400 psf
    - Drained strength (used in evaluation of liner system veneer): c' = 250 psf and ϕ' = 25°
  - Interface strength

    <u>Unit 1</u> (Used in slope stability analysis of Unit 1 at final grades)
    - Floor
      - Peak-displacement strength
        - δ = 12.9° for 0 < σ' < 2,160 psf

            - δ = 12.5° at σ' > 5,760 psf
        - Large-displacement strength
            - δ = 12.6° for 0 < σ' < 2,160 psf
            - δ = 11.2° for σ' > 5,760 psf
    - Side slope (large-displacement values)
        - Phase V:
            - δ = 19.9° for 0 < σ' < 720 psf
            - δ = 15.0° for σ' = 5,760 psf
            - δ = 10.7° for σ' > 10,800 psf
        - Phase III:
            - δ = 12.5° for 0 < σ' < 1,500 psf
            - δ = 10.3° for σ' > 7,000 psf

Unit 2

- Side slope
    - Low-stress strength (used in evaluation of Unit 2 liner system veneer): back-calculated peak and large-displacement strengths in Appendix 4F-1
    - High-stress strength (used in evaluation of Unit 2 interim and final landfill slopes)
        - Peak strength: not applicable (large-displacement strength is used in all calculations)
        - Large-displacement strength: δ = 13° (assumed)
- Floor
    - Low-stress strength: not applicable (used in evaluation of liner system veneer, which is not evaluated for the flat slope of the floor).
    - High-stress strength (used in evaluation of Unit 2 interim and final landfill slopes): back-calculated peak and large-displacement strengths

- Final Cover System
    - Cover soil
        - γ = 120 pcf
        - Undrained strength (used in evaluation of cover system veneer): c = 400 psf
        - Drained strength (used in evaluation of cover system veneer): c' = 250 psf and ϕ' = 25°
    - Interface strength
        - Low-stress strength (used in evaluation of liner system veneer): back-calculated peak and large-displacement strengths in Appendix 4F-1

        - High-stress strength: not applicable (high stresses are not anticipated on top of the cover).
- Waste
    - γ = 80 pcf
    - Drained strength: bi-linear envelope
        - c = 500 psf at $\sigma' \leq 770$ psf
        - c = 0 and $\phi' = 33°$ at $\sigma' \geq 770$ psf

POTENTIOMETRIC SURFACE

As described in the SLQCP (Attachment 10), Strata I and II are considered unsaturated zones, Stratum III is considered a discontinuous potential water bearing zone, and Stratum IV is considered an aquitard. The site soils are considered poorly permeable and groundwater is only intermittently present in Stratum III. Therefore, groundwater is not expected to move sufficiently to exert a force against the liner. However, in the unexpected event that fracture water is observed in the clays and claystones during construction (e.g., through a fracture or at an inferred fault) and that could exert an uplift force on the liner, an evaluation will be made regarding the magnitude of groundwater present. If needed, an active pressure relief/dewatering system will be installed during liner system construction and operated during the short-term until enough ballast is in place. With these measures,, the effect of ground water on liner system stability need not be considered herein.

It is noted that the calculations presented herein assume that pore pressures do not build up within the waste mass and do not consider the potential effects on stability of operating the landfill as a bioreactor.

RESULTS

Foundation Slopes

The calculated minimum factor of safety for the 3H:1V foundation slopes is 1.26. This factor of safety is greater than the target minimum calculated factor of safety of 1.25. Therefore, the calculated factor of safety is considered acceptable. A summary of the evaluated scenarios and calculated factors of safety are presented in the following table. The SLIDE computer outputs and figures with the critical failure surfaces illustrated are presented in Appendix 4F-2.

Written by:	J. Lang/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Foundation Slopes Shear Surface Scenario	Calculated Factor of Safety (✓ if ≥ Target)	Target Minimum Calculated Factor of Safety
Unit 2, Phases I to V: Deep seated circular shear surfaces through the foundation	1.29✓	1.25
Unit 2, Phases I to V: Block-type shear surfaces through the upper (weaker) strata I/II layers	1.26✓	1.25
Unit 2, Phase VI: Deep seated circular shear surfaces through Stratum III/IV interface	1.31✓	1.25
Unit 2, Phase VI: Block-type shear surfaces through Stratum III/IV interface	1.33✓	1.25

Liner System and Final Cover System Veneer

The results of the veneer stability analysis are presented in Appendix 4F-1.

Interim Landfill Slopes

Six shear surface scenarios were considered for the interim landfill slopes of Unit 2:

- block-type shear surfaces through the waste and along the liner system for the section passing through Phases I, II, and III;
- block-type shear surfaces through the waste and along either the liner system or the foundation soils for the section passing through Phases I, II, and III;
- circular shear surfaces through the waste and not through the liner system or foundation soils for the section passing through Phase I, II, and III;
- circular shear surfaces through the waste, liner system, and foundation soils for the section passing through Phases I, II, and III;
- circular shear surfaces through the waste, liner system, and foundation soils for the section passing through Phases V and VI; and
- block-type shear surfaces through the waste and along the liner system for the section passing through Phases V and VI.

The results of the analysis are summarized below. The SLIDE computer outputs and figures that illustrate each of the shear surface scenarios and show the critical failure surface for each scenario are presented in Appendix 4F-2.

The target minimum calculated factor of safety using the peak shear strength of the floor liner system is 1.25; the target minimum calculated factor of safety using the large-displacement shear strength of the floor liner system is 1.0. As shown in the summary table below, block-type shear surfaces extending along the liner system have calculated factors of safety that are greater than or equal to the target when the liner system components meet certain minimum shear strength criteria. Circular shear surfaces through the waste slopes and circular and block shear surfaces through the waste, liner system, and foundation soils have calculated factors of safety that are greater than the target when the back-calculated minimum shear strength of the liner system is used.

Interim Landfill Slopes Shear Surface Scenario	**Calculated Factor of Safety (✓ if ≥ Target)**	**Target Minimum Calculated Factor of Safety**
Phases I, II ,III: block-type shear surfaces through the waste and along the liner system (fill to elevation 790’, 165’ high, peak secant friction angle back-calculated for floor liner system = 9.4°)	1.26✓	1.25
Phases I, II ,III: block-type shear surfaces through the waste and along either the liner system or foundation soils (fill to elevation 790’, 165’ high, peak secant friction angle for floor liner system = 12° (value required on floor for final landfill slope stability, presented subsequently)	1.4✓	1.25
Phases I, II ,III: block-type shear surfaces through the waste and along the liner system (fill to elevation 790’, large-displacement secant friction angle back-calculated for floor liner system = 5.7°)	1.0✓	1.0
Phases I, II ,III: circular shear surfaces through the waste (165’ high)	2.14✓	1.25
Phases I, II, III: circular shear surface through the waste (165’ high), liner system, and foundation soils	1.56✓	1.25
Phase VI: circular shear surfaces through the waste (151’ high), liner system, and foundation soils	**1.47✓**	1.25
Phases VI: block-type shear surfaces through the waste and along the liner system (fill to elevation 790’, 151’ high, peak secant friction angle for floor liner system = 12° (value required on floor for final landfill slope stability, presented subsequently)	**2.75✓**	1.25

Final Landfill Slopes

Three shear surface scenarios were considered for the final landfill slopes at the boundary of Phases I and II (the critical cross section for Unit 2):

- circular shear surfaces through the waste and not through the liner system or foundation soils;
- block-type shear surfaces through the waste and along the liner system; and

- circular and block-type shear surfaces through the waste, liner system, and foundation soils.

Two sections were evaluated for the final landfill slope of Unit 1 at Phases III and V. Only block-type shear surfaces through the waste and along the liner system were considered. The other two scenarios described above were more critical only for the Unit 2 final landfill slope cross-section and therefore, were not evaluated.

As discussed previously, cross section F-F', while less critical than cross section E-E' for final landfill slope stability, was evaluated for completeness using the latest available interface friction test results.

The results of the analysis are summarized below. The SLIDE computer output and figures that illustrate each of the shear surface scenarios and show the critical failure surface for each scenario are presented in Appendix 4F-2.

Final Landfill Slopes Shear Surface Scenario	**Calculated Factor of Safety (✓ if ≥ Target)**	**Target Minimum Calculated Factor of Safety**
Unit 1		
Phase V: Block-type shear surfaces through waste and along the liner system using project-specific testing results (peak strength for floor liner system)	1.48✓	1.25[(1)]
Phase V: Block-type shear surfaces through waste and along the liner system using project specific testing results (large-displacement strength for floor liner system)	1.42✓	1.15
Phase III: Block-type shear surfaces through waste and along the liner system using project-specific testing results (peak strength for floor liner system)	1.35✓	1.25[(1)]
Phase III: Block-type shear surfaces through waste and along the liner system using project-specific testing results (large-displacement strength for floor liner system)	1.29✓	1.15
Unit 2, Phases I-V		
Circular shear surfaces through the waste (3H:1V slope)	2.48✓	1.5
Block-type shear surfaces through the waste and along the liner system (peak secant friction angle for floor liner system = 12°)	1.51✓	1.5[1]
Block-type shear surfaces through the waste and along the liner system (large-displacement secant friction angle for floor liner system = 6.8°)	1.15✓	1.15

Final Landfill Slopes Shear Surface Scenario	**Calculated Factor of Safety (✓ if ≥ Target)**	**Target Minimum Calculated Factor of Safety**
Circular shear surface through the waste, liner system, and foundation soils (secant friction angle for floor liner system = 12°)	1.80✓	1.5
Block-type shear surface through the waste, liner system, and foundation soils (secant friction angle for floor liner system = 12°)	1.62✓	1.5
Unit 2, Phase VI		
Circular shear surface through the waste, liner system, and foundation soils using project-specific testing results (peak strength for floor liner system)	2.51	1.5
Block-type shear surfaces through the waste and along the liner system using project-specific testing results (peak strength for floor liner system)	2.39	1.5

Notes: (1) A factor of safety of 1.25 is acceptable because interface testing was performed on the materials used to construct the liner in the vicinity of the critical cross-section for Unit 1.

As shown in the summary table, for each considered shear surface scenario in Unit 2, the calculated factor of safety of the final landfill slopes is greater than or equal to the target minimum calculated factor of safety. For block-type shear surfaces through the waste and along the liner system, the minimum interface shear strength of the floor liner system required to achieve the target calculated factor of safety was back-calculated. A target minimum calculated factor of safety of 1.5 is achieved if the minimum peak secant interface friction angle along the floor liner system is approximately 12°, which is greater than the minimum value for this interface based on the data presented in Table 4F-3 of Appendix 4F-1. A large-displacement secant interface friction angle of 6.8° for the floor liner system is needed to obtain a calculated factor of safety of approximately 1.15, the target minimum calculated factor of safety for large-displacement conditions. It should be noted that if the required interface friction angle can not be obtained during preconstruction testing using a smooth geomembrane/single-sided geocomposite drainage layer, a textured geomembrane/double-sided geocomposite could be substituted. A minimum large-displacement secant interface friction angle of 13° is needed for the side slopes in order to achieve the calculated factors of safety.

INTERFACE STRENGTH VALUES FOR SLQCP AND FCQCP

Based on the results of the stability analyses the following minimum interface strength values are incorporated into the SLQCP and FCQCP.

	Normal Stress (psf)	Peak Effective-Stress Interface Strength		Large-Displacement Effective-Stress Interface Strength	
		Shear Strength (psf)	Equivalent Secant Friction Angle (°)	Shear Strength (psf)	Equivalent Secant Friction Angle (°)
Side Slope Liner System (3H:1V)	500	195	21.1	151	16.8
	7,500	Not applicable	Not applicable	1,730	13
	15,000	Not applicable	Not applicable	3,460	13
Floor Liner System	500	Not applicable	Not applicable	Not applicable	Not applicable
	7,500	1,595	12	895	6.8
	15,000	3,190	12	1,790	6.8
Final Cover System	500	195	21.3	145	16
	7,500	Not applicable	Not applicable	Not applicable	Not applicable
	15,000	Not applicable	Not applicable	Not applicable	Not applicable

The peak interface strengths of the floor liner system required to achieve the target factors of safety are toward the upper end of the achievable range based on the interface strength data in table 4F-2 of Appendix 4F-1. The interface of concern is the single-sided geocomposite/smooth geomembrane interface. Project specific testing may indicate the necessity of a double-sided geocomposite/textured geomembrane interface on the floor.

REFERENCES

Bishop, A.W. (1955). “The Use of the Slip Circle in the Stability Analysis of Slopes,” *Geotechnique*, Vol. 5, No. 1, pp. 7-17.

Das, B.M. (1990). “*Principles of Geotechnical Engineering*”, PWS-KENT Publishing Company, Boston, MA, 665 p.

Giroud, J.P., Bachus, R.C., and Bonaparte, R. (1995). “Influence of Water Flow on the Stability of Geosynthetic-Soil Layered Systems on Slopes”, *Geosynthetics International*, Vol. 2, No. 6, pp. 1149-1180.

Kavazanjian Jr., E., Matasovic, N., Bonaparte, R., and Schmertmann, G. (1995). “Evaluation of MSW Properties for Seismic Analysis”, *Proceedings, Geoenvironmental 2000, Vol II*, New Orleans, LA, Feb, pp. 1126-1141.

Spencer, E. (1967). "A Method of Analysis of the Stability of Embankments Assuming Parallel Inter-Slice Forces," *Geotechnique*, Vol. 17, No. 1, pp. 11-26.

Stark, T.D. and Eid, H.T. (1994). "Drained Residual Strength of Cohesive Soils," *Journal of Geotechnical Engineering*, Vol. 120, No. 5, pp. 856-871.

Written by:	J. Lang/ L. Peve	Date:	05 21 (YY) /10 /01 (MM) /11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY) /11 /02 (MM) /11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

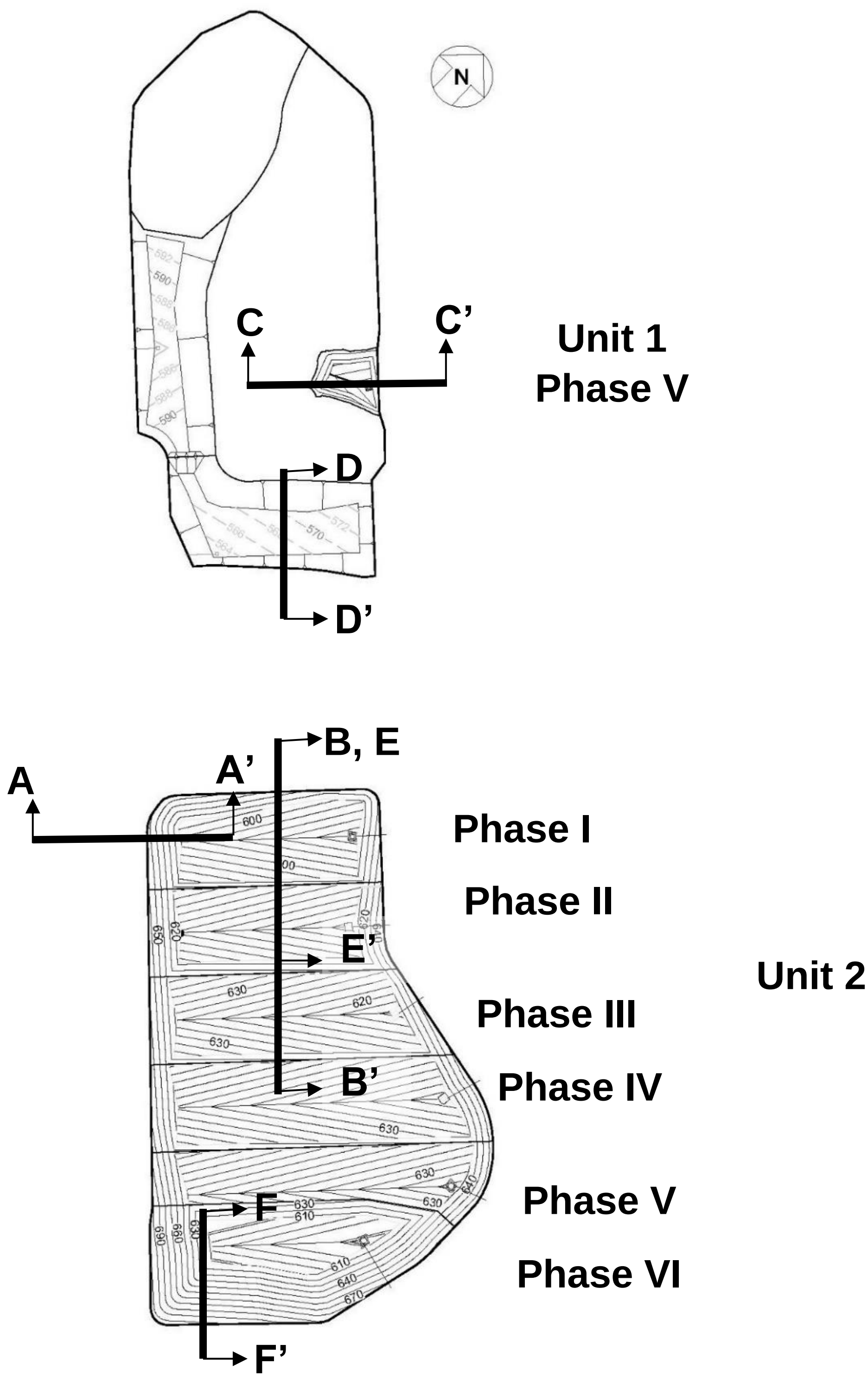


Figure 4F-1. Locations of the Cross Sections in Relation to Overall Base Grading Plan

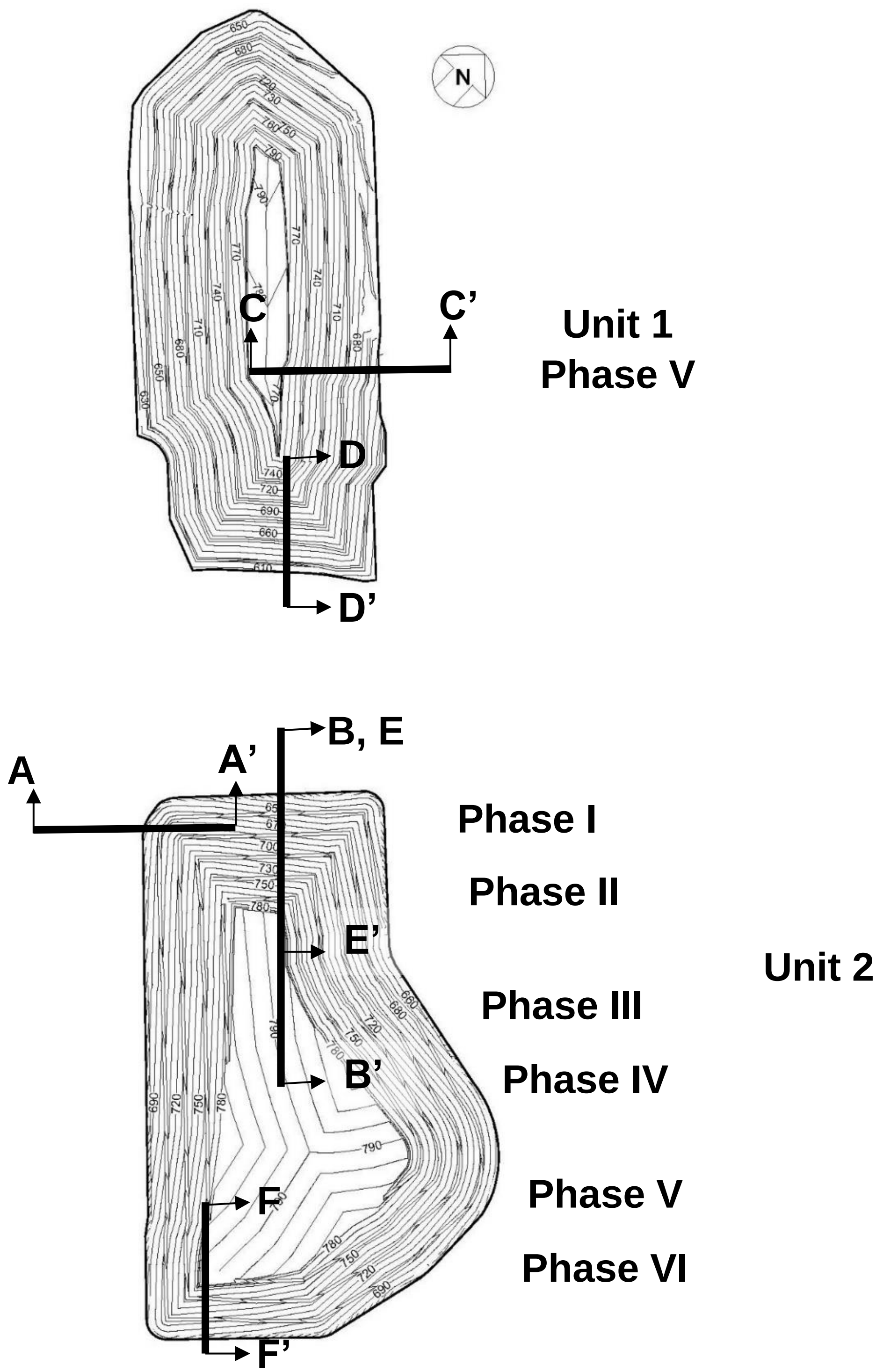


Figure 4F-2. Locations of the Cross Sections in Relation to Overall Final Grading Plan

Written by:	J. Lang/ L. Peve	Date:	05/10/11 21/01/18 (YY/MM/DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05/11/11 21/02/24 (YY/MM/DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

APPENDIX 4F-1

VENEER SLOPE STABILITY ANALYSIS

Written by:	R. El-Sherbiny/ L. Peve	Date:	05/10/10 21/01/14 (YY/MM/DD)	Reviewed by:	B. Gross/ S. Graves
Date:	05/11/11 21/02/24 (YY/MM/DD)				
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435
Task No:	04				

VENEER SLOPE STABILITY ANALYSIS

FOR PERMIT PURPOSES ONLY.
SEALED FOR FEBRUARY 2021 REVISIONS ONLY.

INTRODUCTION

The purpose of this calculation package is to present the veneer slope stability analysis of the liner system of Unit 2 and the final cover system of Units 1 and 2 of the Waste Management of Texas (WMTX) Mesquite Creek Landfill. The liner system will be constructed on 3 horizontal to 1 vertical (3H:1V) excavation side slopes. Since liner system stability represents an interim condition for the period between the liner system installation and waste placement against the liner system, the target minimum calculated factor of safety is 1.25. The final cover system will be constructed on 3H:1V waste slopes. Since final cover system stability represents a long-term condition, the target minimum calculated factor of safety is 1.5. For all cases of veneer stability considered herein, the target minimum calculated factor of safety using large-displacement strengths is 1.0 for liner systems and 1.15 for final cover systems.

The approach taken herein is to assume representative minimum peak and large displacement secant effective-stress friction angles for the liner system and final cover system interfaces, and then calculate the maximum height that protective cover can be placed on the liner or cover system for a selected target factor of safety. The results of the analysis are incorporated into the SLQCP (Attachment 10 of the Site Development Plan (SDP)) and the FCQCP (Attachment 12 to the SDP).

METHOD

An analysis of veneer stability considers noncircular wedge-type potential slip surfaces that extend along a liner system or final cover system. The critical interface for a liner system or cover system that incorporates geosynthetics typically occurs along an interface between a geosynthetic and an adjacent geosynthetic or soil.

The finite slope factor of safety equation, as formulated by Giroud et al. (1995), is:

$$FS=\left[\frac{\gamma_t(t-t_w)+\gamma_b t_w}{\gamma_t(t-t_w)+\gamma_{sat} t_w}\right]\frac{\tan\delta}{\tan\beta}+\frac{a/\sin\beta}{\gamma_t(t-t_w)+\gamma_{sat} t_w}$$

$$+\left[\frac{\gamma_t(t-t^*_w)+\gamma_b t^*_w}{\gamma_t(t-t_w)+\gamma_{sat} t_w}\right]\left[\frac{\tan\phi/(2\sin\beta\cos^2\beta)}{1-\tan\beta\tan\phi}\right]\frac{t}{h}+\left[\frac{1}{\gamma_t(t-t_w)+\gamma_{sat} t_w}\right]\left[\frac{1/(\sin\beta\cos\beta)}{1-\tan\beta\tan\phi}\right]\frac{ct}{h}$$

where: FS = factor of safety;
δ = interface friction angle;
a = apparent interface adhesion;
ϕ = soil internal friction angle;
c = apparent soil cohesion;
γ_t = moist soil unit weight;
γ_b = buoyant soil unit weight;
γ_{sat} = saturated soil unit weight;
t = depth of cover soil above critical interface;
t_w = water depth above critical interface on the sidewall;
t^*_w = water depth at slope toe;
β = sidewall slope angle; and
h = vertical height of slope.

It should be noted that while the above equation specifically applies to an interface above a geomembrane or similar liquid barrier layer, it could also be applied to interfaces below the geomembrane by changing the coefficient of the first term to 1.0 (i.e., the coefficient of $\tan\delta / \tan\beta$ to 1.0).

The finite slope method is used herein to evaluate the factor of safety for veneer slope stability of the liner system and final cover system for the Mesquite Creek Landfill.

It is assumed that the geotextile or geocomposite drainage layer in the liner system and the geocomposite drainage layer in the final cover system have sufficient hydraulic capacity to convey all liquid percolating into them, and that the peak heads in the drainage layers are less than the thickness of the layers (i.e., $t_w \leq 0.2$ in. at the geotextile/geomembrane or geocomposite/geomembrane interface). This value of t_w is very small and has negligible impact on the calculated slope stability factor of safety. Thus, the assumption of $t_w = 0$ can be used in the above equation. It is further assumed that leachate collected in the drainage layer at the toe of the liner system side slope will be allowed to outlet without the buildup of excessive hydraulic head at the slope toe (i.e., $t^*_w \leq 0.2$ in.). For the final cover system, it is assumed that drainage layer outlets at drainage berms and at the toe of the side slope will be maintained to preclude the buildup of excessive hydraulic head at the slope toe (i.e., $t^*_w \leq 0.2$ in.). With $t_w = 0$ and $t^*_w \approx 0$, the finite slope equation simplifies to:

$$FS = \frac{\tan\delta}{\tan\beta} + \frac{a/\sin\beta}{\gamma_t t} + \left[\frac{\tan\phi/(2\sin\beta\cos^2\beta)}{1-\tan\beta\tan\phi}\right]\frac{t}{h} + \left[\frac{1}{\gamma_t t}\right]\left[\frac{1/(\sin\beta\cos\beta)}{1-\tan\beta\tan\phi}\right]\frac{ct}{h}$$

It is further assumed that an active gas collection system will be installed prior to final cover system constructed and will remain fully operational so that gas pressures beneath the final cover system are negligible.

CRITICAL CROSS SECTIONS

The critical cases for veneer stability occur along the longest and steepest slopes.

The liner grading plan, shown on Drawing 1-2 in Attachment 1 to the Site Development Plan (SDP), incorporates 3 horizontal: 1 vertical (3H:1V) side slopes in Unit 2. The tallest 3H:1V liner system side slope for this unit is approximately 106 ft and corresponds to the south slope of Unit 2, Phase VI.

The final cover grading plan, shown on Drawing 1-3 in Attachment 1 to the SDP, has 3H:1V side slopes that reach a maximum height of approximately 165 ft in Unit 2, Phase I, with benches cut into the waste at a vertical spacing of 30 ft. Unit 1 also has benches with the same vertical spacing.

LINER SYSTEM AND FINAL COVER SYSTEM MATERIALS

Liner System on Side Slopes

As shown on Drawing 6-13 in Attachment 6 to the SDP, the side slope liner system cross section for the currently permitted but unconstructed portions of the site as well as the proposed expansion areas consist of the following components from top to bottom:

Unit 2, Phases I to VI

- 2-ft thick protective cover;
- double-sided geocomposite drainage layer (i.e., geonet with geotextile bonded to its top and bottom surfaces) OR 16-oz/sy needlepunched nonwoven geotextile drainage/filter layer;
- 60-mil thick textured high density polyethylene (HDPE) geomembrane liner; and
- 2-ft thick compacted soil liner.

<u>Final Cover System on Side Slopes</u>

The standard final cover system cross section, as shown on Drawing 7-1 in Attachment 7 to the SDP, consists of the following components from top to bottom:

- 2.0-ft thick vegetative soil/cover soil;
- double-sided geocomposite drainage layer;
- 40-mil thick textured polyethylene (PE) geomembrane liner; and
- 1.5-ft thick compacted soil liner.

The alternative final cover system shown on Drawing 7-1 only uses soil components. The soil components in the alternative final cover system have higher strengths than the weakest interface in the standard final cover system, which incorporates geosynthetics. Therefore, only the standard final cover system will be considered herein.

MATERIAL PARAMETERS

Both the liner system and final cover system have two soil components (i.e., cover soil and soil liner) and two geosynthetic components (i.e., drainage geotextile or geocomposite, and geomembrane). Tables 4F-1 and 4F-2 present typical strength properties for compacted soils. Table 4F-3 presents typical interface friction values for common interfaces used in preliminary design. In a veneer slope stability analysis, the unit weight and strength of the soil that buttresses the veneer at the toe of the slope (e.g., the cover soil) and the strength of the weakest interface are required to calculate the factor of safety. A discussion of the selection of the unit weight and shear strength values used for the veneer slope stability analysis is provided below.

<u>Presumed Cover Soil Unit Weight and Strength</u>

On-site soil (generally classified as CL or CH material) will be used as cover soil for the liner system and final cover system. From Tables 4-3 and 4-6 of Attachment 4, the average measured plasticity index of the site soil is 40% (standard deviation = 11 percentage points). The soil will be placed on the liner system and final cover system slopes by pushing soil stockpiled at the toe of the slope up the slope and compacting the soil by tracking it with a low ground-pressure bulldozer.

The moist unit weight of the tracked-in soil was assumed to be 120 pcf. This value falls within the higher end of the range of moist unit weights calculated for lightly to moderately compacted clays using the maximum dry unit weight and optimum moisture content values in Table 4-F1.

For analysis of liner system veneer stability, both undrained and drained cases will be evaluated. An undrained analysis is appropriate if the protective cover remains undrained in the relatively short period from the time it is placed to the time it is covered and buttressed with waste. Because the thickness of the protective cover is small and the protective cover is drained from both sides, however, the protective cover may actually reach partially-drained or fully drained conditions before it is covered and buttressed with waste, In such a case, a drained analysis is needed. Therefore both undrained and drained analyses are conducted herein.

Typical undrained shear strength "cohesion" for CL and CH soils range from 230 psf for saturated CH material to 1,800 psf for as-compacted CL material (Table 4F-1). Since the protective cover is only lightly to moderately compacted, the protective cover may not achieve the full "as-compacted" strengths indicated in Table 4F-1. Also, the presence of the drainage layer beneath the protective cover should prevent the soil from becoming saturated at the toe of the slope where the buttress effect occurs. Based on the above rationale, an undrained shear strength of 400 psf was selected for the protective cover. This value is believed to be a reasonable strength to presume for design since it is substantially lower than the typical strength that is achieved by "as-compacted" soils as indicated in Table 4F-1.

The drained shear strength parameters were chosen based on data collected by Duncan et al. (1989) for compacted clays as a function of clay plasticity (Table 4F-2). Since the clay plasticity within the site is at the higher end of low plasticity clays and the lower end of high plasticity clays, average values between the two ranges were assumed. Therefore, an effective stress friction angle of 25° and an effective stress shear strength intercept "cohesion" of 250 psf were selected.

For analysis of final cover system veneer stability, the drained strength of the cover soil will be used. A drained analysis is appropriate as the cover soil will be exposed for many years after the final cover system is constructed. The short-term stability right after construction of the final cover will also be checked using an undrained strength analysis. The same soil used for the liner system cover are used for the final cover, and therefore, the same soil properties mentioned earlier will be adopted.

Typical Interface Strengths

Typical peak strengths of the liner system and final cover system interfaces are discussed in this section. These values are not used in the stability analysis, but are presented to assess if the required interface friction angles backcalculated in the next section are generally reasonable. It should be noted that the use of values in the upper end of the range of values is acceptable in design for veneer stability because the failure envelopes for interface testing are generally curved, with higher interface friction angles at lower stresses representative of veneer stability conditions.

The interfaces in the Unit 2 liner system and final cover system, from top to bottom, are:

- cover soil / geotextile;
- geotextile / textured geomembrane; and
- textured geomembrane / compacted soil liner.

The peak shear strength between the soil (CL or CH, as previously discussed) and the geotextile filter was estimated using the information presented in Tables 4F-1 and 4F-2 and assuming drained conditions at the interface (due to the presence of the permeable geotextile). Assuming an effective-stress friction angle of 25º for the CL to CH soil and $\tan\delta / \tan\phi = 0.8$ to 0.9 for a clayey soil / geotextile interface, $\delta = 20^\circ$ to 23º.

Based on Table 4F-3, the secant interface friction angle for the geotextile / geomembrane interface may be on the order of 22º to 35º.

The textured geomembrane / compacted soil liner interface was assumed to have the same strength as the soil / geotextile interface (i.e. 20º to 23º).

Based on Table 4F-3, the secant interface friction angle for the textured geomembrane / GCL interface may be on the order of 18º to 37º.

Assuming an effective-stress friction angle of 25º for the clayey subgrade and $\tan\delta / \tan\phi = 0.8$ to 0.9 for a clayey soil / geotextile interface, $\delta = 20^\circ$ to 23º.

RESULTS OF ANALYSES

Site-specific interface testing is required prior to construction of the liner system and final cover system (see the SLQCP in Attachment 10 to the SDP and the FCQCP in Attachment 12 to the SDP). The results of the tests will control the maximum incremental height that soil protective cover can be placed against the liner system while achieving the target calculated factors of safety.

Liner System (3H:1V Side Slopes, $\delta_{peak}=21.1^\circ$, $\delta_{Large\ disp}=16.8^\circ$, $\beta=18.4^\circ$, h = 106')

A table of increment placement heights for the protective cover and corresponding minimum interface friction angles of the liner system to achieve the target calculated factors of safety for both short-term and long-term stability is presented below. Compliance with placement heights from the long-term stability analysis with drained soil conditions is required if the protective cover is to be exposed for a period sufficient for soil drainage. The incremental placement height may be adjusted based on the results of the site-specific interface tests (i.e., taller or shorter increment heights may be used depending on the measured interface friction angle). Based on the results of the calculations, a minimum peak secant interface friction angle of 21.1° and a large displacement secant friction angle of 16.8° is specified at a normal stress of 500 psf for the tallest 3H:1V liner system side slope.

1. Using peak interface friction angle:

1.i. Undrained soil condition:

$$FS = \frac{\tan 21.1°}{\tan 18.4°} + \left[\frac{1}{(120)(2)}\right]\left[\frac{\frac{1}{\sin 18.4° \cos 18.4°}}{1 - \tan 18.4° \tan 0°}\right]\frac{(400)(2)}{(106)}$$

FS = 1.16 + 0.10 = 1.26 (stable (FS = 1.16 >1) without soil buttress)

1.ii. Drained soil condition:

$$FS = \frac{\tan 21.1°}{\tan 18.4°} + \left[\frac{\frac{\tan 25°}{2 \sin 18.4° \cos^2 18.4°}}{1 - \tan 18.4° \tan 25°}\right]\frac{(2)}{(106)} + \left[\frac{1}{(120)(2)}\right]\left[\frac{\frac{1}{\sin 18.4° \cos 18.4°}}{1 - \tan 18.4° \tan 25°}\right]\frac{(250)(2)}{(106)}$$

FS = 1.16 + 0.02 + 0.07 = 1.25(stable (FS = 1.16 >1) without soil buttress)

2. Using large-displacement interface friction angle:

2.i. Undrained soil condition:

$$FS = \frac{\tan 16.8°}{\tan 18.4°} + \left[\frac{1}{(120)(2)}\right]\left[\frac{\frac{1}{\sin 18.4° \cos 18.4°}}{1 - \tan 18.4° \tan 0°}\right]\frac{(400)(2)}{(106)}$$

FS = 0.90 + 0.10 = 1.0 (soil buttress required for stability)

2.ii. Drained soil condition:

Written by:	R. El-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /10 /14 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	04

$$FS = \frac{tan\,16.8°}{tan\,18.4°} + \left[\frac{\frac{tan\,25°}{2\,sin\,18.4°\,cos^2\,18.4°}}{1 - tan\,18.4°\,tan\,25°}\right]\frac{(2)}{(106)} + \left[\frac{1}{(120)(2)}\right]\left[\frac{\frac{1}{sin\,18.4°\,cos\,18.4°}}{1 - tan\,18.4°\,tan\,25°}\right]\frac{(250)(2)}{(106)}$$

FS = 0.90 + 0.02 + 0.08 = 1.0 (soil buttress required for stability)

Incremental Placement Heights for Liner System Protective Cover that Result in a Minimum Calculated Factor of Safety of 1.25.

δ (degrees)	Maximum Protective Cover Incremental Placement Height, h (ft) (3H:1V Slope)	
	Undrained soil condition	**Drained soil condition**
18	40	36
19	51	46
20	70	65
20.1	73	67
21.1	120	106
22	296	271

Final Cover System (3H:1V Side Slopes, δ_{peak}=21.3°, $\delta_{Large\ disp}$=16.0°, β=18.4°, h = 30')

Calculated factors of safety for both short-term and long-term stability of the final cover system are presented below. Based on the results of the calculations, a minimum peak secant interface friction angle of 21.3° and a large displacement secant friction angle of 16.0° is specified at a normal stress of 500 psf to achieve the target factors of safety for the tallest 3H:1V final cover system side slope.

1. Using peak interface friction angle:

1.i. Undrained soil condition:

$$FS = \frac{tan\,21.3°}{tan\,18.4°} + \left[\frac{1}{(120)(2)}\right]\left[\frac{\frac{1}{sin\,18.4°\,cos\,18.4°}}{1 - tan\,18.4°\,tan\,0°}\right]\frac{(400)(2)}{(30)}$$

FS = 1.17 + 0.37 = 1.54 (soil buttress required for stability)

1.ii. Drained soil condition:

$$FS = \frac{tan\,21.3°}{tan\,18.4°} + \left[\frac{\frac{tan\,25°}{2\,sin\,18.4°\,cos^2\,18.4°}}{1 - tan\,18.4°\,tan\,25°}\right]\frac{(2)}{(30)} + \left[\frac{1}{(120)(2)}\right]\left[\frac{\frac{1}{sin\,18.4°\,cos\,18.4°}}{1 - tan\,18.4°\,tan\,25°}\right]\frac{(250)(2)}{(30)}$$

FS = 1.17 + 0.06 + 0.27 = 1.51 (soil buttress required for stability)

2. Using large-displacement interface friction angle

2.i. Undrained soil condition:

$FS = \frac{tan\,16.0°}{tan\,18.4°} + \left[\frac{1}{(120)(2)}\right]\left[\frac{\frac{1}{sin\,18.4°\,cos\,18.4°}}{1 - tan\,18.4°\,tan\,0°}\right]\frac{(400)(2)}{(30)}$ FS = 0.86 + 0.37 = 1.23(soil buttress required for stability)

2.ii. Drained soil condition:

$$FS = \frac{tan\,16.0°}{tan\,18.4°} + \left[\frac{\frac{tan\,25°}{2\,sin\,18.4°\,cos^2\,18.4°}}{1 - tan\,18.4°\,tan\,25°}\right]\frac{(2)}{(30)} + \left[\frac{1}{(120)(2)}\right]\left[\frac{\frac{1}{sin\,18.4°\,cos\,18.4°}}{1 - tan\,18.4°\,tan\,25°}\right]\frac{(250)(2)}{(30)}$$

FS = 0.86 + 0.06 + 0.27 = 1.20 (soil buttress required for stability)

CONCLUSIONS

For the analyses using peak strengths herein, GeoSyntec selected target minimum calculated factors of safety of 1.25 for the liner system and 1.5 for the final cover system. A specified minimum peak secant interface friction angle of 21.1° for the liner system was selected to achieve the target minimum calculated factor of safety (at a normal stress of 500 psf) for the tallest liner slope at the facility. For the liner system, the slope stability analysis shows that the calculated maximum incremental cover placement height varies with the minimum secant interface friction angle. With the specified minimum interface friction angle of 21.1°, the calculated maximum protective cover placement height is 106 ft for 3H:1V side slopes, which is equal to the highest side slope for Unit 2. For all cases, the incremental placement height may be adjusted based on the results of the site-specific interface tests and the table presented above. For the final cover system, the calculated factor of safety is approximately 1.51 for a minimum peak secant interface friction angle of 21.3º (at a normal stress of 500 psf) for the tallest final cover side slope at the facility.

The minimum large-displacement secant interface friction angles for the side slope liner system required to achieve a calculated factor of safety of 1.0 is 16.8° (at a normal stress of 500 psf) for the tallest 3H:1V liner system slope in Unit 2. The minimum large-displacement secant interface friction angle for the final cover system required to achieve a calculated factor of safety of 1.20 is 16.0º (at a normal stress of 500 psf) for the tallest 3H:1V final cover side slope in Unit 2.

The calculated peak and large-displacement interface friction angles to achieve the target factors of safety are incorporated into the SLQCP and FCQCP.

REFERENCES

Duncan, J. M., Horz, R. C., and Yang, T. L. (1989). "S*hear Strength Correlations for Geotechnical Engineering*," Virginia Tech, Department of Civil Engineering, August, 100 p.

Eid, H.T. and Stark, T.D. (1997). "Shear Behavior of an Unreinforced Geosynthetic Clay Liner," *Geosynthetics International*, Vol. 4, No. 6, pp. 645-659.

Eigenbrod, K.K. and Locker, J.G. (1987), "Determination of Friction Values for the Design of Side Slopes Lined or Protected with Geosynthetics," *Canadian Geotechnical Journal*, Vol. 24, No. 4, pp. 509-519.

Giroud, J.P., Bachus, R.C., and Bonaparte, R. (1995). "Influence of Water Flow on the Stability of Geosynthetic-Soil Layered Systems on Slopes", *Geosynthetics International*, Vol. 2, No. 6, pp. 1149-1180.

Koerner, R.M., Martin, J.P., and Koerner, G.R. (1986). "Shear Strength Parameters Between Geomembranes and Cohesive Soils", *Geotextiles and Geomembranes*, Vol. 4, No. 1, pp. 21-30.

Martin, J.P., Koerner, R.M., and Whitty, J.E. (1984). "Experimental Friction Evaluation of Slippage Between Geomembranes, Geotextiles, and Soils", *Proceedings: International Conference on Geomembranes*, Denver, Colorado, pp. 191-196.

Naval Facilities Engineering Command (NAVFAC) (1986). "*Foundations & Earth Structures*", Design Manual DM 7.02.

Sabatini, P.J., Schmertmann, G.R., and Swan, R.H. (1998). "Issues in Clay / Textured Geomembrane Testing", *Sixth International Conference on Geosynthetics*, pp. 423-426.

United States Environmental Protection Agency (USEPA). (1993). "*Solid Waste Disposal Facility Criteria, Technical Manual*", USEPA Report No. EPA530-R-93-017.

Stark, T.D., Arellano, D., Evans, W.D., Wilson, V.L., and Gonda, J.M. (1998). "Unreinforced Geosynthetic Clay Liner Case History," *Geosynthetics International*, Vol. 5, No. 5, pp. 521-544.

Williams N.D. and Houlihan, M.F. (1986). "Evaluation of Friction Coefficients Between Geomembranes, Geotextiles, and Related Products", *Third International Conference on Geotextiles*, Vienna, Austria, pp. 891-896.

Williams N.D. and Houlihan, M.F. (1986). "Evaluation of Interface Friction Properties Between Geosynthetics and Soils", *Geosynthetics '87 Conference*, New Orleans, LA, pp. 616-627.

Williams, N.D. and Luna, J. (1987). "Selection of Geotextiles for Use with Synthetic Drainage Products," *Geotextiles and Geomembranes*, Vol. 5, pp. 45-61.

Written by:	R. El-Sherbiny/ L. Peve	Date:	05 21 (YY) /10 /01 (MM) /10 /14 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY) /11 /02 (MM) /11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	04

Table 4F-1. Typical Properties of Compacted Soils (after NAVFAC, 1986).

Group Symbol	Soil Type	Range of Maximum Dry Unit Weight (pcf)	Range of Optimum Moisture Content (%)	Typical Strength Characteristics			
				Cohesion (as compacted) (psf)	Cohesion (saturated) (psf)	ϕ, Effective-Stress Envelope (degrees)	Tanϕ
SP	Poorly graded clean sands, sand-gravel mix.	100 - 120	12-21	0	0	37	0.74
SM	Silty sands, poorly graded sand-silt mix.	110 - 125	11 - 16	1,050	420	34	0.67
SM-SC	Sand-silt clay mix. with slightly plastic fines	110 - 130	11 - 15	1,050	300	33	0.66
SC	Clayey sands, poorly-graded sand-clay mix.	105 - 125	11 - 19	1,550	230	31	0.60
ML	Inorganic silts and clayey silts	95 - 120	12 - 24	1,400	190	32	0.62
CL	Inorganic clays of low to medium plasticity	95 - 120	12 - 24	1,800	270	28	0.54
CH	Inorganic clays of high plasticity	75 - 105	19 - 36	2,150	230	19	0.35

Written by:	R. El-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /10 /14 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	04

Table 4F-2. Effective-Stress Shear Strength Properties of Compacted Soils (Duncan et al., 1989)

Group Symbol	Soil Type	Maximum Dry Unit Weight (pcf)	Optimum Moisture Content (%)	Typical Strength Characteristics	
				ϕ'	c'
CL	Inorganic clays of low to medium plasticity	108 ± 1	17 - 18	28 ± 2	285 ± 40
CH	Inorganic clays of high plasticity	94 ± 2	24 - 27	19 ± 5	245 ± 120

Table 4F-3. Summary of Documented Interface Friction Values. (Adapted from tests by Martin et al. (1984), Williams and Houlihan (1986), Koerner et al. (1986), Williams and Houlihan (1987),Williams and Luna (1987), Eid and Stark (1997), Sabatini et al. (1998), Stark et al. (1998), manufacturer's literature, and unpublished results from GeoSyntec Consultants.)

GEOSYNTHETIC / GEOSYNTHETIC	δ_p (1) (degrees)	δ_{ld} (1) (degrees)
Smooth HDPE Geomembrane / Nonwoven Geotextile	7 - 12	6 - 11
Smooth LLDPE Geomembrane / Nonwoven Geotextile	10 - 12	
Textured HDPE Geomembrane / Nonwoven Geotextile	22 - 35	
Smooth HDPE Geomembrane / Geonet	7 - 15	
Textured HDPE Geomembrane / Geonet	7 - 16	10 - 12
Textured HDPE Geomembrane / Geocomposite	17 - 29	13 - 20
Geonet / Nonwoven Geotextile	13 - 22	
Smooth HDPE Geomembrane / GCL (hydrated)	8 - 12	
Textured HDPE Geomembrane / GCL (hydrated)	18 - 37	6 - 10
GEOSYNTHETIC / SOIL	$\tan\delta_p/\tan\phi_p$ (1)	$\tan\delta_{ld}/\tan\phi_{ld}$ (1)
Smooth HDPE Geomembrane / Clay	0.4 - 0.7	0.3 - 0.7
Textured HDPE Geomembrane / Clay	0.8 - 0.9	0.6 - 0.9
Smooth HDPE Geomembrane / Sand	0.5 - 0.6	
Textured HDPE Geomembrane / Sand	0.7 - 0.8	
Needlepunched Nonwoven Geotextile / Sand	0.8 - 1.0	
Needlepunched Nonwoven Geotextile / Angular Gravel	0.7 - 0.9	
Needlepunched Nonwoven Geotextile / Rounded Gravel	0.6 - 0.8	

Note: (1) δ = interface friction angle; ϕ = soil internal friction angle; subscript p = peak and subscript ld = large displacement

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY/MM/DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY/MM/DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

APPENDIX 4F-2

SLIDE OUTPUT
Foundation Slopes
Interim Landfill Slopes
Final Landfill Slopes

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05/10/11 21/01/18 (YY/MM/DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05/11/11 21/02/24 (YY/MM/DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Foundation Slopes

Slide Analysis Information

Document Name

File Name: Foundation - Phase I

Project Settings
Project Title: Mesquite Creek Landfill - Foundation Stability of 3:1 Excavation Slopes
Failure Direction: Right to Left
Units of Measurement: Imperial Units   Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Bishop simplified
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

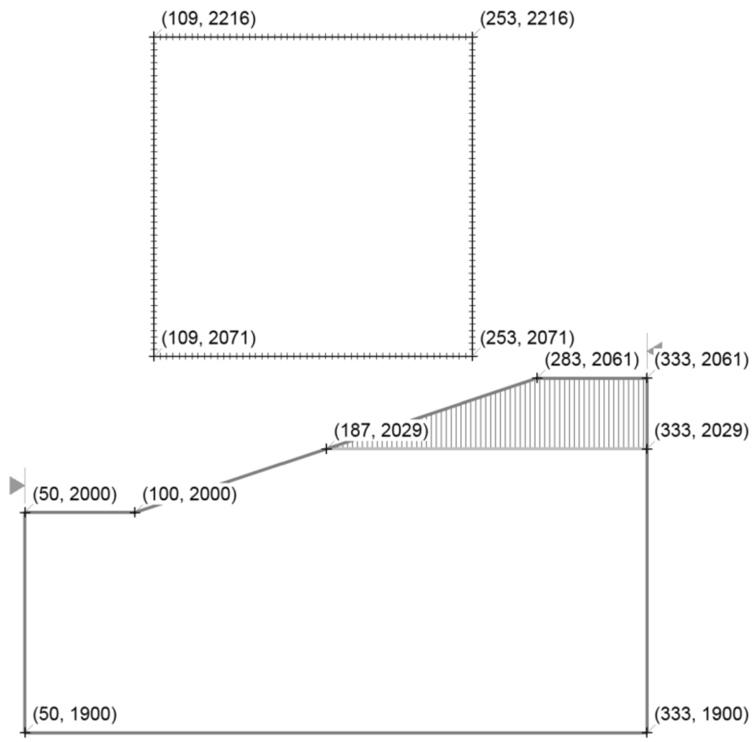
Material Properties

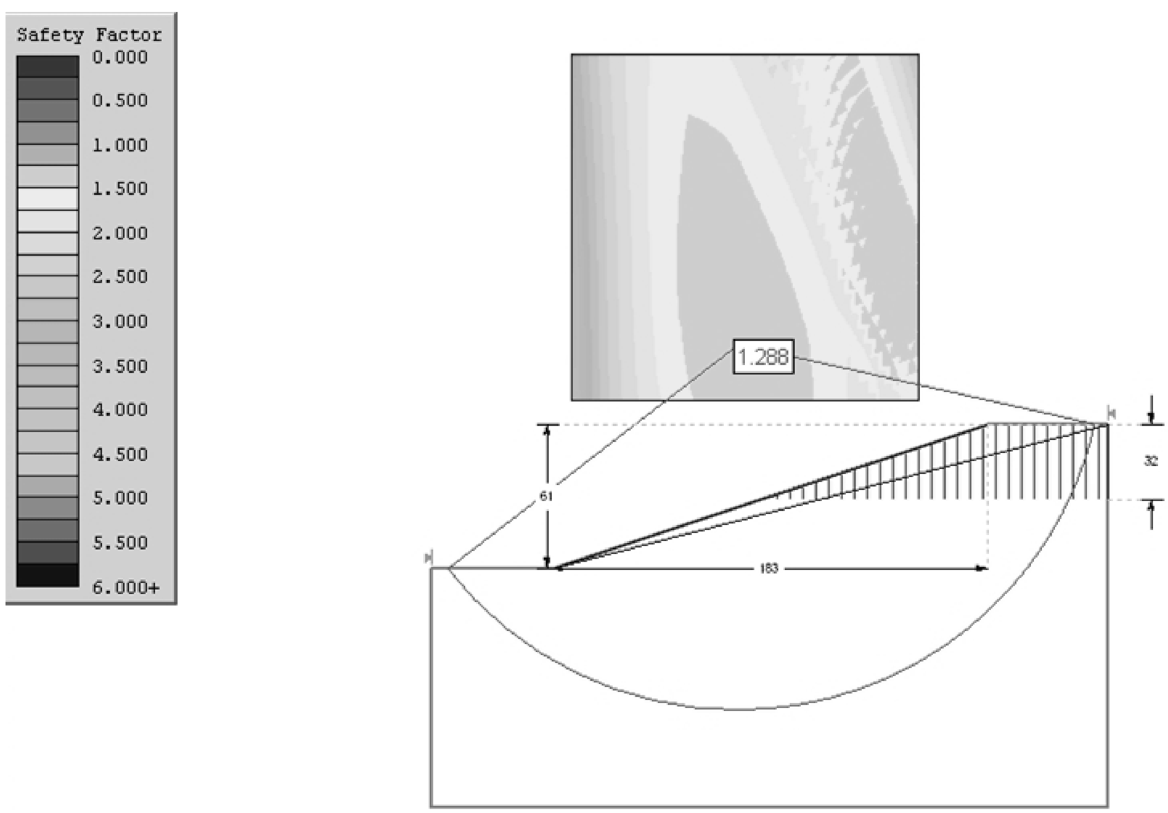
Material: Stratum III/IV
Strength Type: Undrained
Unit Weight: 133 lb/ft3
Cohesion Type: Constant
Cohesion: 1600 psf
Water Surface: None

Material: Stratum I/II
Strength Type: Undrained
Unit Weight: 120 lb/ft3
Cohesion Type: Constant
Cohesion: 500 psf
Water Surface: None

Global Minimums
Method: bishop simplified
FS: 1.287510
Center: 178.119, 2094.246
Radius: 153.724
Left Slip Surface Endpoint: 56.675, 2000.000
Right Slip Surface Endpoint: 328.205, 2061.000
Resisting Moment=7.98275e+007 lb-ft
Driving Moment=6.20015e+007 lb-ft

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves
Date:	05 21 /11 /02 /11 /24 (YY MM DD)				
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435
Task No:	03				





Section A – A'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY) /10 /01 (MM) /11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY) /11 /02 (MM) /11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name

File Name: Foundation - Phase I - block

Project Settings

Project Title: Mesquite Creek Landfill - Foundation Stability of 3:1 Excavation Slopes
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Spencer
Number of slices: 30
Tolerance: 0.005
Maximum number of iterations: 100

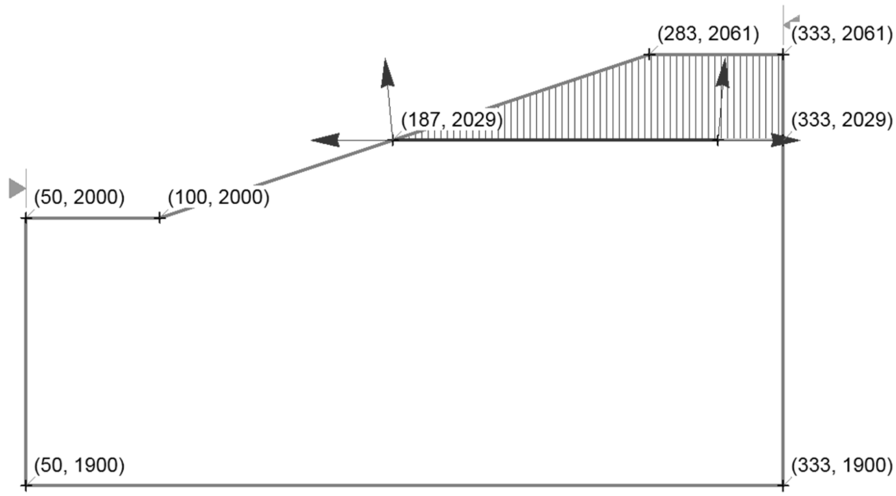
Surface Options
Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 180
Right Projection Angle (Start Angle): 0
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

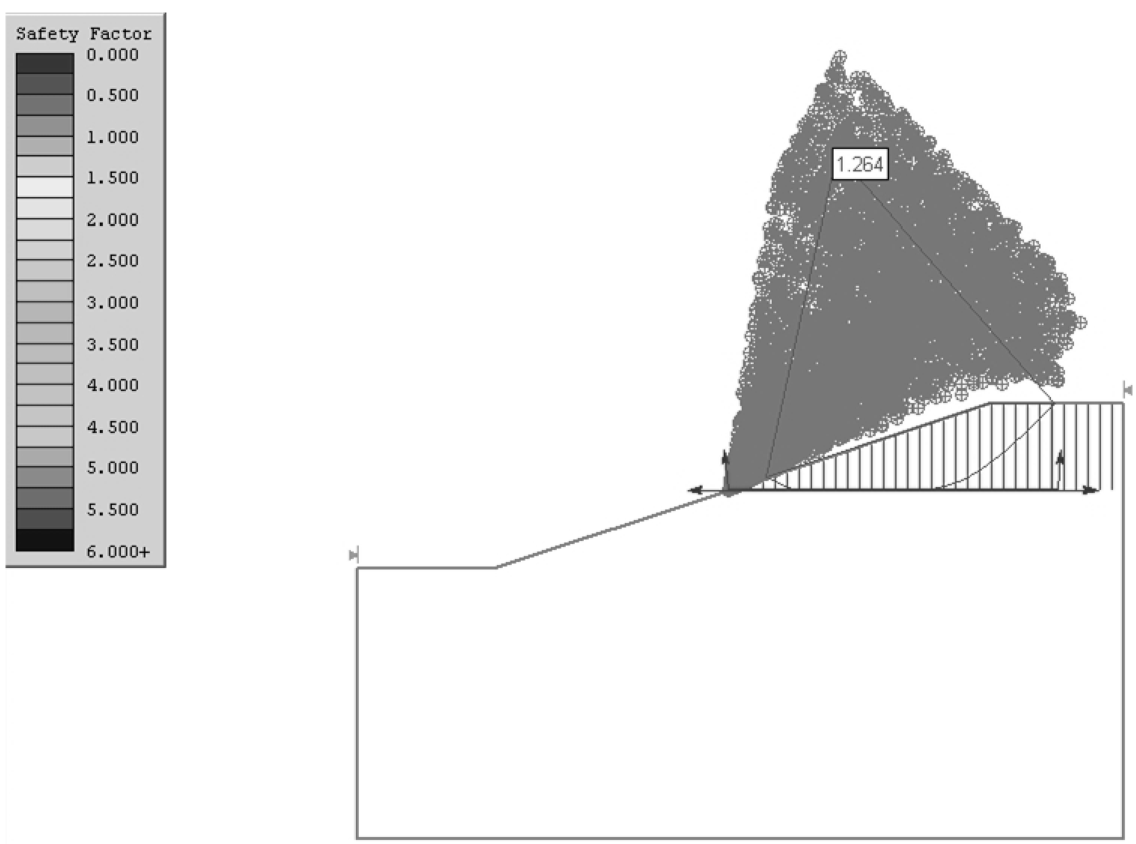
Material Properties
Material: Stratum III/IV
Strength Type: Undrained
Unit Weight: 133 lb/ft3
Cohesion Type: Constant
Cohesion: 1600 psf
Water Surface: None

Material: Stratum I/II
Strength Type: Undrained
Unit Weight: 120 lb/ft3
Cohesion Type: Constant
Cohesion: 500 psf
Water Surface: None

Global Minimums
Method: spencer
FS: 1.263880
Axis Location: 226.830, 2153.843
Left Slip Surface Endpoint: 200.927, 2033.642
Right Slip Surface Endpoint: 307.449, 2061.000
Resisting Moment=7.39851e+006 lb-ft
Driving Moment=5.85381e+006 lb-ft
Resisting Horizontal Force=53261 lb
Driving Horizontal Force=42140.9 lb

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY)	/11 /02 (MM) /11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03			





Section A – A'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name
File Name: Unit 2 Phase VI Foundation Slopes - Rock.slmd

Project Settings
Project Title: Mesquite Creek Landfill Unit 2 Phase VI - Foundation Stability of 3:1 Excavation Slopes

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right
Random Numbers:	Pseudo-random Seed
Random Number Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Analysis Methods

Number of slices:	100
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Surface Options

Surface Type:	Circular
Search Method:	Grid Search
Radius Increment:	10
Composite Surfaces:	Disabled
Reverse Curvature:	Create Tension Crack
Minimum Elevation:	Not Defined
Minimum Depth:	Not Defined
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Material Properties

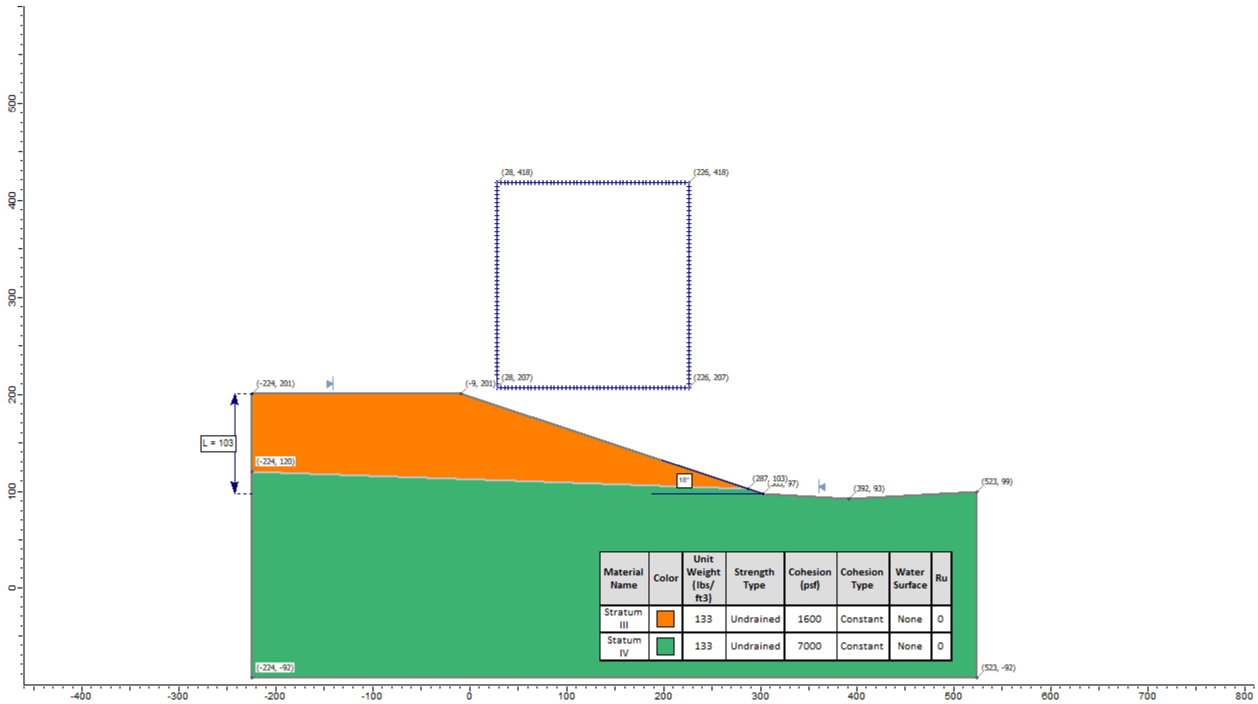
Stratum III	
Strength Type	Undrained
Unit Weight [lbs/ft3]	133
Cohesion [psf]	1600
Cohesion Type	Constant
Water Surface	None
Ru Value	0
Statum IV	
Strength Type	Undrained
Unit Weight [lbs/ft3]	133
Cohesion [psf]	7000
Cohesion Type	Constant
Water Surface	None
Ru Value	0

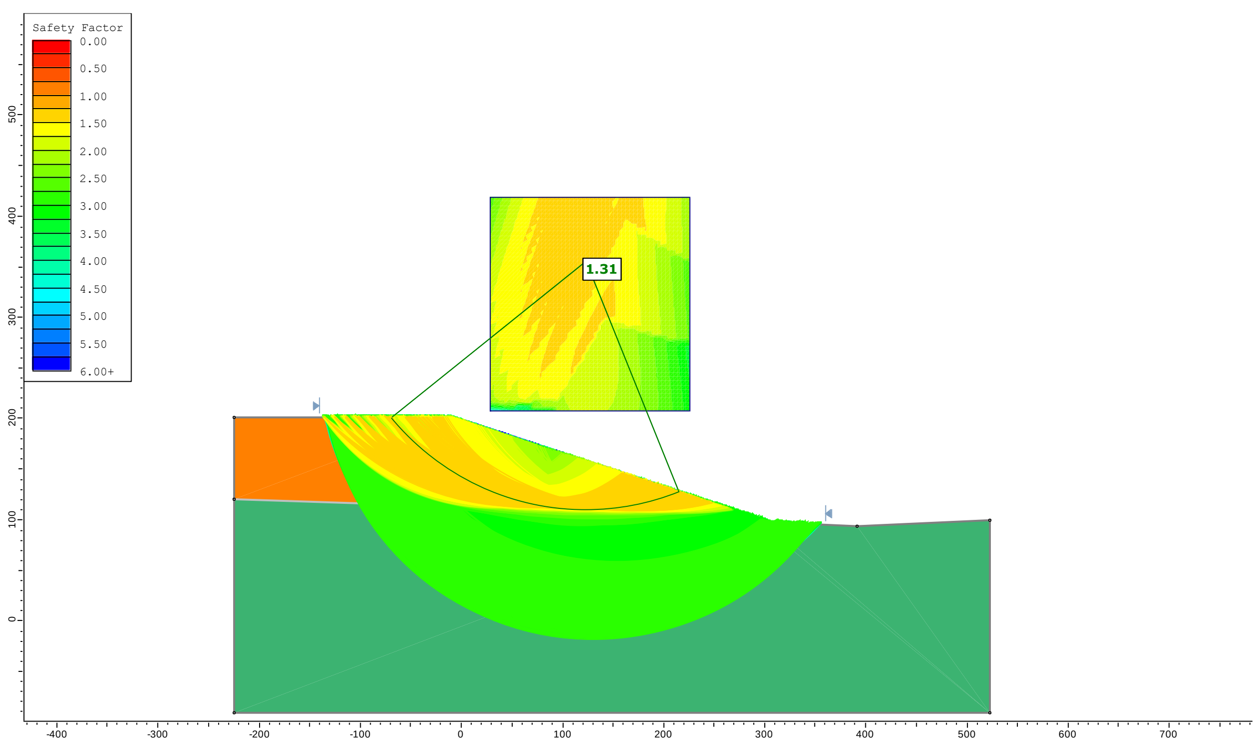
Global Minimums

Method:	spencer
FS:	1.311720
Center:	123.040, 355.049
Radius:	246.822
Left Slip Surface Endpoint:	-69.562, 200.694
Right Slip Surface Endpoint:	215.457, 126.182
Resisting Moment:	1.24665e+08 lb-ft
Driving Moment:	9.49401e+07 lb-ft
Total Slice Area:	12047.1 ft2
Surface Horizontal Width:	285.019 ft
Surface Average Height:	42.2676 ft

Written by: R. EL-Sherbiny/ L. Peve Date: 05 21 / 10 01 / 11 18 (YY/MM/DD) Reviewed by: B. Gross/ S. Graves Date: 05 21 / 11 02 / 11 24 (YY/MM/DD)

Client: WMTX Project: Mesquite Creek Landfill Project/Proposal No.: GT3435 Task No: 03





Section F – F'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05/10/11 21/01/18 (YY/MM/DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05/11/11 21/02/24 (YY/MM/DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name
File Name: Unit 2 Phase VI Foundation Slopes - Rock.slmd

Project Settings
Project Title: Mesquite Creek Landfill Unit 2 Phase VI - Foundation Stability of 3:1 Excavation Slopes

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Left to Right
Random Numbers:	Pseudo-random Seed
Random Number Seed:	10116
Random Number Generation Method:	Park and Miller v.3

Analysis Methods

Number of slices:	100
Tolerance:	0.005
Maximum number of iterations:	75
Check malpha < 0.2:	Yes
Create Interslice boundaries at intersections with water tables and piezos:	Yes
Initial trial value of FS:	1
Steffensen Iteration:	Yes

Surface Options

Surface Type:	Non-Circular Block Search
Number of Surfaces:	5000
Multiple Groups:	Disabled
Pseudo-Random Surfaces:	Enabled
Convex Surfaces Only:	Disabled
Left Projection Angle (Start Angle) [deg]:	135
Left Projection Angle (End Angle) [deg]:	135
Right Projection Angle (Start Angle) [deg]:	45
Right Projection Angle (End Angle) [deg]:	45

Material Properties

<u>Stratum III</u>

Strength Type	Undrained
Unit Weight [lbs/ft3]	133
Cohesion [psf]	1600
Cohesion Type	Constant
Water Surface	None
Ru Value	0

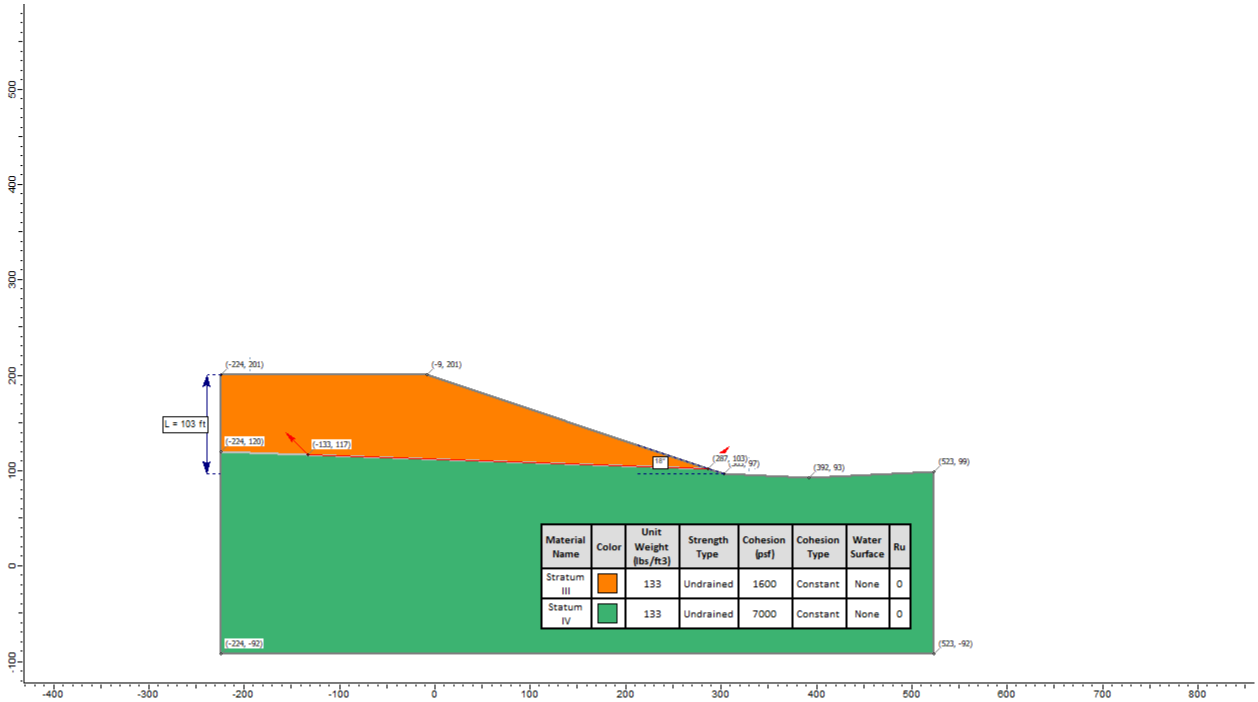
<u>Statum IV</u>

Strength Type	Undrained
Unit Weight [lbs/ft3]	133
Cohesion [psf]	7000
Cohesion Type	Constant
Water Surface	None
Ru Value	0

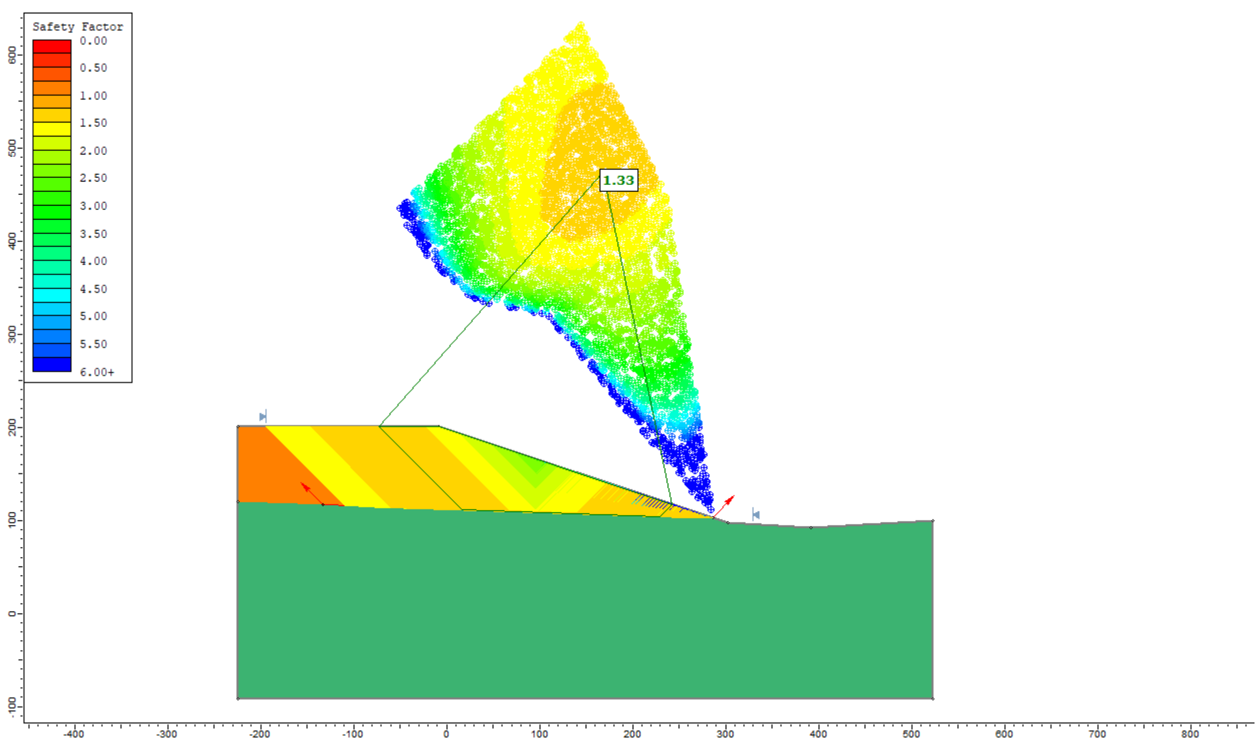
Global Minimums

Method:	spencer
FS	1.333320
Axis Location:	167.880, 473.609
Left Slip Surface Endpoint:	-72.688, 200.694
Right Slip Surface Endpoint:	241.871, 117.406
Resisting Moment:	2.06665e+08 lb-ft
Driving Moment:	1.55001e+08 lb-ft
Resisting Horizontal Force:	503295 lb
Driving Horizontal Force:	377476 lb
Total Slice Area:	14381 ft2
Surface Horizontal Width:	314.559 ft
Surface Average Height:	45.7178 ft

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 /10 /11 21 /01 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 /11 /11 21 /02 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Cohesion Type	Water Surface	Ru
Stratum III		133	Undrained	1600	Constant	None	0
Statum IV		133	Undrained	7000	Constant	None	0



Section F – F'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Interim Slopes

Slide Analysis Information

Document Name
File Name: Phase III-3to1-Backcalculated Peak

Project Settings
Project Title: Mesquite Creek LF - Interim Slope, Backcalculate Floor Peak Secant Friction Angle
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Spencer
Number of slices: 30
Tolerance: 0.005
Maximum number of iterations: 100

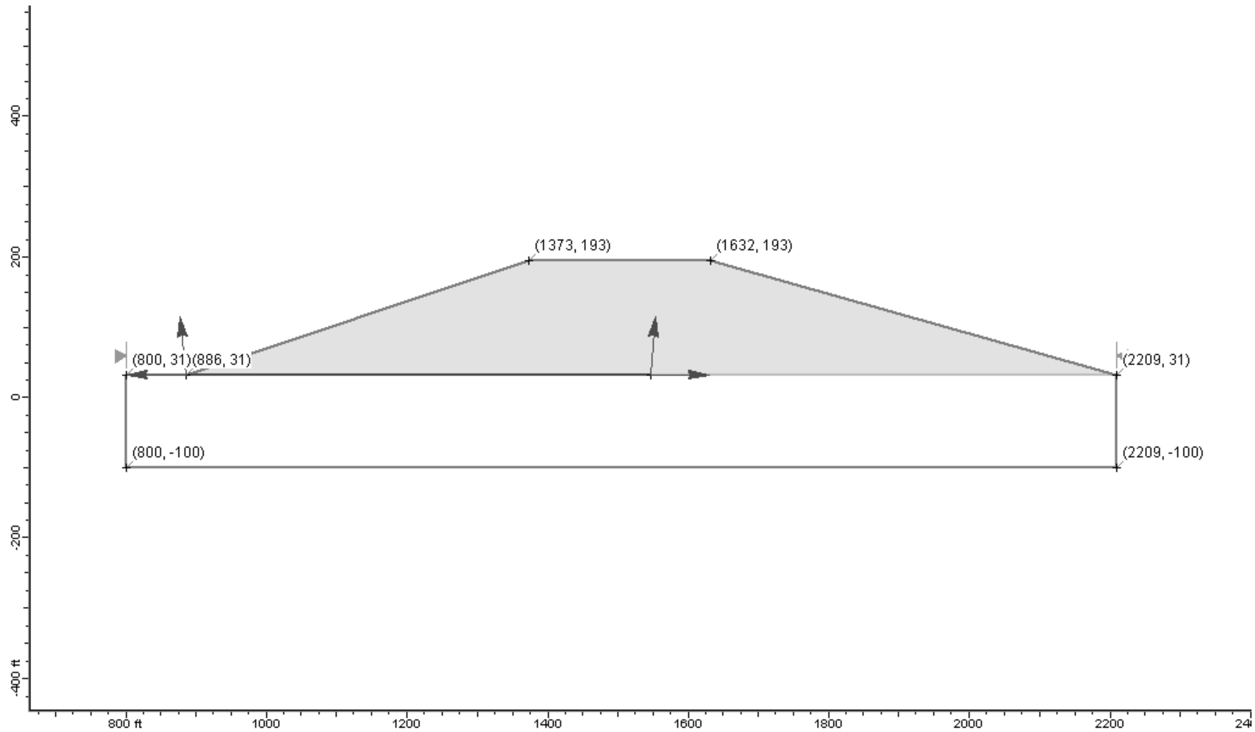
Surface Options
Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 180
Right Projection Angle (Start Angle): 0
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

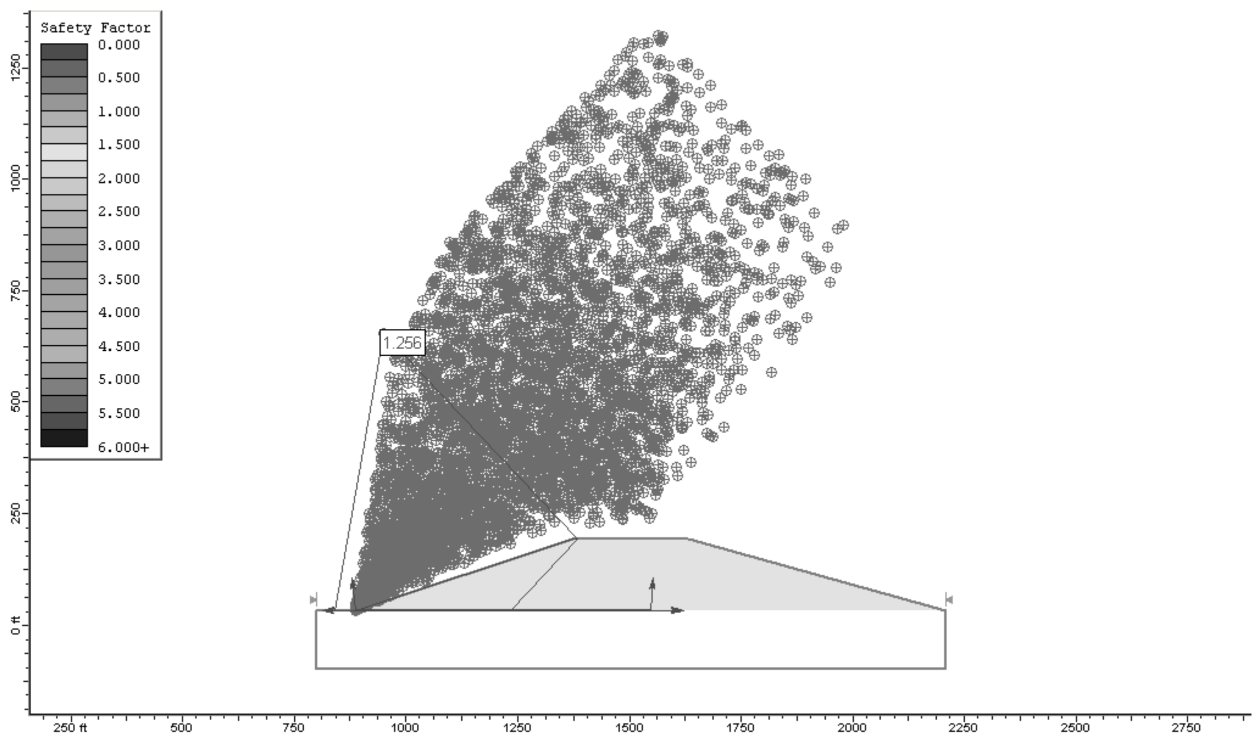
Material Properties
Material: Waste
Strength Type: Shear Normal function
Unit Weight: 80 lb/ft3
Water Surface: None
Material: Floor Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 9.4 degrees
Material: Stratum III/IV
Strength Type: Mohr-Coulomb
Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

Global Minimums
Method: spencer
FS: 1.255760
Axis Location: 949.857, 655.399
Left Slip Surface Endpoint: 840.657, 31.000
Right Slip Surface Endpoint: 1383.857, 193.400
Resisting Moment=4.33142e+008 lb-ft

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY) /10 /01 (MM) /11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY) /11 /02 (MM) /11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Driving Moment=3.44924e+008 lb-ft
Resisting Horizontal Force=557640 lb
Driving Horizontal Force=444065 lb





Section B-B'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name

File Name: Block - Waste, Liner, Foundation

Project Settings
Project Title: Mesquite Creek LF - Phases I, II, III, Block Sliding Through Waste, Liner, and Foundation
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Spencer
Number of slices: 30
Tolerance: 0.005
Maximum number of iterations: 50

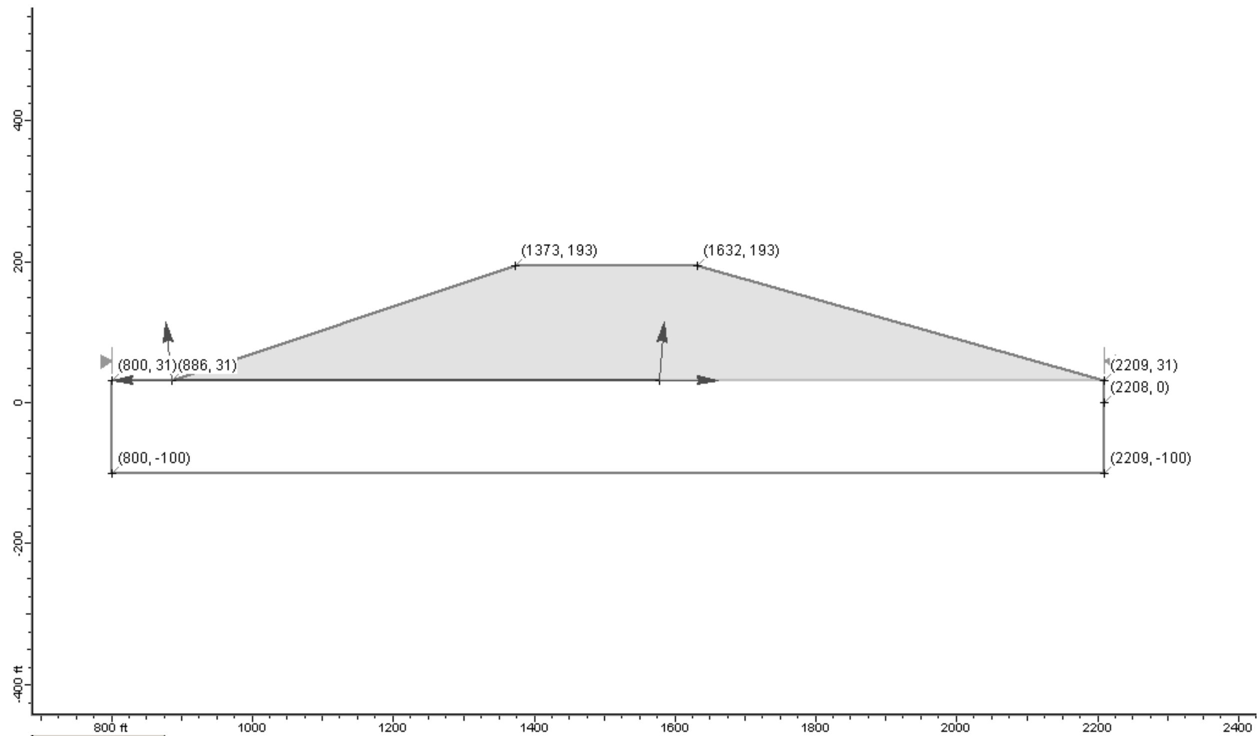
Surface Options
Surface Type: Non-Circular Block Search
Number of Surfaces: 10000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 180
Right Projection Angle (Start Angle): 0
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

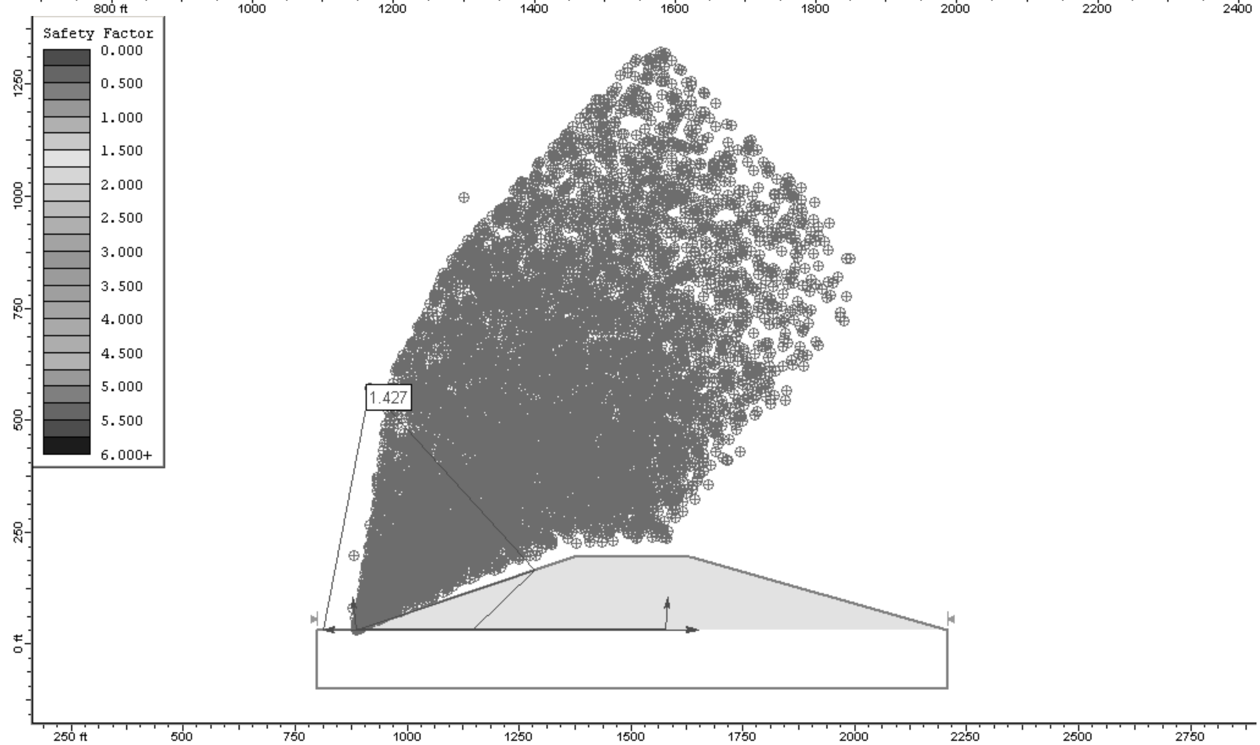
Material Properties
Material: Waste
Strength Type: Shear Normal function
Unit Weight: 80 lb/ft3
Water Surface: None
Material: Floor Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 12 degrees
Water Surface: None
Material: Stratum III/IV
Strength Type: Mohr-Coulomb
Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

Global Minimums
Method: spencer
FS: 1.426880
Axis Location: 915.757, 571.301
Left Slip Surface Endpoint: 812.541, 31.000
Right Slip Surface Endpoint: 1286.068, 164.548
Resisting Moment=2.68574e+008 lb-ft
Driving Moment=1.88224e+008 lb-ft
Resisting Horizontal Force=411393 lb

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY) /10 /01 (MM) /11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY) /11 /02 (MM) /11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Driving Horizontal Force=288317 lb





Section B-B'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 /10 /11 21 /01 /18 YY MM DD	Reviewed by:	B. Gross/ S. Graves	Date:	05 /11 /11 21 /02 /24 YY MM DD
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name
File Name: Phase III-3to1-Large Displacement

Project Settings
Project Title: Mesquite Creek - Interim Slopes, Backcalculate large-displacement secant friction angle for floor
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods
Analysis Methods used:
Spencer
Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

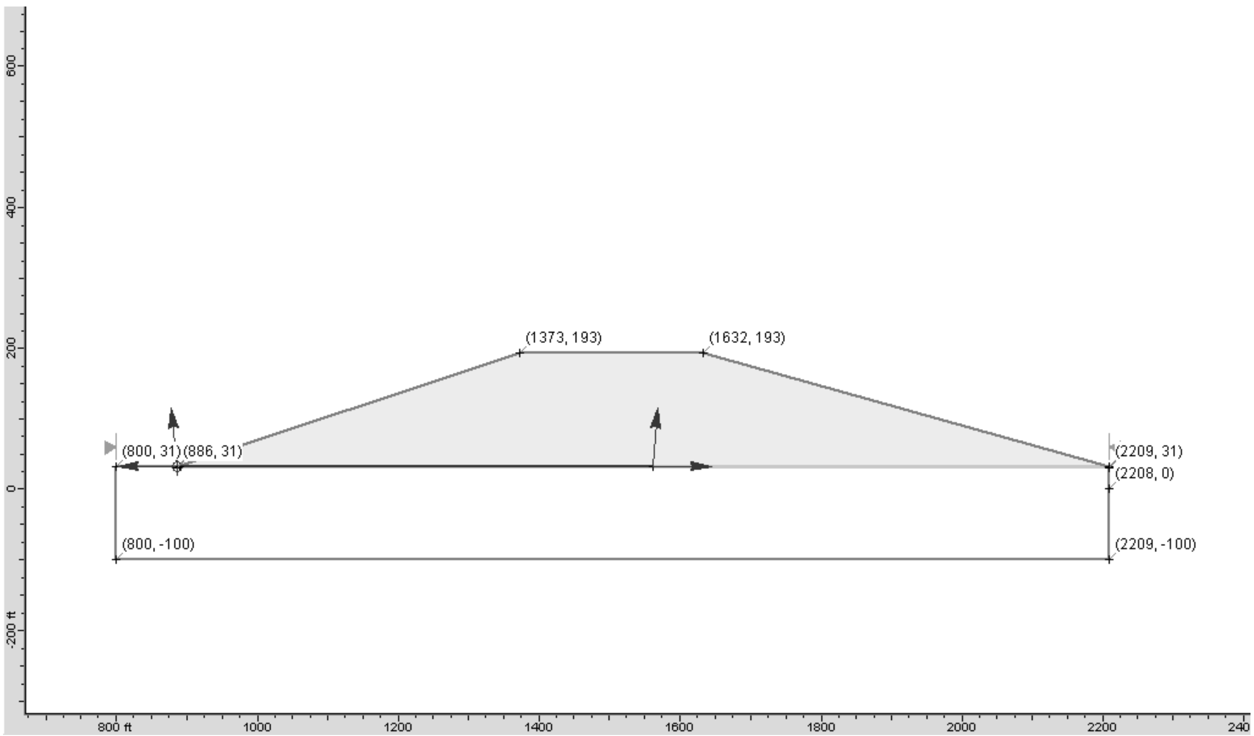
Surface Options
Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 180
Right Projection Angle (Start Angle): 0
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

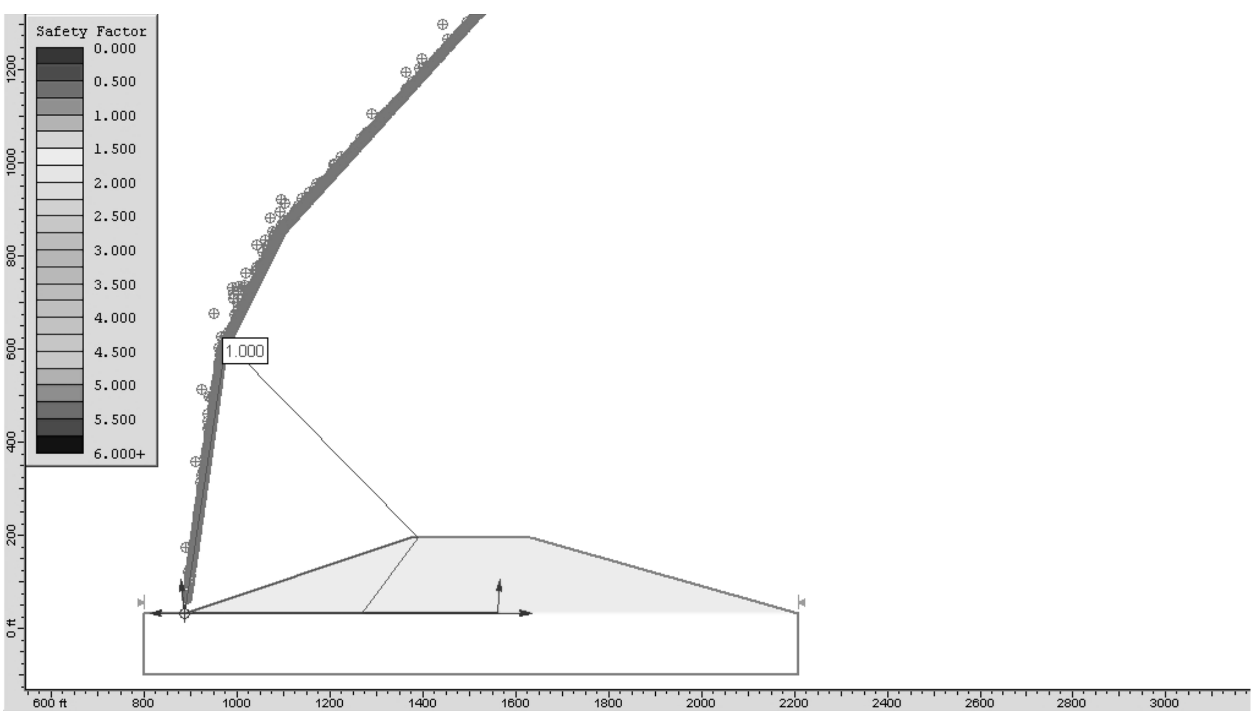
Material Properties
Material: Waste
Strength Type: Shear Normal function
Unit Weight: 80 lb/ft3
Water Surface: None
Material: Floor Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 5.7 degrees
Water Surface: None
Material: Stratum II/III
Strength Type: Mohr-Coulomb
Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

Global Minimums
Method: spencer
FS: 0.999542
Axis Location: 975.183, 615.770
Left Slip Surface Endpoint: 885.799, 31.000
Right Slip Surface Endpoint: 1389.368, 193.400
Resisting Moment=3.19838e+008 lb-ft
Driving Moment=3.19985e+008 lb-ft
Resisting Horizontal Force=408461 lb
Driving Horizontal Force=408648 lb

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY) /11 /02 (MM) /11 /24 (DD)

Client: WMTX Project: Mesquite Creek Landfill Project/Proposal No.: GT3435 Task No: 03





Section B-B'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name

File Name: Circular - Waste

Project Settings
Project Title: Mesquite Creek LF - Interim Slopes, Circular Failure Through Waste
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

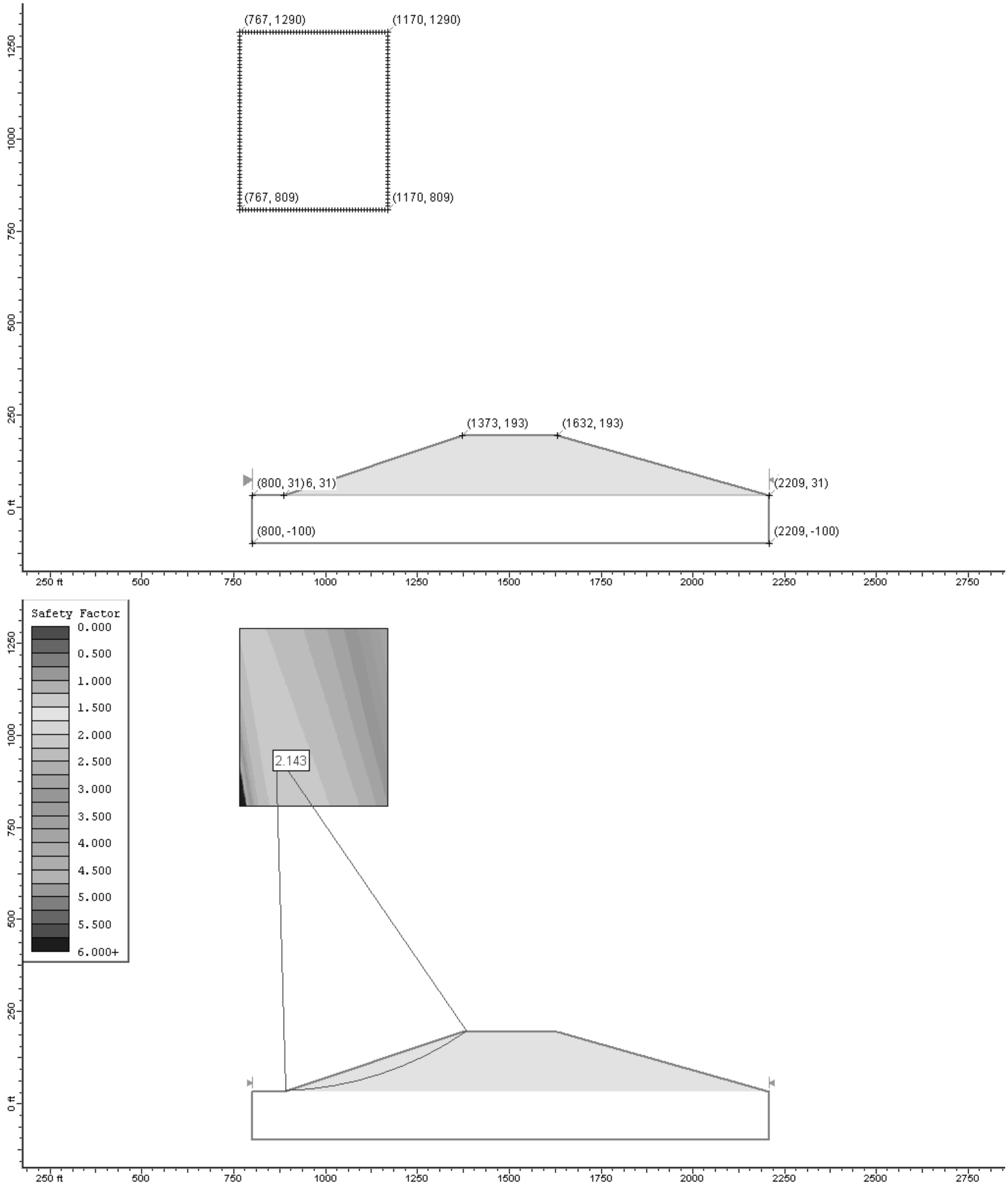
Analysis Methods
Analysis Methods used:
Bishop simplified
Number of slices: 30
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options
Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: 32
Minimum Depth: Not Defined

Material Properties
Material: Waste
Strength Type: Shear Normal function
Unit Weight: 80 lb/ft3
Water Surface: None
Material: Floor Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 12 degrees
Water Surface: None
Material: Stratum III/IV
Strength Type: Mohr-Coulomb
Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

Global Minimums
Method: bishop simplified
FS: 2.143000
Center: 863.519, 953.087
Radius: 921.087
Left Slip Surface Endpoint: 890.149, 32.385
Right Slip Surface Endpoint: 1384.362, 193.400
Resisting Moment=6.78392e+008 lb-ft
Driving Moment=3.16562e+008 lb-ft

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05/10/11 21/01/18 (YY/MM/DD)	Reviewed by:	B. Gross/ S. Graves
Date:	05/11/11 21/02/24 (YY/MM/DD)				
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435
Task No:	03				



Section B-B'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY)	/11 /02 (MM)	/11 /24 (DD)

Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name
File Name: Circular - Waste, Liner, Foundation

Project Settings

Project Title: Mesquite Creek LF - Interim Slopes, Circular Failure Through Waste, Liner, and Foundation
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Waste
Strength Type: Shear Normal function
Unit Weight: 80 lb/ft3
Water Surface: None

Material: Floor Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 12 degrees
Water Surface: None

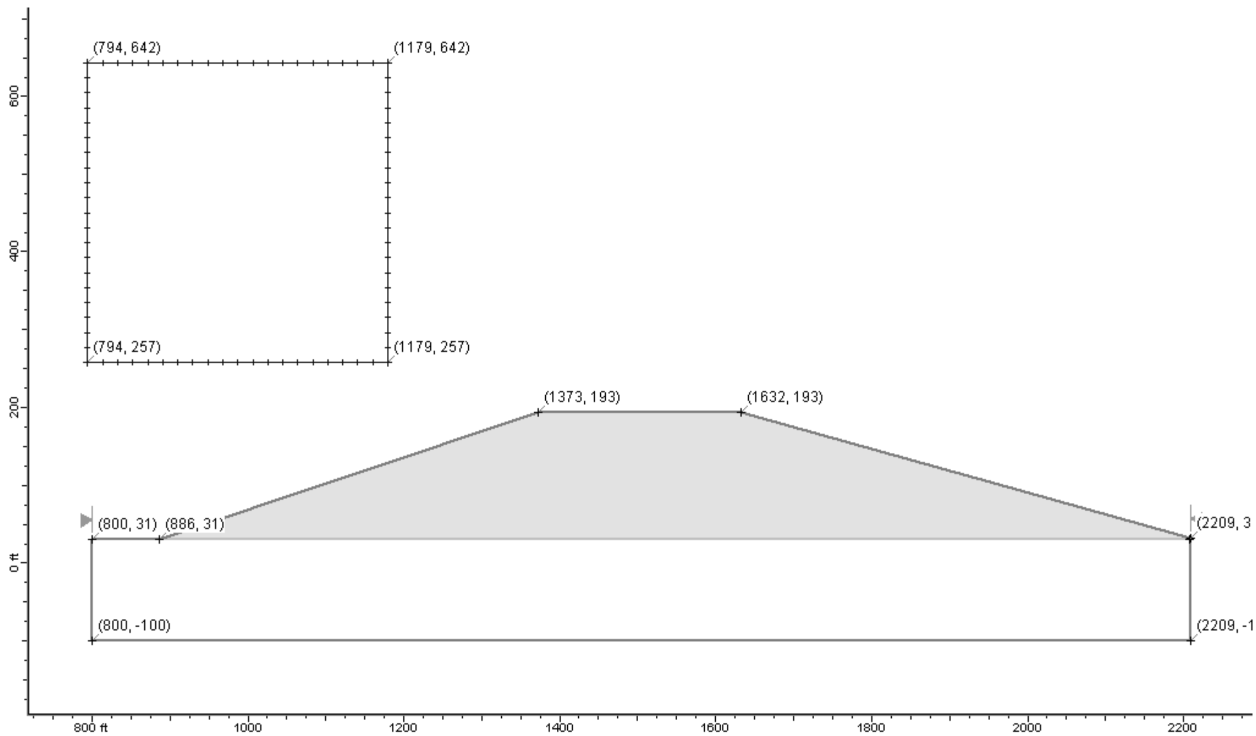
Material: Stratum III/IV
Strength Type: Mohr-Coulomb
Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

Global Minimums

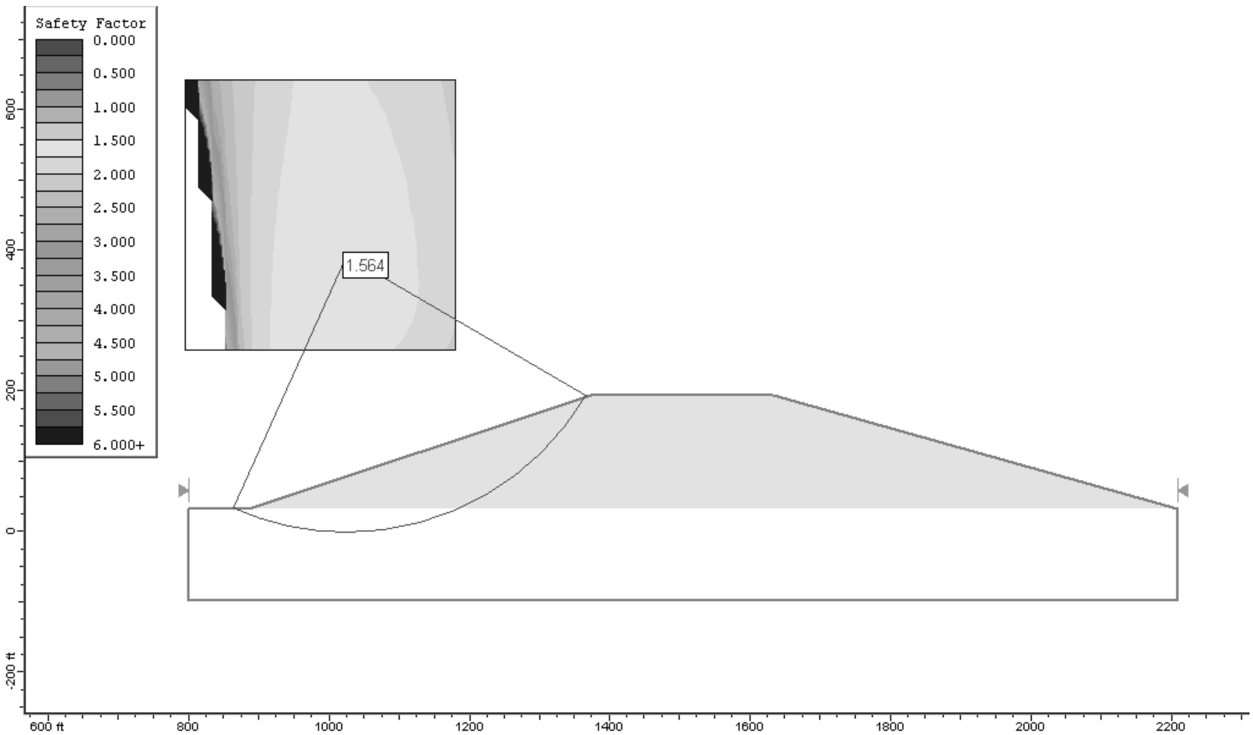
Method: bishop simplified
FS: 1.563900
Center: 1025.284, 391.958

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Radius: 396.234
Left Slip Surface Endpoint: 861.850, 31.000
Right Slip Surface Endpoint: 1367.134, 191.609
Resisting Moment=4.65876e+008 lb-ft
Driving Moment=2.97895e+008 lb-ft



Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03



Section B-B'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY) /10 /01 (MM) /11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY) /11 /02 (MM) /11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name
File Name: Unit 2 Phase VI Interim Landfill Slopes Slopes.slmd

Project Settings
Project Title: Mesquite Creek Landfill Unit 2 Phase VI

Units of Measurement:	Imperial Units
Failure Direction:	Right to Left

Analysis Methods

Number of slices:	100
Tolerance:	0.005
Maximum number of iterations:	75
Steffensen Iteration:	Yes

Surface Options

Surface Type:	Circular
Search Method:	Grid Search
Radius Increment:	10
Reverse Curvature:	Invalid Surfaces

Material Properties

Waste	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	80
Side Liner	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	13
Floor Liner Phase I-V	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	12
Strata III	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	133
Cohesion [psf]	0
Friction Angle [deg]	14
Floor Liner Phase VI	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	12
Stratum IV	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	133
Cohesion [psf]	0
Friction Angle [deg]	26

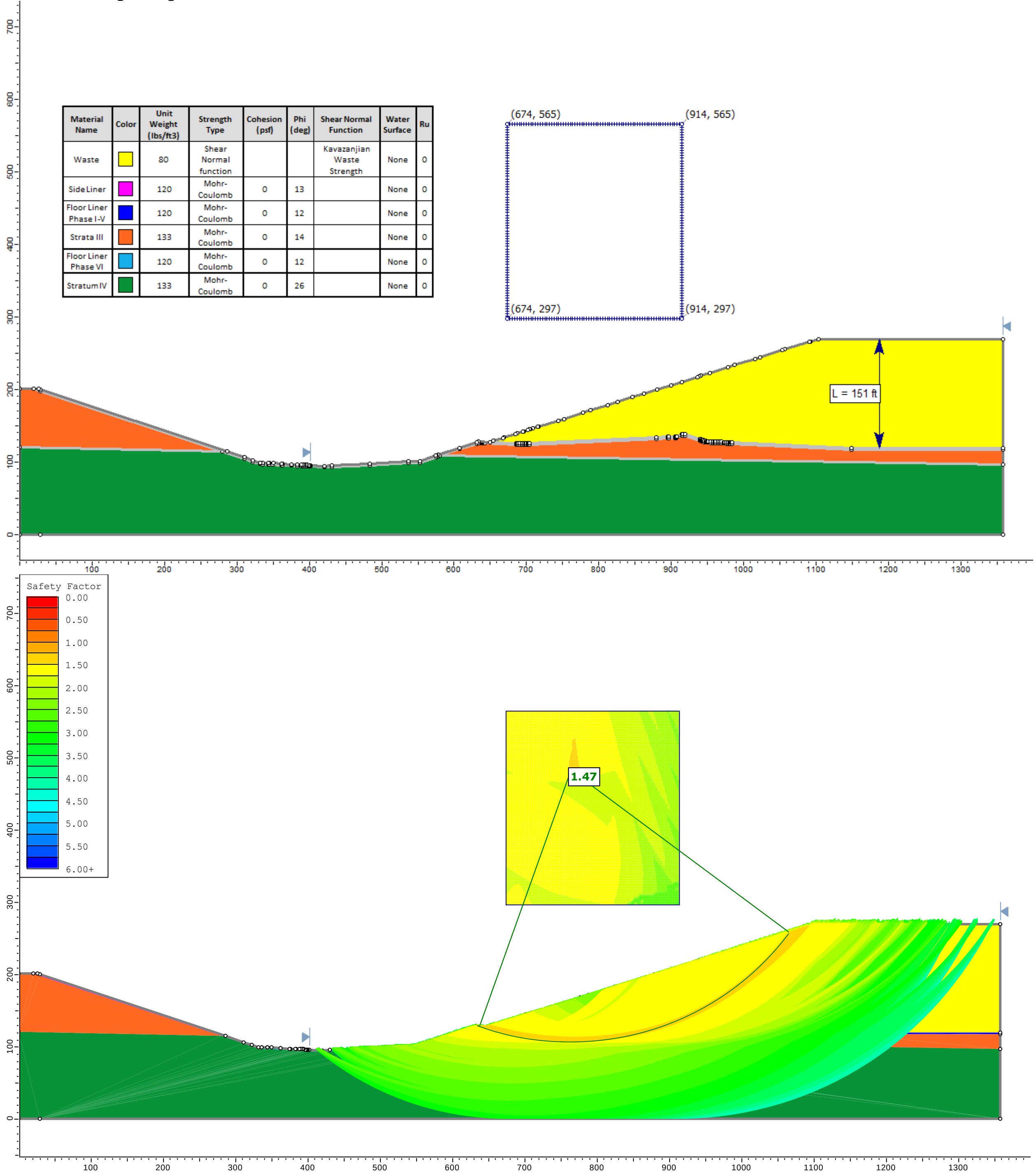
Global Minimums

Method:	spencer
FS	1.472350
Center:	763.608, 483.103
Radius:	377.097
Left Slip Surface Endpoint:	636.999, 127.896
Right Slip Surface Endpoint:	1066.405, 258.346
Resisting Moment:	2.59904e+08 lb-ft
Driving Moment:	1.76523e+08 lb-ft
Resisting Horizontal Force:	619407 lb
Driving Horizontal Force:	420693 lb
Total Slice Area:	21715.2 ft2
Surface Horizontal Width:	429.406 ft

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY) /11 /02 (MM)	/11 /24 (DD)

Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Surface Average Height: 50.5704 ft



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		80	Shear Normal function			Kavazanjian Waste Strength	None	0
Side Liner		120	Mohr-Coulomb	0	13		None	0
Floor Liner Phase I-V		120	Mohr-Coulomb	0	12		None	0
Strata III		133	Mohr-Coulomb	0	14		None	0
Floor Liner Phase VI		120	Mohr-Coulomb	0	12		None	0
Stratum IV		133	Mohr-Coulomb	0	26		None	0

Section F-F’

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name
File Name: Unit 2 Phase VI Interim Slopes.slmd

Project Settings
Project Title: Mesquite Creek Landfill Unit 2 Phase VI

Units of Measurement:	Imperial Units
Failure Direction:	Right to Left

Analysis Methods

Number of slices:	100
Tolerance:	0.005
Maximum number of iterations:	75
Steffensen Iteration:	Yes

Surface Options

Surface Type:	Non-Circular Block Search
Number of Surfaces:	5000
Radius Increment:	10
Reverse Curvature:	Invalid Surfaces

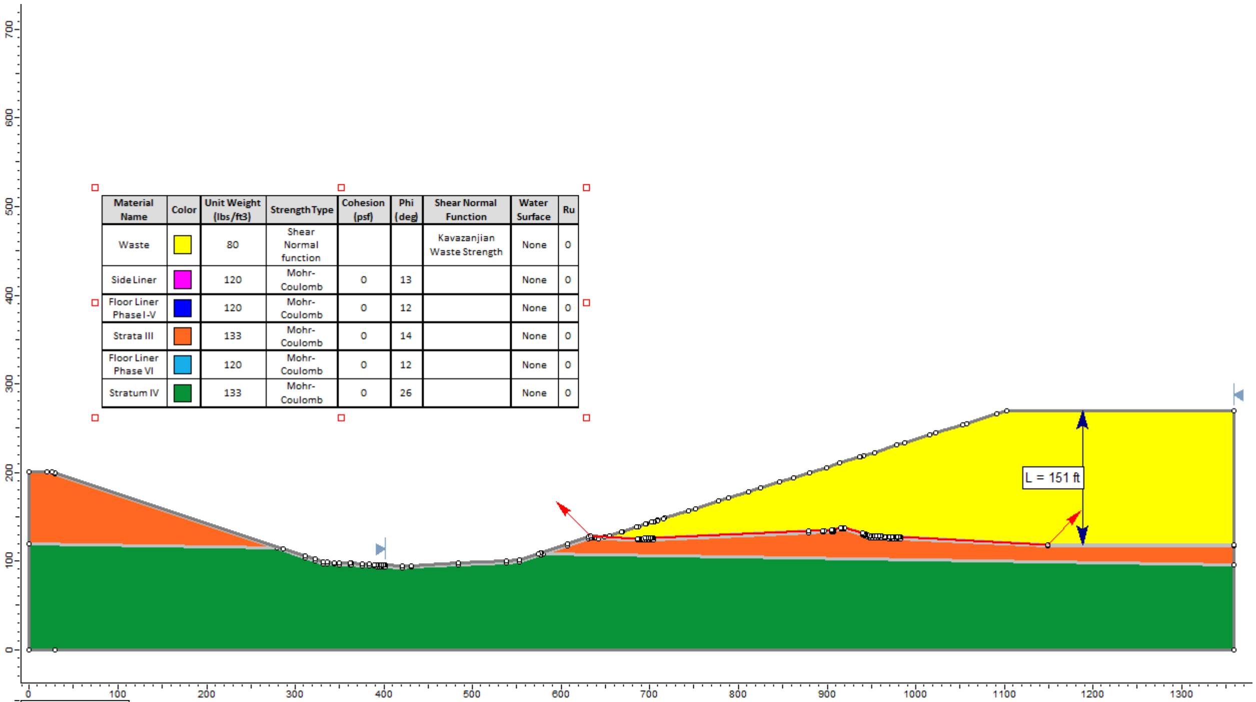
Material Properties

Waste	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	80
Side Liner	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	13
Floor Liner Phase I-V	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	12
Strata III	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	133
Cohesion [psf]	0
Friction Angle [deg]	14
Floor Liner Phase VI	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	0
Friction Angle [deg]	12
Stratum IV	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	133
Cohesion [psf]	0
Friction Angle [deg]	26

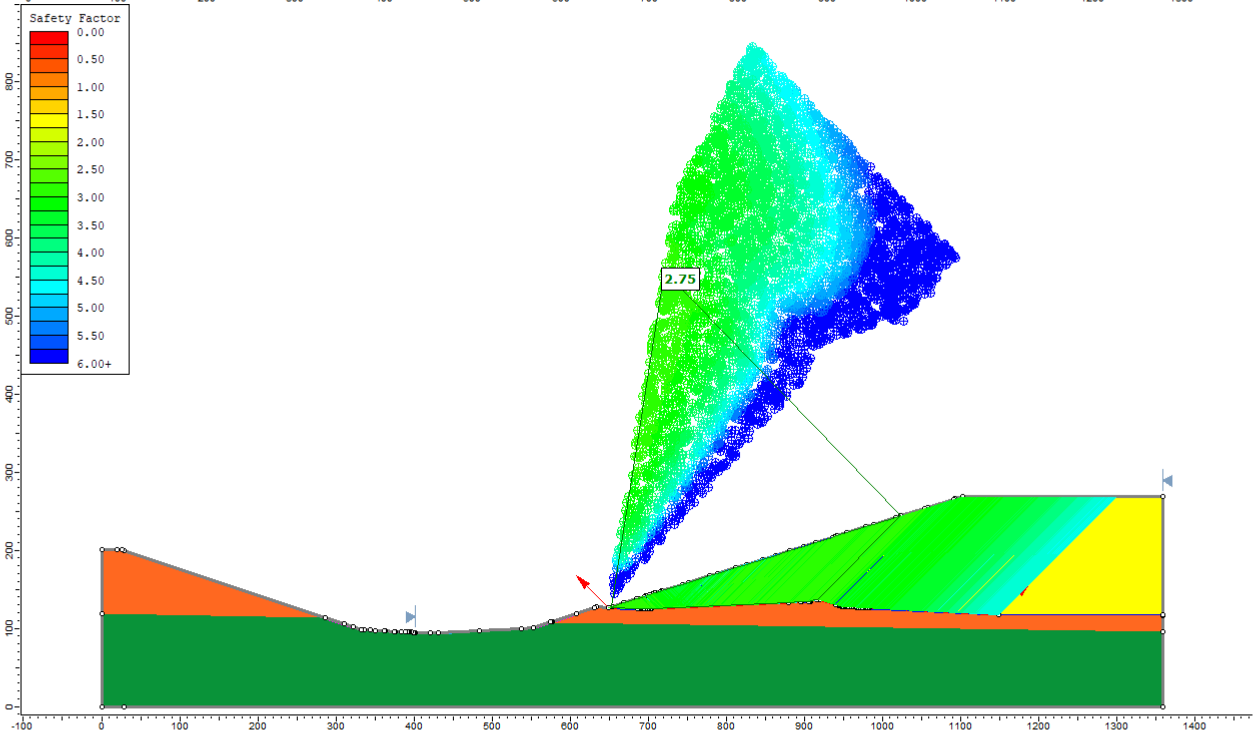
Global Minimums

Method:	spencer
FS	2.752760
Axis Location:	721.011, 557.107
Left Slip Surface Endpoint:	652.030, 128.276
Right Slip Surface Endpoint:	1022.687, 244.623
Resisting Moment:	3.36295e+08 lb-ft
Driving Moment:	1.22167e+08 lb-ft
Resisting Horizontal Force:	715802 lb
Driving Horizontal Force:	260031 lb
Total Slice Area:	14383.2 ft2
Surface Horizontal Width:	370.657 ft
Surface Average Height:	38.8045 ft

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY)	/11 /02 (MM)	/11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill			Project/Proposal No.:	GT3435	Task No:	03		



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		80	Shear Normal function			Kavazanjian Waste Strength	None	0
Side Liner		120	Mohr-Coulomb	0	13		None	0
Floor Liner Phase I-V		120	Mohr-Coulomb	0	12		None	0
Strata III		133	Mohr-Coulomb	0	14		None	0
Floor Liner Phase VI		120	Mohr-Coulomb	0	12		None	0
Stratum IV		133	Mohr-Coulomb	0	26		None	0



Section F-F'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05/10/11 21/01/18 (YY/MM/DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05/11/11 21/02/24 (YY/MM/DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Final Landfill Slopes

Unit 1

Slide Analysis Information

Document Name
File Name: Unit1PhaseVLiner-meas

Project Settings

Project Title: Mesquite Creek Landfill - Unit 1 Liner Failure
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Spencer

Number of slices: 50
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 180
Right Projection Angle (Start Angle): 0
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Waste
Strength Type: Shear Normal function
Unit Weight: 80 lb/ft3
Water Surface: None

Material: Subgrade
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

Material: Floor Liner Interface
Strength Type: Shear Normal function
Unit Weight: 120 lb/ft3
Water Surface: None

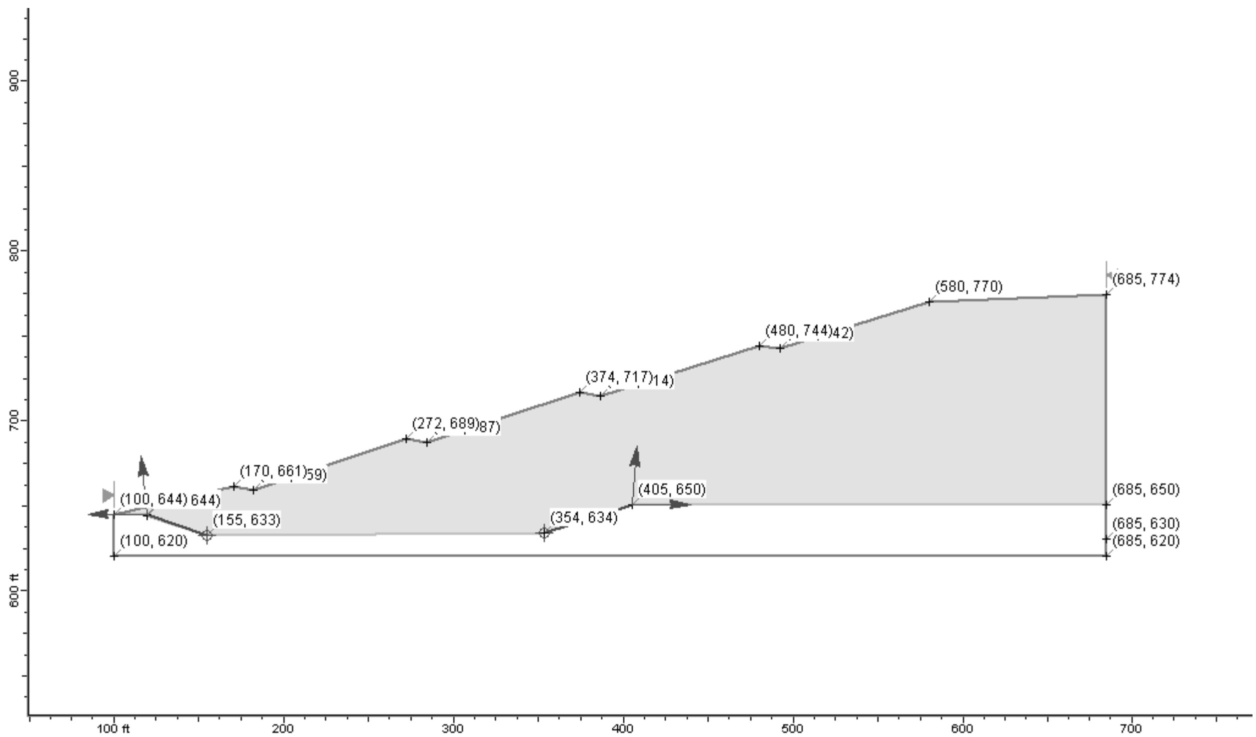
Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY)	/11 /02 (MM)	/11 /24 (DD)

Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Material: Side Slope Liner
Strength Type: Shear Normal function
Unit Weight: 120 lb/ft3
Water Surface: None

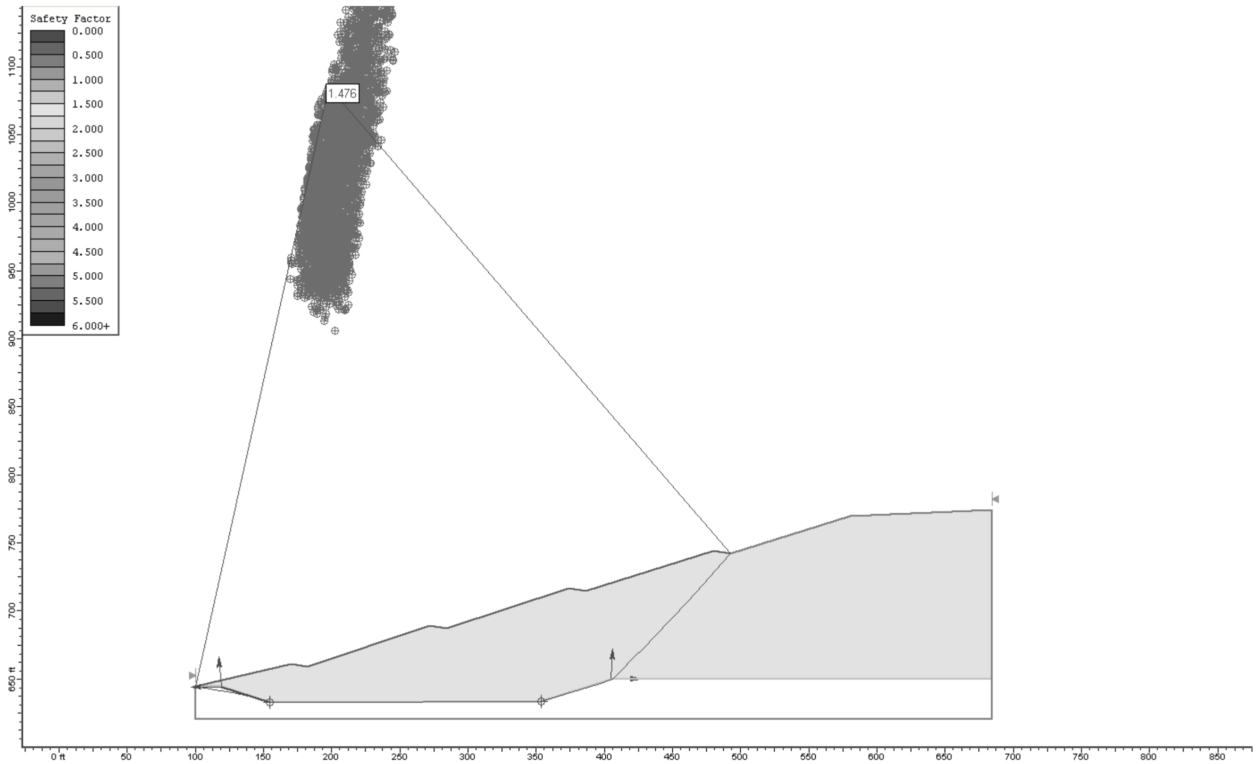
Global Minimums

Method: spencer
FS: 1.476480
Axis Location: 198.200, 1085.600
Left Slip Surface Endpoint: 100.000, 644.200
Right Slip Surface Endpoint: 492.400, 742.200
Resisting Moment=1.97464e+008 lb-ft
Driving Moment=1.3374e+008 lb-ft
Resisting Horizontal Force=377692 lb
Driving Horizontal Force=255806 lb



Written by: R. EL-Sherbiny/ L. Peve | Date: 05/10/11 21/01/18 (YY/MM/DD) | Reviewed by: B. Gross/ S. Graves | Date: 05/11/11 21/02/24 (YY/MM/DD)

Client: WMTX | Project: Mesquite Creek Landfill | Project/Proposal No.: GT3435 | Task No: 03



Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name

File Name: Unit1PhaseVLiner-meas-LD

Project Settings

Project Title: Mesquite Creek Landfill - Unit 1 Liner Failure
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Spencer

Number of slices: 50
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 180
Right Projection Angle (Start Angle): 0
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Waste
Strength Type: Shear Normal function
Unit Weight: 80 lb/ft3
Water Surface: None

Material: Subgrade
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

Material: Floor Liner Interface
Strength Type: Shear Normal function
Unit Weight: 120 lb/ft3
Water Surface: None

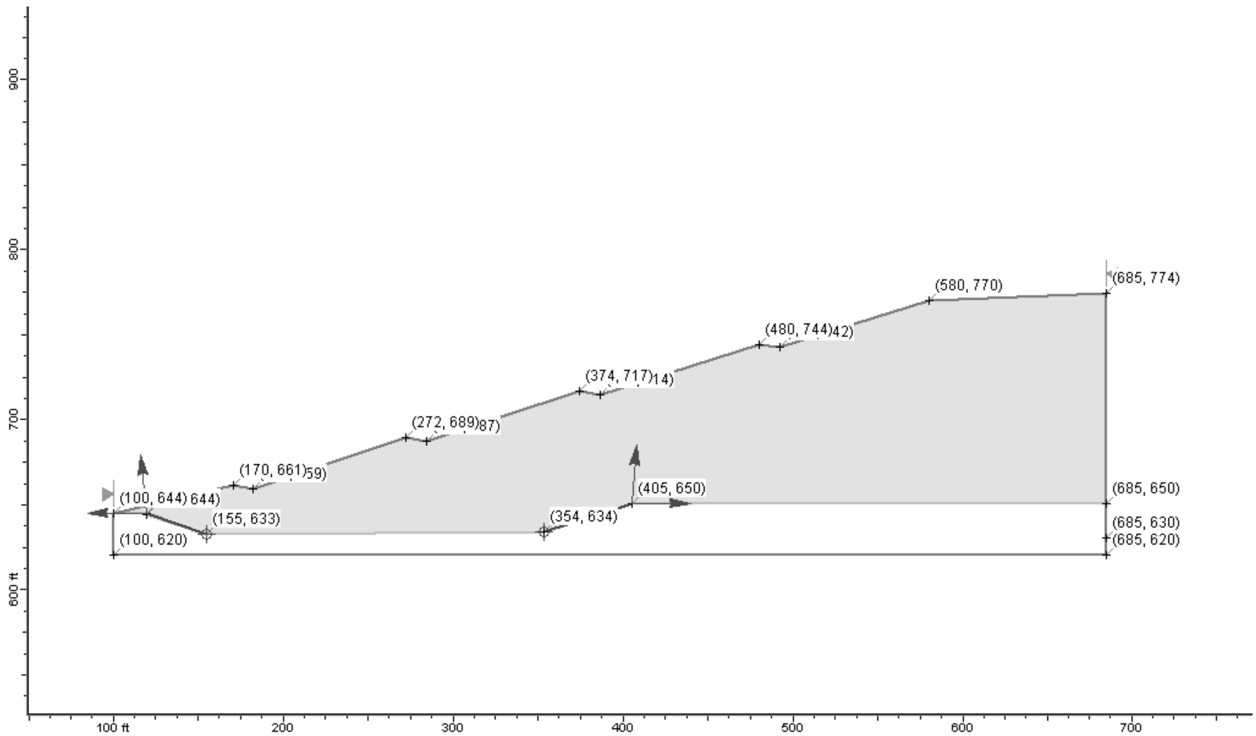
Material: Sideslope Liner
Strength Type: Shear Normal function
Unit Weight: 120 lb/ft3
Water Surface: None

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY)	/11 /02 (MM)	/11 /24 (DD)

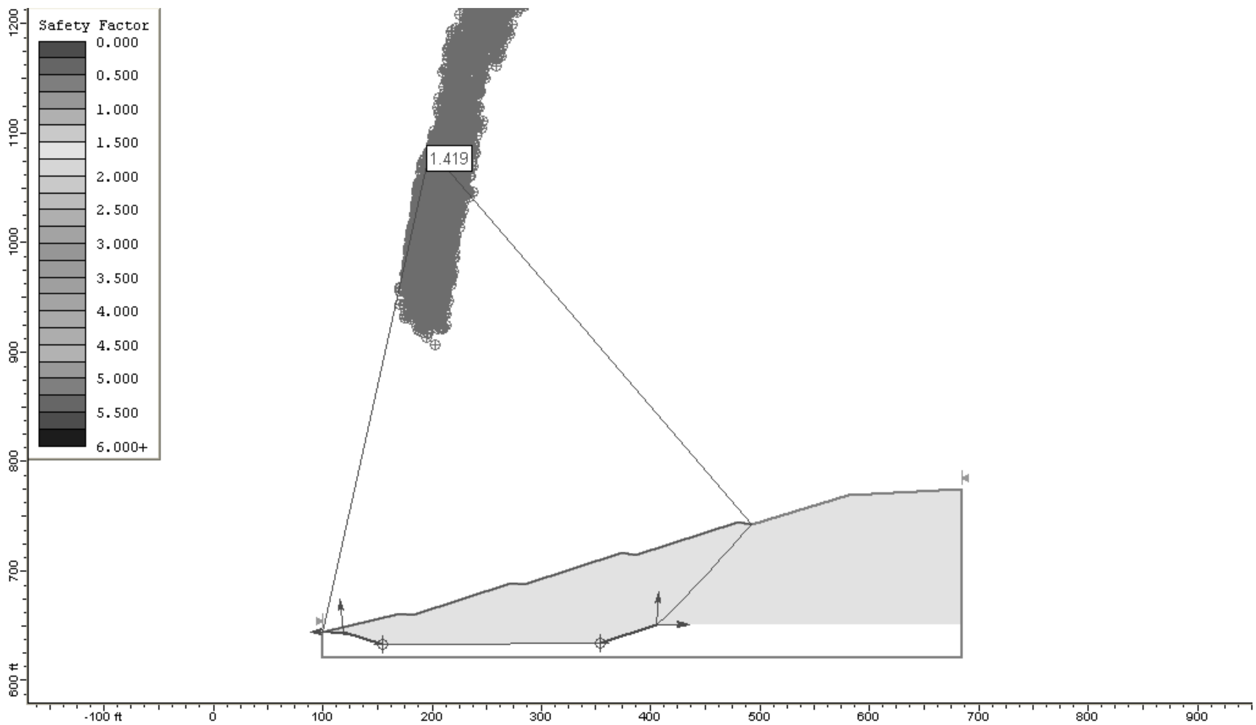
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Global Minimums

Method: spencer
FS: 1.418990
Axis Location: 198.200, 1085.600
Left Slip Surface Endpoint: 100.000, 644.200
Right Slip Surface Endpoint: 492.400, 742.200
Resisting Moment=1.87739e+008 lb-ft
Driving Moment=1.32304e+008 lb-ft
Resisting Horizontal Force=357511 lb
Driving Horizontal Force=251947 lb



Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 /10 /11 21 /01 /18 YY MM DD	Reviewed by:	B. Gross/ S. Graves	Date:	05 /11 /11 21 /02 /24 YY MM DD
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03



Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name

File Name: Unit1-PhaseIII-noncircular-peakII

Project Settings

Project Title: Mesquite Creek Landfill - Unit 1 Liner Failure
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Spencer

Number of slices: 30
Tolerance: 0.0005
Maximum number of iterations: 500

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 10000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 180
Right Projection Angle (Start Angle): 0
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Waste
Strength Type: Shear Normal function
Unit Weight: 80 lb/ft3
Water Surface: None

Material: Subgrade
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

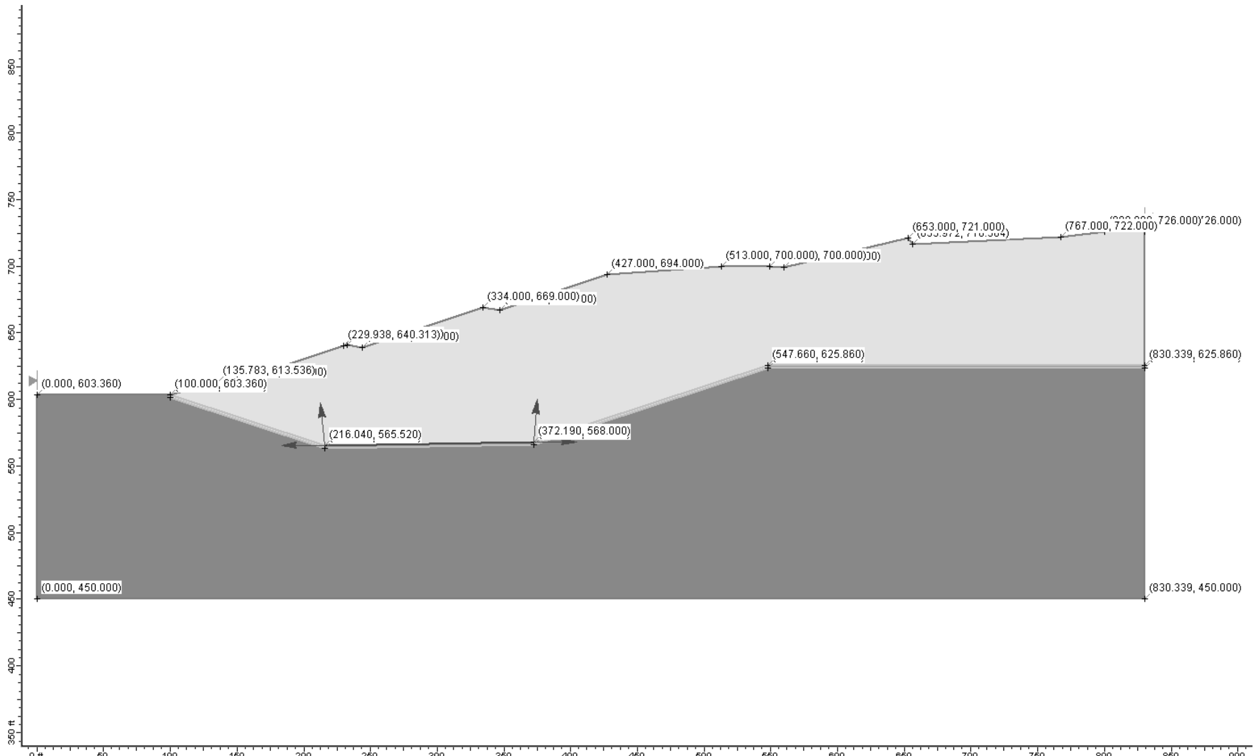
Material: Liner-Floor
Strength Type: Shear Normal function
Unit Weight: 120 lb/ft3
Water Surface: None

Material: Liner-Slope
Strength Type: Shear Normal function
Unit Weight: 120 lb/ft3
Water Surface: None

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY) /10 /01 (MM) /11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY) /11 /02 (MM) /11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

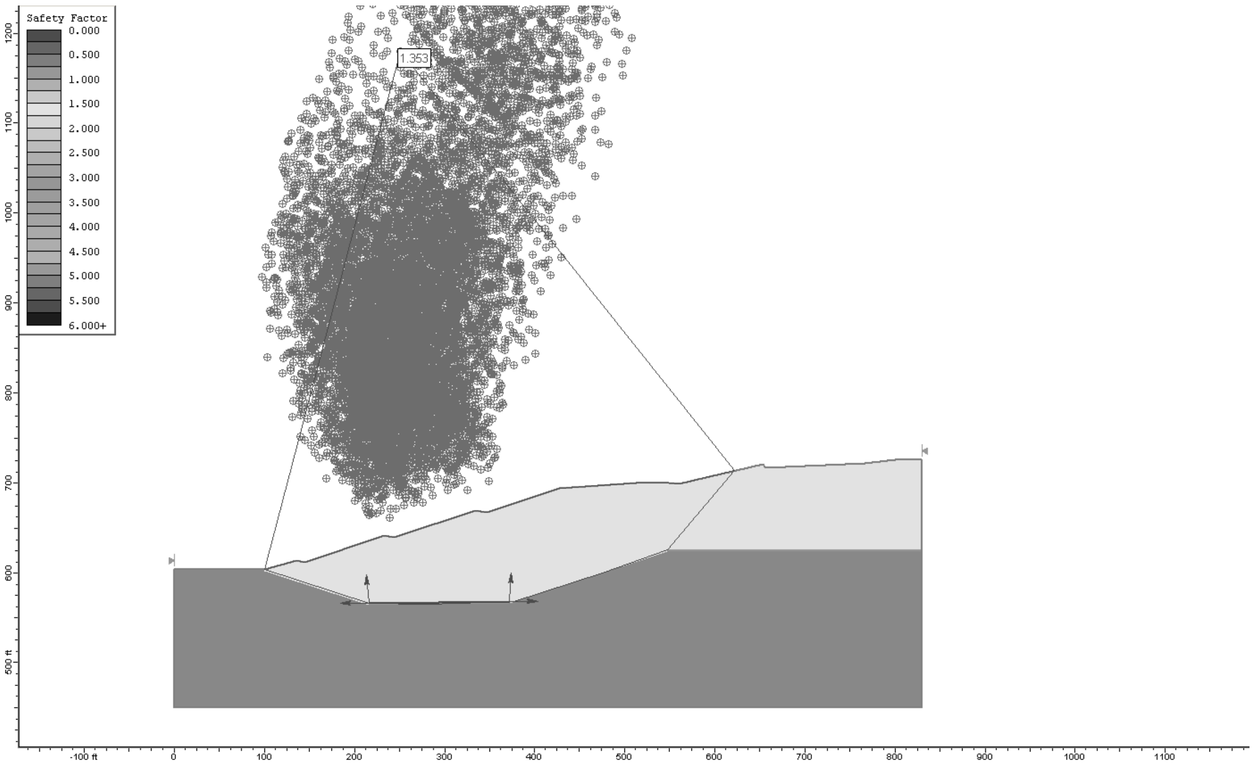
Global Minimums

Method: spencer
FS: 1.353150
Axis Location: 250.488, 1180.185
Left Slip Surface Endpoint: 99.826, 603.360
Right Slip Surface Endpoint: 621.551, 713.560
Resisting Moment=4.29356e+008 lb-ft
Driving Moment=3.17301e+008 lb-ft
Resisting Horizontal Force=641168 lb
Driving Horizontal Force=473833 lb



Written by: R. EL-Sherbiny/ L. Peve Date: 05 21 /10 /01 /11 /18 (YY MM DD) Reviewed by: B. Gross/ S. Graves Date: 05 21 /11 /02 /11 /24 (YY MM DD)

Client: WMTX Project: Mesquite Creek Landfill Project/Proposal No.: GT3435 Task No: 03



Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name

File Name: Unit1-PhaseIII-noncircular-LDII

Project Settings

Project Title: Mesquite Creek Landfill - Unit 1 Liner Failure
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Spencer

Number of slices: 30
Tolerance: 0.0005
Maximum number of iterations: 500

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 10000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 180
Right Projection Angle (Start Angle): 0
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Waste
Strength Type: Shear Normal function
Unit Weight: 80 lb/ft3
Water Surface: None

Material: Subgrade
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

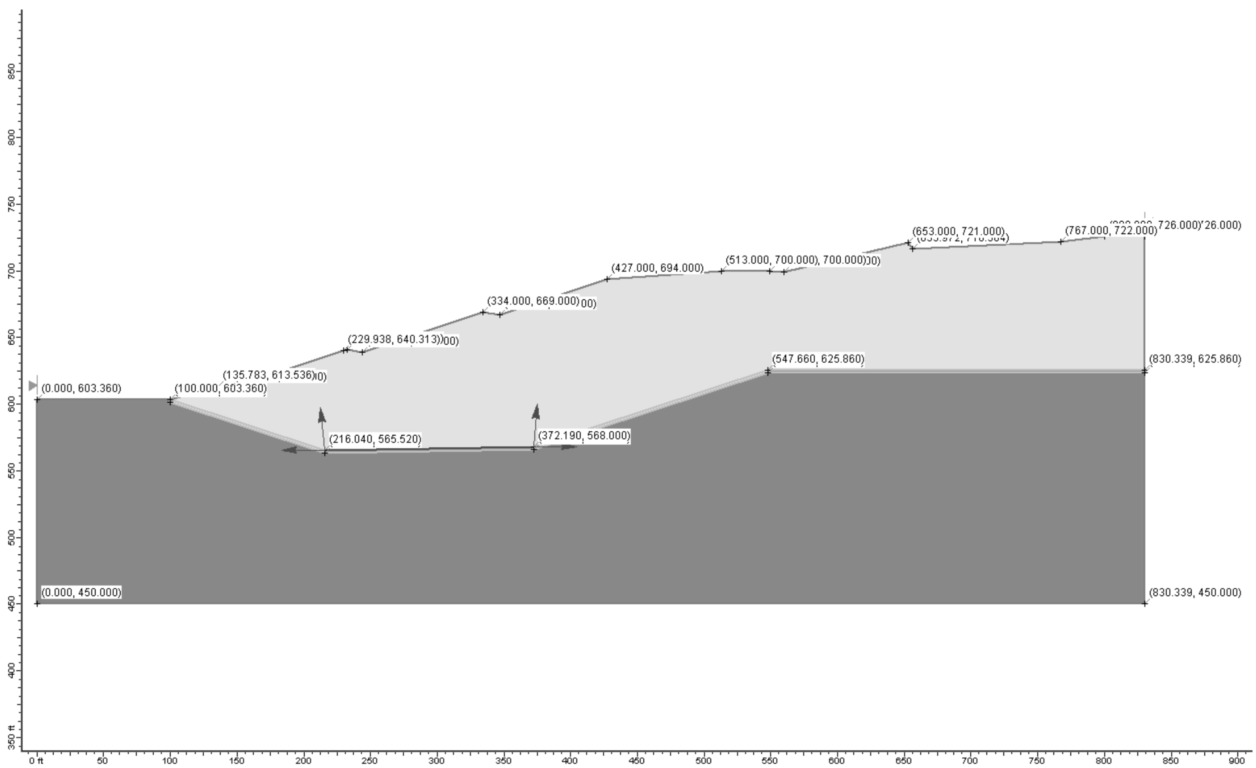
Material: Liner-Floor
Strength Type: Shear Normal function
Unit Weight: 120 lb/ft3
Water Surface: None

Material: Liner-Slope
Strength Type: Shear Normal function
Unit Weight: 120 lb/ft3
Water Surface: None

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 /10 /11 21 /01 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves
Date:	05 /11 /11 21 /02 /24 (YY MM DD)				
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435
Task No:	03				

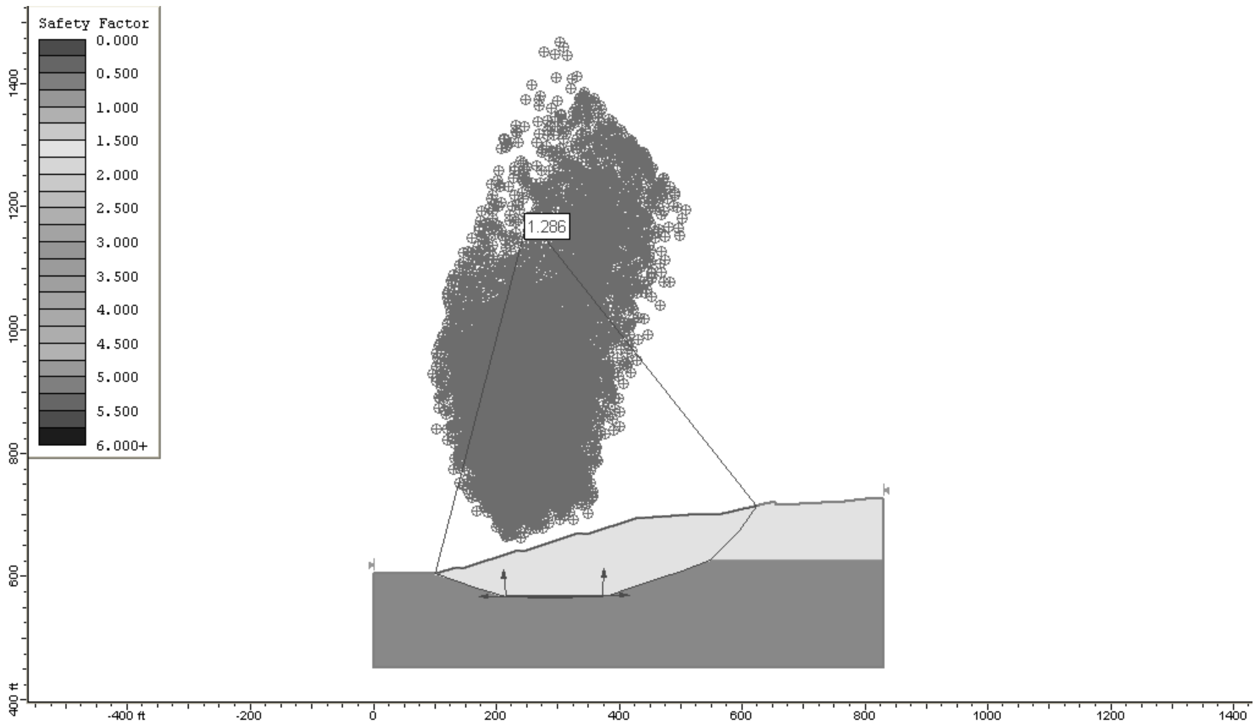
Global Minimums

Method: spencer
FS: 1.285550
Axis Location: 251.320, 1183.160
Left Slip Surface Endpoint: 100.003, 603.361
Right Slip Surface Endpoint: 624.369, 714.227
Resisting Moment=4.19673e+008 lb-ft
Driving Moment=3.26455e+008 lb-ft
Resisting Horizontal Force=622047 lb
Driving Horizontal Force=483877 lb



Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY)	/11 /02 (MM)	/11 /24 (DD)

Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03



Written by:	R. EL-Sherbiny/ L. Peve	Date:	05/10/11 21/01/18 (YY/MM/DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05/11/11 21/02/24 (YY/MM/DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Final Landfill Slopes

Unit 2

Slide Analysis Information

Document Name

File Name: Unit2 Final Grade - Circular, Waste Only

Project Settings

Project Title: Mesquite Creek LF - Final Grades, Circular Failure Through Waste
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: 602
Minimum Depth: Not Defined

Material Properties

Material: Waste
Strength Type: Shear Normal function
Unit Weight: 80 lb/ft3
Water Surface: None

Material: Side Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 10.3 degrees
Water Surface: None

Material: Floor Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 12 degrees
Water Surface: None

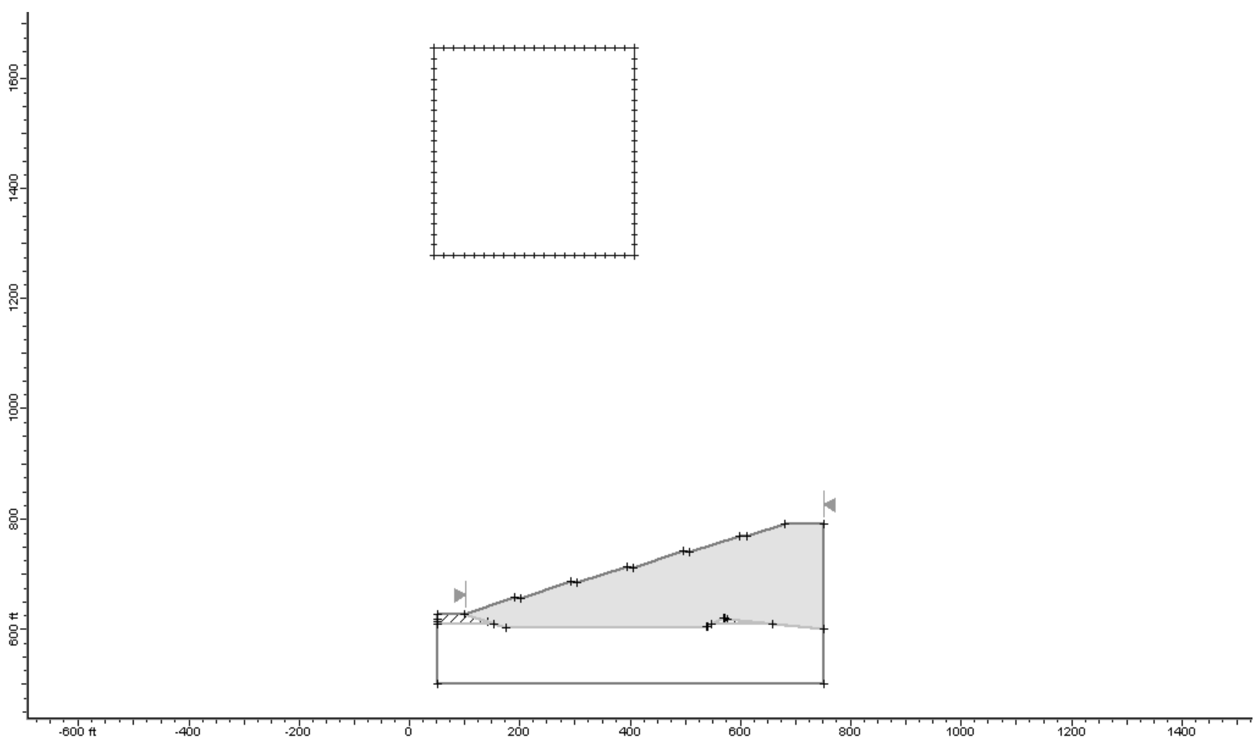
Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY)	/11 /02 (MM)	/11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill			Project/Proposal No.:	GT3435	Task No:	03		

Material: Strata I and II
Strength Type: Mohr-Coulomb
Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

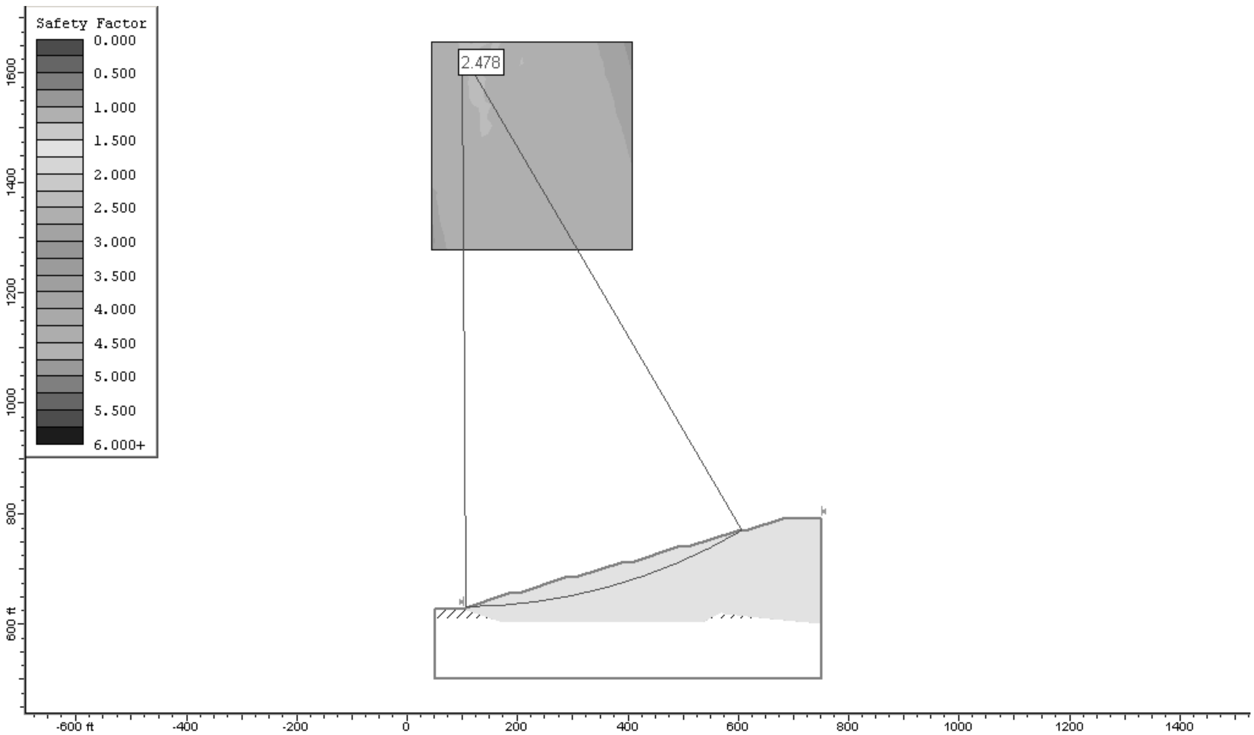
Material: Strata III
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 2.477710
Center: 98.161, 1635.106
Radius: 1005.953
Left Slip Surface Endpoint: 106.562, 629.187
Right Slip Surface Endpoint: 607.218, 767.464
Resisting Moment=6.62994e+008 lb-ft
Driving Moment=2.67583e+008 lb-ft



Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03



Section E-E'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 / 10 01 / 11 18 (YY/MM/DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 / 11 02 / 11 24 (YY/MM/DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name

File Name: Unit2Section2-FS=1.5

Project Settings

Project Title: Mesquite Creek LF - Final Slopes, Backcalculate Minimum Floor Peak Secant Friction Angle
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Spencer

Number of slices: 30
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 10000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 180
Right Projection Angle (Start Angle): 0
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Waste
Strength Type: Shear Normal function
Unit Weight: 80 lb/ft3
Water Surface: None

Material: Side Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 13 degrees
Water Surface: None

Material: Floor Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 12 degrees
Water Surface: None

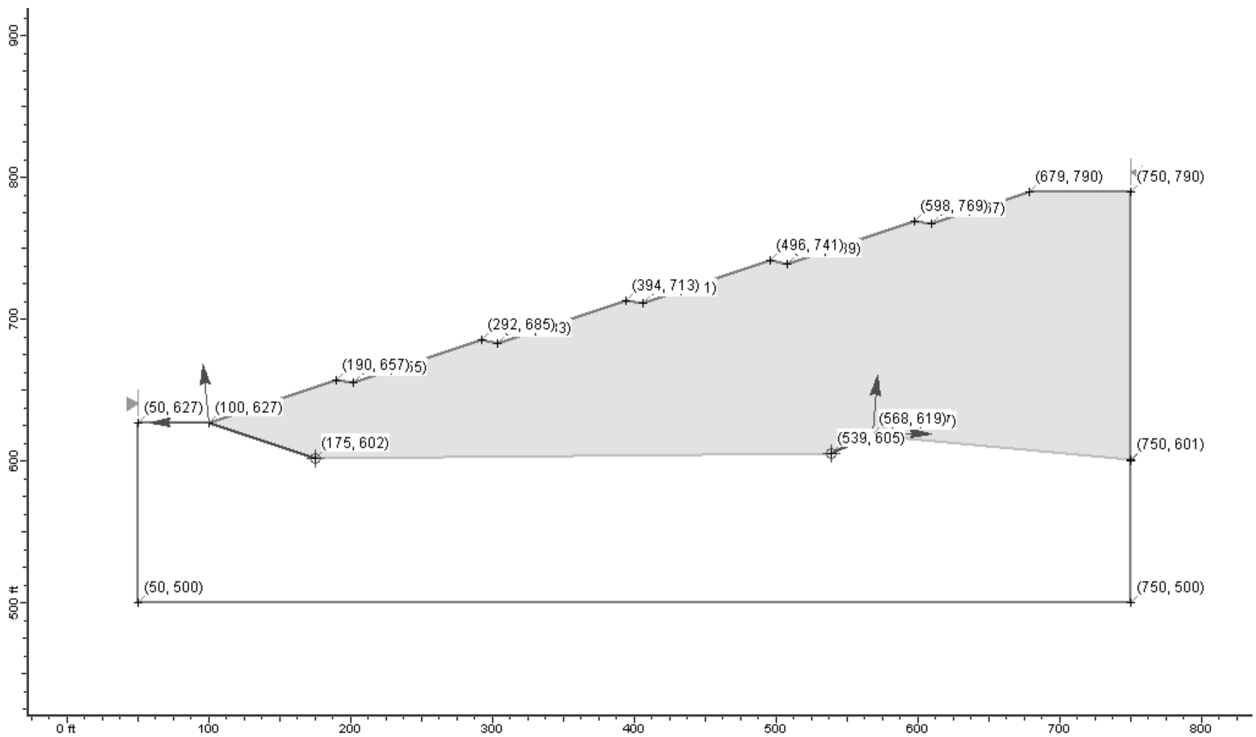
Material: Strata III/IV
Strength Type: Mohr-Coulomb

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

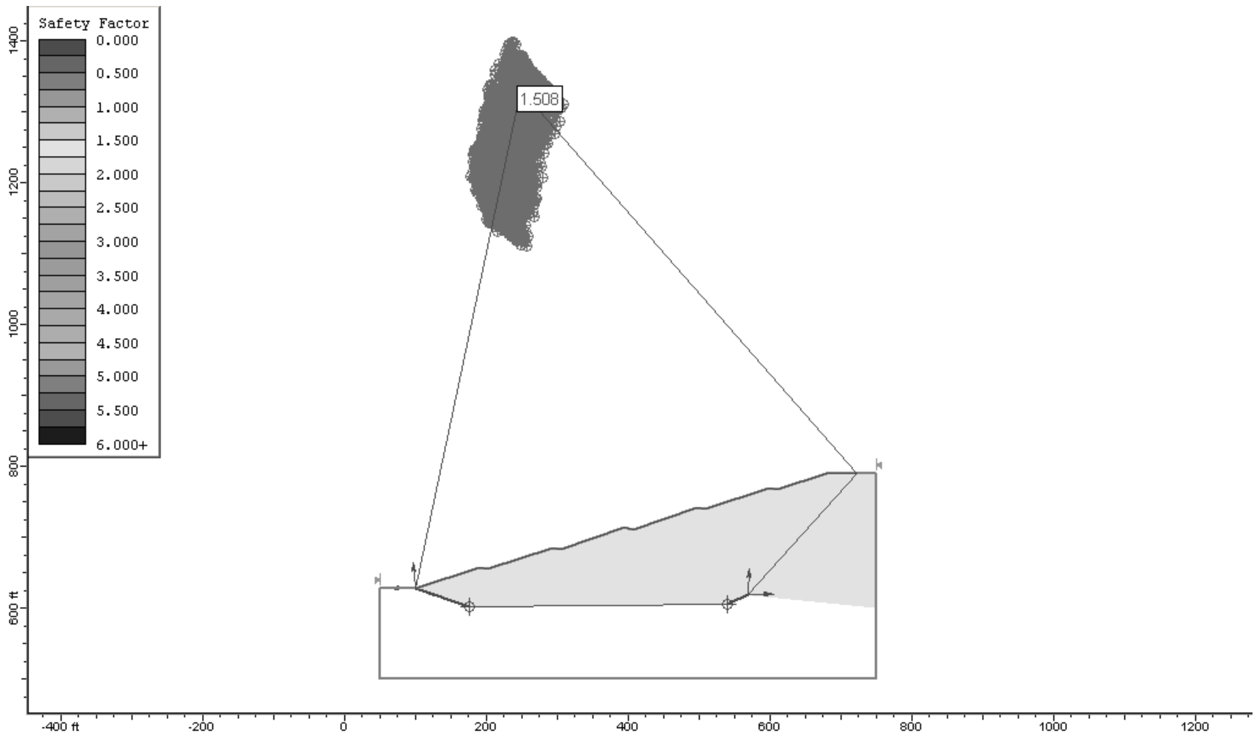
Global Minimums

Method: spencer
FS: 1.507900
Axis Location: 247.659, 1331.017
Left Slip Surface Endpoint: 99.401, 627.000
Right Slip Surface Endpoint: 721.918, 790.000
Resisting Moment=9.24537e+008 lb-ft
Driving Moment=6.13128e+008 lb-ft
Resisting Horizontal Force=1.08681e+006 lb
Driving Horizontal Force=720744 lb



Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY)	/11 /02 (MM)	/11 /24 (DD)

Client: WMTX Project: Mesquite Creek Landfill Project/Proposal No.: GT3435 Task No: 03



Section E-E'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 / 10 01 / 11 18 (YY/MM/DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 / 11 02 / 11 24 (YY/MM/DD)	
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03	

Slide Analysis Information

Document Name
File Name: Unit2Section2-FS=1.15

Project Settings

Project Title: Mesquite Creek LF - Final Landfill Slopes, Backcalculate Large-Displacement Floor Interface Friction Angle
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Spencer

Number of slices: 30
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 10000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 180
Right Projection Angle (Start Angle): 0
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Waste
Strength Type: Shear Normal function
Unit Weight: 80 lb/ft3
Water Surface: None

Material: Side Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 13 degrees
Water Surface: None

Material: Floor Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 6.8 degrees
Water Surface: None

Material: Strata III
Strength Type: Mohr-Coulomb
Unit Weight: 133 lb/ft3

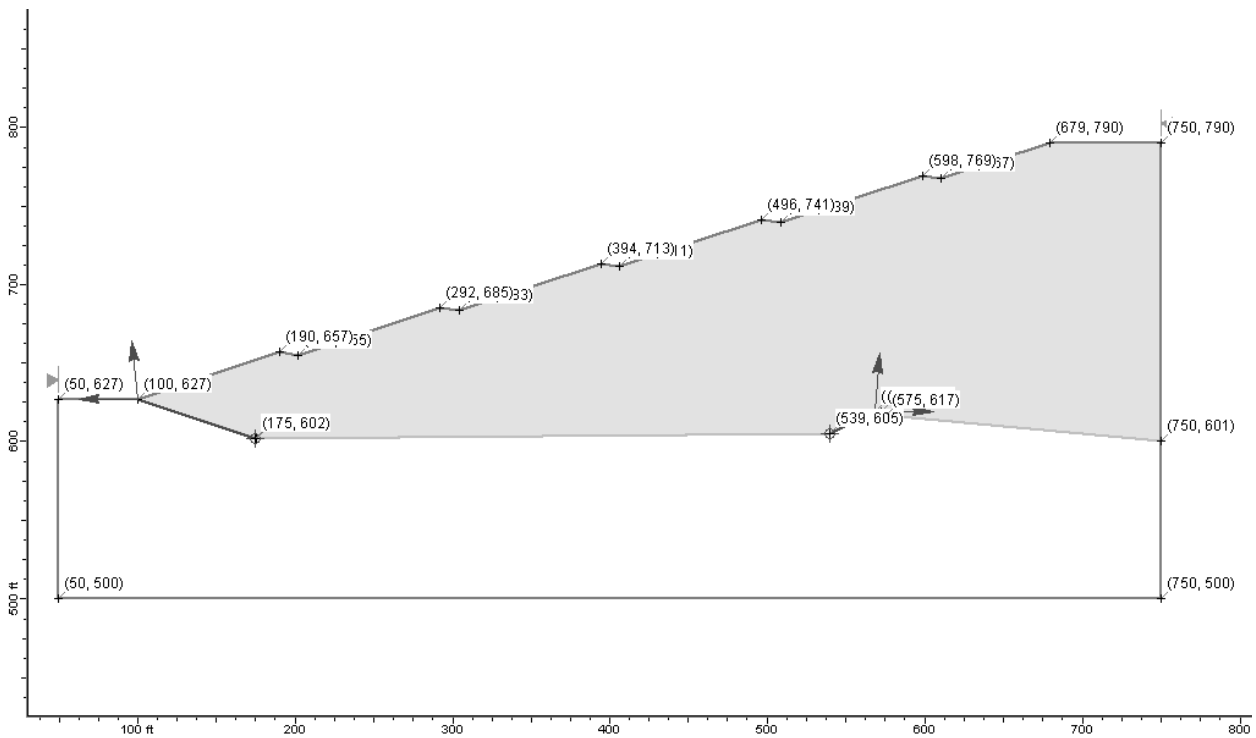
Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY)	/11 /02 (MM)	/11 /24 (DD)

Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

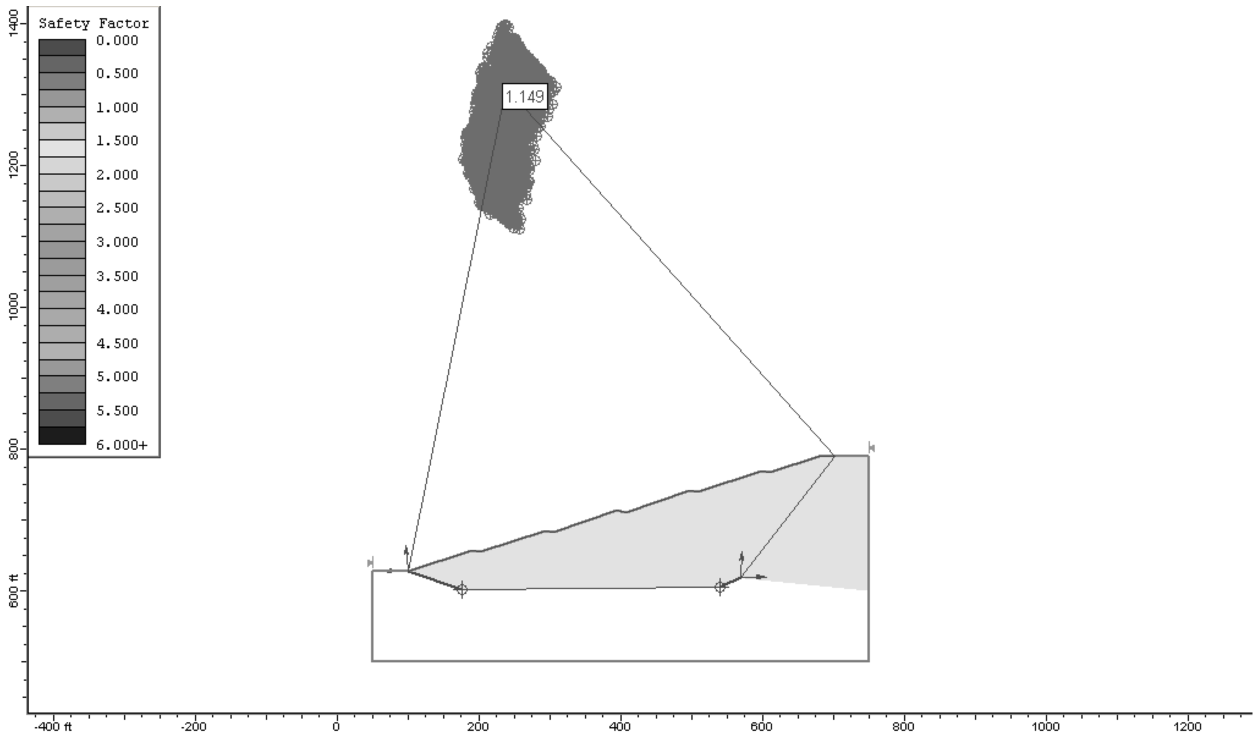
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

Global Minimums

Method: spencer
FS: 1.148580
Axis Location: 237.684, 1309.861
Left Slip Surface Endpoint: 100.003, 627.001
Right Slip Surface Endpoint: 701.364, 790.000
Resisting Moment=6.2624e+008 lb-ft
Driving Moment=5.45228e+008 lb-ft
Resisting Horizontal Force=717413 lb
Driving Horizontal Force=624607 lb



Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY)	/11 /02 (MM)	/11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill			Project/Proposal No.:	GT3435	Task No:	03		



Section E-E'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY) /11 /02 (MM) /11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill			Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name
File Name: Unit2 Final Grade - Circular

Project Settings
Project Title: Mesquite Creek LF- Final Grade, Circular Surface Through Waste, Liner, and Foundation
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Waste
Strength Type: Shear Normal function
Unit Weight: 80 lb/ft3
Water Surface: None

Material: Side Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 13 degrees
Water Surface: None

Material: Floor Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 12 degrees
Water Surface: None

Material: Strata I and II
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

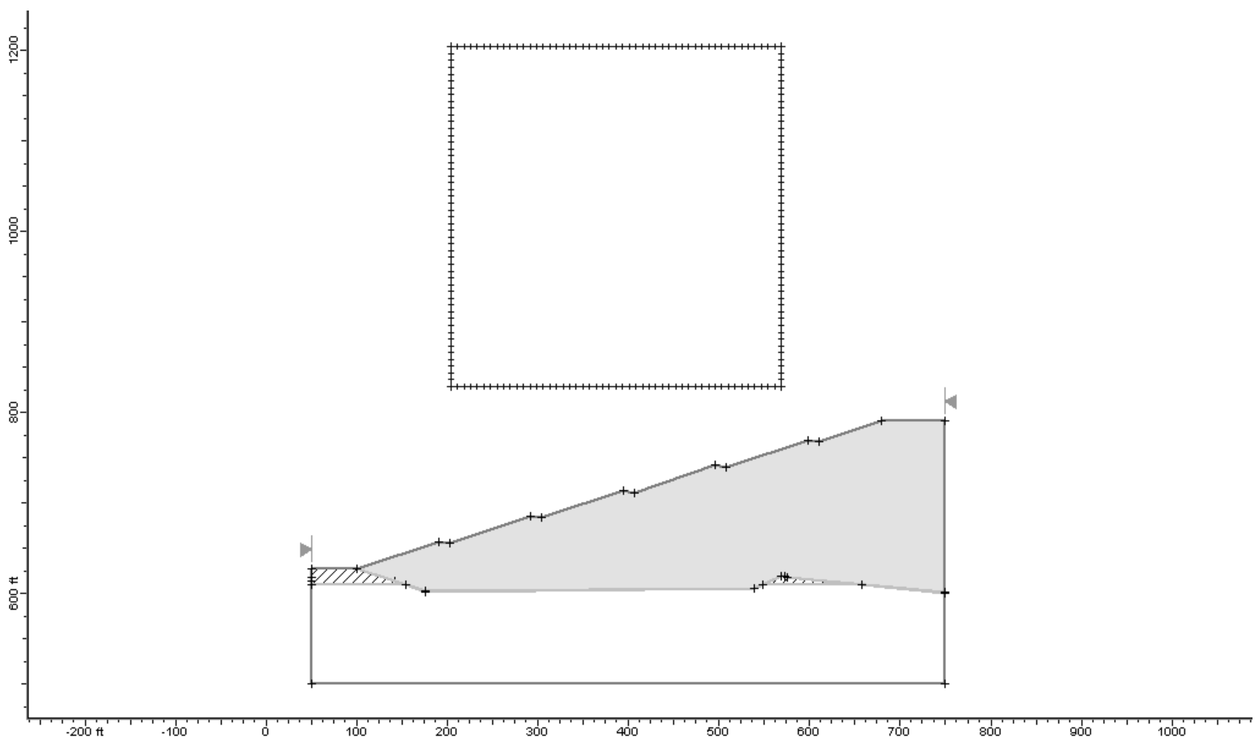
Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY)	/11 /02 (MM)	/11 /24 (DD)

Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

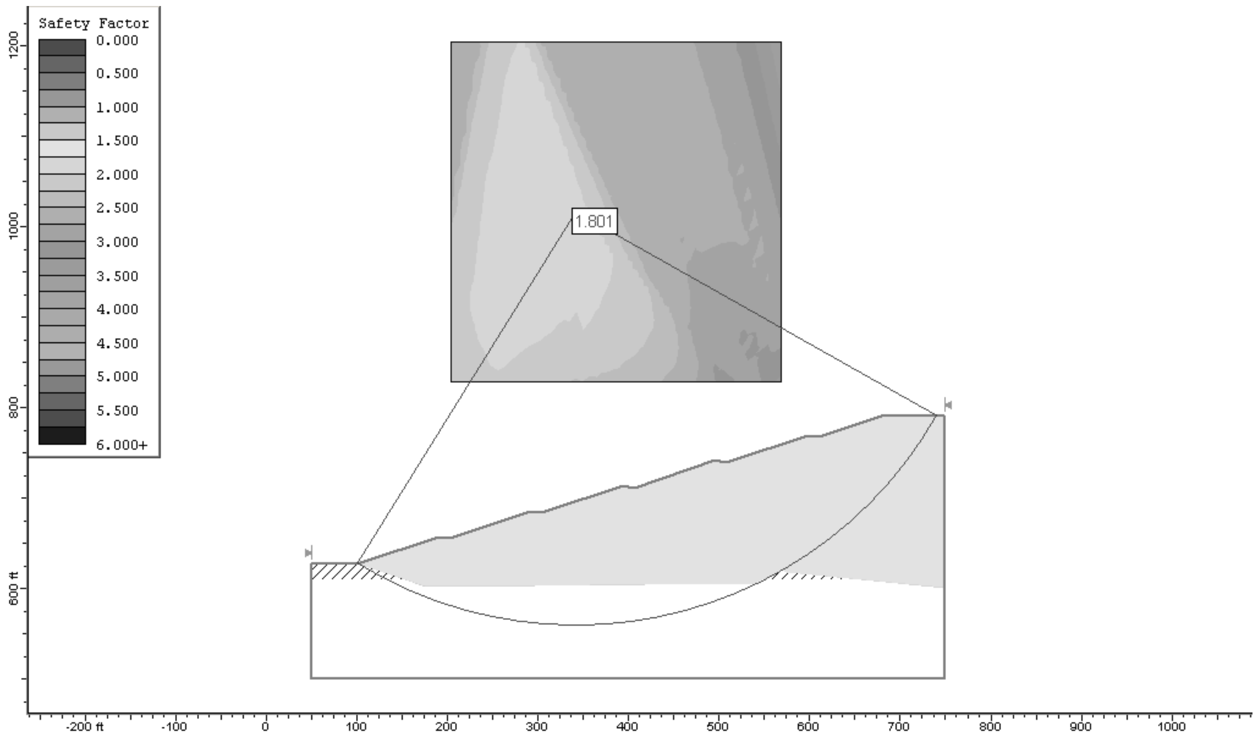
Material: Strata III
Strength Type: Mohr-Coulomb
Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.800960
Center: 342.230, 1015.539
Radius: 458.034
Left Slip Surface Endpoint: 99.674, 627.000
Right Slip Surface Endpoint: 740.888, 790.000
Resisting Moment=9.58383e+008 lb-ft
Driving Moment=5.32151e+008 lb-ft



Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03



Section E-E'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY)	/11 /02 (MM)	/11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill			Project/Proposal No.:	GT3435	Task No:	03		

Slide Analysis Information

Document Name
File Name: Unit2 Final Grade - Block

Project Settings
Project Title: Mesquite Creek LF - Final Landfill Slopes, Block Sliding Through Waste, Liner, and Foundation Soils
Failure Direction: Right to Left
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Spencer

Number of slices: 30
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Block Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Left Projection Angle (Start Angle): 95
Left Projection Angle (End Angle): 180
Right Projection Angle (Start Angle): 0
Right Projection Angle (End Angle): 85
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Waste
Strength Type: Shear Normal function
Unit Weight: 80 lb/ft3
Water Surface: None

Material: Side Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 13 degrees
Water Surface: None

Material: Floor Liner
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 0 psf
Friction Angle: 12 degrees
Water Surface: None

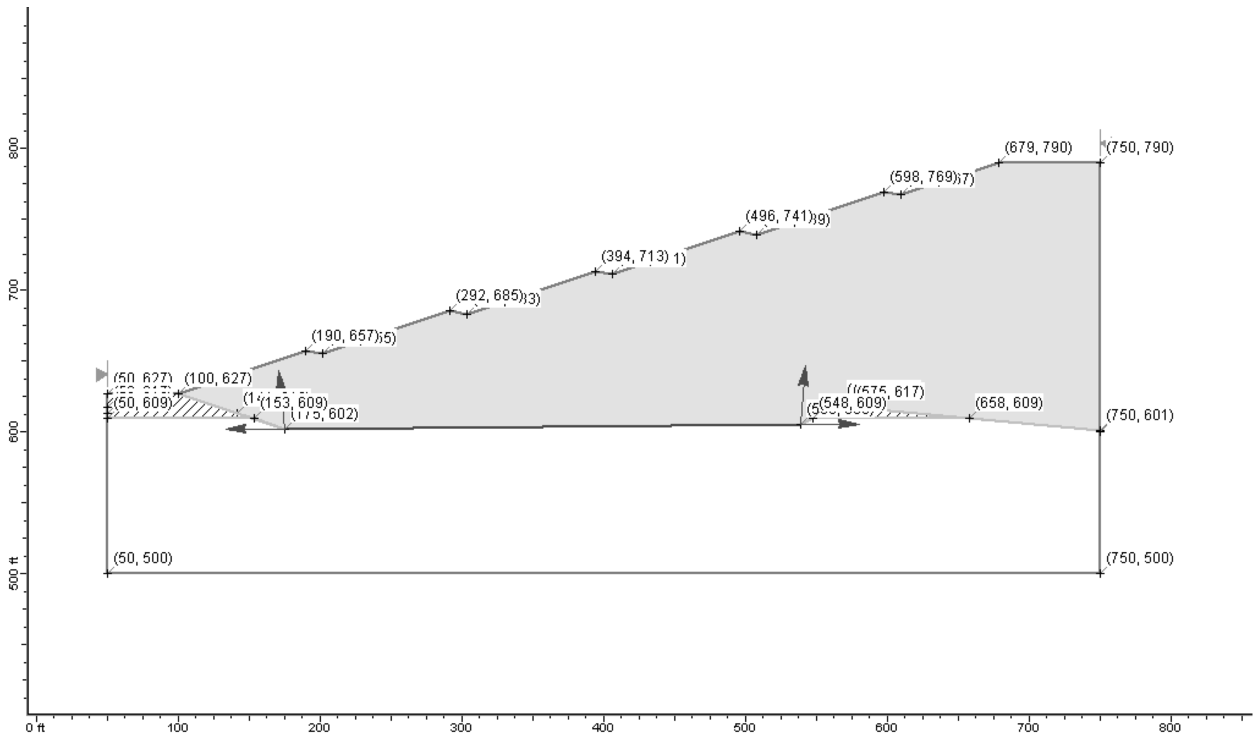
Material: Strata I and II
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3

Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

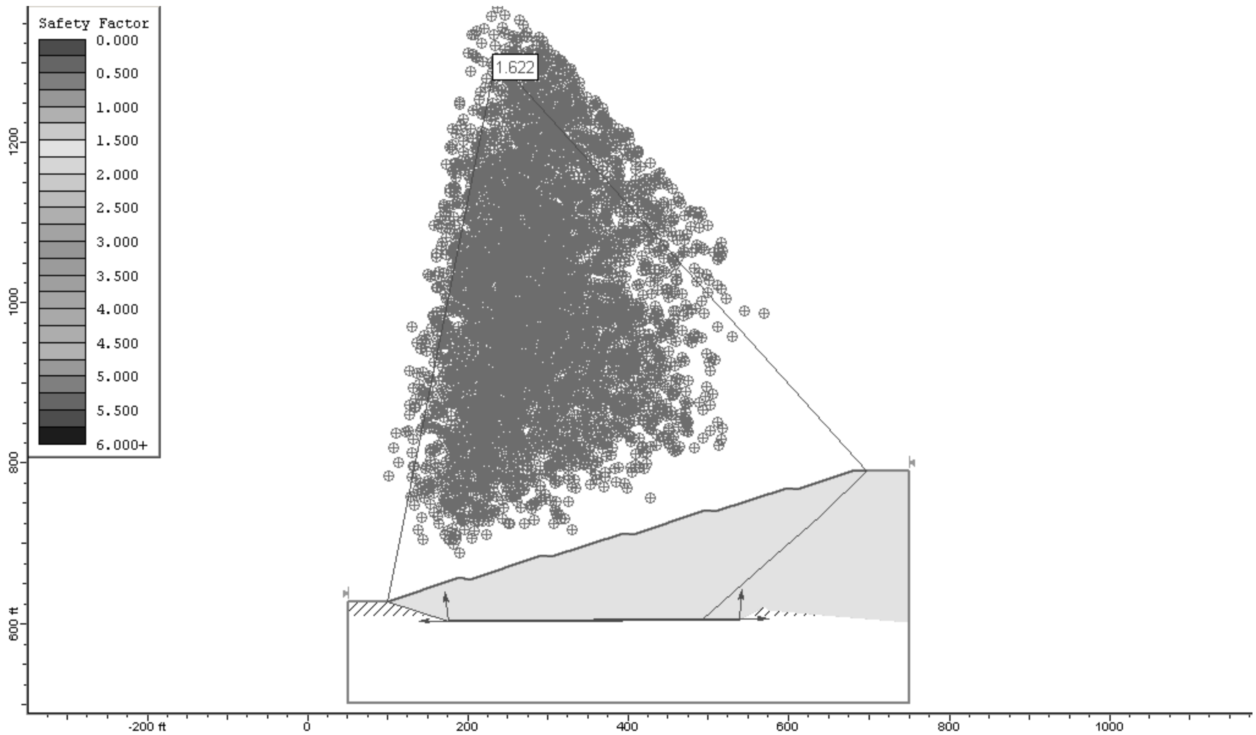
<u>Material: Strata III/IV</u>
Strength Type: Mohr-Coulomb
Unit Weight: 133 lb/ft3
Cohesion: 0 psf
Friction Angle: 14 degrees
Water Surface: None

<u>Global Minimums</u>

<u>Method: spencer</u>
FS: 1.622100
Axis Location: 234.900, 1305.510
Left Slip Surface Endpoint: 99.395, 627.000
Right Slip Surface Endpoint: 696.405, 790.000
Resisting Moment=8.53847e+008 lb-ft
Driving Moment=5.26382e+008 lb-ft
Resisting Horizontal Force=1.05058e+006 lb
Driving Horizontal Force=647665 lb



Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 /10 /11 21 /01 /18 YY MM DD	Reviewed by:	B. Gross/ S. Graves	Date:	05 /11 /11 21 /02 /24 YY MM DD
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03



Section E-E'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 /10 /01 /11 /18 (YY MM DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 /11 /02 /11 /24 (YY MM DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Slide Analysis Information

Document Name
File Name: Unit 2 Phase VI Final Landfill Slopes side LD floor Peak.slmd

Project Settings
Project Title: Mesquite Creek Landfill Unit 2 Phase VI – Final Landfill Slopes

Units of Measurement:	Imperial Units
Failure Direction:	Right to Left

Analysis Methods

Number of slices:	100
Tolerance:	0.005
Maximum number of iterations:	75
Steffensen Iteration:	Yes

Surface Options

Surface Type:	Circular
Search Method:	Grid Search
Radius Increment:	10
Reverse Curvature:	Invalid Surfaces

Material Properties

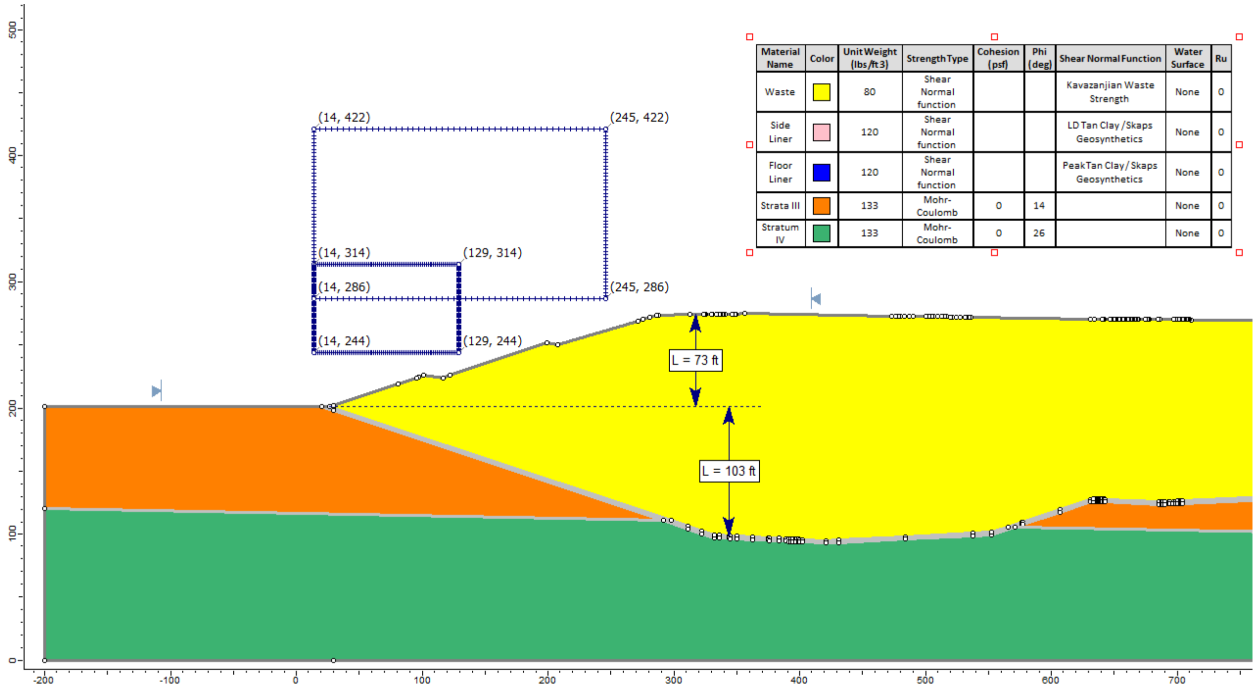
<u>Waste</u>	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	80
<u>Side Liner</u>	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	120
<u>Floor Liner</u>	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	120
<u>Strata III</u>	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	133
Cohesion [psf]	0
Friction Angle [deg]	14
<u>Strata IV</u>	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	133
Cohesion [psf]	0
Friction Angle [deg]	26

Global Minimums

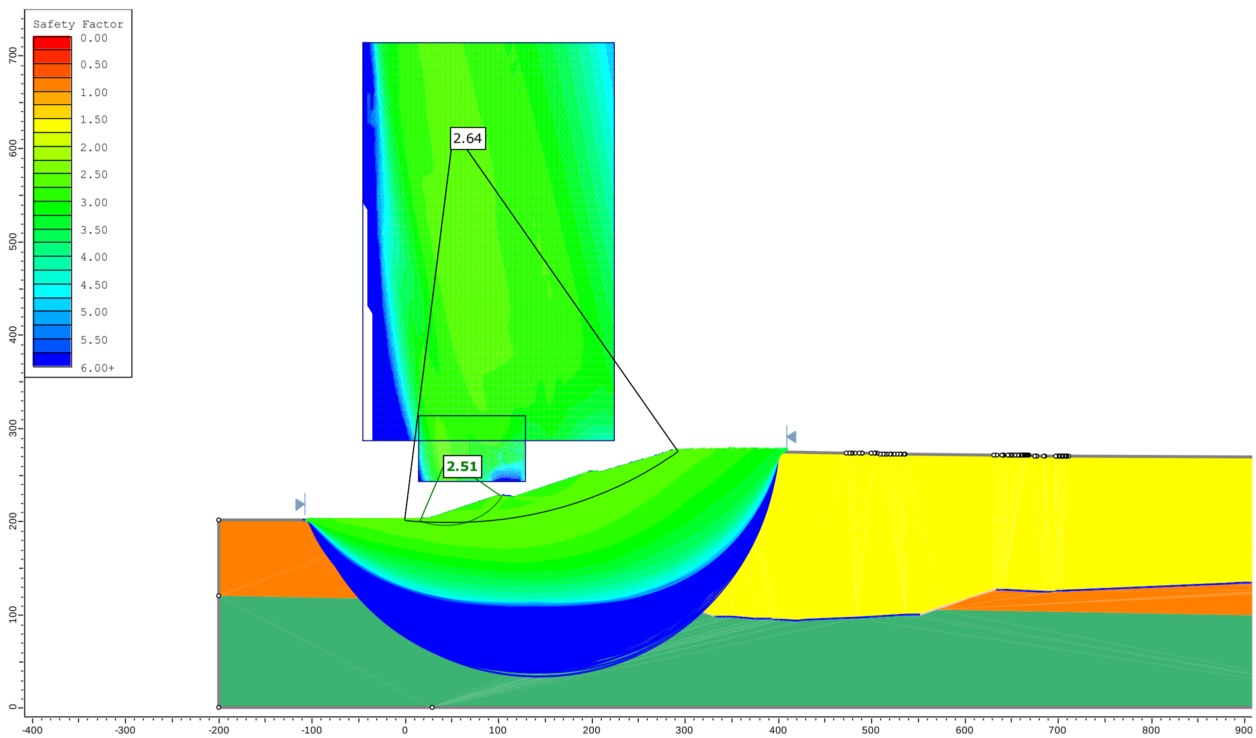
Method:	spencer
FS	2.512360
Center:	44.788, 267.885
Radius:	72.675
Left Slip Surface Endpoint:	16.234, 201.055
Right Slip Surface Endpoint:	103.830, 225.509
Resisting Moment:	3.5533e+06 lb-ft
Driving Moment:	1.41433e+06 lb-ft
Resisting Horizontal Force:	43484.6 lb
Driving Horizontal Force:	17308.3 lb
Total Slice Area:	929.23 ft2
Surface Horizontal Width:	87.5957 ft
Surface Average Height:	10.6082 ft

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY)	/10 /01 (MM)	/11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY)	/11 /02 (MM)	/11 /24 (DD)

Client: WMTX Project: Mesquite Creek Landfill Project/Proposal No.: GT3435 Task No: 03



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		80	Shear Normal function			Kavazanjian Waste Strength	None	0
Side Liner		120	Shear Normal function			LD Tan Clay / Skaps Geosynthetics	None	0
Floor Liner		120	Shear Normal function			Peak Tan Clay / Skaps Geosynthetics	None	0
Strata III		133	Mohr-Coulomb	0	14		None	0
Stratum IV		133	Mohr-Coulomb	0	26		None	0



Section F-F'

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY) /10 /01 (MM) /11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY) /11 /02 (MM) /11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03

Document Name
File Name: Unit 2 Phase VI Final Landfill Slopes side LD floor Peak.slmd

Project Settings
Project Title: Mesquite Creek Landfill Unit 2 Phase VI – Final Landfill Slopes

Units of Measurement:	Imperial Units
Failure Direction:	Right to Left

Analysis Methods

Number of slices:	100
Tolerance:	0.005
Maximum number of iterations:	75
Steffensen Iteration:	Yes

Surface Options

Surface Type:	Non-Circular Block Search
Number of Surfaces:	5000
Radius Increment:	10
Reverse Curvature:	Invalid Surfaces

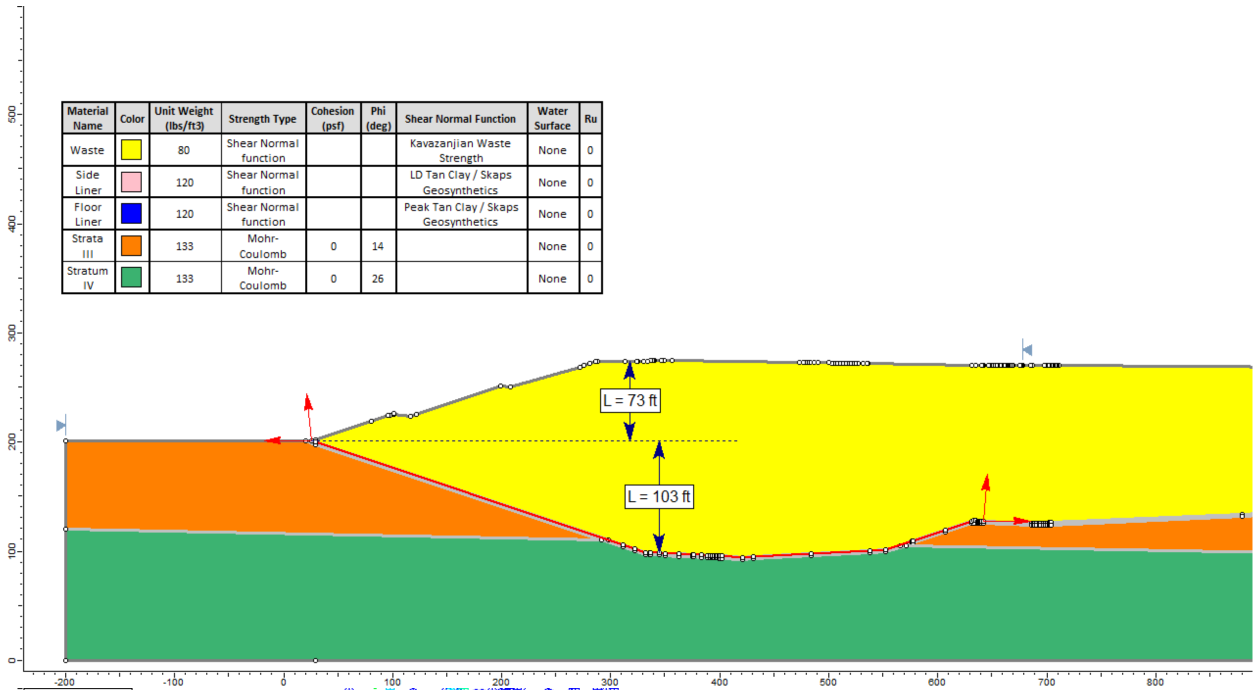
Material Properties

Waste	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	80
Side Liner	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	120
Floor Liner	
Strength Type	Shear Normal function
Unit Weight [lbs/ft3]	120
Strata III	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	133
Cohesion [psf]	0
Friction Angle [deg]	14
Strata IV	
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	133
Cohesion [psf]	0
Friction Angle [deg]	26

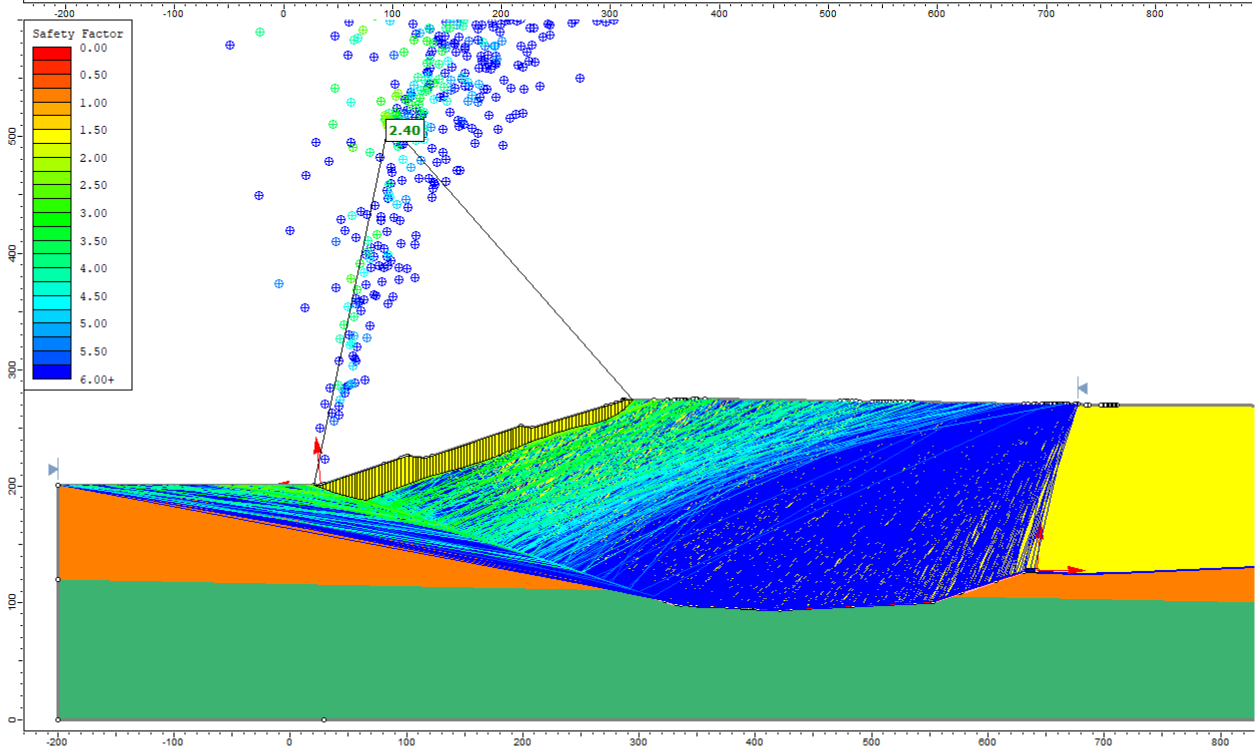
Global Minimums

Method:	spencer
FS	2.400240
Axis Location:	84.580, 512.374
Left Slip Surface Endpoint:	19.895, 201.055
Right Slip Surface Endpoint:	294.824, 273.835
Resisting Moment:	6.07533e+07 lb-ft
Driving Moment:	2.53113e+07 lb-ft
Resisting Horizontal Force:	188963 lb
Driving Horizontal Force:	78726.8 lb
Total Slice Area:	4281.33 ft2
Surface Horizontal Width:	274.929 ft
Surface Average Height:	15.5725 ft

Written by:	R. EL-Sherbiny/ L. Peve	Date:	05 21 (YY) /10 /01 (MM) /11 /18 (DD)	Reviewed by:	B. Gross/ S. Graves	Date:	05 21 (YY) /11 /02 (MM) /11 /24 (DD)
Client:	WMTX	Project:	Mesquite Creek Landfill	Project/Proposal No.:	GT3435	Task No:	03



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Shear Normal Function	Water Surface	Ru
Waste		80	Shear Normal function			Kavazanjian Waste Strength	None	0
Side Liner		120	Shear Normal function			LD Tan Clay / Skaps Geosynthetics	None	0
Floor Liner		120	Shear Normal function			Peak Tan Clay / Skaps Geosynthetics	None	0
Strata III		133	Mohr-Coulomb	0	14		None	0
Stratum IV		133	Mohr-Coulomb	0	26		None	0



Section F-F'