HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS
TCEQ PERMIT NO. MSW-2214B

MAJOR PERMIT AMENDMENT APPLICATION

VOLUME 1 OF 3

Prepared for

BFI Waste Systems of North America, LLC

March 2017

Revised August 2017

Revised December 2017

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

12-29-2017

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0120-758-11-01

This document is intended for permitting purposes only.

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS
TCEQ PERMIT NO. MSW-2214B

MAJOR PERMIT AMENDMENT APPLICATION

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12-29-2017

Facility Name: Hardin County Landfill
Permittee/Registrant Name: BFI Waste Systems of North America, LLC
MSW Authorization #: 2214B
Initial Submittal Date: 04/06/2017
Revision Date: 12/29/2017

Texas Commission on Environmental Quality

Part I Form

New Permit/Registration and Amendment Applications for an MSW Facility

1. Reason for Submittal

☐ Initial Submittal ☒ Notice of Deficiency (NOD) Response

2. Authorization Type

☒ Permit ☐ Registration

3. Application Type

☐ New ☒ Major Amendment

☐ Major Amendment (Limited Scope)

4. Application Fees

☐ Pay by Check ☒ Online Payment

If paid online, e-Pay Confirmation Number: **582EA000255610**

5. Application URL

Is the application submitted for Type I Arid Exempt (AE) and/or Type IV AE facility?

☐ Yes ☒ No

If the answer is "No", provide the URL address of a publicly accessible internet web site where the application and all revisions to that application will be posted.
http://**www.ftwweaverboos.com/DP/Hardin/MPA_index.html**

6. Application Publishing

Party Responsible for Publishing Notice:

☐ Applicant ☐ Agent in Service ☒ Consultant

7. Alternative Language Notice

Is an alternative language notice required for this application? (For determination refer to Alternative Language Checklist on the Public Notice Verification Form TCEQ-20244-Waste)

☐ Yes ☒ No

8. Public Place Location of Application

Name of the Public Place: **Kountze Public Library**

Physical Address: **800 Redwood Ave.**

City: **Kountze** County: **Hardin** State: **TX** Zip Code: **77625**

(Area code) Telephone Number: **(409) 246-2826**

9. Consolidated Permit Processing

Is this submittal part of a consolidated permit processing request, in accordance with 30 TAC Chapter 33?

☐ Yes ☐ No ☒ Not Applicable

If "Yes", state the other TCEQ program authorizations requested:

10. Confidential Documents

Does the application contain confidential documents?

☐ Yes ☒ No

If "Yes", cross-reference the confidential documents throughout the application and submit as a separate attachment in a binder clearly marked "CONFIDENTIAL."

11. Permits and/or Construction Approvals

Select all that apply	Received	Pending	Not Applicable
Hazardous Waste Management Program under the Texas Solid Waste Disposal Act	☐	☐	☒
Underground Injection Control Program under the Texas Injection Well Act	☐	☐	☒
National Pollutant Discharge Elimination System Program under the Clean Water Act and Waste Discharge Program under Texas Water Code, Chapter 26	☒	☐	☐
Prevention of Significant Deterioration Program under the Federal Clean Air Act (FCAA). Nonattainment Program under the FCAA	☐	☐	☒
National Emission Standards for Hazardous Air Pollutants Preconstruction Approval under the FCAA	☐	☐	☒

Select all that apply	Received	Pending	Not Applicable
Ocean Dumping Permits under the Marine Protection Research and Sanctuaries Act	☐	☐	☒
Dredge or Fill Permits under the CWA	☐	☐	☒
Licenses under the Texas Radiation Control Act	☐	☐	☒
Other Environmental Permits			
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐

12. General Facility Information

Facility Name: **Hardin County Landfill**

MSW Authorization No. (if available): **2214B**

Regulated Entity Reference No. (if issued)*: RN**103759643**

Physical or Street Address (if available): **2525 FM 770 Rd**

City: **Kountze** County: **Hardin** State: **TX** Zip Code: **77625**

(Area Code) Telephone Number: **(409) 246-4022**

Latitude (Degrees, Minutes Seconds): **30° 20′ 28.6″**

Longitude (Degrees, Minutes Seconds): **94° 21′ 16.1″**

Benchmark Elevation (above mean sea level): **76.55** ft.

Provide a description of the location of the facility with respect to known or easily identifiable landmarks: **The Hardin County Landfill is located approximately 3 miles southwest of the City of Kountze, Texas, on the south side of Farm to Market Road 770 (2525 FM 770), approximately ½ mile west of the intersection of FM 770 and State Highway 326.**

Detail access routes from the nearest United States or state highway to the facility: **The site is located approximately ½ mile west of the intersection of FM 770 and State Highway (SH) 326. Vehicles traveling either south or north direction on SH 326 take FM 770 west to access the site.**

*If this number has not been issued for the facility, complete a TCEQ Core Data Form (TCEQ-10400) and submit it with this application. List the Facility as the Regulated Entity.

13. Facility Type(s)

☒ Type I ☒ Type IV ☐ Type V

☐ Type I AE ☐ Type IV AE ☐ Type VI

14. Activities Conducted at the Facility

☒ Storage ☒ Processing ☒ Disposal

15. Facility Waste Management Unit(s)

☒ Landfill Unit(s)	☐ Incinerator(s)
☐ Class 1 Landfill Unit(s)	☐ Autoclave(s)
☐ Process Tank(s)	☐ Refrigeration Unit(s)
☒ Storage Tank(s)	☐ Mobile Processing Unit(s)
☐ Tipping Floor	☐ Type VI Demonstration Unit
☐ Storage Area	☐ Compost Pile(s) and/or Vessel(s)
☐ Container(s)	☐ Other (Specify)
☒ Roll-off Boxes	☐ Other (Specify)
☐ Surface Impoundment	☐ Other (Specify)

16. Description of the Revisions to the Facility

Skip this box, if "New" is selected under "Application Type".

Provide a brief description of all revisions to the permit conditions and supporting documents referenced by the permit. Also, provide an explanation of why the amendment is requested. **This major amendment will increase the disposal capacity of the Hardin County Landfill, thereby increasing available solid waste disposal capacity to Hardin and surrounding counties.**

17. Facility Contact Information

Site Operator (Permittee/Registrant) Name: BFI Waste Systems of North America, LLC / Ruby Teague, Environmental Manager

Customer Reference No. (if issued)*: CN**603851882**

Mailing Address: **2525 FM 770**

City: **Kountze** County: **Hardin** State: **TX** Zip Code: **77625**

(Area Code) Telephone Number: **(713) 676-7644**

Email Address: **rteague@republicservices.com**

TX Secretary of State (SOS) Filing Number: **800919279**

*If the Site Operator (Permittee/Registrant) does not have this number, complete a TCEQ Core Data Form (TCEQ-10400) and submit it with this application. List the Site Operator (Permittee/Registrant) as the Customer.

Operator Name[1]: Same as "Site Operator (Permittee)"

Customer Reference No. (if issued)*:

Mailing Address:

City: County: State: Zip Code:

(Area Code) Telephone Number:

Email Address:

TX SOS Filing Number:

[1]If the Operator is the same as Site Operator/Permittee type "Same as "Site Operator (Permittee/Registrant)".
*If the Operator does not have this number, complete a TCEQ Core Data Form (TCEQ-10400) and submit it with this application. List the Operator as the customer.

Consultant Name (if applicable): Weaver Consultants Group, LLC
Nevzat Turan, P.E., Consultant

Texas Board of Professional Engineers Firm Registration Number: **F-3727**

Mailing Address: **6420 Southwest Boulevard, Suite 206**

City: **Fort Worth** County: **Tarrant** State: **TX** Zip Code: **76109**

(Area Code) Telephone Number: **(817) 735-9770**

Mailing Address: nturan@wcgrp.com

Agent in Service Name (required only for out-of-state):

Mailing Address:

City: County: State: Zip Code:

(Area Code) Telephone Number:

E-Mail Address:

18. Facility Supervisor's License

Select the Type of License that the Solid Waste Facility Supervisor, as defined in 30 TAC Chapter 30, Occupational Licenses and Registrations, will obtain prior to commencing facility operations.

☒ Class A ☐ Class B

19. Ownership Status of the Facility

☒ Corporation	☐ Limited Partnership	☐ Federal Government
☐ Individual	☐ City Government	☐ Other Government
☐ Sole Proprietorship	☐ County Government	☐ Military
☐ General Partnership	☐ State Government	☐ Other (Specify):

Does the Site Operator (Permittee/Registrant) own all the facility units and all the facility property?

☒ Yes ☐ No

If "No", provide the information requested below for any additional ownership.

Owner Name:

Street or P.O. Box:

City: County: State: Zip Code:

(Area Code) Telephone Number:

Email Address (optional):

20. Other Governmental Entities Information

Texas Department of Transportation District: Beaumont

District Engineer's Name: **Tucker Ferguson, P.E.**

Street Address or P.O. Box: **8350 Eastex Freeway**

City: **Beaumont** County: **Jefferson** State: **TX** Zip Code: **77708**

(Area Code) Telephone Number: **(409) 898-5731**

E-Mail Address (optional):

The Local Governmental Authority Responsible for Road Maintenance (if applicable): Texas Department of Transportation

Contact Person's Name: **Steven Singleton**

Street Address or P.O. Box: **1942 US 69 N.**

City: **Kountze** County: **Hardin** State: **TX** Zip Code: **77625**

(Area Code) Telephone Number: **(409) 246-2300**

E-Mail Address (optional):

City Mayor Information

City Mayor's Name: **Fred E. Williams**

Office Address: **1025 N Pine St.**

City: **Kountze** County: **Hardin** State: **TX** Zip Code: **77625**

(Area Code) Telephone Number: **(409) 246-2430**

E-Mail Address (optional):

City Health Authority: Hardin County Health Department

Contact Person's Name: **Jana M. Winberg, MD**

Street Address or P.O. Box: **440 W. Monroe St.**

City: **Kountze** County: **Hardin** State: **TX** Zip Code: **77625**

(Area Code) Telephone Number: **(409) 246-5188**

E-Mail Address (optional):

County Judge Information

County Judge's Name: **Wayne McDaniel**

Street Address or P.O. Box: **300 W. Monroe Street**

City: **Kountze** County: **Hardin** State: **Texas** Zip Code: **77625**

(Area Code) Telephone Number: **(409) 246-5120**

E-Mail Address (optional):

County Health Authority: Hardin County Health Department

Contact Person's Name: **Jana M. Winberg, MD**

Street Address or P.O. Box: **440 W. Monroe St.**

City: **Kountze** County: **Hardin** State: **TX** Zip Code: **77625**

(Area Code) Telephone Number: **(409) 246-5188**

E-Mail Address (optional):

State Representative Information

District Number: **19**

State Representative's Name: **James White**

District Office Address: **P.O. Box 395**

City: **Woodville** County: **Tyler** State: **TX** Zip Code: **75979**

(Area Code) Telephone Number: **(409) 283-3700**

E-Mail Address (optional):

State Senator Information

District Number: **3**

State Senator's Name: **Robert Nichols**

District Office Address: **329 Neches Street**

City: **Jacksonville** County: **Cherokee** State: **TX** Zip Code: **75966**

(Area Code) Telephone Number: **(903) 589-3003**

E-Mail Address (optional):

Council of Government (COG) Name: South East Texas Regional Planning Commission

COG Representative's Name: **Shaun P. Davis**

COG Representative's Title: **Executive Director**

Street Address or P.O. Box: **2210 Eastex Freeway**

City: **Beaumont** County: **Jasper** State: **TX** Zip Code: **77703**

(Area Code) Telephone Number: **(409) 899-8444**

E-Mail Address (optional):

River Basin Authority Name: Lower Neches Valley Authority

Contact Person's Name: **Scott Hall, P.E.**

Watershed Sub-Basin Name: **Village Watershed**

Street Address or P.O. Box: **7850 Eastex Freeway**

City: **Beaumont** County: **Jasper** State: **Texas** Zip Code: **77708**

(Area Code) Telephone Number: **(409) 892-4011**

E-Mail Address (optional):

Coastal Management Program

Is the facility within the Coastal Management Program boundary?

☐ Yes ☒ No

U.S. Army Corps of Engineers

The facility is located in the following District of the U.S. Army Corps of Engineers:

☐ Albuquerque, NM ☐ Galveston, TX

☒ Ft. Worth, TX ☐ Tulsa, OK

Local Government Jurisdiction

Within City Limits of: **Kountze, Texas**

Within Extraterritorial Jurisdiction of: **Hardin County, Texas**

Is the facility located in an area in which the governing body of the municipality or county has prohibited the storage, processing or disposal of municipal or industrial solid waste?

☐ Yes ☒ No

(If "Yes", provide a copy of the ordinance or order as an attachment):

Signature Page

I, Ruby Teague Environmental Manager,
(Site Operator (Permittee/Registrant)'s Authorized Signatory) (Title)

certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: Ruby Teague Date: 1/9/2018

TO BE COMPLETED BY THE OPERATOR IF THE APPLICATION IS SIGNED BY AN AUTHORIZED REPRESENTATIVE FOR THE OPERATOR

I, ____________________, hereby designate ________________________
(Print or Type Operator Name) (Print or Type Representative Name)

as my representative and hereby authorize said representative to sign any application, submit additional information as may be requested by the Commission; and/or appear for me at any hearing or before the Texas Commission on Environmental Quality in conjunction with this request for a Texas Water Code or Texas Solid Waste Disposal Act permit. I further understand that I am responsible for the contents of this application, for oral statements given by my authorized representative in support of the application, and for compliance with the terms and conditions of any permit which might be issued based upon this application.

____
Printed or Typed Name of Operator or Principal Executive Officer

____
Signature

SUBSCRIBED AND SWORN to before me by the said Ruby Teague
On this 9th day of January, 2018
My commission expires on the 21st day of January, 2019

Mary Ann McGuire
Notary Public in and for
Harris County, Texas
(Note: Application Must Bear Signature & Seal of Notary Public)

NOTARY PUBLIC STATE OF TEXAS
MARY ANN MCGUIRE
My Commission Expires
January 21, 2019

Part I Attachments

(See Instructions for P.E. seal requirements.)

Required Attachments	**Attachment No.**
Supplementary Technical Report	**Vol. 1, Parts I/II**
Property Legal Description	**Vol. 1, Parts I/II**
Property Metes and Bounds Description	**Vol. 1, Parts I/II**
Facility Legal Description	**Vol. 1, Parts I/II**
Facility Metes and Bounds Description	**Vol. 1, Parts I/II**
Metes and Bounds Drawings	**Vol. 1, Parts I/II**
On-Site Easements Drawing	**Vol. 1, Parts I/II**
Land Ownership Map	**Vol. 1, Parts I/II**
Land Ownership List	**Vol. 1, Parts I/II**
Electronic List or Mailing Labels	**Included with Application**
Texas Department of Transportation (TxDOT) County Map	**Vol. 1, Parts I/II**
General Location Map	**Vol. 1, Parts I/II**
General Topographic Map	**Vol. 1, Parts I/II**
Verification of Legal Status	**Vol. 1, Parts I/II**
Property Owner Affidavit	**Vol. 1, Parts I/II**
Evidence of Competency	**Vol. 1, Parts I/II**

Additional Attachments as Applicable- Select all those apply and add as necessary

- ☒ TCEQ Core Data Form(s)
- ☒ Signatory Authority Delegation
- ☒ Fee Payment Receipt
- ☐ Confidential Documents
- ☐ Waste Storage, Processing and Disposal Ordinances
- ☐ Final Plat Record of Property
- ☒ Certificate of Fact (Certificate of Incorporation)
- ☐ Assumed Name Certificate

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS
TCEQ PERMIT NO. MSW-2214B

MAJOR PERMIT AMENDMENT APPLICATION

PARTS I/II
GENERAL APPLICATION REQUIREMENTS

Prepared for

BFI Waste Systems of North America, LLC.

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LIST OF DRAWINGS

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LIST OF ACRONYMS

BMPs – best management practices

CFR – Code of Federal Regulations

CLOMR –Conditional Letter of Map Revision

EPA – U.S. Environmental Protection Agency

ETJ – extra territorial jurisdiction

FAA – Federal Aviation Administration

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

ft-msl – feet above mean sea level

FWS – U.S. Fish and Wildlife Service

GCCS – Gas Collection and Control System

GLER – Geomembrane Liner Evaluation Report

GWSAP – groundwater sampling and analysis plan

LCS – leachate collection system

LFG – landfill gas

LLDPE – Low Linear Density Polyethylene

MSW – municipal solid waste

NAAQS – National Ambient Air Quality Standards

NFIP – National Flood Insurance Program

NOI – Notice of Intent

NSPS – New Source Performance Standards

NWP – Nationwide Permit

PCBs – polychlorinated biphenyls

PI – Point of Intersection

POTW – publicly owned treatment works

PVI – Point of Vertical Intersection

QA-QC – quality assurance-quality control

RCRA – Resource Conservation Recovery Act

SDP – site development plan

SETRPC – South East Texas Regional Planning Commission

SLER – soils and liner evaluation report

SOP – site operating plan

TAC – Texas Administrative Code

TCEQ – Texas Commission on Environmental Quality

TDH – Texas Department of Health

THC – Texas Historical Commission

TNRCC – Texas Natural Resource Conservation Commission

TPDES – Texas Pollutant Discharge Elimination System

TPWD –Texas Parks and Wildlife Department

TWC – Texas Water Commission

TWDB – Texas Water Development Board

TxDOT – Texas Department of Transportation

LIST OF ACRONYMS (Continued)

USACE – U.S. Army Corps of Engineers

USGS – U.S. Geological Survey

WCG – Weaver Consultants Group, LLC

1 INTRODUCTION

This section addresses §330.59, §330.61, and §305.45.

Parts I/II of this permit amendment application for the Hardin County Landfill (landfill) has been prepared consistent with the State of Texas requirements set forth in Title 30 Texas Administrative Code (30 TAC) §330.59 and §330.61. Part II has been combined with Part I in accordance with 30 TAC §330.57(c)(2). Section 2, Supplementary Technical Report, presents an overview of the project and a detailed facility description as well as the types of waste that will be accepted at the facility. The remaining portions of Parts I/II present information on specific existing conditions on and around the site and regulatory matters related to the application process.

2 SUPPLEMENTARY TECHNICAL REPORT

2.1 Facility Location and Project Overview

This section addresses §305.45(a)(7), §305.45(a)(8), §330.57(i), §330.59(b), §330.61(b), §330.61(l), §330.61(o), and §330.61(p).

The landfill is an existing 79-acre Type I/IV municipal solid waste management facility (TCEQ Permit No. MSW-2214A) in Hardin County, Texas. The landfill is located approximately 3 miles southwest of the City of Kountze, Texas, on the south side of Farm to Market Road 770 (2525 FM 770), approximately ½ mile west of the intersection of FM 770 and State Highway 326. The site was originally permitted as a 79-acre solid waste landfill under Texas Department of Health (TDH) Permit No. MSW-2214, which was issued in July 1995. The permit was amended by the TCEQ in January 2001 (Permit No. MSW-2214A) to allow the facility to take additional waste streams.

The purpose of this Major Permit Amendment is to expand the Type I MSW volumetric waste disposal capacity of the existing landfill by deepening and vertically increasing the existing waste disposal footprint. The currently permitted 79.0-acre permit boundary, including the 49.6-acre Type I waste disposal footprint and 2.4-acre Type IV waste disposal footprint, will remain unchanged for this permit amendment. This landfill expansion will provide for the long-term disposal needs of Hardin County and surrounding communities. Approximately 1.4 acres of the 2.4-acre Type IV C&D landfill have been developed. Approximately 32 acres of the 49.6-acre Type I landfill have been constructed. Approximately 16.7 acres of the remaining 17.6 acres (Cells 7 and 8) at the Type I landfill will be deepened to a depth not exceeding the previously established Elevation of Deepest Excavation (EDE) of 45.23 feet msl, and the entire Type I MSW landfill will be vertically expanded from the permit MSW-2214A final grades. The landfill will not be deepened or vertically increased within 125' of any properties not owned by BFI (buffer zone). The maximum permitted final cover elevation will be increased from 115 ft-msl to 234 ft-msl. The resulting capacity will increase from the previously permitted 2.11 million cubic yards to 5.74 million cubic yards for this permit amendment, for a net gain in Type I disposal capacity of 3.63 million cubic yards.

The existing landfill currently serves communities and businesses in Hardin County and surrounding counties.

This service area is based on current economic conditions. As economic and market conditions and available landfill disposal capacity change, the landfill may accept waste from areas other than those noted above, or from industries not currently served by the landfill.

The quantity and types of waste accepted at the landfill and the site design and operations are discussed in the following subsections. Consistent with 30 TAC §330.61(b), the sources and characteristics of wastes are detailed in the following sections. In addition, waste screening and acceptance procedures are further discussed in Part IV – Site Operating Plan (SOP).

2.1.1 Waste Acceptance Plan

The landfill is currently operated as a Type I municipal solid waste disposal facility with a separate Type IV C&D unit. The facility accepts waste for disposal from both public and private entities in Hardin County, Texas and surrounding counties. The design and operation of the facility considers the characteristics of the waste types discussed in this section.

The major classifications of solid waste to be accepted at the landfill include household waste, yard waste, commercial waste, industrial waste (non-hazardous), construction-demolition waste, and some special wastes. Each classification of waste is defined by 30 TAC §330.3 as follows:

- **Household Waste:** Any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households (including single and multiple residences, hotels, motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas); does not include brush.
- **Yard Waste:** Leaves, grass clippings, yard and garden debris, and brush, including clean woody vegetative material not greater than 6 inches in diameter that results from landscaping maintenance and land-clearing operations. The term does not include stumps, roots, or shrubs with intact root balls.
- **Commercial Solid Waste:** All types of solid waste generated by stores, offices, restaurants, warehouses, and other non-manufacturing activities, excluding residential and industrial wastes.
- **Industrial Waste (Nonhazardous):** Solid waste resulting from or incidental to any process of industry, manufacturing, mining or agricultural operations.
  - Class 2 Industrial Solid Waste – any individual solid waste or combination of industrial solid wastes that cannot be described as Class 1 or Class 3, as defined in §335.506 (relating to Class 2 waste determination).

- Class 3 Industrial Solid Waste – any inert and essentially insoluble industrial solid waste, typically including, but not limited to, materials such as rock, brick, glass, dirt, and certain plastics and rubber, etc. that are not readily decomposable as further defined in 30 TAC §335.507 (relating to Class 3 waste determination).
- Class 1 Industrial Solid Waste – waste that is defined as Class 1 only because of its asbestos content will be accepted and handled in accordance with Title 30 TAC §330.171(c)(3)(I) and §330.173(c).

  Any industrial solid waste or mixture of industrial solid wastes that because of its concentration, or physical or chemical characteristics is toxic, corrosive, flammable, a strong sensitizer or irritant, a generator of sudden pressure by decomposition, heat, or other means, or may pose a substantial present or potential danger to human health or the environment when improperly processed, stored, transported, or disposed of or otherwise managed, as further defined in 30 TAC §335.505. The landfill will not accept Class 1 waste.

- **Construction-Demolition (C&D) Waste:** Waste resulting from construction or demolition projects; includes all materials that are directly or indirectly the by-products of construction work or that result from demolition of buildings and other structures, including but not limited to, paper, cartons, gypsum board, wood, excelsior, rubber, and plastics.
- **Special Waste:** Any solid waste or combination of solid wastes that because of its quantity, concentration, physical or chemical characteristics, or biological properties requires special handling and disposal to protect human health or the environment. If improperly handled, transported, stored, processed, or disposed of, or otherwise managed, it may pose a present or potential danger to human health or the environment. Refer to the Special Waste Acceptance Plan in Part IV, Appendix IVC of the application for additional information regarding the acceptance of special waste (note that not all of the special wastes listed in 30 TAC §330.3(148) will be accepted at this site – refer to Part IV – SOP for additional information).

Consistent with 30 TAC §330.15 the facility will not accept for disposal liquid waste, regulated hazardous waste, prohibited PCBs, infectious medical wastes, or other wastes prohibited by TCEQ regulations.

A Citizen Convenience Center comprised of roll-off containers is provided for use by the general public (i.e., small-vehicle landfill customers) to dispose of their waste in an area separate from the MSW working face. This improves site safety by reducing traffic at the MSW working face. Waste material is off-loaded from the small vehicles to roll-off containers. The site then hauls the roll-off containers periodically to the MSW working face for disposal (refer to Parts I/II, Figure I/II-A.5 and Part IV, Section 8.2.1 for additional information).

Waste will only be disposed of in the 49.6-acre Type I MSW Unit or the 2.4-acre Type IV C&D Unit as described in this permit amendment. No other waste disposal activities will occur within the 79-acre landfill permit boundary.

2.1.2 Disposal Rate and Volume of Waste

The landfill is currently accepting approximately 152 tons per day or 55,579 tons per year, which is projected to increase to 181 tons per day or 66,151 tons per year over the permitted life of the facility, based on the 2016 TCEQ annual report, and population growth projections developed from Texas Water Development Board – 2016 Regional Water Plan data. These rates include both Type I and Type IV waste received at the facility. However, in the event that either BFI Waste Systems of North America, LLC. (BFI) identifies other available waste streams and markets within the state that can be disposed at the Hardin County Landfill, the facility may accept up to 3,000 tons per day, or 1,095,000 tons per year based on the increased rates of disposal.

The waste inflow rate is assumed to increase consistent with the projected growth rate for the landfill's primary service area, which for this evaluation is assumed to be Hardin, Jasper, Jefferson, Liberty, Newton, Orange, Polk and Tyler counties. Although the landfill has taken waste from other counties, the waste received from these counties make up a small percentage of the total daily volume; therefore, they were not considered in the facility's general service area.

It is projected that the service area generates approximately 55,579 tons per year (in 2016) or 92,632 cubic yards (using an in-place density of 1,200 lb/cy) of solid waste (152 tons per day based on a 365-day operating schedule).

It is assumed, that the incoming waste rate will increase at the same rate as the population of the facility's general service area. The annual projected population growth rates shown below are based on the population projections beginning with the year 2016, as presented in the Texas Water Development Board – 2016 Regional Water Plan data. However, waste flows to the facility may increase beyond population growth resulting from changes to available markets and waste streams.

- Growth Rate (years 2015-2020) = 5.4% or Annualized Growth Rate of 0.88%
- Growth Rate (years 2021-2030) = 7.58% or Annualized Growth Rate of 0.73%
- Growth Rate (years 2031-2040) = 5.0% or Annualized Growth Rate of 0.49%
- Growth Rate (years 2041-2047) = 2.5% or Annualized Growth Rate of 0.35%

Operating criteria for a range of waste acceptance rates are included in Part IV – SOP. The above projections are based on current market conditions and may vary as market conditions change. These waste acceptance rates are not a limiting parameter of this permit. The actual yearly waste acceptance rate is a rolling quantity based on the sum of the previous four quarters of waste acceptance.

The estimated maximum annual waste acceptance rate for the facility for five years (beginning in 2017 and using the base year as 2016) is shown in the following table.

Year	Waste Acceptance Rate (tons per year)
2017	56,068
2018	56,561
2019	57,059
2020	57,561
2021	57,982
2022	58,405
2023	58,831

*Actual acceptance rate based on 2016 TCEQ Annual Report.

The projected waste acceptance rate for other years is summarized in Part III, Appendix IIIB.

Based on an estimated 5 pounds of waste generated daily per person and an average waste inflow of 169 tons per day, the average population equivalent for this site is approximately 67,600 persons. As landfill disposal conditions change within the landfill service areas, adjustments to the service area population may occur.

2.1.3 Solid Waste Containment System

The design objective of the containment system (final cover, Subtitle D liner and leachate management systems) is to isolate the solid waste and remove leachate (defined as water that has contacted solid waste) that may collect on the liner system. The Subtitle D liner system proposed for the landfill is a composite liner (compacted clay/60-mil geomembrane liner and drainage geocomposite). The containment system for the landfill is shown in Figure 2.1. Design information and the required QA/QC construction procedures for the individual components of the containment system are presented in Part III of this application.

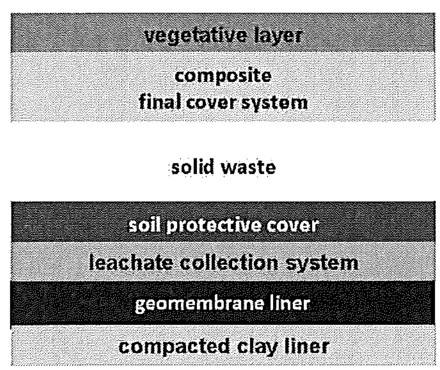


Figure 2.1. The liner and cover systems will be designed to meet or exceed all state and federal regulations.

2.1.4 Site Development Plan

The site development plan (SDP) is included in Part III of this application. This plan sets forth the overall design and operating characteristics of the landfill. Drawings showing the proposed landfill configuration during site development are presented in Parts I/II, Appendix I/IIA – Facility Layout Maps. A summary of the landfill configuration is provided below.

- The current permit boundary of the landfill encompasses 79 acres. The current area available for solid waste fill is approximately 52 acres.
- Two separate solid waste disposal units are contained within the 79-acre permit boundary, as discussed below.
  - Type I Waste Landfill. The 49.6-acre Type I landfill was originally permitted in 1995 as Permit No. MSW-2214. The Type I landfill was adjusted vertically through a one-time 10-foot height extension and drainage improvement modification in 2010. Approximately 32 acres of the 49.6-acre Type I landfill has been developed.
  - Type IV Waste Landfill. The 2.4-acre Type IV landfill was permitted in 1995 as a part of Permit No. MSW-2214. The Type IV landfill is permitted to receive Type IV wastes only. Only wastes identified as Type IV C&D waste consisting of brushy wastes, construction and demolition wastes, and rubbish (trash) that are free of putrescible and household waste will be allowed. Class II and Class III industrial wastes similar to Type IV wastes may be accepted.
- A summary of the capacity (volume of waste and cover soils) of the site is listed below:
  - Remaining capacity of existing site (TCEQ Permit No. MSW-2214A) = 0.74 million cubic yards (as of May 2016).
  - Increase due to major permit amendment application = 3.63 million cubic yards.
  - Remaining capacity of the site with the major permit amendment application (TCEQ Permit No. MSW-2214B) = 4.38 million cubic yards (as of May 2016).
- The maximum elevation of the final cover will be 234.2 ft-msl, and the maximum waste elevation will be 230.2 ft-msl.
- The minimum elevation of the landfill excavation grades (or the elevation of the deepest excavation) will be 45.23 ft-msl (i.e., bottom of excavation in deepest sump). The minimum elevation of the excavation grades in the 17.6-acre Cells 7 and 8 is 45.23 ft-msl. Throughout this application, the term "minimum elevation of excavation" and "elevation of the deepest excavation" (or EDE) are used interchangeably.

A Subtitle D composite liner (2-feet-thick compacted clay liner overlain by a 60-mil HDPE geomembrane liner) for the Type I MSW Unit and leachate collection system will be constructed according to 30 TAC §330.331(a)(2) and §330.333. Details for the liner and LCS are provided in Part III, Appendix IIIA-A – Liner and Final Cover System Details.

- Above grade waste disposal will conform to the lines and grades set forth in Part III, Appendix IIIA, Drawing IIIA-A.2 – Landfill Completion Plan. Side fill slopes will not exceed 25 percent (4H:1V) from the toe of the side embankment to the top of the side embankment. The slope of the landfill top deck will be constructed at a 4 percent maximum slope to facilitate drainage.
- A final cover system will be constructed over the filled waste material, as shown in Part III, Appendix IIIA-A – Liner and Final Cover System Details. Each final cover system option is designed to minimize storm water infiltration.
- The existing citizen convenience center is located east of the scalehouse, and is comprised of 30 or 40-yard roll-off containers used by citizens for waste disposal. Operational requirements are included in Part IV-SOP. The convenience center uses watertight containers. Traffic to the convenience center is controlled by scale operators to ensure a safe and efficient operation.

2.1.5 Site Monitoring Systems

To verify the integrity of the environmental protection systems, the following existing and proposed landfill monitoring systems will be installed and/or maintained.

- Groundwater Monitoring System – The purpose of the groundwater monitoring system is to verify the integrity of the containment systems and to confirm that area groundwater is not adversely impacted by the landfill. This is accomplished by obtaining groundwater samples from the monitoring wells on the perimeter of the landfill, which are screened in the uppermost groundwater zone. The TCEQ-approved groundwater monitoring system consists of eight groundwater detection monitoring wells. The currently approved groundwater monitoring system was updated in 2009 to comply with Title 30 TAC §330.403(a)(2). No changes are proposed to this approved groundwater monitoring system. Monitoring wells MW-1, MW-11, and MW-12 are background wells. The point of compliance monitoring wells include MW-4, MW-5R, MW-6R, MW-7, and MW-13. The facility also maintains five observations wells (OW-2, OW-3, OW-8, OW-9, and OW-10) for groundwater gauging purposes which are not part of the detection monitoring system. The monitoring well locations are shown in Part III, Appendix IIIH, Figure IIIH-A.1.

- Gas Monitoring System – The purpose of the landfill gas monitoring system is to monitor and verify that landfill gas does not migrate off-site or accumulate in enclosed structures. The TCEQ-approved landfill gas monitoring system consists of 7 existing gas probes (GMP-1 through GMP-7) located along the permit boundary. Additional discussion regarding the gas probes is provided in Part III, Appendix III I.
- Surface Water Monitoring Requirements – The landfill is subject to TCEQ stormwater permit requirements. A copy of the TPDES permit is included in Appendix I/IIE. Surface water monitoring is conducted consistent with TPDES requirements.

2.1.6 Site Operations

The landfill is operated by trained and TCEQ-certified personnel. The SOP for the landfill is presented in Part IV of this permit application. The SOP details the required equipment, personnel, and safety procedures required to operate the site in accordance with 30 TAC §330.65. The active landfill area will be covered each evening to prevent potential nuisance conditions such as odors and vectors. The landfill will continue to be inspected by the TCEQ on a regular basis for compliance with state regulations.

The site may operate 24 hours per day, seven days per week. These operating hours include acceptance of waste, the transportation of materials, and heavy equipment operation. However, hours of operation may vary within a 24-hour period depending on incoming volumes of waste.

2.2 Regulatory Agency Coordination

Documentation of coordination with the following regulatory agencies is included in Appendix I/IIB:

- Federal Aviation Administration
- Texas Historical Commission
- Texas Department of Transportation
- Texas Parks and Wildlife Department
- South East Texas Planning Commission (SETPC)
- U.S. Army Corps of Engineers
- U.S. Department of the Interior, Fish and Wildlife Service

2.3 Texas Historical Commission Review

As noted in Section 2.2, a Texas Historical Commission coordination letter is included in Appendix I/IIB. The Historical Commission concluded that no historic properties will be affected by the proposed expansion.

2.4 South East Texas Regional Planning Commission

The expansion of the landfill is consistent with the South East Texas Regional Planning Commission (SETRPC) Regional Plan. Parts I/II of this application were submitted to the SETRPC in April 2017. A letter documenting that Parts I/II was submitted to the SETRPC is included in Appendix I/IIB.

2.5 Abandoned Oil and Water Wells

At the time of this submittal, there are no known abandoned oil or gas water wells at the site. However, if an abandoned oil or gas well is located in the future, the Site Manager will provide written notification to the TCEQ's executive director of their location within 30 days after discovery during the course of facility development. One plugged water well (Well I.D. 232600) is located near the facility entrance. The location of this well is identified on Figure IIIG-A.10 in Appendix IIIG of Part III. According to the facility, this water well was plugged in December 2016. The plugged water well location is outside the facility's waste footprint. As the site is developed, if any wells are encountered, they will be exposed, the casing cut to a minimum of 2 feet below the excavation, and the well capped and plugged in accordance with all applicable rules and regulations of the TCEQ, the Railroad Commission of Texas, or other applicable state agency.

The Site Manager will provide written notification to the executive director of the location of any existing or abandoned water wells within the facility upon discovery during site development. Within 30 days of such a discovery, the Site Manager will provide written notification and certification to the executive director of the TCEQ that all such wells have been capped, plugged, and closed in accordance with all applicable rules and regulations of the TCEQ or other applicable state agency.

For crude oil or natural gas wells, or other wells associated with mineral recovery that are under the jurisdiction of the Railroad Commission of Texas, within 30 days after the plugging of any such well, the Site Manager will provide the Executive Director of the TCEQ with written certification that all such wells have been properly capped, plugged, and closed in accordance with all applicable rules and regulations of the Railroad Commission of Texas. A copy of the well plugging report to be submitted to the appropriate state agency will also be submitted to the executive director of the TCEQ within 30 days after the well has been plugged. In the event that an abandoned well causes a change to the liner installation plan, a permit modification will be submitted to the Executive Director in accordance with §330.161(d).

2.6 Internet Posting

In accordance with 30 TAC §330.57(i), a complete copy of this permit application will be posted to the internet at the following publicly accessible website: http://www.ftwweaverboos.com/DP/Hardin/MPA index.html. All future revisions or supplements to this permit application will also be posted at the same location. This internet posting is for informational purposes only.

2.7 Existing Permits/Authorizations

In accordance with 30 TAC §305.45(a)(7), the existing permits and authorizations for the facility are summarized in Table 2-1.

Table 2-1
Existing Permits/Authorizations

RQD = Required APP = Applied For REC = Received N/A = Not Applicable

N/A	Hazardous Waste Management program under the Texas Solid Waste Disposal Act
N/A	Underground Injection Control (UIC) program under the Texas Injection Well Act
REC[2]	Texas Pollutant Discharge Elimination System (TPDES) program under the Federal Clean Water Act (CWA) and Waste Discharge program under the Texas Water Code, Chapter 26
N/A	Prevention of Significant Deterioration (PSD) Program under the Federal Clean Air Act
N/A	Nonattainment Program under the Federal Clean Air Act
N/A	National Emission Standards for Hazardous Pollutants (NESHAPS) preconstruction approval under the Clear Air Act
N/A	Ocean dumping permits under the Marine Protection Research and Sanctuaries Act
N/A[1]	Dredge or fill permits under of the Federal Clean Water Act
REC[2]	TPDES Stormwater Pollution Control, Section 26 of the Texas Water Code
N/A[1]	U. S. Army Corps of Engineers Dredge and Fill Permit Section 404
RQD	TCEQ Air Quality Permit or Registration
	Other environmental permits (provide list)

1 Refer to Parts I/II – Section 11 for more information.
2 Refer to Appendix I/IIE for more information regarding the site's Multi-Sector Stormwater General Permit (TCEQ Permit No. TXR05V267).

3 EXISTING CONDITIONS SUMMARY

3.1 Site History

This section addresses §330.61(a).

The landfill is an existing 79-acre municipal solid waste facility (TCEQ Permit No. MSW-2214B) in Hardin County. The site was originally permitted in July 1995 under TDH Permit No. MSW-2214. The permit was amended in January 2001 to incorporate the receipt of additional waste streams. The permit was further modified in 2010 to allow a one-time 10-foot vertical expansion adjustment in conjunction with drainage improvements.

The existing permitted final contour plan and top of liner plan are reproduced in Figures I/II-3.1 and I/II-3.2. The 2016 topographic survey of the currently constructed portion of the landfill is shown on Figure I/II-3.3.

3.2 Existing Liner Systems

The existing liner systems for the constructed cells in the 49.6-acre Type I and 2.4-acre Type IV disposal units are described below, including discussion of leachate collection and storage systems.

3.2.1 Type IV Disposal Unit

The Type IV disposal unit is designated to accept only wastes identified as Type IV waste consisting of brushy wastes, construction and demolition wastes, and rubbish (trash) that are free of putrescible and household waste. Class II and Class III industrial wastes similar to Type IV wastes will also be accepted. Approximately 1.4 acres of the 2.4-acre Type IV landfill have been constructed.

The Type IV disposal unit is divided into 5 cells, each of approximate size 0.5 acres. Each cell is lined with a 3-foot-thick compacted clay liner with a permeability no greater than $10x10^{-7}$ cm/sec, overlain by a 1-foot-thick soil protective cover. Leachate collection is not provided in the Type IV cells. Each of the subsequently constructed Type IV cells is tied into the adjacent cell, which will result in a single 2.4-acre cell or trench upon completion of the Type IV disposal unit.

3.2.2 Type I MSW Disposal Units

The 49.6-acre Type I MSW disposal unit is divided into seven sectors, which are further divided into cells. For this permit amendment application, thirteen disposal cells have been constructed, varying in size from approximately 3.7 acres to 7.6 acres in size, with an additional 16.4 acres (Cells 6 and 7 for the 1995 permit and renumbered Cells 7 and 8 for this application) remaining to be constructed. The cells are shown on Figure I/II-3.3.

The cells are constructed with a Subtitle D-compliant bottom liner system comprised of 2 or 3 feet of compacted clay with a permeability not greater than $1x10^{-7}$ cm/sec, overlain by 60-mil HDPE geomembrane. Portions of the cells that were constructed with the 3-foot-thick compacted clay liner were identified in the permit as being excavated to an elevation below the seasonal high groundwater level. The use of the thickened clay liner ended and an underdrain system was substituted in portions of cell constructed below the seasonal high groundwater level. Underdrains will be constructed for future Cells 7 and 8.

3.2.3 Existing Leachate Collection System

The existing leachate collection systems for the Subtitle D lined areas in Sectors 1 through 6 consist of a 1-foot-thick drainage sand layer (Cell W1 only) or geocomposite (single-sided or double-sided on the cell floor grades and double-sided on the cell sideslopes) with a 1-foot-thick soil protective cover. The leachate collection layer slopes to drain toward perforated leachate collection pipes surrounded by drainage stone. The leachate collection pipes convey leachate to the leachate sumps. Leachate collection pipes in Sectors 1 to 5 are constructed of schedule 80 Polyvinyl Chloride (PVC), with the leachate collection pipes in Sectors 6 and 7 constructed of SDR 17 HDPE.

Leachate is pumped from the current sump located along the north boundary of the landfill into one or more tankers, which are transported off site for properly authorized disposal. For this permit amendment, a future 100,000-gallon storage tank option has been included for future leachate storage.

3.3 Groundwater Monitoring System

As noted in Section 2.1.5, the currently approved groundwater monitoring system was updated in 2009 to comply with Title 30 TAC §330.403(a)(2). No changes are proposed to this approved groundwater monitoring system. The approved groundwater monitoring network utilizes eight detection monitoring wells including three background and five point of compliance wells. Designated background detection monitoring include: MW-1, MW-11 and MW-12. Designated point of compliance detection monitoring wells include: MW-4, MW-5R, MW-6R, MW-7, and MW-13. The facility also maintains five observations wells (OW-2, OW-3, OW-8, OW-9, and OW-10). These observation wells remain for groundwater gauging purposes and are not part of the detection monitoring system. All facility groundwater monitoring and observation wells are screened within the Upper Sand Stratum which constitutes the uppermost aquifer beneath the site. The Upper Sand Stratum aquifer is underlain by the Lower Clay Stratum aquiclude. The facility's existing permitted eight groundwater detection monitor wells are sampled semiannually for the constituents specified in Appendix IIIH – Groundwater Sampling and Analysis Plan. The facility's groundwater monitoring system is in compliance with TCEQ groundwater monitoring requirements and there are no wells in assessment or corrective action status as of January 2017.

3.4 Landfill Gas Monitoring System

TCEQ "Guidelines for Preparing a Landfill Gas Management Plan" requires that a Landfill Gas Management Plan (LGMP) be developed for the landfill and that the LGMP describe the existing and proposed upgrades to the landfill gas (LFG) monitoring network. It also discusses the operation and monitoring of this network, notification procedures, and possible remediation activities, if required. In addition, the LGMP includes a description of the landfill gas collection and control system (GCCS) installation.

A site plan for the landfill is included as Figure III I-A-1 in Appendix III I-A of Part III. As shown on Figure III I-A-1, currently there are seven permanent existing LFG monitoring probes installed around the perimeter of the permit boundary to monitor the potential migration of LFG. The probes were constructed as multiple completions (shallow and deep) in single borings with each having two monitoring points. Information regarding the existing LFG monitoring probes is included in Appendix III I-C.

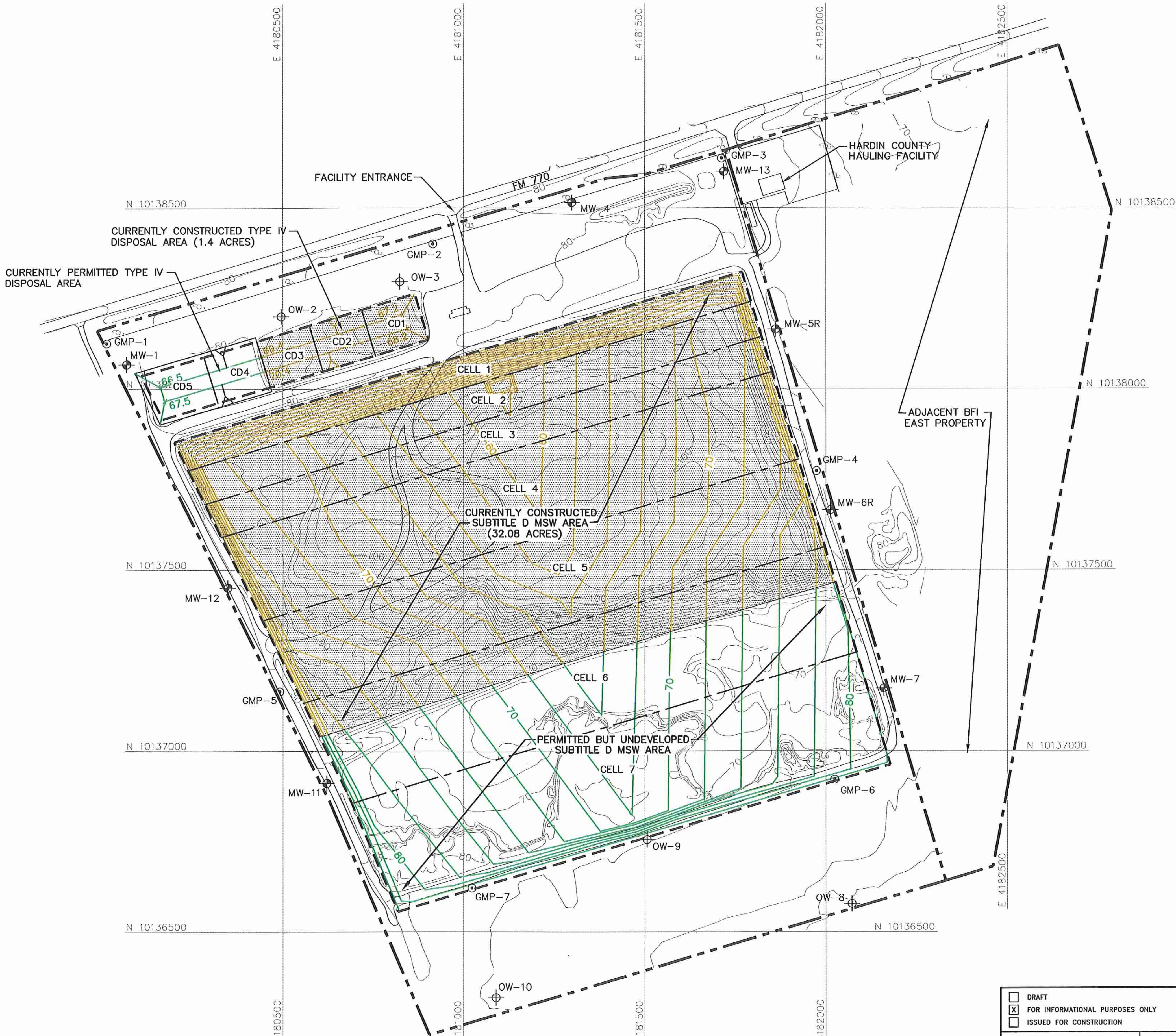
As a result of the proposed landfill expansion, existing probe GMP-4 will be abandoned and reinstalled, and six existing probes will remain in-place for a total of seven probes. Table III I-1 summarizes the probes that will remain in-place, probes that will be abandoned, and the probes that will be added as a result of the proposed landfill expansion. Refer to Appendix III I, Section 3 of Part III for a detailed discussion of the perimeter monitoring network.

3.5 Existing Landfill Air Permits

Hardin County Landfill will obtain a Standard Air Permit under 30 TAC 330, Subchapter U upon approval of the expansion. Given that the site capacity with the proposed expansion will be less than 2.5 MM Megagrams and 2.5 MM cubic meters the site is not subject to Federal New Source Performance Standards (NSPS) requirements. Hardin County Landfill will comply with all state and federal requirements.

3.6 Convenience Center

The citizens convenience center at the landfill is comprised of two or more 30 or 40-yard rolloff containers. The convenience center allows landfill customers to safely and efficiently dispose of their waste in an area that is in close proximity to the scalehouse without having to travel to the working face. Landfill personnel periodically (but at least weekly) take the roll-off containers to the working face for disposal. The convenience center uses watertight containers. Refer to Part IV – Site Operating Plan, Section 8.2.1 for operational procedures associated with the citizens convenience center.



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SCALE IN FEET

LEGEND

- BFI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- CELL BOUNDARY (SEE NOTE 3)
- 70 — EXISTING CONTOUR
- 60 — CONSTRUCTED TOP OF PROTECTIVE COVER CONTOUR (SEE NOTE 4)
- 60 — PERMITTED TOP OF PROTECTIVE COVER CONTOUR (SEE NOTE 4)
- N 10137500 — STATE PLANE COORDINATE GRID
- EXISTING SUBTITLE-D LINER AREA
- MW-1 — EXISTING GROUNDWATER MONITOR WELL
- OW-2 — EXISTING GROUNDWATER OBSERVATION WELL
- GMP-1 — EXISTING GAS MONITORING PROBE

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016.
2. CURRENTLY PERMITTED TYPE IV CELLS INCLUDES CD1 THROUGH CD5. CD1, CD2, AND CD3 ARE CURRENTLY DEVELOPED AND RECEIVED TYPE IV WASTE.
3. CURRENTLY APPROVED CELL DEVELOPMENT (CELL BOUNDARIES AND LABELS) SHOWN.
4. CONTOURS FOR THE CURRENTLY PERMITTED CONDITIONS PLAN REPRESENT THE TOP OF LINER PROTECTIVE COVER CONTOURS WHICH ARE 4 TO 5 FEET ABOVE THE EXCAVATION GRADES. THE PROPOSED EXCAVATION PLAN CONTOURS WERE DEVELOPED BY WEAVER CONSULTANTS GROUP.

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

12-5-2017

☐ DRAFT ☒ FOR INFORMATIONAL PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR BFI WASTE SYSTEMS OF NORTH AMERICA, LLC		MAJOR PERMIT AMENDMENT PERMITTED EXCAVATION PLAN HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
DATE: 03/2017 FILE: 0120-758-11 CAD: I/II 3.3-PERMITTED EXCAV PLAN.DWG	DRAWN BY: SRF DESIGN BY: NT REVIEWED BY: NT		

REVISIONS

NO.	DATE	DESCRIPTION
1	08/2017	FIRST NOD RESPONSE
2	11/2017	OWNERSHIP CHANGE

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

WWW.WCGRP.COM

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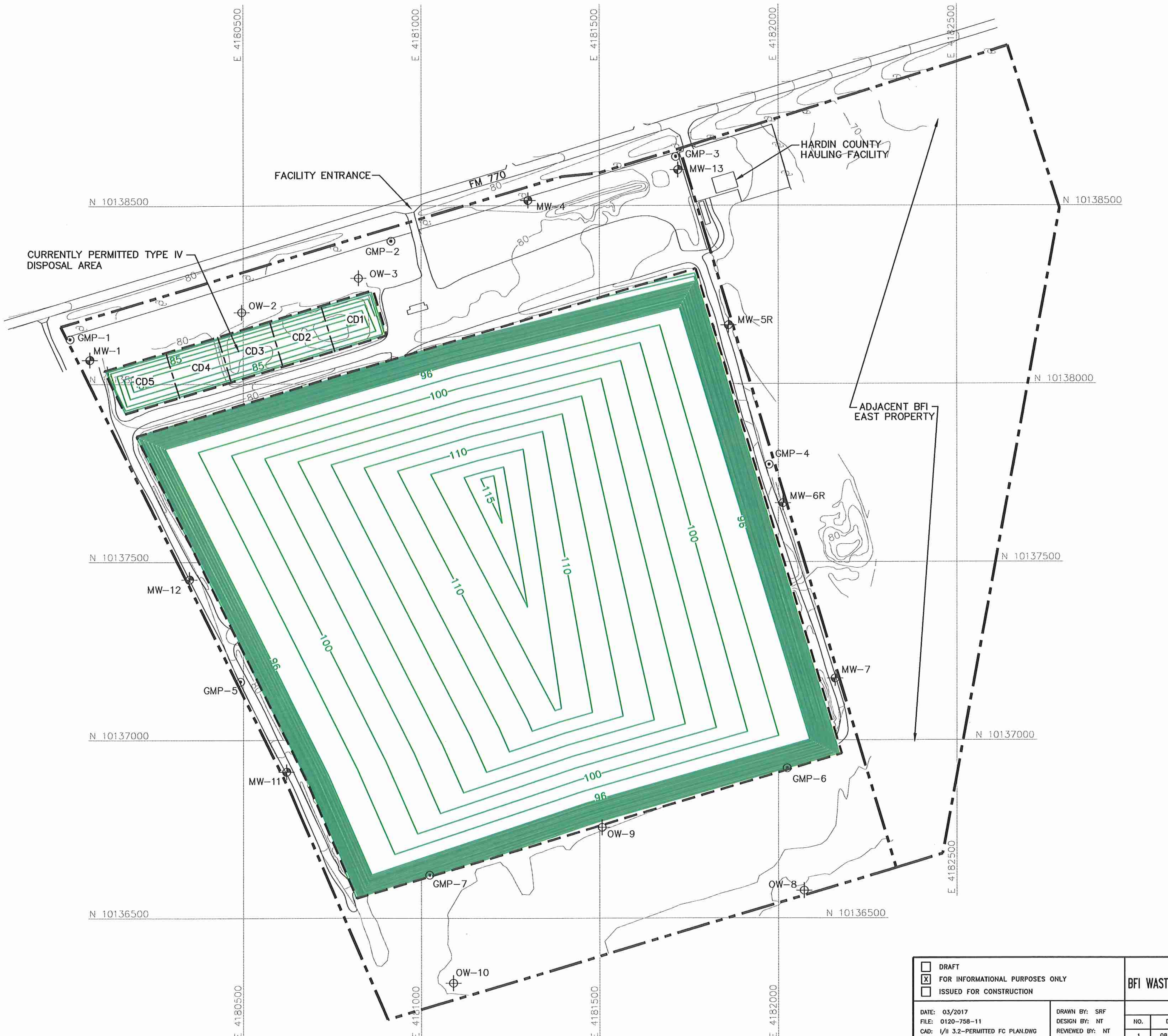

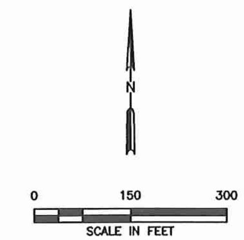

LEGEND

	BFI EAST PROPERTY BOUNDARY
	PERMIT BOUNDARY
	CURRENTLY PERMITTED LIMITS OF WASTE
	CELL BOUNDARY
70	EXISTING CONTOUR
110	PERMITTED FINAL CONTOUR (SEE NOTE 2)
N 10137500	STATE PLANE COORDINATE GRID
MW-1	EXISTING GROUNDWATER MONITOR WELL
OW-2	EXISTING GROUNDWATER OBSERVATION WELL
GMP-1	EXISTING GAS MONITORING PROBE

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016.
2. PERMITTED COMPLETION PLAN FINAL COVER CONTOURS ARE OBTAINED FROM 1995 HARDIN COUNTY LANDFILL MSW PERMIT NO. 2214, AS MODIFIED IN 2010 TO PROVIDE A 10 FT. VERTICAL EXPANSION AND DRAINAGE IMPROVEMENTS.

STATE OF TEXAS
NEVZAT TURAN
84059
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PROFESSIONAL ENGINEER

12-5-2017

☐ DRAFT
☒ FOR INFORMATIONAL PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 03/2017
FILE: 0120-758-11
CAD: I/II 3.2-PERMITTED FC PLAN.DWG

DRAWN BY: SRF
DESIGN BY: NT
REVIEWED BY: NT

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	08/2017	FIRST NOD RESPONSE
2	11/2017	OWNERSHIP CHANGE

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

MAJOR PERMIT AMENDMENT
PERMITTED FINAL CONTOUR PLAN

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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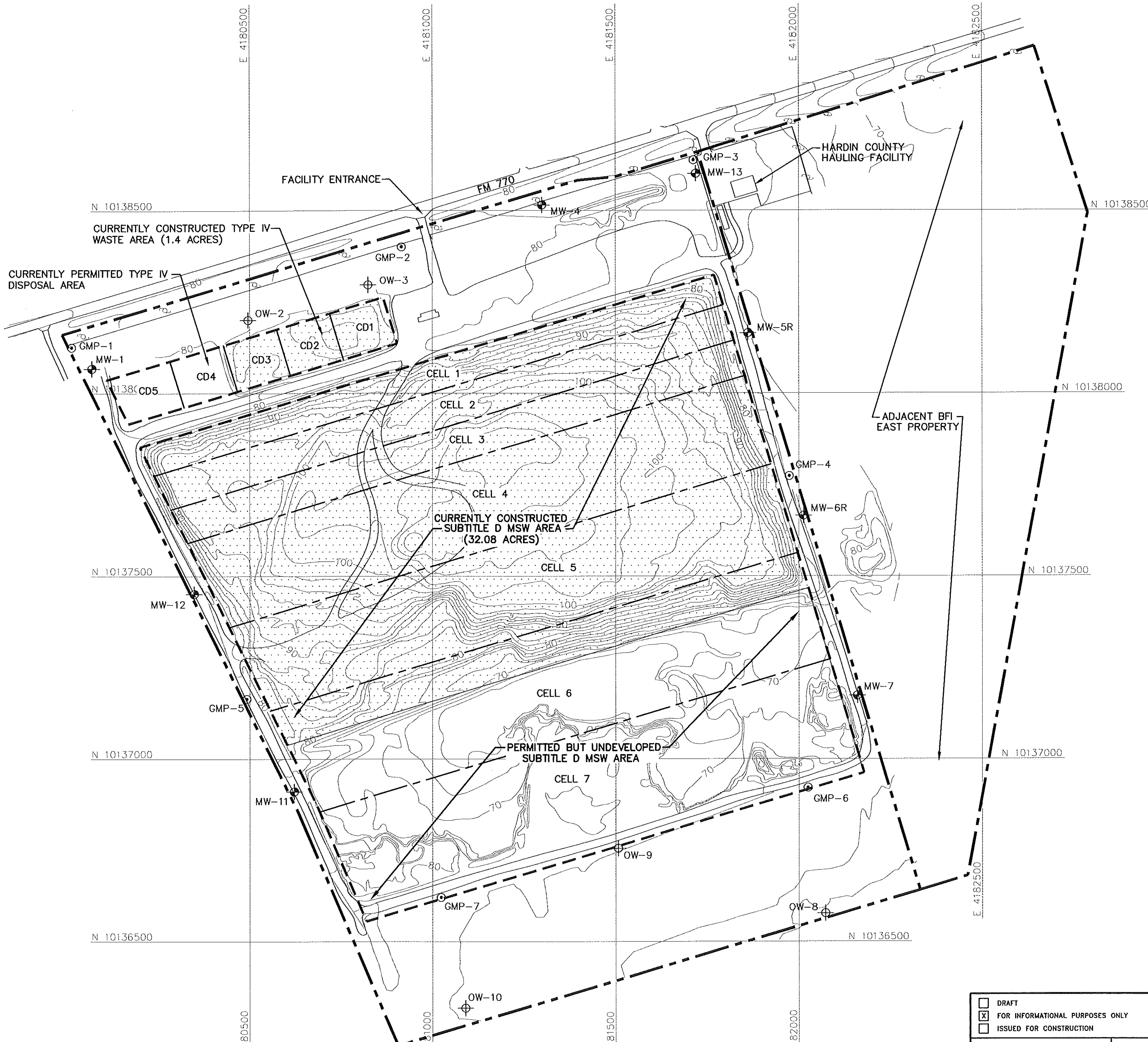

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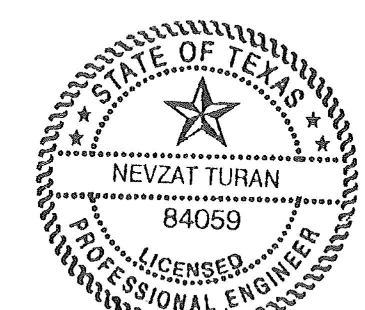
SCALE IN FEET

LEGEND

— · — — · —	BFI EAST PROPERTY BOUNDARY
— · — · —	PERMIT BOUNDARY
— — — —	CURRENTLY PERMITTED LIMITS OF WASTE
— · —	CELL BOUNDARY (SEE NOTE 3)
70	EXISTING CONTOUR
N 10137500	STATE PLANE COORDINATE GRID
	EXISTING SUBTITLE-D LINER AREA
MW-1	EXISTING GROUNDWATER MONITOR WELL
OW-2	EXISTING GROUNDWATER OBSERVATION WELL
GMP-1	EXISTING GAS MONITORING PROBE

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CURRENTLY PERMITTED TYPE IV CELLS INCLUDES CD1 THROUGH CD5. CD1, CD2, AND CD3 ARE CURRENTLY DEVELOPED AND RECEIVED TYPE IV WASTE.
3. CURRENTLY APPROVED CELL DEVELOPMENT (CELL BOUNDARIES AND LABELS) SHOWN.



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☐ DRAFT
☒ FOR INFORMATIONAL PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 03/2017
FILE: 0120-758-11
CAD: I/II 3.1-SITE PLAN.DWG

DRAWN BY: SRF
DESIGN BY: NT
REVIEWED BY: NT

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	08/2017	FIRST NOD RESPONSE
2	11/2017	OWNERSHIP CHANGE

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

MAJOR PERMIT AMENDMENT
EXISTING SITE PLAN

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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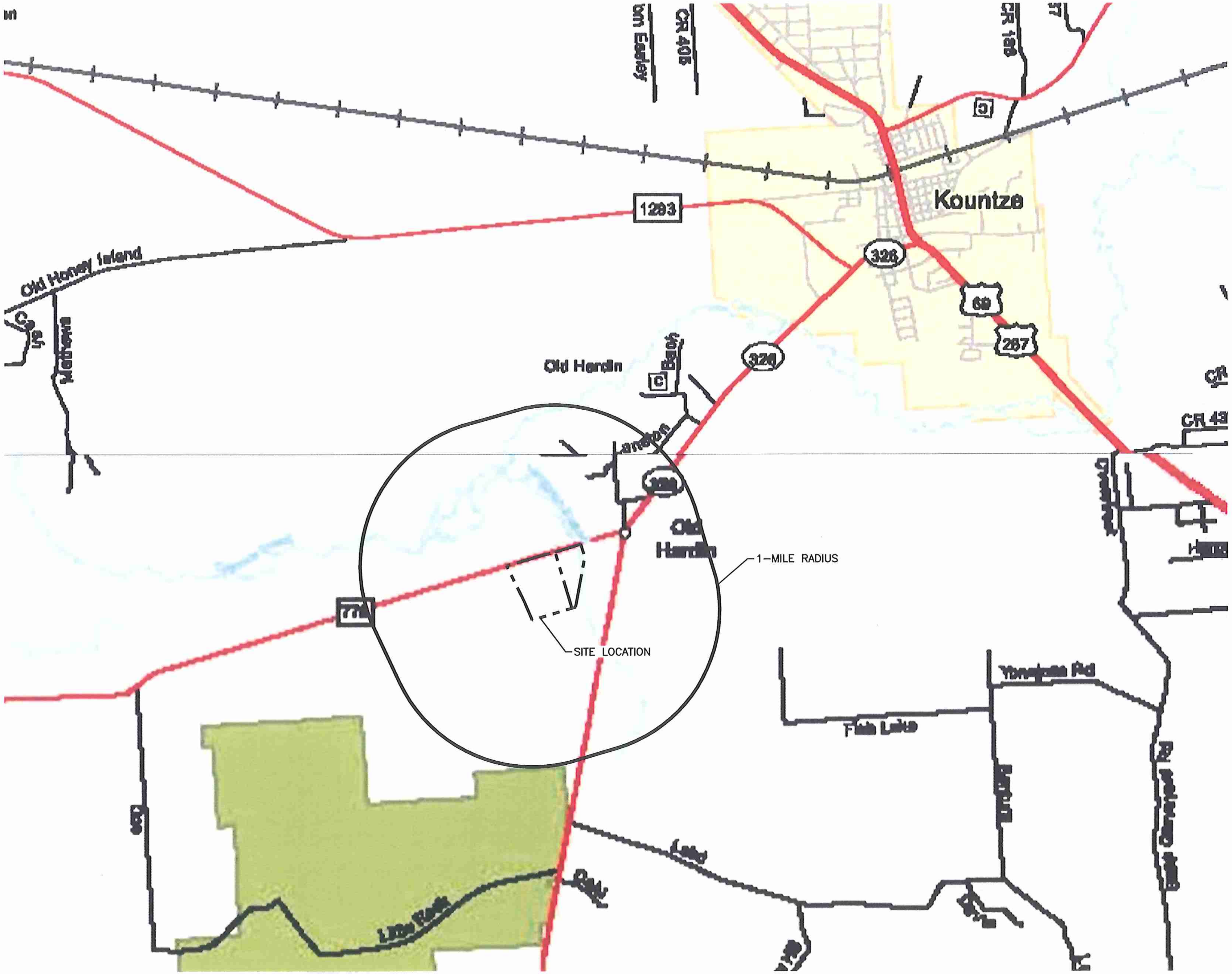
DRAWING I/II-3.3

4 MAPS

This section addresses §330.59(c), §330.61(c), §330.61(e), §305.45(a)(6)(A), and §305.45(a)(6)(C).

A site location map and general topographic map are presented on Figures I/II-4.1 and I/II-4.2. Structures and inhabitable buildings located within 500 feet, as well as the nearest residences, are shown on Figure I/II-4.3.

Figure I/II-4.1 and Figure I/II-4.2 show surface water bodies in accordance with 30 TAC §330.59(c)(1) and §305.45(a)(6)(A). Figure I/II-4.2 shows wells and springs in accordance with Title 30 TAC §330.59(c)(1) and §305.45(a)(6)(A). As noted in Figure I/II-4.2, no known springs exist within a one-mile radius of the site.



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SCALE IN FEET

LEGEND

EXISTING PERMIT BOUNDARY
BFI EAST PROPERTY BOUNDARY

Legend

- IH, BI
- US, BU, UA, UP
- SH, BS
- SL, SS, PR
- FM, BF, RM, RR, RE, RS, PA
- County Road
- City Street or other Non-County Maintained Road
- Railroad
- Incorporated City
- Unincorporated Community
- Airport
- Airport
- Airport Runway
- School
- Military Installation
- Prison
- National or State Park
- Cemetery
- Dam
- County Line
- District Line
- Canal
- Flowing Stream
- Intermittent Stream
- River
- Gulf Intracoastal Waterway
- Other Body of Water

NOTE:

1. MAP OBTAINED FROM TEXAS DEPARTMENT OF TRANSPORTATION HARDIN COUNTY, TEXAS DATED 2014.

STATE OF TEXAS
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CAD: I/II 4.1-SITE LOCATION MAP.DWG

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REVIEWED BY: NT

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2017	OWNERSHIP CHANGE

MAJOR PERMIT AMENDMENT
SITE LOCATION MAP

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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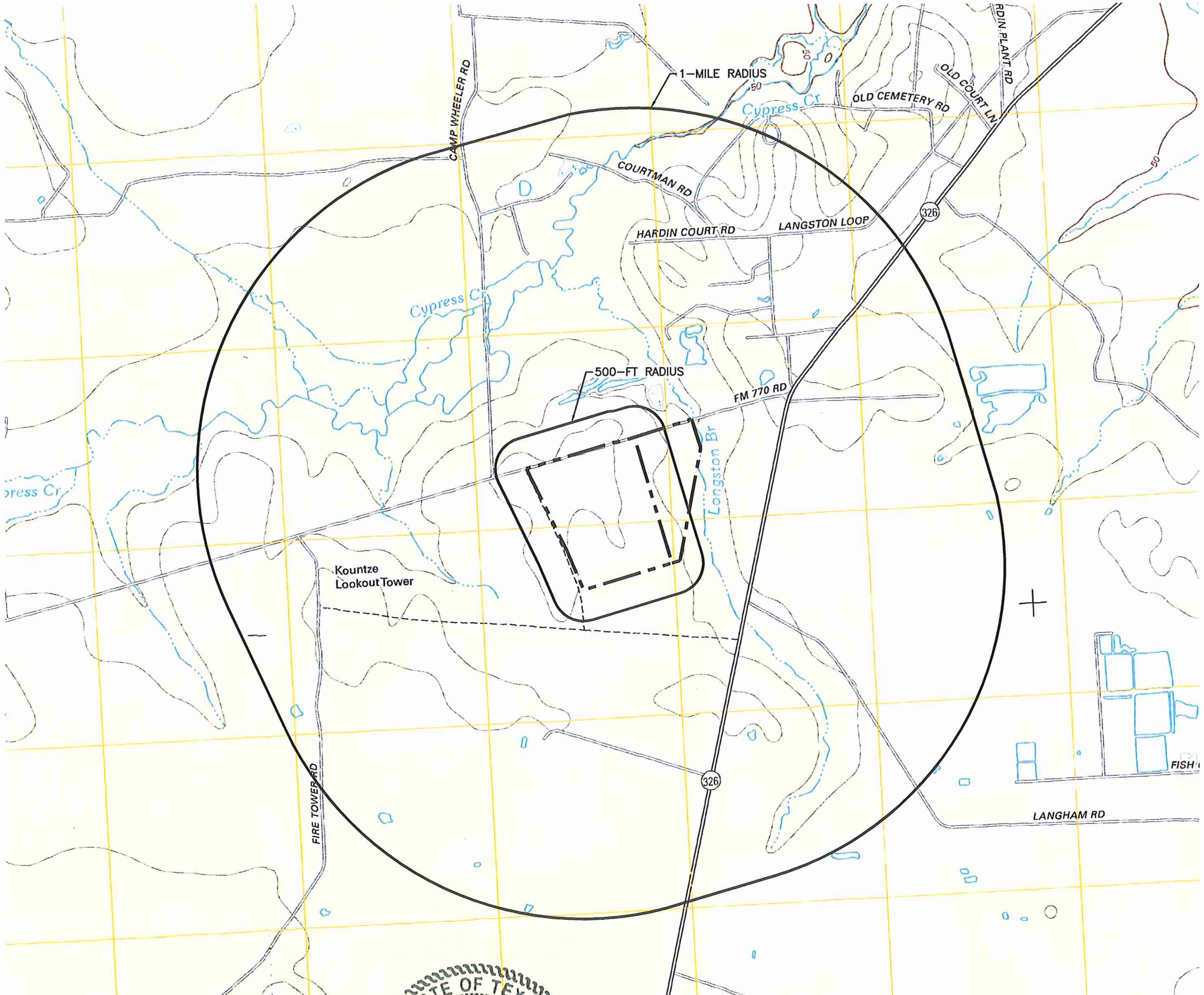


N

0 1000 2000
SCALE IN FEET

LEGEND

EXISTING PERMIT BOUNDARY

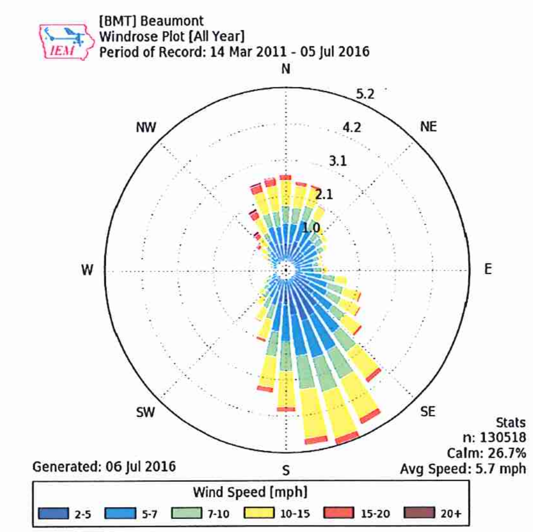
BFI EAST PROPERTY BOUNDARY

ROAD CLASSIFICATION

Interstate Route
US Route
Ramp
State Route
Local Road
4WD
Interstate Route
US Route
State Route

KOUNTZE SW, TX
2013

KOUNTZE SOUTH, TX
2013



NOTES:

1. NO KNOWN SPRINGS EXIST WITHIN A 1 MILE RADIUS OF THE PERMIT BOUNDARY.
2. WIND ROSE IS OBTAINED FOR THE CLOSEST AIRPORT.

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DATE: 03/2017 FILE: 0120-758-11 CAD: I/II 4.2-GENERAL TOPO MAP.DWG DRAWN BY: SRF DESIGN BY: NT REVIEWED BY: NT	REVISIONS NO. 1 — DATE 11/2017 — DESCRIPTION OWNERSHIP CHANGE	
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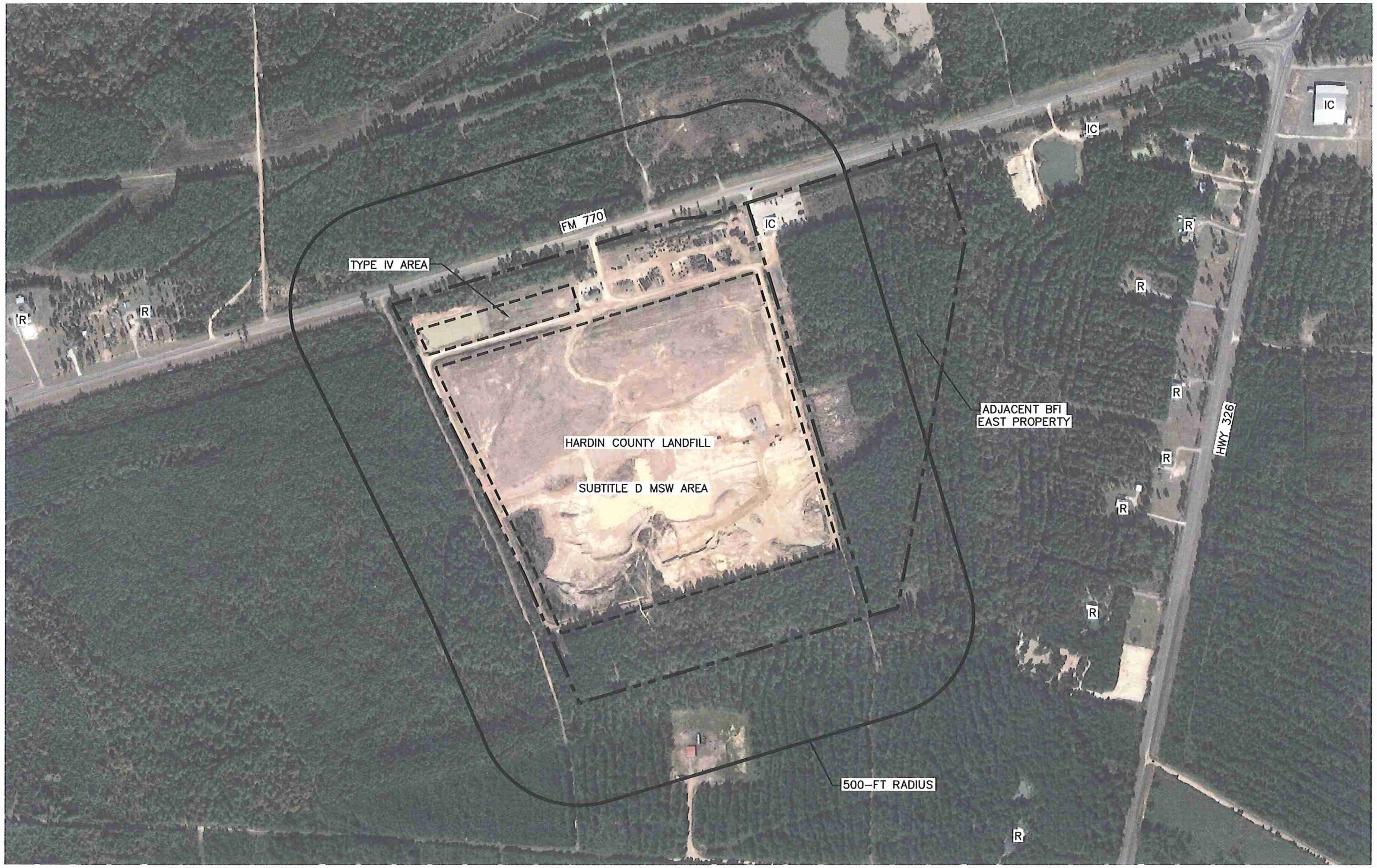

N

0 300 600
SCALE IN FEET

LEGEND

— · · —	EXISTING PERMIT BOUNDARY
— · — · —	BFI EAST PROPERTY BOUNDARY
— — — —	PERMITTED LIMITS OF WASTE
R	RESIDENTIAL INHABITABLE STRUCTURE
IC	INDUSTRIAL/COMMERCIAL INHABITABLE STRUCTURE

NOTE:

1. AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH AND DATED 2016.
2. ALL STRUCTURES WITHIN 500 FEET ARE SHOWN ON THIS FIGURE. EACH STRUCTURE IS ASSUMED TO BE HABITABLE. LAND USE WITHIN A 500–FOOT RADIUS OF THE SITE CONSISTS OF COMMERCIAL AND AGRICULTURAL AREAS. THE NEAREST STRUCTURE TO THE PERMIT BOUNDARY IS APPROXIMATELY 50 FEET EAST OF THE PERMIT BOUNDARY.

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MAJOR PERMIT AMENDMENT
STRUCTURES AND INHABITABLE BUILDINGS WITHIN 500 FEET

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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5 LANDOWNER AND MINERAL RIGHTS LIST AND MAP

This section addresses §330.59(c) and §305.45(a)(6)(D).

The following List of Adjacent Landowners and Figure I/II-5.1 provide the names, mailing addresses, and locations of the "Adjacent and Potentially Affected Landowners" around the facility. The list is based on appraisal district records located at the Hardin County Appraisal District office and includes tracts within ¼ mile of the permit boundary. Refer to Figure I/II-5.1, Land Ownership Map, for location of the properties. The numbers on the landowners list correspond to the numbers listed on Figure I/II-5.1. Easement holders are also listed in Table I/II-5.1.

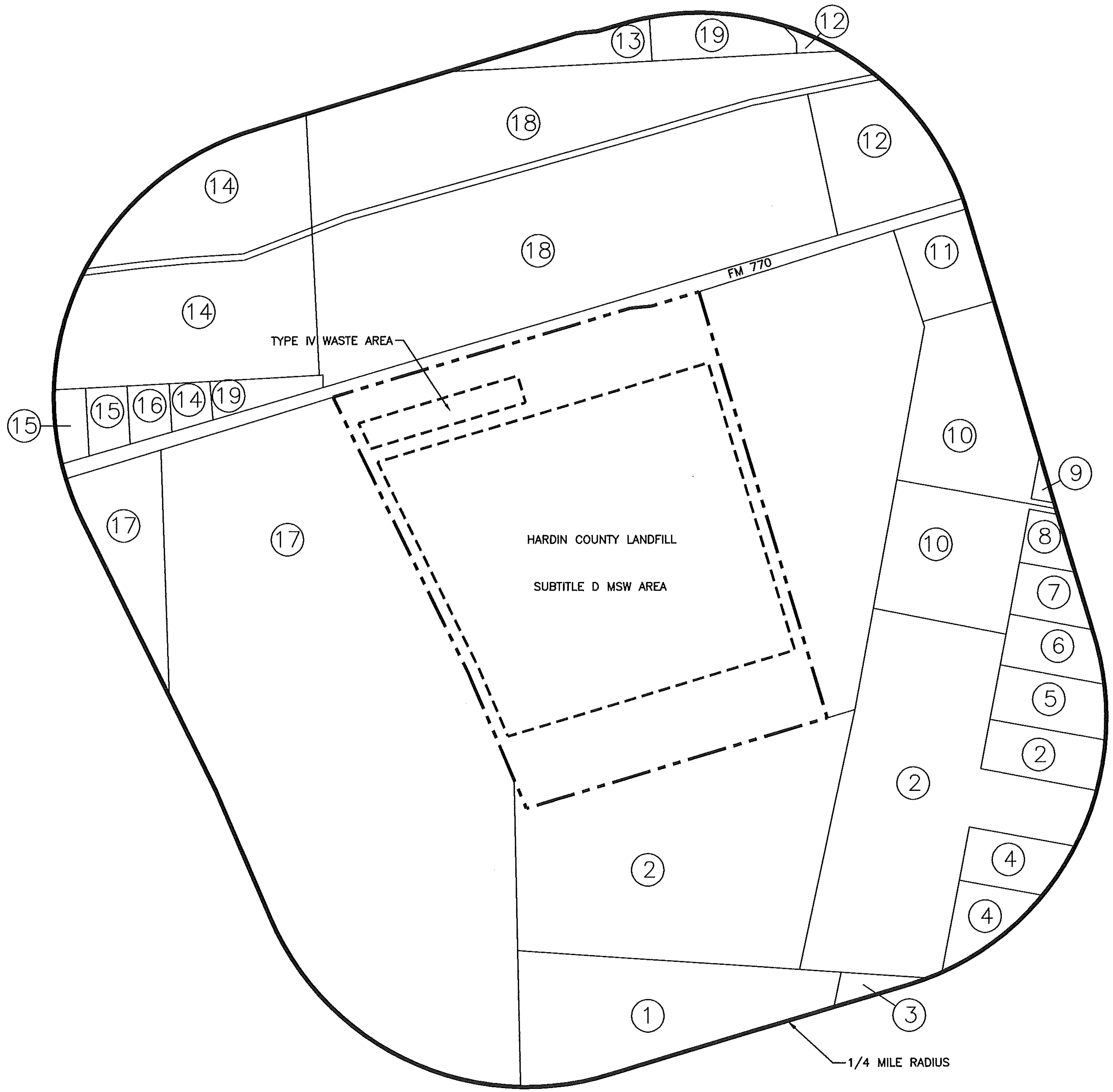
The real property appraisal records of Hardin County do not show any mineral interest ownership under the permit property.

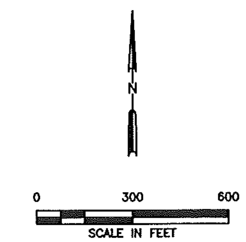
ADJACENT PROPERTY OWNERS INFORMATION

The following table lists the names and mailing addresses of the adjacent and potentially affected landowners around the landfill's permit boundary (and easement holders located within the landfill permit boundary). The list is based on the Hardin County Appraisal District records and includes all property owners within ¼ mile of the site (as of November 2017). Refer to Figure I/II-5.1, Adjacent Property Owners Map, for location of the properties. The numbering of this list corresponds to the numbers of the Land Ownership Map.

TABLE I/II-5.1
LANDOWNER LIST

1. ALFREDO JIMENEZ
   8075 HOMER DR
   BEAUMONT TX 77706
2. BRUCE ALAN HOFFER
   PO BOX 1621
   KOUNTZE TX 77625
3. S&M AFFILIATED INC
   3033 BUSH DR
   KOUNTZE TX 77625-6052
4. STACY ANN SIMS
   4500 HIGHWAY 326 N
   KOUNTZE TX 77625-7761
5. ZECHARIAH & JANIS SHELTON
   PO BOX 1798
   KOUNTZE TX 77625-1798
6. HUNTER EPPES
   5007 FM RD 1293
   KOUNTZE TX 77625
7. TODD SAVOY
   4156 HIGHWAY 326 N
   KOUNTZE TX 77625-7072
8. BEN & ALLISON MERRITT
   4068 HWY 326 N
   KOUNTZE TX 77625
9. ROBERT C & GLORIA JOHNSON
   4000 HIGHWAY 326 N
   KOUNTZE TX 77625-7043
10. EARL KNOBLOCK
    1160 OLD BEAUMONT RD
    SOUR LAKE TX 77659
11. RICHARD W & KATHY FOWLER
    1939 FM 770 RD
    KOUNTZE TX 77625-7751
12. LEONARD T GRUBBS
    PO BOX 97
    KOUNTZE TX 77625-0097
13. NEAL A WRIGHT JR
    PO BOX 1613
    KOUNTZE TX 77625-1613
14. CATCHMARK HBU LLC
    FIVE CONCOURSE PARKWAY
    ATLANTA GA 30328
15. JEFFREY A BEAM
    3068 FM 770 RD
    KOUNTZE TX 77625-4100
16. ELIZABETH CARLISLE
    PO BOX 337
    KOUNTZE TX 77625
17. 25/69 INVESTMENT LLC
    PO BOX 70
    PORT NECHES TX 77651
18. HARDIN COUNTY
    PO BOX 2260
    KOUNTZE TX 77625-2260
19. ALBERT L WRIGHT
    10797 BONWELL LOOP
    KOUNTZE TX 77625-6040





LEGEND

- EXISTING PERMIT BOUNDARY
- PERMITTED LIMITS OF WASTE

NOTES:

1. (1) REFER TO LANDOWNERS LISTED ON LANDOWNERS LIST IN SECTION 5, LANDOWNERS LIST AND MAP.
2. THIS LINE REPRESENTS A 1/4 MILE DISTANCE FROM THE LIMIT OF THE PERMIT BOUNDARY.
3. LANDOWNERS AND MINERAL RIGHTS OWNERS LIST WAS DEVELOPED FROM JANUARY 2017 HARDIN COUNTY APPRAISAL DISTRICT RECORDS.

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FILE: 0120-758-11
CAD: I/II 5.1-LAND OWNERS MAP.DWG

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1	11/2017	OWNERSHIP CHANGE

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MAJOR PERMIT AMENDMENT
LAND OWNERSHIP MAP

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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6 AERIAL PHOTOGRAPH

An aerial photograph of the site and the surrounding area (minimum of 1-mile radius from the site) is presented on Figure I/II-6.1.

This section addresses §330.61(f).

N

0 300 600
SCALE IN FEET

LEGEND

- EXISTING PERMIT BOUNDARY
- IESI EAST PROPERTY BOUNDARY
- PERMITTED LIMITS OF WASTE

NOTE:

1. AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH AND DATED 2016.

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CAD: I/II 6.1-AERIAL PHOTOGRAPH.DWG

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DESIGN BY: NT
REVIEWED BY: NT

PREPARED FOR
IESI TX LANDFILL LP

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2017	OWNERSHIP CHANGE

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

MAJOR PERMIT AMENDMENT
AERIAL PHOTOGRAPH

IESI HARDIN COUNTY LANDFILL
KOUNTZE COUNTY, TEXAS

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DRAWING I/II-6.1

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7 LAND USE

7.1 Character of Surrounding Land and Land Use

This section addresses §330.61(g), §330.61(h), and §305.45(a)(6)(B).

A land use evaluation was performed for the area within 1 mile of the landfill permit property boundary. Growth trends within 5 miles of the facility were also evaluated. Land use information is summarized on the following four maps.

- Figure I/II-7.1 (Land Use Map – Aerial). This map highlights land use within a 1-mile radius of the site on an aerial photograph.
- Figure I/II-7.2 (Land Use Map). This map indicates major land uses within 1 mile of the site.
- Figure I/II-7.3 (Zoning Map). There is no zoning within a 2-mile radius of the permit boundary.
- Figure I/II-7.4 (Cities within 5 Miles – Aerial). This map is used to show area cities within 5 miles.

7.2 Location and Zoning

The landfill is about 3 miles southwest of the center of the incorporated City of Kountze, but lies wholly outside its city limits and extraterritorial jurisdiction (ETJ). The site is about 2.2 miles from the nearest city limits boundary. Although the City of Kountze is the closest incorporated city to the permit property, the City has no zoning authority over the site. Hardin County also has no zoning or special-use requirements that affect the landfill or its expansion.

7.3 Surrounding Land Use

As shown on Figures I/II-7.1 and I/II-7.2, land use within 1 mile of the site consists of predominantly commercial timber production and undeveloped lands and forested lands/agricultural/open space land. Individual residences are scattered within a 1-mile radius of the permit boundary. No homes were observed existing within the 500-foot radius from the permit boundary. A closed MSW landfill (approximately 13 acres) is located immediately north of the site (across FM 770 on land owned by Hardin County).

7.4 Growth Trends of the Nearest Communities

As shown on Figure I/II-7.4, the City of Kountze, Hardin County, and the Beaumont-Port Arthur Metropolitan Area (a US census area that includes the counties of Hardin, Jefferson, Newton and Orange) selected as representative of growth trends for the population served by the landfill. Census data was used to determine the growth trend (or percent change in population) of the City of Kountze, Hardin County, and the Beaumont-Port Arthur Metro Area. The census information and growth trends for these communities are presented in Table I/II-7.1. The population projections were obtained from the Texas Water Development Board and from the Office of State Demographer, Texas State Data Center.

Table I/II-7.1
Growth Trends

Entity	2000 Census	2010 Census	Growth Rate			
			2010-2020	2021-2030	2031-2040	2041-2050
City of Kountze	2,115	2,123	2,129	2,135	2,139	2,142
Hardin County	48,073	54,635	59,477	63,986	67,194	69,560
Beaumont-Port Arthur Metro Area[1]	385,090	403,190	427,628	453,284	477,367	502,655

[1]Includes the counties of Hardin, Jefferson, Newton, and Orange.

No known major new developments are planned for the area within a 5-mile radius of the site. It is projected that area growth patterns will be consistent with the growth patterns over the last several years (i.e., scattered homes and businesses may continue to be built in the area).

7.5 Proximity to Residences and Other Uses

Based on an examination of a recent aerial photograph, it is estimated that there are 50 residences (houses and mobile homes) located within a 1-mile radius of the permit boundary. The nearest residence is approximately 1,100 feet from the southeast corner of the permit boundary (refer to Figure I/II-7.1). There are no business establishments within 1 mile of the permit boundary, except for the industrial/commercial trailer and shop affiliated with BFI for their hauling operation, located as close as 15 feet from the permit boundary on the northeast portion of the site.

There are no schools, licensed day care facilities, churches, hospitals, or cemeteries within 1 mile of the site. In addition, there are not any known archaeologically significant sites, historical sites, or sites of exceptional aesthetic quality within 1 mile of the permit boundary. The proximity of residences and other uses are shown on the Land Use Map – Aerial (Figure I/II-7.1).

Based on this information, the population density of residential areas within 500 feet and 1 mile of the site is zero persons per acre (for a household population of zero) and 0.044 persons per acre (or an approximate population of 132 for 3012.6 acres), respectively.

7.6 Land Use Conclusions

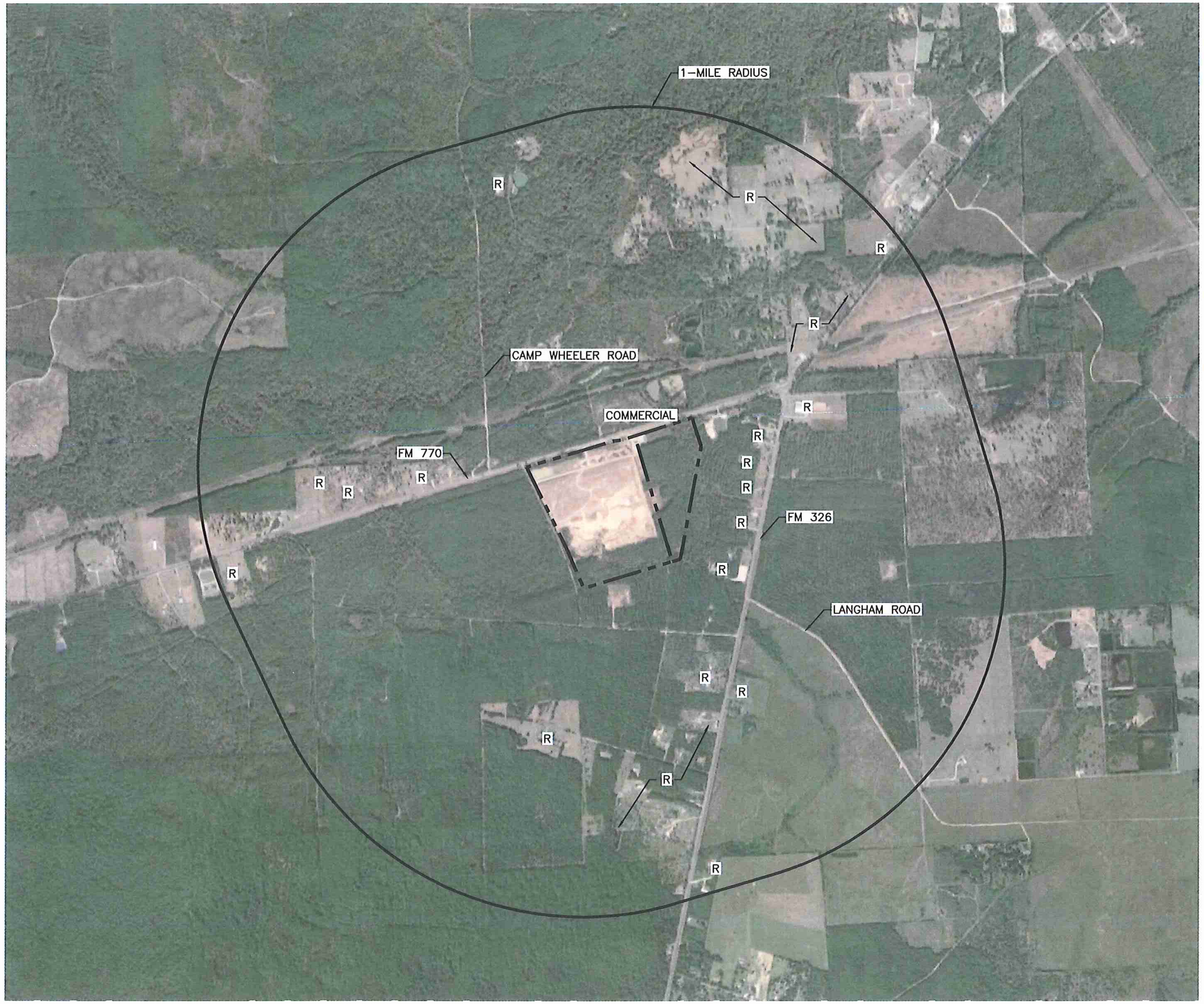
The use of this land for a municipal solid waste site represents a compatible land use for the following reasons.

- The site has been permitted as a landfill since 1995. Prior to the operation of this facility, an adjacent property across FM 770 was used as a landfill.
- The landfill waste placement footprint is considerably buffered from nearby uses. The landfill expansion area provides the required 125 foot minimum buffer requirement listed in 30 TAC §330.543.
- The site has not and will not affect area growth trends.
- The generally rural/undeveloped nature of the existing land uses in the area is compatible with the proposed expansion.
- The site is ideally situated next to a suitable transportation corridor.

In summary, the existing site has long been established as a waste processing and disposal facility. The expansion of the landfill will provide long term waste disposal for area communities at a facility that will continue to be developed to meet or exceed all regulatory requirements. The proposed expansion within the existing 79-acre area permit boundary will have little impact on the surrounding area.

7.7 Water Wells Within 500 Feet

Registered water wells within a one-mile radius of the facility permit boundary are presented in Part III, Appendix IIIG, Figure IIIG-A.10. Two registered water wells were identified within 500 feet of the landfill. These include one well (232600) within the landfill permit boundary and one well (211340) located on the adjacent property, both of which are owned by BFI. Onsite water well 232600 provided water for the landfill prior to being plugged in December 2016. At this time the landfill utilizes water piped from water well 211340 located on the adjacent BFI - owned property. As shown on Figure IIIG-A.10, no other registered water wells are located within 500 feet of the permit boundary. No registered water wells in the landfill area are known to produce groundwater from the same shallow interval as the landfill's uppermost aquifer. Additional details regarding water well searches are presented in Section 1.5 in Appendix IIIG of Part III.



N

0 1000 2000
SCALE IN FEET

LEGEND

EXISTING PERMIT BOUNDARY

BFI EAST PROPERTY BOUNDARY

R RESIDENCE

NOTE:

1. AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH AND DATED 2016.
2. LAND USE INDICATED FROM TIMBER AND UNDEVELOPED AREAS.

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NO.	DATE	DESCRIPTION
1	08/2017	FIRST NOD RESPONSE
2	11/2017	OWNERSHIP CHANGE

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MAJOR PERMIT AMENDMENT
LAND USE AERIAL PHOTOGRAPH

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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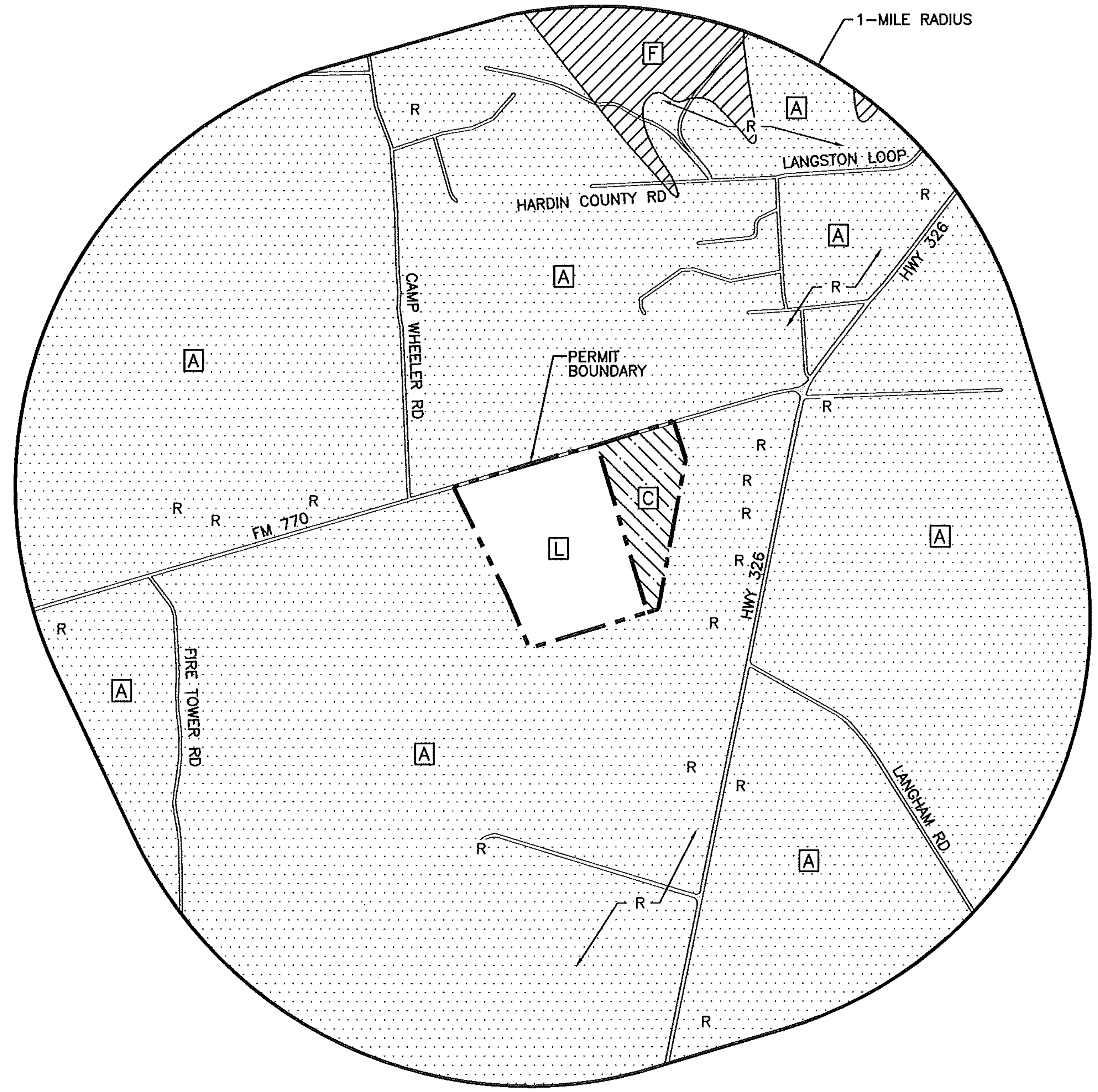

0 1000 2000
SCALE IN FEET

LEGEND

	EXISTING PERMIT BOUNDARY
	BFI EAST PROPERTY BOUNDARY
L	LANDFILL SITE
F	FLOODPLAIN
T	TRANSPORTATION CORRIDOR
A	AGRICULTURE/OPEN SPACE (INCLUDING SCATTERED RESIDENCES)
C	COMMERCIAL
R	RESIDENCE

LAND USE WITHIN 1 MILE OF PERMIT BOUNDARY [1]	
LANDFILL PERMIT BOUNDARY	2.62%
AGRICULTURE/OPEN SPACE (INCLUDING SCATTERED RESIDENCES)	91.85%
FLOODPLAIN	2.22%
TRANSPORTATION CORRIDOR	2.27%
COMMERCIAL	1.04%
TOTAL	100.00%

NOTES:

1. AREAS ARE ESTIMATED.
2. TRANSPORTATION CORRIDOR BASED ON AN ASSUMED TYPICAL ROW WIDTH OF 50 FT.

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1	08/2017	FIRST NOD RESPONSE
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MAJOR PERMIT AMENDMENT
LAND USE MAP

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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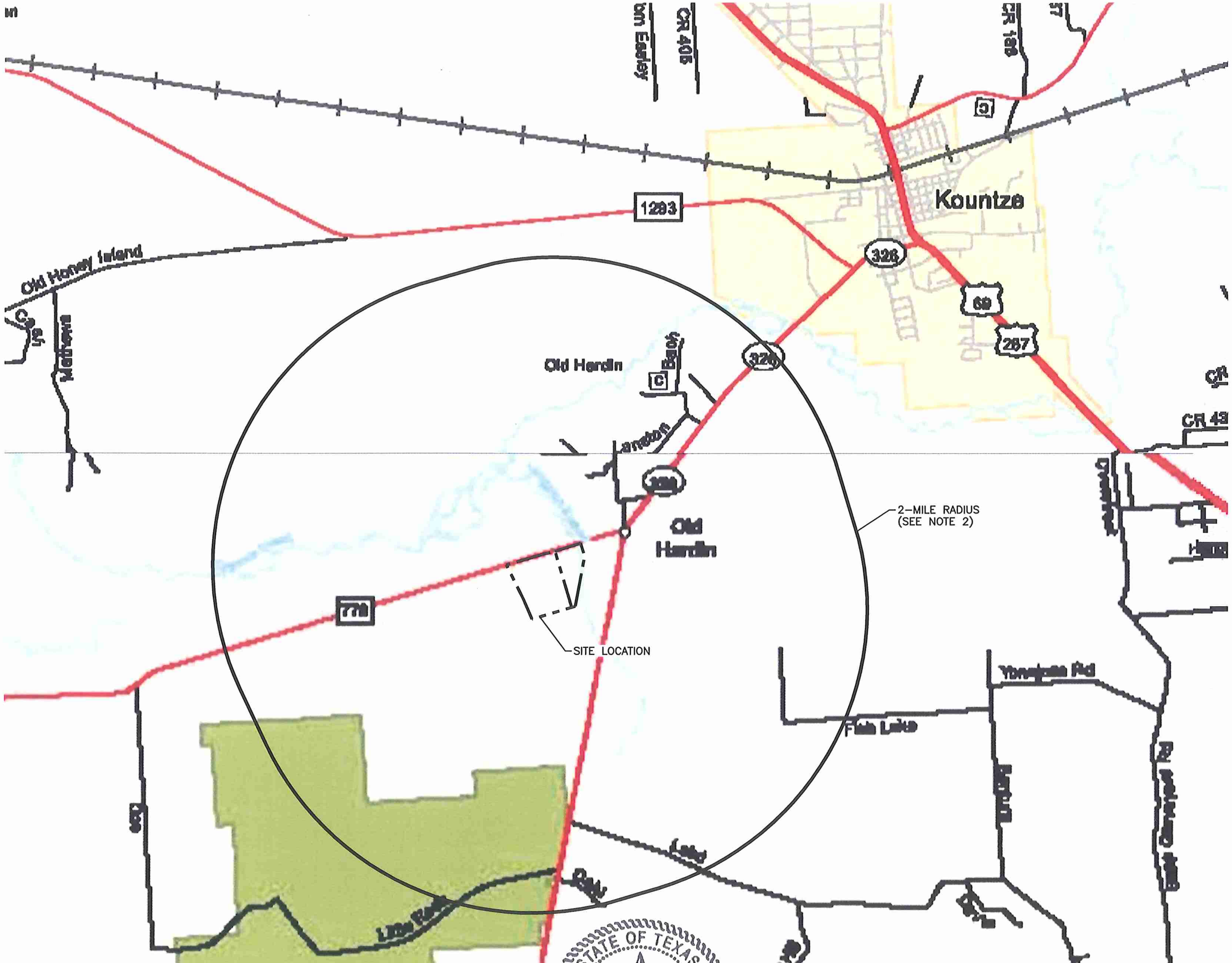

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SCALE IN FEET

LEGEND

EXISTING PERMIT BOUNDARY
BFI EAST PROPERTY BOUNDARY

Legend

IH, BI
US, BU, UA, UP
SH, BS
SL, SS, PR
FM, BF, RM, RR, RE, RS, PA
County Road
City Street or other Non-County Maintained Road
Railroad
Incorporated City
Unincorporated Community
Airport
Airport
Airport Runway
School
Military Installation
Prison
National or State Park
Cemetery
Dam
County Line
District Line
Canal
Flowing Stream
Intermittent Stream
River
Gulf Intracoastal Waterway
Other Body of Water

NOTE:

1. MAP OBTAINED FROM TEXAS DEPARTMENT OF TRANSPORTATION HARDIN COUNTY, TEXAS DATED 2014.
2. NO ZONING EXISTS WITHIN A 2 MILE RADIUS OF THE PERMIT BOUNDARY.

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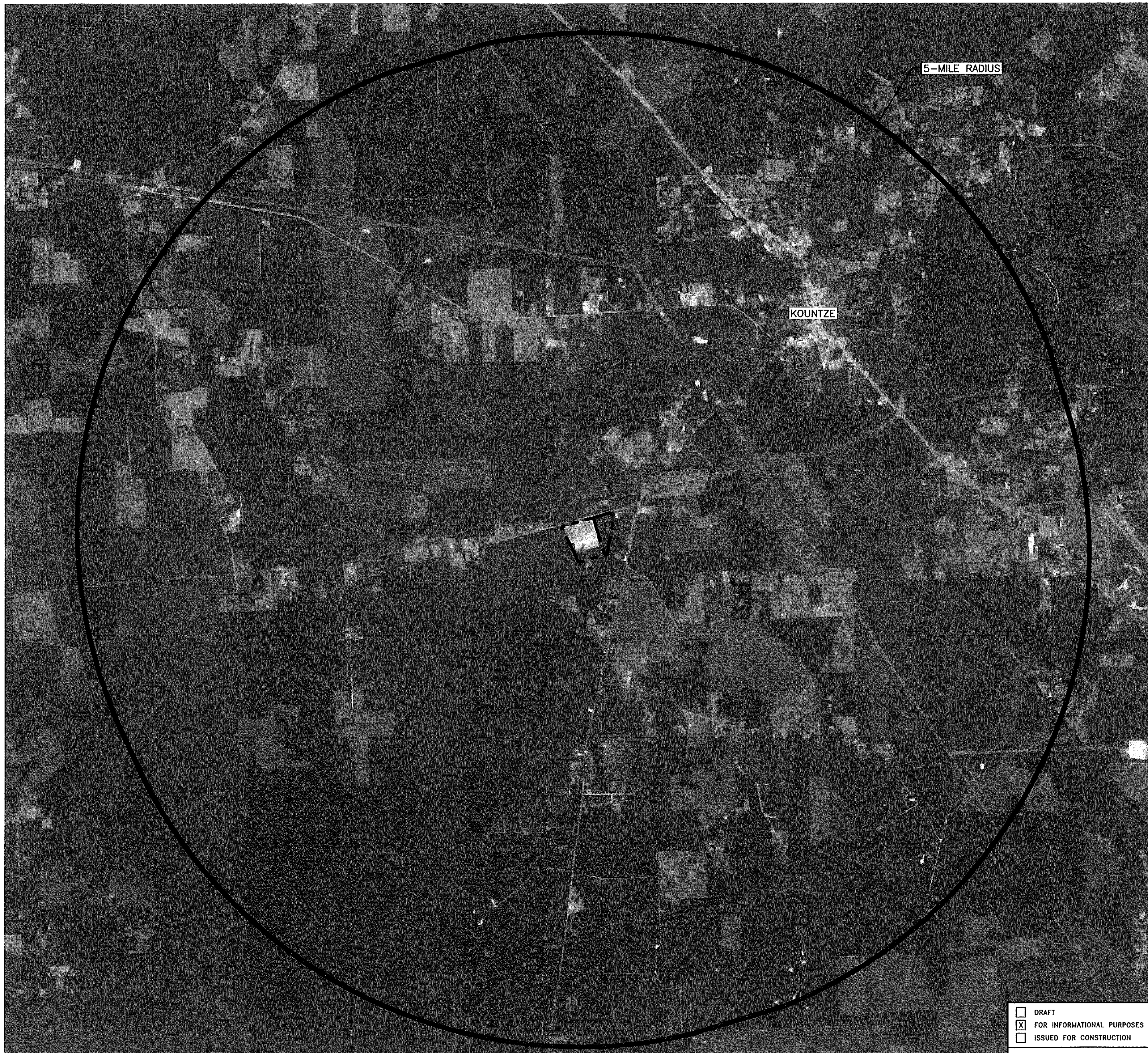
DATE: 03/2017 FILE: 0120-758-11 CAD: I/II 7.3-ZONING MAP.DWG DRAWN BY: SRF DESIGN BY: NT REVIEWED BY: NT	REVISIONS NO. 1 — DATE 11/2017 — DESCRIPTION OWNERSHIP CHANGE	HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group TBPE REGISTRATION NO. F-3727		WWW.WCGRP.COM — DRAWING I/II-7.3



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SCALE IN FEET

LEGEND

EXISTING PERMIT BOUNDARY

BFI EAST PROPERTY BOUNDARY

NOTE:

1. AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH AND DATED 2016.

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MAJOR PERMIT AMENDMENT
CITIES WITHIN 5-MILE RADIUS

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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8 TRANSPORTATION

8.1 Traffic Information

The landfill is served by Farm to Market (FM) 770, and is located approximately 0.7 miles west of the intersection of FM 770 and SH 326. FM 770 and SH 326 provide more than adequate access to the site under existing and future projected traffic conditions.

This section addresses §330.61(i).

A traffic impact study was prepared in October 2016 by WCG to reflect the current site life and expected waste inflow rates for the site. The traffic study is included in Parts I/II, Appendix I/IID.

In summary, the traffic study concludes that the access roads within 1 mile of the landfill will continue to provide excellent access to the site. In addition, the existing roadway, including the intersection of FM 770 and the access roadway to the landfill, will provide good and safe access to the landfill. No roadway improvements are needed.

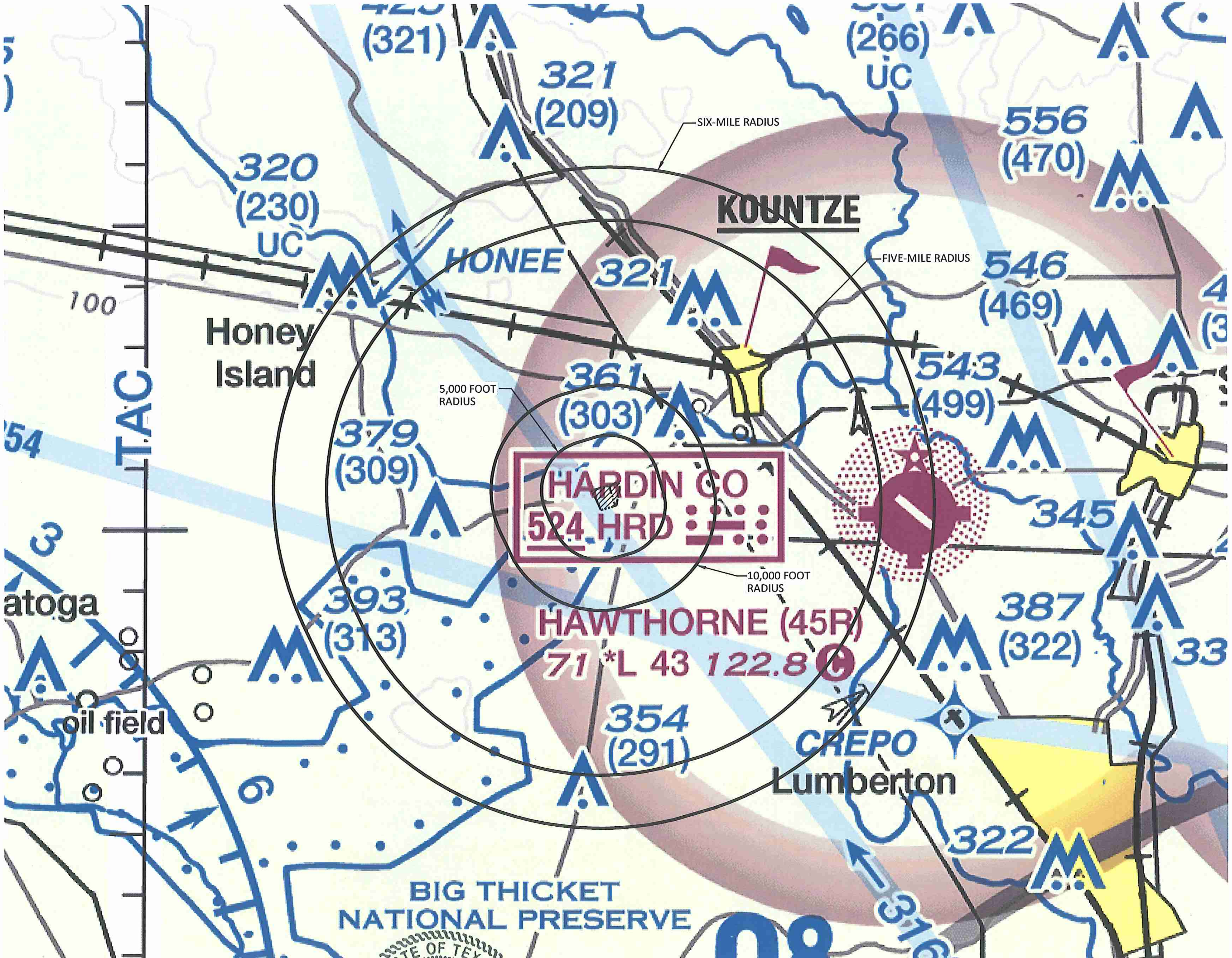
Coordination with TxDOT regarding traffic and location restrictions is included in Appendix I/IIB (TxDOT tab).

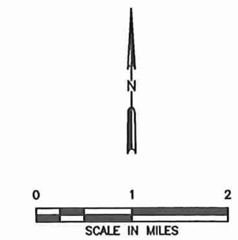
8.2 Airport Impact

TCEQ distance restrictions set forth in 30 TAC §330.545 require land disposal sites to be located no closer than 10,000 feet to any runway end used by turbojet aircraft or no closer than 5,000 feet to any runway end used by piston-engine aircraft. As shown on Figure I/II-8.1, the closest public airport is the Hawthorne Field Airport, located approximately 5.4 miles east of the landfill. The publically-owned airport is owned and operated by Hardin County. Both a wildlife review and a height review were performed for this amendment.

In the FAA's letter dated November 9, 2016 (see correspondence in Appendix I/IIB), the FAA had no objection to the proposed changes from the standpoint of potential bird hazards to aircraft or the height of the expansion. Appendix I/IIB includes a letter from FAA that confirms that the FAA has completed the evaluation necessary to determine that an incompatibility does not exist with area airports and the landfill.

The Airport Safety Location Restriction is included in Appendix I/IIC.

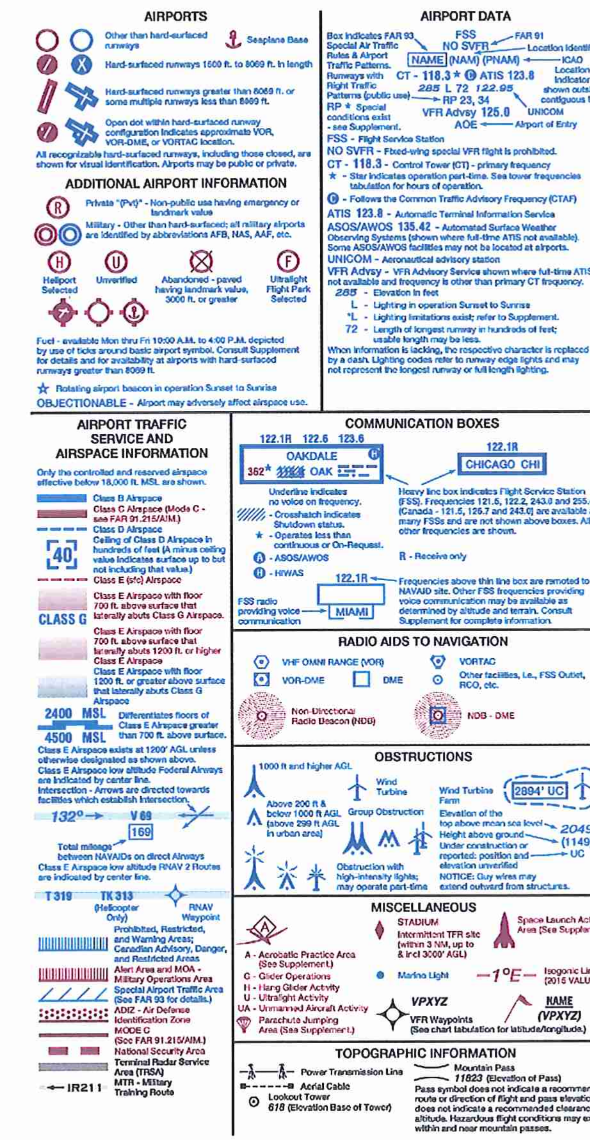




LEGEND

BFI EAST PROPERTY BOUNDARY

PERMIT BOUNDARY



NOTE:

1. THIS MAP REPRODUCED FROM THE FAA HOUSTON SECTIONAL AERONAUTICAL CHART 98th EDITION DATED SEPTEMBER 15, 2016.

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED PROFESSIONAL ENGINEER

12-5-2017

☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR BFI WASTE SYSTEMS OF NORTH AMERICA, LLC		MAJOR PERMIT AMENDMENT FAA AIRPORT VICINITY MAP HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
DATE: 03/2017 FILE: 0771-365-11 CAD: FIG 6-FAA AIRPORT VICINITY MAP.DWG	DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. 1 — DATE 11/2017 — DESCRIPTION: OWNERSHIP CHANGE	
Weaver Consultants Group TBPE REGISTRATION NO. F-3727			WWW.WCGRP.COM — FIGURE I/II – 8.1

0:\0120\758\22148 EXPANSION\PARTS I-II\8.1-AREA AIRPORTS.dwg, 11/15/2017 4:08:44 PM, rsellers, 1:2

STATE OF TEXAS
AARON K. EVANS
GEOLOGY
11143
LICENSED
PROFESSIONAL GEOSCIENTIST

12-05-17

9 GENERAL GEOLOGY AND SOILS STATEMENT

9.1 Geology and Soils

This section addresses §330.61(j).

According to the Texas Bureau of Economic Geology Geologic Atlas of Texas (1992), the site is located upon the Quaternary Lissie Formation as shown on the Figure IIIG-A.1 – Regional Geologic Map in Appendix IIIG of Part III. The Lissie Formation is described as a sequence of interbedded fluviatile channel sands separated by interchannel muds consisting of clay, silt, sand, and minor quantities of gravel. The Lissie formation is approximately 400 feet thick beneath the facility and overlies the Willis Formation. The Pliocene-age Willis Formation, and Miocene-age Goliad Sand Formation, Fleming Formation, and Catahoula Formation constitute the Tertiary aged stratigraphic units that underlay the Lissie Formation. The approximate depths and thicknesses of these units and their predominant lithologic characteristics are summarized in Appendix IIIG of Part III.

Regional aquifers beneath the landfill include the Chicot, Evangeline, and Jasper hydrogeologic units of the larger Gulf Coast Aquifer system. The Gulf Coast Aquifer system is classified by the Texas Water Development Board (TWDB) (Ashworth and Hopkins, 1995) as a major Texas aquifer. The Gulf Coast Aquifer is comprised of, from youngest to oldest, five hydrogeologic units: the Chicot Aquifer, the Evangeline Aquifer, the Burkville Confining System, the Jasper Aquifer, and the Catahoula confining system (Baker, 1979). These hydrogeologic units consist of complex interbedded clays, silts, sands, and gravels which are regionally hydraulically connected and form a large leaky artesian aquifer system.

According to the US Department of Agriculture's Natural Resources Conservation Service (NRCS) website (https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx), the soils at the site consist predominately of Kirbyville sandy loam (43%) with lesser areas of Plank silt loam (24%), Sorter-Dallardsville complex loam (Sorter Series silt loam and Dallardsville Series sandy loam)(18%), and Lelavale silt loam(15%). The NRCS describes these soils as follows:

- Kirbyville Series: very deep (up to 80 inches), moderately to poorly drained, acidic, grading from soft sandy loam at surface to slightly hard sandy clay loam at depth.

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- Plank Series: very deep (up to 180 inches), poorly drained, acidic, grading from firm to hard silty loam at surface to hard clay at depth.
- Sorter Series: very deep (up to 110 inches), poorly drained, acidic, grading from firm to hard silty loam at surface to hard sandy clay loam and fine sandy loam at depth.
- Dallardsville Series: very deep (up to 80 inches), moderately well drained, acidic, hard to very hard fine sandy loam occurring in complex with Sorter Series.
- Lelavale Series: very deep (up to 80 inches), very poorly drained, acidic, grading from firm to hard silty loam at surface to hard clay loam at depth.

The NRCS database indicates all five soil series to be nearly level to gently sloping with less than 2 percent slopes and formed on loamy fluviomarine deposits of the Lissie Formation.

9.2 Fault Areas

The landfill and the surrounding area were examined for the presence of geologic faulting in conformance with §330.555 criteria. The study was conducted by reviewing available literature, maps, and aerial photographs of the area. In addition, a site reconnaissance and review of 45 site borehole logs (drilled to a maximum depth of 98 feet below ground surface) was completed. The subsurface data were analyzed to evaluate the facility for the presence of Holocene faulting. No unusual scarps or topographic breaks were interpreted within 200 feet of the site. No evidence of faulting was found associated with on-site or adjacent roadways. No structural influence of stream courses was observed. In addition, no unusual relief or topographic features, such as sag ponds, truncated alluvial spurs, or offset tributary alignments, were observed. According to the USGS Quaternary Fault and Fold database, the landfill is located within the Gulf-margin normal fault zone area which extends from south Texas to the Florida panhandle. However, the USGS database does not identify individual Quaternary faults within the zone. A review of regional topographic, tectonic, and structural feature maps and data indicated no Holocene faults are located within 200 feet of the landfill permit boundary. Therefore, the site is in compliance with the fault areas location restriction. The fault area location restriction demonstration is included in Appendix I/IIC.

9.3 Seismic Impact Zones

The seismic impact zone location restriction defined by 30 TAC §330.557 is an area with a 10 percent or greater probability that the maximum horizontal acceleration in rock, expressed as a percentage of the earth's gravitational pull, will exceed 0.10 g in 250 years. According to the USGS earthquake hazard website (http:/earthquake.usgs.gov/hazards), the site-specific probability that the maximum horizontal seismic acceleration will exceed 0.1 g (one-tenth of the force of gravity) in a 250-year time period is 0.038 (3.8 percent). As such, the USGS-derived site-specific probability of a horizontal acceleration exceeding 0.1 g is significantly lower than the 10 percent or greater horizontal acceleration required for seismic impact zone classification. Drawing I/IIC-8 in Appendix I/IIC presents a USGS seismic impact zone map (USGS, 2014). As shown on this drawing, the site is not located within a seismic impact zone. For these reasons, the seismic impact zone location restriction does not apply to the Hardin County Landfill. The seismic impact zone location restriction demonstration is included in Appendix I/IIC.

9.4 Unstable Areas

30 TAC §330.359 notes that an unstable area is defined to be a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity of some or all of a landfill's structural components responsible for preventing releases from the landfill: unstable areas can include poor foundation conditions, areas susceptible to mass movement, and karst terrains. As discussed in Appendix I/IIC, Section 10, the bottom liner is founded within a geologic formation that will provide an excellent foundation layer, the final cover system is designed to withstand the predicted differential settlement, the stability analysis shows that each landfill component will be stable and no mass movements will occur. Due to the absence of massive bedded limestone in the near surface beneath the facility, there is no potential for karst development to occur.

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STATE OF TEXAS
NEVZAT TURAN
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12-5-2017

10 GROUNDWATER AND SURFACE WATER STATEMENT

10.1 Groundwater Statement

This section addresses §330.61(k).

Groundwater at the site occurs within the site-specific Upper Sand Stratum and Lower Sand Stratum. The Upper Sand Stratum is the uppermost aquifer for groundwater monitoring purposes. These two saturated strata are separated by the low permeability clay of the Lower Clay Stratum (aquiclude). Groundwater in the Upper Sand Stratum uppermost aquifer flows to the east and northeast toward the Point of Compliance and network of groundwater detection monitoring wells. The uppermost aquifer is further discussed in Part III, Appendix IIIG.

The Lower Clay Stratum aquiclude ranges in thickness from 9 to 26 feet across the site. Table 3-2 in Appendix IIIG of Part III indicates that the low permeability Lower Clay Stratum separating the uppermost aquifer from the underlying Lower Sand Stratum has a vertical hydraulic conductivity of 1.1x10-8 cm/s. A static hydraulic head separation of approximately five feet between the Upper Sand Stratum and Lower Sand Stratum demonstrate a lack of hydraulic interconnectivity between the two saturated sand strata at the site. The site-specific and regional hydrogeology is discussed in Appendix IIIG of Part III.

10.2 Surface Water Statement

The site sits upon a geographical high point, with natural drainage patterns away from the permit boundary. Surface water flowing off the permit boundary onto adjacent properties flows in a generally south/southeast direction. As discussed in Section 4 of Appendix IIIF – Drainage Report, the postdevelopment peak discharge into Longton Branch or any other downstream drainage structure is not adversely impacted by the proposed vertical expansion of the landfill.

For the proposed expansion, the final cover system will include erosion control structures to effectively minimize erosion of final cover soils. The proposed drainage system also includes a perimeter channel system that will convey stormwater collected from the landfill surface to the south permit boundary, into a detention pond designed specifically for the landfill expansion. The detention pond will be used to route water from the permit property prior to discharge onto the abutting property at a discharge rate that does not exceed the post-development discharge rate set forth in the original MSW permit. The perimeter channels have been designed to carry the 25-year storm event to the detention pond. The detention pond has been designed to release the collected stormwater at a rate that is consistent with the existing permitted drainage conditions.

The site is designed to prevent the unauthorized discharge of pollutants into waters of the state or waters of the United States, as defined by the Texas Water Code and the Federal Clean Water Act, respectively. The landfill is subject to TCEQ's storm water permit requirements. A copy of the Multi-Sector General Permit (MSGP) TPDES permit authorization is included in Appendix I/IIE. Surface water monitoring will be conducted consistent with TPDES requirements. Given the above, the applicant understands and is in full compliance with TPDES under the Clean Water Act, Section 402 as amended.

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12-5-2017

11 FLOODPLAINS AND WETLANDS STATEMENT

11.1 Floodplains Statement

This section addresses §330.61(m).

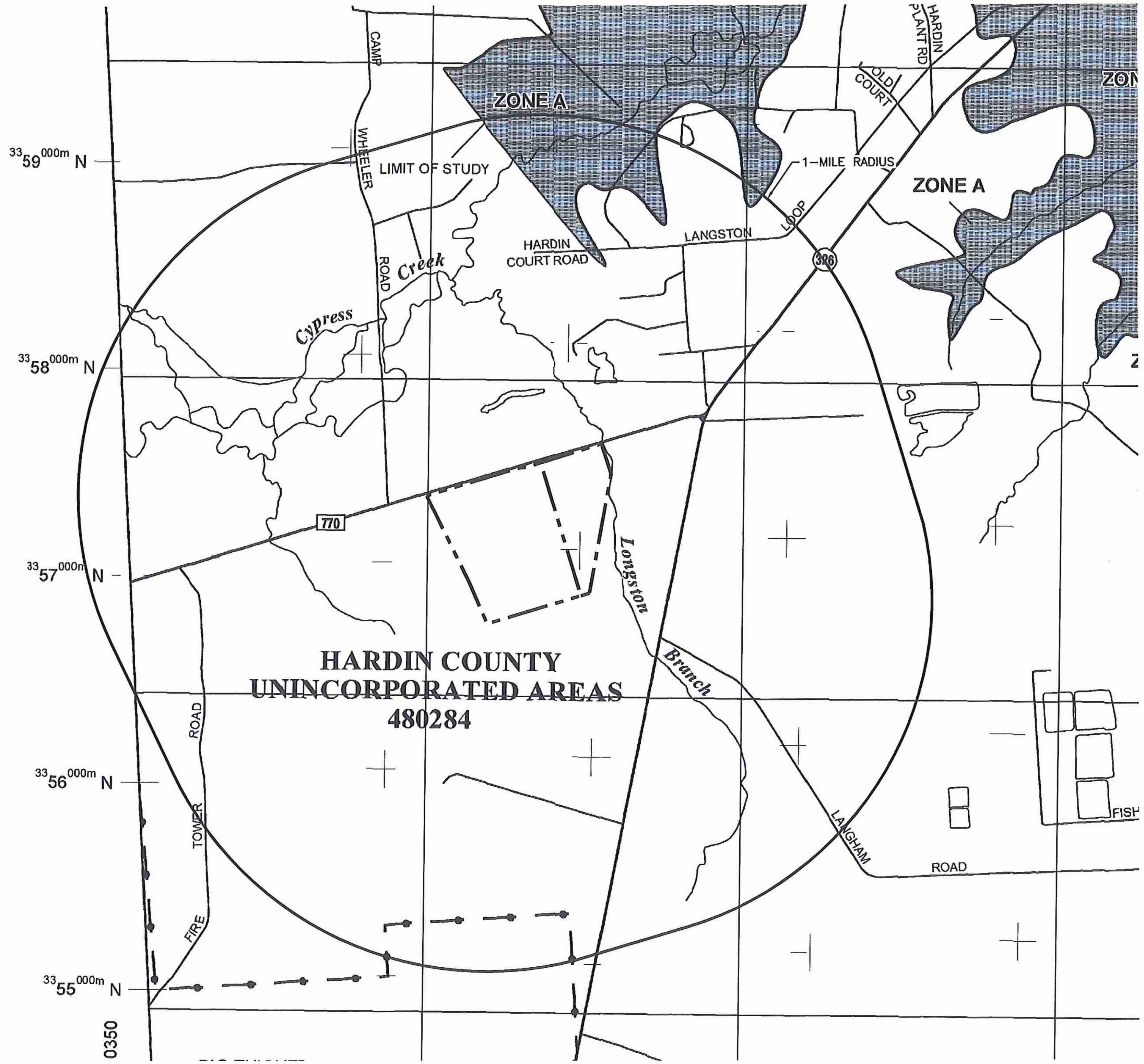
A floodplain evaluation was prepared in support of the 1995 MSW permit that demonstrates that the permit site is not located within a 100-year floodplain. In general, the permit property sits upon a higher elevation than surrounding properties, with surface water from the permit property flowing over the surface downslope onto adjacent properties.

Based on the above, the proposed subsurface and vertical expansion of the landfill will not restrict the flow of the 100-year flood, reduce the temporary water stage capacity of the floodplain, or result in washout of solid waste. Compliance with the floodplain location restrictions is further discussed in Appendix I/IIC.

The FEMA Flood Insurance Rate Map for the area of the landfill is provided on Figure I/II-11.1. As shown, no floodplains or floodways exist within the permit boundary.

11.2 Wetlands Statement

Goshawk Environmental Consulting, Inc. (Goshawk) performed a delineation of the aquatic features of the BFI property (111 acres total, which included the 79-acre landfill permit property), which was compiled into a delineation report. A copy of the delineation report is included in this appendix. Data from the records review and field investigations concluded that property does not contain any jurisdictional waters of the US. The report was submitted to the US Army Corps of Engineers (USACE) for a regulatory determination of jurisdiction under Section 404 of the Clean Water Act for each aquatic resource identified within the property. In correspondence dated April 18, 2016, the USACE concluded, based on review of the report, additional off-site data, and information provided and acquired during a February 10, 2016 site visit, that the 111-acre property does not contain waters of the United States, including jurisdictional wetlands. The USACE further concluded that the subject property is not subject to Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbors Act, and the discharge of fill material onto the property does not require a Department of Army permit. The April 18, 2016 USACE correspondence included an approved jurisdictional determination for the property. A copy of the USACE letter is included in this appendix.



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SCALE IN FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0375F

FIRM
FLOOD INSURANCE RATE MAP
HARDIN COUNTY, TEXAS
AND INCORPORATED AREAS

PANEL 375 OF 650
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
HARDIN COUNTY	480284	0375	F
KOUNTZE, CITY OF	480845	0375	F

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER 48199C0375F

MAP REVISED OCTOBER 6, 2010

Federal Emergency Management Agency

EXISTING PERMIT BOUNDARY
BFI EAST PROPERTY BOUNDARY

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

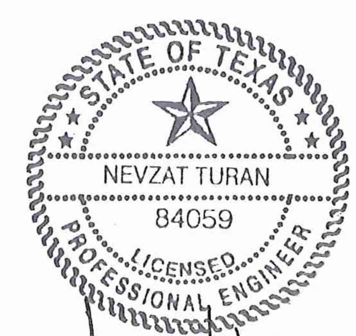
CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

Floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

(A)—(A)	Cross section line
(23)- - - - -(23)	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
$^{42}75^{000m}$N	1000-meter Universal Transverse Mercator grid, zone 15
6000000 FT	5000-foot grid : Texas State Plane coordinate system, central zone (FIPSZONE 4203), Lambert Conformal Conic
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile



12-5-2017

☐ DRAFT ☒ FOR INFORMATIONAL PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR BFI WASTE SYSTEMS OF NORTH AMERICA, LLC		MAJOR PERMIT AMENDMENT PRELIMINARY FLOOD INSURANCE RATE MAP (FIRM) HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
DATE: 03/2017 FILE: 0120-758-11 CAD: I/II 11.2-FIRM.DWG	DRAWN BY: SRF DESIGN BY: NT REVIEWED BY: NT		

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2017	OWNERSHIP CHANGE

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

WWW.WCGRP.COM

DRAWING I/II-11.1

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12 PROTECTION OF ENDANGERED SPECIES

This section addresses §330.61(n).

A written request regarding endangered or threatened species or their critical habitat with respect to the site was sent to the U.S. Fish and Wildlife Service (FWS) and the Texas Parks and Wildlife Department (TPWD). Correspondence with the FWS and TPWD is included in Appendix I/IIB.

In addition, a site specific threatened and endangered species habitat assessment was completed in May 1993 for the facility, a copy of which was provided to FWS and TPWD (refer to the TPWD and FWS tabs in Appendix I/IIB). This study concluded that the area within the landfill permit boundary would not likely be occupied by any federally-listed threatened or endangered species.

A response to the initial submittal of this 1993 report was received from the FWS requesting that an additional assessment be performed that obtained project-specific fish and wildlife resources from FWS using the IPaC system. A December 2015 site-specific threatened and endangered species habitat assessment previously completed by Goshawk Environmental Consultants, Inc. was then submitted to FWS. This study utilized the IPaC system to obtain project-specific fish and wildlife resources. This study concluded that it is highly unlikely any federally listed species would occur on the site and that no state-listed species are known to exist on the site and were not observed. A copy of this report and associated correspondence is also included in this appendix.

The 79-acre site has been substantially cleared and disturbed during previously authorized landfill operations and construction activity. Therefore, it is concluded that the subsurface and vertical expansion of the landfill will not result in the destruction or adverse modification of the critical habitat of any threatened or endangered species, or cause or contribute to the taking of any threatened or endangered species.

Given the above, the facility is in compliance with all applicable federal, state, and local laws regarding threatened or endangered species.

13 LEGAL DESCRIPTION

A legal description of the 79-acre permit boundary is included on the following pages. The area within the permit boundary is owned by BFI Waste Systems of North America, LLC. The current ownership record for the property may be found as Tract 2 of Volume 900, Pages 747-749 of the Hardin County Deed Records.

This section addresses §330.59(d)(1).

The limits of waste (fill area) was recorded in October 1995 in Volume 7, Page 210 of the Hardin County Deed Records. A copy of the legal description is also included on the following pages.

EXHIBIT "A"

Being 79.000 acres of land located in the HARDIN COUNTY SCHOOL, LAND SURVEY NO. 315, ABSTRACT NO. 535 in Hardin County, Texas and being part of the 1,107.80 acre tract of land described as Tract 54 in the deed from Nona Mills Company to Southland Paper Mills, Inc. dated December 31, 1968 and recorded in Volume 539 page 90 of the Deed Records of Hardin County, Texas. Said 79.000 acre tract being more particularly described by metes and bounds as follows to-wit:

BEGINNING at the North corner of the herein describe 79.000 acre tract, a 3" round concrete monument stamped HR-488JYH set for corner witnessed by an 11" Pine South 67 deg. 17 min. East 42.60 feet, an 11" Pine South 58 deg. 03 min. East 39.47 feet, and an 8" Pine South 42 deg. 57 min. East 42.04 feet and from said corner the South corner of a 6.368 acre tract of land described in the deed from Champion International Corporation to the County of Hardin dated March 28, 1990 bears North 59 deg. 24 min. 07 sec. East 758.50 feet and the South corner of the 20.00 acre tract of land descried in the Judgement styled Hardin County, Texas vs. St. Regis Paper Company, dated January 29, 1982 and recorded in Volume 22 page 465 of the District Court Records of the said county bears North 89 deg. 54 min. 52 sec. West 500.22 feet;

THENCE South 13 deg. 47 min. 42 sec. East with the Northeast boundary line of the said 79.000 acre tract, at 2098.70 feet the East corner of the said 79.000 acre tract, a 3" round concrete monument stamped HR-779XX set for corner witnessed by a 9" Pine North 66 deg. 15 min. East 51.98 feet, a 9" Sweet Gum South 25 deg. 54 min. West 13.60 feet, and a 12" Pine South 59 deg. 50 min. West 10.93 feet;

THENCE South 76 deg. 12 min. 18 sec. West with the Southeast boundary line of the said 79.000 acre tract, at 1479.87 feet the South corner of the said 79.000 acre tract, a 3" round concrete monument stamped HR-779XY set for corner witnessed by a 7" Pine South 28 deg. 40 min. East 17.48 feet, an 8" Pine South 34 deg. 01 min. West 16.24 feet, and a 10" Pine North 76 deg. 37 min. West 14.16 feet;

THENCE North 20 deg. 19 min. 27 sec. West with the Southwest boundary line of the said 79.000 acre tract, at 695.29 feet an angle corner in the Southwest boundary line of the said 79.000 acre tract, a 3" round concrete monument stamped HR-779X set for corner witnessed by a 7" Pine South 88 deg. 29 min. East 64.80 feet, an 8" Pine South 81 deg. 05 min. East 48.63 feet, and an 11" Pine South 55 deg. 38 min. West 93.15 feet;

THENCE North 23 deg. 20 min. 09 sec. West continuing with the Southwest boundary line of the said 79.000 acre tract, a 1447.96 feet intersect the Southeast right of way line of FM Highway No. 770, a 3" round concrete monument stamped HR-778X set for corner witnessed by a 17" Pine North 89 deg. 54 min. East 25.99 feet, a 13" Pine South 39 deg. 38 min. West 94.25 feet, and a 7" Holly South 73 deg. 31 min. West 110.75 feet;

THENCE North 76 deg. 12 min. 18 sec. East with the Southeast right of way of the said FM Highway and the Northwest boundary line of the said 79.000 acre tract, at 1462.93 feet an angle corner in the said Southeast right of way line, a 3" x 3" concrete monument for corner witnessed by a 9" Pine South 01 deg. 41 min. East 58.22 feet, an 8" Pine South 00 deg. 23 min. West 66.64 feet, an 8" Pine South 05 deg. 20 min. West 68.48 feet, and a 13" Pine South 06 deg. 35 min. West 51.93 feet;

THENCE North 87 deg. 31 min. 05 sec. East continuing with the said Southeast right of way line and the Northwest boundary line of the said 79.000 acre tract, at 101.98 feet an angle corner in the said Southeast right of way line, a 3" x 3" concrete monument for corner witnessed by a 10" Pine South 62 deg. 22 min. East 44.56 feet, an 9" Pine South 52 deg. 16 min. East 48.42 feet, a 9" Pine South 44 deg. 43 min. East 34.43 feet, and a 10" Pine South 27 deg. 26 min. East 28.72 feet;

THENCE North 76 deg. 12 min. 18 sec. East continuing with the said Southeast right of way line and the Northwest boundary line of the said 79.000 acre tract, at 236.00 feet the point and place of BEGINNING, containing 79.000 acres of land, more or less.

Shine & Johnston, Inc.
Professional Surveyors

STATE OF TEXAS <>

COUNTY OF HARDIN <>

Field notes describing a 56.729 acre tract, same being the proposed fill area for the Hardin County landfill out of a 79.000 acre tract out of the Hardin County School Land Survey #315, Abstract 535, Hardin County, Texas. Said 79.000 acre tract is out of the 1,107.80 acre tract of land described as Tract 54 in a deed from Nona Mills Company to Southland Paper Mills, Inc. dated December 31, 1968 and recorded in Volume 539 page 90 of the Deed Records of Hardin County, Texas.

NOTE: Bearings herein are oriented to the call bearings on the 79.000 acre tract as described in Tract #2 of Volume 900, Page 747 of the Deed Records of Hardin County, Texas. (See aaccompanying plat)

BEGINNING at a 1/2" iron rod with cap stamped "S&J 2079" set at the northwest corner of the herein described tract. Said beginning iron rod bears S 41°25'58" E 173.84 feet from a concrete monument stamped "HR778-X" found at the northwest corner of said 79.000 acre tract in the south right-of-way line of F.M. Hwy. No. 770.

THENCE N 76°12'33" E one-hundred and fifty-four feet perpendicular distance southerly from and parallel with the most northerly north line of said 79.000 acre tract 1664.07 feet to a 1/2" iron rod with cap stamped "S&J 2079" set for corner.

THENCE S 13°47'44" E fifty-four feet perpendicular distance westerly from and parallel with the east line of said 79.000 acre tract 1614.70 feet to a 1/2" iron rod with cap stamped "S&J 2079" set for corner.

THENCE S 76°12'44" W three-hundred and fifty feet perpendicular distance northerly from and parallel with the south line of said 79.000 acre tract 1411.48 feet to a 1/2" iron rod with cap stamped "S&J 2079" set for corner.

THENCE N 20°18'30" W fifty-four feet perpendicular distance easterly from and parallel with the most southerly west line of said 79.000 acre tract 350.50 feet to a 1/2" iron rod with cap stamped "S&J 2079" set for corner.

145 East Avenue H
P. O. Box 391
Silsbee, Texas 77656
(409) 385-5266
FAX (409) 385-0936

THENCE N 23°20'09" W fifty-four feet perpendicular distance easterly from and parallel with the most northerly west line of said 79.000 acre tract 1284.18 to the PLACE OF BEGINNING, containing 56.729 acres of land.

I, J. Gilbert Johnston, Registered Professional Land Surveyor Number 2079 in the State of Texas, do hereby certify that the above field notes reflect an actual survey made by me on the ground and according to law; that the limits, boundaries and corners, with the marks, natural and artificial, are truly described in the foregoing field notes just as I found them on the ground.

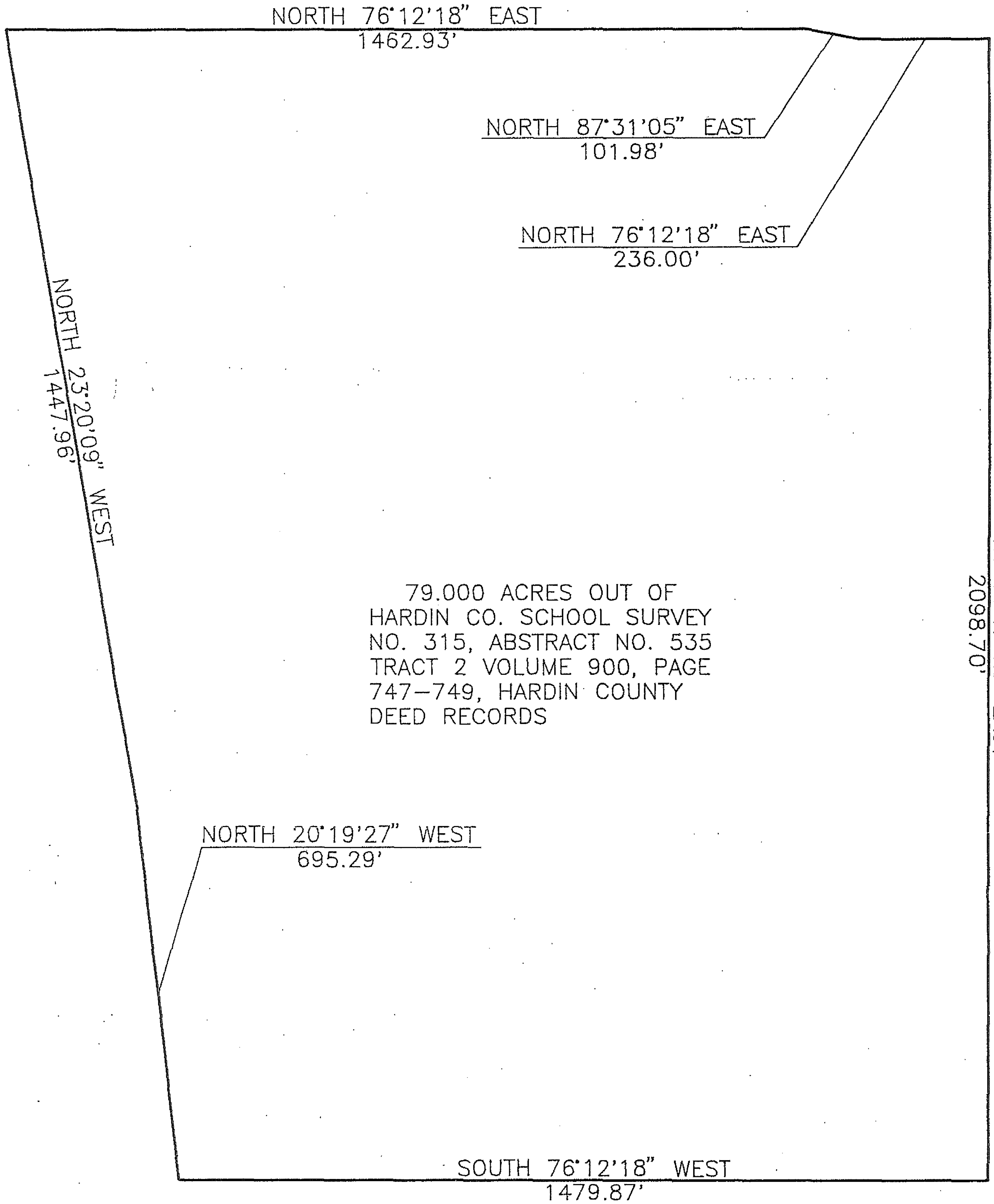
Given under my hand and seal this 28th day of September, 1995.

STATE OF TEXAS
REGISTERED
J. GILBERT JOHNSTON
2079
PROFESSIONAL LAND SURVEYOR

J. Gilbert Johnston
Registered Professional Land Surveyor No. 2079

2HCSL535.995

I, DEE HATTON, COUNTY CLERK IN and for HARDIN COUNTY, TEXAS, do hereby certify that the forgoing is a true and correct copy as same appears on record in my office. Witness my hand and seal of office on: 10-3-95
DEE HATTON, COUNTY CLERK
Hardin County, Texas
By Deputy: Sherry Cook
SHERRY COOK



LAND WEST, SOUTH, AND EAST OF PROPERTY OWNED BY CHAMPION INTERNATIONAL.

CONTACT: DAVE LATERNO
CHAMPION INTERNATIONAL
P.O. BOX 1873
KOUNTZE, TX. 77625
(409) 246–4608

PROPOSED SITE FRONTS ON FM 770

CONTACT: WALTER O. CROOK, P.E.
DISTRICT ENGINEER,
TxDOT DISTRICT XX
P.O. BOX 3468
BEAUMONT, TX. 77704

LAND ON THE NORTH SIDE OF FM 770 ACROSS FROM THE SITE IS OWNED BY THE APPLICANT.

SCALE IN FEET

200 0 200

SCALE: 1"=200'

N

FOR PERMITTING PURPOSES ONLY

STATE OF TEXAS
BILLY A. SIMS
53016
REGISTERED
PROFESSIONAL ENGINEER

I/II-13-6

PERMIT NO. MSW 2214 - APPROVED, ISSUED, AND EFFECTIVE JULY 28, 1995

KSA ENGINEERS, INC. ENGINEERS - SURVEYORS
1313 S. JOHN REDDITT DR.–P.O. BOX 151508
LUFKIN, TEXAS 75915–1508 (409) 637–6061
DALLAS LONGVIEW LUFKIN TYLER

SURVEYED	DESIGNED	DRAWN	APPROVED	JOB NO.	DATE
NA	ALS II	DLM	BDS	HN–001	AUG. 1994

PROJECT NAME: HARDIN COUNTY LANDFILL PERMIT APPLICATION–PART I&II

SHEET NAME: DEED DRAWING

DRAWING SCALE: VERT: NONE HORIZ: 1"=200'
PLOT: AUG. 199
FN: PROPERTY

SHEET NO. 17 OF

Shine & Johnston, Inc.
Professional Surveyors

STATE OF TEXAS <>

COUNTY OF HARDIN <>

Field notes describing a 56.729 acre tract, same being the proposed fill area for the Hardin County landfill out of a 79.000 acre tract out of the Hardin County School Land Survey #315, Abstract 535, Hardin County, Texas. Said 79.000 acre tract is out of the 1,107.80 acre tract of land described as Tract 54 in a deed from Nona Mills Company to Southland Paper Mills, Inc. dated December 31, 1968 and recorded in Volume 539 page 90 of the Deed Records of Hardin County, Texas.

NOTE: Bearings herein are oriented to the call bearings on the 79.000 acre tract as described in Tract #2 of Volume 900, Page 747 of the Deed Records of Hardin County, Texas. (See aaccompanying plat)

BEGINNING at a 1/2" iron rod with cap stamped "S&J 2079" set at the northwest corner of the herein described tract. Said beginning iron rod bears S 41°25'58" E 173.84 feet from a concrete monument stamped "HR778-X" found at the northwest corner of said 79.000 acre tract in the south right-of-way line of F.M. Hwy. No. 770.

THENCE N 76°12'33" E one-hundred and fifty-four feet perpendicular distance southerly from and parallel with the most northerly north line of said 79.000 acre tract 1664.07 feet to a 1/2" iron rod with cap stamped "S&J 2079" set for corner.

THENCE S 13°47'44" E fifty-four feet perpendicular distance westerly from and parallel with the east line of said 79.000 acre tract 1614.70 feet to a 1/2" iron rod with cap stamped "S&J 2079" set for corner.

THENCE S 76°12'44" W three-hundred and fifty feet perpendicular distance northerly from and parallel with the south line of said 79.000 acre tract 1411.48 feet to a 1/2" iron rod with cap stamped "S&J 2079" set for corner.

THENCE N 20°18'30" W fifty-four feet perpendicular distance easterly from and parallel with the most southerly west line of said 79.000 acre tract 350.50 feet to a 1/2" iron rod with cap stamped "S&J 2079" set for corner.

145 East Avenue H
P. O. Box 391
Silsbee, Texas 77656
(409) 385-5266
FAX (409) 385-0936

THENCE N 23°20'09" W fifty-four feet perpendicular distance easterly from and parallel with the most northerly west line of said 79.000 acre tract 1284.18 to the PLACE OF BEGINNING, containing 56.729 acres of land.

I, J. Gilbert Johnston, Registered Professional Land Surveyor Number 2079 in the State of Texas, do hereby certify that the above field notes reflect an actual survey made by me on the ground and according to law; that the limits, boundaries and corners, with the marks, natural and artificial, are truly described in the foregoing field notes just as I found them on the ground.

Given under my hand and seal this 28th day of September, 1995.

STATE OF TEXAS REGISTERED ★ J. GILBERT JOHNSTON 2079 PROFESSIONAL LAND SURVEYOR

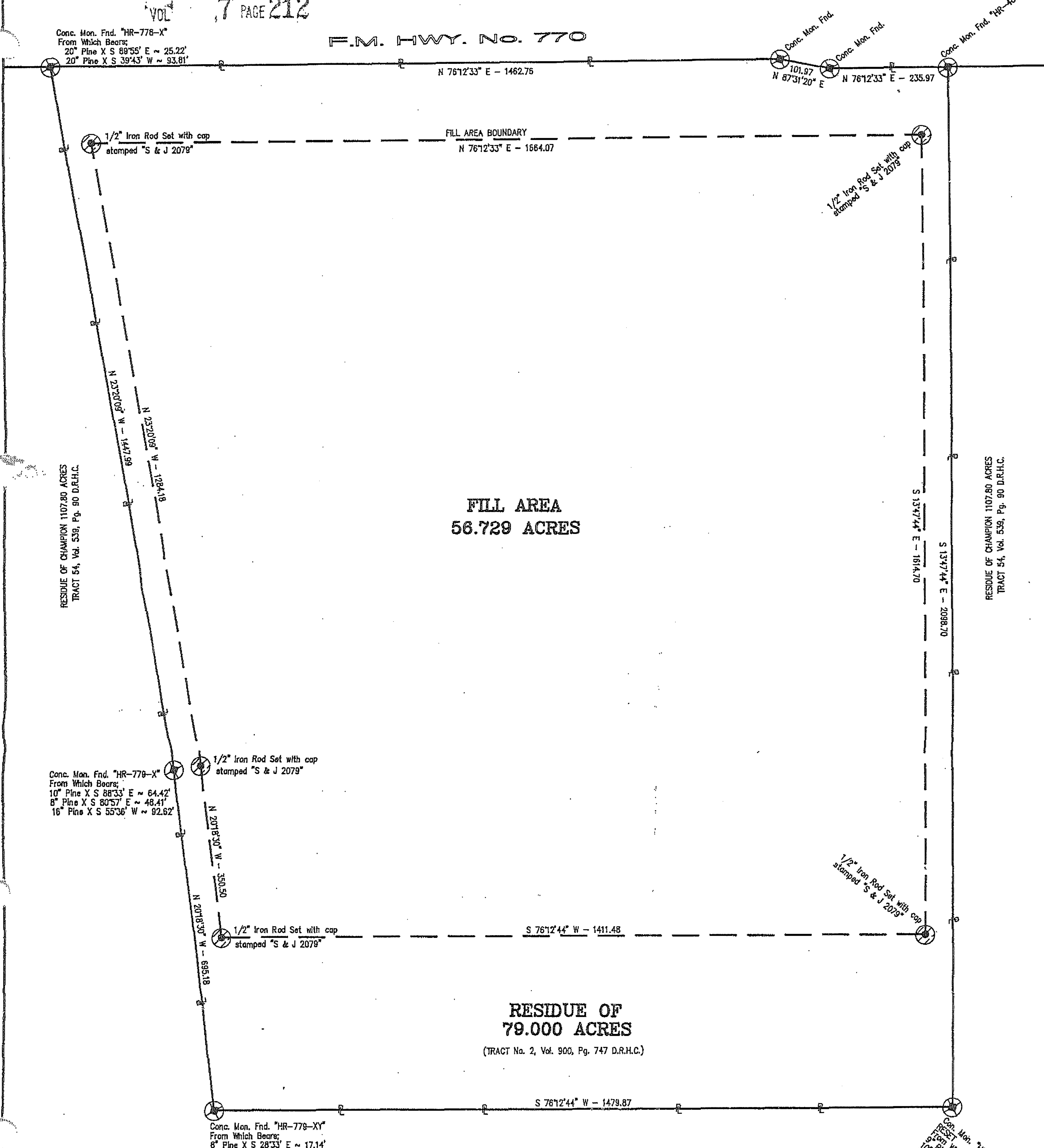
J. Gilbert Johnston
Registered Professional Land Surveyor No. 2079

2HCSL535.995

I, DEE HATTON, COUNTY CLERK IN and for HARDIN COUNTY, TEXAS, do hereby certify that the forgoing is a true and correct copy as same appears on record in my office. Witness my hand and seal of office on: 10-3-95
DEE HATTON, COUNTY CLERK
Hardin County, Texas
By Deputy: Sherry Cook
SHERRY COOK

File Name: LANDFILL TMH
Plot Date: 19 SEP 95

VOL 7 PAGE 212



NOTE: BEARINGS HEREON ARE ORIENTED TO THE CALL BEARINGS ON THE 79.000 ACRE TRACT AS DESCRIBED IN TRACT #2 OF VOL. 900, PG. 747 OF THE DEED RECORDS OF HARDIN COUNTY, TEXAS.

SURVEY PLAT SHOWING

PROPOSED 56.729 ACRE FILL AREA

FOR THE

HARDIN COUNTY LANDFILL SITE

OUT OF THE

HARDIN COUNTY SCHOOL LAND SURVEY #315

ABSTRACT 535

Harcin County, Texas

19 September, 1995

STATE OF TEXAS
REGISTERED
J. GILBERT JOHNSTON
2079
PROFESSIONAL LAND SURVEYOR

J. GILBERT JOHNSTON
REGISTERED PROFESSIONAL LAND SURVEYOR NO. 2079

LEGEND
- PROPERTY LINE
- BARBED WIRE FENCE
- CHAIN LINK FENCE
- FLOW LINE OF DITCH
- LEACHATE PIPE
- MONITORING WELL
- CLEAN OUT
- BUFFER ZONE MARKER
- BOUNDARY MARKER
- BENCH MARKS

S&J

200 0 200

SCALE: 1" = 200'

Shine & Johnston, Inc.
P.O. Box 391
Silsbee, Texas. 77656
(409) 385-5266

I/II-13-9

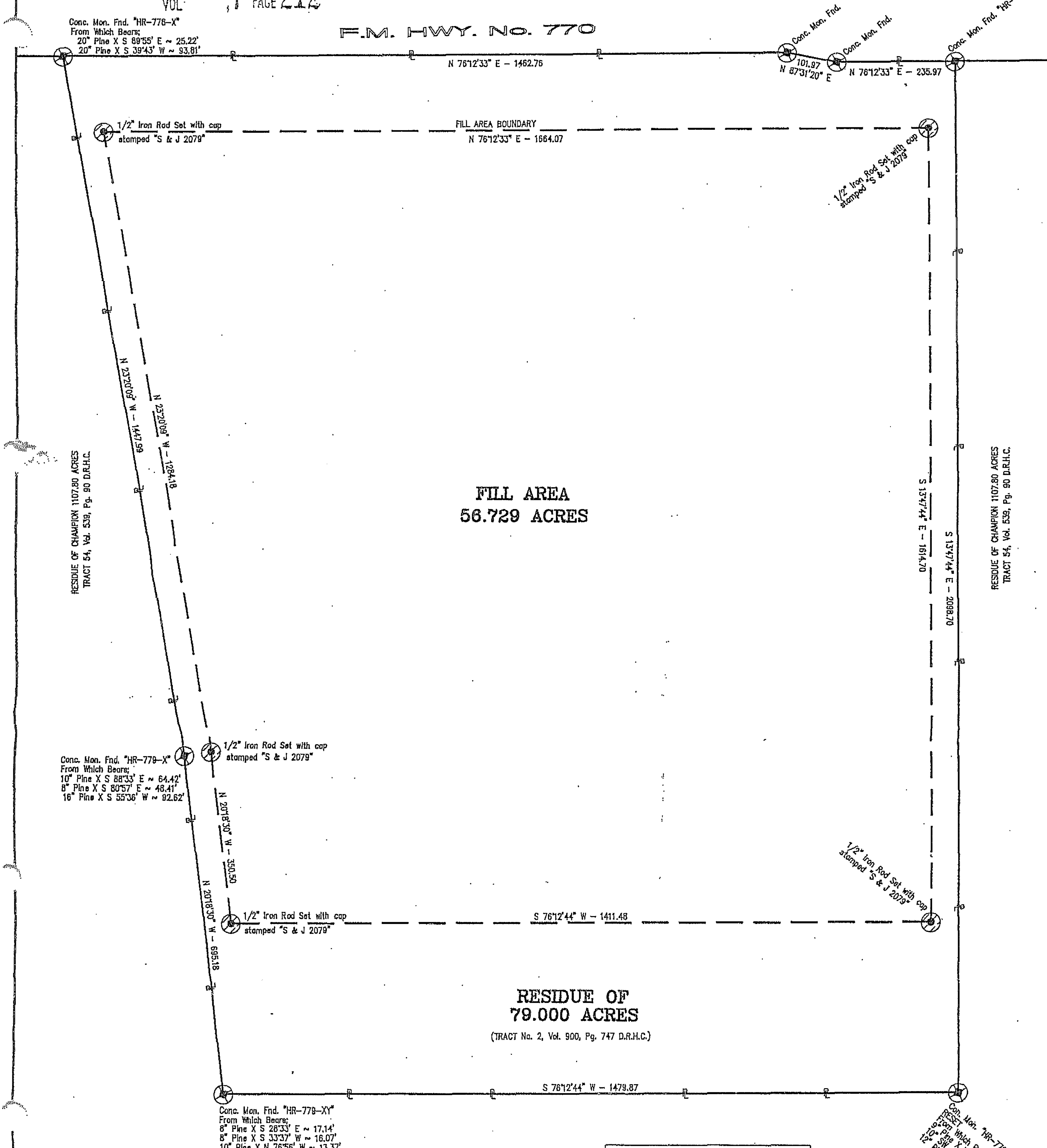
14 PROPERTY OWNER AFFIDAVIT

A property owner affidavit from BFI Waste Systems of North America, LLC and the legal description of the property are included in this section.

This section addresses §330.59(d)(2).

File Name: LA TMH
Plot Date: 19 95

VOL 7 PAGE 212



NOTE: BEARINGS HEREON ARE ORIENTED TO THE CALL BEARINGS ON THE 79.000 ACRE TRACT AS DESCRIBED IN TRACT #2 OF VOL. 900, PG. 747 OF THE DEED RECORDS OF HARDIN COUNTY, TEXAS.

SURVEY PLAT SHOWING

PROPOSED 56.729 ACRE FILL AREA

FOR THE

HARDIN COUNTY LANDFILL SITE

OUT OF THE

HARDIN COUNTY SCHOOL LAND SURVEY #315
ABSTRACT 535

Harcin County, Texas

19 September, 1995

LEGEND
- PROPERTY LINE
- BARBED WIRE FENCE
- CHAIN LINK FENCE
- FLOW LINE OF DITCH
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- CLEAN OUT
- BUFFER ZONE MARKER
- BOUNDARY MARKER
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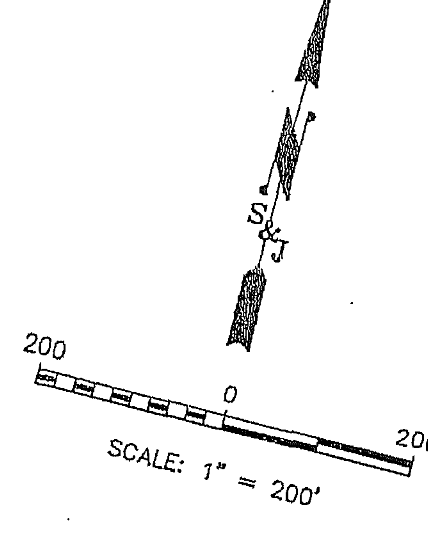

SCALE: 1" = 200'

STATE OF TEXAS
REGISTERED
J. GILBERT JOHNSTON
2079
PROFESSIONAL
LAND SURVEYOR

J. GILBERT JOHNSTON
REGISTERED PROFESSIONAL LAND SURVEYOR NO. 2079

Shine & Johnston, Inc.
P.O. Box 391
Silsbee, Texas. 77656
(409) 385-5266

I/II-14-1a

PROPERTY OWNER AFFIDAVIT

STATE OF TEXAS §
§
COUNTY OF HARDIN §

On this day, Ruby Teague, on behalf of BFI Waste Systems of North America, LLC, appeared before me, the undersigned notary public, and after I administered an oath to him upon his oath he said:

"My name is Ruby Teague. I am more than 21 years of age and capable of making this affidavit."

BFI Waste Systems of North America, LLC, hereafter referred to as the site owner, acknowledges that:

- The State of Texas may hold the site owner of record either jointly or severally responsible for the operation, maintenance, and closure and postclosure care of the site.
- The site owner has a responsibility to file with the County deed records an affidavit to the public advising that the permitted property has been used for a solid waste facility, at such time as the site actually begins operating as a municipal solid waste landfill facility. Additionally, the site owner has a responsibility to file a final recording upon completion of disposal operations and closure of the landfill units in accordance with Title 30 TAC §330.19.
- The site owner or operator and the State of Texas shall have access to the property during the active life and for a period of not less than 30 years after closure for the purpose of inspection and maintenance.

Ruby Teague
Environmental Manager

Ruby Teague
Signature

1/9/2018
Date

SWORN TO AND SUBSCRIBED BEFORE ME by Ruby Teague on the 9th day of January, 2018, which witness my hand and seal of office.

MARY ANN MCGUIRE
My Commission Expires
January 21, 2019
NOTARY PUBLIC STATE OF TEXAS

Mary Ann McGuire
Notary Public in and for the State of Texas

Mary Ann McGuire
Printed Name

My Commission Expires 1-21-19

Note: A legal description of the permit boundary is attached to this affidavit.

15 LEGAL AUTHORITY

The certificates on the following pages document the legal status of the applicant.

This section addresses §330.59(e).

[INSERT LEGAL CERTIFICATES]

Corporations Section
P.O.Box 13697
Austin, Texas 78711-3697

Rolando B. Pablos
Secretary of State

Office of the Secretary of State

The undersigned, as Secretary of State of Texas, does hereby certify that the attached is a true and correct copy of each document on file in this office as described below:

BFI Waste Systems of North America, LLC
Filing Number: 800919279

Application for Registration	January 03, 2008
Public Information Report (PIR)	December 31, 2008
Certificate of Assumed Business Name	January 20, 2009
Change of Name or Address by Registered Agent	April 19, 2010
Public Information Report (PIR)	December 31, 2010
Certificate of Assumed Business Name	January 13, 2012
Certificate of Assumed Business Name	February 07, 2012
Public Information Report (PIR)	December 31, 2012
Change of Name or Address by Registered Agent	December 02, 2013
Public Information Report (PIR)	December 31, 2013
Public Information Report (PIR)	December 31, 2014
Public Information Report (PIR)	December 31, 2016
Certificate of Assumed Business Name	September 26, 2017

In testimony whereof, I have hereunto signed my name officially and caused to be impressed hereon the Seal of State at my office in Austin, Texas on December 19, 2017.

Corporations Section
P.O.Box 13697
Austin, Texas 78711-3697

Rolando B. Pablos
Secretary of State

Office of the Secretary of State

Rolando B. Pablos
Secretary of State

Form 503 **(Revised 09/13)** Return in duplicate to: Secretary of State P.O. Box 13697 Austin, TX 78711-3697 512 463-5555 FAX: 512 463-5709 **Filing Fee: $25**	**Assumed Name Certificate**	This space reserved for office use. **FILED** **In the Office of the** **Secretary of State of Texas** **SEP 26 2017** **Corporations Section**

Assumed Name

1. The assumed name under which the business or professional service is, or is to be, conducted or rendered is: Hardin County Landfill

Entity Information

2. The legal name of the entity filing the assumed name is:

BFI Waste Systems of North America, LLC

State the name of the entity as currently shown in the records of the secretary of state or on its organizational documents, if not filed with the secretary of state.

3. The entity filing the assumed name is a: (Select the appropriate entity type below.)

- ☐ For-profit Corporation
- ☐ Nonprofit Corporation
- ☐ Professional Corporation
- ☐ Professional Association
- ☒ Limited Liability Company
- ☐ Limited Partnership
- ☐ Limited Liability Partnership
- ☐ Cooperative Association
- ☐ Other ______

Specify type of entity. For example, foreign real estate investment trust, state bank, insurance company, etc.

4. The file number, if any, issued to the entity by the secretary of state is: 800919279

5. The state, country, or other jurisdiction of formation of the entity is: Delaware

6. The entity's principal office address is:

18500 North Allied Way

Street or Mailing Address

Phoenix	AZ	U.S.	85054
City	*State*	*Country*	*Postal or Zip Code*

Period of Duration

☒ 7a. The period during which the assumed name will be used is 10 years from the date of filing with the secretary of state.

OR

☐ 7b. The period during which the assumed name will be used is _____ years from the date of filing with the secretary of state (not to exceed 10 years).

OR

☐ 7c. The assumed name will be used until ______________ (not to exceed 10 years).

mm/dd/yyyy

RECEIVED
SEP 26 2017
Secretary of State

County or Counties in which Assumed Name Used

8. The county or counties where business or professional services are being or are to be conducted or rendered under the assumed name are:

☐ All counties

☐ All counties with the exception of the following counties: ______________________

☒ Only the following counties: Hardin

Execution

The undersigned signs this document subject to the penalties imposed by law for the submission of a materially false or fraudulent instrument and also certifies that the person is authorized to sign on behalf of the identified entity. If the undersigned is acting in the capacity of an attorney in fact for the entity, the undersigned certifies that the entity has duly authorized the undersigned in writing to execute this document.

Date: 9.25.2017

Eileen B. Schuler, VP & Secretary

Signature of a person authorized by law to sign on behalf of the identified entity (see instructions)

STATE OF ARIZONA)
) ss.
County of Maricopa)

On this, the 25th day of September, 2017, before me, the undersigned Notary Public, personally appeared EILEEN B. SCHULER, who acknowledged that she executed the foregoing instrument in her capacity as Vice President and Secretary of BFI Waste Systems of North America, LLC, a Delaware limited liability company, for the purposes therein contained.

Andrea Wing
Notary Public

My Commission Expires: 11/11/18

Notary Public State of Arizona
Maricopa County
Andrea Wing
My Commission Expires 11/11/2018

16 EVIDENCE OF COMPETENCY

16.1 Solid Waste Sites

This section addresses §330.59(e) and (f).

The Hardin County Landfill is owned and operated by BFI Waste Systems of North America, LLC (BFI). BFI Waste Systems of North America, LLC, is a Delaware limited partnership qualified to do business in Texas. BFI Waste Systems of North America, LLC's managing general partner is Allied Waste Landfill Holdings, Inc., which is an indirect, wholly-owned subsidiary of Republic Services (Republic). Republic owns, operates, or maintains a financial interest in the facilities identified in Tables 16-1 and 16-2. A listing of the state regulatory agencies for these landfills is provided in Table 16-3. Republic acquires, operates, and develops nonhazardous waste disposal facilities on a national basis and is one of the largest providers of municipal waste services in the United States. Republic is a Delaware corporation whose shares are publicly traded on the New York stock exchange. As documented in Republic's 2016 Annual Report, no person or entity owns 20 percent or more of the company.

16.2 BFI Waste Systems of North America, LLC Key Personnel

The key personnel involved in the management and operations of the landfill are listed below.

Bryan Boyer, Area President

Mr.-Boyer is responsible for all hauling, transfer stations, and landfill operations in the South Texas area. Responsibilities include financial planning and environmental compliance, as well as other management responsibilities. Also, he oversees operations; sales and marketing; and finance for Republic's landfills, transfer stations, recycling, and waste collection operations.

Scott A. Trebus, Area Manager, Engineering and Environmental

Mr. Trebus is responsible for the engineering management, regulatory coordination, and environmental compliance of Republic's facilities within the South Area. He has several years of experience in environmental engineering related projects, which includes Texas MSW facilities.

Brandon Rogers, General Manager

Mr. Rogers is responsible for operations of the Hardin County Landfill and other hauling and landfill facilities in the Houston Area. Generally, Mr. Rogers responsibilities include management of all operational aspects of these facilities, such as engineering, construction, environmental compliance, equipment maintenance, operational strategy, safety programs, financial planning and budgeting. Additionally, Mr. Rogers plays a key role in securing new permits and permit expansions, and he assists with community relations, as well as customer development.

Ruby Teague, Environmental Manager

Ms. Teague has management and oversight responsibilities for environmental compliance at Republic's landfills, transfer stations, and hauling facilities in the Southeast Texas area. Ms. Teague has primary responsibility for permitting and environmental compliance at the Hardin County Landfill.

Forest Hunter, Landfill Manager

Mr. Hunter is responsible for the daily operations of the Hardin County Landfill. His responsibilities include oversight of hourly employees, equipment maintenance, construction management, and operations compliance. Mr. Hunter has a Texas Class A license for MSW Landfill Management and Operations.

16.3 Equipment

The equipment listed in Part IV, Site Operating Plan, is used to operate this site. Additional or different units of equipment may be provided as necessary to enhance operational efficiency. Other equivalent types of equipment may be substituted for this equipment on an as-needed basis.

Table 16-1
Texas Solid Waste Facilities
BFI Waste Systems of North America, LLC Affiliated Facilities
(as of December 2016)

Name & Location	Permit Type & No.	Dates of Operation [1]
NORTH TEXAS AREA		
Southwest Landfill Randall County	Type 1, MSW No. 1663B	1985 to present
Abilene Regional Landfill Jones County	Type 1, MSW No. 1469A	1983 to present
Brazos Transfer Station Parker County	Type 5TS, MSW No. 2356	April 7, 2008, to present
Camelot Landfill Denton County	Type 1, MSW No. 1312AB	Dec. 1979 to present
Charter Waste Landfill Ector County	Type 1, MSW No. 2158A	May 26, 1992, to present
City of Arlington Landfill Tarrant County	Type 1, MSW No. 358A	March 14, 1978, to present
City of Fort Worth Southeast Landfill Tarrant County	Type 1, MSW No. 218C	1976 to present
CSC Landfill Ellis County	Type 1, MSW No. 1209B	July 15, 1999, to present
ECD Landfill Ellis County	Type 1, MSW No. 1745B	1988 to present
Fort Worth Regional Landfill Tarrant County	Type 1, MSW No. 464A	Mar. 1987 to Oct. 1995 (CLOSED)
Fort Worth Transfer Station Tarrant County	Type V, MSW No. 2275A	2001 to present
Greenwood Farms Landfill Smith County	Type 1, MSW No. 1972A	Sept. 1988 to present
Hutchins Landfill Dallas County	Type 1, MSW No. 1236A	CLOSED in 1992
Itasca Landfill Hill County	Type 1, MSW No. 241D	1988 to present
Lewisville Landfill Denton County	Type 1V, MSW No. 1749B	1986 to present
Maloy Landfill Hunt County	Type 1, MSW No. 1195A	January 23, 1979, to present
Mexia Landfill Limestone County	Type 1, MSW No. 1558A	1983 to present
Mill Creek Landfill Tarrant County	Type 1, MSW No. 208A	1973 to Nov. 2001 (CLOSED)

Table 16-1 (Continued)
Texas Solid Waste Facilities
Republic Services, Inc.
(as of November 2017)

Name & Location	Permit Type & No.	Dates of Operation [1]
NORTH TEXAS AREA (Continued)		
Pinehill Landfill Gregg County	Type 1, MSW No. 1327B	Dec. 1987 to present
Pleasant Oaks Landfill Titus County	Type 1, MSW No. 797A	1960 to present
Quail Canyon Landfill Lubbock County	Type 1, MSW No. 987A	1977 to 1992 (CLOSED)
Royal Oaks Landfill Cherokee County	Type 1, MSW No. 1614A	Dec. 1988 to present
Trinity Oaks Landfill Dallas County	Type 1, MSW No. 556	1976 to Nov. 2002 (CLOSED)
SOUTH TEXAS AREA		
BFI Burnet TS Burnet County	Registration No. 40035	Aug. 17, 1994 to present
BFI Sealy TS Austin County	Registration No. 40025	April 19, 1995 to present
BFI Corpus Christi Recyclery Nueces County	Registration No. 65019	July 31, 2002 to present
BFI Galveston County TS Galveston County	Registration No. 1680	Oct. 4, 1989 to present
Blue Ridge Landfill Fort Bend County	Type 1, MSW No. 1505A	Dec. 10, 1990, to present
Cefe Valenzuela Landfill Nueces County	Type 1, MSW No. 2269	July 22, 2005 to present
City of El Campo CCS Wharton County	Type 5CC, MSW No. 120025	March 17, 2009, to present
El Centro Landfill Nueces County	Type 1, MSW No. 2267	2003 to present
Galveston County Landfill Galveston County	Type 1, MSW No. 1149B	January 14, 1971, to present
Golden Triangle Landfill Jefferson County	Type 1, MSW No. 2027	May 24, 1991, to present
Gulf West Landfill Chambers County	Type 1, MSW No. 39039	March 1991 to present
Hardin County Landfill Hardin County	Type 1, MSW No. 2214A	September 2017 to the present
Holmes Road Landfill Harris County	Type 1, MSW No. 38 (N ½) & MSW No. 377 (S ½)	CLOSED in 1978
Houston Northwest TS Harris County	Type 5TS, MSW No. 1092	Jan. 12, 1999 to present
Houston Southeast TS Harris County	Type 5TS, MSW No. 1074	December 22, 1983, to present

Table 16-1 (Continued)
Texas Solid Waste Facilities
Republic Services, Inc.
(as of November 2017)

Name & Location	Permit Type & No.	Dates of Operation 1
SOUTH TEXAS AREA (Continued)		
Houston Southwest TS Harris County	Type 5TS, MSW No. 1091	November 23, 1977, to present
Kerrville Landfill Kerr County	Type 1, MSW No. 1506A	1984 to present
La Feria TS Cameron County	Type 5TS, MSW No. 2375	November 9, 2011, to present
La Gloria Ranch Landfill Hidalgo County	Type 1, MSW No. 2348	May 24, 2007, to present
La Porte LF Harris County	Type 1, MSW No. 1765	Closed in 1988
McCarty Road Landfill Harris County	Type 1, MSW No. 261B	1972 to present
North County Landfill Galveston County	Type 4, MSW No. 1849B	April 24, 1998, to present
Pinn Road 1 Landfill Bexar County	Type 1 and IV, MSW No. 92	Type 1: 1975 to April 1986; revised to Type 1V to Sept. 1991 (CLOSED)
Pinn Road 2 Landfill Bexar County	Type 1, MSW No. 14	Jul. 1975 to 1994 (CLOSED)
Port Arthur Landfill Jefferson County	Type 1, MSW No. 1815	CLOSED in 1985
Rio Grande Valley Landfill Hidalgo County	Type 1, MSW No. 1948	Jan. 19, 1994, to present
Sinton Landfill San Patricio County	Type 1, MSW No. 242A	Sept. 8, 1972, to 2003 (CLOSED)
Sunset Farms Landfill Travis County	Type 1, MSW No. 1447	May 17, 1982, to present
Tessman Road Landfill Bexar County	Type 1, MSW No. 1410B	1981 to present
Total Roll-Offs TS Washington County	Registration No. 40173	Sept. 4, 2001 to present
Victoria Landfill Victoria County	Type 1, MSW No. 1522A	Nov. 15, 1982, to present
Whispering Pines Landfill Harris County	Type 1, MSW No. 1193	Jan. 1, 1984, to present

[1]This list includes the approximate dates of operation of the facility. This includes the previous owner/operators of certain facilities prior to the facility being acquired by Republic Services, Inc., or its subsidiaries.

Table 16-2
List of Republic Services, Inc. Solid Waste Sites in States Other Than Texas (as of November 2012)

Facility Name	Location		Facility Type	Dates of Operation[a]
Mobile TS	Mobile	AL	TS	June 1980 to Present
Marshall County TS	Albertville	AL	TS	March 1999 to Present
Andalusia TS	Andalusia	AL	TS	April 2000 to Present
BFI Waste Services of Anniston / Albertville TS	Albertville	AL	TS	June 2003 to Present
Little Creek TS	Guin	AL	TS	December 1999 to Present
BFI Waste Services of Greenville	Greenville	AL	TS	December 1993 to Present
BFI Huntsville MRF	Huntsville	AL	MRF	December 1975 to Present
Prattville C&D Landfill	Prattville	AL	LF	November 2004 to Present
Prattville Transfer Station	Prattville	AL	TS	December 1999 to Present
BFI Athens TS	Athens	AL	TS	December 1999 to Present
BFI Selma TS	Selma	AL	TS	May 1995 to Present
Brundidge LF	Brundidge	AL	LF	May 2000 to Present
Chilton Landfill	Clanton	AL	CLF	Closed
Sand Valley LF	Collinsville	AL	LF	May 2000 to Present
Greenville TS	Greenville	AL	TS	December 1993 to Present
Morris Farms LF	Hillsboro	AL	LF	June 1996 to Present
Pineview LF	Dora	AL	LF	March 1993 to Present
Talledaga TS	Lincoln	AL	TS	December 1999 to Present
Timberlands LF	Brewton	AL	LF	August 1993 to Present
Willow Ridge LF	Haleyville	AL	LF	May 2000 to Present
Bella Vista Hauling & TS	Bella Vista	AR	TS	August 1996 to Present
Model Fill LF	Little Rock	AR	LF	February 1991 to Present
7th Street TS	Phoenix	AZ	TS	*
7th Street MRF	Phoenix	AZ	MRF	*
Central Arizona Transfer	Queen Creek	AZ	TS	December 1999 to Present
Cave Creek Transfer Station	Phoenix	AZ	TS	December 1999 to Present
Aztec Waste	Phoenix	AZ	TS	December 1999 to Present
Apache Junction LF	Apache Junction	AZ	LF	October 1993 to Present
Cactus Landfill	Eloy	AZ	LF	December 2004 to Present
Chandler LF Services	Chandler	AZ	LF	August 1982 to Present
Cocopah Landfill	Somerton	AZ	CLF	Closed
Copper Mountain LF	Wellton	AZ	LF	June 2000 to Present
La Paz County LF	Parker	AZ	LF	November 1993 to Present
Lake Havasu LF Services	Lake Havasu	AZ	LF	May 1997 to Present
Mesa TS	Queen Creek	AZ	TS	*
Mohave Valley LF	Fort Mohave	AZ	LF	October 1996 to Present
Paradise Waste TS	Phoenix	AZ	TS	January 1998 to Present
Allied Waste Transfer Services of Page	Page	AZ	TS	April 1997 to Present
Queen Creek LF	Queen Creek	AZ	CLF	Closed
Southwest Regional LF	Buckeye	AZ	LF	December 1994 to Present
Suburban Transfer	Yuma	AZ	TS	April 2000 to Present
Seagull Sanitation Systems	Avalon	CA	LF	April 2001 to Present
West Contra Costa Sanitary Landfill (WCCSL)	Richmond	CA	LF	Closed
Barrett Junction Burn Site	Dulzura	CA	LF	July 2000 to Present
Boulevard Burn Site	Boulevard	CA	LF	*
Campo Burn Site	Campo	CA	LF	July 2000 to Present
ECDC LF Group - Northwest	San Francisco	CA	LF	*
ECDC LF Group - Southwest	Newport Beach	CA	LF	*
Julian Burn Site	Julian	CA	LF	Closed
Palomar Mountain Burn Site	Palomar Mountain	CA	LF	Closed
Ranchita Burn Site	Ranchita	CA	LF	August 1998 to Present
Viejas Burn Site	Alpine	CA	LF	Closed
Independent Trucking	Stockton	CA	TS	*
American Waste TS	San Carlos	CA	TS	April 1998 to Present

Table 16-2
List of Republic Services, Inc. Solid Waste Sites in States Other Than Texas
(as of November 2012)

Facility Name	Location		Facility Type	Dates of Operation[a]
Bel-Art TS	Gardena	CA	TS	May 1995 to Present
Del Norte Regional Recycling and Transfer Station	Oxnard	CA	TS	June 1999 to Present
LA Consolidated East LA Transfer Station	Los Angeles	CA	TS	*
West County Resource Recovery	Richmond	CA	TS	*
Vallecito TS	Julian	CA	TS	December 1999 to Present
Sunshine Summit TS	Warner Springs	CA	TS	December 1999 to Present
Ocotillo Wells TS	Borrego Springs	CA	TS	December 1999 to Present
French Camp LF	Stockton	CA	CLF	Closed
Central LA Recycling and Transfer Station	Los Angeles	CA	TS	December 1999 to Present
Azusa Land Reclamation	Azusa	CA	CLF	Closed
Vasco Road LF	Livermore	CA	LF	December 1999 to Present
BFI Compton TS	Compton	CA	TS	September 1989 to Present
BFI Falcon TS	Wilmington	CA	TS	July 1997 to Present
BFI Mussel Rock TS	Daly City	CA	TS	January 1995 to Present
BFI Pescadero TS	Pescadero	CA	TS	December 1996 to Present
BFI Rice Road MRF	Fresno	CA	MRF	February 1990 to Present
BFI Rice Road TS	Fresno	CA	TS	February 1990 to Present
BFI San Carlos TS	San Carlos	CA	TS	June 1968 to Present
Allied Waste Transfer of San Mateo County	San Carlos	CA	TS	June 1968 to Present
Borrego Springs LF	Borrego Springs	CA	LF	October 1997 to Present
Chateau Fresno LF	Fresno	CA	CLF	Closed
Chestnut Avenue LF	Fresno	CA	CLF	Closed
Contra Costa Transfer	Martinez	CA	TS	March 1994 to Present
Devlin Road TS & Recycling Facility	American Canyon	CA	TS	February 1994 to Present
Elder Creek Recovery and Trash Station	Sacramento	CA	TS	May 2000 to Present
Elder Creek Recovery and Trash Station	Sacramento	CA	MRF	May 2000 to Present
Forward LF	Manteca	CA	LF	March 1973 to Present
Allied Imperial LF	Imperial	CA	LF	April 2000 to Present
Keller Canyon LF	Pittsburgh	CA	LF	September 1991 to Present
Newby Island LF	Milpitas	CA	LF	August 1987 to Present
Otay LF	Chula Vista	CA	LF	October 1997 to Present
Ox Mountain LF	Half Moon Bay	CA	LF	June 1987 to Present
Palomar TS	Carlsbad	CA	TS	November 1997 to Present
Ramona LF	Ramona	CA	LF	October 1997 to Present
Ranchita TS	Ranchita	CA	TS	Closed
Allied Waste Recyclery of San Mateo County	San Carlos	CA	MRF	October 1991 to Present
Sunshine Canyon LF	Sylmar	CA	LF	March 1955 to Present
Sycamore Canyon LF	Santee	CA	CLF	Closed
The Recyclery at Newby Island	Milpitas	CA	MRF	August 1987 to Present
Valley Environmental MRF	El Centro	CA	MRF	June 2000 to Present
BFI Glenwood Springs TS	Glenwood Springs	CO	TS	December 1999 to Present
Washington Street TS	Denver	CO	TS	December 1999 to Present
BFI Glenwood Springs TS	Glenwood Springs	CO	TS	December 1991 to Present
Greeley TS	Greeley	CO	TS	November 1995 to Present
Boulder LF	Boulder	CO	CLF	Closed
Basalt TS	Basalt	CO	TS	January 1999 to Present
Denver Regional LF North	Erie	CO	CLF	Closed
Foothills LF	Golden	CO	LF	September 1992 to Present
Grand Junction Recyclery	Grand Junction	CO	MRF	February 1982 to Present
Jeffco 1 LF		CO	CLF	Closed
Tower LF	Commerce City	CO	LF	November 1982 to Present
ADS of Connecticut - Stratford	Stratford	CT	TS	December 1999 to Present
PM Services Transfer	Hartford	CT	TS	December 1999 to Present
Capitol Recycling & Brokerage	Hartford	CT	MRF	November 1990 to Present

Table 16-2
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Facility Name	Location		Facility Type	Dates of Operation[a]
BFI Consolidated TS	WASHINGTON	DC	TS	
BFI Waste Services of Washington (Consolidated TS)	Washington	DC	TS	September 1994 to Present
545 Landfill	Winter Garden	FL	LF	*
Cedar Trail Landfill	Bartow	FL	LF	*
Nine Mile Road	St. Augustine	FL	LF	*
Metro Recycling	Tampa	FL	TS	*
Envirocycle	Ft. Lauderdale	FL	MRF	*
Rocket Blvd Material Recovery Facility	Orlando	FL	MRF	*
Southland Recycling Services	Jacksonville	FL	MRF	*
Buckeye Landfill (CLOSED TO PUBLIC)	Perry	FL	LF	December 1999 to Present
BFI Sarasota TS	Sarasota	FL	TS	December 1999 to Present
Delta Lakefill	Pompano Beach	FL	LF	December 1999 to Present
Key West Recyclery	Key West	FL	MRF	December 1999 to Present
Miami Beach TS	Miami Beach	FL	TS	December 1999 to Present
Pensacola TS	Pensacola	FL	TS	December 1999 to Present
Royal Oaks Ranch C&D LF	Titusville	FL	CLF	Closed
Tall Pines Recycling	W Palm Beach	FL	MRF	December 1999 to Present
BFI Pasco Recyclery	New Port Richey	FL	MRF	Closed
Pensacola TS	Pensacola	FL	TS	January 1990 to Present
BFI Pensacola Recyclery	Pensacola	FL	MRF	January 1990 to Present
BFI Tampa Bay Recyclery	Clearwater	FL	MRF	December 1986 to Present
Cone Road LF C&D	Tampa	FL	LF	March 1991 to Present
Delta Dade TS	Miami	FL	TS	December 1998 to Present
Ft. Lauderdale MRF	Davie	FL	MRF	December 1991 to Present
Ft. Walton TS	Ft. Walton Beach	FL	TS	April 2002 to Present
Jacksonville MRF	Jacksonville	FL	MRF	October 1978 to Present
Jones Road LF (C&D)	Jacksonville	FL	LF	October 1989 to Present
McKay Bay TS	Tampa	FL	TS	December 2001 to Present
Miami MRF	Miami	FL	MRF	March 1990 to Present
Miami TS	Miami	FL	TS	March 1990 to Present
Nassau LF (C&D)	Callahan	FL	LF	August 2002 to Present
BFI Sarasota Recyclery	Sarasota	FL	MRF	September 1990 to Present
Broadhurst Environmental	Screven	GA	LF	*
Highway 78 C&D Landfill	Monroe	GA	LF	*
Oak Grove LF	Winder	GA	LF	*
Pine Ridge Recycling	Griffin	GA	LF	*
Savannah Regional Landfill	Port Wentworth	GA	LF	*
Speedway LF	Winder	GA	LF	*
Swift Creek Environmental	Macon	GA	LF	*
Evans Co, Transfer Station	Claxton	GA	TS	*
Lee Transfer Station	Austell	GA	TS	*
Mauldin Drive Transfer Station	Alpharetta	GA	TS	*
Newnan Transfer Station	Winder	GA	TS	*
BFI Fayette County TS	Fayetteville	GA	TS	December 1999 to Present
Inland Paper & Packaging LF	Rome	GA	LF	October 2001 to Present
NORTH GEORGIA TRANSFER STATION	Rome	GA	TS	December 1999 to Present
SSES Newnan	Newman	GA	TS	December 1999 to Present
Tifton TS	Tifton	GA	TS	December 1999 to Present
BFI East Point TS	E. Point	GA	TS	January 1996 to Present
BFI Marble Mill TS	Marietta	GA	TS	August 1991 to Present
BFI Smyrna TS	Smyrna	GA	TS	January 1991 to Present
BFI Waste Services of Atlanta/Smyrna TS	Smyrna	GA	TS	January 1991 to Present
East DeKalb LF (C&D)	Lithonia	GA	LF	January 1992 to Present
Fayette County LF (C&D)	Fayetteville	GA	CLF	Closed

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Facility Name	Location		Facility Type	Dates of Operation[a]
Gateway LF	Ringgold	GA	CLF	Closed
Golden Waste Disposal/Tifton TS	Tifton	GA	TS	June 1998 to Present
Hickory Ridge LF	Conley	GA	LF	September 1992 to Present
Richland Creek LF	Buford	GA	LF	November 1995 to Present
Roberts Road LF	Fayetteville	GA	CLF	Closed
Southern States TS	Thomaston	GA	TS	July 1996 to Present
Southern States TS	Columbus	GA	TS	December 1993 to Present
Taylor County LF	Mauk	GA	LF	September 1987 to Present
Watts Road LF	Atlanta	GA	CLF	Closed
Wayne County Regional Landfill	Screven	GA	LF	*
Delaware Transfer Station	Manchester	IA	TS	December 1999 to Present
Hawkeye TS	Clinton	IA	TS	December 1999 to Present
Dubuque MRF	Dubuque	IA	MRF	December 1995 to Present
Hawkeye Disposal	Clinton	IA	TS	July 1998 to Present
Hawkeye Disposal	Maquoketa	IA	TS	January 1999 to Present
Boise TS	Boise	ID	TS	December 1999 to Present
C.C. LF	Danville	IL	LF	*
Southern Illinois Regional Landfill	DeSoto	IL	LF	*
Suburban Warehouse	Riverdale	IL	LF	*
AWS - Northlake TS	Northlake	IL	TS	*
Marion TS	Marion	IL	TS	*
Sparta TS	Sparta	IL	TS	*
Alliance Waste Services - Rockford	Belleville	IL	TS	December 1999 to Present
Alliance Waste Services - Rockford MRF	Rockford	IL	MRF	December 1999 to Present
Bloomington TS	Bloomington	IL	TS	December 1999 to Present
Bond County Landfill	Greenville	IL	LF	October 2003 to Present
Dukane TS	W Chicago	IL	TS	December 1999 to Present
Evanston TS	Evanston	IL	TS	December 1999 to Present
Kankakee Quarry	Momence Township	IL	CLF	Closed
LandComp LF	Ottawa	IL	LF	November 2002 to Present
Litchfield-Hillsboro LF	Litchfield	IL	LF	November 1998 to Present
Loop Recycling #1	Chicago	IL	MRF	December 1999 to Present
Melrose Park Transfer Station	Melrose Park	IL	TS	December 1999 to Present
Palatine MRF	Palatine	IL	MRF	December 1999 to Present
Planet Resources	Chicago	IL	MRF	December 1999 to Present
Robbins Transfer Station	Robbins	IL	TS	December 1999 to Present
Rolling Meadows TS	Rolling Meadows	IL	TS	December 1999 to Present
Southern Illinois TS (Metropolis)	Metropolis	IL	TS	December 1999 to Present
Speelman TS	Chicago	IL	TS	December 1999 to Present
Spoon Ridge LF	Fairview	IL	LF	July 1999 to Present
Tri-State MRF	Northlake	IL	MRF	December 1999 to Present
Urbana TS	Urbana	IL	TS	December 1999 to Present
Zion LF - Site 1A	Zion	IL	LF	December 1999 to Present
Zion LF, Site 1 - Phase B	Zion	IL	CLF	Closed
Zion LF, Site 2 (Old)	Zion	IL	LF	December 1999 to Present
34th Street Sorting Center	Chicago	IL	MRF	February 2003 to Present
Bloomington TS	Bloomington	IL	TS	November 1997 to Present
Apollo TS	Momence	IL	TS	April 1996 to Present
Belleville LF	Belleville	IL	CLF	Closed
BFI Elk Grove Recyclery	Elk Grove Village	IL	MRF	February 1996 to Present
BFI Quad Cities LF - Phase 1/2	Milan	IL	CLF	Closed
BFI Quad Cities LF - Phase 3	Milan	IL	CLF	March 1983 to Present
Brickyard Disposal	Danville	IL	LF	November 1995 to Present
Brickyard Unit #1	Danville	IL	CLF	Closed

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Facility Name	Location		Facility Type	Dates of Operation[a]
Calumet TS	Chicago	IL	TS	May 1997 to Present
Urbana TS	Urbana	IL	TS	February 1996 to Present
Citiwaste TS (C&D Only)	Joliet	IL	TS	March 1996 to Present
City of Paris TS	Paris	IL	TS	December 1998 to Present
Congress Development Company	Hillside	IL	LF	March 1974 to Present
D&L Disposal	Greenville	IL	TS	April 1996 to Present
Davis Junction LF	Davis Junction	IL	CLF	Closed
Dixon/GROP LF No. 2	Dixon	IL	CLF	Closed
Environtech LF	Morris	IL	LF	December 1986 to Present
Envotech LF	Litchfield	IL	LF	April 1996 to Present
ERC / Coles County LF	Charleston	IL	LF	June 2000 to Present
Groen TS	Crestwood	IL	TS	June 1981 to Present
Herrin TS	Herrin	IL	TS	May 1994 to Present
Illini Recycling	Champaign	IL	MRF	April 1996 to Present
Illinois LF	Hoopeston	IL	LF	December 1991 to Present
Illinois Valley Recycling	Ottawa	IL	MRF	July 2000 to Present
Illinois Waste System LF	Milford	IL	CLF	Closed
Jersey Sanitation LF	Jerseyville	IL	CLF	Closed
K&H Disposal	Donovan	IL	CLF	Closed
Lee County LF	Dixon	IL	LF	October 1997 to Present
Livingston LF	Pontiac	IL	LF	August 2001 to Present
Loop Recycling (64th Street)	Chicago	IL	MRF	August 1998 to Present
Loop Recycling (Laflin Street)	Chicago	IL	MRF	September 1994 to Present
Loop Transfer (Laflin Street)	Chicago	IL	TS	August 1998 to Present
Loop Transfer (64th Street)	Chicago	IL	TS	August 1998 to Present
Mallard Lake LF	Hanover Park	IL	CLF	Closed
McCook TS	McCook	IL	TS	September 1996 to Present
McLean County LF	Bloomington	IL	LF	November 1997 to Present
Medill Sorting Center	Chicago	IL	MRF	February 2003 to Present
Midtown TS	Chicago	IL	TS	June 1982 to Present
Modern LF (Belleville) (MIG/DEWANE)	Belleville	IL	CLF	Closed
New Age Recycling	Danville	IL	MRF	October 1988 to Present
North Chicago LF	North Chicago	IL	CLF	Closed
Northwest Sorting Center	Chicago	IL	MRF	February 2003 to Present
Okaw Valley Recycling	Sullivan	IL	MRF	April 1999 to Present
Planet Recovery	Chicago	IL	TS	January 1992 to Present
Planet Recovery MRF	Chicago	IL	MRF	January 1992 to Present
RCS LF	Jerseyville	IL	LF	January 1993 to Present
Roxana LF	Edwardsville	IL	LF	October 1985 to Present
Roxana MRF	Edwardsville	IL	MRF	October 1985 to Present
Saline County LF	Harrisburg	IL	LF	May 1999 to Present
Sangamon Valley LF	Springfield	IL	LF	November 1999 to Present
Shred-All Recycling	Chicago	IL	TS	December 1995 to Present
Shred-All Recycling & Transfer	Chicago	IL	TS	September 1997 to Present
Shred-All TS	Chicago	IL	TS	December 1995 to Present
South Barrington LF	South Barrington	IL	CLF	Closed
Streator Area LF	Streator	IL	LF	December 1991 to Present
Upper Rock Island LF	East Moline	IL	LF	October 1994 to Present
Watts-Springfield Unit 1 LF	Springfield	IL	CLF	Closed
Wayne County LF	Fairfield	IL	LF	June 1997 to Present
National Serv-All Landfill	Fort Wayne	IN	LF	*
Sycamore Ridge Landfill	Pimento	IN	LF	*
Wabash Valley Landfill	Wabash	IN	LF	*
Advantage Transfer Station	Huntingburg	IN	TS	*

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Facility Name	Location		Facility Type	Dates of Operation[a]
Circle City Recycling	Indianapolis	IN	TS	*
National Serv-ALL/Scott TS	Shipshewana	IN	TS	*
National Serv-ALL TS	Auburn	IN	TS	*
Vincennes TS	Vincennes	IN	TS	*
C.A.R.E.	Fort Wayne	IN	MRF	*
EAST CHICAGO COMPOST	East Chicago	IN	MRF	*
Republic Services - Langsdale Recycling	Indianapolis	IN	MRF	*
Blackfoot LF	Winslow	IN	LF	December 1999 to Present
Clinton County Landfill	Frankfort	IN	LF	May 2004 to Present
Illiana Transfer Station - Crown Point	Crown Point	IN	TS	December 1999 to Present
Illiana Transfer Station III	Crown Point	IN	TS	December 1999 to Present
Key Waste MRF	Culver	IN	MRF	December 1999 to Present
Koester TS	Evansville	IN	TS	December 1999 to Present
Metropolitan Landfill	Albany	IN	CLF	Closed
County Line LF	Argos	IN	LF	April 1994 to Present
Illiana Waste Transfer Station I	Schererville	IN	TS	January 1994 to Present
Illiana Waste Transfer Station II	East Chicago	IN	TS	February 2002 to Present
Illiana Waste Transfer Station IV	Lake Station	IN	TS	August 1998 to Present
Kosciusko County LF	Claypool	IN	LF	February 1998 to Present
Lake County C&D LF	Lowellville	IN	LF	June 1988 to Present
Laubascher Meadow LF	Evansville	IN	LF	October 1982 to Present
Newton County Development LF	Brook	IN	LF	February 1996 to Present
Ooms Brothers TS	DeMotte	IN	TS	December 1994 to Present
Springfield Environmental C&D LF	Mt Vernon	IN	LF	April 2000 to Present
Tri-County TS	Covington	IN	TS	June 1994 to Present
United Refuse Landfill	Fort Wayne	IN	LF	*
Finney County LF	Garden City	KS	CLF	Closed
American Disposal Services - Galena	Galena	KS	TS	February 1996 to Present
Forest View Landfill	Kansas City	KS	CLF	Closed
Resource Recovery LF	Cherryvale	KS	LF	April 1986 to Present
Wheatland LF	Columbus	KS	LF	March 1997 to Present
Dozit Company	Morganfield	KY	LF	October 1993 to Present
Epperson Waste Disposal	Williamstown	KY	LF	March 1992 to Present
Ohio County Balefill	Beaver Dam	KY	LF	*
Tri-K Landfill	Stanford	KY	LF	April 1992 to Present
Valley View Landfill	Sulpher	KY	LF	August 1999 to Present
Blue Grass Waste Alliance	Lexington	KY	TS	February 2003 to Present
CSI Covington TS	Covington	KY	TS	*
CWI of Kentucky - Paducah TS	Paducah	KY	TS	June 2003 to Present
Daviess County Solid Waste	Owensboro	KY	TS	June 2002 to Present
Dozit Company - Henderson Transfer	Henderson	KY	TS	*
Ohion County Balefill - City of Hopkinsville	Hopkinsville	KY	TS	*
Kenneday Road (merged w/ div 993)	Lexington	KY	TS	December 1999 to Present
Louisville Recyclery	Louisville	KY	MRF	December 1999 to Present
Mother Earth LF	Louisville	KY	LF	December 1999 to Present
Bath County TS	Owingsville	KY	TS	May 2000 to Present
Benson Valley LF	Frankfort	KY	LF	July 2002 to Present
BFI Danville	Danville	KY	TS	May 2000 to Present
BFI Elizabethtown TS	Elizabethtown	KY	TS	September 1990 to Present
Blue Ridge LF	Irvine	KY	LF	May 2000 to Present
Green Valley LF	Ashland	KY	LF	March 2000 to Present
Morehead LF	Morehead	KY	LF	May 2000 to Present
Stevens Dispos-All	Danville	KY	TS	May 2000 to Present
St. John Pickup Station	Laplace	LA	TS	December 1999 to Present

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Facility Name	Location		Facility Type	Dates of Operation[a]
Sugarmill TS	Broussard	LA	TS	December 1999 to Present
Area 90 LF	Avondale	LA	CLF	Closed
Baton Rouge MRF	Baton Rouge	LA	MRF	December 1999 to Present
BFI Shreveport MRF	Shreveport	LA	MRF	February 2000 to Present
Carlyss LF	Carlyss	LA	CLF	Closed
CECOS - Calcasieu	Sulphur	LA	CLF	Closed
Colonial LF	Sorrento	LA	LF	November 1984 to Present
Crescent Acres LF	New Orleans	LA	CLF	Closed
East St. Charles LF	Kenner	LA	CLF	Closed
Geismar LF	Darrow	LA	CLF	Closed
Hackberry LF	Hackberry	LA	CLF	Closed
Jefferson Davis LF	Welsh	LA	LF	July 1989 to Present
New Orleans MRF	Metairie	LA	MRF	May 1974 to Present
North Baton Rouge LF	Zachary	LA	LF	November 1993 to Present
Siegen Lane LF	Baton Rouge	LA	CLF	Closed
Webster Parrish LF	Minden	LA	LF	February 2000 to Present
West Saint Charles LF	Boutte	LA	CLF	Closed
White Oaks LF	Monroe	LA	CLF	Closed
Woodland Hills LF	Sulphur	LA	CLF	Closed
Woolworth Road LF	Keithville	LA	LF	October 1986 to Present
Auburn Transcyclery	Auburn	MA	TS	December 1999 to Present
Cambridge TS	Cambridge	MA	TS	December 1999 to Present
Holliston LF	Holliston	MA	LF	December 1999 to Present
Holliston TS	Holliston	MA	TS	December 1999 to Present
Allied Waste Services of MA, LLC	Peabody	MA	TS	May 1997 to Present
BFI Brockton Recyclery	Brockton	MA	MRF	October 1984 to Present
BFI Howard TS	Roxbury	MA	TS	December 1976 to Present
BFI Waste Services of Tyngsboro	Tyngsboro	MA	TS	February 1993 to Present
Chicopee LF	Chicopee	MA	CLF	Closed
East Bridgewater LF	East Bridgewater	MA	CLF	Closed
Fall River LF	Fall River	MA	LF	March 1983 to Present
Halifax LF	Halifax	MA	CLF	Closed
McNamara Transfer	Springfield	MA	TS	July 1995 to Present
Oak Bluff - Tisbury	Oakbluffs	MA	TS	May 1993 to Present
Oak Bluff - Tisbury	Oakbluffs	MA	MRF	May 1993 to Present
BFI Peabody TS	Peabody	MA	TS	August 1990 to Present
Plainville LF	Plainville	MA	CLF	Closed
Randolph LF	Randolph	MA	CLF	Closed
Honey-Go-Run Reclamation	Perry Hall	MD	LF	*
BFI Elkridge Recyclery	Elkridge	MD	MRF	December 1999 to Present
Millenium	Baltimore	MD	MRF	December 1999 to Present
BFI Baltimore Processing Center	Baltimore	MD	MRF	July 1996 to Present
BFI Waste Services of Baltimore	Baltimore	MD	TS	December 1994 to Present
ERCA - Norris Farms LF	Baltimore	MD	CLF	Closed
BFI Hagerstown Recyclery	Hagerstown	MD	MRF	December 1981 to Present
Montgomery County	Derwood	MD	CLF	Closed
Oaks LF	Laytonsville	MD	CLF	Closed
Quarantine LF	Baltimore	MD	CLF	Closed
Solley Road LF	Glen Burnie	MD	CLF	Closed
Maine Organics - Ops & Trucking	Unity	ME	MRF	December 1999 to Present
New England Organics	Falmouth	ME	MRF	December 1999 to Present
Carleton Farms LF	Carleton	MI	LF	*
Forest Lawn Landfill	Three Oaks	MI	LF	April 1993 to Present
Republic Services of Northern MI - Whitefeather LF	Pinconning	MI	LF	August 2002 to Present

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Facility Name	Location		Facility Type	Dates of Operation[a]
Coldwater TS	Coldwater	MI	TS	*
Reliable Disposal of S. Haven	South Haven	MI	TS	May 2002 to Present
Republic Services - Cork Street TS	Kalamazoo	MI	TS	October 1999 to Present
Arbor Hills LF	Northville	MI	CLF	Closed
Arbor Hills Recyclery	Northville	MI	MRF	December 1999 to Present
B & R TS	Redford	MI	TS	December 1999 to Present
BFI of Western Michigan	Kalamazoo	MI	TS	December 1999 to Present
Detroit TS	Detroit	MI	TS	December 1999 to Present
Ford Assembly Plants TS	Wayne	MI	TS	December 1999 to Present
Kalamazoo Recylery	Kalamazoo	MI	MRF	December 1999 to Present
KVG LF	Climax	MI	LF	December 1999 to Present
Schaefer Road TS	Dearborn	MI	TS	December 1999 to Present
SMDA TS	Roseville	MI	TS	December 1999 to Present
Taymouth Landfill	Birch Run	MI	LF	*
Utica Ford TS	Utica	MI	TS	December 1999 to Present
Adrian LF	Adrian	MI	CLF	Closed
Adrian LF	Adrian	MI	LF	January 1997 to Present
Kalamazoo TS	Kalamazoo	MI	TS	December 1999 to Present
C & C LF	Marshall	MI	LF	June 1982 to Present
Central Sanitary LF	Pierson	MI	LF	February 1996 to Present
Citizens Disposal LF	Grand Blanc	MI	LF	October 1988 to Present
Community Recycling Services	Muskegon	MI	MRF	June 2003 to Present
Dinverno MRF	Detroit	MI	MRF	January 1988 to Present
Hillsdale TS	Hillsdale	MI	TS	December 1996 to Present
Lyon Development LF	New Hudson	MI	CLF	Closed
Manistee County LF	Manistee	MI	LF	May 1989 to Present
Oakland Heights Development	Auburn Hills	MI	LF	March 1997 to Present
Ohio Demo LF (C&D Only)	Toledo	MI	LF	August 1972 to Present
Ottawa County Farms LF	Coopersville	MI	LF	September 2000 to Present
Rockwood LF	Newport	MI	LF	August 1997 to Present
Sauk Trail Hills LF	Canton	MI	LF	December 1983 to Present
Southfield Transfer Station	Southfield	MI	TS	December 1997 to Present
Sunset Waste Services - Hamilton	Hamilton	MI	TS	April 1999 to Present
Tri-City TS	Kalamazoo	MI	TS	December 1999 to Present
Vienna Junction LF	Erie	MI	LF	August 1999 to Present
Hennepin Transfer, Inc.	Inver Grove Heights	MN	TS	*
Eden Prairie Recyclery	Eden Praire	MN	MRF	December 1999 to Present
Mall of America	Bloomington	MN	MRF	December 1999 to Present
Minden Transfer Station	St Cloud	MN	TS	December 1999 to Present
Woodlake LF	Medina	MN	CLF	Closed
BFI Brooklyn Park TS	Brooklyn Park	MN	TS	December 1999 to Present
BFI Flying Cloud TS	Eden Praire	MN	TS	March 1972 to Present
BFI Hennepin TS	Burnsville	MN	TS	March 1990 to Present
BFI Waste Services of the Twin Cities	Brooklyn Park	MN	TS	December 1999 to Present
BFI Waste Services of the Twin Cities	Inver Grove Heights	MN	MRF	April 1988 to Present
BFI Waste Services of Twin Cities	Minneapolis	MN	MRF	September 1992 to Present
Blaine TS	Blaine	MN	TS	December 2001 to Present
Flying Cloud LF	Eden Praire	MN	CLF	Closed
Bloomington TS	Bloomington	MN	TS	November 1997 to Present
Bloomington TS	Bloomington	MN	MRF	November 1997 to Present
Pine Bend LF	Inver Grove Heights	MN	LF	April 1991 to Present
Southwest Regional Sanitary LF	Jasper	MO	LF	March 2007 to Present
CWI - Potosi Transfer Station	Cadet	MO	TS	*
CWI of Missouri (Potosi)	Potosi	MO	TS	*

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Facility Name	Location		Facility Type	Dates of Operation[a]
Bridgeton Transfer Station	Bridgeton	MO	TS	December 1999 to Present
Jefferson City TS	Jefferson City	MO	TS	December 1999 to Present
New Madrid	Dexter	MO	TS	December 1999 to Present
Saint Louis Recyclery	St Louis	MO	MRF	December 1999 to Present
Springfield Recyclery	Springfield	MO	MRF	December 1999 to Present
St Louis Waste TS	St Louis	MO	TS	December 1999 to Present
American Disposal Services - Ozarks	Springfield	MO	TS	February 1975 to Present
American Disposal Services - Reeds Spring	Reeds Spring	MO	TS	February 1975 to Present
American Disposal Services - Springfield	Springfield	MO	TS	February 1975 to Present
Backridge LF	LaGrange	MO	LF	December 1990 to Present
Bridgeton LF	Bridgeton	MO	LF	November 1985 to Present
Butler County LF Authority	Poplar Bluff	MO	LF	July 1980 to Present
Cass County TS	Harrisonville	MO	TS	Closed
Courtney Ridge LF	Sugar Creek	MO	LF	August 2000 to Present
Ellis-Scott LF	Clinton	MO	CLF	Closed
Jackson LF	Jackson	MO	CLF	Closed
Jackson TS	Jackson	MO	TS	October 1995 to Present
Jefferson City LF	Jefferson City	MO	LF	January 1998 to Present
Johnson County LF	Warrensburg	MO	CLF	Closed
Lamar LF (CLOSED SITE)	Lamar	MO	CLF	Closed
Lemons East Sanitary LF	Dexter	MO	LF	December 1992 to Present
Lemons LF West	Dexter	MO	CLF	Closed
Jefferson City TS	Jefferson City	MO	TS	January 1983 to Present
Midwest LF	Lonedell	MO	CLF	Closed
Missouri City LF	Liberty	MO	CLF	Closed
Missouri Pass LF	Maryland Heights	MO	CLF	Closed
Mo Pass (Yard Waste Transfer Station)	Maryland Heights	MO	TS	January 1988 to Present
Modern TS	Osage Beach	MO	TS	April 1999 to Present
Plattco LF	Parkville	MO	CLF	Closed
Prairieview Regional Waste Facility	Lamar	MO	LF	May 1997 to Present
Redbird LF	Arnold	MO	CLF	Closed
Show-Me Regional LF	Warrensburg	MO	LF	May 1991 to Present
Southeast LF	Kansas City	MO	CLF	Closed
St Louis TS	St. Louis	MO	TS	May 1986 to Present
St. Louis Jeffco L/F	Arnold	MO	CLF	Closed
Wayne County LF	Greenville	MO	CLF	Closed
BFI Biloxi Recyclery	Biloxi	MS	MRF	December 1999 to Present
BFI Biloxi TS	Biloxi	MS	TS	December 1999 to Present
BFI Vicksburg TS	Vicksburg	MS	TS	December 1999 to Present
MAGNOLIA C&D LF	Kiln	MS	LF	September 2005 to Present
Pleasant Hills LF	Olive Branch	MS	LF	July 1999 to Present
Three Rivers LF	Pontotoc	MS	LF	December 1999 to Present
BFI Marks TS	Marks	MS	TS	January 1994 to Present
BFI Waste Services of Hattiesburg	Hattiesburg	MS	TS	May 1993 to Present
BFI Waste Services of the Gulf Coast	Vancleave	MS	MRF	December 1999 to Present
BFI Biloxi TS	Biloxi	MS	TS	December 1999 to Present
Big River LF	Leland	MS	LF	October 1987 to Present
Gulf Pines LF	Biloxi	MS	CLF	Closed
Little Dixie LF	Ridgeland	MS	LF	August 1999 to Present
Missoula Recycling	Missoula	MT	MRF	*
BFI Waste Services of Missoula	Missoula	MT	MRF	December 1999 to Present
Boseman Recycle Now	Bozeman	MT	MRF	December 1999 to Present
Great Falls	Great Falls	MT	MRF	December 1999 to Present
Helena	Helena	MT	MRF	December 1999 to Present

Table 16-2
List of Republic Services, Inc. Solid Waste Sites in States Other Than Texas
(as of November 2012)

LF = Active Landfill; CLF = Closed Landfill; TS = Transfer Station; MRF = Material Recovery Facility

[a] This list includes the approximate dates of operation of the facility. This includes the previous owners/operators of certain facilities prior to the facility being acquired by Republic Services, Inc., or its subsidiaries.

* Initial date of ongoing operation is not clear from site records.

Table 16-3
Regulatory Agencies for Republic Services, Inc. Solid Waste Sites

Alabama Department of Environmental Management (ADEM)
P. O. Box 301463, Montgomery, AL 36130-1463

Arizona Department of Environmental Quality (ADEQ)
1100 West Washington Street, Phoenix, AZ 85007-2935

Arkansas Department of Environmental Quality (ADEQ)
Solid Waste Management Division
5301 North Shore Drive, North Little Rock, AR 72118-5317

California Integrated Waste Management Board (CIWMB)
Cal-EPA Building
1001 I Street, P.O. Box 4025, Sacramento, CA 95812-4025

Colorado Department of Public Health and Environment (CDPHE)
Hazardous Materials and Waste Management Division
4300 Cherry Creek Drive South, Denver, CO 80246-1530

Connecticut Department of Environmental Protection (CDEP)
Materials and Waste Management
79 Elm Street, Hartford, CT 06106-5127

District Department of the Environment (DDOE)
51 N Street, NE 6th Floor, Washington, DC 20002

Florida Department of Environmental Protection (FDEP)
3900 Commonwealth Blvd., M.S. 49, Tallahassee, FL 32399

Georgia Department of Natural Resources
Environmental Protection Division (EPD)
2 Martin Luther King, Jr. Drive, Suite 1152 East Tower, Atlanta, GA 30334

Idaho Department of Environmental Quality (IDEQ)
1410 North Hilton, Boise, ID 83706

Illinois Environmental Protection Agency (IEPA)
1021 North Grand Avenue East, P.O. Box 19276, Springfield, IL 62794-9276

Indiana Department of Environmental Management (IDEM)
Indiana Government Center North
100 North Senate Avenue; Indianapolis, IN 46204-2251

Iowa Department of Natural Resources (IDNR)
502 East 9th Street, Des Moines, IA 50319-0034

Kansas Department of Health and Environment (KDHE)
Charles Curtis State Office Building
1000 Southwest Jackson, Topeka, KS 66612

Kentucky Energy and Environment Cabinet
Division of Waste Management, Department for Environmental Protection
200 Fair Oaks Lane, Frankfort KY 40601

Louisiana Department of Environmental Quality (LDEQ)
602 North Fifth Street, Baton Rouge, LA 70802

Maine Department of Environmental Protection (MDEP)
17 State House Station, Augusta, ME 04333-0017

Maryland Department of the Environment (MDE)
1800 Washington Boulevard, Baltimore, MD 21230

Massachusetts Department of Environmental Protection (MDEP)
One Winter Street, 2nd Floor, Boston, MA 02108

Michigan Department of Environmental Quality (MDEQ)
Waste Management Division
Constitution Hall, 525 West Allegan Street, P.O. Box 30473, Lansing, MI 48909-7973

Minnesota Pollution Control Agency (MPCA)
520 Lafayette Road North, St. Paul, MN 55155-4194

Mississippi Department of Environmental Quality (MDEQ)
Solid Waste Policy, Planning, and Grants Branch
515 East Amite Street, Jackson, MS 39201

Missouri Department of Natural Resources (MDNR)
Waste Management Program, Division of Environmental Quality
P.O. Box 176, Jefferson City, MO 65102

Montana Department of Environmental Quality (MDEQ)
1520 East Sixth Avenue, P.O. Box 200901, Helena, MT 59620-0901

Nebraska Department of Environmental Quality (NDEQ)
1200 "N" Street, Suite 400, P.O. Box 98922, Lincoln, NE 68509

Nevada Division of Environmental Protection (NDEP)
901 South Stewart Street, Suite 4001, Carson City, NV 89701-5249

New Hampshire Department of Environmental Services (NHDES)
Waste Management Division
29 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095

New Jersey Department of Environmental Protection (NJDEP)
401 East State Street, 7th Floor, East Wing, P.O. Box 402, Trenton, NJ 08625-0402

New York State Department of Environmental Conservation (NYSDEC)
Division of Solid and Hazardous Materials
625 Broadway, Albany, NY 12233-1010

North Carolina Department of Environment and Natural Resources (NCDENR)
1601 Mail Service Center, Raleigh, NC 27699-1601

Ohio Environmental Protection Agency (OEPA)
Division of Solid & Infectious Waste Management
50 West Town Street, Suite 700, Columbus, OH 43215

Oklahoma Department of Environmental Quality (ODEQ)
707 North Robinson, Oklahoma City, OK 73102

Oregon Department of Environmental Quality (ODEQ)
Waste Prevention and Management Division
811 Southwest Sixth Ave., Portland, OR 97204-1390

Pennsylvania Department of Environmental Protection (PDEP)
Rachel Carson State Office Building
400 Market Street, Harrisburg, PA 17101

Rhode Island Department of Environmental Management (RIDEM)
235 Promenade St., Providence, RI 02908-5767

South Carolina Department of Health and Environmental Control (SCDHEC)
2600 Bull St., Columbia, SC 29201

Tennessee Department of Environment and Conservation (TDEC)
401 Church St., L&C Tower, Nashville, TN 37243-0435

Utah Department of Environmental Quality (UDEQ)
Division of Solid and Hazardous Waste
288 North 1460 West, 4th Floor, P. O. Box 144880, Salt Lake City, UT 84114-4880

Vermont Department of Environmental Conservation (DEC)
Waste Management Division
103 South Main Street, West Office Building, Waterbury, VT 05671-0404

Virginia Department of Environmental Quality (VDEQ)
629 East Main Street, P.O. Box 1105, Richmond, VA 23218

Washington State Department of Ecology
P. O. Box 47600, Olympia, WA 98504-7600

West Virginia Department of Environmental Protection (WVDEP)
Division of Water and Waste Management
601 57th Street SE, Charleston, WV 25304

Wisconsin Department of Natural Resources (WDNR)
101 South Webster Street, P.O. Box 7921, Madison, WI 53707-7921

Puerto Rico Department of Natural and Environmental Resources
P.O. Box 366147, San Juan, Puerto Rico 00936

17 APPOINTMENTS

The appointment prepared for this permit application meets the requirements of 30 TAC §330.59(g) and §305.44. The Notice of Appointment is provided on the following page.

This section addresses §330.59(g).

NOTICE OF APPOINTMENT
Agent for the Applicant

Mr. Richard A. Hyde, P.E.
Executive Director
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Dear Mr. Hyde:

I am an Authorized Agent of BFI Waste Systems of North America, LLC, a Delaware corporation (the "General Partner"), the General Partner of BFI Waste Systems of North America, LLC, a Delaware limited partnership (the "Partnership").

This letter is to advise that the General Partner, in its capacity as general partner of the Partnership, and the Partnership, have duly appointed Ruby Teague, Environmental Manager, as their Agent. Ruby Teague, is hereby authorized to execute and deliver permit applications, permit modifications, and compliance related documentation for the Hardin County Landfill, and any and all other documents as required in connection with MSW Permit 2214B.

Very truly yours,

BFI Waste Systems of North America, LLC

Bryan Boyer

Bryan Boyer
Authorized Agent
Area President

SWORN TO AND SUBSCRIBED BEFORE ME by Bryan Boyer on the 8th day of 2018, 20 , which witness my hand and seal of office.

ANA L. GALLARDO NOTARY PUBLIC STATE OF TEXAS EXPIRES NOVEMBER 1, 2020 NOTARY ID: 12510406-4

Ana L. Gallardo
Notary Public in and for the State of Texas

Ana L. Gallardo
Printed Name

My Commission Expires 11/1/20

Q:\REPUBLIC\HARDIN COUNTY\EXPANSION\2214B EXPANSION\PARTS I-II\PARTS I-II TEXT-CLEAN.DOC

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS
TCEQ PERMIT NO. MSW-2214B

MAJOR PERMIT AMENDMENT APPLICATION

APPENDIX I/IIA
FACILITY LAYOUT MAPS

Prepared for

BFI Waste Systems of North America, LLC

March 2017
Revised August 2017

Revised December 2017

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

12-5-2017

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0120-758-11-02

This document is intended for permitting purposes only.

CONTENTS

This appendix addresses §330.61(d).

STATE OF TEXAS
NEVZAT TURAN
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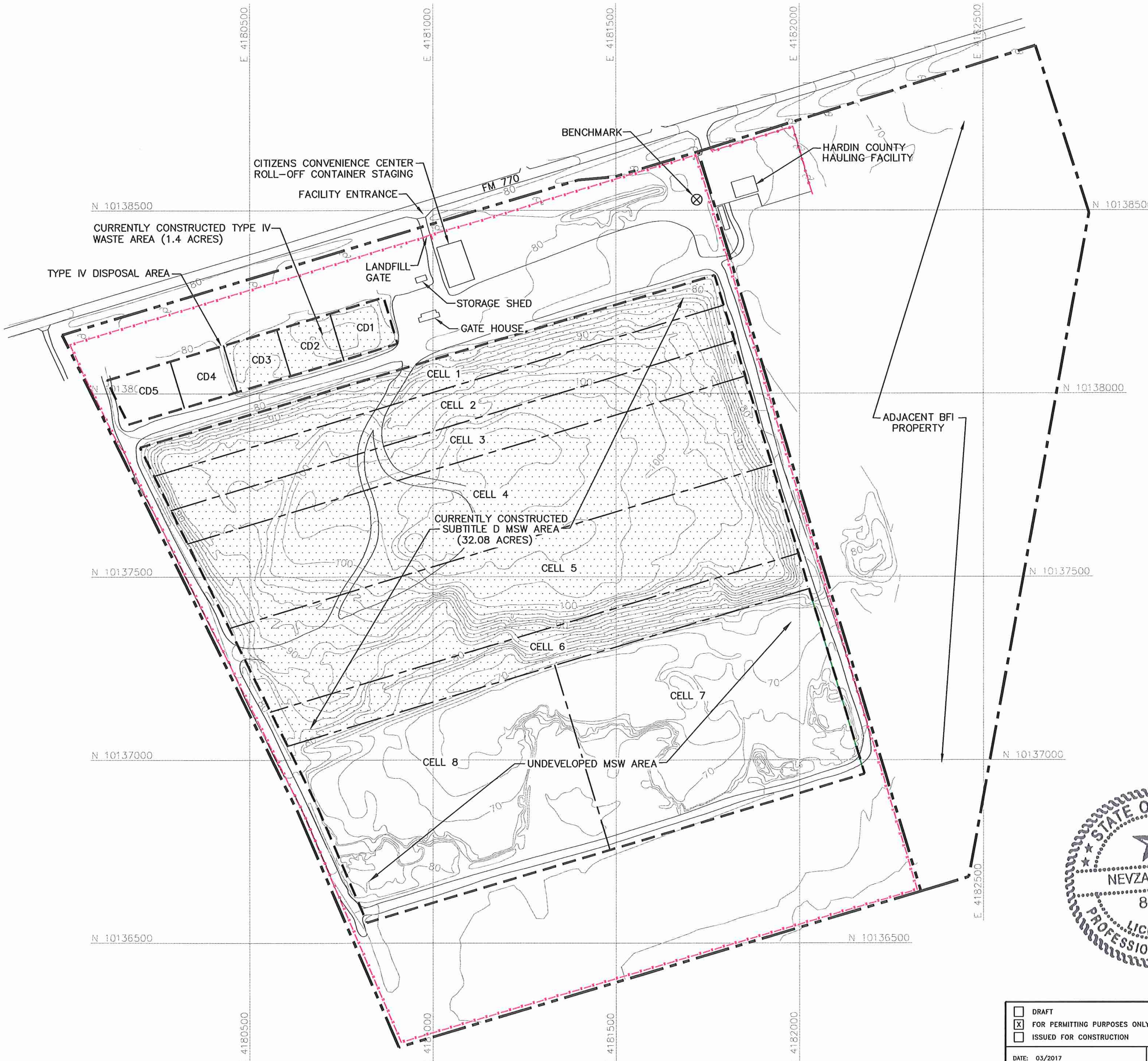
12-5-2017



LEGEND

— · —	BFI EAST PROPERTY BOUNDARY
— · · —	PERMIT BOUNDARY
— — —	CURRENTLY PERMITTED LIMITS OF WASTE
— - —	CELL BOUNDARY
70	EXISTING CONTOUR
N 10137500	STATE PLANE COORDINATE GRID
	EXISTING SUBTITLE-D LINER AREA
	EXISTING FENCE

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. PERMIT BOUNDARY AND PROPERTY BOUNDARIES PROVIDED BY IESI.
3. SITE BENCHMARK INFORMATION IS LISTED BELOW.

SITE BENCHMARK INFORMATION

NORTHING	EASTING	ELEVATION (FT-MSL)
10138528.79	4181721.10	76.55

* SITE BENCHMARK IS A BRONZE SURVEY MARKER SET IN CONCRETE AND HAS THE BENCHMARK ELEVATION AND SURVEY DATE STAMPED ON IT.

STATE OF TEXAS
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12-5-2017

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DATE: 03/2017
FILE: 0120-758-11
CAD: I/II A.1-SITE PLAN.DWG

DRAWN BY: SRF
DESIGN BY: NT
REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	08/2017	FIRST NOD RESPONSE
2	11/2017	OWNERSHIP CHANGE AND TCEQ COMMENT RESPONSE

MAJOR PERMIT AMENDMENT GENERAL SITE PLAN

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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DRAWING I/II-A.1

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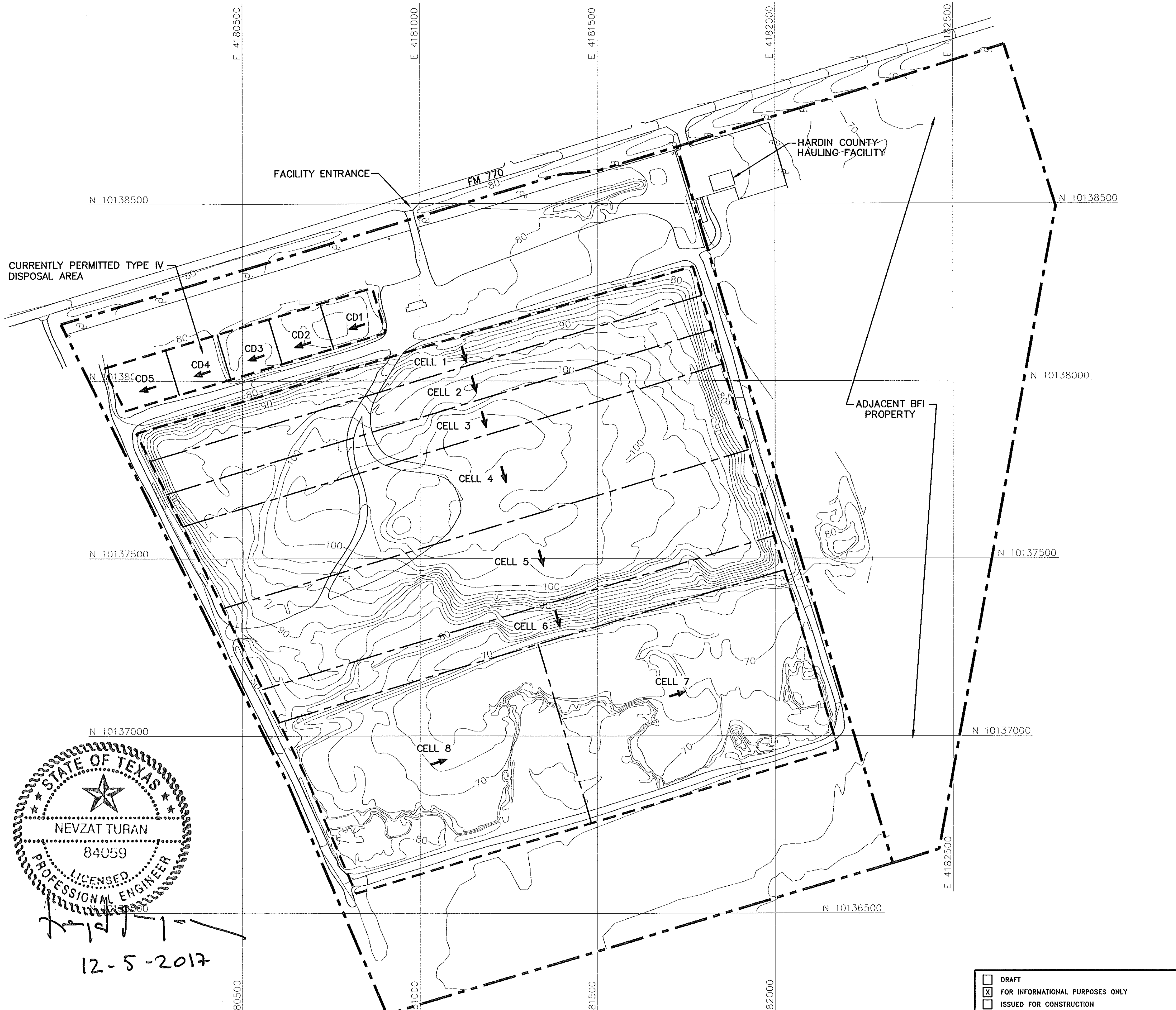

STATE OF TEXAS
NEVZAT TURAN
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12-5-2017

LEGEND

- BFI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- CELL BOUNDARY
- 70 EXISTING CONTOUR
- N 10137500 STATE PLANE COORDINATE GRID
- FILL DIRECTION (SEE NOTE 3)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. PERMIT BOUNDARY AND PROPERTY BOUNDARIES PROVIDED BY IESI.
3. SECTOR DESIGNATIONS INDICATE GENERAL PROGRESSION OF LANDFILL OPERATIONS. FILL DIRECTION ARROWS INDICATE GENERAL DIRECTION OF FILL WITHIN A SECTOR.
4. TYPICAL SECTOR CROSS SECTION APPENDIX IIIA-B – CROSS SECTIONS.
5. SEE DRAWINGS I/IIA.4 THROUGH I/IIA.6 FOR DETAILED SECTOR DEVELOPMENT PLANS.

TYPE I CELL SUMMARY

CELL	MAX LENGTH (FT)	MAX WIDTH (FT)	AREA (ACRES)
CELL 1	1622	86	3.17
CELL 2	1622	104	3.77
CELL 3	1605	101	3.69
CELL 4	1588	257	9.12
CELL 5	1545	254	8.79
CELL 6	1503	105	3.57
CELL 7	1485	200	6.74
CELL 8	1453	326	10.68

TYPE IV CELL SUMMARY

CELL	MAX LENGTH (FT)	MAX WIDTH (FT)	AREA (ACRES)
CD1	151	132	0.58
CD2	151	132	0.58
CD3	151	132	0.58
CD4	151	132	0.58
CD5	151	132	0.58

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CAD: I/II A.2-SECTOR DEVELOPMENT.DWG | REVIEWED BY: NT

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PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2017	OWNERSHIP CHANGE

MAJOR PERMIT AMENDMENT
SECTOR DEVELOPMENT SEQUENCE

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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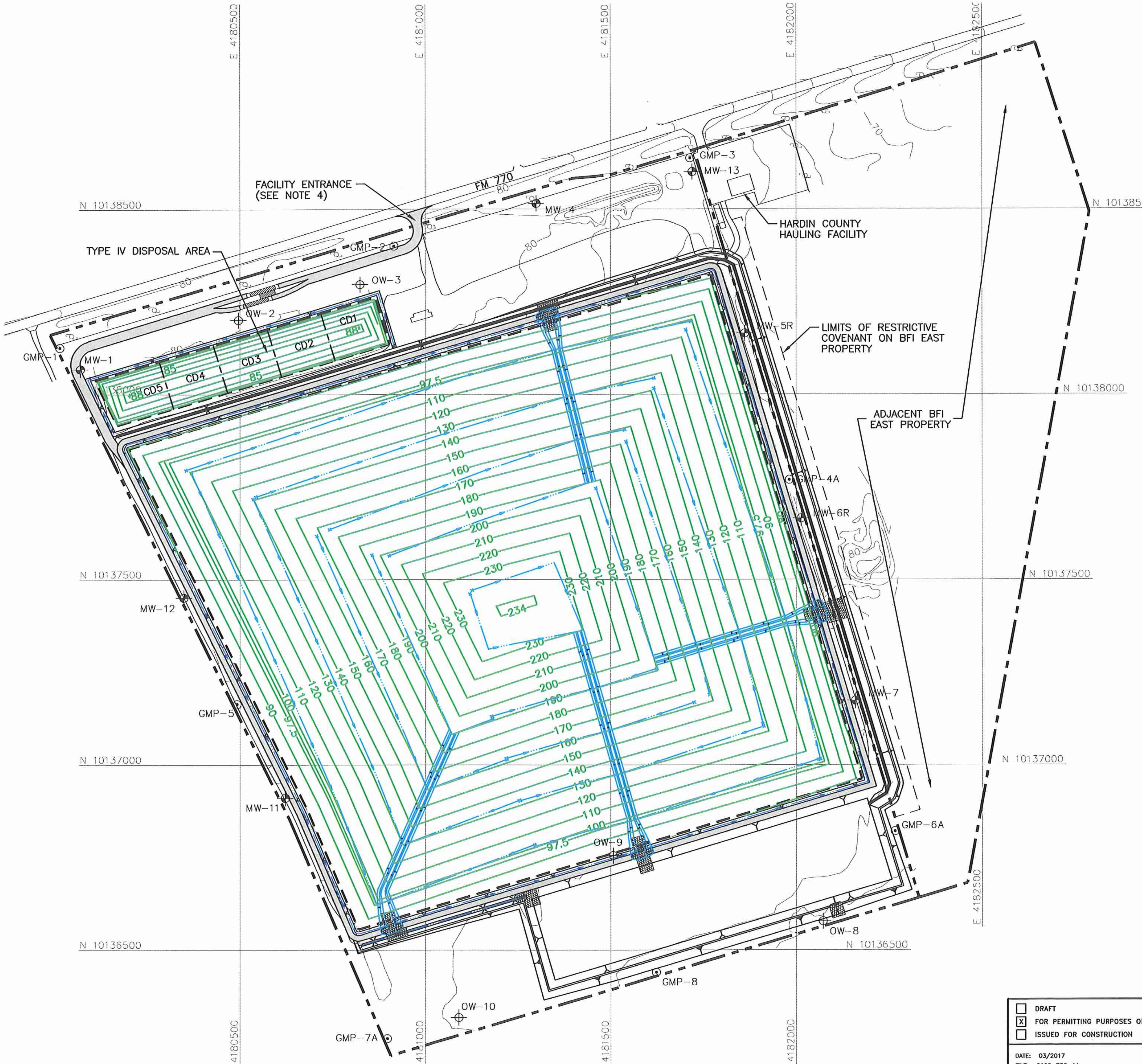

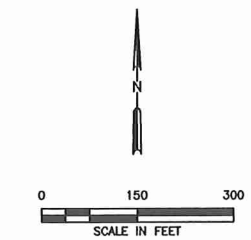

LEGEND

- BFI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- CELL BOUNDARY
- N 10137500 — STATE PLANE COORDINATE GRID
- 70 — EXISTING CONTOUR
- 234 — FINAL CONTOUR (SEE NOTE 3)
- DRAINAGE SWALE
- DRAINAGE CHUTE
- MW-1 — GROUNDWATER MONITOR WELL
- OW-2 — GROUNDWATER OBSERVATION WELL
- GMP-1 — GAS MONITORING PROBE

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.

STATE OF TEXAS
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DATE: 03/2017 FILE: 0120-758-11 CAD: A.3-LANDFILL COMPLETION PLAN.DWG	DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS		HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group TBPE REGISTRATION NO. F-3727		NO.	DATE	DESCRIPTION
		1	11/2017	OWNERSHIP CHANGE
				WWW.WCGRP.COM — DRAWING I/IIA.3

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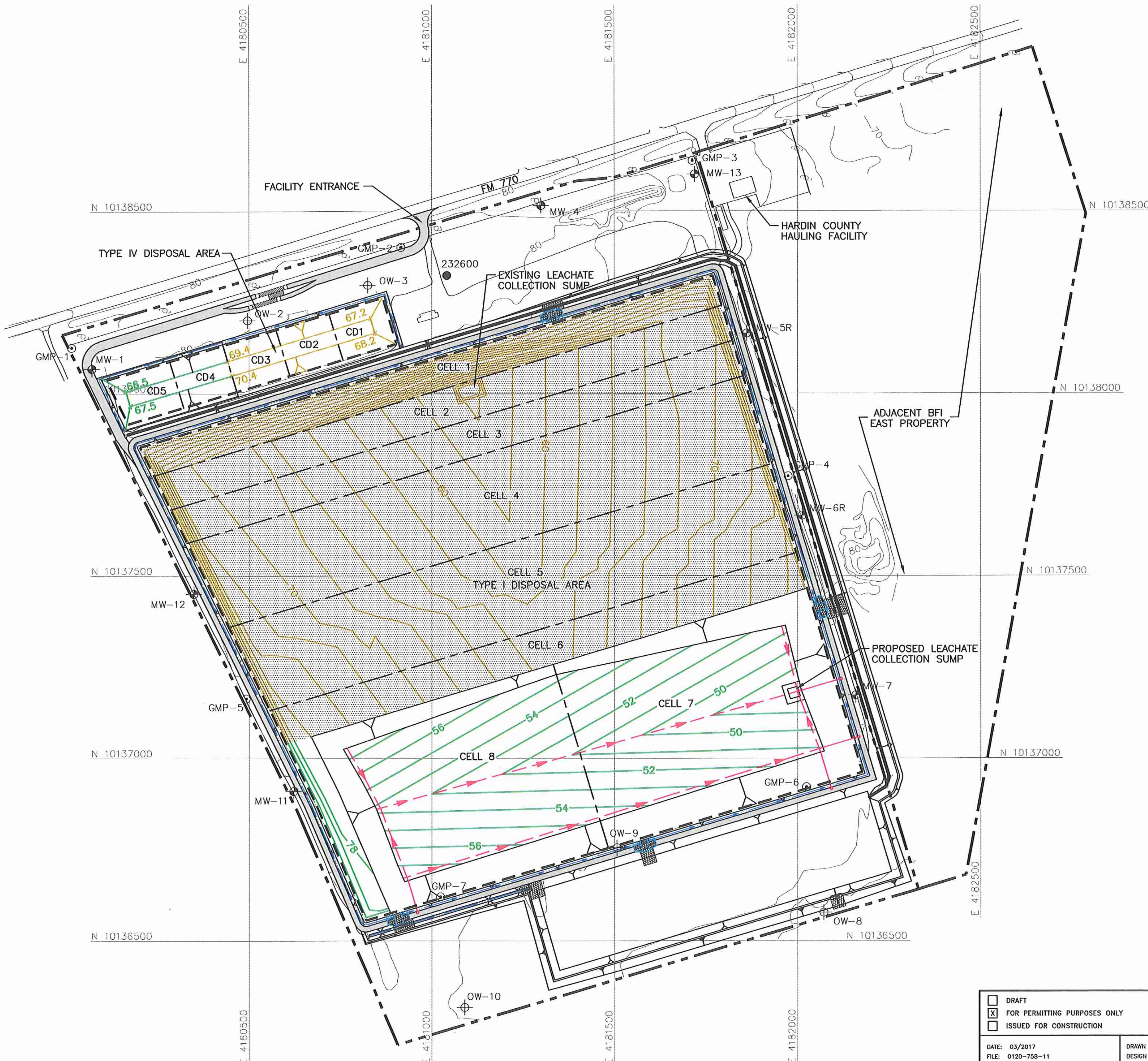

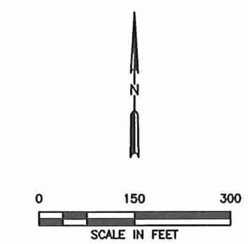

LEGEND

	BFI EAST PROPERTY BOUNDARY
	PERMIT BOUNDARY
	CURRENTLY PERMITTED LIMITS OF WASTE
70	EXISTING CONTOUR (SEE NOTE 1)
N 10137000	STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
	CELL BOUNDARY
50	PROPOSED EXCAVATION CONTOUR
70	CONSTRUCTED TOP OF PROTECTIVE COVER CONTOUR
	LEACHATE LINE
	LEACHATE RISER
	EXISTING SUBTITLE D COMPOSITE LINER AREA
MW-1	GROUNDWATER MONITOR WELL
OW-2	GROUNDWATER OBSERVATION WELL
GMP-1	GAS MONITORING PROBE
232600	PLUGGED WATER WELL

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CURRENTLY PERMITTED TYPE IV CELLS INCLUDES CD1 THROUGH CD5. CD1, CD2, AND CD3 ARE CURRENTLY DEVELOPED AND RECEIVED TYPE IV WASTE.

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REVIEWED BY: NT

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TBPE REGISTRATION NO. F-3727

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BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	08/2017	FIRST NOD RESPONSE
2	11/2017	OWNERSHIP CHANGE

MAJOR PERMIT AMENDMENT
EXCAVATION PLAN

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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DRAWING I/IIA.4

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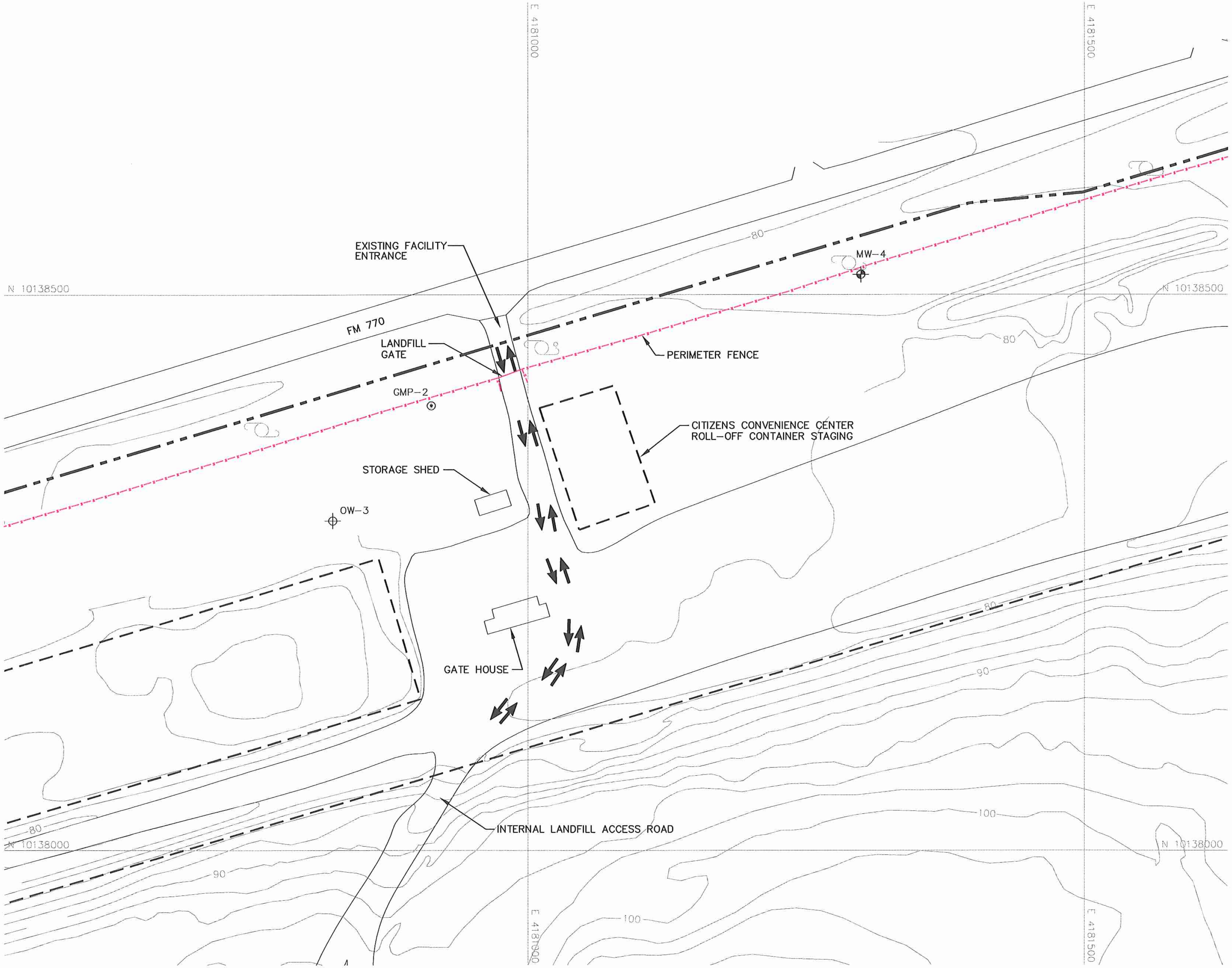

N

0 50 100

SCALE IN FEET

LEGEND

- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- 80 — EXISTING CONTOUR
- MW-4 — EXISTING GROUNDWATER MONITOR WELL
- OW-3 — EXISTING GROUNDWATER OBSERVATION WELL
- GMP-2 — EXISTING GAS MONITORING PROBE
- TRAFFIC ROUTING LANDFILL
- EXISTING FENCE

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. PERMIT BOUNDARY AND PROPERTY BOUNDARIES PROVIDED BY IESI.

STATE OF TEXAS
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DRAWN BY: SRF
DESIGN BY: NT
REVIEWED BY: NT

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2	11/2017	OWNERSHIP CHANGE AND TCEQ COMMENT RESPONSE

MAJOR PERMIT AMENDMENT
EXISTING SITE ENTRANCE PLAN

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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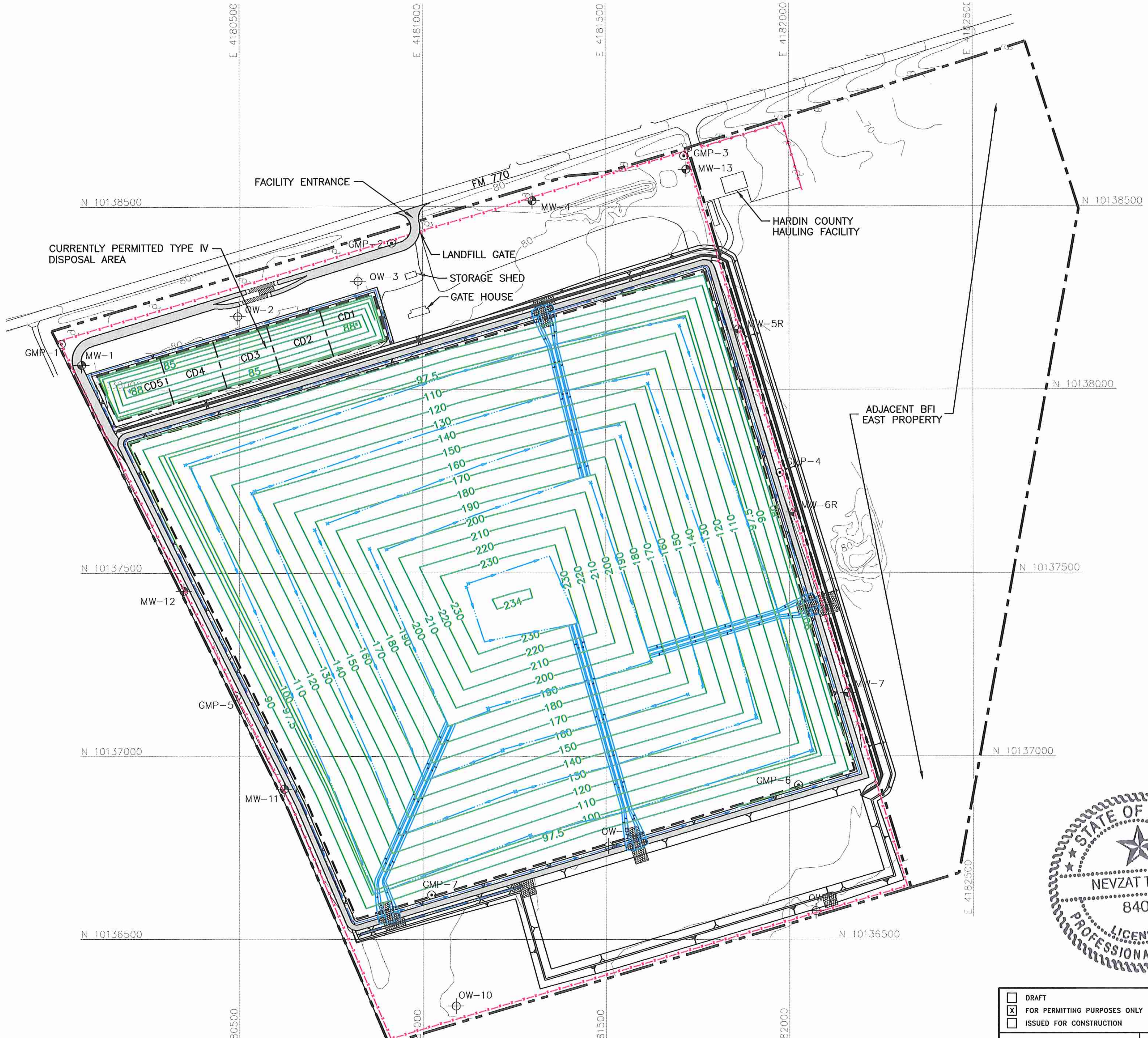

N
0 150 300
SCALE IN FEET

LEGEND

- BFI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY (SEE NOTE 3)
- CURRENTLY PERMITTED LIMITS OF WASTE
- CELL BOUNDARY
- N 10137500 STATE PLANE COORDINATE GRID
- 70 EXISTING CONTOUR
- 234 PROPOSED FINAL CONTOUR (SEE NOTE 3)
- PROPOSED DRAINAGE SWALE
- PROPOSED DRAINAGE CHUTE
- MW-1 EXISTING GROUNDWATER MONITOR WELL
- OW-2 EXISTING GROUNDWATER OBSERVATION WELL
- GMP-1 EXISTING GAS MONITORING PROBE
- EXISTING FENCE (SEE NOTE 2)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. ACCESS TO THE SITE WILL BE CONTROLLED BE PERIMETER FENCING (MINIMUM 4-FEET HIGH, 3-STRAND BARBED WIRE FENCE), AND A GATED ENTRANCE.
3. PERMIT BOUNDARY COINCIDES WITH THE EXISTING FENCE.

STATE OF TEXAS
NEVZAT TURAN
84059
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PROFESSIONAL ENGINEER

12-5-2017

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DATE: 03/2017
FILE: 0120-758-11
CAD: A.11-ACCESS CONTROL PLAN.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

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TBPE REGISTRATION NO. F-3727

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	08/2017	FIRST NOD RESPONSE
2	11/2017	OWNERSHIP CHANGE AND TCEQ COMMENT RESPONSE

MAJOR PERMIT AMENDMENT ACCESS CONTROL PLAN

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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DRAWING I/IIA.6

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APPENDIX I/IIB

DEMONSTRATION OF COORDINATION

- Coordination with Federal Aviation Administration
- Coordination with Texas Historical Commission
- Coordination with Texas Department of Transportation
- Coordination with Texas Parks and Wildlife Department
- Coordination with South East Texas Planning Commission (SETPC)
- Coordination with U.S. Army Corps of Engineers
- Coordination with U.S. Department of the Interior, Fish and Wildlife Service

COORDINATION WITH FEDERAL AVIATION ADMINISTRATION

CONTENTS

U.S. Department
of Transportation
**Federal Aviation
Administration**

Federal Aviation Administration
Airports Division, Southwest Region Safety and
Standards Branch

10101 Hillwood Parkway
Fort Worth, Texas 76177

November 9, 2016

Nevzat Turan, P.E.
Weaver Consultants Group, LLC
6420 Southwest Boulevard Suite 206
Fort Worth, TX 76109

Subject: IESI Hardin County Landfill
Municipal Solid Waste (MSW) – Proposed Landfill Expansion
Permit Number TCEQ Permit MSW-2214A
FAA File No. 17-001-TX

Dear Mr. Turan:

This letter is in response to your October 31, 2016 notice advising us of the application submitted by your company on behalf of IESI Hardin County Landfill, a Type I MSW in Hardin County, Texas.

Using coordinates of 30 20' 09" N and 94 21' 10" W, we determined that there is one public-owned public-use airport within 6 statute miles: Hawthorne Field (45R) Azimuth 89.63 Distance 4.94nm/5.9sm 30,042 feet.

The Hawthorne Airport location was evaluated in 1994 in conjunction with the original Hardin County Landfill site request. At that time it was determined the landfill site did not conflict with our criteria concerning landfills near airports and there was no objection from FAA.

We continue to have no objection to the application submitted by Weaver Consultants LLC on behalf of IESI Hardin County Landfill for an expansion. Our position of no objection is based on our guidance for hazardous wildlife attractants on or near airports FAA Advisory Circular 150/5200-33B.

This site has been assigned our file No. 17-001-TX. Please refer to this number in any future correspondence regarding this site. Thank you for coordinating this project with us. If there are any questions, you can contact me at 817-222-5671 or gary.loftus@faa.gov.

Sincerely,

Gary J. Loftus
Airports Compliance Program Manager
Airport Certification Safety Inspector
FAA Southwest Region Airports Division

cc: Texas Department of Transportation
Division of Aviation
125 East 11th Street
Austin, TX 78701-2483

Weaver Consultants Group

October 31, 2016
Project No. 0771-365-11-07-03

Mr. Joe Washington
Airports Division – Safety and Standards Branch, ASW 620
US Department of Transportation
Federal Aviation Administration
2601 Meacham Boulevard
Fort Worth, Texas 76137-4298

Re: Compliance with Airport Location Restriction
Proposed IESI Hardin County Landfill Expansion
Hardin County, Texas

Dear Mr. Washington:

The purpose of this letter is to demonstrate coordination with the Federal Aviation Administration (FAA), consistent with Title 30 Texas Administrative Code (TAC) Chapter §330.61(i)(5) and §330.545. This regulation requires that an applicant amending a municipal solid waste facility permit demonstrate coordination with the FAA regarding the potential impact of the referenced project to existing airports or air traffic. Specific 30 TAC §330.545 requirements relevant to the subject landfill are:

> (a) Landfill expansions *"that are located within 10,000 feet of any airport runway end used by turbojet aircraft or within 5,000 feet of any airport runway end used by only piston-type aircraft shall demonstrate that the units are designed and operated so that the municipal solid waste landfill unit does not pose a bird hazard to aircraft."*
>
> (d) *"All landfill facilities within a six-mile radius of any small general service airport runway or within a five-mile radius of any large general public commercial airport shall be critically evaluated to determine if an incompatibility exists."*

Weaver Consultants Group, LLC is preparing a permit amendment application, under contract with IESI TX Landfill LP to expand its existing landfill that is located approximately 0.7 miles west of the intersection of Farm-to-Market (FM) 770 and State Highway (SH) 326 in central Hardin County. To assist you in your determination, please find attached the following information:

- Project Summary and Site Location Maps.
- FAA Airport Vicinity Map. As shown, no airports are located within 10,000 feet of the landfill. The Hawthorne Field Airport runway end is located

approximately 5.4 miles from the southeast corner of the permitted property boundary, or approximately 4.8 nautical miles from the threshold of Hawthorne Field Airport Runway 13 (as noted in the 1994 FAA correspondence attached).

- Proposed Landfill Completion Plan. This plan shows Point A, which was uploaded to the FAA Notice Criteria Tool webpage for evaluation. Note that the elevation of the top of the completed landfill (plus an additional 45 feet) was used for the evaluation. A printout of the completed Notice Criteria Tool webpage is also included demonstrating that the vertical expansion of the landfill does not exceed Notice Criteria.
- 1994 FAA Correspondence. The correspondence includes the previous determination by FAA during the 1994 permitting of the landfill.

Please note also that the Site Operating Plan includes requirements to maintain the working face of the landfill, where trash is exposed, to as small of an area as practical. Specific working face sizes are listed in the permit documents to minimize the potential of the site to attract birds.

Your response that the proposed vertical expansion of the IESI Hardin County Landfill complies with TCEQ and FAA requirements related to potential impacts to existing airports or air traffic will be sincerely appreciated. Please call if you have any questions or need additional information.

Sincerely,
Weaver Consultants Group, LLC

Nevzat Turan, P.E.
Senior Engineer

Attachments: Project Summary and Site Location Maps
FAA Airport Vicinity Map
Landfill Completion Plan with Notice Criteria Tool Worksheet
1994 FAA Correspondence

cc: Brett O'Connor, IESI TX Landfill, LP

PROJECT SUMMARY
AND
SITE LOCATION MAPS

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

10/31/2016

Project Summary
IESI Hardin County Landfill Expansion
Hardin County, Texas

Introduction

The IESI Hardin County Landfill is in the process of developing a major permit amendment application that will provide long-term disposal capacity for authorized solid waste that is generated in Hardin County and surrounding counties. The objective of this summary is to provide an overview of the proposed landfill expansion. The following subsections detail information regarding the owner and operator of the landfill, general site information, and a summary of the proposed landfill design.

Owner/Operator Information

The IESI Hardin County Landfill is owned and operated by IESI TX Landfill LP. IESI TX Landfill LP is a subsidiary of Waste Connections, Inc. Waste Connections is one of the leading providers of solid waste services in the nation. Waste Connections provides nonhazardous waste collection, transfer, recycling, and disposal services to residential, municipal, industrial and commercial customers across the country.

Site Information

The following drawings are attached to this summary.

- Figure 1 – Site Location Map. This drawing shows the site location on a standard TxDOT county highway map.
- Figure 2 – General Topographic Map. This drawing shows the permit boundary and permitted landfill footprint on a USGS map.
- Figure 3 – Aerial Photograph. This figure shows the permit boundary and permitted landfill footprint on an aerial photograph.
- Figure 4 – Permitted and Proposed Excavation Plan. This figure provides a comparison between the currently permitted landfill excavation plan and the proposed amended landfill excavation plan.

- Figure 5 – Permitted and Proposed Landfill Completion Plan. This figure provides a comparison between the currently permitted landfill completion plan and the proposed amended landfill completion plan.

The IESI Hardin County Landfill is an existing 79-acre Municipal Solid Waste (MSW) landfill (current TCEQ Permit No. MSW-2214A) located approximately 0.7 miles west of the intersection of FM 770 and SH 326 in central Hardin County.

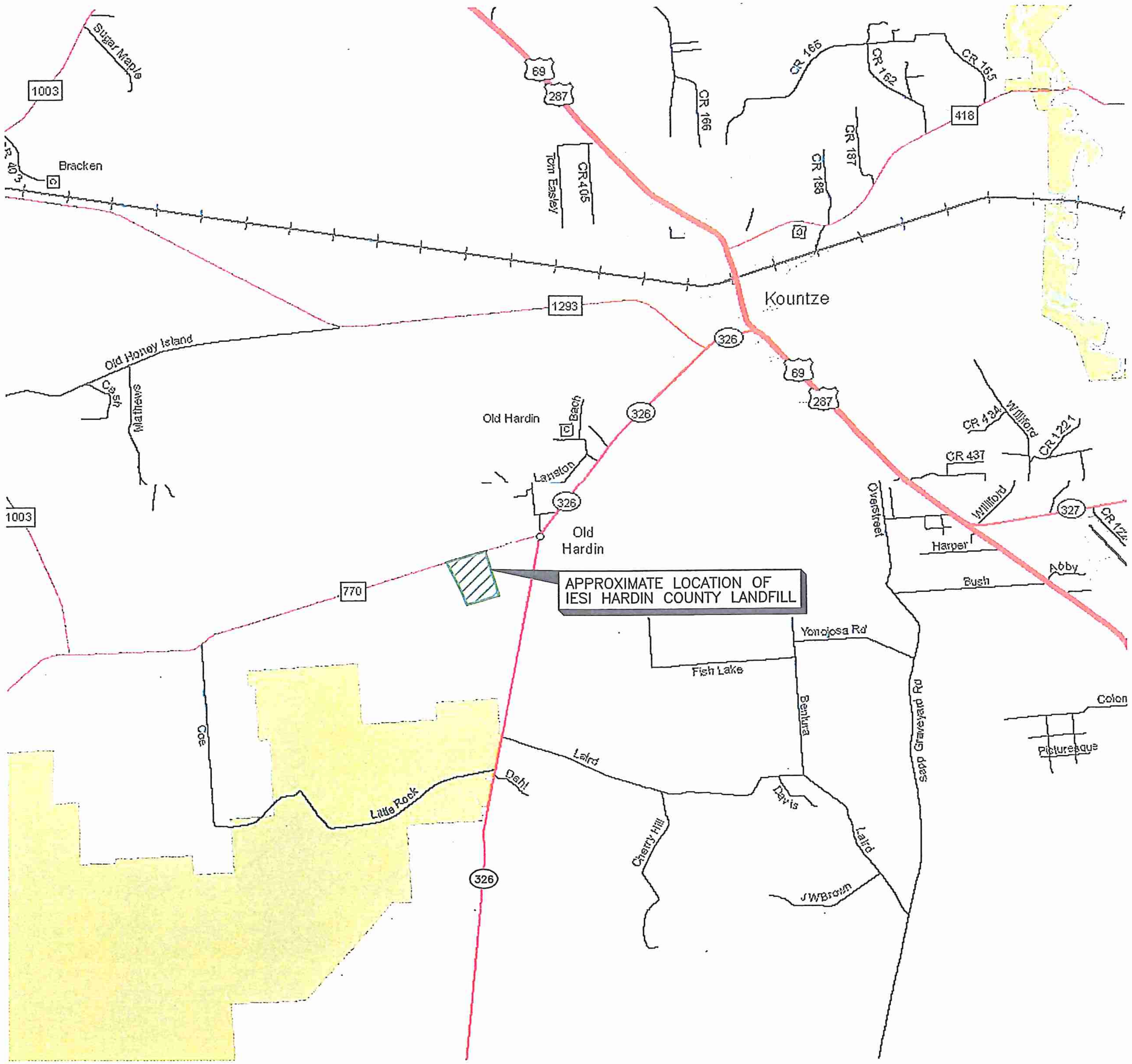
The site was originally permitted as a MSW landfill by the Texas Natural Resource Conservation Commission (TNRCC) in 1995. Approximately 32 acres of the 49.6-acre Subtitle D (i.e., composite bottom liner system) MSW disposal area has currently been developed. The facility also includes a 2.4-acre construction and demolition debris disposal unit, of which approximately 1.4 acres have been developed. The original permit number was Permit No. MSW-2214. The permit was transferred in 2002 from Hardin County to IESI TX Landfill LP.

Design Summary

The following information presents a summary of the design and operations for the proposed IESI Hardin County Landfill expansion:

- The IESI Hardin County Landfill is an existing municipal solid waste landfill facility (current TCEQ Permit No. MSW-2214A). The existing landfill currently serves residences and businesses in Hardin County and surrounding counties.
- With this expansion, the existing 79-acre permit boundary and existing 52-acre limits of waste will remain unchanged. The permitted but undeveloped waste disposal area will be deepened as shown on Figure 4, which shows both permitted top of protective cover grades (over constructed cells) and proposed excavation grades. The completion grades will be increased to optimize the disposal capacity of the permitted waste fill area. The currently permitted and proposed complete plans are shown on Figure 5.
- Accepted wastes will remain consistent with the current MSW landfill permit. The facility currently accepts municipal solid waste resulting from or incidental to municipal, community, commercial, institutional, and recreational activities; municipal solid waste resulting from construction and demolition activities; Class 2 and Class 3 nonhazardous industrial solid waste; and certain special wastes as permitted by the TCEQ. For this permit amendment cells 6 and 7 will be constructed in accordance with 30 TAC 335.590, and will accept Class 1 non-hazardous industrial waste in addition to the waste streams received by the landfill under the current permit.

- Access to the landfill will be provided via the existing site access road entrance off of FM 770. Based on travel patterns of existing landfill traffic, vehicles bound for the landfill will generally access the site using SH 326 and FM 770.
- A bottom liner system and final cover system that meet all regulatory requirements will be used for constructing the solid waste containment system. The design objective of the containment system (liner, leachate management system, and final cover) is to isolate the solid waste and remove leachate (defined as liquid that has contacted solid waste) that collects on the liner system. Leachate that is removed from the landfill is transported to an offsite, permitted treatment facility. The construction procedures of the liner system and final cover system follow strict TCEQ-approved quality control and quality assurance procedures, which are verified by an independent testing firm, and approved by a professional engineer licensed in the State of Texas. Liner construction is divided into approximately 3 to 4 acre "cells" across the permitted bottom of the landfill. Each of the containment system components must be approved by the engineer, and thoroughly reviewed and approved by the TCEQ before solid waste is placed into each constructed cell.
- To verify that the highest level of environmental protection is maintained, the following landfill monitoring systems are provided:
  - Groundwater Monitoring System. The purpose of the groundwater monitoring system is to verify the integrity of the containment system and demonstrate that area groundwater is not adversely impacted by the landfill. This is accomplished by obtaining water samples from the monitor wells, located on the perimeter of the landfill, which are screened to monitor groundwater quality. The water samples are tested at an offsite laboratory.
  - Gas Monitoring System. The purpose of the landfill gas monitoring system is to verify that landfill gas does not migrate beyond the permit boundary. Landfill gas probes are placed along the perimeter of the permit boundary.
  - These monitoring systems are sampled and tested periodically per the TCEQ-approved monitoring plans. The results are filed with the TCEQ and are public record.
- Site Operations. The site will be operated by properly trained personnel. A detailed Site Operating Plan will be included in the permit amendment application. The plan will detail the required equipment, personnel, and safety procedures required to operate the site in accordance with TCEQ regulations. The IESI Hardin County Landfill will continue to be inspected by the TCEQ on a regular basis to ensure the site is in compliance with state regulations and developed as permitted.



N

0 3000 6000
SCALE IN FEET

LEGEND

SITE LOCATION

NOTE:

1. MAP OBTAINED FROM TEXAS DEPARTMENT OF TRANSPORTATION DATED 2014.

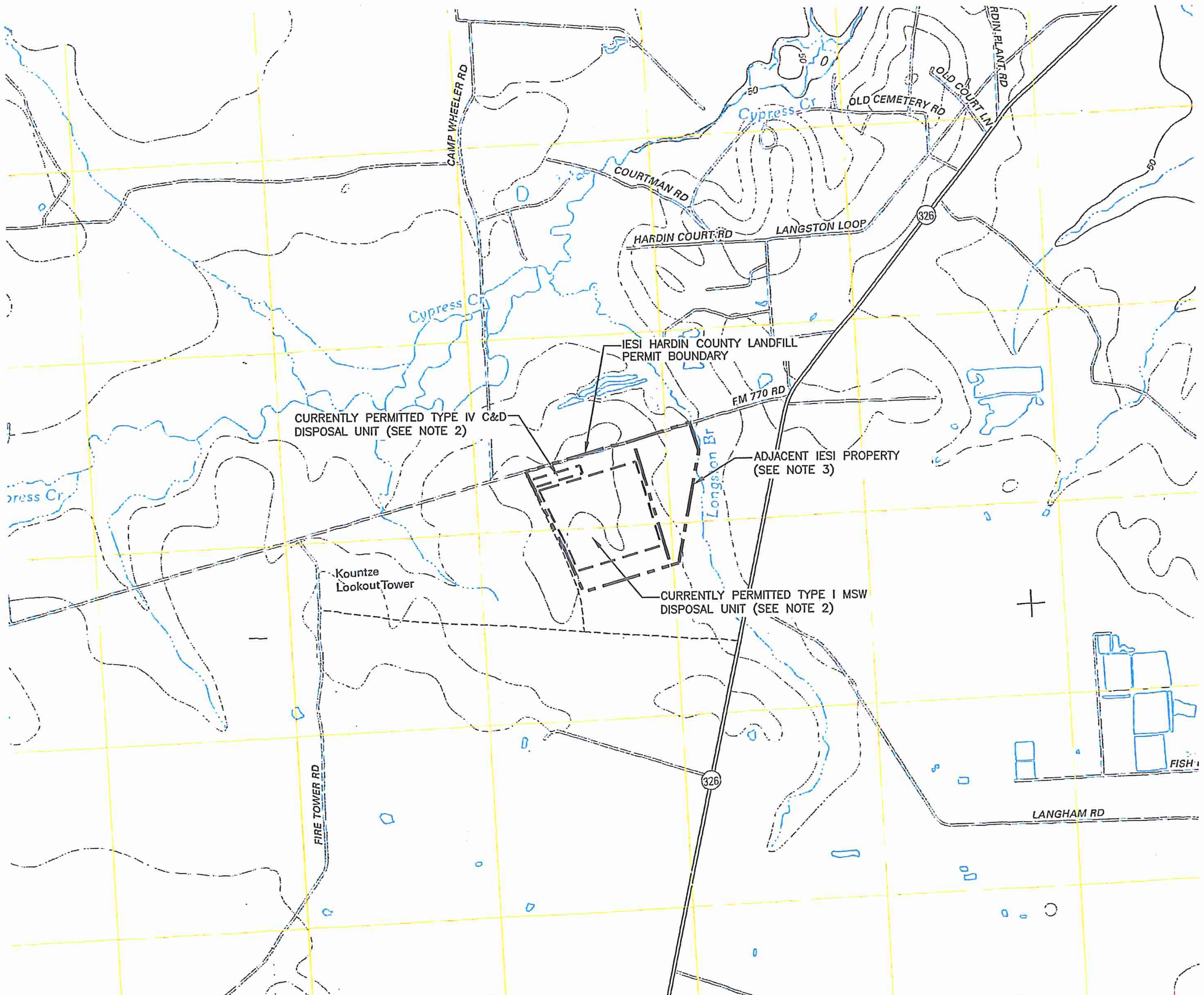
STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED PROFESSIONAL ENGINEER

10/31/2016

I/IIB-10

☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR IESI TX LANDFILL LP	MAJOR PERMIT AMENDMENT SITE LOCATION MAP
DATE: 10/2016 FILE: 0771-365-11 CAD: FIG 1-SITE LOCATION MAP.DWG DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. / DATE / DESCRIPTION	IESI HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group TBPE REGISTRATION NO. F-3727		WWW.WCGRP.COM / FIGURE 1

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 1-SITE LOCATION MAP.dwg, jwilson, 1:2



N

0 1000 2000
SCALE IN FEET

LEGEND

IESI PROPERTY BOUNDARY
PERMIT BOUNDARY
LIMITS OF WASTE

ROAD CLASSIFICATION

Interstate Route — State Route
US Route — Local Road
Ramp — 4WD
Interstate Route — US Route — State Route

KOUNTZE SW, TX 2013 **KOUNTZE SOUTH, TX** 2013

NOTES:

1. ADAPTED FROM USGS 7.5 MINUTE QUADRANGLE TOPOGRAPHIC MAPS (KOUNTZE SOUTH, TX 2013 AND KOUNTZE SW, TX 2013).
2. THE FACILITY HAS TWO SEPARATE PERMITTED DISPOSAL UNITS. THE FIRST UNIT IS A TYPE I MUNICIPAL SOLID WASTE (MSW) DISPOSAL UNIT AND IT ENCOMPASSED APPROXIMATELY 49.6 ACRES. THE SECOND PERMITTED UNIT IS A 2.4 ACRE TYPE IV CONSTRUCTION AND DEMOLITION (C&D) DISPOSAL UNIT.
3. THE ADJACENT IESI PROPERTY IS APPROXIMATELY 31.3 ACRES. THIS PROPERTY WILL NOT BE JOINED TO THE DISPOSAL AREA; HOWEVER, A RESTRICTIVE COVENANT MAY BE OBTAINED FOR A PORTION OF THIS AREA FOR LANDFILL-RELATED DRAINAGE FACILITIES.

I/IIB-11

STATE OF TEXAS
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84059
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10/31/2016

☐ DRAFT
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DATE: 10/2016
FILE: 0771-365-11
CAD: FIG 2-GENERAL TOPO MAP.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

PREPARED FOR
IESI TX LANDFILL LP

REVISIONS

NO.	DATE	DESCRIPTION

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

MAJOR PERMIT AMENDMENT
GENERAL TOPOGRAPHIC MAP

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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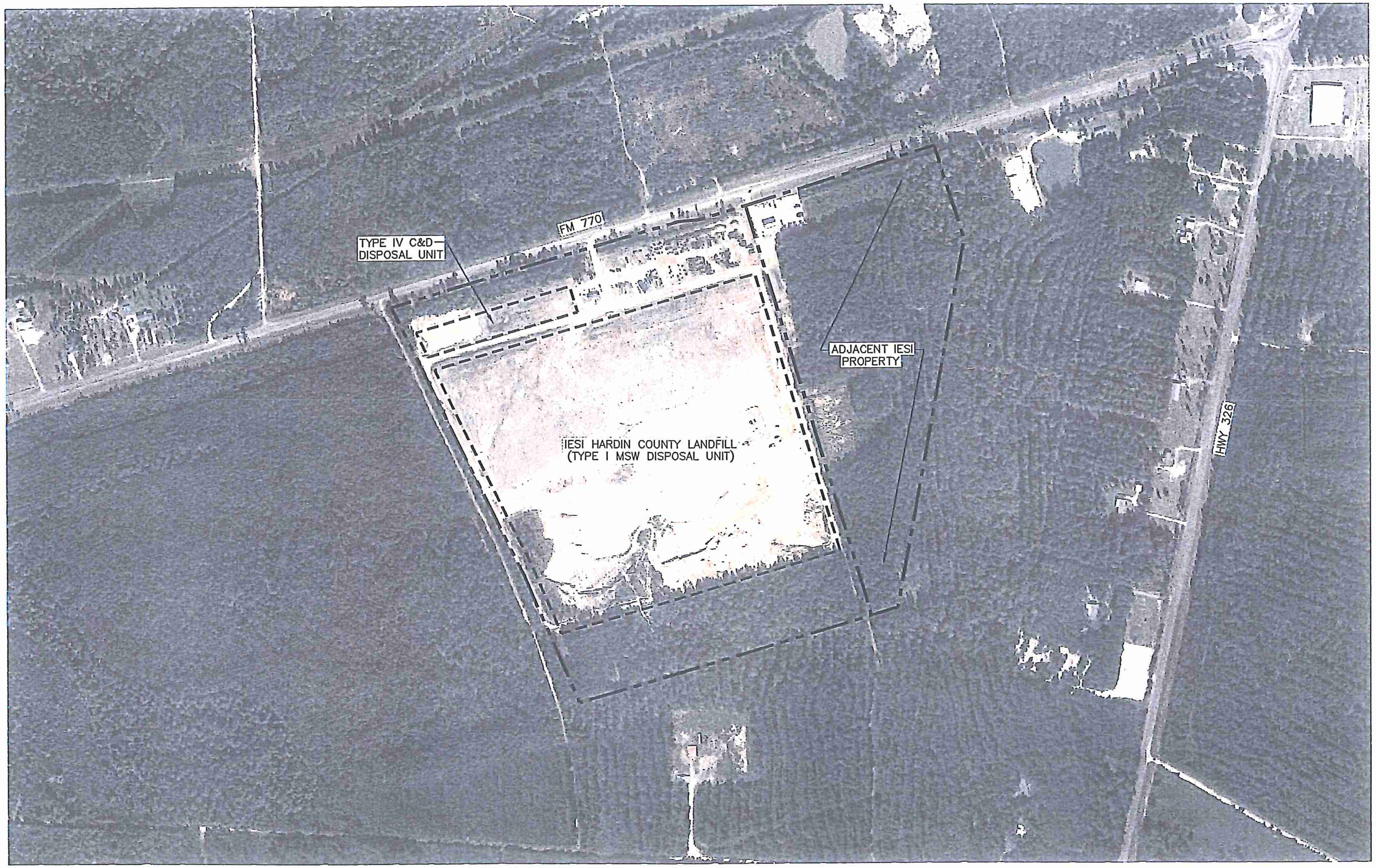
FIGURE 2

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 2-GENERAL TOPO MAP.dwg, jwilson, 1:2



N

0 300 600
SCALE IN FEET

LEGEND

IESI PROPERTY BOUNDARY
PERMIT BOUNDARY
LIMITS OF WASTE

NOTE:

1. AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH AND DATED 2016.

STATE OF TEXAS
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PROFESSIONAL ENGINEER

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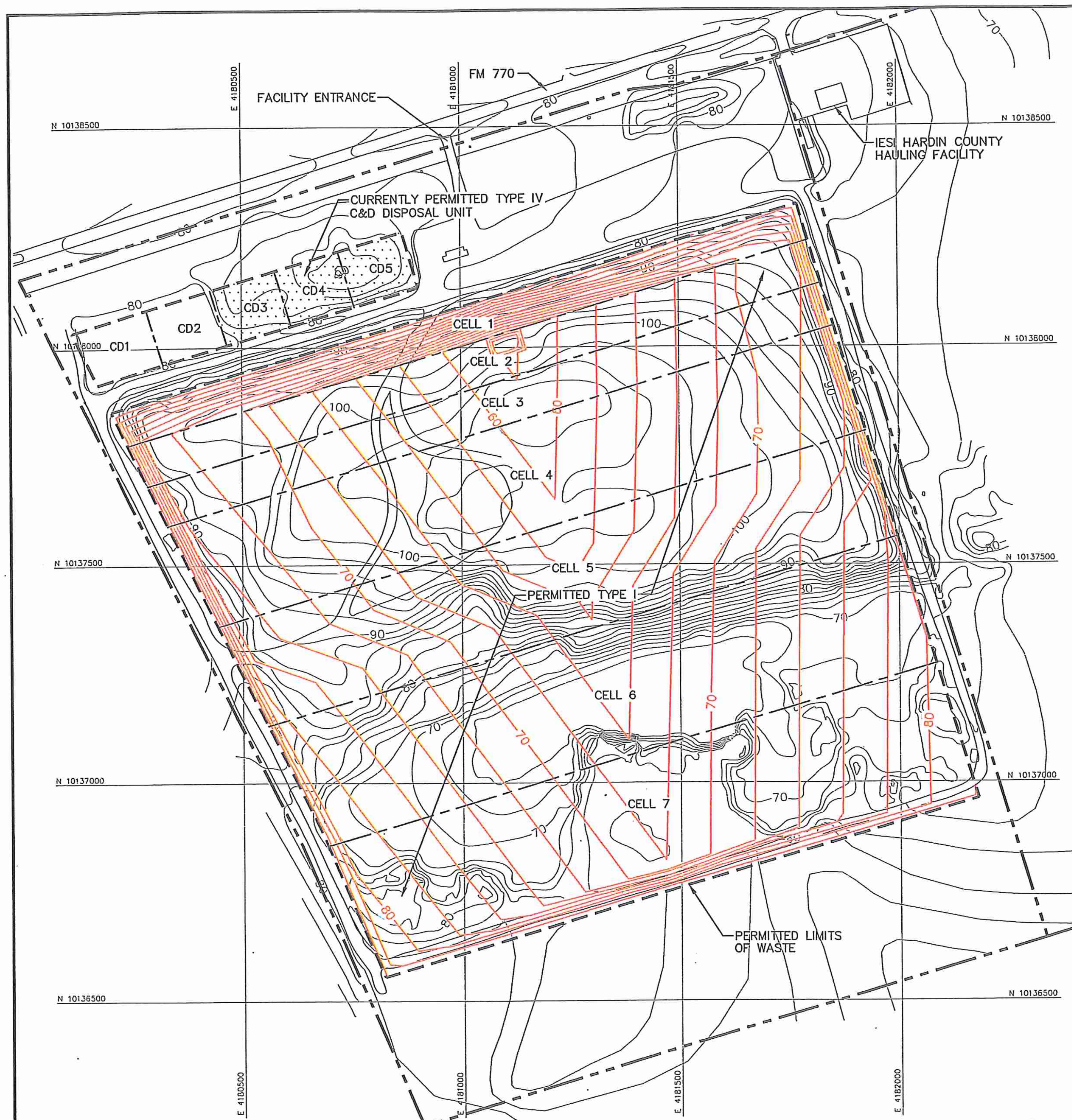
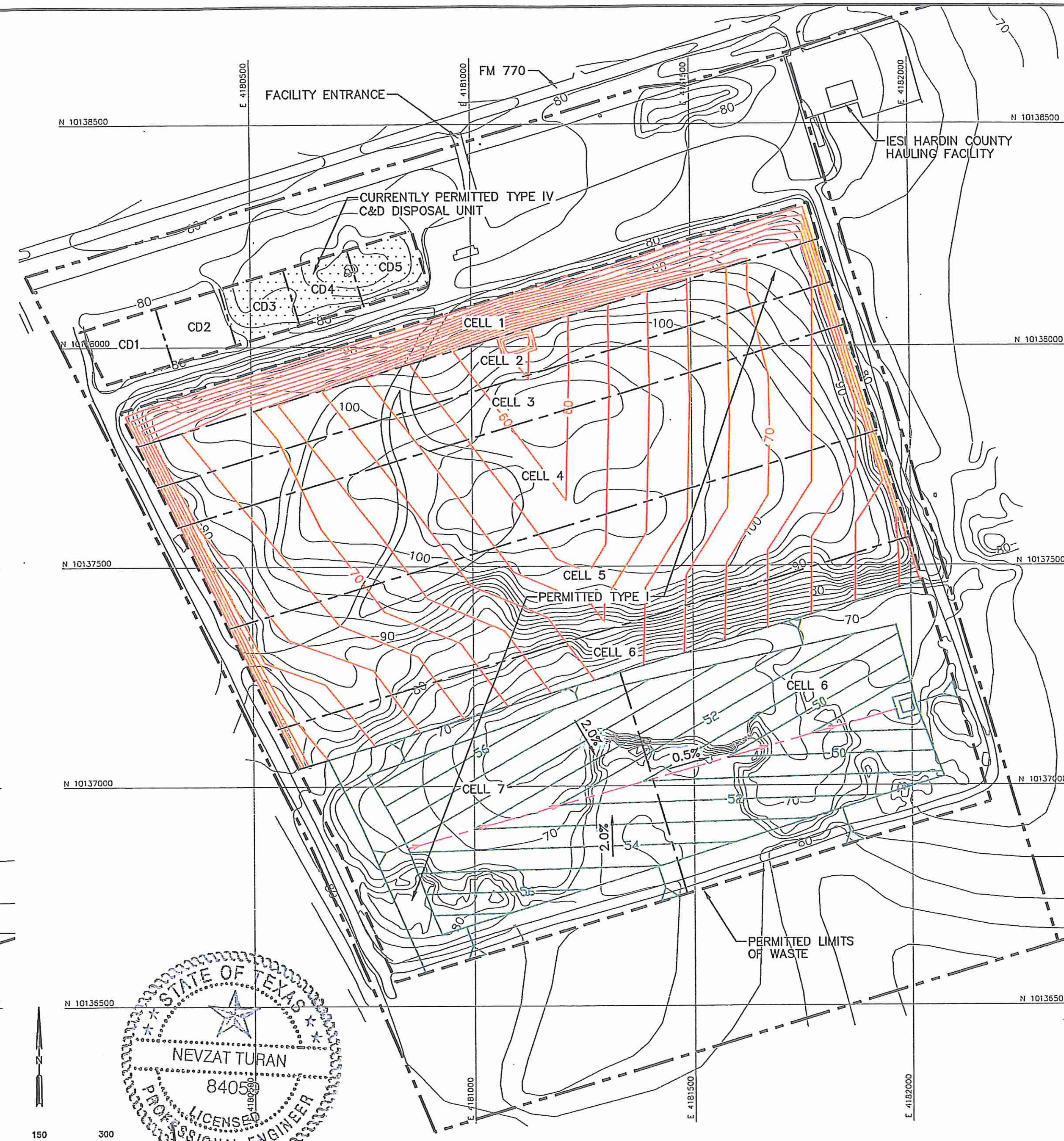
I/IIB-12

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 3-AERIAL PHOTOGRAPH.dwg, jwilson, 1:2

☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION		PREPARED FOR IESI TX LANDFILL LP	MAJOR PERMIT AMENDMENT AERIAL PHOTOGRAPH
DATE: 10/2016 FILE: 0771-365-11 CAD: FIG 3-AERIAL PHOTOGRAPH.DWG	DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. / DATE / DESCRIPTION	IESI HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group TBPE REGISTRATION NO. F-3727			WWW.WCGRP.COM / FIGURE 3



CURRENTLY PERMITTED CONDITIONS PLAN



10/31/2016

PROPOSED EXCAVATION PLAN

I/IIB-13

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05–17–2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CONTOURS FOR THE CURRENTLY PERMITTED CONDITIONS PLAN REPRESENT THE TOP OF LINER PROTECTIVE COVER CONTOURS WHICH ARE 4 TO 5 FEET ABOVE THE EXCAVATION GRADES. THE PROPOSED EXCAVATION PLAN CONTOURS WERE DEVELOPED BY WEAVER CONSULTANTS GROUP AS PART OF THE DESIGN BASIS MEMORANDUM FOR THE PROPOSED MAJOR AMENDMENT APPLICATION.
3. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.

LEGEND

	IESI EAST PROPERTY BOUNDARY
	PERMIT BOUNDARY
	PERMITTED LIMITS OF WASTE
	PROPOSED LIMITS OF WASTE
	CELL BOUNDARY
70	EXISTING CONTOUR (SEE NOTE 1)
N 10137000	STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
60	PERMITTED TOP OF PROTECTIVE COVER CONTOUR (SEE NOTE 2)
60	PROPOSED EXCAVATION CONTOUR (SEE NOTE 2)
	LEACHATE LINE

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 10/2016
FILE: 0771-365-11
CAD: FIG 4-EXCAVATION PLAN COMP.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

PREPARED FOR
IESI TX LANDFILL LP

REVISIONS

NO.	DATE	DESCRIPTION

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

MAJOR PERMIT AMENDMENT
PERMITTED AND PROPOSED EXCAVATION PLAN

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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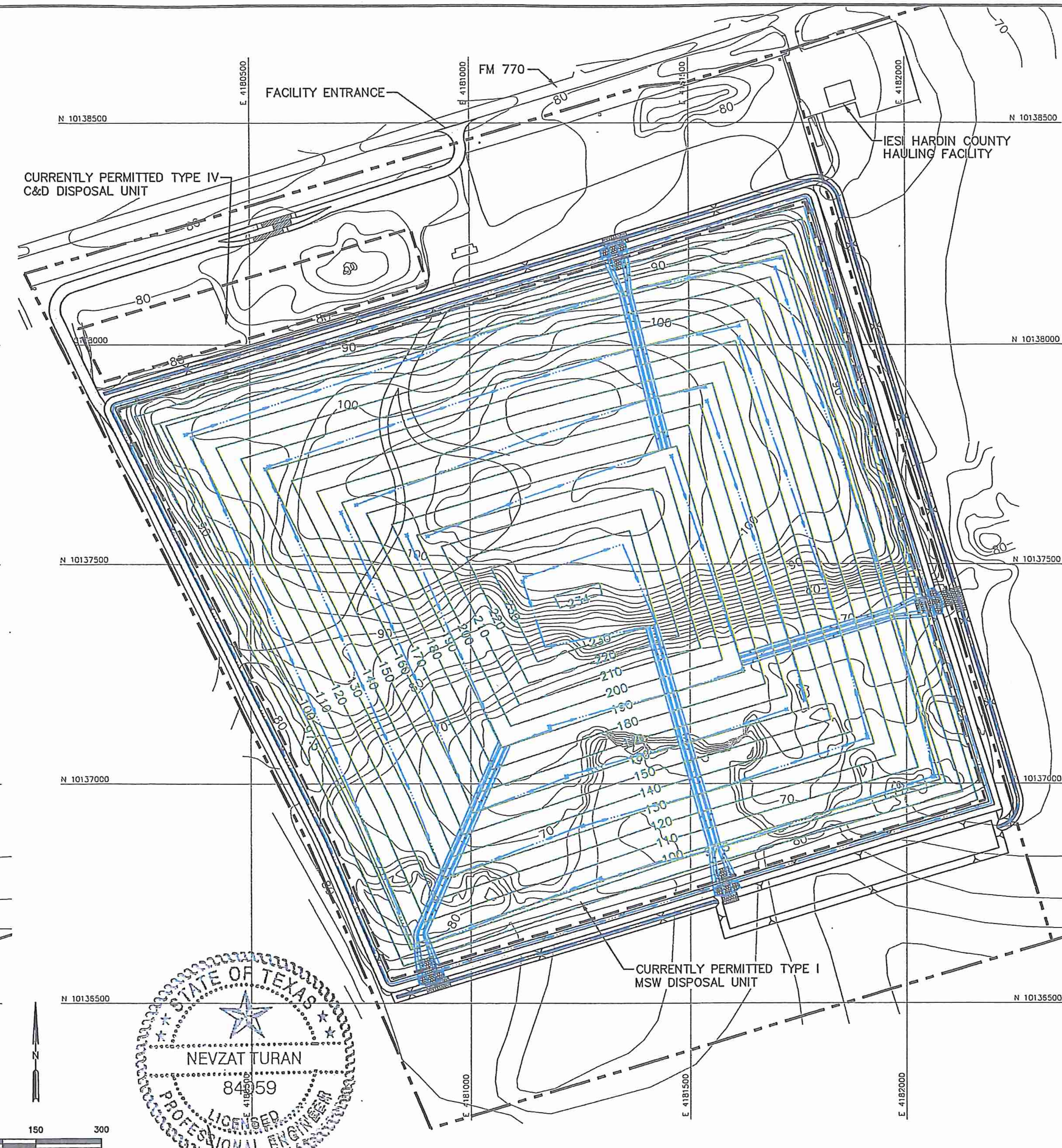
FIGURE 4

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 4-EXCAVATION PLAN COMPARISON.dwg, jwilson, 1:2

PERMITTED COMPLETION PLAN



10/31/2016

PROPOSED COMPLETION PLAN

0 150 300
SCALE IN FEET

I/IIB-14

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. PERMITTED COMPLETION PLAN FINAL COVER CONTOURS ARE OBTAINED FROM 2010 HARDIN COUNTY LANDFILL MSW PERMIT NO. 2214A. THE PROPOSED PERMITTED COMPLETION PLAN FINAL COVER CONTOURS WERE DEVELOPED BY WEAVER CONSULTANTS GROUP AS PART OF THE DESIGN BASIS MEMORANDUM FOR THE PROPOSED MAJOR AMENDMENT APPLICATION.
3. THE PROPOSED COMPLETION PLAN DRAINAGE STRUCTURES ARE SHOWN FOR INFORMATIONAL PURPOSES. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.

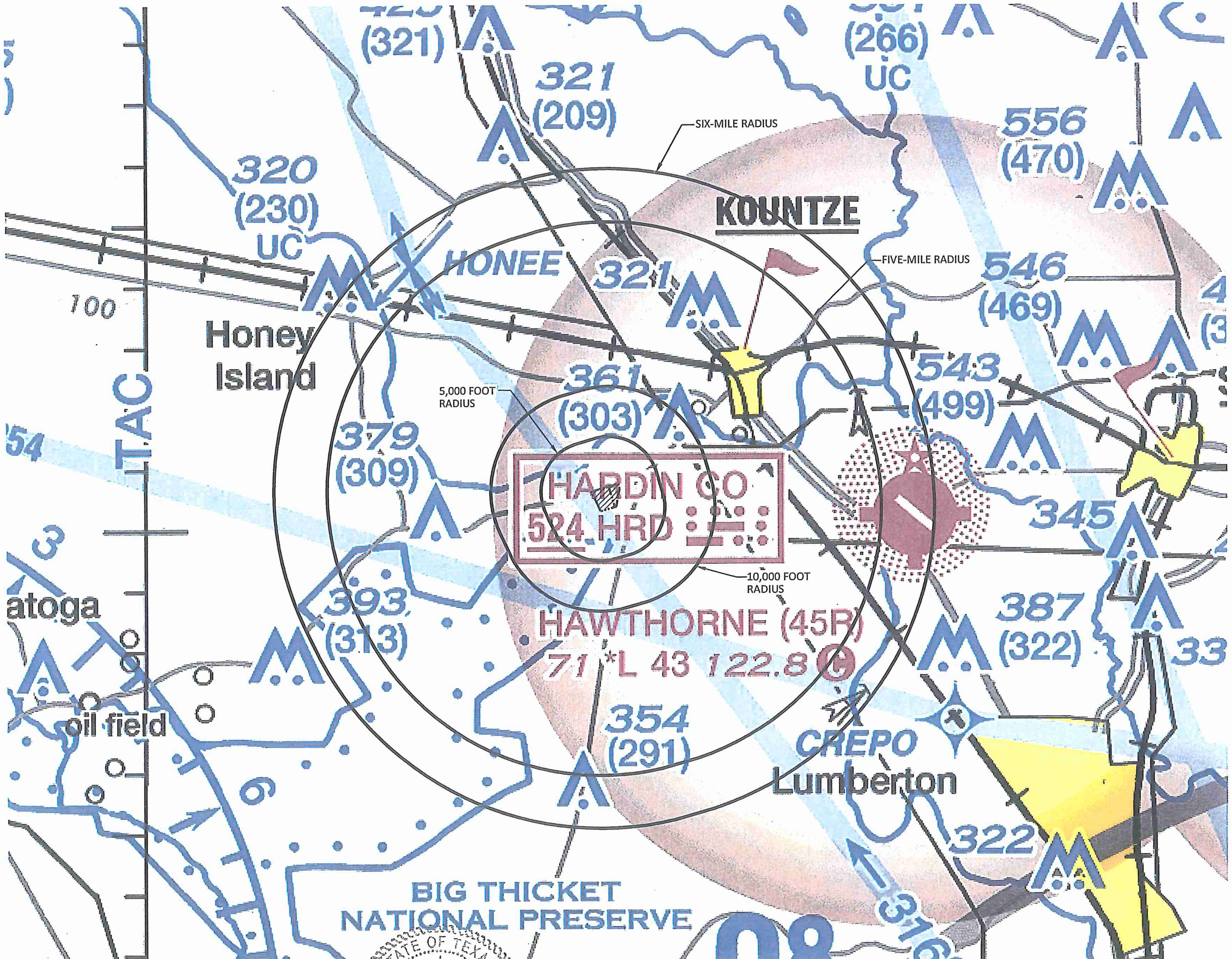
LEGEND

- IESI PROPERTY BOUNDARY
- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- 70 — EXISTING CONTOUR (SEE NOTE 1)
- N 10137000 — STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
- 220 — FINAL COVER CONTOUR (SEE NOTE 2)
- PROPOSED DRAINAGE SWALE
- PROPOSED DRAINAGE CHUTE

☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR IESI TX LANDFILL LP	MAJOR PERMIT AMENDMENT PERMITTED AND PROPOSED COMPLETION PLAN IESI HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
DATE: 10/2016 FILE: 0771-365-11 CAD: FIG 4-COMPLETION PLAN COMP.DWG DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. / DATE / DESCRIPTION	
Weaver Consultants Group TBPE REGISTRATION NO. F-3727		WWW.WCGRP.COM / FIGURE 5

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 5-COMPLETION PLAN COMPARISON.dwg, jwilson, 1:2

FAA AIRPORT VICINITY MAP

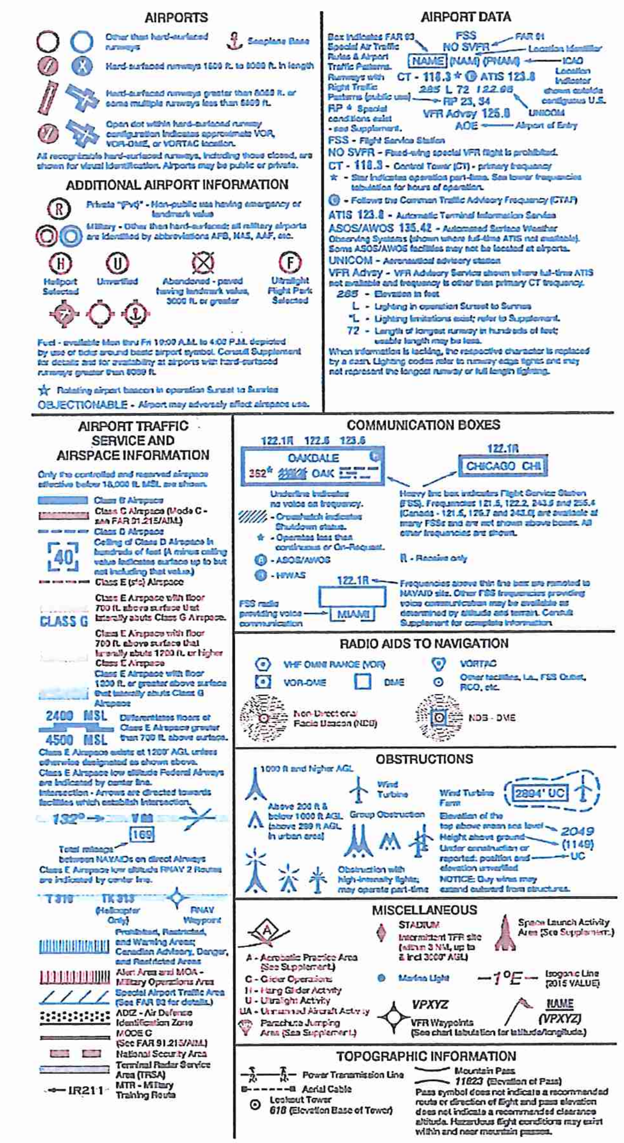


0 1 2
SCALE IN MILES

LEGEND

IESI PROPERTY BOUNDARY

PERMIT BOUNDARY



NOTE:

1. THIS MAP REPRODUCED FROM THE FAA HOUSTON SECTIONAL AERONAUTICAL CHART 98th EDITION DATED SEPTEMBER 15, 2016.

I/IIB-16

STATE OF TEXAS
NEVZAT TURAN
84059
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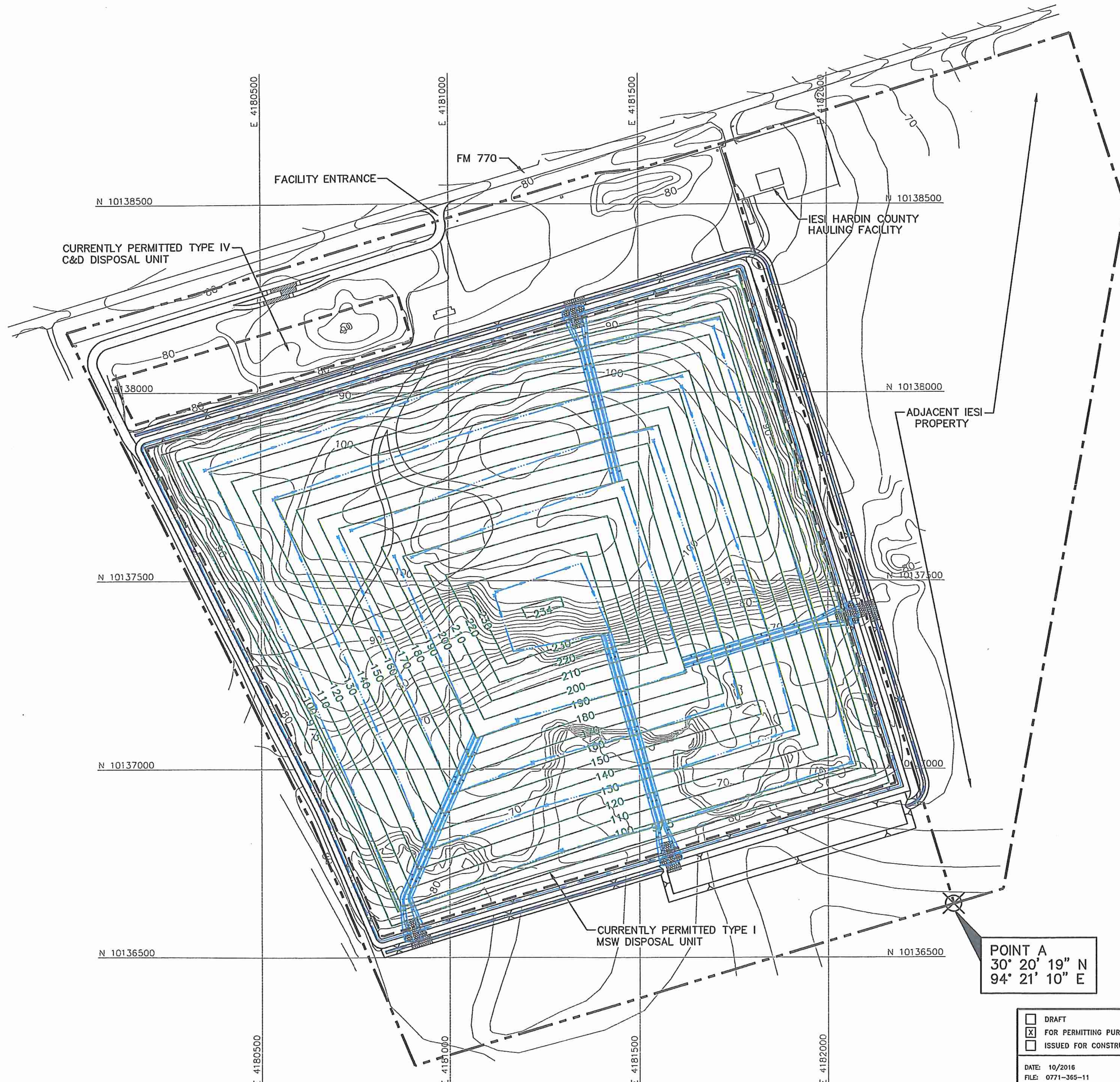
PROFESSIONAL ENGINEER

10/31/2016

☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR IESI TX LANDFILL LP	MAJOR PERMIT AMENDMENT FAA AIRPORT VICINITY MAP
DATE: 10/2016 FILE: 0771-365-11 CAD: FIG 6-FAA AIRPORT VICINITY MAP.DWG	DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	IESI HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group TBPE REGISTRATION NO. F-3727	REVISIONS NO. / DATE / DESCRIPTION	WWW.WCGRP.COM — FIGURE 6

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 6-LOCAL AIRPORTS.dwg, 10/28/2016 3:31:22 PM, rsellers, 1:2

LANDFILL COMPLETION PLAN WITH NOTICE CRITERIA TOOL WORKSHEET



0 150 300
SCALE IN FEET

LEGEND

- IESI PROPERTY BOUNDARY
- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- 70 EXISTING CONTOUR (SEE NOTE 1)
- N 10137000 STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
- 220 FINAL COVER CONTOUR (SEE NOTE 2)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. THE PROPOSED PERMITTED COMPLETION PLAN FINAL COVER CONTOURS WERE DEVELOPED BY WEAVER CONSULTANTS GROUP AS PART OF THE DESIGN BASIS MEMORANDUM FOR THE PROPOSED MAJOR AMENDMENT APPLICATION.
3. THE PROPOSED CONDITIONS DRAINAGE STRUCTURES ARE SHOWN FOR INFORMATIONAL PURPOSES. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY. (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

10/31/2016

I/IIB-18

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 10/2016
FILE: 0771-365-11
CAD: FIG 7-PROP COMPLETION PLAN.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
IESI TX LANDFILL LP

REVISIONS

NO.	DATE	DESCRIPTION

MAJOR PERMIT AMENDMENT
PROPOSED LANDFILL COMPLETION PLAN

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

WWW.WCGRP.COM

FIGURE 7

FAA NOTICE CRITERIA TOOL WORKSHEET

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

Latitude:	30 Deg 20 M 09 S N
Longitude:	94 Deg 21 M 10 S E
Horizontal Datum:	NAD83
Site Elevation (SE):	80 (nearest foot)
Structure Height :	199 (nearest foot)
Traverseway:	No Traverseway (Additional height is added to certain structures under 77.9(c)) User can increase the default height adjustment for Traverseway, Private Roadway and Waterway
Is structure on airport:	◉ No ○ Yes
	Submit

Results

You do not exceed Notice Criteria.

Notes

1. Site elevations vary from 60 to 108 ft-msl. The perimeter of the waste fill area is generally located at 80 feet-msl, the value used for the evaluation above.

2. The structure height (i.e., height of landfill) is approximately 154 feet from elevation 80 feet-msl. An additional 45 feet was added to the height for the evaluation to account for landfill equipment that may be used on top of the landfill on a temporary basis (e.g., a 45-foot high drill rig used to install gas recovery wells into the landfill).

3. Datum point used for the analysis was the southeast corner of the landfill permit boundary, the point closest to Hawthorne Field Airport runway end, located approximately 5.4 miles due east of the landfill.

1994 FAA CORRESPONDENCE

ADA ENGINEERS, INC.

1313 S. JOHN REDDITT
P.O. BOX 151508
LUFKIN, TX 75915-1508
(409) 637-6061 or (409) 637-6969
FAX (409) 637-6239

February 22, 1994

Mr. William E. Mitchell
Airport Certification Safety Inspector
DOT/FAA
ASW-621B
Fort Worth, Texas 76193-0620

RE: Proposed Hardin County Landfill
Proximity to Hawthorne Field
Hardin County, Texas

Dear Mr. Mitchell:

Per our telephone conversation, I am writing to request a review of the planned location for the proposed Hardin County Landfill in relation to Hawthorne [Air]Field, Hardin County, Texas. We are interested in determining whether or not the landfill, when located as proposed, will pose a safety hazard to birds and aircraft in the vicinity. Additionally, we would like to know whether or not the landfill will be within the jurisdiction of the FAA with regards to distance from Hawthorne Field and the potential bird hazard.

The proposed landfill is to be located on approximately 79 acres of land about 3 miles southwest of Kountze, Texas. More specifically the site is located on the south side of F.M. 770 approximately 0.5 mile west of the intersection of F.M. 770 and S.H. 326. Previously used for timber production, most of this site has been clear cut and currently exists as an open field. On the south end of the site there is a 2.94 acre wetlands area which could serve as a habitat for a small number of birds. The north end of the site has a buffer of pine trees which were left standing to act as an aesthetic screen between F.M. 770 and development of the site. The landfill is proposed for the effective disposal of municipal solid waste. Cover will be applied daily for the control of pests and animals.

Included with this letter are photocopies of the United States Geological Survey (USGS) quadrangle which represents the area in question. Each copy is marked with the location of the proposed landfill site and Hawthorne Field where shown. Two of the copies are on 8 1/2" X 11" paper and provide you with the means to determine the coordinates of the features if you so desire. On the 11" x 17" copy, I have included the geographic coordinates of the northeast and southeast corners of the landfill. The coordinates of the northeast and southeast corners are as follow:

Northeast Corner: 30° 20' 29" N
94° 21' 16" E

Southeast Corner: 30° 20' 09" N
94° 21' 10" E

It appears that the landfill will be located greater than 5 miles from Hawthorne Field, therefore being outside the jurisdiction of the FAA. Please review this letter and the accompanying drawings and write back with your determination of the landfill's proximity to the airfield and the potential for air safety hazards. If the landfill poses a threat to the airfield, we are also interested in knowing our next course of action to get this site approved for use by the County as a landfill while ensuring air safety. If you have any questions about this letter or the accompanying drawings, please call me or Billy Sims at 409/637-6061.

Sincerely,
KSA ENGINEERS, INC.

Lonnie Sikes

Lonnie Sikes,
Design Engineer

U.S. Department
of Transportation
**Federal Aviation
Administration**

Southwest Region
Arkansas, Louisiana,
New Mexico, Oklahoma,
Texas

Fort Worth, Texas 76193-0000

March 15, 1994

RECEIVED
MAR 18 1994

Mr. Lonnie Sikes
Design Engineer
KSA Engineers, Inc.
1313 S. John Redditt
P.O. Box 151508
Lufkin, TX 75915-1508

Dear Mr. Sikes:

In response to your February 22, 1994, request, a preliminary review of your proposal to locate a landfill near the Hawthorne Field Airport was conducted. Based on the information provided, we determined that the landfill site would be located approximately 4.8 nautical miles, or approximately 29,181 feet, west of the threshold of Hawthorne Field Airport Runway 13. This site, as proposed in your February 22, 1994, letter, does not conflict with our criteria concerning landfills near airports. We would not object to this proposed site location for the landfill. If there are any questions concerning this matter, please feel free to contact us.

Sincerely,

for

William E. Mitchell
Airport Certification Safety Inspector

COORDINATION WITH TEXAS HISTORICAL COMMISSION

CONTENTS

- November 15, 2016 Response from THC of No Survey Required – Project May Proceed.
- October 31, 2016 THC Impact to Cultural Resources Determination Request from WCG.

Weaver Consultants Group

October 31, 2016
Project No. 0771-365-11-07-03

Mr. Mark Wolfe
Texas Historical Commission
State Historic Preservation Officer
P.O. Box 12276
Austin, Texas 78711-2276

RECEIVED
NOV 01 2016

Re: Impact to Cultural Resources Determination
Proposed IESI Hardin County Landfill Expansion
Hardin County, Texas

Dear Mr. Wolfe:

The purpose of this letter is to demonstrate coordination with the Texas Historical Commission, consistent with Title 30 Texas Administrative Code (TAC) §330.61(o). This regulation requires that a permit applicant for an expansion of a municipal solid waste facility coordinate with the Texas Historical Commission regarding the potential impact of the referenced project to the cultural resources of the state of Texas.

Weaver Consultants Group, LLC (WCG) is preparing a permit amendment application, on behalf of IESI TX Landfill LP, to expand the IESI Hardin County Landfill (Landfill) located in Hardin County, Texas. The existing permit boundary or limits of waste will not be changed from the boundary included in the current TCEQ permit. The landfill will only be expanded vertically. To assist you in your determination, please find attached a project summary and site location maps.

The Landfill has operated for over 20 years. The majority of the area within the permit boundary has been disturbed by earth moving activities (i.e., landfill operations). To verify compliance with 30 TAC §330.61(o), we will need to include a letter from the Texas Historical Commission within the permit application. The landfill was permitted initially in 1995. Prior to the TCEQ permit being issued, the Texas Historical Commission completed a review of the area that comprises the current 79.6-acre permit boundary. The Cultural Resources Assessment that was completed in 1993 concluded that there were no previously recorded historic or prehistoric sites in the immediate area of the Landfill. In addition, no new historic or prehistoric sites were encountered during the 1993 site-specific Cultural Resources Assessment. As shown in the documentation attached to this letter, the Texas Historical Commission accepted the findings of the 1993 Cultural Resources Assessment, and Antiquities Permit #1289 was issued for the Landfill.

Given the above, it is requested that the Texas Historical Commission concur with our assessment that no significant cultural resources will be affected by the proposed project and that documentation of concurrence be provided to WCG for inclusion in the permit application.

Please note that the municipal solid waste permit documents will include a request that if material that may have value as a cultural resource is uncovered during site development, the Texas Historical Commission will be notified and construction stopped in that area immediately until proper investigations can be completed.

Your assistance with this matter is sincerely appreciated. Please call if you have any questions or need additional information.

Sincerely,
Weaver Consultants Group, LLC

Nevzat Turan, P.E.
Senior Engineer

Attachments: 1993 Cultural Resource Assessment of the IESI Hardin County Landfill
Project Summary and Site Location Maps

cc: Brett O'Connor, IESI TX Landfill LP

ANTIQUITIES CODE OF TEXAS REVIEW
NO SURVEY REQUIRED
PROJECT MAY PROCEED
by
for Mark Wolfe
Executive Director, THC
Date 11/15/16
Track# 201701632

Weaver Consultants Group

October 31, 2016
Project No. 0771-365-11-07-03

Mr. Mark Wolfe
Texas Historical Commission
State Historic Preservation Officer
P.O. Box 12276
Austin, Texas 78711-2276

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Proposed IESI Hardin County Landfill Expansion
Hardin County, Texas

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Nevzat Turan, P.E.
Senior Engineer

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Project Summary and Site Location Maps

cc: Brett O'Connor, IESI TX Landfill LP

1993 CULTURAL RESOURCES ASSESSMENT OF THE IESI HARDIN COUNTY LANDFILL

RECEIVED

MAY 17 1993

SOUTHWESTERN LABORATORIES, INC.

THE STATE OF TEXAS

CURTIS TUNNELL
EXECUTIVE DIRECTOR

TEXAS HISTORICAL COMMISSION

P.O. BOX 12276 AUSTIN, TEXAS 78711 (512)463-6100

DEPARTMENT OF ANTIQUITIES PROTECTION

May 10, 1993

Ms. Rhonda D. Chance
Technical Specialist of Wetlands and Endangered Species Services
Southwestern Laboratories, Inc.
P.O. Box 8768
Houston, TX 77249

Re: 80 acre tract for landfill, Hardin County
(COE-FWD, F2, F13)

Dear Ms. Chance:

Thank you for providing the opportunity to review the project referenced above. After examining our files, we note that the location of the project area has potential for containing archeological sites, some of which may be eligible for inclusion in the National Register of Historic Places. Although no sites are recorded within the boundaries of your tract, to the best of our knowledge, this area has never been examined by a professional archeologist.

An archeological survey undertaken by a qualified professional should be conducted within those portions of the project area that will be subjected to ground disturbing activities. The survey should include shovel tests sufficient to identify subsurface cultural materials. Collection of materials from any sites found during the survey is required, and all material should be curated according to 36CFR79. A report of investigations should be produced in conformance with the Secretary of the Interior's Guidelines for Archaeology and Historic Preservation.

We will continue review of this project upon receipt of the requested documentation. If you have any questions, please contact Bill Martin of our staff at 512/463-5867.

Sincerely,

James E. Bruseth, Ph.D.
Deputy State Historic Preservation Officer

Sincerely,

Timothy K. Perttula, Ph.D.
Assistant Director for Antiquities Review

JEB/TKP/wam

The State Agency for Historic Preservation

TEXAS ANTIQUITIES COMMITTEE
P.O. Box 12276 Austin, Texas 78711 (512) 463-6098

DEPARTMENT OF ANTIQUITIES PROTECTION

RECEIVED BY:
OCT 4 1993
KSA ENGINEERS, INC.
Lufkin, TX

September 16, 1993

SEP 1993
RECEIVED
HARDIN COUNTY
JUDGE

Hardin County
P.O. Box 760
Kountze, TX 77625

Re: Antiquities Permit #1289
Hardin County Landfill
Hardin County, Texas

Dear Sir/Madam:

Enclosed is a final copy of your Antiquities Permit for the above referenced project. Please keep this copy for your files. Thank you for your attention to this matter.

Sincerely,

James E. Bruseth, Ph.D.
Deputy State Historic Preservation Officer

Timothy K. Perttula, Ph.D.
Asst. Dir. for Antiquities Review

JB/TKP/lft

Enclosure

State of Texas

TEXAS ANTIQUITIES COMMITTEE

ARCHEOLOGY PERMIT # 1289

This permit is issued by the Texas Antiquities Committee, herafter referred to as the Committee, represented herein by and through its duly authorized and empowered representatives. The Committee, under authority of the Texas Natural Resources Code, Title 9, Chapter 191, and subject to the conditions hereinafter set forth, grants this permit for:

Archeological Survey

To be performed on a potential or designated landmark or other public land known as:

Title: Hardin County Landfill
County: Hardin
Location: A 79 acre tract is 3000 feet west of intersection of SH 770 and SH 326.

Owned or Controlled by:

Hardin County
P.O. Box 760
Kountze, Texas 77625

Sponsored by (hereafter known as the Sponsor):

Hardin County
P.O. Box 760
Kountze, Texas 77625

The Principal Investigator/Investigation Firm representing the Owner or Sponsor is:

Carol Weed
1403 Brittmoore Rd.
Houston, Texas 77043-4005

This permit is to be in effect for a period of:

6 months

and Will Expire on:

2/16/94

During the preservation, analysis, and preparation of a final report or until furhter notice by the Committee, artifacts, field notes, and other data gathered during the investigation will be kept temporarily at:

EMANCO, Inc.

Upon completion of the final permit report, the same artifacts, field notes, and other data will be placed in a permanent curatorial repository at:

Non collection policy

Scope of Work under this permit shall consist of:

An intensive 100% pedestrian survey with shovel probe testing of all cultural features or sites recorded and possible shovel probe and/or mechanical testing of any high probability areas.

ARCHEOLOGY PERMIT # 1289

This permit is granted on the following terms and conditions:

1) This project must be carried out in such a manner that the maximum amount of historic, scientific, archeological, and educational information will be recovered and preserved and must involve the exclusive use of scientific techniques for recovery, recording, preservation and analysis commonly used in archeological investigations.
2) The Permittee, Sponsor and Principal Investigator/Investigation Firm, are responsible for cleaning, cataloging, and preserving all collections, specimens, samples, artifacts, materials and records and, at no charge to the Committee, is responsible for the publication of results of the investigations in a thorough technical report containing relevant descriptions, maps, documents, drawings, and photographs, twelve (12) copies of which shall be furnished to the Committee; all within the time allotted by the permit.
3) All specimens, artifacts, materials, samples, and original field notes, maps, drawings, and photographs resulting from the investigations remain the property of the State of Texas. Duplicate copies of all requested records shall be furnished to the Committee before the permit expiration date.
4) If the Permittee, Project Sponsor, or Archeologist/Investigation Firm fails to comply with any of the Committee's Rules of Practice and Procedure or with any of the specific terms of this permit or fails to properly conduct or complete this project within the allotted time, the Committee may immediately cancel the permit. Notification of Cancellation shall be sent to the Permittee by registered mail to the last address furnished to the Committee by the Permittee. Upon notification of cancellation, the Sponsor and Archeologist must halt work immediately, remove all personnel and secure the site specified on this permit within twenty-four (24) hours. Upon cancellation, the Project Sponsor and the Archeologist forfeit all rights to the specimens, materials, and data recovered. A permit which has been canceled may be reinstated by the Committee if good cause is shown within thirty (30) days of cancellation.
5) The Permittee, Sponsor and Principal Investigator/Investigation Firm, in the conduct of the activities hereby authorized, must comply with all laws, ordinances and regulations of the State of Texas and of its political subdivisions including, but not limited to, the Antiquities Code of Texas; they must conduct the investigation in such a manner as to afford protection to the rights of any and all lessees or easement holders or other persons having an interest in the property; and they must return the property to its original condition insofar as possible, to leave it in a state which will not create hazard to life nor contribute to the deterioration of the site or adjacent lands by natural forces.
6) Any duly authorized and empowered representative of the Committee may, at any time, visit the site and examine this permit as well as the field records, materials, and specimens being recovered.
7) This permit may not be assigned by the Permittee in whole or in part to any other individual, organization, institution, or corporation not specifically mentioned in this permit.
8) The Archeologist shall have a copy of this permit available at the site of the investigation during all working hours.
9) Hold Harmless: The Permittee hereby expressly releases the State and agrees that Permittee will hold harmless, indemnify, and defend (including reasonable attorney's fees and costs of litigation) the State, its officers, agents, and employees in their official and/or individual capacities from every liability, loss, or claim for damages to persons or property, direct or indirect of whatsoever nature arising out of, or in any way connected with, any of the activities covered by this permit.
10) Addendum: The Permittee must abide by any addenda hereto attached.

Upon a finding that it is in the best interest of the State, this permit is Issued on 8/11/93.

James E. Corbin

James E. Corbin, Chairman
Texas Antiquities Committee

Hardin County Judge
Hardin County Courthouse
P.O. Drawer 760
Kountze, Texas 77625
Attention: Mr. John Richardson
(409) 246-5120

CULTURAL RESOURCES SURVEY
OF A
PROPOSED HARDIN COUNTY LANDFILL SITE,
HARDIN COUNTY, TEXAS

Performed Under
Texas Antiquities Permit
#1289

By

Carol S. Weed,
Principal Investigator
and
J. Brett Cruse

EMANCO Inc.
1403 Brittmoore Rd.
Houston, Texas 77043
(713) 467-7046

Report of Archaeological Investigations No. 31

15 November 1993

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LIST OF FIGURES

ABSTRACT

On August 18, 1993, Carol S. Weed and J. Brett Cruse completed an archaeological survey of a proposed 79 acre landfill site in Hardin County, Texas. We performed this work under Texas Antiquities Permit #1289 for the Hardin County Judge's Office, Kountze, Texas. Except for a narrow strip of grass and trees which separate the proposed landfill from Highway 770, the site has been clear-cut, stumped, bulldozed, and brush-piled. Few trees remain standing. Approximately half of the proposed landfill is wetland (Wenstrom 1993). We systematically walked the property and excavated four shovel tests in relatively undisturbed locations to observe subsurface stratigraphy and to investigate the possible presence of buried cultural materials. We found no cultural material or features on or below the surface except for recent trash. We believe that developing the site as a landfill poses no threat to significant cultural resources and that additional investigation for unknown cultural resources is unwarranted because of substantial disturbance of surface and near-surface soil during logging.

CHAPTER 1.0

DESCRIPTION AND LOCATION OF THE PROJECT

1.1 Scope of Work

On August 3, 1993, Mr. John Richardson, coordinator for the Office of the County Judge, Hardin County, Kountze, Texas, hired us to perform a Phase 1 (reconnaissance) survey of a proposed landfill site in Hardin County, Texas (Figure 1), in accord with the requirements for such a survey of the Texas Historical Commission.

On August 6, 1993, we submitted an application to Mr. Mark Denton, Texas Antiquities Committee (TAC), for a permit to conduct the survey. Our application was approved on August 12, 1993, and TAC issued Permit #1289 for the study (Appendix A).

According to Permit #1289, the objective of the work was to survey the non-wetland portions of the site for presently unknown cultural resources. The study consisted of three stages.

1.1.1 Stage 1

During this stage, we reviewed in-house literature and other bibliographic sources pertinent to the project area. According to Mr. Bill Martin of THC, no previously recorded cultural resource sites are listed in the files of that agency on or near the property. As needed, we also proposed to check files of the Houston Archaeological Society and the files and records of the Hardin County Historical Society.

1.1.2 Stage 2

Stage 2 was an intensive surface reconnaissance of the site by two professional archaeologists. The archaeologists systematically traversed the property on foot at 30 meter (m) intervals inspecting the ground

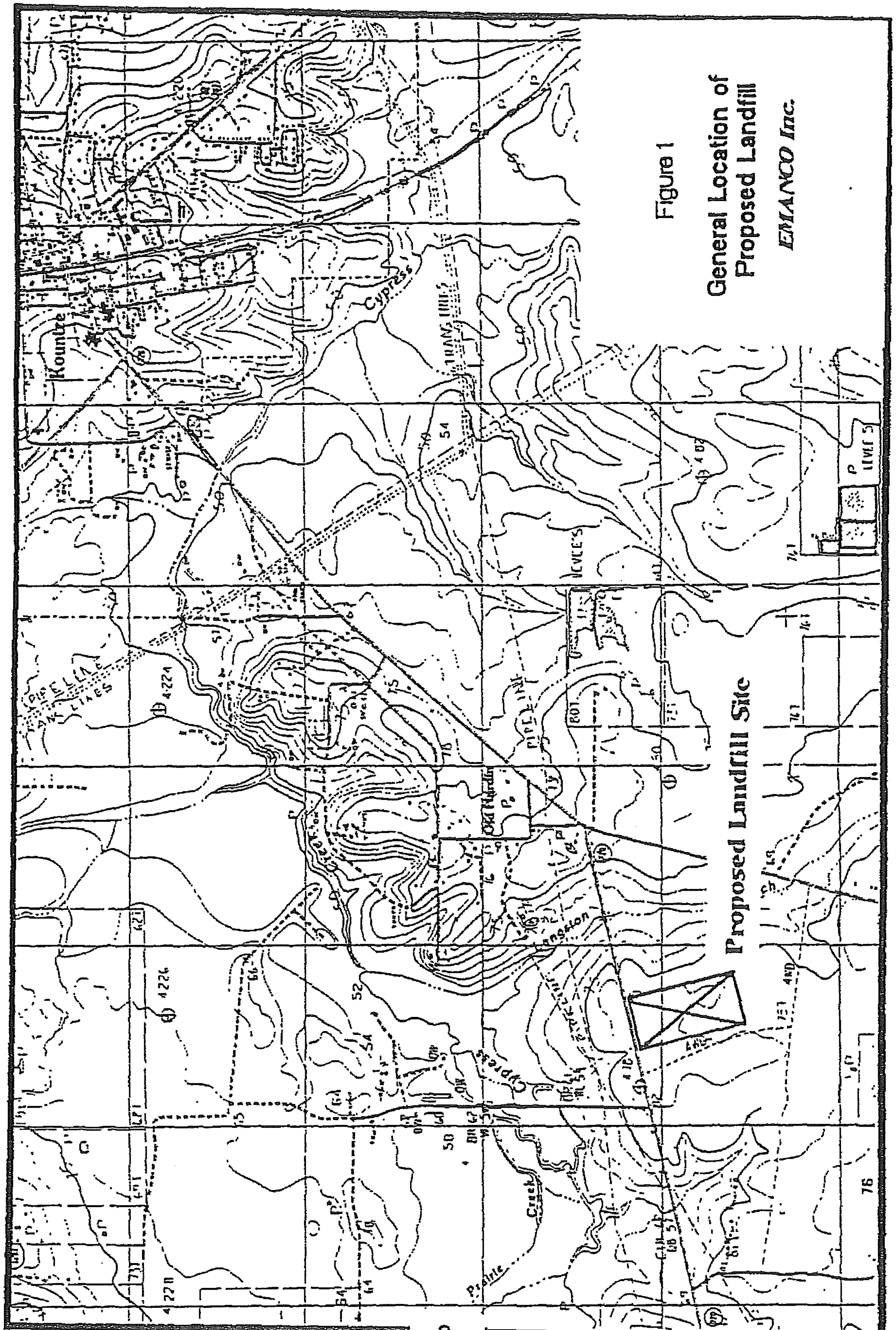


Figure 1
General Location of Proposed Landfill
EMANCO Inc.

2

For clarification see Part I & II, Pages 8 & 10 surface for evidence of cultural material. We noted all cultural occurrences including those of obviously modern trash and debris. We also examined stump holes for evidence of cultural material.

We proposed to supplement pedestrian inspection with limited subsurface testing using 50cmX50cm units. We proposed to screen fill from each unit through quarter-inch mesh screen, and take appropriate notes, including observations on soil texture, Munsell color, and artifact content, if any, by natural strata or arbitrary levels. We were also to identify by type and photograph artifacts in the field and replace them where found on the surface or in an excavation before backfilling.

We limited subsurface testing to four, 40cm diameter shovel tests (Figure 2) due to extensive surface disturbance across the site. Shovel Test (ST) 1 was in a non-wetlands woods immediately south of Highway 770. We excavated the test to a depth of 73cm below ground surface (bgs). ST2, to a depth of 60cm bgs, was south of the woods in a wetland. ST3 was excavated to a depth of 63cm bgs in a central non-wetland portion of the site. ST4 was in a disturbed clearing.

We completed Stage 2 fieldwork on August 18, 1993. We began about 9:30am under slightly overcast weather conditions that cleared by noon with the occurrence of high, scattered clouds. We finished fieldwork at about 3:45pm. An automatic time and temperature sign in Cleveland, Texas, showed the temperature as 104°F at 4:30pm.

1.1.3 Stage 3

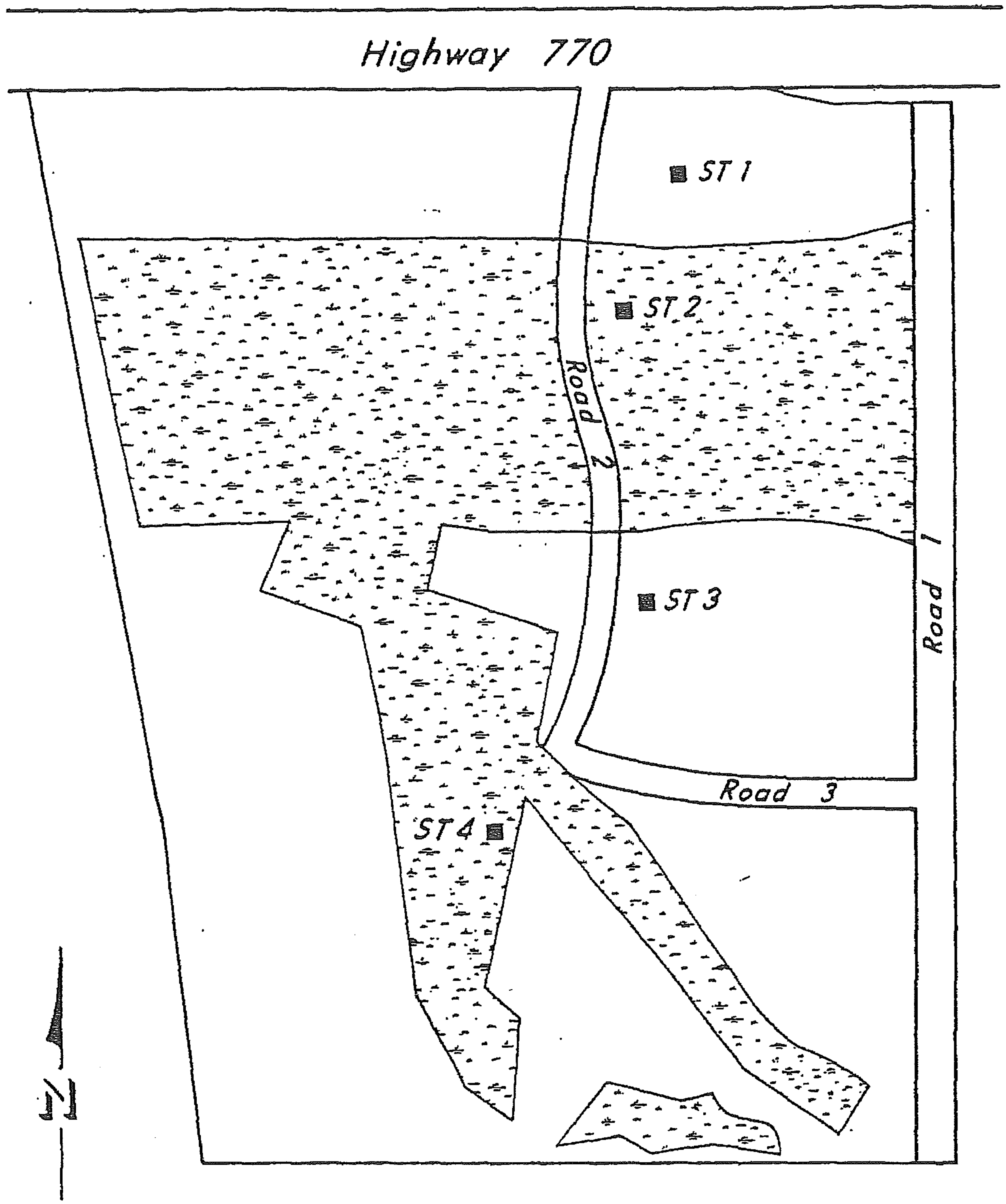
This stage consisted on preparing a written report documenting Stages 1 and 2. This report would be appropriately illustrated with maps and photographs as needed. It conforms to the report standards outlined by TAC (nd).

1.2 Location

The proposed landfill site consists of 79 acres and is about 0.5 miles (mi) west of the intersection of State Highways 770 and 326 in Hardin County, Texas (see Figure 1). The site is bounded on the north by Highway 770 and is directly across Highway 770 from an existing Hardin County landfill. The property is rectangular in shape with its long axis oriented roughly north-south.

Mr. Alvin Stephens, an equipment operator at the existing landfill, stated that Hardin County acquired the property about two years ago. The property was formerly a pine plantation, and was clear-cut at least once. It was again cut at the time it was acquired by Hardin County.

The property is on the Coastal Plain. In conducting an endangered species survey on the site, Wenstrom (1993:2) characterized it as an "*...essentially flat, low-lying distributary between Cypress Creek to the north and Langston Branch to the east.*" No part of the site is closer than 300m to either of these drainages. There is also no active water source on the property. Wenstrom (1993:3) also noted that "*[m]uch of the ground*



LEGEND

SHOVEL TEST

WETLANDS

SCALE

0 100 200 400 FEET

0 50 100 METERS

Figure 2

PROJECT AREA

EMANCO Inc.

surface [is] very wet [with] ground cover...primarily of hydrophilic invader grasses and forbs, with residual shrubs and small trees remaining after the logging operation".

CHAPTER 2.0

CULTURAL HISTORY OF THE PROJECT AREA

Hardin County contains portions of the Big Thicket National Biological Preserve (BTNBP), the location of several previous cultural resource investigations (Baxter *et al.* 1975; Shafer *et al* 1975; Carlson and Holloway 1982; Swanson and Weed 1982; Webb and Swanson 1982; Swanson 1983). The proposed landfill is about 1.5mi north of the northern border of the Lance Rosier Unit of BTNBP. Thus, review of previous BTNBP studies suggests the types of prehistoric and historic resources one might encounter within the general area of the current project.

Although the results of previous investigations are variable, work inside and outside BTNBP indicate active use of the area beginning in late Paleo-Indian or early Archaic times (Duffield 1963; Shafer *et al.* 1975). The principal artifactual indicators of these occupations are San Patrice points, Clear Fork-like gouges, and small end scrapers (Shafer *et al.* 1975). By Middle Archaic times, dart points such as Bulverde-like, Calf Creek, Wells, and Yarbrough are common. Shafer *et al.* (1975) say that Middle Archaic sites tend to occur on dry landforms like ridgetops outside bottomlands.

The Late Archaic settlement pattern seems to shift somewhat. Sites occur on more recent landforms including bottomland sandy knolls and T1 terraces (Shafer *et al.* 1975; Aten 1983). Projectile points styles include Evans, Gary, Palmillas, and Pontchartrain types. Evans and Pontchartrain forms suggest increasing interaction on the part of local residents with groups in Louisiana east of the Sabine River. Such interaction is also indicated by the use of clay balls (Shafer 1968). While not classic Poverty Point objects, their presence at east Texas Late Archaic sites documents some awareness of ceramic technology by local residents.

The advent of the Early Ceramic period by about 100BC actually heralds few changes. Shafer *et al.* (1975) argue that the Archaic pattern remains effectively in place with the only alteration being the addition of ceramics to the technological repetoire. However, the sandy paste, Tchefuncte-like ceramics which appear at the beginning of the Early Ceramic are technologically inferior to Louisiana varieties of the same age (Aten and Bollich 1969; Aten 1983). Despite a halting start, area residents achieved a firmer grasp of ceramic technology by the middle of the Early Ceramic period.

Indigenous populations of southeast Texas were influenced by Caddoan and Lower Mississippi River people by about 900AD. Nonetheless, East Texas residents continued basically a hunting and gathering lifestyle. Caddoan and Lower Mississippi River ceramics appear commonly. However, locals produced utilitarian sand-, grog- and shell-tempered wares. Additionally, there is no substantive data suggesting that locals practiced horticulture, although horticulturally based Caddoan sites occur as far south in Texas as the Conroe basin (Shafer *et al.* 1975).

The Late Ceramic pattern continues well into the historic period. The Atakapan Bidai, Deadose, Patiri, and Akokisa (Newcomb 1961) engaged in limited horticulture, but maintained their lifestyle primarily by hunting and gathering. Although their relations with the French and Spanish colonial powers and subsequent Texas and U.S. administrations appear cordial, all of these groups were decimated by European diseases. By the end of the 19th century they were gone from the scene (Newcomb 1961). A small immigrant Native American population composed of Alabama and Koasati (Coushatta) managed to maintain a presence in east Texas. Today they represent one of only two resident native groups in the state.

The piney woods of east Texas were obviously capable of supporting resident indigenous groups. To a large extent, however, the arriving Euro-Americans had a more difficult time. The landscape was not particularly suited to large-scale agriculture. Prior to the 20th century, cattle raising and timbering were the principal mainstays. The Beaumont oil and gas strikes of the early part of this century altered the picture. For the most part, however, Hardin County today remains rural. Timbering, cattle, dairy operations, truck farming, and oil and gas production are dominant economic activities.

CHAPTER 3.0

RESEARCH DESIGN AND EXPECTATIONS

In order to develop a research design, we relied on summary and primary data presented in Aten (1983), Patterson (1989a, 1989b), Phillips (1982), Shafer *et al.* (1975), Swanson (1983), Swanson and Weed (1982), Thomas (1983), and Webb and Swanson (1982). Our review of these sources indicated that research priorities for the prehistoric and historic cultural resources of Hardin County are very similar. Both involve acquisition of locational data, isolation of temporal components, and definition of the range of site types by temporal period or cultural affiliation.

In this case, like the usual situation, research at the reconnaissance survey level focused on locational issues. What is the distribution of cultural properties, if any, within the project area? Is the distribution of prehistoric and historic sites the same or different? What are the variables (natural or cultural) which might influence the distribution of sites or lend themselves to the definition of archaeological sensitive areas?

3.1 Site Location

As a wet, flat, low-lying distributary between two creeks, one would normally consider the landfill site a low probability area for the occurrence of cultural resources. It is, however, slightly elevated above Cypress Creek and Langston Branch. Shafer *et al.* (1975), Aten (1983), and Swanson (1983) suggest that such elevated settings might contain prehistoric sites. Overall, however, previous work in the general area indicates very low site density in this type of location. Shafer *et al.* (1975) hypothesize that fluvial masking of sites, paucity of dry land, and survey bias explain the negative findings of most of the prior work.

3.2 Temporal Components and Site Types

Swanson (1983) and Patterson (1989a) indicate that previously recorded sites in Hardin County have yielded diagnostic artifacts representative of the Archaic and Ceramic stages. Shafer *et al.* (1975) reported a dearth of lithic-only sites, with most sites yielding low densities of ceramics, lithics, and shell debris in sand middens. There are virtually no data relating to structures or cultural features at these sites other than burned rock hearths.

3.3 Survey Expectations

For the prehistoric period, we anticipated very limited evidence of late stage occupations. Given the significant amount of wetlands on the property, we believed that the most probable site type would be a low density extractive site aimed at exploiting some specific type of natural resource. However. we also believed that the likelihood of finding any type of prehistoric site there was very low.

Settlement of the area in the historic period followed the traditional dispersed single family rural homesite and small hamlet pattern with an overlay of oil and gas related industrial activities. Examination of the U.S. Geologic Survey (USGS) quadrangle map of the project area (see Figure 1), however, shows no standing structures on or near the proposed landfill site. Further, the property is recently clear-cut. We believed, therefore, that any historic material in the area would most likely represent discard not associated with the structural remains of a house, barn, or other habitation.

CHAPTER 4.0

RESULTS AND CONCLUSIONS

4.1 Observations

Field observation revealed that most of the ground surface at the property was severely impacted from logging, stumping, brush-piling, and other uses of heavy tracked and wheeled vehicles and equipment. Large piles of slash, brush and stumps occur randomly across about half of the site (Figure 3).

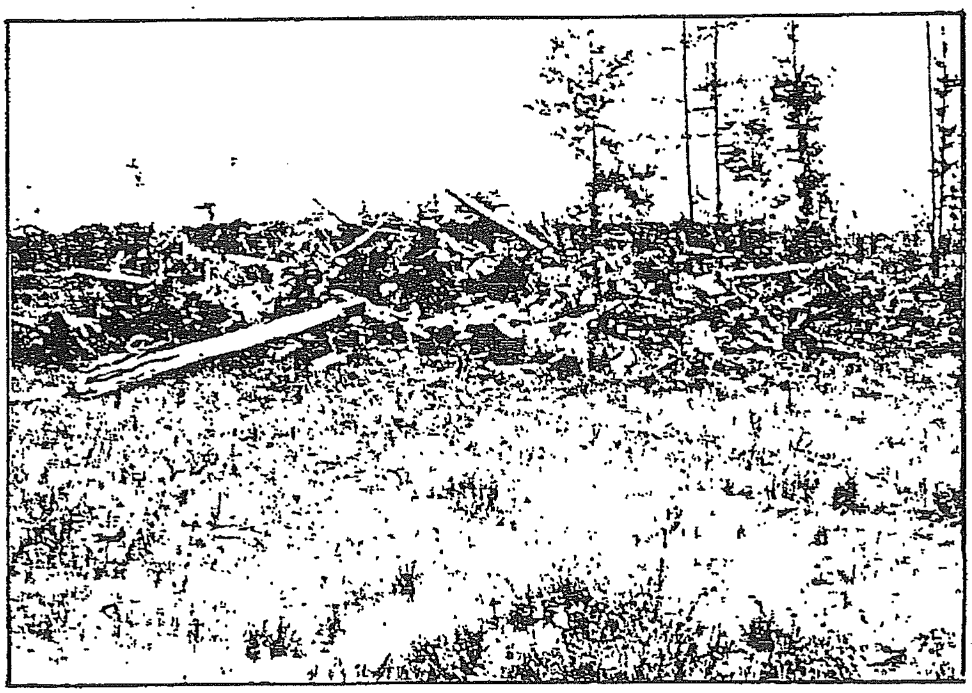


Figure 3 - Typical Slash/Stump Pile on Proposed Landfill Site.

A strip of grass and woods borders Highway 770 (Figure 4). This strip was probably left to help in screening the future landfill from travelers along the highway. Scattered trees with white paint splotches, mostly now dead pine and occasional oak, mark the borders of the property.

Figure 4 - Vegetative Screen Separating Landfill from Highway 770.

The rest of the site is covered in residual trees not harvested during the recent logging operation, low secondary brush, grass, and forbs (Figure 5). The latter areas were also stumped although the stumps have not been piled. Visibility of surface soils across the area ranged from excellent to good because of the extent of disturbance to the soil.

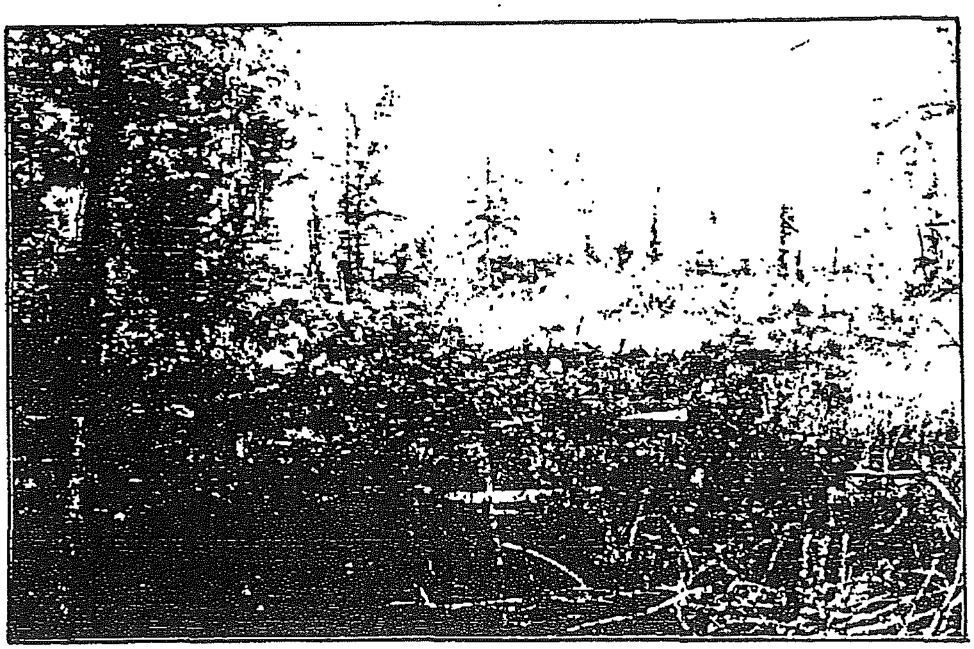


Figure 5 - Typical View of Residual Trees and Brush at Landfill Site.

A bulldozer track oriented northwest to southeast occurs in the southcentral section of the property. According to Mr. Stephens, the track is the result of bulldozing to facilitate drainage. It is bounded by linear spoil piles and vegetated by low, spotty grass and weeds.

In addition to the bulldozer track, we observed three temporary logging roads on the property (see Figure 2). Twelve piezometer sites also ring the border of the property at irregular intervals. Five bore holes, dug by Southwestern Laboratories, Inc. of Houston, Texas, occur in the north-central and east areas. We relocated one of the holes during our visit.

With the exception of the above, we observed no evidence of cultural activity on the property or any cultural materials other than modern trash consisting of gasoline and oil containers and aluminum cans. Although we found some gravel, gravel occurs naturally below the surface in low to moderate density (Deshotels 1978).

Matrix in ST1 consisted of a silt to silt clay which graded from 10YR6/3 pale brown to 10YR5/3 brown (Figure 6). We found some small pea gravel but no cultural material.

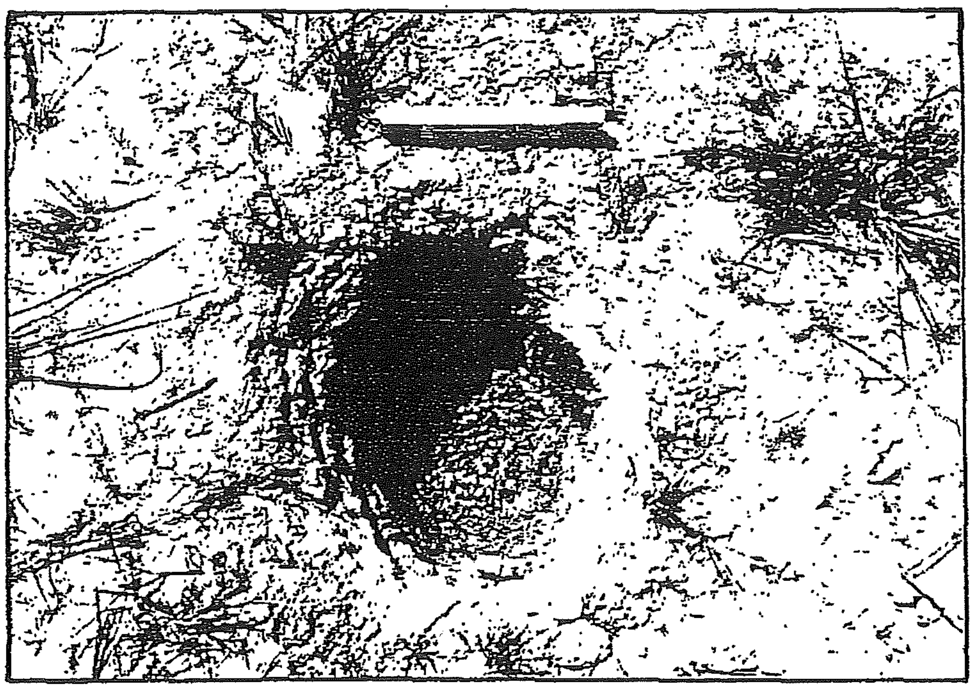


Figure 6 - Shovel Test 1 at Depth of 40cm Below Surface.

We identified three strata in ST2. Stratum 1 extended from the surface to 19cm bgs. It is a mottled 10YR6/4 light yellowish brown fine silt with roots, decaying vegetation, and some gravel. Stratum 2 (19-49cm) is a mottled 10YR5/2 grayish brown silt with clay. It was very compact and contained little gravel and organic matter. Stratum 3 (49-60cm) is a 10YR5/4 yellowish brown silty clay with large 10YR5/2 grayish brown mottles. The gravel increased significantly in this stratum and was pea size.

We identified two strata in ST3. Stratum 1 (0-43cm) is a mottled 10YR6/2 light brownish gray silty clay with minimal gravel, some roots, and decaying vegetation. Stratum 2 (43-63cm) is 10YR6/6 brownish yellow clay with some silt. It contained light gravel but few organics.

We found two strata in ST4. Stratum 1 (0-23cm) consists of a very mottled 10YR6/2 light brownish gray silty clay which was compact and organically rich. Stratum 2 (23-40cm) is 10YR5/1 gray clay which was very moist and gravel rich. It was compact, sticky, and displayed organic traces throughout.

In addition to observing soil profiles in shovel tests as described above, we also examined subsoil exposed in numerous stump holes, vehicle ruts, and low berms and dirt piles created by bulldozing during logging on the property. All soil exposures were sterile of cultural material such as artifacts, midden, and the other evidence of human occupation known to occur in Hardin County.

4.2 Conclusions

We found no cultural material in any shovel test, nor did we observe any such material with the exception of recently discarded trash during pedestrian survey. Similarly, background research, including review of USGS maps and a check of the state site file, revealed no former structures or other previously known cultural resources on or in the immediate vicinity of the proposed landfill. Accordingly, we have no evidence of any cultural activity on the property except use for silviculture in the recent historic period.

Soil in Hardin County, Texas, developed from parent material of Pleistocene and Recent age. Soil at the proposed landfill site is of Pleistocene age. Accordingly, it is relatively old and deep with weakly expressed structure but active mixing due to crayfish activity. There is little possibility of encountering Holocene or more recent surfaces buried underneath the existing soil. There is a similarly low probability of finding deeply buried cultural deposits under the sterile surface. Accordingly, we confined our field work to pedestrian observation of the disturbed ground surface supplemented with examination of shovel tests and other subsoil exposures. We do not believe additional intensive subsurface investigation by backhoe or other mechanical means is warranted in this situation.

The area is generally low-lying and wet. Soil is poorly drained and slowly permeable so that it is water-saturated for long periods throughout the year. We assume that wetness discouraged permanent habitation at the site. Additionally, prior disturbance of surface and near-surface soil associated with logging, including recent clear-cutting, would probably have obliterated whatever meager evidence of earlier transient occupations that might have occurred there.

The absence of cultural remains on the property fulfilled our expectation that it was one of low probability for the occurrence of such resources. Accordingly, we are unable to address any of the research issues outlined earlier in this report except negatively. We have no new evidence of any cultural activity on this site or in the general area. Therefore, we conclude that the proposed landfill is not an area of archaeological sensitivity and that there is little or no likelihood that development and use of the property by Hardin County as a public landfill will negatively impact any significant cultural resources. We further conclude that the probability of finding cultural remains there is so low that additional cultural resource investigation is unwarranted.

CHAPTER 5.0

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APPENDIX A

TAC Permit

PROJECT SUMMARY
AND
SITE LOCATION MAPS

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

10/31/2016

Project Summary
IESI Hardin County Landfill Expansion
Hardin County, Texas

Introduction

The IESI Hardin County Landfill is in the process of developing a major permit amendment application that will provide long-term disposal capacity for authorized solid waste that is generated in Hardin County and surrounding counties. The objective of this summary is to provide an overview of the proposed landfill expansion. The following subsections detail information regarding the owner and operator of the landfill, general site information, and a summary of the proposed landfill design.

Owner/Operator Information

The IESI Hardin County Landfill is owned and operated by IESI TX Landfill LP. IESI TX Landfill LP is a subsidiary of Waste Connections, Inc. Waste Connections is one of the leading providers of solid waste services in the nation. Waste Connections provides nonhazardous waste collection, transfer, recycling, and disposal services to residential, municipal, industrial and commercial customers across the country.

Site Information

The following drawings are attached to this summary.

- Figure 1 – Site Location Map. This drawing shows the site location on a standard TxDOT county highway map.
- Figure 2 – General Topographic Map. This drawing shows the permit boundary and permitted landfill footprint on a USGS map.
- Figure 3 – Aerial Photograph. This figure shows the permit boundary and permitted landfill footprint on an aerial photograph.
- Figure 4 – Permitted and Proposed Excavation Plan. This figure provides a comparison between the currently permitted landfill excavation plan and the proposed amended landfill excavation plan.

- Figure 5 – Permitted and Proposed Landfill Completion Plan. This figure provides a comparison between the currently permitted landfill completion plan and the proposed amended landfill completion plan.

The IESI Hardin County Landfill is an existing 79-acre Municipal Solid Waste (MSW) landfill (current TCEQ Permit No. MSW-2214A) located approximately 0.7 miles west of the intersection of FM 770 and SH 326 in central Hardin County.

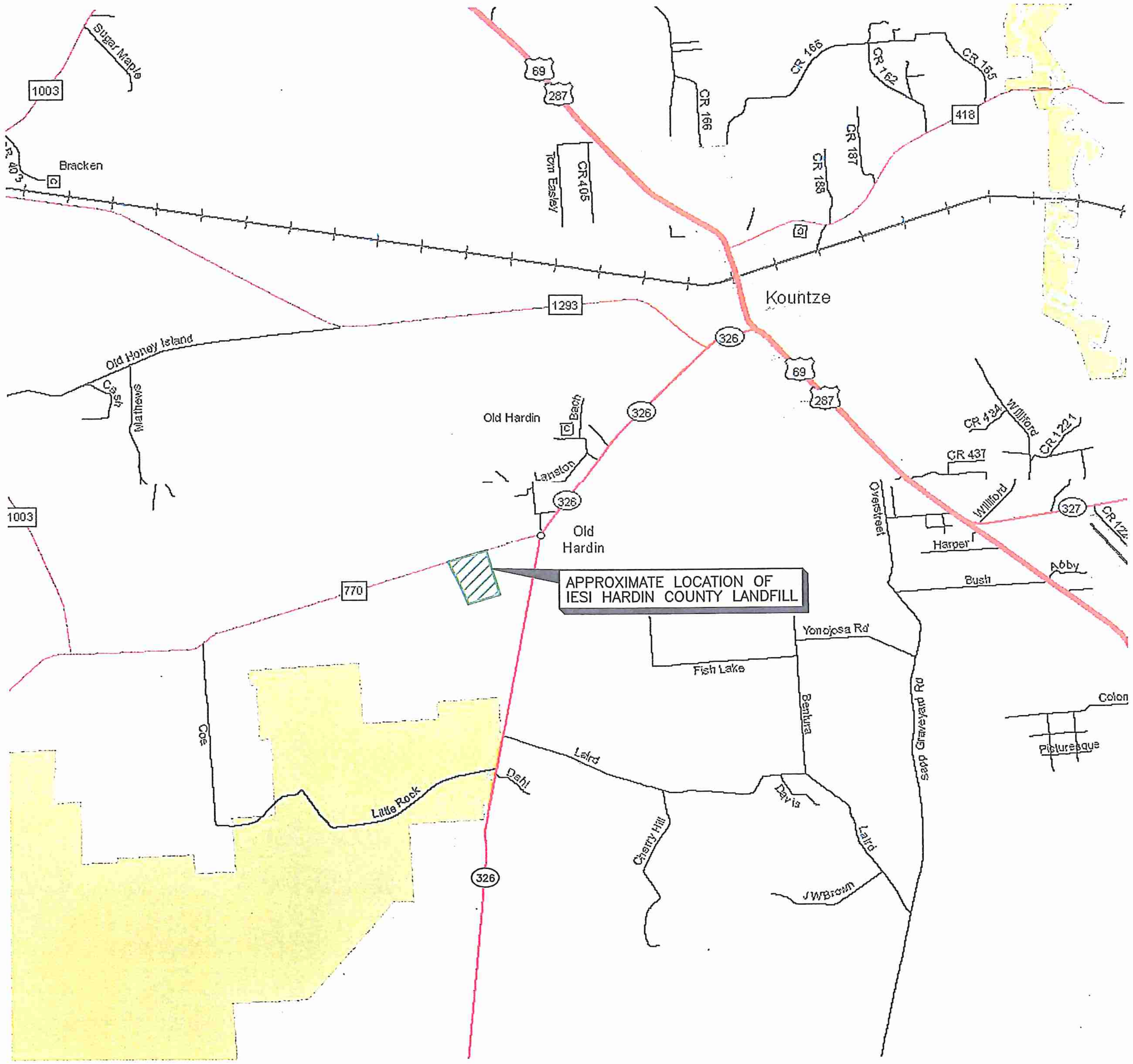
The site was originally permitted as a MSW landfill by the Texas Natural Resource Conservation Commission (TNRCC) in 1995. Approximately 32 acres of the 49.6-acre Subtitle D (i.e., composite bottom liner system) MSW disposal area has currently been developed. The facility also includes a 2.4-acre construction and demolition debris disposal unit, of which approximately 1.4 acres have been developed. The original permit number was Permit No. MSW-2214. The permit was transferred in 2002 from Hardin County to IESI TX Landfill LP.

Design Summary

The following information presents a summary of the design and operations for the proposed IESI Hardin County Landfill expansion:

- The IESI Hardin County Landfill is an existing municipal solid waste landfill facility (current TCEQ Permit No. MSW-2214A). The existing landfill currently serves residences and businesses in Hardin County and surrounding counties.
- With this expansion, the existing 79-acre permit boundary and existing 52-acre limits of waste will remain unchanged. The permitted but undeveloped waste disposal area will be deepened as shown on Figure 4, which shows both permitted top of protective cover grades (over constructed cells) and proposed excavation grades. The completion grades will be increased to optimize the disposal capacity of the permitted waste fill area. The currently permitted and proposed complete plans are shown on Figure 5.
- Accepted wastes will remain consistent with the current MSW landfill permit. The facility currently accepts municipal solid waste resulting from or incidental to municipal, community, commercial, institutional, and recreational activities; municipal solid waste resulting from construction and demolition activities; Class 2 and Class 3 nonhazardous industrial solid waste; and certain special wastes as permitted by the TCEQ. For this permit amendment cells 6 and 7 will be constructed in accordance with 30 TAC 335.590, and will accept Class 1 non-hazardous industrial waste in addition to the waste streams received by the landfill under the current permit.

- Access to the landfill will be provided via the existing site access road entrance off of FM 770. Based on travel patterns of existing landfill traffic, vehicles bound for the landfill will generally access the site using SH 326 and FM 770.
- A bottom liner system and final cover system that meet all regulatory requirements will be used for constructing the solid waste containment system. The design objective of the containment system (liner, leachate management system, and final cover) is to isolate the solid waste and remove leachate (defined as liquid that has contacted solid waste) that collects on the liner system. Leachate that is removed from the landfill is transported to an offsite, permitted treatment facility. The construction procedures of the liner system and final cover system follow strict TCEQ-approved quality control and quality assurance procedures, which are verified by an independent testing firm, and approved by a professional engineer licensed in the State of Texas. Liner construction is divided into approximately 3 to 4 acre "cells" across the permitted bottom of the landfill. Each of the containment system components must be approved by the engineer, and thoroughly reviewed and approved by the TCEQ before solid waste is placed into each constructed cell.
- To verify that the highest level of environmental protection is maintained, the following landfill monitoring systems are provided:
  - Groundwater Monitoring System. The purpose of the groundwater monitoring system is to verify the integrity of the containment system and demonstrate that area groundwater is not adversely impacted by the landfill. This is accomplished by obtaining water samples from the monitor wells, located on the perimeter of the landfill, which are screened to monitor groundwater quality. The water samples are tested at an offsite laboratory.
  - Gas Monitoring System. The purpose of the landfill gas monitoring system is to verify that landfill gas does not migrate beyond the permit boundary. Landfill gas probes are placed along the perimeter of the permit boundary.
  - These monitoring systems are sampled and tested periodically per the TCEQ-approved monitoring plans. The results are filed with the TCEQ and are public record.
- Site Operations. The site will be operated by properly trained personnel. A detailed Site Operating Plan will be included in the permit amendment application. The plan will detail the required equipment, personnel, and safety procedures required to operate the site in accordance with TCEQ regulations. The IESI Hardin County Landfill will continue to be inspected by the TCEQ on a regular basis to ensure the site is in compliance with state regulations and developed as permitted.



0 3000 6000

SCALE IN FEET

LEGEND

SITE LOCATION

NOTE:

1. MAP OBTAINED FROM TEXAS DEPARTMENT OF TRANSPORTATION DATED 2014.

STATE OF TEXAS
NEVZAT TURAN
84059
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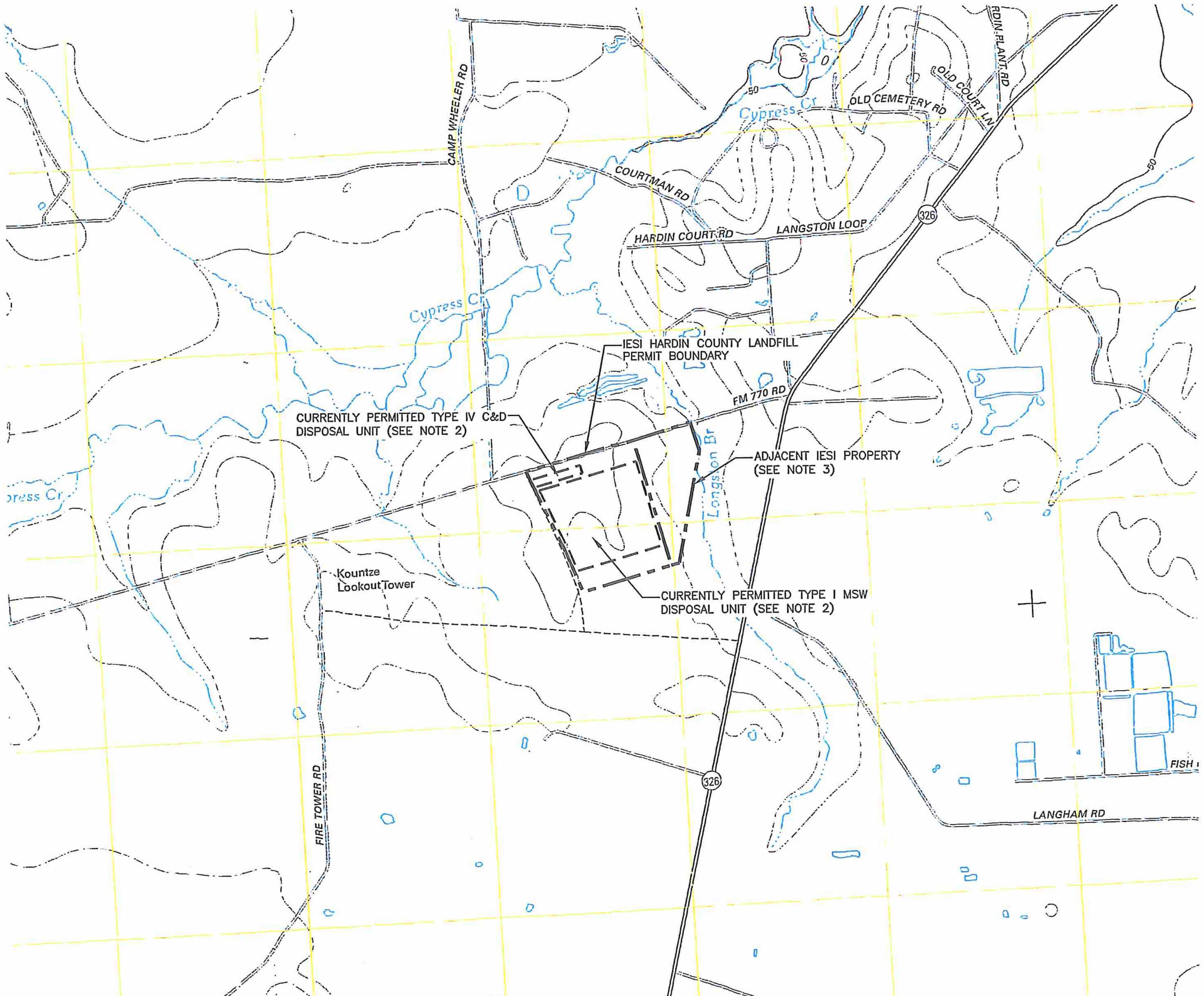
PROFESSIONAL ENGINEER

10/31/2016

I/IIB-60

☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR IESI TX LANDFILL LP	MAJOR PERMIT AMENDMENT SITE LOCATION MAP IESI HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
DATE: 10/2016 FILE: 0771-365-11 CAD: FIG 1-SITE LOCATION MAP.DWG DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. / DATE / DESCRIPTION	
Weaver Consultants Group TBPE REGISTRATION NO. F-3727		WWW.WCGRP.COM / FIGURE 1

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 1-SITE LOCATION MAP.dwg, jwilson, 1:2



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SCALE IN FEET

LEGEND

IESI PROPERTY BOUNDARY
PERMIT BOUNDARY
LIMITS OF WASTE

ROAD CLASSIFICATION

Interstate Route
US Route
Ramp
State Route
Local Road
4WD
Interstate Route
US Route
State Route

KOUNTZE SW, TX 2013

KOUNTZE SOUTH, TX 2013

NOTES:

1. ADAPTED FROM USGS 7.5 MINUTE QUADRANGLE TOPOGRAPHIC MAPS (KOUNTZE SOUTH, TX 2013 AND KOUNTZE SW, TX 2013).
2. THE FACILITY HAS TWO SEPARATE PERMITTED DISPOSAL UNITS. THE FIRST UNIT IS A TYPE I MUNICIPAL SOLID WASTE (MSW) DISPOSAL UNIT AND IT ENCOMPASSED APPROXIMATELY 49.6 ACRES. THE SECOND PERMITTED UNIT IS A 2.4 ACRE TYPE IV CONSTRUCTION AND DEMOLITION (C&D) DISPOSAL UNIT.
3. THE ADJACENT IESI PROPERTY IS APPROXIMATELY 31.3 ACRES. THIS PROPERTY WILL NOT BE JOINED TO THE DISPOSAL AREA; HOWEVER, A RESTRICTIVE COVENANT MAY BE OBTAINED FOR A PORTION OF THIS AREA FOR LANDFILL-RELATED DRAINAGE FACILITIES.

I/IIB-61

STATE OF TEXAS
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DATE: 10/2016
FILE: 0771-365-11
CAD: FIG 2-GENERAL TOPO MAP.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

PREPARED FOR
IESI TX LANDFILL LP

REVISIONS

NO.	DATE	DESCRIPTION

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

MAJOR PERMIT AMENDMENT
GENERAL TOPOGRAPHIC MAP

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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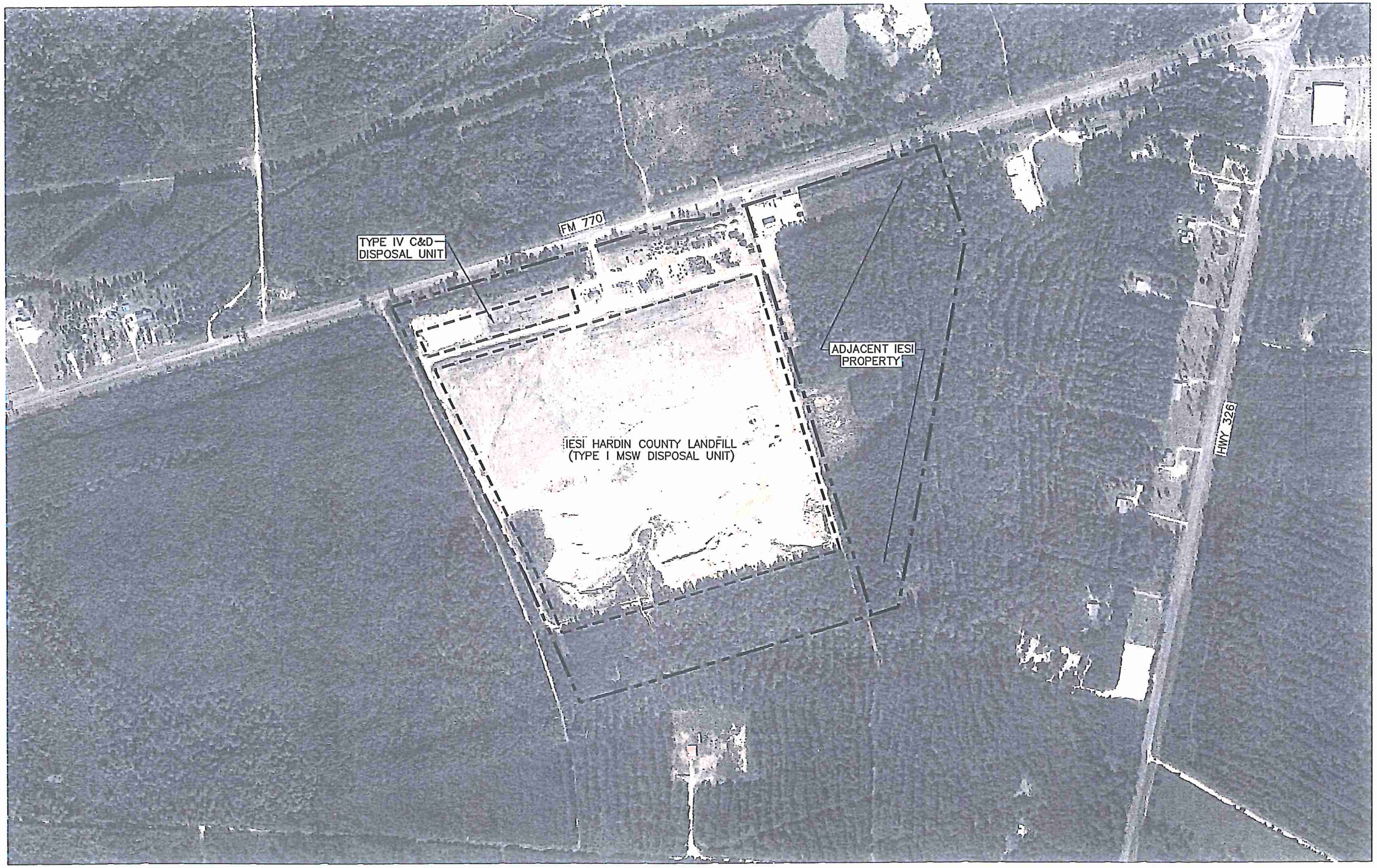
FIGURE 2

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 2-GENERAL TOPO MAP.dwg, jwilson, 1:2



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SCALE IN FEET

LEGEND

- IESI PROPERTY BOUNDARY
- PERMIT BOUNDARY
- LIMITS OF WASTE

NOTE:

1. AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH AND DATED 2016.

STATE OF TEXAS
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I/IIB-62

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DATE: 10/2016
FILE: 0771-365-11
CAD: FIG 3-AERIAL PHOTOGRAPH.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
IESI TX LANDFILL LP

REVISIONS

NO.	DATE	DESCRIPTION

MAJOR PERMIT AMENDMENT
AERIAL PHOTOGRAPH

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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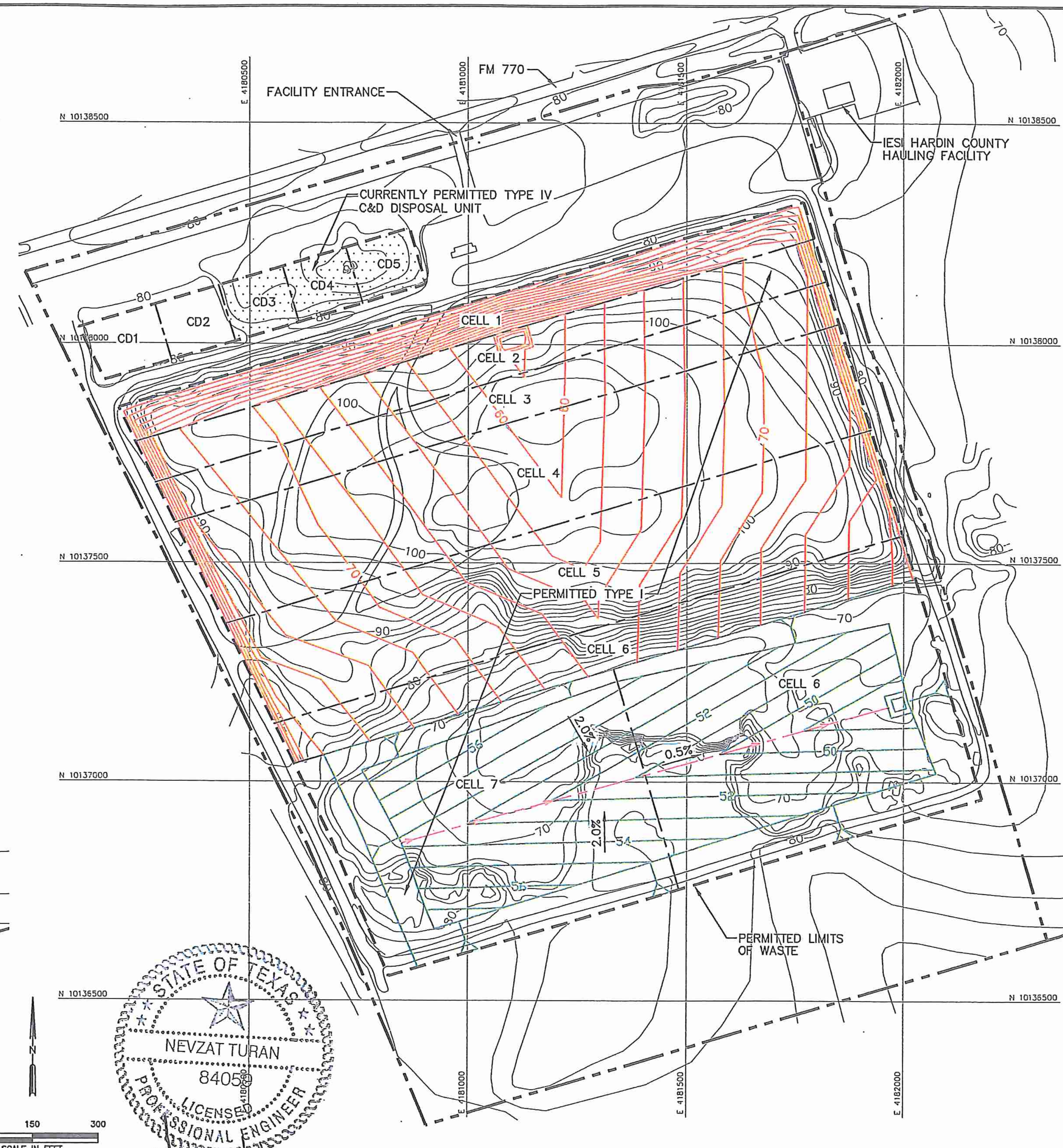
FIGURE 3

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 3-AERIAL PHOTOGRAPH.dwg, jwilson, 1:2

CURRENTLY PERMITTED CONDITIONS PLAN



STATE OF TEXAS
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10/31/2016

PROPOSED EXCAVATION PLAN

I/IIB-63

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CONTOURS FOR THE CURRENTLY PERMITTED CONDITIONS PLAN REPRESENT THE TOP OF LINER PROTECTIVE COVER CONTOURS WHICH ARE 4 TO 5 FEET ABOVE THE EXCAVATION GRADES. THE PROPOSED EXCAVATION PLAN CONTOURS WERE DEVELOPED BY WEAVER CONSULTANTS GROUP AS PART OF THE DESIGN BASIS MEMORANDUM FOR THE PROPOSED MAJOR AMENDMENT APPLICATION.
3. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.

LEGEND

	IESI EAST PROPERTY BOUNDARY
	PERMIT BOUNDARY
	PERMITTED LIMITS OF WASTE
	PROPOSED LIMITS OF WASTE
	CELL BOUNDARY
70	EXISTING CONTOUR (SEE NOTE 1)
N 10137000	STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
60	PERMITTED TOP OF PROTECTIVE COVER CONTOUR (SEE NOTE 2)
60	PROPOSED EXCAVATION CONTOUR (SEE NOTE 2)
	LEACHATE LINE

☐ DRAFT
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DATE: 10/2016
FILE: 0771-365-11
CAD: FIG 4-EXCAVATION PLAN COMP.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

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TBPE REGISTRATION NO. F-3727

PREPARED FOR
IESI TX LANDFILL LP

REVISIONS

NO.	DATE	DESCRIPTION

MAJOR PERMIT AMENDMENT
PERMITTED AND PROPOSED EXCAVATION PLAN

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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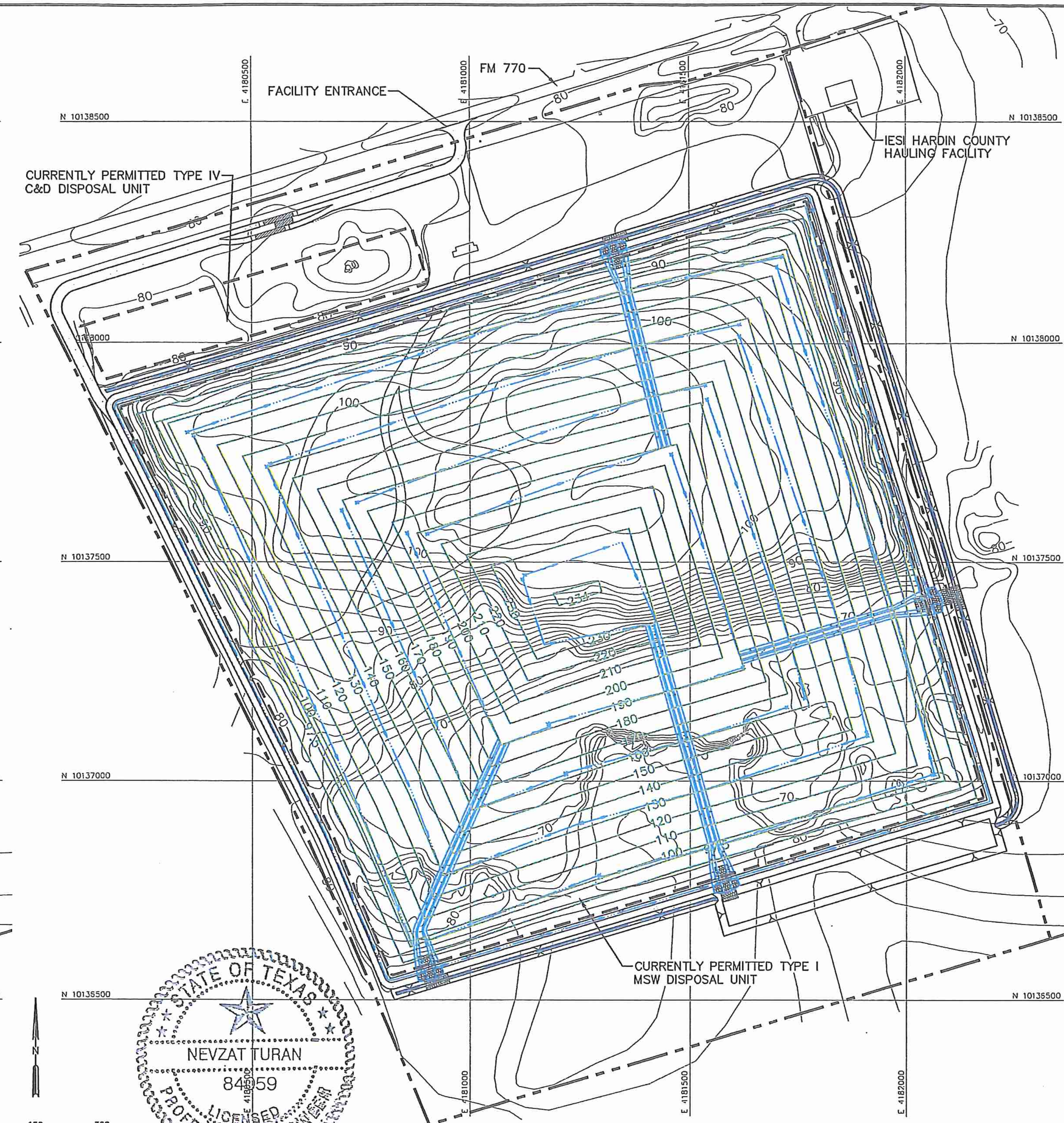
FIGURE 4

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 4-EXCAVATION PLAN COMPARISON.dwg, jwilson, 1:2

PERMITTED COMPLETION PLAN



PROPOSED COMPLETION PLAN

10/31/2016

0 150 300
SCALE IN FEET

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NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. PERMITTED COMPLETION PLAN FINAL COVER CONTOURS ARE OBTAINED FROM 2010 HARDIN COUNTY LANDFILL MSW PERMIT NO. 2214A. THE PROPOSED PERMITTED COMPLETION PLAN FINAL COVER CONTOURS WERE DEVELOPED BY WEAVER CONSULTANTS GROUP AS PART OF THE DESIGN BASIS MEMORANDUM FOR THE PROPOSED MAJOR AMENDMENT APPLICATION.
3. THE PROPOSED COMPLETION PLAN DRAINAGE STRUCTURES ARE SHOWN FOR INFORMATIONAL PURPOSES. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.

LEGEND

	IESI PROPERTY BOUNDARY
	PERMIT BOUNDARY
	CURRENTLY PERMITTED LIMITS OF WASTE
70	EXISTING CONTOUR (SEE NOTE 1)
N 10137000	STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
220	FINAL COVER CONTOUR (SEE NOTE 2)
	PROPOSED DRAINAGE SWALE
	PROPOSED DRAINAGE CHUTE

I/IIB-64

☐ DRAFT
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DATE: 10/2016
FILE: 0771-365-11
CAD: FIG 4-COMPLETION PLAN COMP.DWG

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DESIGN BY: AE
REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
IESI TX LANDFILL LP

REVISIONS

NO.	DATE	DESCRIPTION

MAJOR PERMIT AMENDMENT
PERMITTED AND PROPOSED
COMPLETION PLAN

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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FIGURE 5

COORDINATION WITH TEXAS DEPARTMENT OF TRANSPORTATION

CONTENTS

- August 4, 2017 Texas Department of Transportation Approval Letter.
- October 31, 2016 Texas Department of Transportation Demonstration of Coordination Letter from WCG.

Texas Department of Transportation

8350 EASTEX FREEWAY, BEAUMONT, TEXAS 77708 | 409.892.7311 | WWW.TXDOT.GOV

August 4, 2017

Nevzat Turan, P.E.
Weaver Consultant Group
6420 Southwest Boulevard
Suite 206
Fort Worth, TX. 76109

Re: Traffic Location Restriction Information
Proposed IESI Hardin County Landfill Amendment
Hardin County Texas

Dear Mr. Turan:

The Texas Department of Transportation, Beaumont District, received your request for approval of the Traffic Study for the proposed IESI Hardin County Landfill expansion project. The findings show that there will be no significant increase in landfill traffic over the 30 years. In addition, the findings show that FM 770 and SH 326 can handle the minor traffic increases expected from this expansion project. TxDOT has reviewed the study and approves of the findings as presented in the report.

Due to the impacts being found to be minor, there will not be a need to complete a new driveway access permit at this time. In the future, if actual traffic volumes exceed the projected values, it might require another analysis and or driveway access permit. Please proceed with your construction of the expansion project.

If I may be of further assistance, please contact me at (409) 898-5768 or email me at cory.taylor@txdot.gov

Sincerely,

, P.E.

Cory W Taylor, P.E.
Beaumont Director of Transportation Operations

[THE FOLLOWING DOCUMENT WAS SUBMITTED TO TEXAS DEPARTMENT OF TRANSPORTATION ON OCTOBER 31, 2016, AND WCG IS WAITING FOR A RESPONSE.]

Weaver Consultants Group

October 31, 2016
Project No. 0771-365-11-07-03

Mr. Tucker Ferguson, P.E.
District Engineer
Texas Department of Transportation, Beaumont District
8350 Eastex Freeway
Beaumont, Texas 77708-1701

Re: Traffic Location Restriction Information
Proposed IESI Hardin County Landfill Amendment
Hardin County, Texas

Dear Mr. Ferguson:

The purpose of this letter is to demonstrate coordination with the Texas Department of Transportation (TxDOT) consistent with Title 30 Texas Administrative Code (TAC) §330.61(i)(4). This regulation requires that a permit applicant for expansion of a municipal solid waste (MSW) facility coordinate with TxDOT regarding any potential traffic or location restrictions.

Weaver Consultants Group, LLC is preparing a permit amendment application, under contract with IESI Texas Landfill LP, to increase the capacity of the IESI Hardin County Landfill located southwest of the City of Kountze in central Hardin County. The landfill expansion will be limited to deepening a portion of the permitted landfill footprint, and vertically expanding the landfill footprint. The amendment application will be submitted to the Texas Commission on Environmental Quality for review and approval before the landfill is expanded.

The site entrance road is located along Farm to Market (FM) 770, approximately 0.7 miles west of the intersection of FM 770 and State Highway (SH) 326. The landfill has used this site entrance road for the previous 20 years of landfill operation, and will continue to use the entrance for future operations.

The attached traffic study has been prepared to provide a history of the site and to show that FM 770 and the existing site entrance road will continue to provide adequate access to the site throughout the life of the facility. The traffic study includes a Project Summary and Site Location Maps, and previous (1993 and 2010) TxDOT coordination letters.

To verify compliance with 30 TAC §330.61(i)(4), we will need to include a letter from TxDOT in the permit application regarding the adequacy of the site access roads and any traffic or location restrictions at or near the site.

Your assistance with this matter is sincerely appreciated. Please call if you have any questions or need additional information.

Sincerely,
Weaver Consultants Group, LLC

Nevzat Turan, P.E.
Senior Engineer

Attachments: Traffic Study

cc: Brett O'Connor, IESI TX Landfill LP

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS
TCEQ PERMIT NO. MSW-2214B

TRAFFIC STUDY

Prepared for

IESI TX Landfill LP

October 2016

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

10/31/2016

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

WBC Project No. 0771-365-11-07-03

CONTENTS

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

10/31/2016

1 INTRODUCTION

1.1 Purpose

The purpose of this study is to show that the IESI Hardin County Landfill access roads (Farm to Market (FM) 770 and State Highway (SH) 326) will provide excellent access to the site. The study is completed consistent with the requirements listed in Title 30 Texas Administrative Code (30 TAC) §330.61(i), which requires the following information.

- Provide data on the availability and adequacy of roads that the owner or operator will use to access the site;
- Provide data on the volume of vehicular traffic on access roads within one mile of the proposed facility, both existing and expected, during the expected life of the proposed facility;
- Project the volume of traffic expected to be generated by the facility on the access roads within one mile of the proposed facility; and
- Submit documentation of coordination of all designs of proposed public roadway improvements such as turning lanes, storage lanes, etc., associated with site entrances with the agency exercising maintenance responsibility of the public roadway involved. In addition, the owner or operator shall submit documentation of coordination with the Texas Department of Transportation for traffic and location restrictions.

1.2 Summary of Proposed Landfill Expansion

The IESI Hardin County Landfill is an existing municipal solid waste landfill located in central Hardin County, approximately 0.7 miles west of the intersection of FM 770 and SH 326. The waste disposal unit is approximately 52 acres in size. The proposed expansion will not laterally increase the waste footprint. It is a vertical expansion only which includes deepening a portion of the landfill and increasing the height of the landfill within the existing permitted footprint.

A project summary and site location maps are provided in Appendix A.

2 TRAFFIC INFORMATION

2.1 Availability and Adequacy of Roads

As shown on the TxDOT Map (Figure 1 in Appendix A), the two access roads within one mile of the site are Farm to FM 770 and SH 326. The IESI Hardin County Landfill site access road enters the landfill along the north property boundary from FM 770. FM 770 is a 2-lane, asphalt-paved state highway. FM 770 intersects SH 326 approximately 0.7 miles northwest of the site entrance. SH 326 also is a 2-lane asphalt-paved state highway.

FM 770 and SH 326 will serve as the primary roadways within the vicinity of the landfill for collection vehicles delivering waste to the landfill. Other roads within one mile of the site include Camp Wheeler Road, Hardin Court Road, Miller Road, Fire Tower Road, Hargroves Lane, and Langham Road. These roads maybe periodically be used by collection vehicles to serve residences and businesses located along or near these roadways; however, they are not main access roads that collection vehicles will use to access the landfill.

The existing landfill was permitted in 1995 with an updated traffic study completed in 2010. Previous correspondence with TxDOT is included in Appendix B.

2.2 Volume of Vehicular Traffic

The volume of vehicle traffic on FM 770 and SH 326 is summarized in Table 2.1. As noted in Table 2.1, TxDOT traffic counts for 2015 were available for FM 770 and SH 326. The 2015 TxDOT traffic counts were adjusted to account for the additional traffic created by area growth over the life of the site (based on growth rates projected by the Texas Water Development Board). Growth was projected to 2047, the lifespan of the proposed landfill expansion.

Table 2.2 presents a summary of the estimated traffic patterns and vehicle counts for the access roads within 1 mile of the site. A list of the various assumptions that were used to derive the estimates is presented as notes to Table 2.2.

The traffic volume impact assessment is summarized in Table 2.2. As shown, the development of the landfill will have a minimal impact on all access roads. The level of service (LOS) for FM 770 is estimated to remain the same throughout the life of the landfill based on growth projections. In summary, the traffic associated with the landfill only utilizes a minimum amount of the capacity of the access roads (i.e., less than 0.5 percent for FM 770, and less than 0.3 percent for SH 326).

2.3 Intersection Analysis

An analysis of the landfill entrance road and FM 770 intersection is summarized on Figure 6 in Appendix A. ***As shown on Figure 6, vehicles traveling eastbound on FM 770 will arrive at the intersection at a maximum rate of one vehicle every 20 seconds in 2015 and every 17 seconds in 2047 during the peak hour flow rate. In addition, landfill vehicles accessing the site will arrive westbound at the intersection of FM 770 and the landfill entrance road every 6 minutes in 2015 and every 5 minutes in 2047 during the peak hour flow rate.*** Because of the low traffic volume associated with the intersection (landfill vehicles arrive over 5 minutes apart in both cases), the FM 770 and landfill entrance road is adequate for the associated traffic volume throughout the life of the facility.

FM 770 intersects SH 326 approximately 0.7 miles east of the landfill entrance. As shown in Table 2.2, the landfill vehicles make up a small percentage of the roadway capacity (less than 0.5 percent). Therefore, any situation that would cause the level of service provided by the intersection to decrease, such as a large amount of development in the immediate area, would not be caused from the landfill.

2.4 Queuing/Mud Control

The current configuration includes a gravel entrance road from FM 770 to the landfill perimeter road, approximately 340 feet. The long road length and gravel allows mud on vehicles to "spin off" onto the entrance road within the landfill property before the vehicle returns to FM 770. In addition, the 340-foot entrance road allows an ample queuing area for four or five landfill vehicles within the landfill to avoid disturbing vehicular traffic along FM 770, with additional queuing available on the landfill perimeter road.

Table 2.1
2-Way Traffic Volumes[1]

Location	Traffic Volumes[2] (Veh/Day)		Existing Traffic Volume 2015 (Veh/Day)						Projected Traffic Volume[3] 2047 (Veh/Day)					
			Daily			Peak Hour[4]			Daily			Peak Hour[4]		
	Daily	Peak Hour[4]	Landfill Trips[5]	Non-Landfill Trips	Total	Landfill Trips	Non-Landfill Trips	Total	Landfill Trips[5]	Non-Landfill Trips	Total	Landfill Trips	Non-Landfill Trips	Total
FM 770	1,831	183	100	1,731	1,831	10	173	183	122	2,058	2,180	12	206	218
SH 326(N)	4,478	448	70	4,408	4,478	7	441	448	86	5,245	5,331	8	525	533
SH 326(S)	1,887	189	30	1,857	1,887	3	186	189	36	2,238	2,274	4	220	224

Notes:
1 Traffic volumes listed in this table include two-way traffic volumes.
2 Traffic information was taken from a 2015 TxDOT Traffic Map.
3 The projected traffic volumes were obtained using projected growth rates for the surrounding area growth rate (non-landfill vehicles). The growth rates were obtained from the Texas Water Development Board, 2015 Regional Water Plan. The population increase for 2015-2020 is 0.88% per year, for 2021-2030 is 0.73%, for 2031-2040 is 0.49%, and for 2041-2047 is 0.35%.
4 Peak hour volumes are assumed to be ten percent of total daily traffic.
5 Landfill trips estimated from information provided by the site operator and increased as discussed in Note 3.

Table 2.2
Traffic Impact Assessment[1]

Location	Roadway Capacity[4] (Veh/Hr)	2015 Traffic Conditions				Projected 2047 Traffic Conditions[3]			
		Peak Hour Volume (Veh/Hr)	% of Roadway Capacity Used	LOS Based on Percent Time Spent Following[5]	% of Roadway Capacity Used by Landfill Vehicles	Peak Hour Volume (Veh/Hr)	% of Roadway Capacity Used	LOS Based on Percent Time Spent Following[5]	% of Roadway Capacity Used by Landfill Vehicles
FM 770	2,800	183	6.5	A	0.36	218	7.8	A	0.43
SH 326(N)	2,800	448	16.0	A	0.25	533	19.0	B	0.29
SH 326(S)	2,800	189	6.8	A	0.11	227	8.0	B	0.14

Notes:
1 Traffic volumes listed in this table include two-way traffic volumes.
2 Traffic information was taken from a 2015 TxDOT Traffic Map.
3 The projected traffic volumes were obtained using projected growth rates for the surrounding area growth rate (non-landfill vehicles). The growth rates were obtained from the Texas Water Development Board, 2015 Regional Water Plan. The population increase for 2015-2020 is 0.88% per year, for 2021-2030 is 0.73%, for 2031-2040 is 0.49%, and for 2041-2047 is 0.35%.
4 The capacities were obtained from the Highway Capacity Manual, 2000.
5 Level of service was calculated using Chapter 20 of the Highway Capacity Manual, 2000, and is based on percent time spent following for Class II highways.

3 COMPLIANCE WITH HIGHWAY BEAUTIFICATION ACT

The Texas Transportation Code (TTC) Chapter 391 outlines compliance conditions and regulations to ensure that areas adjacent to interstate and primary transportation systems in Texas comply with the Highway Beautification Act (HBA), 23 U.S.C. §131.136, and 319. In the context of the HBA, landfills are classified as junk yards, and no junkyard may be established within 1,000 feet of the right of way of a highway in the interstate or primary systems. The right of way of FM 770 is within 1,000 feet of the permit boundary of the IESI Hardin County Landfill. However, based on the definitions set forth in the HBA and the TTC, it is understood that FM 770 is not a part of the primary highway system. Therefore, the requirements set forth in the HBA are not applicable to the IESI Hardin County Landfill.

However, the design and operating requirements listed in the proposed Texas Commission on Environmental Quality (TCEQ) permit application were developed to meet the intent of the screening standards for landfills set forth in the TxDOT Right of Way Manual (Volume 7 – Beautification, Chapter 10 – Control of Junkyards). According to the TxDOT Right of Way Manual, landfills will be considered appropriately screened by:

- Fencing the landfill area;
- Confining the refuse to the smallest practical area;
- Reducing the refuse to the smallest practical volume; and
- Covering the refuse with a layer of earth at the conclusion of each day's operation or at more frequent intervals if necessary.

A summary of each of these requirements is listed in Table 3-1.

Table 3-1
IESI Hardin County Landfill Expansion
Landfill Screening Requirements

TxDOT Screening Requirements	Existing and Proposed Site Design or Permit Operating Condition
Fencing the Landfill Area	The IESI Hardin County Landfill is currently fenced along the northern permit boundary and wooded areas along the west south and east. Access into the landfill is restricted to the entrance road on the north side of the site.
Confining the Refuse to the Smallest Practical Area and Volume	Solid waste at the IESI Hardin County Landfill is disposed of at the working face of the landfill. The working face is the only portion of the disposal area containing exposed solid waste. The size of the working face is required to be confined to as small of an area as practical. Specific working face size limitations are included in the existing and proposed Site Operating Plan.
Covering the Refuse with a Layer of Earth at the Conclusion of Each Day's Operation or at More Frequent Intervals if Necessary	The Site Operating Plan mandates that at least once every 24 hours, exposed solid waste will be covered by at least six inches of earthen cover material or by TCEQ-approved alternate daily cover material. Additionally, areas that have received daily cover and become inactive for at least 180 days will receive an additional 6 inches of well-compacted cover material. This intermediate cover will be graded and seeded such that sustainable vegetation is established on these inactive areas. The erosion control plan for the IESI Hardin County Landfill outlines inspection and maintenance requirements designed to maintain the vegetation and integrity of the intermediate cover.

4 SUMMARY

In summary, the area roadway system providing access to the IESI Hardin County Landfill is excellent. The existing roadway, including the intersection of FM 770 and the access roadway to the landfill, provide good and safe access to the landfill. No roadway improvements are needed as a result of the proposed expansion.

APPENDIX A

PROJECT SUMMARY AND SITE LOCATION MAPS

PROJECT SUMMARY
AND
SITE LOCATION MAPS

STATE OF TEXAS
NEVZAT TURAN
84059
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PROFESSIONAL ENGINEER

10/31/2016

Project Summary
IESI Hardin County Landfill Expansion
Hardin County, Texas

Introduction

The IESI Hardin County Landfill is in the process of developing a major permit amendment application that will provide long-term disposal capacity for authorized solid waste that is generated in Hardin County and surrounding counties. The objective of this summary is to provide an overview of the proposed landfill expansion. The following subsections detail information regarding the owner and operator of the landfill, general site information, and a summary of the proposed landfill design.

Owner/Operator Information

The IESI Hardin County Landfill is owned and operated by IESI TX Landfill LP. IESI TX Landfill LP is a subsidiary of Waste Connections, Inc. Waste Connections is one of the leading providers of solid waste services in the nation. Waste Connections provides nonhazardous waste collection, transfer, recycling, and disposal services to residential, municipal, industrial and commercial customers across the country.

Site Information

The following drawings are attached to this summary.

- Figure 1 – Site Location Map. This drawing shows the site location on a standard TxDOT county highway map.
- Figure 2 – General Topographic Map. This drawing shows the permit boundary and permitted landfill footprint on a USGS map.
- Figure 3 – Aerial Photograph. This figure shows the permit boundary and permitted landfill footprint on an aerial photograph.
- Figure 4 – Permitted and Proposed Excavation Plan. This figure provides a comparison between the currently permitted landfill excavation plan and the proposed amended landfill excavation plan.

- Figure 5 – Permitted and Proposed Landfill Completion Plan. This figure provides a comparison between the currently permitted landfill completion plan and the proposed amended landfill completion plan.

The IESI Hardin County Landfill is an existing 79-acre Municipal Solid Waste (MSW) landfill (current TCEQ Permit No. MSW-2214A) located approximately 0.7 miles west of the intersection of FM 770 and SH 326 in central Hardin County.

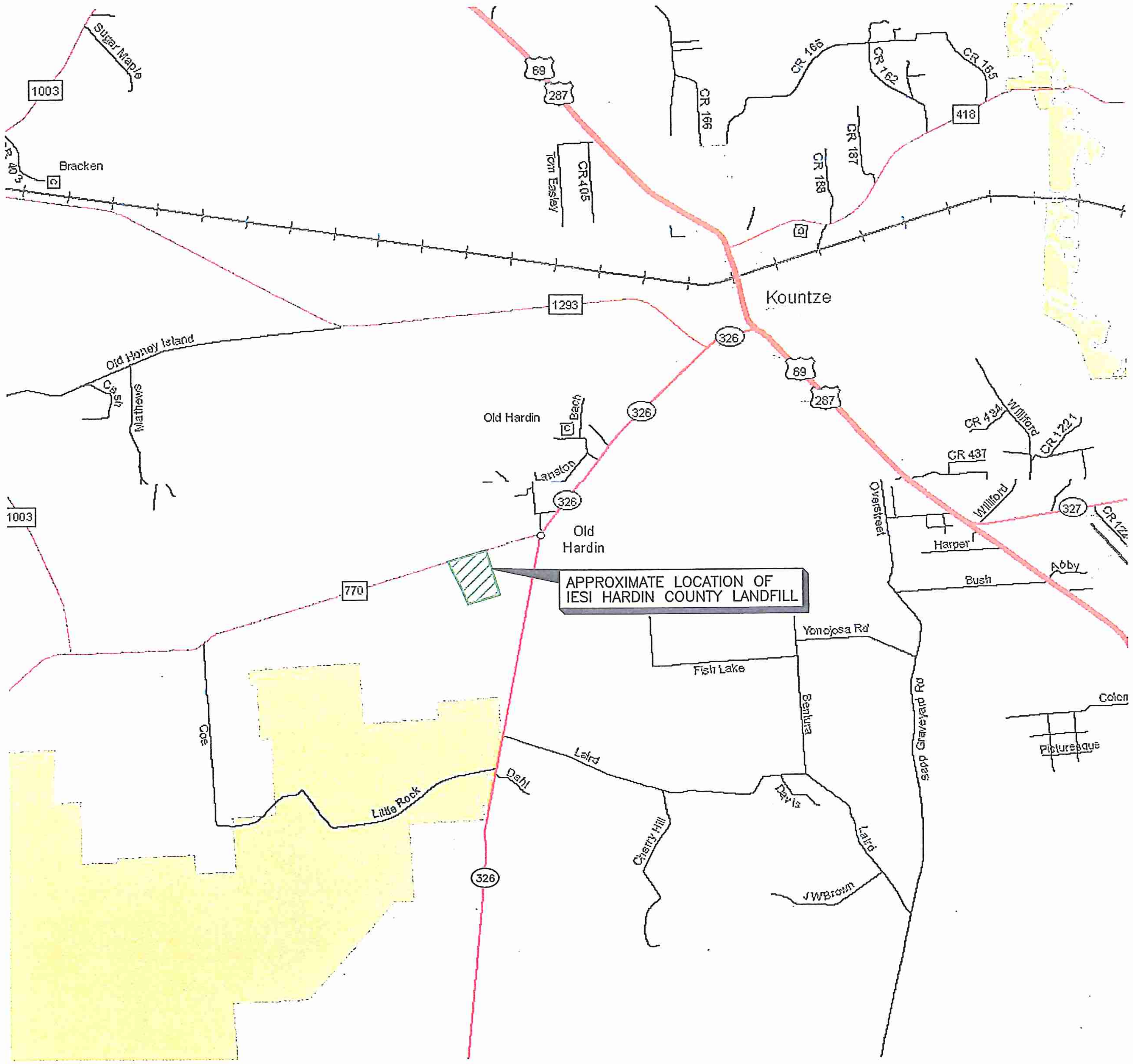
The site was originally permitted as a MSW landfill by the Texas Natural Resource Conservation Commission (TNRCC) in 1995. Approximately 32 acres of the 49.6-acre Subtitle D (i.e., composite bottom liner system) MSW disposal area has currently been developed. The facility also includes a 2.4-acre construction and demolition debris disposal unit, of which approximately 1.4 acres have been developed. The original permit number was Permit No. MSW-2214. The permit was transferred in 2002 from Hardin County to IESI TX Landfill LP.

Design Summary

The following information presents a summary of the design and operations for the proposed IESI Hardin County Landfill expansion:

- The IESI Hardin County Landfill is an existing municipal solid waste landfill facility (current TCEQ Permit No. MSW-2214A). The existing landfill currently serves residences and businesses in Hardin County and surrounding counties.
- With this expansion, the existing 79-acre permit boundary and existing 52-acre limits of waste will remain unchanged. The permitted but undeveloped waste disposal area will be deepened as shown on Figure 4, which shows both permitted top of protective cover grades (over constructed cells) and proposed excavation grades. The completion grades will be increased to optimize the disposal capacity of the permitted waste fill area. The currently permitted and proposed complete plans are shown on Figure 5.
- Accepted wastes will remain consistent with the current MSW landfill permit. The facility currently accepts municipal solid waste resulting from or incidental to municipal, community, commercial, institutional, and recreational activities; municipal solid waste resulting from construction and demolition activities; Class 2 and Class 3 nonhazardous industrial solid waste; and certain special wastes as permitted by the TCEQ. For this permit amendment cells 6 and 7 will be constructed in accordance with 30 TAC 335.590, and will accept Class 1 non-hazardous industrial waste in addition to the waste streams received by the landfill under the current permit.

- Access to the landfill will be provided via the existing site access road entrance off of FM 770. Based on travel patterns of existing landfill traffic, vehicles bound for the landfill will generally access the site using SH 326 and FM 770.
- A bottom liner system and final cover system that meet all regulatory requirements will be used for constructing the solid waste containment system. The design objective of the containment system (liner, leachate management system, and final cover) is to isolate the solid waste and remove leachate (defined as liquid that has contacted solid waste) that collects on the liner system. Leachate that is removed from the landfill is transported to an offsite, permitted treatment facility. The construction procedures of the liner system and final cover system follow strict TCEQ-approved quality control and quality assurance procedures, which are verified by an independent testing firm, and approved by a professional engineer licensed in the State of Texas. Liner construction is divided into approximately 3 to 4 acre "cells" across the permitted bottom of the landfill. Each of the containment system components must be approved by the engineer, and thoroughly reviewed and approved by the TCEQ before solid waste is placed into each constructed cell.
- To verify that the highest level of environmental protection is maintained, the following landfill monitoring systems are provided:
  - Groundwater Monitoring System. The purpose of the groundwater monitoring system is to verify the integrity of the containment system and demonstrate that area groundwater is not adversely impacted by the landfill. This is accomplished by obtaining water samples from the monitor wells, located on the perimeter of the landfill, which are screened to monitor groundwater quality. The water samples are tested at an offsite laboratory.
  - Gas Monitoring System. The purpose of the landfill gas monitoring system is to verify that landfill gas does not migrate beyond the permit boundary. Landfill gas probes are placed along the perimeter of the permit boundary.
  - These monitoring systems are sampled and tested periodically per the TCEQ-approved monitoring plans. The results are filed with the TCEQ and are public record.
- Site Operations. The site will be operated by properly trained personnel. A detailed Site Operating Plan will be included in the permit amendment application. The plan will detail the required equipment, personnel, and safety procedures required to operate the site in accordance with TCEQ regulations. The IESI Hardin County Landfill will continue to be inspected by the TCEQ on a regular basis to ensure the site is in compliance with state regulations and developed as permitted.



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0 3000 6000
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LEGEND

SITE LOCATION

NOTE:

1. MAP OBTAINED FROM TEXAS DEPARTMENT OF TRANSPORTATION DATED 2014.

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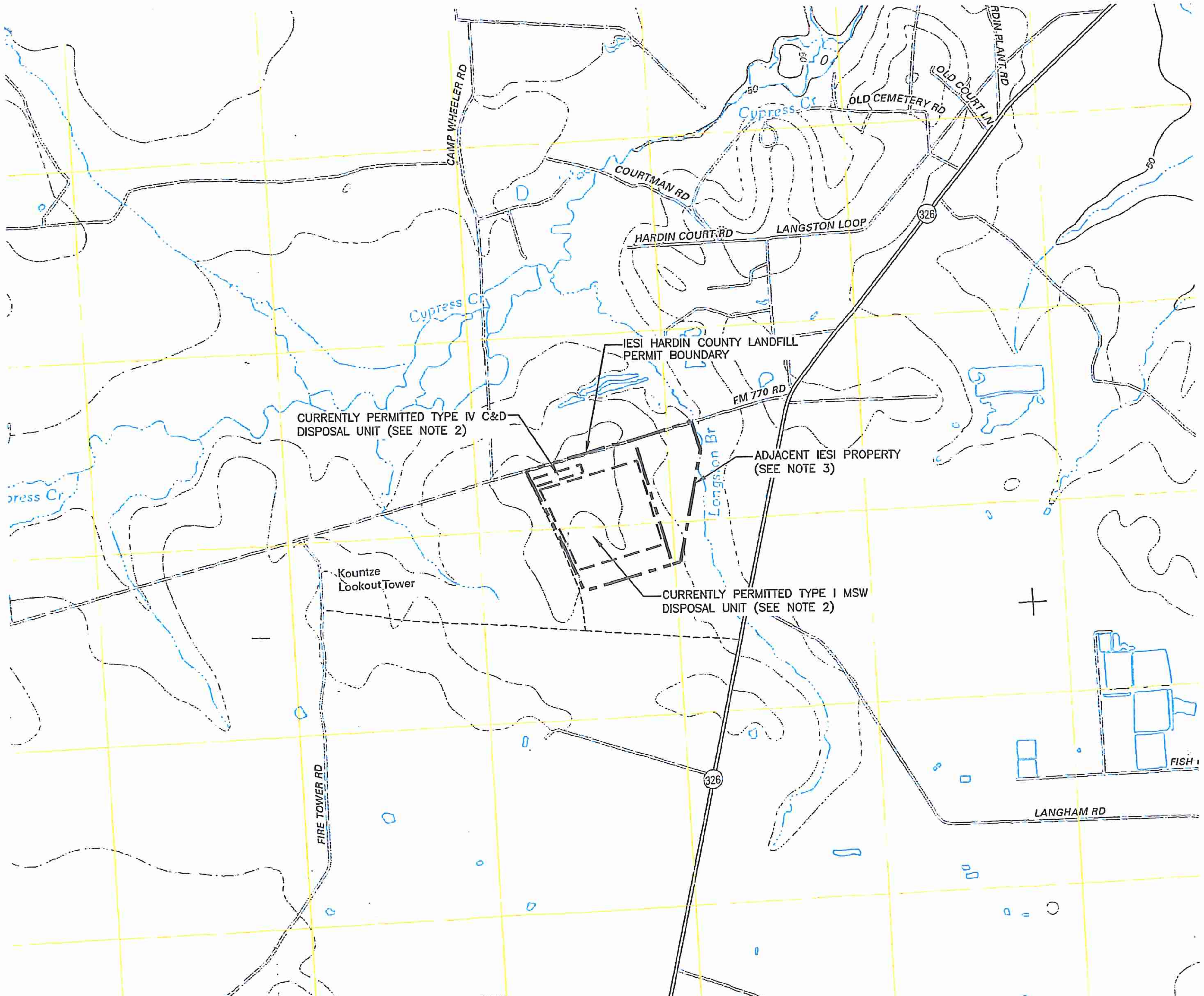
DATE: 10/2016 FILE: 0771-365-11 CAD: FIG 1-SITE LOCATION MAP.DWG DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. / DATE / DESCRIPTION	
Weaver Consultants Group TBPE REGISTRATION NO. F-3727		WWW.WCGRP.COM / FIGURE 1

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 1-SITE LOCATION MAP.dwg, jwilson, 1:2



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LEGEND

IESI PROPERTY BOUNDARY
PERMIT BOUNDARY
LIMITS OF WASTE

ROAD CLASSIFICATION

Interstate Route
US Route
Ramp
State Route
Local Road
4WD
Interstate Route
US Route
State Route

KOUNTZE SW, TX
2013

KOUNTZE SOUTH, TX
2013

NOTES:

1. ADAPTED FROM USGS 7.5 MINUTE QUADRANGLE TOPOGRAPHIC MAPS (KOUNTZE SOUTH, TX 2013 AND KOUNTZE SW, TX 2013).
2. THE FACILITY HAS TWO SEPARATE PERMITTED DISPOSAL UNITS. THE FIRST UNIT IS A TYPE I MUNICIPAL SOLID WASTE (MSW) DISPOSAL UNIT AND IT ENCOMPASSED APPROXIMATELY 49.6 ACRES. THE SECOND PERMITTED UNIT IS A 2.4 ACRE TYPE IV CONSTRUCTION AND DEMOLITION (C&D) DISPOSAL UNIT.
3. THE ADJACENT IESI PROPERTY IS APPROXIMATELY 31.3 ACRES. THIS PROPERTY WILL NOT BE JOINED TO THE DISPOSAL AREA; HOWEVER, A RESTRICTIVE COVENANT MAY BE OBTAINED FOR A PORTION OF THIS AREA FOR LANDFILL-RELATED DRAINAGE FACILITIES.

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MAJOR PERMIT AMENDMENT
GENERAL TOPOGRAPHIC MAP

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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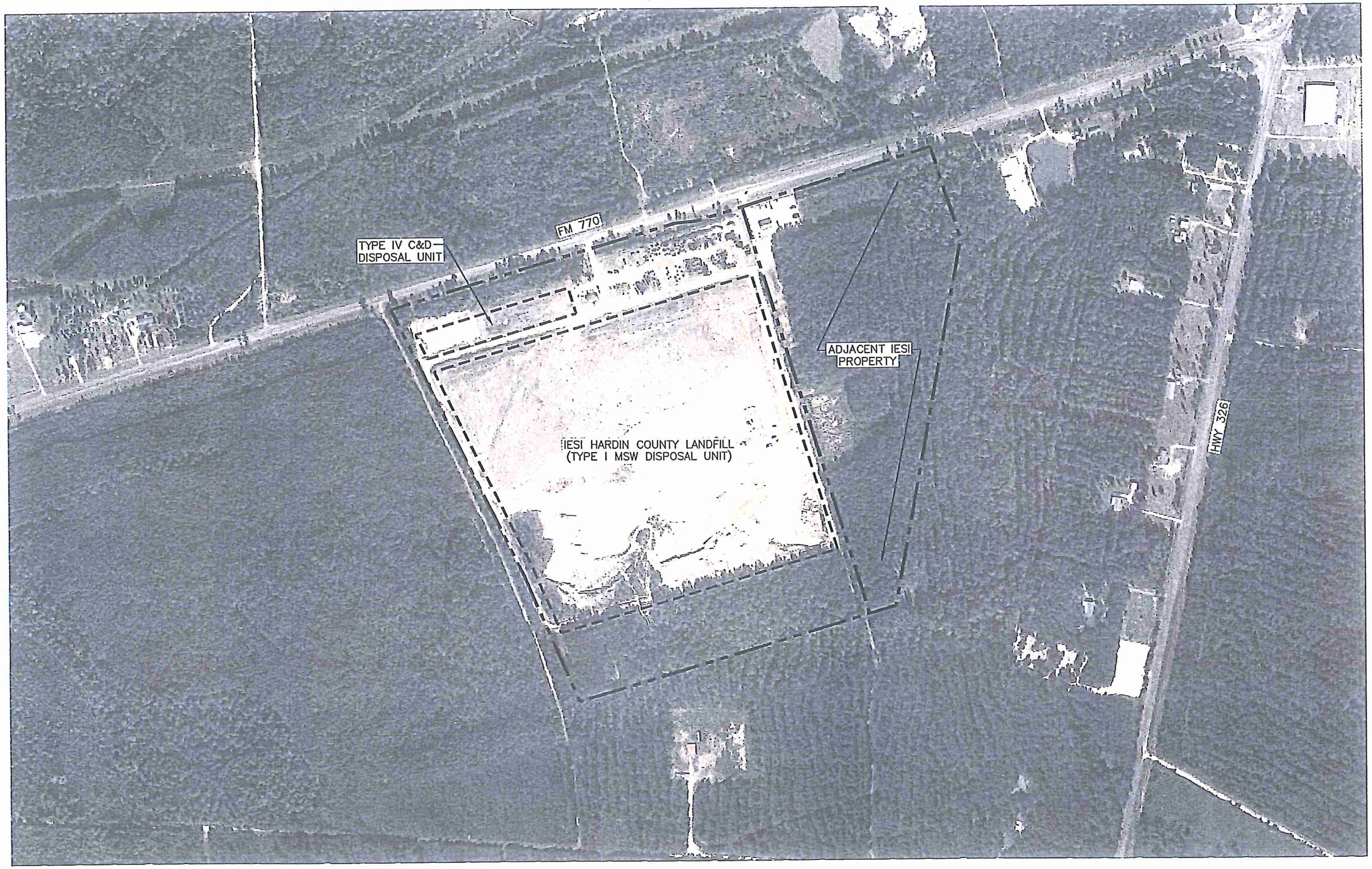
FIGURE 2

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 2-GENERAL TOPO MAP.dwg, jwilson, 1:2

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 3-AERIAL PHOTOGRAPH.dwg, jwilson, 1:2



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LEGEND

IESI PROPERTY BOUNDARY

PERMIT BOUNDARY

LIMITS OF WASTE

NOTE:

1. AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH AND DATED 2016.

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MAJOR PERMIT AMENDMENT
AERIAL PHOTOGRAPH

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HARDIN COUNTY, TEXAS

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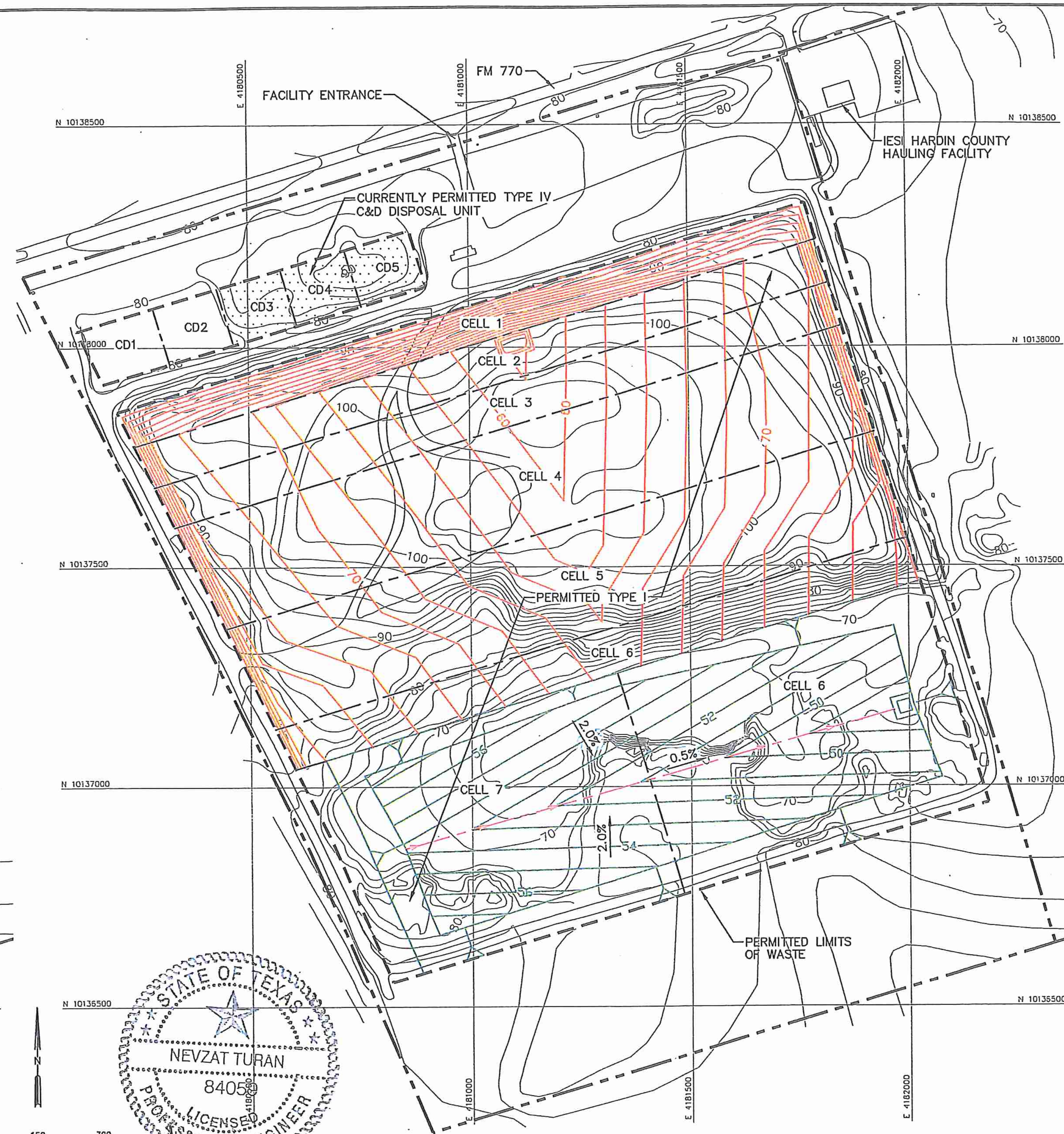
FIGURE 3

CURRENTLY PERMITTED CONDITIONS PLAN



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PROPOSED EXCAVATION PLAN

I/IIB-87

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CONTOURS FOR THE CURRENTLY PERMITTED CONDITIONS PLAN REPRESENT THE TOP OF LINER PROTECTIVE COVER CONTOURS WHICH ARE 4 TO 5 FEET ABOVE THE EXCAVATION GRADES. THE PROPOSED EXCAVATION PLAN CONTOURS WERE DEVELOPED BY WEAVER CONSULTANTS GROUP AS PART OF THE DESIGN BASIS MEMORANDUM FOR THE PROPOSED MAJOR AMENDMENT APPLICATION.
3. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.

LEGEND

- IESI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY
- PERMITTED LIMITS OF WASTE
- PROPOSED LIMITS OF WASTE
- CELL BOUNDARY
- 70 — EXISTING CONTOUR (SEE NOTE 1)
- N 10137000 — STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
- 60 — PERMITTED TOP OF PROTECTIVE COVER CONTOUR (SEE NOTE 2)
- 60 — PROPOSED EXCAVATION CONTOUR (SEE NOTE 2)
- LEACHATE LINE

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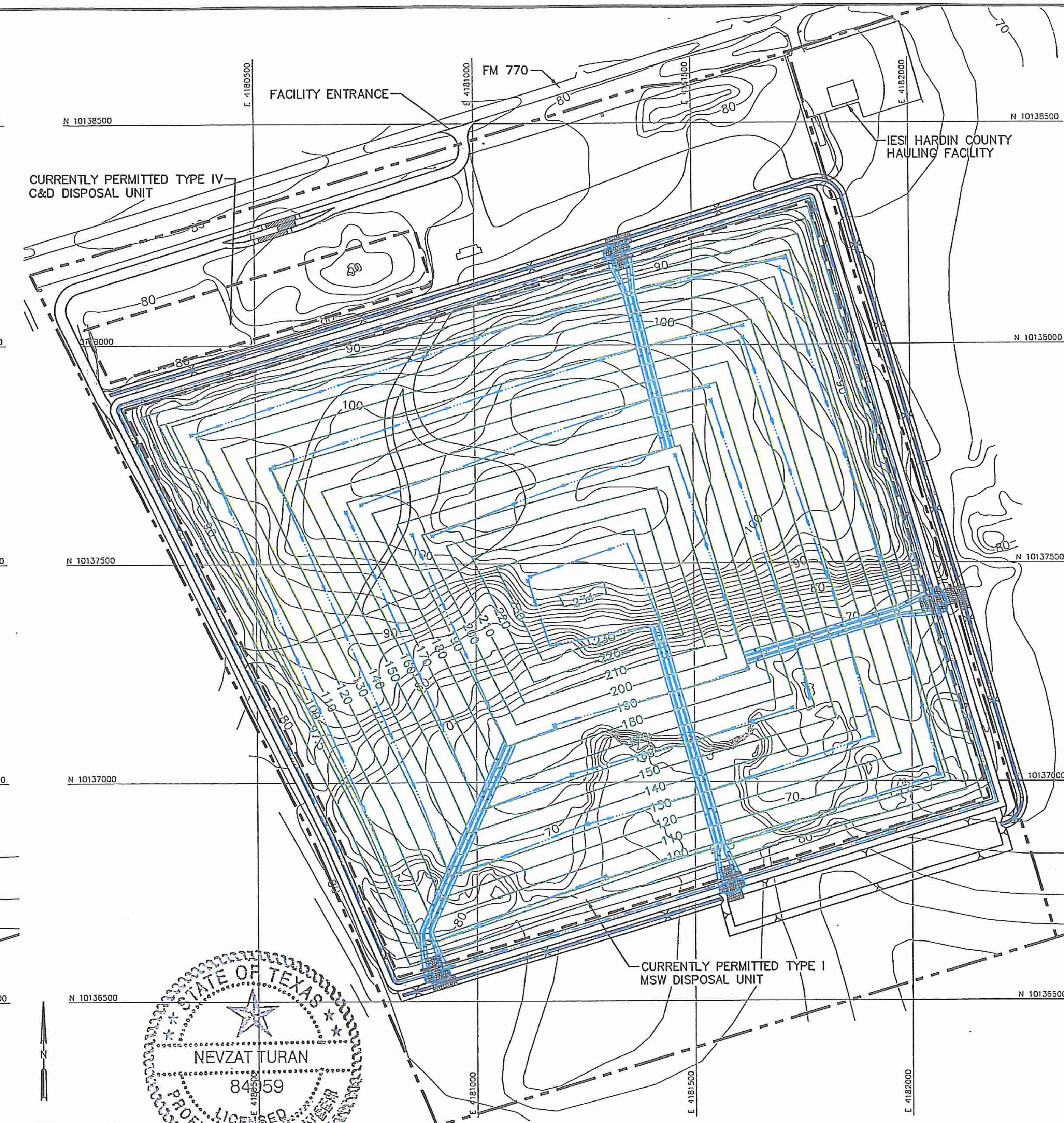
DATE: 10/2016 FILE: 0771-365-11 CAD: FIG 4-EXCAVATION PLAN COMP.DWG	DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. / DATE / DESCRIPTION		
Weaver Consultants Group TBPE REGISTRATION NO. F-3727				WWW.WCGRP.COM — FIGURE 4

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 4-EXCAVATION PLAN COMPARISON.dwg, jwilson, 1:2

PERMITTED COMPLETION PLAN



PROPOSED COMPLETION PLAN

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SCALE IN FEET

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NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. PERMITTED COMPLETION PLAN FINAL COVER CONTOURS ARE OBTAINED FROM 2010 HARDIN COUNTY LANDFILL MSW PERMIT NO. 2214A. THE PROPOSED PERMITTED COMPLETION PLAN FINAL COVER CONTOURS WERE DEVELOPED BY WEAVER CONSULTANTS GROUP AS PART OF THE DESIGN BASIS MEMORANDUM FOR THE PROPOSED MAJOR AMENDMENT APPLICATION.
3. THE PROPOSED COMPLETION PLAN DRAINAGE STRUCTURES ARE SHOWN FOR INFORMATIONAL PURPOSES. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY. (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.

LEGEND

	IESI PROPERTY BOUNDARY
	PERMIT BOUNDARY
	CURRENTLY PERMITTED LIMITS OF WASTE
70	EXISTING CONTOUR (SEE NOTE 1)
N 10137000	STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
220	FINAL COVER CONTOUR (SEE NOTE 2)
	PROPOSED DRAINAGE SWALE
	PROPOSED DRAINAGE CHUTE

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MAJOR PERMIT AMENDMENT
PERMITTED AND PROPOSED COMPLETION PLAN

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HARDIN COUNTY, TEXAS

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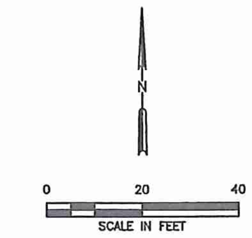
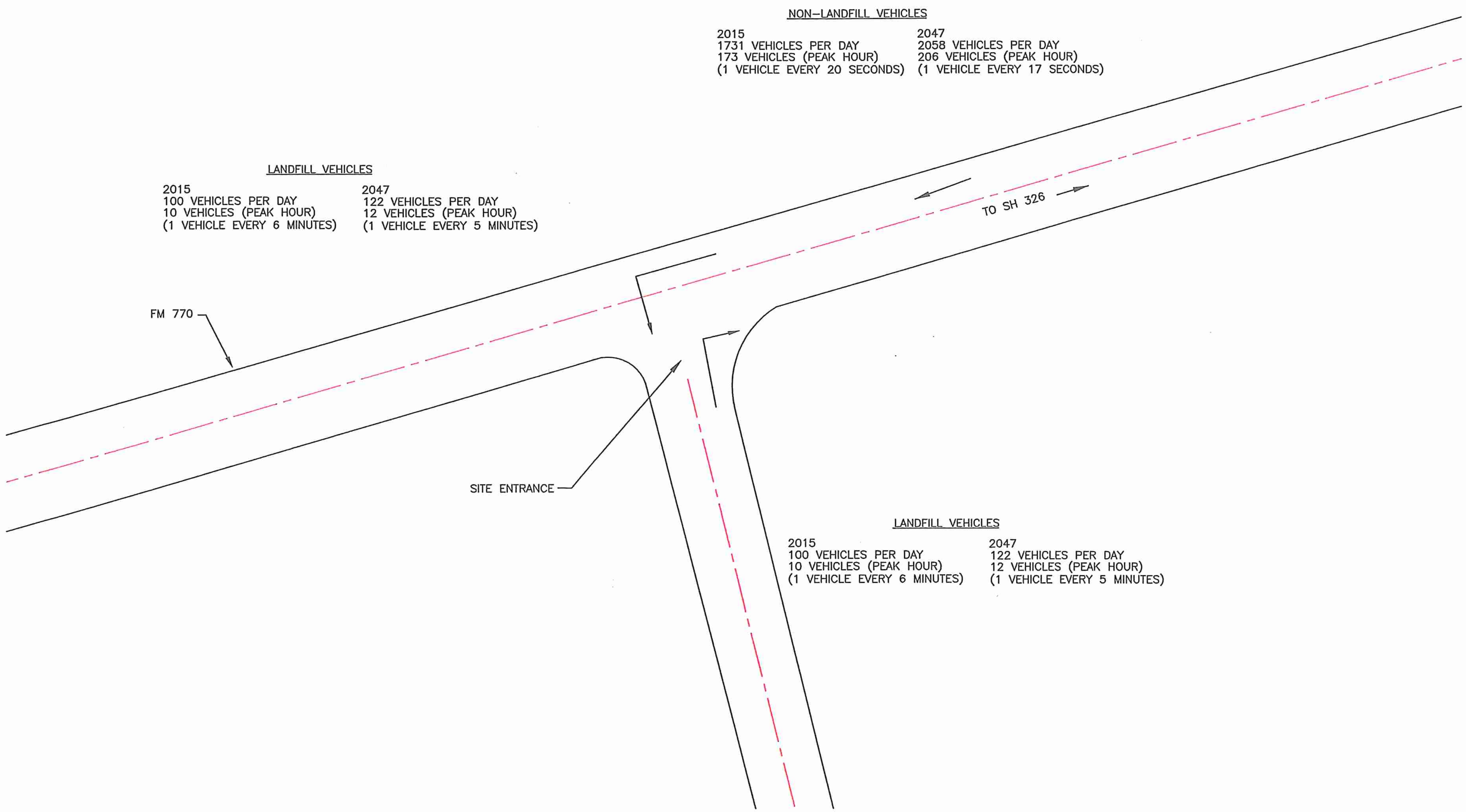
FIGURE 5

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 5-COMPLETION PLAN COMPARISON.dwg, jwilson, 1:2





CONCLUSION:

VEHICLES ENTERING AND EXITING THE SITE WILL NOT IMPEDE TRAFFIC ON FM770. AS SHOWN, THE PEAK HOUR FLOW RATES FOR NON–LANDFILL VEHICLES TRAVELING SOUTHBOUND ON FM770 IS APPROXIMATELY 1 VEHICLE PER 20 SECONDS IN 2015 AND 2047. IN ADDITION, THE PEAK HOUR FLOW RATE FOR LANDFILL VEHICLES ACCESSING THE SITE IS LESS THAN 1 VEHICLE PER 6 MINUTES IN BOTH 2015 AND 2047.

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O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 6-LANDFILL ENTRANCE.dwg, 10/28/2016 3:30:22 PM, rsellers, 1:2

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MAJOR PERMIT AMENDMENT
FM 770 AND LANDFILL
ENTRANCE INTERSECTION

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

WWW.WCGRP.COM

FIGURE 6

APPENDIX B

2010 AND 1993 TxDOT COORDINATION LETTERS

BIGGS & MATHEWS ENVIRONMENTAL
Consulting Engineers ◆ *Hydrogeologists*
Mansfield ◆ **Arlington** ◆ **Dallas** ◆ **Wichita Falls**

March 29, 2010

Mr. Duane Browning
Area Engineer
Texas Department of Transportation
8450 Eastex Freeway
Beaumont, Texas 77708

Re: IESI Hardin County Landfill, TCEQ Permit No. MSW 2214A
Hardin County, Texas
Coordination Letter – Availability and Adequacy of FM 770 and SH 326

Dear Mr. Browning:

On behalf of IESI TX Landfill LP (IESI), this letter is submitted is to demonstrate coordination with the Texas Department of Transportation (TxDOT) consistent with Title 30 Texas Administrative Code (TAC) §330.61(i). This regulation requires that a municipal solid waste (MSW) facility coordinate with the Texas Department of Transportation regarding the availability and adequacy of roads that the facility uses to operate the site. As shown on the attached General Highway Map, the IESI Hardin County Landfill (TCEQ Permit No. MSW 2214A) site entrance is located on the south side of FM 770, approximately 0.7 mile west of the intersection of FM 770 and SH 326.

On behalf of IESI, we have submitted a permit modification to the Texas Commission on Environmental Quality (TCEQ) to revise the waste acceptance rate currently listed in the facility's permit. The permit currently states that approximately 20 vehicles will be entering the facility per day. Based on the proposed increase in waste acceptance, approximately 46 vehicles per day entered the facility in calendar year 2009, which included approximately 35 waste hauling vehicles and 11 support vehicles per day. In addition, the TCEQ is requesting that we coordinate with TxDOT regarding the proposed increased waste acceptance and the availability and adequacy of FM 770 and SH 326.

The permit application for the IESI Hardin County Landfill was prepared and submitted to the TCEQ in the early to mid 1990s. As part of the permit application process, correspondence was submitted on behalf of IESI to TxDOT in February 1993 requesting documentation confirming that the anticipated traffic would not have an impact on FM 770 traffic. TxDOT responded to this request in March 1993 stating that development of the site would not have much impact on the traffic of FM 770 based on the anticipated 20 vehicles per day entering the site and Annual Average Daily Traffic (AADT) value of 1,400 for FM 770.

Additional correspondence was submitted from TxDOT to IESI as part of the permit application process that included the historic AADT counts and 1992 AADT counts and depicted the traffic count locations for all AADT counts. Based on the most recent published online 2008 District Traffic Count Maps, we have compiled the 2008 AADT values for the same traffic count locations to provide a direct comparison, which is shown in Table 1 below. The traffic counts were measured on FM 770 and at locations on SH 326, north and south of

1700 Robert Road, Suite 100 ◆ Mansfield, Texas 76063 ◆ 817-563-1144 ◆ Fax 817-563-1224

the FM 770 intersection. As shown in Table 1, traffic has significantly increased from 1992 to 2008 within the vicinity of the facility, which demonstrates that FM 770 and SH 326 are available and adequate to handle the increased amount of trips generated by the IESI Hardin County Landfill based on the increased waste acceptance rate.

Table 1 - Annual Average Daily Traffic (AADT) Comparison

Year	FM 770	SH 326 (South)	SH 326 (North)
1992	1,400	1,300	2,900
2008	1,900	2,300	4,900
Percent Increase	35.7%	76.7%	68.9%
* Note: 1992 and 2008 AADT values based on TxDOT information.			

Table 2 below demonstrates that the total trips generated by the IESI Hardin County Landfill represent a significantly low percentage of the total AADT for FM 770 and that the continued waste acceptance does not have an impact on FM 770 traffic.

The updated site life calculations for the proposed waste acceptance rate permit modification determine that the site will consume its available landfill capacity in year 2024. As a result, we have projected the incoming vehicles per day and the AADT for FM 770 through year 2024 in Table 2 below to demonstrate that the facility trips will continue to remain a small percentage of the total AADT. The projected number of 70 incoming vehicles per day for 2024 includes approximately 55 waste hauling vehicles and 15 support vehicles and is a function of the incoming waste acceptance rate, which is anticipated to increase each year. The 2024 AADT was determined by projecting the average annual percent increase of 2.2% from the provided 1992 and published 2008 AADT values forward to 2024 for FM 770.

Table 2 - Facility Traffic and AADT Comparison (FM 770)

Year	Incoming Vehicles/Day	Total Trips Generated/Day	FM 770 (AADT)	Percent Facility Trips of AADT
1992	20	40	1,400	2.9%
2009	46	92	1,950*	4.7%
2024	70	140	2,700*	5.2%
* Note: Projected value based on 2.2% annual increase from 1992 to 2008 AADT values.				

Currently, approximately 70% and 30% of the incoming vehicles enter FM 770 from SH 326 north and south of the FM 770 intersection, respectively. Based on the trip distribution of 70% and 30% of incoming vehicles per day traveling from SH 326 north and south of the FM 770 intersection, respectively, the percent trips generated per day of AADT is calculated below in Tables 3 and 4, which demonstrate that the facility trips will remain a significantly low percentage of the total AADT for SH 326 north and south of the FM 770 intersection.

Table 3 - Facility Traffic and AADT Comparison (SH 326 North)

Year	Incoming Vehicles/Day	Total Trips Generated/Day	SH 326 North (AADT)	Percent Facility Trips of AADT
1992	14	28	2,900	0.9%
2009	32	64	5,100*	1.3%
2024	49	98	9,625*	1.0%
* Note: Projected value based on 4.3% annual increase from 1992 to 2008 ADT values.				

Table 4 - Facility Traffic and AADT Comparison (SH 326 South)

Year	Incoming Vehicles/Day	Total Trips Generated/Day	SH 326 South (AADT)	Percent Facility Trips of AADT
1992	6	12	1,300	0.9%
2009	14	28	2,410*	1.2%
2024	21	42	4,870*	0.9%
* Note: Projected value based on 4.8% annual increase from 1992 to 2008 ADT values.				

Based on the information provided in the discussion and tables above, we do not expect the proposed waste acceptance rate and corresponding facility vehicular traffic to have an impact on the availability and adequacy of FM 770 and SH 326.

In accordance with §330.61(i), we respectfully request a letter from TxDOT that confirms coordination that demonstrates the availability and adequacy of roads regarding the proposed waste acceptance rate and corresponding facility vehicular traffic to be included with our permit modification. The attached General Highway Map has been provided to assist you with your review.

We appreciate your assistance with this matter. Please call if you have any questions or need additional information.

Sincerely,

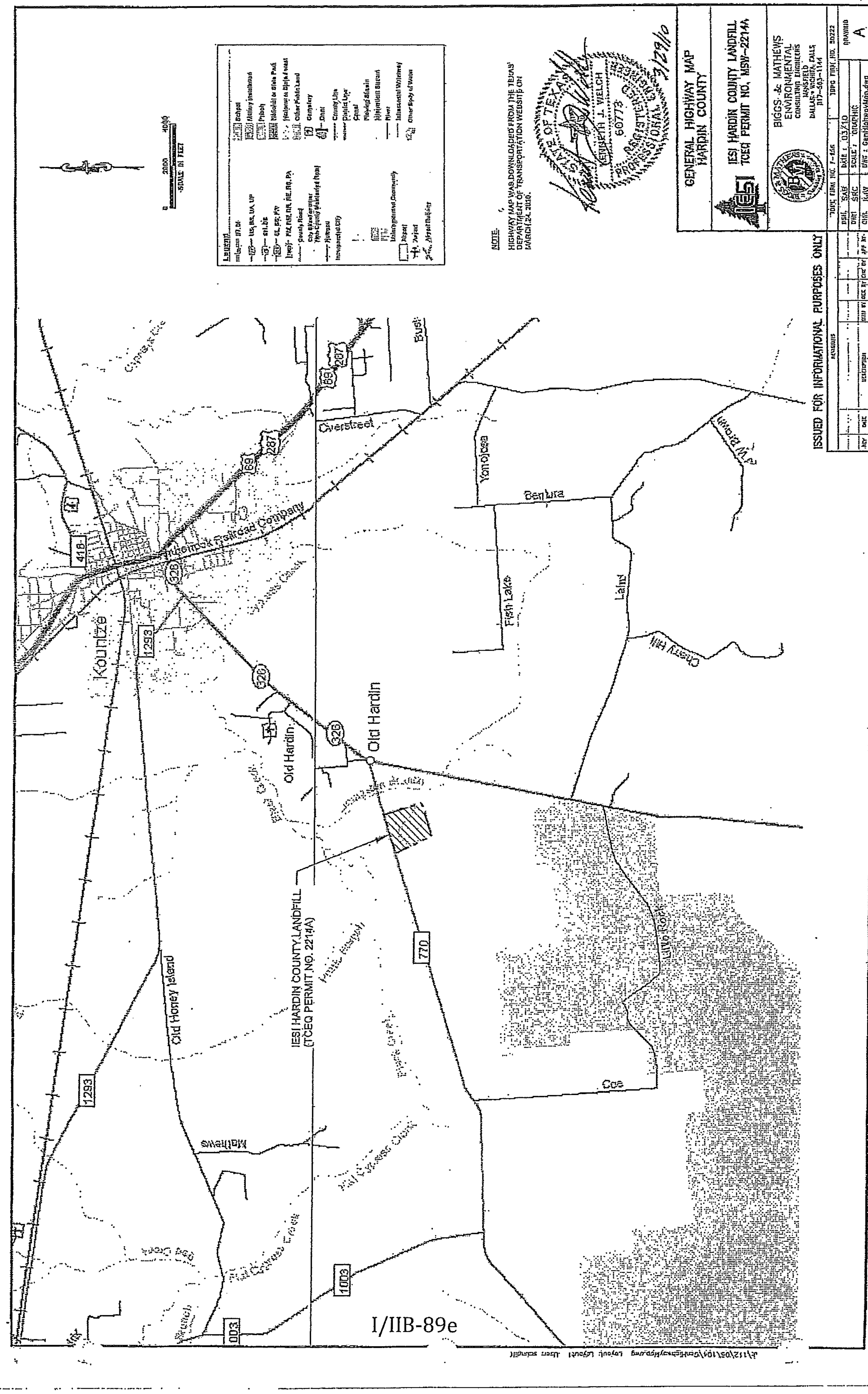
BIGGS & MATHEWS ENVIRONMENTAL
TBPE No. F-256 • TBPG No. 50222

Kenneth J. Welch

Kenneth J. Welch, P.E.
Principal Engineer

Attachments: Drawing A – General Highway Map Hardin County

cc: Mr. Joseph Viecelli, IESI (1)
Mr. Chris Brockman, IESI (1)


GENERAL HIGHWAY MAP
HARDIN COUNTY
IESI HARDIN COUNTY LANDFILL
TCEQ PERMIT NO. MSW-2214A
BIGGS & MATHEWS
ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD
DALLAS • WICHITA FALLS
817-563-1144
ISSUED FOR INFORMATIONAL PURPOSES ONLY
DATE : 03/10
SCALE : GRAPHIC
DWG : GenHighwayMap.dwg
DRAWING
A
NOTE:
HIGHWAY MAP WAS DOWNLOADED FROM THE TEXAS DEPARTMENT OF TRANSPORTATION WEBSITE ON MARCH 24, 2010.
KENNETH J. WELCH
60773
3/29/10
SCALE IN FEET
0
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4000
Legend
IESI HARDIN COUNTY LANDFILL
(TCEQ PERMIT NO. 2214A)
Kountze
Old Hardin
Overstreet
Bentura
Fish Lake
Cherry Hill
Coe
Old Honey Island
Mathews
Little Rock
Railroad Company
1293
418
326
69
287
770
1003
Bush

HN-001

KSA ENGINEERS, INC.

NATIONS BANK BLDG.
415 S. FIRST ST., SUITE 270
P.O. BOX 1605
LUFKIN, TEXAS 75902-1605
(409) 637-6061
FAX (409) 632-9256

February 5, 1993

Edward Domingos, P.E.
Supervising Resident Engineer
1150 West Avenue N
Silsbee, Texas 77656

RE: Impact of proposed Hardin County Landfill on local traffic

Dear Mr. Domingos:

As per our telephone conversation of Thursday, February 4, 1993, I am writing to request a review of traffic impacts and necessary improvements which may result from the construction of the above referenced project. Included with this letter, please find copies of portions of our original Texas Water Commission Landfill Permit Application which pertain to this topic, drawings indicating the general location of the proposed site, and a copy of a letter from Alfred E. Smith providing us with traffic count data for the area in question.

As shown on the drawings, the site is removed from the greater portion of traffic in and around the City of Kountze, being primarily in contact with general highway traffic. The current site is located on the north side of FM 770, north and east of the center of the proposed site which will be on the south side of the road. The new location is anticipated to only change traffic patterns as far as turning direction is concerned.

The enclosed portion of the Permit Application text provides our proposed discussion of the existing and expected traffic conditions surrounding the site. This text draws from information provided in the letter from Mr. Smith as well as traffic information specific to to the current and proposed landfill sites. It is anticipated that there will be an average of 20 vehicles per day entering and exiting the proposed site. On site there will be sufficient entrance roadway to store 3 vehicles, with additional space, if necessary, on around the perimeter of the fill.

Following their first administrative review of this Landfill Permit Application, the Texas Water Commission listed among their comments a need for review of the project by the Texas Department of Transportation for any "necessary traffic improvements". We believe, in considering the historic traffic data and proposed facilities, that no improvements to the highway system will be necessary to adjust for traffic surrounding the proposed site. As such, we are requesting a review by the Texas Department of Transportation of the proposed project as it relates to the local traffic patterns, with written approval of our conclusions or suggestions as to what other actions need to be taken to insure the safety and efficiency of the State Highway system.

Thank you for your help in addressing this request. If we need to provide any more information than is included with this letter, please call. I or Billy Sims will be available to answer any questions at 409/637-6061.

Sincerely,

KSA ENGINEERS, INC.

Lonnie Sikes
Design Engineer

Texas Department of Transportation

P.O. BOX 3468 • BEAUMONT, TEXAS 77704-3468 • (409) 892-7311

1150 West Avenue N
Silsbee, Texas 77656

March 4, 1993

Mr. Lonnie Sikes, Design Engineer
KSA Engineers, Inc.
P.O. Box 1605
Lufkin, Texas 75902-1605

Dear Lonnie:

In response to your letter of February 5, 1993 requesting review of traffic impact on FM 770 as a result of construction of proposed Hardin County Landfill, we offer the following statement:

> It is almost impossible to ascertain prior to the actual opening what impact this new landfill site will have upon the operations of FM 770. However, based upon the 1991 ADT of 1,400 for FM 770 and the reported 20 average daily vehicular use of this site, it does not appear that this site will have much impact upon FM 770 traffic. The only way to know is to observe the operations after the site has been opened and traffic patterns have been established.

Sincerely,

Ed Dominguez P.E.

Edward C. Dominguez, P.E.
Area Resident Engineer

ECD/csk
xc: File

MAR 10 1993

COORDINATION WITH TEXAS PARKS AND WILDLIFE DEPARTMENT

CONTENTS

- _______________ Texas Parks and Wildlife Approval Letter.
- October 31, 2016 Texas Parks and Wildlife Department Threatened or Endangered Species Assessment.

[THE FOLLOWING DOCUMENT WAS SUBMITTED TO TEXAS DEPARTMENT OF TRANSPORTATION ON OCTOBER 31, 2016, AND WCG IS WAITING FOR A RESPONSE.]

Weaver Consultants Group

October 31, 2016
Project No. 0771-365-11-05

Ms. Julie Wicker
Wildlife Habitat Assessment Program
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas 78744

Re: Threatened or Endangered Species Assessment
Proposed IESI Hardin County Landfill Expansion
Hardin County, Texas

Dear Ms. Wicker:

The purpose of this letter is to demonstrate coordination with the Texas Parks and Wildlife Department (TPWD), consistent with Title 30 Texas Administrative Code (TAC) §330.61(n)(2). This regulation requires that a permit applicant for an expansion of a municipal solid waste facility coordinate with the TPWD regarding locations and any specific data relating to threatened or endangered species.

Weaver Consultants Group, LLC is preparing a permit amendment application, under contract with IESI TX Landfill LP, to increase the capacity of the IESI Hardin County Landfill located southwest of the City of Kountze in central Hardin County. The landfill expansion will be limited to deepening a portion of the permitted landfill footprint, and vertically expanding the landfill footprint above currently permitted final grades. The amendment application will be submitted to the Texas Commission on Environmental Quality for review and approval before the landfill is expanded.

To assist you in your determination regarding threatened or endangered species or their critical habitat within or near the referenced project, please find attached (1) a project summary and site location maps, (2) previous agency correspondence, and (3) a site specific Endangered Species Survey completed as an element of the 1995 solid waste permit application.

The landfill was permitted in 1995 and has operated for over 20 years Most of the land within the landfill permit boundary has been disturbed by earth moving activities (e.g., landfill operations, cultivated fields and previous timber harvesting). Prior to being permitted as a landfill the property was used for timber cultivation, with most of the stumps and remnants from the timber harvesting having now been removed from the property. The attached project summary and site location maps provide description of the site location, currently permitted conditions, and the proposed expansion of the landfill.

Attached previous agency correspondence include a letter from the United States Department of the Interior – Fish and Wildlife Service dated October 2, 1992, and a National Parks Service correspondence dated October 14, 1992. The Fish and Wildlife Service correspondence states that based on review of Fish and Wildlife Service files and the provided project maps "indicates that no federally listed threatened or endangered species are likely to occur at the project site." The second correspondence, which specifically addressed impacts to the Big Thicket National Preserve, concluded that the proposed landfill would cause no adverse impacts provided construction complied with current and future State and Federal regulations.

The third attached correspondence, from TPWD, concluded that a site-specific threatened or endangered species survey would be required for TPWD to make an assessment of the project. This survey (titled Endangered Species Survey for Proposed Hardin County Landfill, Southwestern Laboratories, Inc., May 7, 1993) was submitted as an attachment to the original solid waste permit for the landfill. The survey included both background and field studies of the property prior to landfill development, and concluded that there is "little likelihood that operation of the landfill at this site will have adverse biological consequences to any local population" of the sensitive species identified in the survey (pg. 2, 1993).

To verify compliance with §330.61(n)(2), we will need to include a review letter from Texas Parks and Wildlife within the permit application. Your assistance with this matter is sincerely appreciated. Please call if you have any questions or need additional information.

Sincerely,
Weaver Consultants Group, LLC

Nevzat Turan, P.E.
Senior Engineer

Attachments: Project Summary and Site Location Maps
October 1992 US Department of Interior Fish and Wildlife Service and National Parks Service Correspondence
February 1993 Texas Parks and Wildlife Department Correspondence
Endangered Species Survey, Southwestern Laboratories, Inc., May 7, 1993

cc: Brett O'Connor, IESI TX Landfill LP

PROJECT SUMMARY AND SITE LOCATION MAPS

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

10/31/2016

Project Summary
IESI Hardin County Landfill Expansion
Hardin County, Texas

Introduction

The IESI Hardin County Landfill is in the process of developing a major permit amendment application that will provide long-term disposal capacity for authorized solid waste that is generated in Hardin County and surrounding counties. The objective of this summary is to provide an overview of the proposed landfill expansion. The following subsections detail information regarding the owner and operator of the landfill, general site information, and a summary of the proposed landfill design.

Owner/Operator Information

The IESI Hardin County Landfill is owned and operated by IESI TX Landfill LP. IESI TX Landfill LP is a subsidiary of Waste Connections, Inc. Waste Connections is one of the leading providers of solid waste services in the nation. Waste Connections provides nonhazardous waste collection, transfer, recycling, and disposal services to residential, municipal, industrial and commercial customers across the country.

Site Information

The following drawings are attached to this summary.

- Figure 1 – Site Location Map. This drawing shows the site location on a standard TxDOT county highway map.
- Figure 2 – General Topographic Map. This drawing shows the permit boundary and permitted landfill footprint on a USGS map.
- Figure 3 – Aerial Photograph. This figure shows the permit boundary and permitted landfill footprint on an aerial photograph.
- Figure 4 – Permitted and Proposed Excavation Plan. This figure provides a comparison between the currently permitted landfill excavation plan and the proposed amended landfill excavation plan.

- Figure 5 – Permitted and Proposed Landfill Completion Plan. This figure provides a comparison between the currently permitted landfill completion plan and the proposed amended landfill completion plan.

The IESI Hardin County Landfill is an existing 79-acre Municipal Solid Waste (MSW) landfill (current TCEQ Permit No. MSW-2214A) located approximately 0.7 miles west of the intersection of FM 770 and SH 326 in central Hardin County.

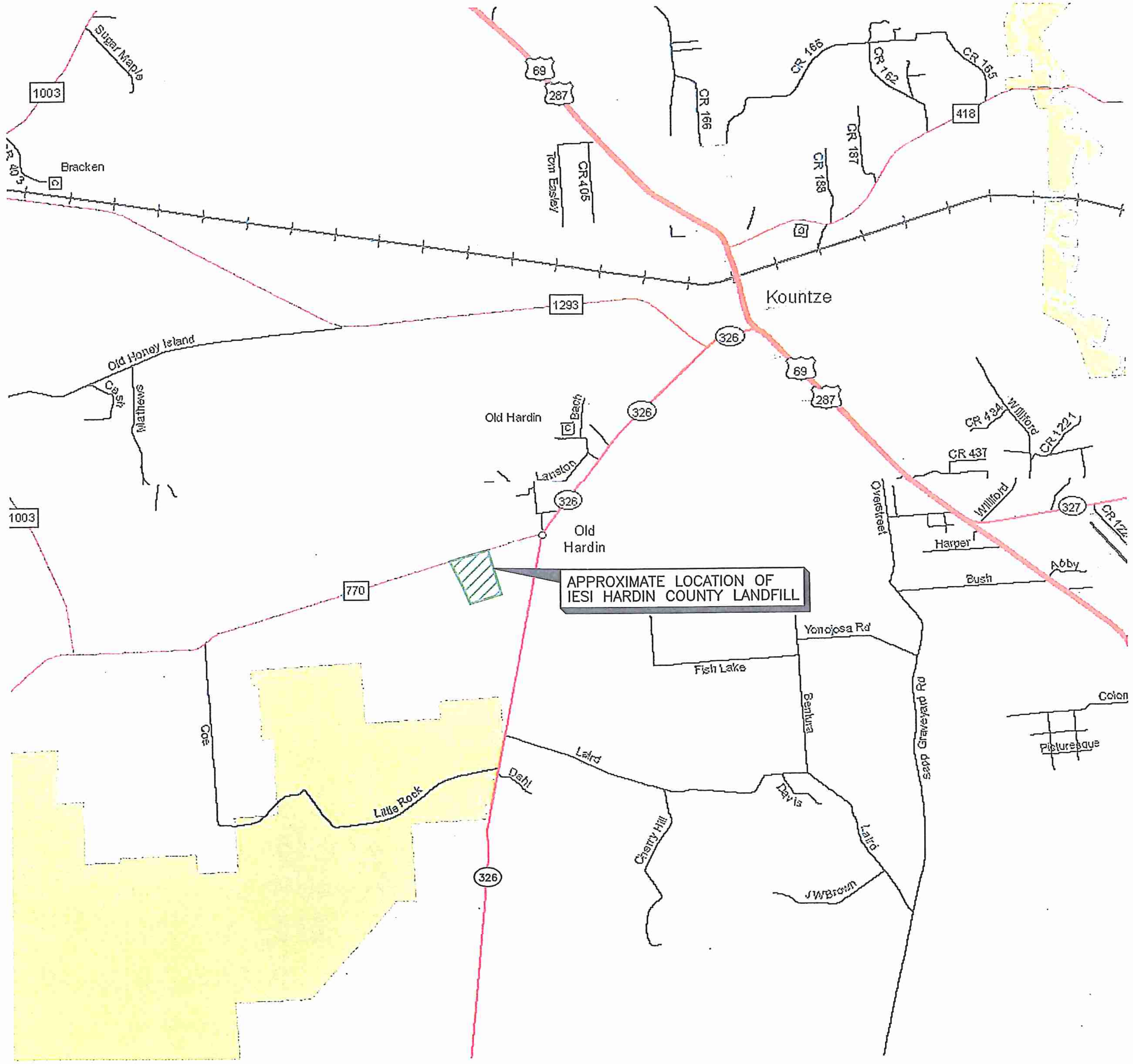
The site was originally permitted as a MSW landfill by the Texas Natural Resource Conservation Commission (TNRCC) in 1995. Approximately 32 acres of the 49.6-acre Subtitle D (i.e., composite bottom liner system) MSW disposal area has currently been developed. The facility also includes a 2.4-acre construction and demolition debris disposal unit, of which approximately 1.4 acres have been developed. The original permit number was Permit No. MSW-2214. The permit was transferred in 2002 from Hardin County to IESI TX Landfill LP.

Design Summary

The following information presents a summary of the design and operations for the proposed IESI Hardin County Landfill expansion:

- The IESI Hardin County Landfill is an existing municipal solid waste landfill facility (current TCEQ Permit No. MSW-2214A). The existing landfill currently serves residences and businesses in Hardin County and surrounding counties.
- With this expansion, the existing 79-acre permit boundary and existing 52-acre limits of waste will remain unchanged. The permitted but undeveloped waste disposal area will be deepened as shown on Figure 4, which shows both permitted top of protective cover grades (over constructed cells) and proposed excavation grades. The completion grades will be increased to optimize the disposal capacity of the permitted waste fill area. The currently permitted and proposed complete plans are shown on Figure 5.
- Accepted wastes will remain consistent with the current MSW landfill permit. The facility currently accepts municipal solid waste resulting from or incidental to municipal, community, commercial, institutional, and recreational activities; municipal solid waste resulting from construction and demolition activities; Class 2 and Class 3 nonhazardous industrial solid waste; and certain special wastes as permitted by the TCEQ. For this permit amendment cells 6 and 7 will be constructed in accordance with 30 TAC 335.590, and will accept Class 1 non-hazardous industrial waste in addition to the waste streams received by the landfill under the current permit.

- Access to the landfill will be provided via the existing site access road entrance off of FM 770. Based on travel patterns of existing landfill traffic, vehicles bound for the landfill will generally access the site using SH 326 and FM 770.
- A bottom liner system and final cover system that meet all regulatory requirements will be used for constructing the solid waste containment system. The design objective of the containment system (liner, leachate management system, and final cover) is to isolate the solid waste and remove leachate (defined as liquid that has contacted solid waste) that collects on the liner system. Leachate that is removed from the landfill is transported to an offsite, permitted treatment facility. The construction procedures of the liner system and final cover system follow strict TCEQ-approved quality control and quality assurance procedures, which are verified by an independent testing firm, and approved by a professional engineer licensed in the State of Texas. Liner construction is divided into approximately 3 to 4 acre "cells" across the permitted bottom of the landfill. Each of the containment system components must be approved by the engineer, and thoroughly reviewed and approved by the TCEQ before solid waste is placed into each constructed cell.
- To verify that the highest level of environmental protection is maintained, the following landfill monitoring systems are provided:
  - Groundwater Monitoring System. The purpose of the groundwater monitoring system is to verify the integrity of the containment system and demonstrate that area groundwater is not adversely impacted by the landfill. This is accomplished by obtaining water samples from the monitor wells, located on the perimeter of the landfill, which are screened to monitor groundwater quality. The water samples are tested at an offsite laboratory.
  - Gas Monitoring System. The purpose of the landfill gas monitoring system is to verify that landfill gas does not migrate beyond the permit boundary. Landfill gas probes are placed along the perimeter of the permit boundary.
  - These monitoring systems are sampled and tested periodically per the TCEQ-approved monitoring plans. The results are filed with the TCEQ and are public record.
- Site Operations. The site will be operated by properly trained personnel. A detailed Site Operating Plan will be included in the permit amendment application. The plan will detail the required equipment, personnel, and safety procedures required to operate the site in accordance with TCEQ regulations. The IESI Hardin County Landfill will continue to be inspected by the TCEQ on a regular basis to ensure the site is in compliance with state regulations and developed as permitted.



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0 3000 6000
SCALE IN FEET

LEGEND
SITE LOCATION

NOTE:

1. MAP OBTAINED FROM TEXAS DEPARTMENT OF TRANSPORTATION DATED 2014.

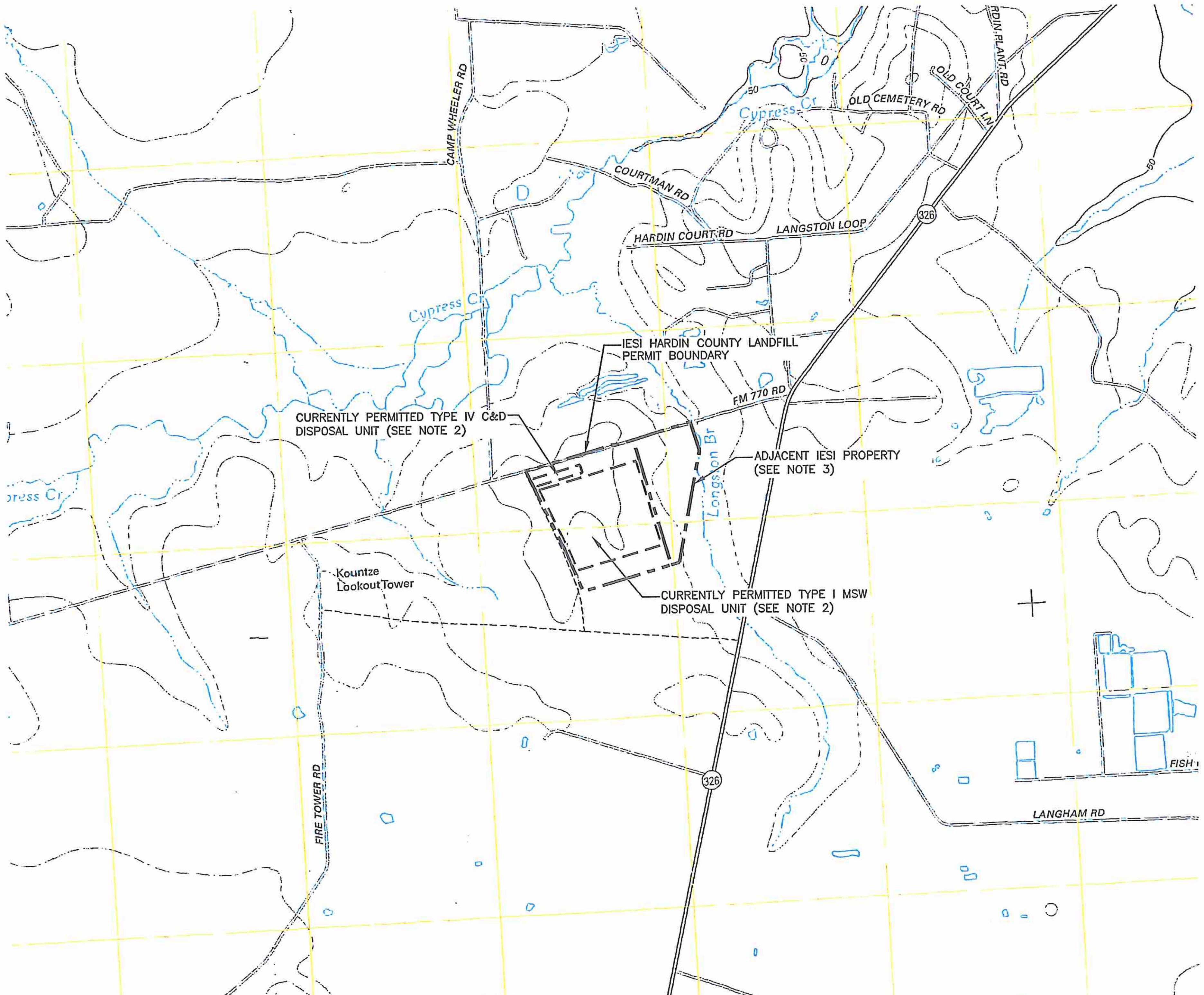
STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

10/31/2016

I/IIB-97

☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR IESI TX LANDFILL LP	MAJOR PERMIT AMENDMENT SITE LOCATION MAP
DATE: 10/2016 FILE: 0771-365-11 CAD: FIG 1-SITE LOCATION MAP.DWG DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. / DATE / DESCRIPTION	IESI HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group TBPE REGISTRATION NO. F-3727		WWW.WCGRP.COM / FIGURE 1

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 1-SITE LOCATION MAP.dwg, jwilson, 1:2



N

0 1000 2000
SCALE IN FEET

LEGEND

IESI PROPERTY BOUNDARY
PERMIT BOUNDARY
LIMITS OF WASTE

ROAD CLASSIFICATION

Interstate Route
US Route
Ramp
State Route
Local Road
4WD
Interstate Route
US Route
State Route

KOUNTZE SW, TX
2013

KOUNTZE SOUTH, TX
2013

NOTES:

1. ADAPTED FROM USGS 7.5 MINUTE QUADRANGLE TOPOGRAPHIC MAPS (KOUNTZE SOUTH, TX 2013 AND KOUNTZE SW, TX 2013).
2. THE FACILITY HAS TWO SEPARATE PERMITTED DISPOSAL UNITS. THE FIRST UNIT IS A TYPE I MUNICIPAL SOLID WASTE (MSW) DISPOSAL UNIT AND IT ENCOMPASSED APPROXIMATELY 49.6 ACRES. THE SECOND PERMITTED UNIT IS A 2.4 ACRE TYPE IV CONSTRUCTION AND DEMOLITION (C&D) DISPOSAL UNIT.
3. THE ADJACENT IESI PROPERTY IS APPROXIMATELY 31.3 ACRES. THIS PROPERTY WILL NOT BE JOINED TO THE DISPOSAL AREA; HOWEVER, A RESTRICTIVE COVENANT MAY BE OBTAINED FOR A PORTION OF THIS AREA FOR LANDFILL-RELATED DRAINAGE FACILITIES.

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

10/31/2016

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DATE: 10/2016
FILE: 0771-365-11
CAD: FIG 2-GENERAL TOPO MAP.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
IESI TX LANDFILL LP

REVISIONS

NO.	DATE	DESCRIPTION

MAJOR PERMIT AMENDMENT
GENERAL TOPOGRAPHIC MAP

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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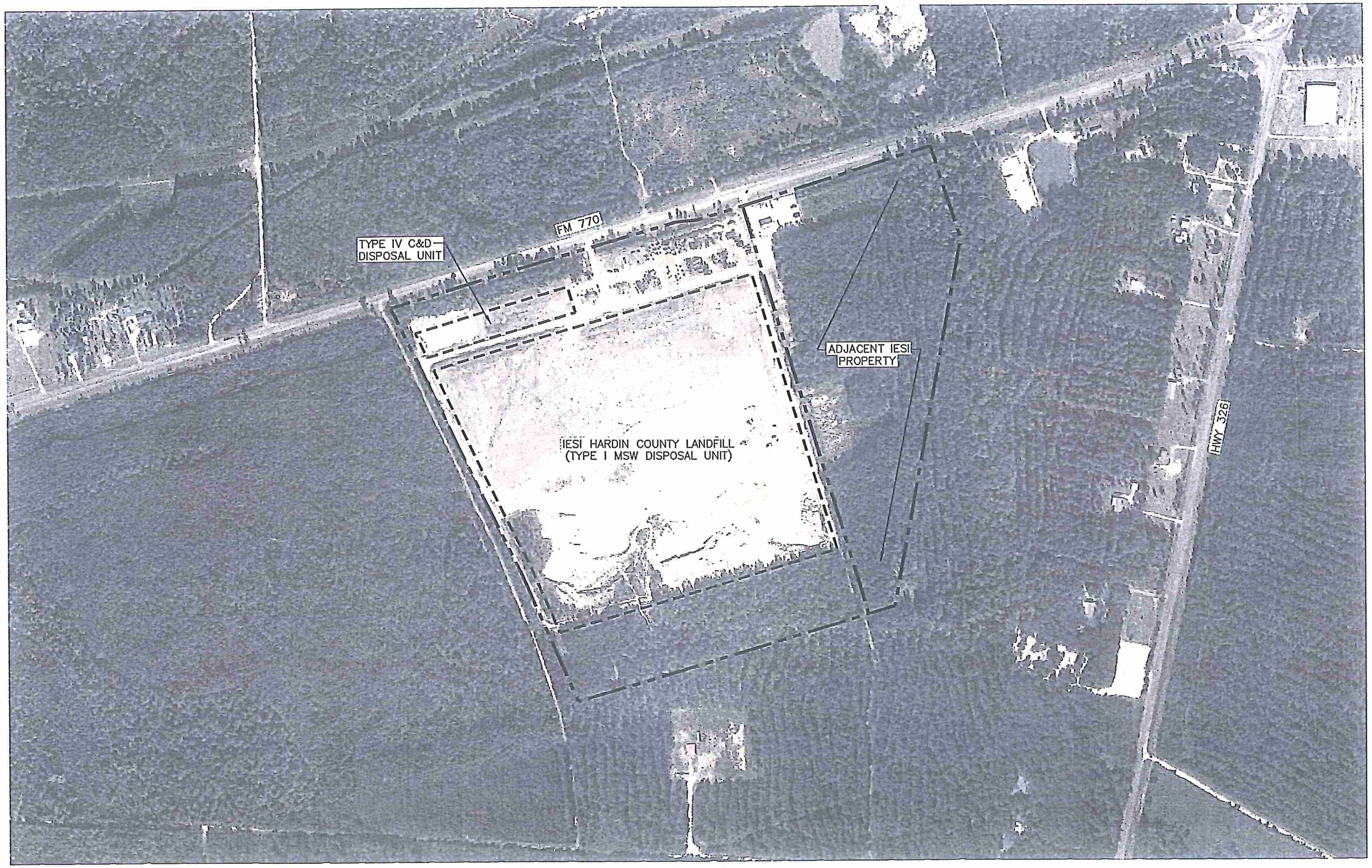
FIGURE 2

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 2-GENERAL TOPO MAP.dwg, jwilson, 1:2



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SCALE IN FEET

LEGEND

- IESI PROPERTY BOUNDARY
- PERMIT BOUNDARY
- LIMITS OF WASTE

NOTE:

1. AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH AND DATED 2016.

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED PROFESSIONAL ENGINEER

10/31/2016

I/IIB-99

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 10/2016	DRAWN BY: SRF
FILE: 0771-365-11	DESIGN BY: AE
CAD: FIG 3-AERIAL PHOTOGRAPH.DWG	REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
IESI TX LANDFILL LP

REVISIONS

NO.	DATE	DESCRIPTION

MAJOR PERMIT AMENDMENT
AERIAL PHOTOGRAPH

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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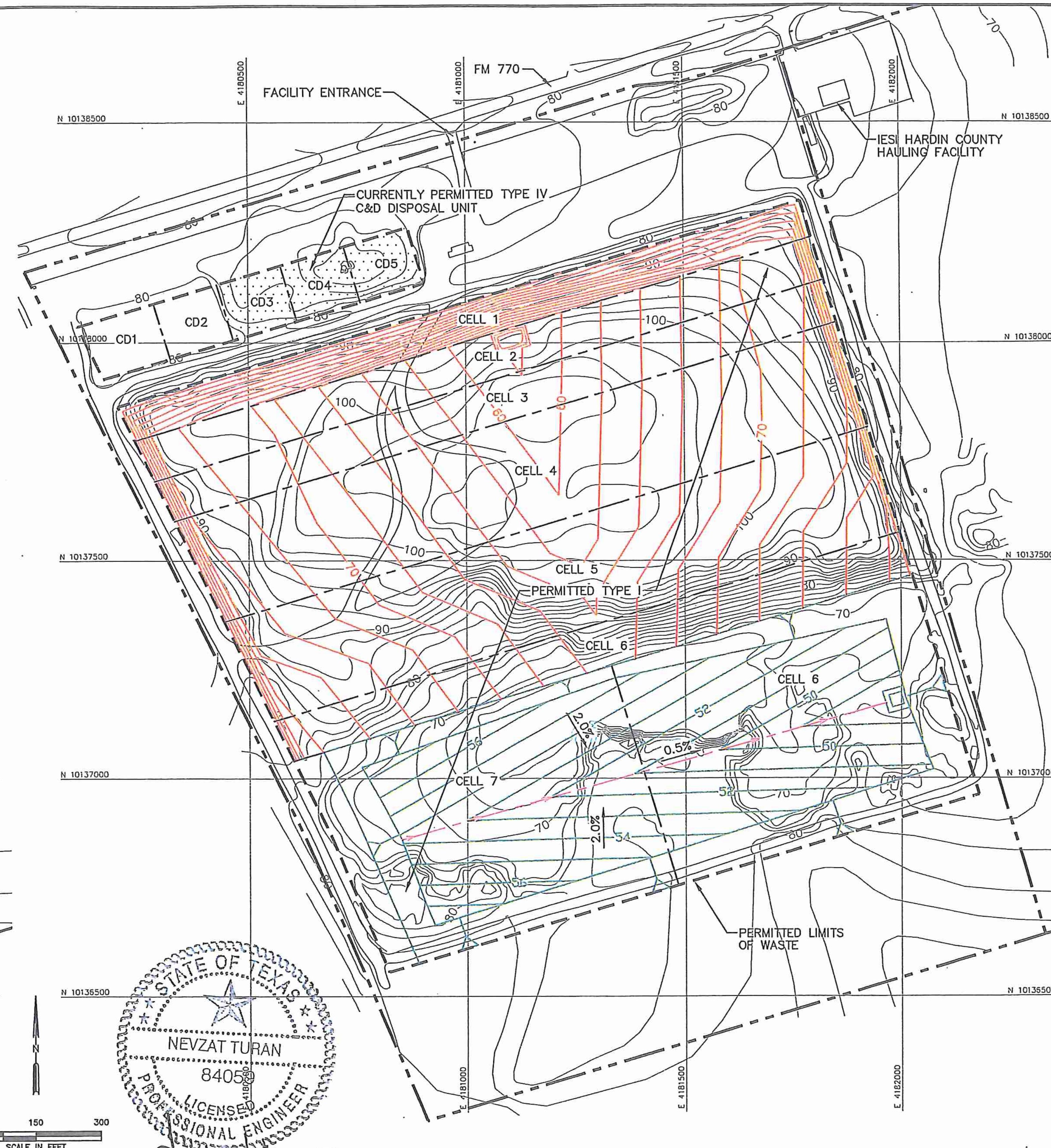
FIGURE 3

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 3-AERIAL PHOTOGRAPH.dwg, jwilson, 1:2

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 4-EXCAVATION PLAN COMPARISON.dwg, jwilson, 1:2

CURRENTLY PERMITTED CONDITIONS PLAN



PROPOSED EXCAVATION PLAN

I/IIB-100

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CONTOURS FOR THE CURRENTLY PERMITTED CONDITIONS PLAN REPRESENT THE TOP OF LINER PROTECTIVE COVER CONTOURS WHICH ARE 4 TO 5 FEET ABOVE THE EXCAVATION GRADES. THE PROPOSED EXCAVATION PLAN CONTOURS WERE DEVELOPED BY WEAVER CONSULTANTS GROUP AS PART OF THE DESIGN BASIS MEMORANDUM FOR THE PROPOSED MAJOR AMENDMENT APPLICATION.
3. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.

LEGEND

- IESI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY
- PERMITTED LIMITS OF WASTE
- PROPOSED LIMITS OF WASTE
- CELL BOUNDARY
- 70 EXISTING CONTOUR (SEE NOTE 1)
- N 10137000 STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
- 60 PERMITTED TOP OF PROTECTIVE COVER CONTOUR (SEE NOTE 2)
- 60 PROPOSED EXCAVATION CONTOUR (SEE NOTE 2)
- LEACHATE LINE

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 10/2016
FILE: 0771-365-11
CAD: FIG 4-EXCAVATION PLAN COMP.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
IESI TX LANDFILL LP

REVISIONS

NO.	DATE	DESCRIPTION

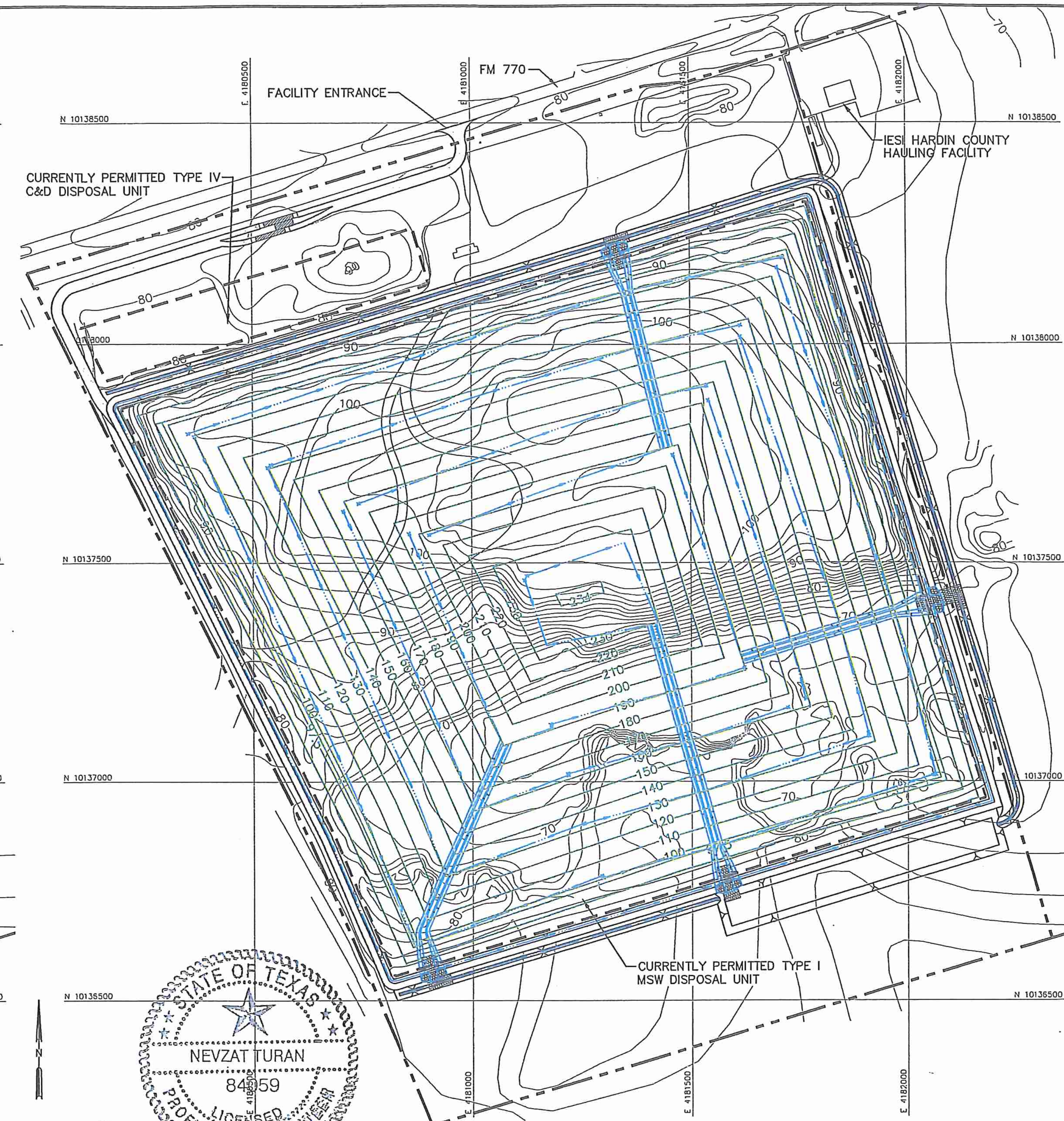
MAJOR PERMIT AMENDMENT
PERMITTED AND PROPOSED
EXCAVATION PLAN

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

WWW.WCGRP.COM

FIGURE 4

PERMITTED COMPLETION PLAN



PROPOSED COMPLETION PLAN

0 150 300
SCALE IN FEET

STATE OF TEXAS
NEVZAT TURAN
84559
LICENSED
PROFESSIONAL ENGINEER

10/31/2016

I/IIB-101

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. PERMITTED COMPLETION PLAN FINAL COVER CONTOURS ARE OBTAINED FROM 2010 HARDIN COUNTY LANDFILL MSW PERMIT NO. 2214A. THE PROPOSED PERMITTED COMPLETION PLAN FINAL COVER CONTOURS WERE DEVELOPED BY WEAVER CONSULTANTS GROUP AS PART OF THE DESIGN BASIS MEMORANDUM FOR THE PROPOSED MAJOR AMENDMENT APPLICATION.
3. THE PROPOSED COMPLETION PLAN DRAINAGE STRUCTURES ARE SHOWN FOR INFORMATIONAL PURPOSES. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY. (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.

LEGEND

- IESI PROPERTY BOUNDARY
- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- 70 EXISTING CONTOUR (SEE NOTE 1)
- N 10137000 STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
- 220 FINAL COVER CONTOUR (SEE NOTE 2)
- PROPOSED DRAINAGE SWALE
- PROPOSED DRAINAGE CHUTE

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

PREPARED FOR
IESI TX LANDFILL LP

DATE: 10/2016	DRAWN BY: SRF
FILE: 0771-365-11	DESIGN BY: AE
CAD: FIG 4-COMPLETION PLAN COMP.DWG	REVIEWED BY: NT

REVISIONS

NO.	DATE	DESCRIPTION

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

MAJOR PERMIT AMENDMENT
PERMITTED AND PROPOSED
COMPLETION PLAN

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

WWW.WCGRP.COM

FIGURE 5

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 5-COMPLETION PLAN COMPARISON.dwg, jwilson, 1:2

OCTOBER 1992
DEPARTMENT OF INTERIOR CORRESPONDENCE

PROTECTION OF ENDANGERED SPECIES

The United States Department of the Interior Fish and Wildlife Service and the Texas Parks and Wildlife Department were contacted to determine what endangered species might habitat the area. Both sources indicated that this site posed no threat of taking, harassing, or harming endangered species or their critical habitats for those known to exist in the general area. To insure that the proposed landfill would not take, harass, or harm any endangered species, a consultant was retained through Southwestern Laboratories to assess the site. Through their investigations, it was found that no endangered species would be negatively affected by development of this site as proposed. Copies of correspondence with government agencies and the consultant's report are included on the following pages of this report.

KSA ENGINEERS, INC.

HN - 002

NATIONS BANK BLDG.
415 S. FIRST ST., SUITE 270
P.O. BOX 1605
LUFKIN, TEXAS 75902-1605
(409) 637-6061
FAX (409) 632-9256

September 21, 1992

Ms. Edith Erfling
United States Fish and Wildlife Service
17629 El Camino Real Suite 211
Houston, Texas 77058

RE: Proposed Hardin County Landfill Site and possible impact on local plants and wildlife.

Dear Ms. Erfling,

As per our conversation today, I am writing to inform you of the proposed location for the new Hardin County Landfill and inquire of any adverse impact this location might present to any endangered species of plants or animals in Hardin County.

KSA Engineers has been retained by Hardin County to aid them in the application for a state landfill permit from the Texas Water Commission. The design of the landfill itself will follow current and expected state and federal regulations. Following these regulations will provide for the protection of the environment surrounding the site through use of a composite liner, a quality control plan, and a thorough operations plan.

The proposed 79 acre site for this landfill is located on the south side of FM 770 about one-half mile west of FM 326. More generally, the site is located approximately 3 miles southwest of Kountze, 1 mile north of the Big Thicket Lance Rosier Preserve, and directly across FM 770 from Hardin County's existing landfill. Enclosed with this letter are maps which illustrate the location of the proposed landfill site.

This site, until recently, has been used for the commercial production of pine trees. The last stand of trees which was grown at this site has been clear-cut and efforts are currently underway to begin the removal of the remaining stumps. Surrounding the site is a mixture of forested and cultivated lands. Over a mile to the south of the site are other timberlands in various stages of production.

It is important to us that this site be a benefit to the community. We are interested in a landfill which will provide Hardin County with a place to dispose of its solid waste without negatively affecting the surrounding environment. If you will, please review this letter and the enclosed site location maps, considering potential concerns with respect to the local plants and wildlife, especially those listed as endangered. Having reviewed this information, we then request that you write us with any comments that you may have about the project and its potential impact on the endangered species in the area.

If you have any questions that are not addressed in this letter, please feel free to call me, or our Lufkin Branch Manager, Billy Sims at (409) 637-6061. We look forward to hearing from you.

Sincerely,

KSA Engineers, Inc.

Lonnie Sikes/Kat

Lonnie Sikes,
Design Engineer

Enclosures

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
Division of Ecological Services
17629 El Camino Real, Suite 211
Houston, Texas 77058

October 14, 1992

Lonnie Sikes
KSA Engineers, Inc.
Nations Bank Bldg.
P.O. Box 1605
Lufkin, Texas 75902-1605

Dear Mr. Sikes:

This responds to your September 21, 1992 letter requesting information on federally listed species or those proposed to be listed as threatened or endangered which may be in your project area. The proposed project involves a new landfill to be located on the south side of FM 770 about one-half mile west of FM 326 in Hardin County, Texas.

A review of U.S. Fish and Wildlife Service files and your project maps indicates that no federally listed threatened or endangered species are likely to occur at the project site.

If we can be of further assistance, please contact Edith Erfling at (713) 286-8282.

Sincerely,

Kenneth D. Frazier

Kenneth D. Frazier
Acting Chief, Regulatory Activities

KSA ENGINEERS, INC.

HN-002

NATIONS BANK BLDG.
415 S. FIRST ST., SUITE 270
P.O. BOX 1605
LUFKIN, TEXAS 75902-1605
(409) 637-6061
FAX (409) 632-9256

September 21, 1992

Mr. Ronald R. Switzer
Superintendent of Big Thicket Preserve
3785 Milam
Beaumont, Texas 77701

RE: Proposed Hardin County Landfill Site and possible impact on Big Thicket Preserve

Dear Mr. Switzer,

As referenced by Ranger Mike Livingston, I am writing to inform you of the proposed location for the new Hardin County Landfill and inquire of any adverse impact this location might present to the Big Thicket Preserve.

KSA Engineers has been retained by Hardin County to aid them in the application for a state landfill permit from the Texas Water Commission. The design of the landfill itself will follow current and expected state and federal regulations. Following these regulations will provide for the protection of the environment surrounding the site through use of a composite liner, a quality control plan, and a thorough operations plan.

The proposed 79 acre site for this landfill is located on the south side of FM 770 about one-half mile west of FM 326. More generally, the site is located approximately 3 miles southwest of Kountze, 1 mile north of the Big Thicket Lance Rosier Preserve, and directly across FM 770 from Hardin County's existing landfill. Enclosed with this letter are maps which illustrate the location of the proposed landfill site.

This site, until recently, has been used for the commercial production of pine trees. The last stand of trees which was grown at this site has been clear-cut and efforts are underway to begin the removal of the remaining stumps. Surrounding the site are other timberlands in various stages of production.

It is important to us that this site be a benefit to the community. We are interested in a landfill which will provide Hardin County with a place to dispose of its solid waste without negative effects to the surrounding environment, which includes the Big Thicket Preserve. If you will, please review this letter and the enclosed site location maps, considering potential concerns with respect to the Big Thicket Preserve. Having reviewed this information, we then request that you write us with any comments that you may have about the project as they relate to the Preserve.

If you have any questions that are not addressed in this letter, please feel free to call me, or our Lufkin Branch Manager, Billy Sims at 409/637-6061. We look forward to hearing from you.

Sincerely,

KSA Engineers, Inc.

Lonnie Sikes / kab

Lonnie Sikes,
Design Engineer

Enclosures

United States Department of the Interior

TAKE PRIDE IN AMERICA

NATIONAL PARK SERVICE
Big Thicket National Preserve
3785 Milam
Beaumont, Texas 77701

IN REPLY REFER TO:

N16(BITH)

October 2, 1992

Mr. Lonnie Sikes, Design Engineer
KSA Engineers, Inc.
Nations Bank Building
415 S. First St., Suite 270
P.O. Box 1605
Lufkin, TX 75902-1605

Dear Mr. Sikes:

Thank you for your letter of September 21, 1992, regarding the proposed Hardin County Landfill Site and its possible impact on the Big Thicket National Preserve (Big Thicket). After a review of your letter, accompanying maps, and information in our files pertaining to drainage patterns and other resource concerns, we have determined that your proposed landfill should not pose any problems for the Big Thicket provided the design of the landfill and its construction comply with all current and future State and Federal regulations as you have suggested.

Again, we appreciate your informing us of your proposed actions and would appreciate being kept apprised of your construction activities as construction of the Hardin County Landfill progresses. Any future correspondence on this or other resource concerns may be directed to Richard Strahan of the Resources Management Division at either the above address or telephone number (409) 839-2689.

Sincerely,

Ronald R. Switzer

Ronald R. Switzer
Superintendent

OCT 5 1992

FEBRUARY 1993
TEXAS PARKS AND WILDLIFE CORRESPONDENCE

TEXAS
PARKS AND WILDLIFE DEPARTMENT

4200 Smith School Road • Austin, Texas 78744 • 512-389-4800

MAR 3 1993

February 19, 1993

Mr. Lonnie Sikes
KSA Engineers, Inc.
Nations Bank Bldg.
415 S. First St., suite 270
Lufkin, Texas 75902-1605

RE: Preliminary Application Report, Proposed Hardin County Landfill site

Dear Mr. Sikes:

The Environmental Quality Branch of the Texas Parks and Wildlife Department (TPWD) acknowledges receipt of the premliminary solid waste landfill permit application for the proposed Type I landfill site in Hardin County. The following is submitted in response to your request for comments on the proposed site.

You state that a review and comment letter from the TPWD is needed before the referenced site can be given formal consideration by the Texas Water Commission (TWC). After having discussed the matter with Robert Sims, Municipal Solid Waste Division, TWC-Austin, it was stated that, when required by the TWC, it is part of the scope and responsibility of the applicant to address any site or operating concerns when submitting a permit application. It is also the applicant's responsibility to conduct or contract out services including site investigations to determine any detrimental effects or impacts related to the proposed facility using the best available data or information. In the proposed application, some contacts and information related to endangered species and habitat regimes have been provided to you by the TPWD to be addressed in the permit application.

However, it is not the responsibility of the TPWD to make the assessment for the applicant. Comments based on information and data provided by the TPWD should be coordinated with actual site investigations conducted by the applicant or their designated representative.

In this instance, the TWC related to us that the preliminary application does not specify the status of biological or environmental features, or components, of the site except list the general occurrences of fauna and flora for the region described as given to you by the Department. The occurrence or absence of sensitive organisms, or the impact to sensitive biological communities, can only be documented by on-site investigations, a task to be performed by the applicant. The Department is interested in reviewing those findings as they are incorporated into the application. Consequently, to comment on those issues without specific familiarity with the actual site would be of little value at this time.

For your information, a preliminary review by the Habitat Assessment Program staff of TPWD indicates no perceived problems concerning the wetland issue raised in your letter. However, we reserve the right to make additional comments on this and other issues once a complete application packet is submitted. TPWD will be offered the opportunity to comment on the application during the procedural review established by the TWC. At that time, comments may be submitted which refer to this and other areas of concern.

If you have any questions concerning this matter, please call me in Austin at (512) 389-4580.

Sincerely,

Ismael Nava

Ismael Nava, Program Leader
Contaminant Assessment Program
Environmental Quality Branch
Resource Protection Division

cc: Robert Sims, P.E.
Municipal Solid Waste Division
Texas Water Commission

ENDANGERED SPECIES SURVEY
MAY 1993

ENDANGERED SPECIES SURVEY
FOR
PROPOSED HARDIN COUNTY LANDFILL
NEAR KOUNTZE, TEXAS

Prepared for

HARDIN COUNTY

SwL Project No. 505193-231

May 7, 1993

Prepared by
SOUTHWESTERN LABORATORIES, INC.
1225 North Loop West, Suite 1000
P.O. Box 8768
Houston, Texas 77249
713/869-7913

SWL
ENVIRONMENTAL SERVICES

1225 North Loop West
Suite 1000
P.O. Box 8768
Houston, Texas 77249
Phone: (713) 869-7913
Fax: (713) 869-7374

May 7, 1993

Honorable Tom Mayfield
County Judge
P.O. Box 760
Kountze, Texas 77625

Re: Endangered Species Survey
Proposed Hardin County Landfill
Near Kountze, Hardin County, Texas
SwL Project No. 505193-231

Dear Judge Mayfield:

Southwestern Laboratories, Inc. (SwL) has performed an Endangered Species Survey for the above referenced project according to our verbal agreement authorized by Honorable Judge Tom Mayfield of Hardin County and Lonnie Sikes of KSA Engineers, Inc. on March 18, 1993. The site was inspected on Wednesday, April 14, 1993 at 9:30 a.m. by William P. Wenstrom, Ph.D., representing SwL-Houston.

The objective of this biological survey was to address the potential of endangered species and the likelihood of their respective habitats at the property in question for purposes of developing the site as a municipal solid waste landfill.

In establishing the Endangered Species Act (ESA) of 1973, the U.S. Congress recognized that many wildlife and plant species had already been rendered extinct by human-related activities. It also recognized that many additional species were so depleted in numbers that they were in danger of becoming extinct. Congress determined that these species were of aesthetic, ecological, educational, recreational, and scientific value to the nation's public.

In response, the ESA was passed with the stated purposes of conserving these threatened or endangered species, and the ecosystems upon which these species depended. Congress further declared it policy that all Federal departments and agencies would utilize their authority to further these purposes of the ESA.

The scope of the investigation included the following tasks:

* Review of available aerial photographs, topographic maps, and readily available literature concerning the habitat requirements of specified species; and

* an on-site inspection to identify potential listed species habitats and the likelihood of their occurrence on-site.

This endangered species survey was performed in accordance with generally accepted practices of the profession undertaking similar studies at the same time and in the same geographical area, and SwL observed that degree of care and skill generally exercised by the profession under similar circumstances and conditions. No other warranty is expressed or implied.

This study and report has been prepared on behalf of and for the exclusive use of Hardin County solely for use in the biological evaluation of the site. This report and the findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party, nor used by any other party in whole or in part, without the prior written consent of Hardin County.

Background

According to information provided by the Texas Parks and Wildlife Department, a search of records contained in the Texas Natural Heritage Program Information System revealed five sensitive species possibly occurring in the general area of the proposed landfill based on the documented occurrence of the species in Hardin County, Texas. These species and their special status are as follows:

Species	Common Name	Status	
		Federal	State
Plants			
Phlox nivalis texensis	Texas trailing phlox	Endangered	Endangered
Silene subciliata	scarlet catchfly	Candidate	None
Cyperus oravioides	Mohlenbrock's umbrella sedge	Candidate	None
Animals			
Picoides borealis	Red-Cockaded woodpecker	Endangered	Endangered
Cemophora occcinea copei	Northern scarlet snake	None	Threatened

General Observations

The northern border of the proposed landfill fronts Highway 770 about three miles southwest of Kountze, Texas. The western border of the property consists of an unimproved dirt road. The eastern and southern borders of the property were marked at the time of the visit with white paint splotches on the trunks of scattered pine trees.

The proposed landfill has been recently clearcut as has the adjacent land. With the exception of a narrow buffer strip along Highway 770 and scattered trees along its southern and eastern borders, the only trees remaining on the site are apparently unmarketable specimens of small pine and hardwood. There are numerous large piles of bulldozed stumps, limbs and other slash throughout the site as well as significant surface rutting associated with the use of tracked and wheeled vehicles and equipment. Many of these ruts contained standing water as did numerous other small depressions. Unidentified tadpoles were common in the ruts and puddles of standing water.

According to the U.S. Geological Survey Kountze South, Texas, 7.5-minute quadrangle map of the area, the elevation of the site is from 75-80 feet above mean sea level. There is no appreciable topographic relief on the property which occupies an essentially flat, low-lying distributary between Cypress Creek to the north and Langston Branch to the east.

Because of the extensive surface disturbance from logging, it was difficult to determine whether the area contained any of the so-called "pimple mounds" or other circular or elongate mounds that are numerous in nearby portions of the Lance Rosier Unit. At a slightly higher elevation than surrounding terrain, mounds permit less hydric plant communities to develop than would otherwise be the case in a generally low-lying area.

Numerous white-tailed deer, opossum, and raccoon tracks, and the disarticulated skeleton of a white-tailed deer were observed on-site. Killdeer were the most common bird species on the property and several unidentified shore bird tracks were observed at the margin of several puddles where these birds forage by probing. In addition, yellow-belly sapsucker holes were noted on some of the residual pines on the property along with several common crows, many unidentified frogs, anoles, and skinks. No snakes were observed the day of the inspection.

The paucity of birds and other wildlife may, in part, be due to (1) the lack of any appreciable shrub and forested habitat on most of the site as well as (2) deteriorating weather in advance of a squall-line of serious thunderstorms that moved into the area about 1:15 p.m.

Habitat Considerations

There exists a substantial amount of information concerning the plant communities of Hardin County, most compiled in association with investigations of the Big Thicket Biological Preserve (BTBP). Perhaps the most definitive is that of Harcombe and Marks (1979) who characterized forest vegetation under contract to the Southwestern Regional Office of the National Park Service. Watson (see, for example, 1979) has also written extensively on Big Thicket plant ecology and has published numerous informal checklists (n.d.; 1980) and summaries often focusing on endemics and other rare species.

According to Harcombe and Marks (Ibid.), the area in and near the Lance Rosier Unit is topographically uniform in comparison to some of the other units of BTBP. It occupies the lowest and most recent of the Pleistocene surfaces in this area. As a result, drainage there like drainage at the proposed landfill site is generally poor. Poor drainage and flat topography allow the interdigital, intermingling of several common plant community types that normally range monotypically from lower, upland slopes to broad, swampy wetlands, including Flatland Hardwood, Lower Slope Hardwood Pine, and Wetland Pine Savanna.

Although cutover, the forest vegetation on the landfill property would have probably been classified per the topography of Harcombe and Marks (Ibid.) as wet, mixed Lower Slope Hardwood Pine or Wetland Pine Savanna prior to logging. Either of these associations are suggested by the importance of American holly (Ilex opaca), Yaupon (Ilex vomitoria), and Sweetbay (Magnolia virginiana) in the existing understory on and near the landfill site (Brown and Grelin, 1977). In almost no case do these forests offer the type of habitat required by the species of concern in this case.

The nesting and foraging habitat of the red-cockaded woodpecker in upland southern pine forests, for example, is relatively well understood (Hooper, et al., 1980). These birds need older, live trees in which to excavate cavities for roosting and extensive pine and pine-hardwood forests nearby in which to forage. Generally, the longer the rotation age of these forests and the higher the degree of hardwood control by selective cutting and burning, the greater is the opportunity for the species to maintain existing breeding colonies and to create new ones.

The landfill property is probably too low-lying and the pines located there appeared much too young before they were cut to be acceptable cavity trees. There was similarly no visual evidence of any cavities or cavity-starts based on careful examination with binoculars of the young residual pine trees along the border of the property. The property probably supported a relatively dense understory of shrubs and hardwoods prior to logging. This also suggests that the area lacked the more open, park-like structure favored by the red-cockaded woodpecker for roosting and feeding.

Like the xerix plant discussed below, the northern scarlet snake is an inhabitant of dry uplands with well-drained sandy or loamy soils. The northern scarlet snake is a subspecies that, in eastern Texas, is at the extreme western end of its presumed range that extends southerly along the Atlantic coast from New Jersey. Reportedly semi-fossorial, it is a burrower rarely seen during the day-light hours (Behler and King, 1979). Although sometimes discovered under rotting logs during the day, finding a specimen of the brightly-colored species (which somewhat resembles the venomous Coral snake (Micrurus fulvius tènere) even in suitable forested habitat is an arduous task in east Texas. It is probably an impossible task on the proposed landfill site which is lacking the well-drained soils preferred by the species.

Texas trailing phlox (Phlox nivalis texensis), scarlet catchfly (Silene subciliata), and Mohlenbrock's umbrella sedge (Cyperus grayioides) are xerophytes that require sunny locations on well-drained, deep, sterile sandy soils of the type usually found on river gravel deposits, sand ridges, and old stream levees. According to Ajilvsgi (1979), the so-called arid "Oak-farkleberry sandyland" offers optimum habitat for the trailing phlox and scarlet catchfly in the area. Such communities are essentially very open upland pine-oak savannas where the dominant trees are Longleaf pine (Pinus palustris) and Blue jack oak (Quercus incana), with Farkleberry (Vaccinium arboreum) commonly the only understory shrub.

In the past, fire probably prevented brush from encroaching into the sandyland savanna. The Texas trailing phlox, for example, is highly responsive to fire and would proliferate quickly after periodic burning. These types of plants also disappear quickly when shaded by hardwood understories or dense forb layers and accumulation of leaf litter and other plant debris that changes the prevailing temperature of the humus from hot to cool. Fire suppression in more-or-less "natural" stands and planting pines in sandy uplands are probably the factors most responsible for the loss of xeric vegetation in and around BTBP.

In this case, however, there is little likelihood that any of these xerophytes ever occurred on the proposed landfill site. The area is much too low and wet to offer suitable soil conditions for the growth of these species. Similarly, the site was formerly vegetated with a stand of sufficient basal area to have killed shade-intolerant plants.

Conclusions

None of the species of interest were observed by SwL, represented by Dr. Wenstrom, during the site inspection. Based on the site inspection and the habitat requirements of these species, SwL concludes that none occur on-site at this time nor is there any real possibility that any of these species occurred at this location in the recent past. Accordingly, there is equally little likelihood that operation of the landfill at this site will have adverse biological consequences to any local population of these sensitive species in Hardin County, Texas.

All of the data accumulated for the investigation (photographs, field notes, etc.) will be kept in your project file. If you have any questions or need any additional information, please do not hesitate to call. The report and information in your file is considered confidential and will not be released without your authorization.

We appreciate the opportunity to work with you on this project and hope you will contact SwL for future projects.

Sincerely,

SOUTHWESTERN LABORATORIES, INC.

Rhonda G. Chance

Rhonda G. Chance
Wetland Specialist

Steve Wolford

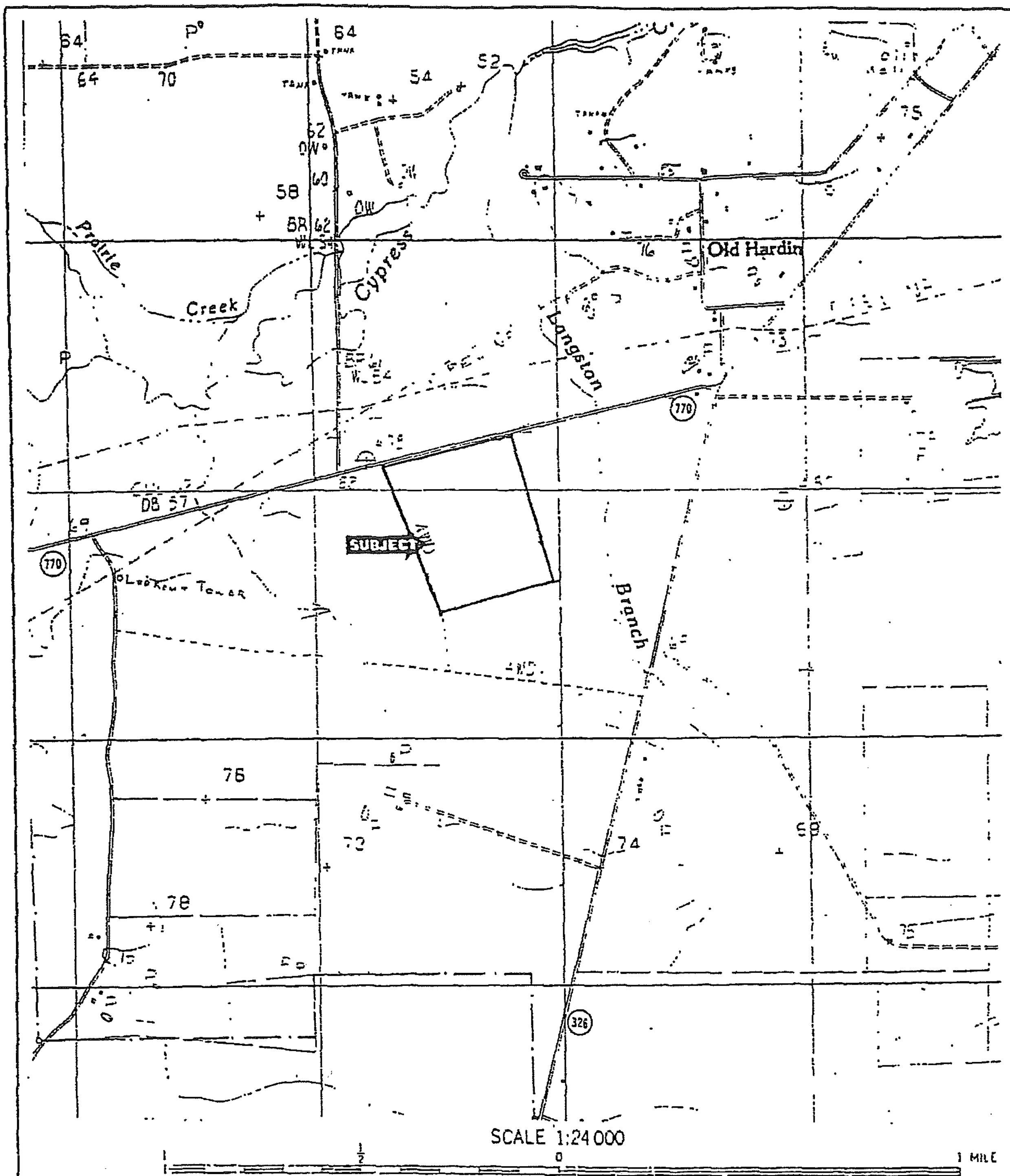
Steve Wolford, R.E.M.
Project Manager

RC/SW:ng

A

APPENDIX A

SWL



For clarification see Part I & II, Page 10.

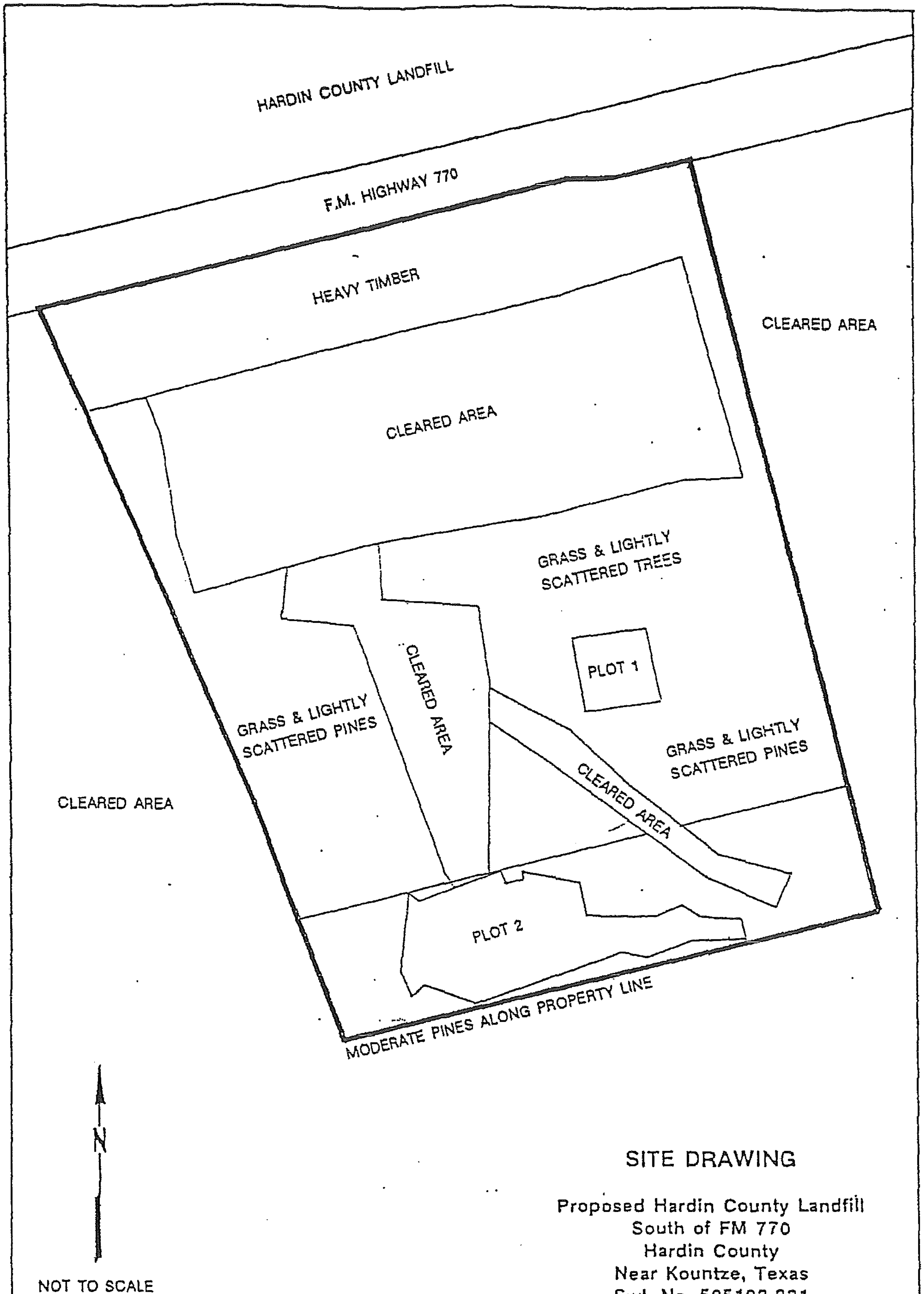
KOUNTZE SOUTH QUADRANGLE
TEXAS–HARDIN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

TOPOGRAPHIC MAP

Proposed Hardin County Landfill
South of FM 770
Hardin County
Near Kountze, Texas
SwL No. 505193-231

SOUTHWESTERN LABORATORIES

AUGUST 31, 1994



SITE DRAWING

Proposed Hardin County Landfill
South of FM 770
Hardin County
Near Kountze, Texas
SwL No. 505193-231

SOUTHWESTERN LABORATORIES

AUGUST 31, 1994

PART I & II -128

B

-APPENDIX B

SWL

Source: TNRIS
File No. 03-086
May 5, 1988

Scale: 1" = 1350'

N

1988

Proposed Hardin County Landfill
South of FM 770
Hardin County
Near Kountze, Texas
SwL No. 505193-231

SOUTHWESTERN LABORATORIES

AUGUST 31, 1994

R E F E R E N C E S

REFERENCES

SWL

SOURCE REFERENCES

Ajilvsgi, G. 1979. Wild flowers of the Big Thicket. Texas A&M University Press, College Station.

Federal Emergency Management Agency, 1990, Flood Insurance Rate Map.

Granata, G., Guevara, E., Dreitler, C.W., and McKalips, D.; Hydrogeology of Gulf Coast Aquifers, Houston-Galveston Area, Texas. Prepared by the Bureau of Economic Geology, The University of Texas at Austin, Geological Circular 77-4, 1977.

Ground Water Unit, Ground-Water Conditions in Texas, 1980-1985. Prepared by the Texas Water Development Board, 1988.

Harcombe, P.A. and P.L. Marks, 1979. Forest vegetation of the Big Thicket National Preserve, Report to Office of Natural Sciences, Southwestern Region, National Park Service, Santa Fe, New Mexico under Contract No. PX7029-8-0437.

U.S. Department of Agriculture Soil Conservation Service, 1991, General Soil Map of Hardin County.

Watson, G. N.D. Rare plants of the Big Thicket. Photocopied checklist of rare or uncommon plants.

__________. 1979. Big Thicket plant ecology and introduction. Big Thicket Museum Publication Series No. 5, Saratoga.

__________. 1980. Vegetation of the Lance Roiser Unit of the Big Thicket National Preserve. Photocopied summary of vegetation with species checklist.

PROJECT TEAM MEMBERS

ENVIRONMENTAL CONSULTING

Wolford, Steve D. Project Manager	B.S. Biology M.P.H. Env. Health Sciences M.B.A. Finance EPA Accredited Asbestos Inspector State of Texas Licensed Asbestos Inspector, License #60-0083 40 Hour Hazardous Waste Operations OSHA Course Registered Environmental Professional #4013
Chance, Rhonda G. Wetland Specialist	B.S. Horticulture Science Wetland Training Institute Wetlands Assessor 40 Hour Hazardous Waste Operations OSHA Course EPA Accredited Asbestos Inspector State of Texas Licensed Asbestos Inspector, License #60-0081
Wenstrom, William P. Terrestrial Biologist	Ph.D. Wildlife Ecology University of Minnesota Traineeship, Public Health Biology Workshops, short courses, seminars in management and computer applications in natural resource management

ARCHAEOLOGY SUMMARY

On August 18, 1993, the site was subjected to an archaeological survey by Emanco of Houston, Texas. Emanco's representatives systematically walked the site, excavated four shovel tests, and generally surveyed the topography. Research of historical records were conducted as well and a report compiled. The general conclusion is that the site poses no threat to significant cultural resources. A copy of Emanco's Cultural Resources Survey follows these comments.

RECEIVED

MAY 17 1993

SOUTHWESTERN LABORATORIES, INC.

CURTIS TUNNELL
EXECUTIVE DIRECTOR

TEXAS HISTORICAL COMMISSION

P.O. BOX 12276 AUSTIN, TEXAS 78711 (512)463-6100

DEPARTMENT OF ANTIQUITIES PROTECTION

May 10, 1993

Ms. Rhonda D. Chance
Technical Specialist of Wetlands and Endangered Species Services
Southwestern Laboratories, Inc.
P.O. Box 8768
Houston, TX 77249

Re: 80 acre tract for landfill, Hardin County
(COE-FWD, F2, F13)

Dear Ms. Chance:

Thank you for providing the opportunity to review the project referenced above. After examining our files, we note that the location of the project area has potential for containing archeological sites, some of which may be eligible for inclusion in the National Register of Historic Places. Although no sites are recorded within the boundaries of your tract, to the best of our knowledge, this area has never been examined by a professional archeologist.

An archeological survey undertaken by a qualified professional should be conducted within those portions of the project area that will be subjected to ground disturbing activities. The survey should include shovel tests sufficient to identify subsurface cultural materials. Collection of materials from any sites found during the survey is required, and all material should be curated according to 36CFR79. A report of investigations should be produced in conformance with the Secretary of the Interior's Guidelines for Archaeology and Historic Preservation.

We will continue review of this project upon receipt of the requested documentation. If you have any questions, please contact Bill Martin of our staff at 512/463-5867.

Sincerely,

James E. Bruseth, Ph.D.
Deputy State Historic Preservation Officer

Sincerely,

Timothy K. Perttula, Ph.D.
Assistant Director for Antiquities Review

JEB/TKP/wam

COORDINATION WITH SOUTH EAST TEXAS PLANNING COMMISSION (SETPC)

CONTENTS

- March 31, 2017 SETPC Coordination Demonstration Letter.

Weaver
Consultants
Group

Project No. 0771-365-11-07
March 31, 2017

Mr. Shaun P. Davis, Executive Director
South East Texas Regional Planning Commission
2210 Eastex Freeway
Beaumont, TX 77703

Re: Request for Determination of Compliance with the Regional Solid Waste Plan
Proposed IESI Hardin County Landfill Expansion
Hardin County, Texas

Dear Mr. Davis:

The purpose of this letter, submitted on behalf of our client IESI TX Landfill LP (IESI), is to demonstrate that the proposed permit amendment for the referenced facility is consistent with the South East Texas Regional Planning Commission's Regional Solid Waste Plan, as required by Title 30 Texas Administrative Code (30 TAC) §330.61(p). Weaver Consultants Group, LLC has prepared a permit amendment application to vertically expand the existing IESI Hardin County Landfill.

Attached is a copy of Parts I/II of the permit amendment application, as required by 30 TAC §330.61(p). A project summary is included in the document. As described in the summary, the project is limited to the vertical expansion of the landfill.

If you need additional copies of this submittal or any other information, please call either Brett O'Connor of IESI at 832-442-2920, or myself.

Sincerely,

Nevzat Turan, P.E.
Senior Engineer

Attachments: IESI Hardin County Landfill Permit Amendment Application, Parts I/II

cc: Brett O'Connor, IESI

COORDINATION WITH U.S. ARMY CORPS OF ENGINEERS

CONTENTS

- April 18, 2016 Approved Jurisdictional Determination from the USACE.
- November 20, 2015 Request for Jurisdictional Determination by Goshawk Environmental Consulting, Inc.

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1229
GALVESTON, TEXAS 77553-1229

April 18, 2016

REPLY TO
ATTENTION OF:

Compliance Branch

SUBJECT: **SWG-1994-00016**, Approved Jurisdictional Determination, 111-acre Site, Kountze, Hardin County, Texas.

Mr. Joseph Vieceli
IESI TX Landfill LP
2301 Eagle Parkway, Suite 200
Fort Worth, Texas 76177

Dear Mr. Vieceli:

This letter is in response to the November 20, 2015 letter, submitted on your behalf by Goshawk Environmental Consulting, Inc., requesting a jurisdictional determination for an approximately 111-acre tract of land. The tract of land is located at and adjacent to the IESI Hardin County Landfill, approximately 0.6 mile west of the intersection of Texas State Highway 326 and Farm-to-Market Road 770, Kountze, Hardin County, Texas (map enclosed).

Based on a review of your wetland delineation, dated November 12, 2015, additional off-site data, and information provided and acquired during a February 10, 2016 site visit, we determined that the subject 111-acre tract does not contain waters of the United States, including jurisdictional wetlands. Therefore, the subject tract is not subject to Section 404 of the Clean Water Act (CWA) or Section 10 of the Rivers and Harbors Act, and the discharge of fill material onto the tract does not require a Department of the Army permit. This approved determination is valid for 5 years from the date of this letter unless new information warrants a revision of the determination prior to the expiration date.

Corps determinations are conducted to identify the limits of the Corps Clean Water Act jurisdiction for particular sites. This determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985, as amended. If you or your tenant are USDA program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service prior to starting work.

This letter contains an approved jurisdictional determination for your site. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 331.5. Also enclosed are a combined Notification of Administrative Appeal Options and Process (NAP) and Request for Appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA to the Southwestern Division Office at the following address:

Also enclosed are a combined Notification of Administrative Appeal Options and Process (NAP) and Request for Appeal (RFA) form.
If you request to appeal this determination you must submit a completed RFA to the Southwestern Division Office at the following address:

Mr. Elliott Carman
Administrative Appeals Officer (CESWD-PD-O)
U.S. Army Corps of Engineers
1100 Commerce Street, Suite 831
Dallas, Texas 75242-1317
Telephone: 469-487-7061; FAX: 469-487-7199

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete; that it meets the criteria for appeal under 33 CFR Part 331.5, and that it has been received by the Division Office within **60 days** of the date of the NAP. It is not necessary to submit an RFA form to the Division office if you do not object to the determination in this letter.

If you have any questions please reference **SWG-1994-00016** and contact Mr. Kevin Mannie, Regulatory Specialist, at the letterhead address or by telephone at 409-766-3016. To assist us in improving our service to you, please complete the survey found at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0.

Sincerely,

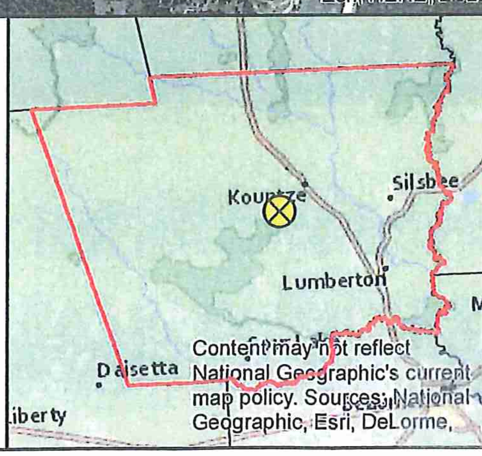
John Davidson
Acting Chief, Compliance Branch

Enclosures

SWG-1994-00016
IESI TX Landfill LP
Hardin County Landfill
Jurisdictional Determination
Kountze, Hardin County, Texas

Review_Area

Data Source: Google Earth Aerial
Date: 29 February 2016



I/IIB-133c

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: IESI TX Landfill LP	File Number: SWG-1994-00016	Date: 18 April 2016

Attached is:		See Section below
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL	C
X	APPROVED JURISDICTIONAL DETERMINATION	D
	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits/appeals.aspx or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:
Mr. Kevin Mannie
Regulatory Specialist
CESWG-RD-C
U.S. Army Corps of Engineers
P.O. Box 1229
Galveston, Texas 77553-1229
409-766-3016; FAX: 409-766-3931

If you only have questions regarding the appeal process you may also contact:
Mr. Elliott Carman
Administrative Appeals Review Officer (CESWD-PD-O)
U.S. Army Corps of Engineers
1100 Commerce Street, Suite 831
Dallas , Texas 75242-1317
469-487-7061

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

Signature of appellant or agent.	Date:	Telephone number:

WATERS OF THE US DETERMINATION REQUEST
±111-ACRE IESI TX LANDFILL LP PROPERTY
HARDIN COUNTY, TEXAS

Report Prepared by:
Goshawk Environmental Consulting, Inc.
P.O. Box 151525
Austin, TX 78715

Report Prepared on Behalf of:
IESI TX Landfill LP
c/o Joseph Vieceli, Senior Engineer
2301 Eagle Parkway, Suite 200
Fort Worth, Texas 76177

Report Prepared for Submission to:
USACE Galveston District
Regulatory Division
2000 Fort Point Road
Galveston, Texas 77553

SWG-2015-??????

12 November 2015

TABLE OF CONTENTS

1.0 PURPOSE

Goshawk Environmental Consulting, Inc. (Goshawk) performed a delineation of aquatic features on the IESI TX Landfill LP Property (site) in Hardin County, Texas. Data from our records review and field investigation suggests the site does not contain any jurisdictional Waters of the US (WATERS). The purpose of this submittal is to obtain the US Army Corps of Engineer's (USACE's) official regulatory determination of jurisdiction under Section 404 of the Clean Water Act for each of the aquatic resources identified within the site. Our client will utilize the determination for site planning and ultimately permitting if impacts to Waters of the US are necessitated. We submit this determination request on behalf of:

IESI TX Landfill LP
c/o Joseph Vieceli, Senior Engineer
2301 Eagle Parkway, Suite 200
Fort Worth, Texas 76177

The site encompasses ±111 acres southwest of the city of Kountze, Texas in Hardin County (Sheet 1 of 9, Appendix A). The site is comprised of the IESI Hardin County Landfill permit boundary (79.63 acres) and 31.34 acres of land adjacent to the eastern landfill permit boundary line (Sheet 2 of 9, Appendix A). IESI Hardin County Landfill is a Type I municipal solid waste (MSW) disposal facility currently permitted by the Texas Commission on Environmental Quality (TCEQ). The permitted landfill (TCEQ permit number: MSW-2214A) serves residences and businesses within Hardin County and surrounding communities. The site is located along the south frontage of Farm Road (FR) 770, approximately 0.6 mile west of its intersection with State Highway 326. The latitude/longitude of the approximate center of the project is at 30° 20' 17.38" N and 94° 21' 19.55" W, as determined using an electronic 1:24000 US Geological Survey (USGS) topographic map. The site is located within a primarily rural area with surrounding land use dominated by timber production. The IESI Hardin County Landfill permit boundary includes a disposal area and narrow strip of undeveloped woodlands to the south. The adjacent land includes mostly undeveloped woodlands and IESI Hauling Operations is located along FR 770 in the northern portion.

2.0 METHODOLOGY

The WATERS Routine Determination consisted of a resource review and field investigation. The resource review was performed prior to the field investigation to gather site specific information and evaluate the potential presence of WATERS within the site. A field investigation was then performed to further evaluate potential WATERS identified by the resource review and provide supporting documentation to the jurisdictional status of the WATERS.

The field investigation was performed in general accordance with the consensus document known as the "US Army Corps of Engineers Wetlands Delineation Manual" (hereinafter referred to as the "1987 Manual") and the "Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region." The purpose of the WATERS Routine Determination was to identify potential wetlands, surface water bodies, and drainages on the site; determine their boundaries; and render a professional opinion as to whether or not they meet the criteria to be regulated as WATERS.

A baseline was established along the western site boundary. According to the 1987 Manual, a baseline length of approximately 2,100 feet requires a minimum of three transects to conduct a Routine Determination. However, due to the dense woodland vegetation, four transects (T1-T4) were traversed within the undeveloped portions of the site (Sheet 3 of 9, Appendix A). An assessment of the developed portions of the site was conducted but transects were not extended to the developed portions of the site. Data were recorded at sample points (SP1-SP11) along transects at each identified vegetative community and within each aquatic resource encountered. A Trimble Model GeoXH™ handheld GNSS receiver was used to collect positional data, including data sample points and boundaries of the wetlands identified within the site. The GeoXH™ delivers real-time decimeter accuracy positioning.

3.0 RESOURCE REVIEW

The resource review included inspection of the 7.5 minute USGS Kountze South, Texas topographic quadrangle; National Agriculture Imagery Program (NAIP) digital aerial orthoimagery (2014); Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Map (DFIRM) Community Panel Number 48199C0375F (dated 06 October 2010); National Wetland Inventory (NWI) data; and the Natural Resource Conservation Service (NRCS) Soil Survey Geographic Database (SSURGO).

3.1 TOPOGRAPHIC QUADRANGLE

The USGS topographic quadrangle (Sheet 4 of 9, Appendix A) indicates the western portion of the site is more or less a flat hilltop with an elevation of 80 feet above mean sea level (AMSL). The site slopes downward toward Langston Branch which is located off site to the east. Elevation near the eastern boundary is 65 feet AMSL. No improvements are indicated on the site, however, FR 770 is noted along the northern boundary. There are no indications on the topographic map that suggest any potential WATERS exist within the site boundaries.

3.2 AERIAL ORTHOIMAGERY

The 2014 natural color aerial orthoimagery indicates the site is predominantly a solid waste landfill with undisturbed woodlands located south and east of the developed areas (Sheet 5 of 9, Appendix A). Several structures/buildings and associated parking lot, along with an open area utilized for machinery/equipment parking are located between the disposal area and FR770. A perimeter road is obvious surrounding the disposal area of the landfill. There is an open water pond noted in the northwestern corner of the site adjacent to perimeter road. A larger pit, inundated with water, is present in the south-central portion of the landfill. The only discernable vegetation within the landfill is a narrow tree line along the northern and western boundaries and an area of minimal vegetation in the southwest corner. The woodlands south and east of the perimeter road appear to be dense stands of pine for timber. An area within the eastern woodland has been clear-cut of trees and appears to be dominated by herbaceous vegetation. Besides the open water pond and inundated pit within the active landfill, no other potential waters are evident on the aerial orthoimagery for the site.

3.3 FEMA DFIRM

The FEMA DFIRM indicates the entire site lies within Zone X; area of minimal flood hazard (Sheet 6 of 9, Appendix A). The nearest mapped floodplain is Zone A (1% annual chance of flood hazard) located along Cypress Creek in excess of o.5 mile north of the site.

3.4 National Wetland Inventory Map

The NWI map (Sheet 7 of 9, Appendix A) does not indicate any potential wetlands mapped within the site boundaries. Several palustrine wetlands (forested and emergent) are indicated northeast of the site along Langston Branch. Another palustrine, forested, broad-leaved deciduous (PFO1A) wetland is indicated to the southwest of the site.

3.5 Soil Survey

According to the NRCS SSURGO spatial data (Sheet 8 of 9, Appendix A) soils present on the site by prevalence are Kirbyville fine sandy loam, Plank silt loam, Sorter-Dallardsville complex, Lelavale silt loam, and Jayhawker silt loam. Kirbyville fine sandy loam occupies the majority of the central and eastern portions of the site. The Kirbyville series consist of very deep, moderately permeable fine sandy loams over loam and clay loam. These nearly level to gently sloping soils are well drained to somewhat poorly drained. The Plank series underlies the western portion of the site. Plank soils consist of very deep, poorly drained silt loam. Although the Plank soils tend to be saturated during the winter months, they are primarily used for timber production. Sorter-Dallardsville complex is found along the northern boundary of the site. The Sorter series is predominately silt loam while Dallardsville series is a fine sandy loam. Both series in the complex are very deep soils found on nearly flat to slightly sloping land. Lelavale silt loam occupies a narrow crescent band within the central portion of the site. This series consists of very deep, poorly drained loams that can remain ponded during the growing season. Jayhawker silt loam is mapped along Langston Branch but extends slightly onto the eastern boundary of the site. The Jayhawker series are very deep, poorly drained soils on nearly level topography or within slight depressions. These soils can be frequently ponded and are primarily used for native woodland wildlife habitat. All five soil types mapped within the site are listed on the 2014 NRCS National List of Hydric Soils as hydric soils or possess hydric components.

4.0 FIELD INVESTIGATION

Goshawk ecologists, Bear Aspra and Mitch Juenke, conducted a field investigation on 1 October 2015. Transects were traversed, however, as wetlands were encountered positional data was collected around the boundaries. Table 1 summarizes the sample points and corresponding data forms for each vegetative community encountered. Data forms DF1 through DF9 are in Appendix B. Additionally, representative photographs of the vegetative communities encountered are provided in Appendix C. Communities described for the Hardin County Landfill site include permitted landfill, upland pine woodlands, herbaceous upland spoil, herbaceous wetland, and sedimentation ponds. A sixth community, Langston Branch, is described below even though it is not located within the site boundary.

Three wetlands (W1, W2, and W3) were delineated within the site boundaries (Sheet 9 of 9, Appendix A). Wetland W1 and wetland W3 are sedimentation ponds associated with the permitted landfill. Wetland W2 is a depressional area within the pine woodland just south of the active landfill.

TABLE 1: Summary of Sample Points and Corresponding Data Forms

TRANSECT	SAMPLE POINT (SP-)	COMMUNITY	LATITUDE	LONGITUDE	DATA FORM (DF-)
T1	SP-1	Upland Woodland	30° 20' 7.846"N	94° 21' 27.119"W	DF1
T1	SP-2	Sedimentation Pond (W1)	30° 20' 8.326"N	94° 21' 26.883"W	DF2
T1	SP-3	Upland Woodland	30° 20' 8.806"N	94° 21' 22.501"W	DF3
T1	SP-4	Herbaceous Wetland (W2)	30° 20' 8.988"N	94° 21' 21.68"W	DF4
T1	SP-5	Upland Woodland	30° 20' 10.002"N	94° 21' 16.887"W	DF5
T2	SP-6	Upland Woodland	30° 20' 15.199"N	94° 21' 10.627"W	DF6
T3	SP-7	Herbaceous Upland Spoil	30° 20' 19.52"N	94° 21' 11.897"W	DF7
T3	SP-8	Upland Woodland	30° 20' 20.02"N	94° 21' 9.111"W	DF6
T4	SP-9	Upland Woodland	30° 20' 25.725"N	94° 21' 9.871"W	DF6
--	SP-10	Sedimentation Pond (W3)	30° 20' 24.217"N	94° 21' 30.927"W	DF8
--	SP-11	Langston Branch (offsite)	30° 20' 27.362"N	94° 21' 3.008"W	DF9

4.1 DEVELOPED AREAS

The majority of the site is developed. An entrance road provides access to the landfill from FR 770 from the north and a perimeter road (Photo 1, Appendix C) completely surrounds the disposal area. A gatehouse lies along the entrance road as well as an area to store roll-off dumpsters. The disposal areas just south of the northern perimeter road have vegetated soil cover. Heavy equipment was noted working the disposal areas in the south-central portion of the landfill during the field investigation. This is the area visible on the aerial orthoimagery as an open water pit. The pit had been established due to the ongoing landfill development activities, however, this area is within the permitted waste disposal footprint and no evidence of standing water remains. Two sedimentation ponds are located within the permitted landfill but will be described below as a separate community.

The other developed portion of the site lies at the northeast corner along FR 770. This area includes a building and associated parking area utilized by IESI Hauling Operations. It has a separate access drive from FR 770 and is not part of the permitted landfill.

4.2 UPLAND PINE WOODLANDS

Upland pine woodland is the dominant vegetation community south and east of the permitted landfill. Although the predominant species within the upland pine woodlands is loblolly pine (*Pinus taeda*), there are some slight differences in soils and in the less dominant vegetative species throughout the area. No hydrology characteristics or drainage patterns exist within the upland pine woodlands.

Four data forms (DF1, DF3, DF5, and DF6, Appendix B) describe the minor differences at the sample points within the upland pine woodland community. DF1 indicates vegetation within the woodland is almost exclusively loblolly pine. Underlying soils are a uniform brown (10YR4/3) loam. Vegetation within DF3 includes a small percentage of Chinese tallow (*Triadica sebifera*) within the tree stratum. Soils at this sample point are yellowish-brown, loamy clays. Vegetation at DF5 exhibits a slightly greater mixture of deciduous trees and shrubs intermixed with the loblolly pine (Photo 2, Appendix C). The most common species include sweetgum (*Liquidambar styraciflua*), water oak (*Quercus nigra*), red maple (*Acer rubrum*), sweetbay (*Magnolia virginiana*), and yaupon (*Ilex vomitoria*). Soils underlying the upland woodland at DF5 are brown (10YR4/3) loams with no evidence of redox features. DF6 describes the majority of the upland woodlands located east of the permitted landfill (SP-6, SP-8, SP-9). Vegetation is almost exclusively loblolly pine varying from 75% canopy coverage up to 100%. Soils are uniformly brown (10YR5/3) loams without any evidence of redox features.

4.3 HERBACEOUS UPLAND SPOIL

The clear cut area identified on the aerial orthoimagery within the eastern woodlands appears to be an area where soil from the landfill excavation has been temporarily stored. This area has a slightly raised elevation compared to the surrounding natural topography. Vegetation coverage is high and composed of mostly herbaceous species with a few shrubs and saplings (Photo 3, Appendix C). Little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*), and goldenrod (*Solidago altissima*) are the most common herbaceous species while Roosevelt weed (*Baccharis neglecta*) and loblolly pine are the most common shrub and saplings (DF7, Appendix B). Soils are very dry loamy clays exhibiting a brown matrix color. No hydrology indicators are present within the herbaceous upland spoil area.

4.4 HERBACEOUS WETLAND

Wetland W2 is a "claw-shaped" depression (0.71 acres) located immediately south of the permitted landfill. The northwest portion of this wetland is a slightly deeper depression which becomes shallower toward the southeast. There is up to 4 inches of water in the deeper portion and this area is dominated by primarily herbaceous species, it is surrounded by upland woodlands (Photo 4, Appendix C). The most common species are spikerush (*Eleocharis* sp.), common rush (*Juncus effuses*), flat sedge (*Cyperus* sp.), water primrose (*Ludwigia* sp.), and cattail (DF4, Appendix B). As the depression shallows toward the southeast there is no standing water within the bottom. Additionally, buttonbush (*Cephalanthus occidentalis*), red maple, and loblolly pine become more prevalent. The loamy clay soils are saturated and exhibit 10YR5/6 matrix color in the upper 8 inches with 5YR5/8 redox concentrations. Although this isolated depression meets the criteria to be considered a wetland, it appears to have a reduced watershed which seems to be allowing encroachment of woodland species such as pine and maple.

4.5 SEDIMENTATION PONDS

The narrow and long rectangular sedimentation pond (Wetland W1) located at the southwest corner of the permitted landfill is approximately 0.12 acre in size (Photo 5, Appendix C). Cattail (*Typha latifolia*) and water primrose (*Ludwigia* sp.) are the most common species within this emergent wetland (DF2, Appendix B). Water is directed to this wetland from a culvert under the perimeter road to the north. This area has standing water at least 6 inches deep. Soil within wetland W1 do not appear to be native because clay dominated the lower portions of the column. However, a depleted matrix with obvious redox concentrations indicates this wetland is inundated regularly.

Wetland W3 is the sedimentation pond located in the northwest corner of the permitted landfill. This sedimentation pond is within an area of the permitted landfill that will be utilized for Type IV Construction and Demolition Waste. This wetland is approximately 1.02 acres and of a similar shape to that visible on the aerial orthoimagery. Vegetation was very limited to non-existent within wetland W3 (DF8, Appendix B). This area appears to be fairly deep, inundated to at least 12 inches. A soil sample was not examined within wetland W3 due to the amount of inundation and obvious lack of natural soils. This wetland appears to be dredged regularly, and possibly recently which may have resulted in the lack of vegetation.

4.6 LANGSTON BRANCH (OFFSITE)

Langston Branch was evaluated during the field investigation due to a poorly defined eastern property boundary. Goshawk recorded positional data along Langston Branch to confirm it did not enter the eastern boundary of the site. Langston Branch (DF9, Appendix B) exhibits a well-defined ordinary high water mark within a mixed woodland (Photo 6, Appendix C). This stream is approximately 5 feet wide with incised banks up to 2 feet. Vegetation in the adjacent woodland consists of loblolly pine, green ash (*Fraxinus pennsylvanica*), water oak, cottonwood (*Populus deltoides*), and sweetgum with an understory dominated by yaupon and inland sea oats (*Chasmanthium latifolium*).

5.0 JURISDICTIONAL DETERMINATION

The two sedimentation ponds, wetland W1 and wetland W3, are within the permitted MSW landfill and appear to have been constructed within uplands. Both sedimentation ponds appear to be functioning as designed and are likely periodically dredged to remove any excess sediment that has been collected. Neither of these aquatic features has any evidence of a surface connection between them and the nearest WATERS, Langston Branch. Since both sedimentation ponds continue to function as designed, coupled with the fact they are not hydrologically connected to Langston Branch, both sedimentation ponds should not be considered jurisdictional under current Section 404 definitions.

Wetland W2 is a slight depression located near the top of a natural hill. This depression probably historically collected water from the surrounding upland woodlands, supporting wetland vegetation and hydric soils over a slightly larger area. With the development of the permitted MSW landfill, a portion of the natural watershed to this depression has been removed. Wetland W2 continues to collect water and exhibit wetland characteristics, however, it is likely somewhat smaller than it was historically. There is no evidence of a natural surface outfall from Wetland W2. Since this depression is completely surrounded by upland woodlands, it does not have a hydrologic connection to the nearest WATERS, Langston Branch. Wetland W2 should be considered isolated, therefore not regulated under current Section 404 definitions.

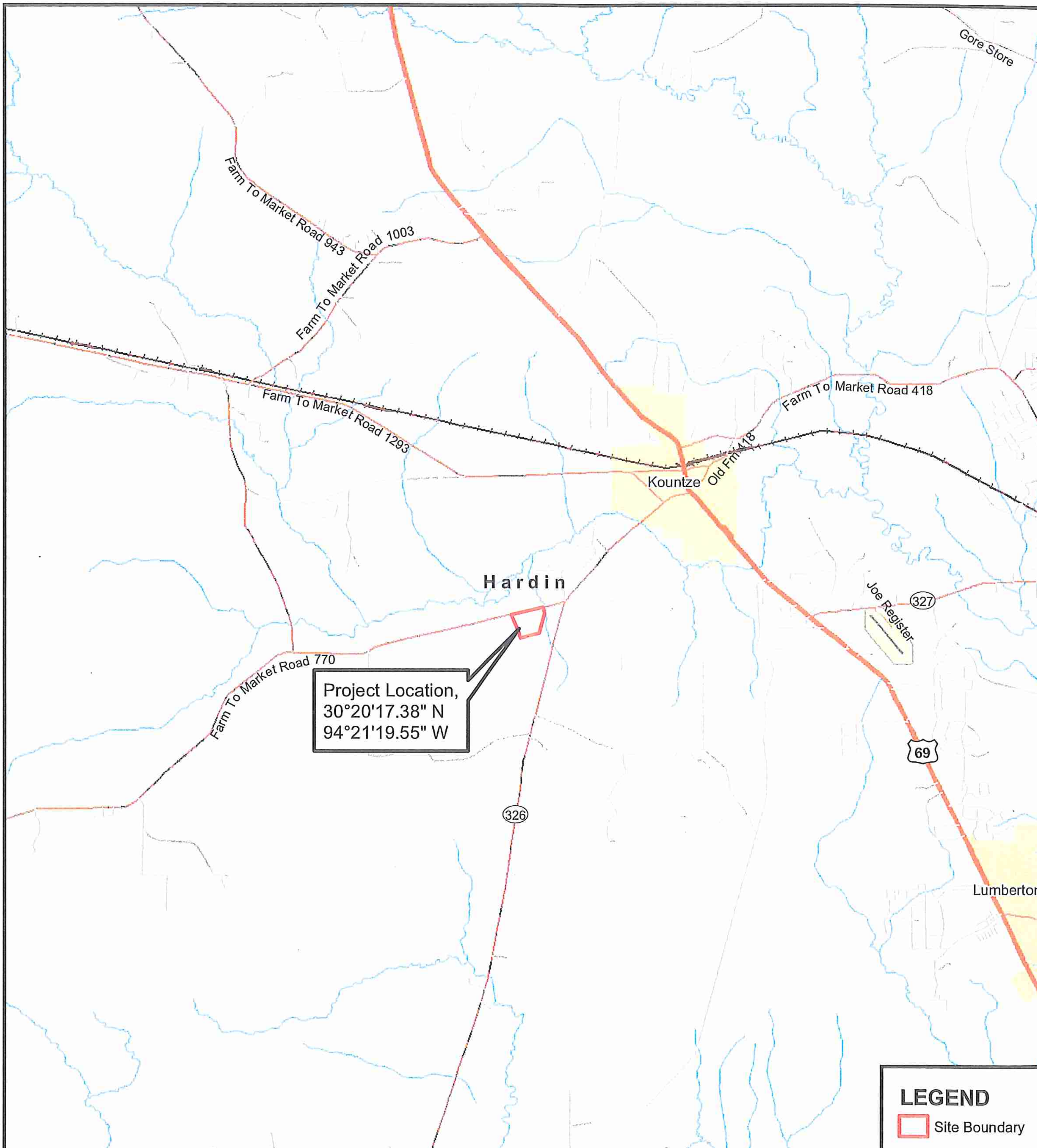
6.0 SUMMARY

The resource review and field investigation revealed three aquatic features within the ±111-acre IESI TX Landfill LP Property site in Hardin County, Texas. It is Goshawk's opinion that the two constructed sedimentation ponds, which are within the permitted landfill, are not subject to USACE regulation because they are within uplands and have no hydrologic connection to any other Waters of the US. Although, the herbaceous wetland identified south of the permitted landfill appears to be a natural depression, there is no obvious hydrologic connection to any other Waters of the US. It is Goshawk's opinion this wetland should be considered isolated and not regulated under current Section 404 definition.

Serving as agent, Goshawk requests the USACE review the enclosed documentation and provide a formal determination of jurisdiction for the IESI Landfill LP Property site. Your prompt attention to this matter will allow the client to develop necessary plans to continue development at the site. If you desire additional information please call 512-203-0484 or email zhomesley@goshawkenv.com.

APPENDIX A

SHEETS 1-9 OF 9



Source: ESRI, Maps & Data. 10.2
USA Base Map. 2013

0 1.5 3 Miles

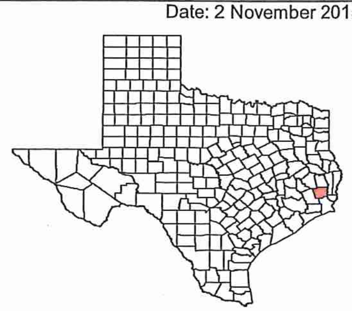
GOSHAWK ENVIRONMENTAL CONSULTING, INC.

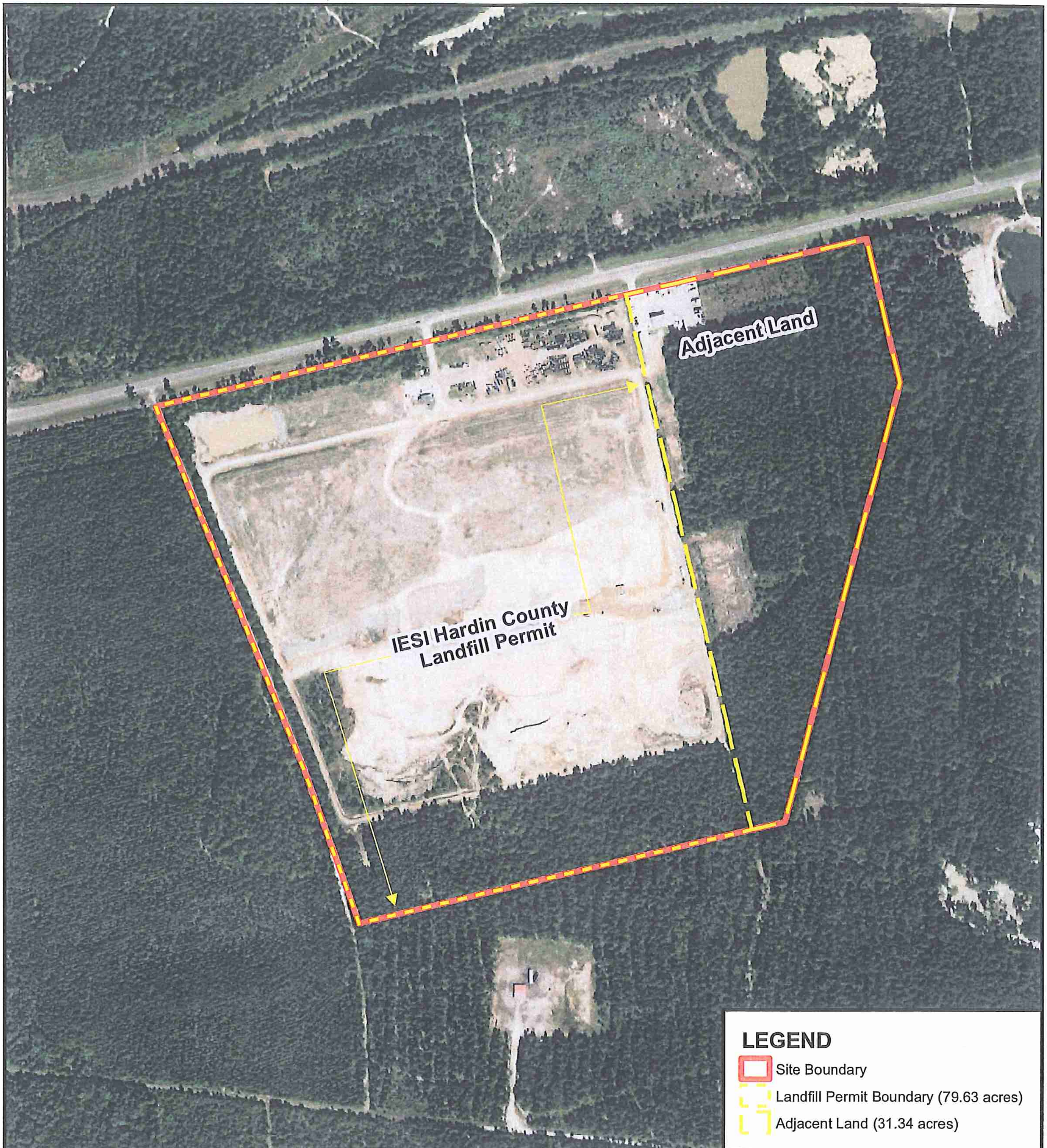
Sheet 1 of 9
Vicinity Map
Hardin County, Texas

IESI TX Landfill LP Property
SWG-2015-?????
I/IIB-146

Date: 2 November 2015

N





Map Source: USDA, 2014 NAIP Natural Color Imagery for Texas.

0 250 500 Feet

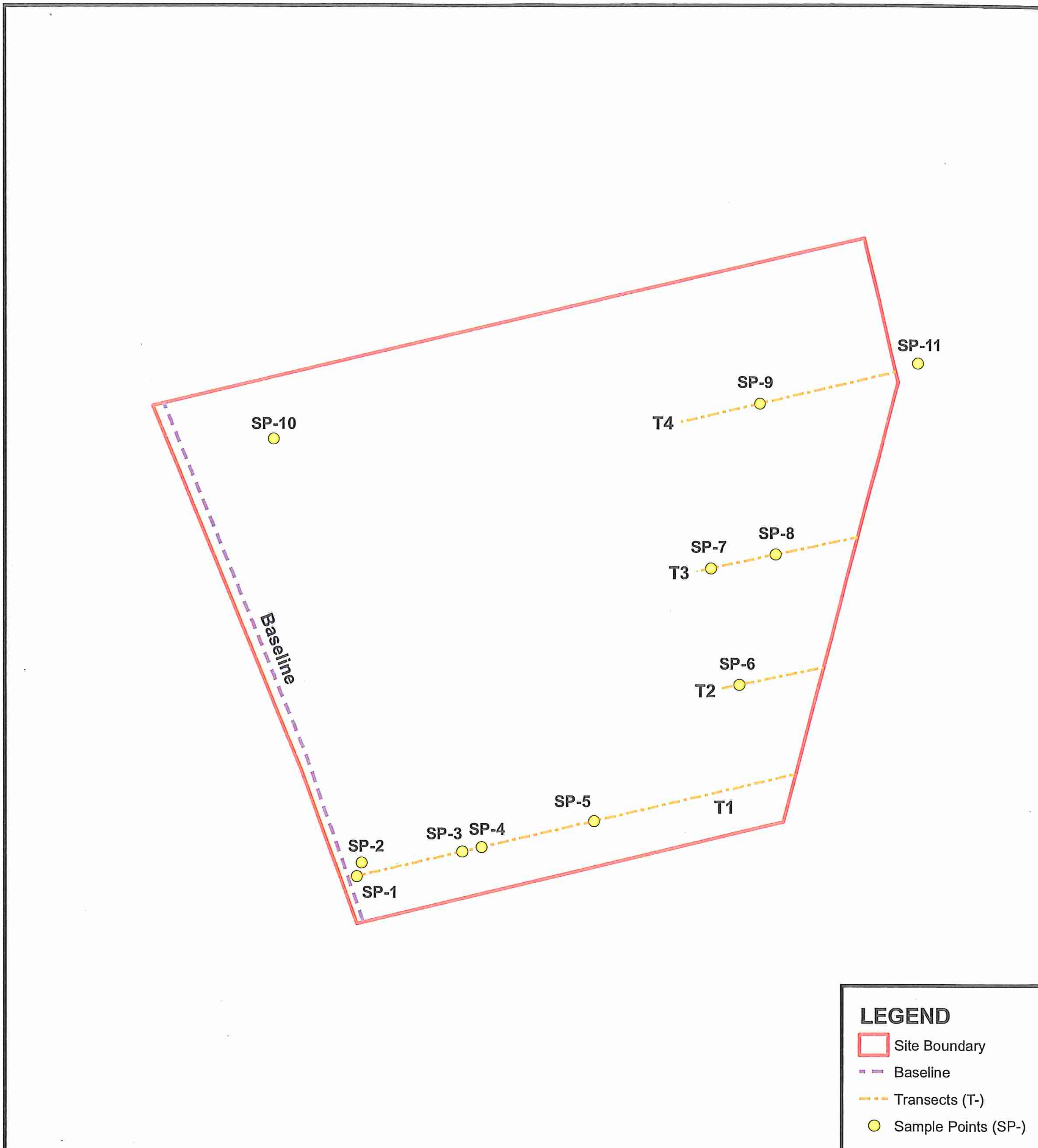
GOSHAWK ENVIRONMENTAL CONSULTING, INC.

Sheet 2 of 9
Parcels Map
Hardin County, Texas

IESI TX Landfill LP Property
SWG-2015-?????
I/IIB-147

Date: 2 November 2015

N



Map Source: Positional Data Collected with Trimble Model GeoXH™ handheld GNSS receiver.

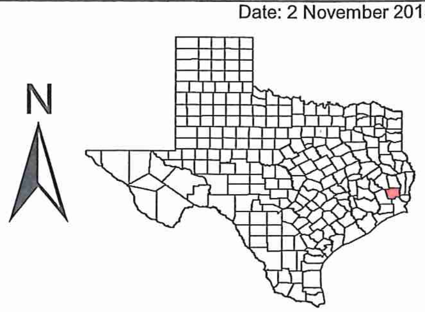
0 250 500 Feet

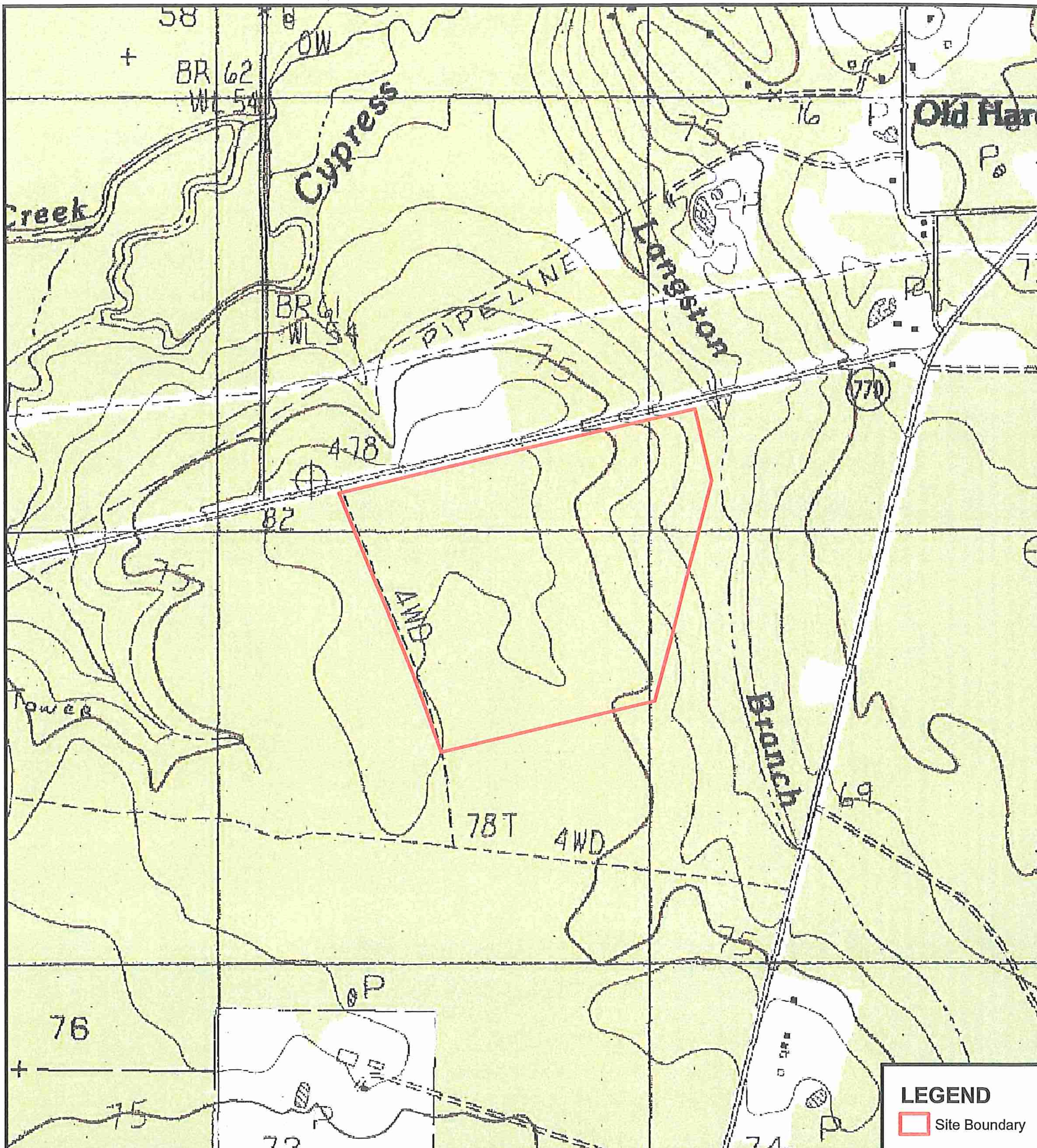
GOSHAWK ENVIRONMENTAL CONSULTING, INC.

Sheet 3 of 9
Methodology Map
Hardin County, Texas

IESI TX Landfill LP Property
SWG-2015-?????
I/IIB-148

Date: 2 November 2015





Map Source: USGS, Kountze South, Texas Quadrangle.

Date: 2 November 2015

0 500 1,000 Feet

Sheet 4 of 9
Topographic Map
Hardin County, Texas

GOSHAWK ENVIRONMENTAL CONSULTING, INC.

IESI TX Landfill LP Property
SWG-2015-?????

I/IIB-149

Map Source: USDA, 2014 NAIP Natural Color Imagery for Texas.

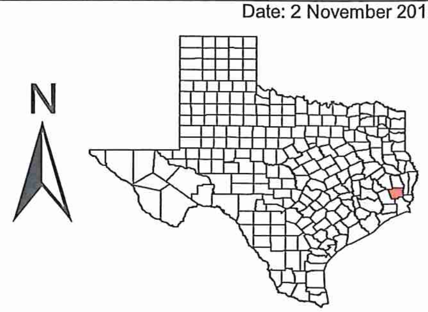
0 250 500 Feet

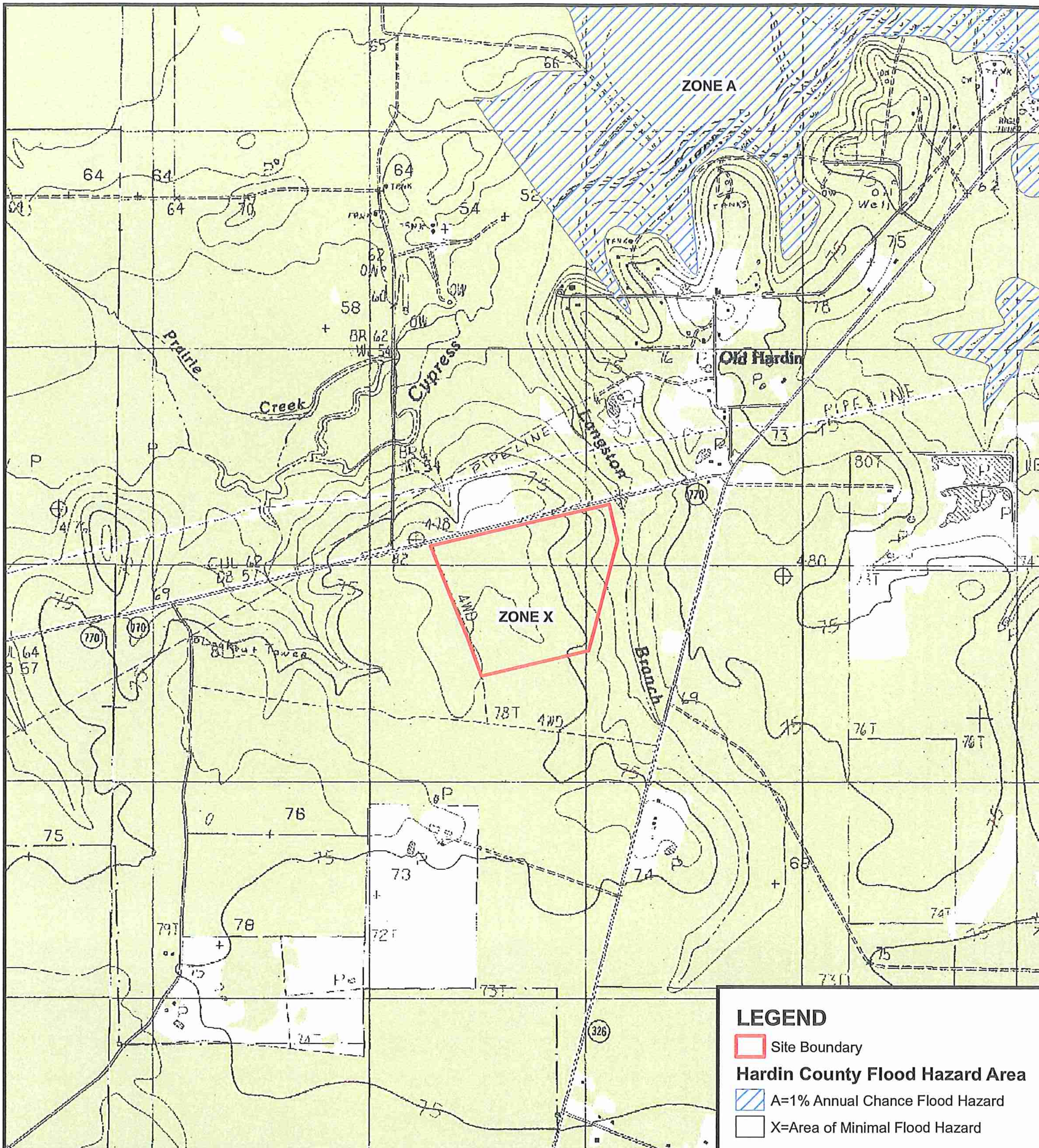
GOSHAWK ENVIRONMENTAL CONSULTING, INC.

Sheet 5 of 9
Aerial Orthoimagery
Hardin County, Texas

IESI TX Landfill LP Property
SWG-2015-?????
I/IIB-150

Date: 2 November 2015





Map Source: FEMA, DFIRM Database, Hardin County, Texas; Panels #48199C0375F; Effective Date: October 06, 2010.
USGS, Kountze South, Texas Quadrangle.

0 1,000 2,000 Feet

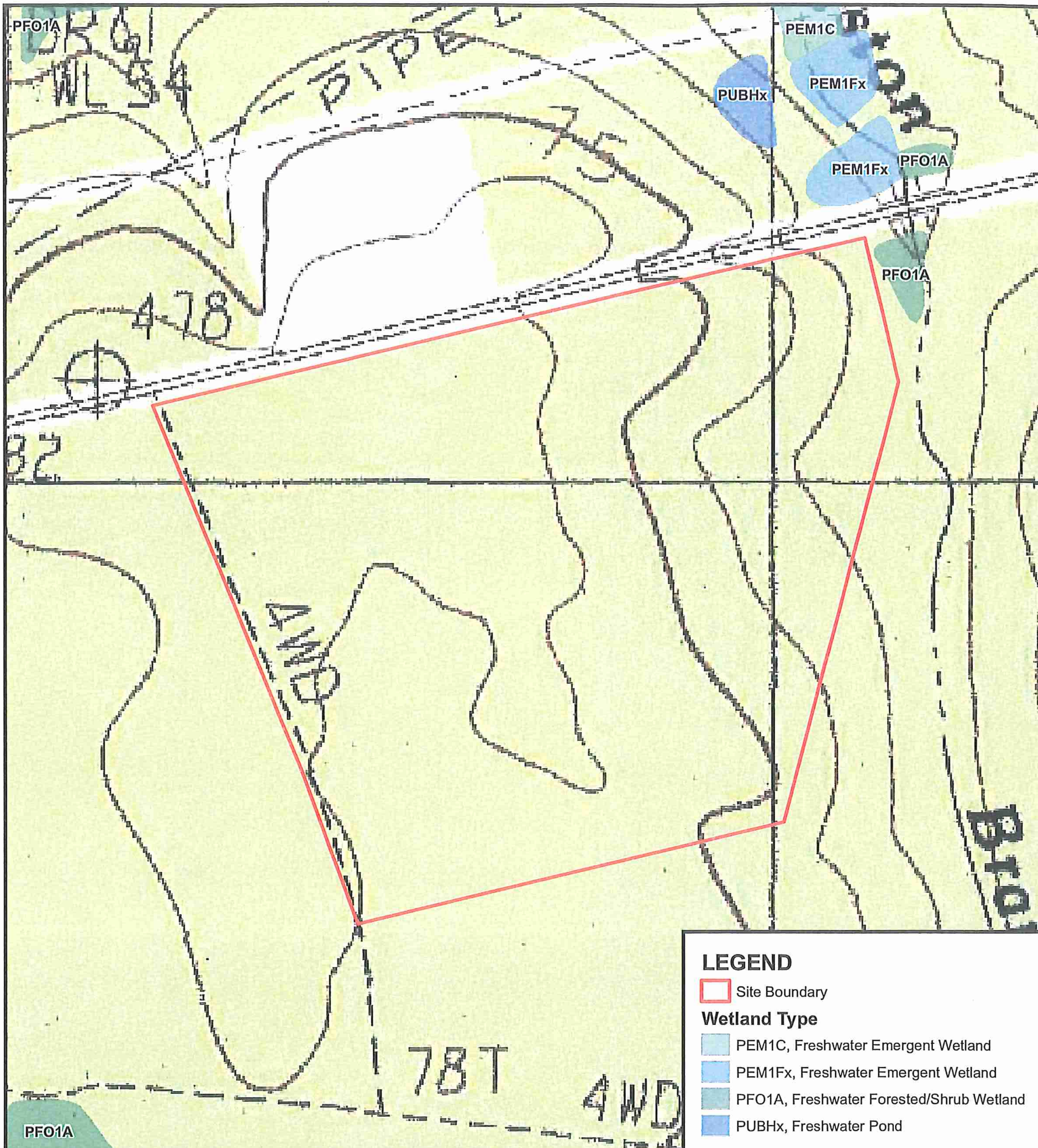
GOSHAWK ENVIRONMENTAL CONSULTING, INC.

Sheet 6 of 9
FEMA DFIRM
Hardin County, Texas

IESI TX Landfill LP Property
SWG-2015-?????

Date: 2 November 2015

N



Map Source: National Wetland Inventory Digital Data, US Department of Interior, Fish & Wildlife Service, USGS, Kountze South, Texas Quadrangle.

0 250 500 Feet

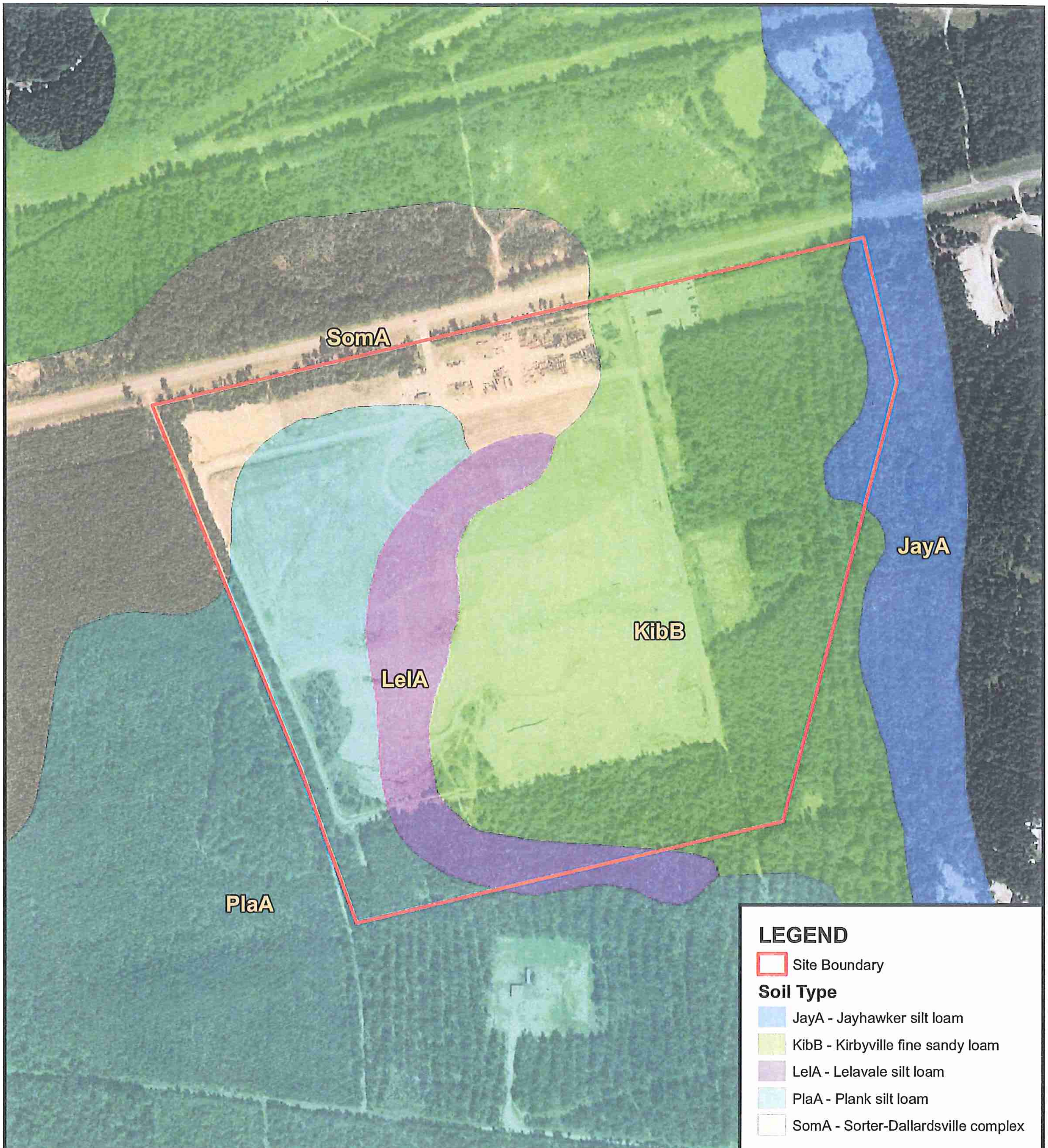
GOSHAWK ENVIRONMENTAL CONSULTING, INC.

Sheet 7 of 9
National Wetlands Inventory Map
Hardin County, Texas

IESI TX Landfill LP Property
SWG-2015-?????
I/IIB-152

Date: 2 November 2015

N



Map Source: USDA/NRCS - National Geospatial Center of Excellence. Soil Survey Geographic (SSURGO) Hardin County, TX.
USDA, 2014 NAIP Natural Color Imagery for Texas.

0 250 500 Feet

GOSHAWK ENVIRONMENTAL CONSULTING, INC.

Sheet 8 of 9
NRCS SSURGO Map
Hardin County, Texas

IESI TX Landfill LP Property
SWG-2015-?????
I/IIB-153

Date: 2 November 2015

N

Map Source: USDA, 2014 NAIP Natural Color Imagery for Texas.

0 250 500 Feet

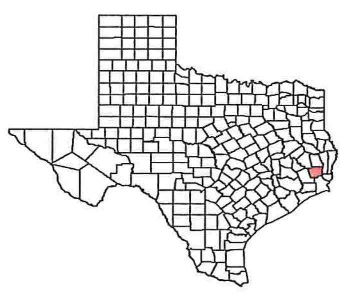
GOSHAWK ENVIRONMENTAL CONSULTING, INC.

Sheet 9 of 9
Findings Map
Hardin County, Texas

IESI TX Landfill LP Property
SWG-2015-?????
I/IIB-154

Date: 2 November 2015

N



APPENDIX B

DATA FORMS

Data Form-1

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: ±111-acre IESI TX Landfill Property City/County: Hardin County Sampling Date: 1-Oct-15

Applicant/Owner: IESI TX Landfill LP State: TX Sampling Point: T1, SP-1

Investigator(s): Bear Aspra, Mitch Juenke Section, Township, Range: ___

Landform (hillslope, terrace, etc.): hilltop Local relief (concave, convex, none): flat Slope (%): 0

Subregion (LRR or MLRA): LLR T Lat: 30° 20' 7.846"N Long: 94° 21' 27.119"W Datum: NAD1983

Soil Map Unit Name: Plank Silt Loam NWI Classification: N/A

Are climatic/hydrologic conditions on the site typical for this time of the year? Yes X No ___ (If no, explain in Remarks)

Are Vegetation No , Soil No , or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation No , Soil No , or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes ___	No X	**Is the Sampled Area within a Wetland?**	Yes ___	No X
Hydric Soil Present?	Yes ___	No X			
Wetland Hydrology Present?	Yes ___	No X			

Remarks:
Sample Point within dense upland pine woodland with layer of pine needles covering the ground surface. Limited vegetation within shurb and herbaceous stratum. Canopy cover very dense up to 100%.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___	
Water Table Present'	Yes ___	No X	Depth (inches): ___	
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___	**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No stream data. 2014 aerial orthoimagery reviewed.

Remarks:

No Hydrology indicators present in this area. Area seems somewhat topographically high but very flat. No drainage or waterflow patterns were noted within the area. Aerial orthoimagery shows this area as a very dense woodland and there is no evidence of possible water at this sample point in the orthoimagery.

Data Form-1

VEGETATION (Four Strata) -- Use scientific names of plants.

Sampling Point: T1, SP-1

Tree Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. *Pinus taeda*	100	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	100	= Total Cover	
50% of total cover:	50	20% of total cover:	20

Sapling/Shrub Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. *Pinus taeda*	20	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	20	= Total Cover	
50% of total cover:	10	20% of total cover:	4

Herb Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Woody Vine Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1.			
2.			
3.			
4.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Dominance Test worksheet

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100%	(A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 (1m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (If observed, list morphological adaptations below).

This sample point is within a mature pine dominated woodland with a very limited understory and no ground cover. Pine saplings are the predominant vegetation within the understory. A layer of pine needles were noted covering the ground surface. Although loblolly pine is indicated as Facultative, with it being the by far the most dominant species and typically considered an upland species, we have indicated hydrophytic vegetation present as "No".

SOIL

Sampling Point: T1, SP-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (Inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 4/3		n/a				loam	fairly uniform brown color

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, MS = Masked Sand Grains. [2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A18) **(MRLA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153D)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if observed):
Type: ___
Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks: The criteria for hydric soil have not been met.

Pine needles cover the surface. Soils were dry and uniform thoroughout the column. The loamy soils exhibit a yellowish brown matrix color with no evidence of redox features.

Data Form-2

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: ±111-acre IESI TX Landfill Property City/County: Hardin County Sampling Date: 1-Oct-15

Applicant/Owner: IESI TX Landfill LP State: TX Sampling Point: SP-2

Investigator(s): Bear Aspra, Mitch Juenke Section, Township, Range: ___

Landform (hillslope, terrace, etc.): hilltop Local relief (concave, convex, none): pond Slope (%): 0

Subregion (LRR or MLRA): LLR T Lat: 30° 20' 8.326"N Long: 94° 21' 26.883"W Datum: NAD1983

Soil Map Unit Name: Plank Silt Loam NWI Classification: N/A

Are climatic/hydrologic conditions on the site typical for this time of the year? Yes X No ___ (If no, explain in Remarks)

Are Vegetation Yes , Soil Yes , or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes ___ No X

Are Vegetation No , Soil No , or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes	X	No		Is the Sampled Area within a Wetland? Yes X No ___
Hydric Soil Present?	Yes	X	No		
Wetland Hydrology Present?	Yes	X	No		

Remarks:
Sample Point is within an excavated sedimentation pond that is within the permitted municipal solid waste landfill. Sedimenation pond is a very narrow rectangle as originally designed. Culvert under perimeter road allows water into this sedimentation pond.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- X Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- X Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes	X	No		Depth (inches):	>6
Water Table Present'	Yes		No	X	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes	X	No		Depth (inches):	

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No stream data. 2014 aerial orthoimagery reviewed.

Remarks:
This sedimentation pond is visible on the aerial orthoimagery. It was inundated at the time of the field investigation from recent runoff from the adjacent landfill. The sedimentation pond is an excavated depression designed to collect storm water runoff from the landfill

Data Form-2

VEGETATION (Four Strata) -- Use scientific names of plants.

Sampling Point: SP-2

Tree Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Sapling/Shrub Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Herb Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. *Typha latifolia*	60	Yes	OBL
2. *Ludwigia spp.*	10	No	OBL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	70	= Total Cover	
50% of total cover:	35	20% of total cover:	14

Woody Vine Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1.			
2.			
3.			
4.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Dominance Test worksheet

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100%	(A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals		(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 (1m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (If observed, list morphological adaptations below).

Sedimentation pond was dominated by cattail. Ludwigia also present intersperced within and along the ponds edge. About 25% of the sedimentation pond exhibited open water. The edge of the sedimenation pond exhibited some sapling loblolly pine and fairly large yaupon.

SOIL

Sampling Point: SP-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (Inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 5/2		10YR 5/8		RM	M	loam	light brown matrix
3-12	10YR 6/2		10YR 5/6		RM	M	clay	brownish gray matrix

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, MS = Masked Sand Grains. [2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A18) **(MRLA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153D)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if observed):
Type: ______
Depth (inches): ______

Hydric Soil Present? Yes X No ___

Remarks: The criteria for hydric soil have been met.

The lower portion of the soil column seemed to be predominatly clay, likely included as part of the construction of the sedimentation pond. Redox features were evident in the saturated soils. Allowing the soil to dry some increased the evidence of redox features.

Data Form-3

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: ±111-acre IESI TX Landfill Property City/County: Hardin County Sampling Date: 1-Oct-15

Applicant/Owner: IESI TX Landfill LP State: TX Sampling Point: T1, SP-3

Investigator(s): Bear Aspra, Mitch Juenke Section, Township, Range: ___

Landform (hillslope, terrace, etc.): Plain Local relief (concave, convex, none): Flat Slope (%): 0

Subregion (LRR or MLRA): LLR T Lat: 30° 20' 8.806"N Long: 94° 21' 22.501"W Datum: NAD1983

Soil Map Unit Name: Lelavale silt loam NWI Classification: N/A

Are climatic/hydrologic conditions on the site typical for this time of the year? Yes X No ___ (If no, explain in Remarks)

Are Vegetation No , Soil No , or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation No , Soil No , or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes ___	No X			
Hydric Soil Present?	Yes ___	No X	**Is the Sampled Area within a Wetland?**	**Yes** ___	**No** X
Wetland Hydrology Present?	Yes ___	No X			

Remarks:
Sample Point within dense upland pine woodland with a layer of pine needles covering the ground surface. Limited vegetation within the herbaceous stratum. Canopy cover up to 90%. This point is within the upland woodland prior to entering the adjacent herbaceous wetland.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15) **(LRR U)**
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)
___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___
Water Table Present' Yes ___ No X Depth (inches): ___
Saturation Present? Yes ___ No X Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No stream data available for this point. Aerial orthoimagery dated 2014 was reviewed.

Remarks:
No hydrology indicators are present at this sample point. Area is topographically flat to slightly sloping toward the east. No drainage patterns were noted at this point. Aerial orthoimagery suggests this area is a very dense woodland and there is no evidence of possible standing water or water flow.

Data Form-3

VEGETATION (Four Strata) -- Use scientific names of plants.

Sampling Point: T1, SP-3

Tree Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. *Pinus taeda*	85	Yes	FAC
2. *Triadica sebifera*	5	No	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	90	= Total Cover	
50% of total cover:	45	20% of total cover:	18
Sapling/Shrub Stratum (Plot size: 30ft)			
1. *Pinus taeda*	15	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	15	= Total Cover	
50% of total cover:	7.5	20% of total cover:	3
Herb Stratum (Plot size: 30ft)			
1. *N/A*			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0
Woody Vine Stratum (Plot size: 30ft)			
1. *N/A*			
2.			
3.			
4.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Dominance Test worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals		(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 (1m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** ___ **No** X

Remarks: (If observed, list morphological adaptations below).

This sample point is within a mature pine woodland with a few Chinese tallow intermixed. There shrub layer is limited to only pine saplings. No ground cover vegetation exists. Although loblolly pine is considered Facultative, since it is the primary species and typically considred an upland species, we have indicated hydrophytic vegetation present as "No".

SOIL

Sampling Point: T1, SP-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (Inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 4/4		N/A				loamy clay	yellowish brown matrix

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, MS = Masked Sand Grains. [2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Organic Bodies (A6) **(LRR P, T, U)**
___ 5 cm Mucky Mineral (A7) **LRR P, T, U)**
___ Muck Presence (A8) **(LRR U)**
___ 1 cm Muck (A9) **(LRR P, T)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Coast Prairie Redox (A18) **(MRLA 150A)**
___ Sandy Mucky Mineral (S1) **(LRR O, S)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7) **(LRR P, S, T, U)**
___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
___ Thin Dark Surface (S9) **(LRR S, T, U)**
___ Loamy Mucky Mineral (F1) **(LRR O)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) **(LRR U)**
___ Depleted Ochric (F11) **(MLRA 151)**
___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
___ Umbric Surface (F13) **(LRR P, T, U)**
___ Delta Ochric (F17) **(MLRA 151)**
___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) **(LRR O)**
___ 2 cm Muck (A10) **(LRR S)**
___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 153D)**
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if observed):
Type: ___
Depth (inches): ___

Hydric Soil Present? **Yes** x **No** ___

Remarks: The criteria for hydric soil have been met.

A layer of pine needles cover the surface of the soil. The clay dominated soils exhibit an uniform yellowish brown color throughout the sample. No redox featueres were noted.

Data Form-4

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: ±111-acre IESI TX Landfill Property City/County: Hardin County Sampling Date: 1-Oct-15

Applicant/Owner: IESI TX Landfill LP State: TX Sampling Point: T1, SP-4

Investigator(s): Bear Aspra, Mitch Juenke Section, Township, Range: ___

Landform (hillslope, terrace, etc.): depression Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): LLR T Lat: 30° 20' 8.988"N Long: 94° 21' 21.68"W Datum: NAD1983

Soil Map Unit Name: Lelavale silt loam NWI Classification: N/A

Are climatic/hydrologic conditions on the site typical for this time of the year? Yes X No ___ (If no, explain in Remarks)

Are Vegetation No , Soil No , or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation No , Soil No , or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS

	Yes	No
Hydrophytic Vegetation Present?	X	
Hydric Soil Present?	X	
Wetland Hydrology Present?	X	

Is the Sampled Area within a Wetland? Yes X No ___

Remarks:
Sample Point taken within a slight depression. Standing water within the deeper portions and saturated soils in shallower portion. Some runoff from landfill may enter this wetland area.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- X Water Marks (B1)
- X Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- X Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?	X		0-4
Water Table Present?		X	
Saturation Present? (includes capillary fringe)	X		10

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No stream data available for this point. Aerial orthoimagery dated 2014 was reviewed.

Remarks:
There is a slight indication on the aerial orthoimagery that there is a opening in the woodland, however, standing water is not visible on the aerial. Standing water does exist within the deeper (northeast) portion of this depression. The shallower portions did not exhibit standing water. There was no obvious outfall from this depression.

Data Form-4

VEGETATION (Four Strata) -- Use scientific names of plants.

Sampling Point: T1, SP-4

Tree Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. *Pinus taeda*	5	Yes	FAC
2. *Platanus occidentalis*	5	Yes	FACW
3. *Acer rubrum*	5	Yes	FAC
4.			
5.			
6.			
7.			
8.			
	15	= Total Cover	
50% of total cover:	7.5	20% of total cover:	3

Sapling/Shrub Stratum (Plot size: 30ft)			
1. *Pinus taeda*	5	Yes	FAC
2. *Ilex vomitoria*	5	Yes	FAC
3. *Cephalanthus occidentalis*	5	Yes	OBL
4.			
5.			
6.			
7.			
8.			
	15	= Total Cover	
50% of total cover:	7.5	20% of total cover:	3

Herb Stratum (Plot size: 30ft)			
1. *Typha latifolia*	5	No	OBL
2. *Ludwigia alternifolia*	15	Yes	OBL
3. *Cyperus strigosus*	10	No	FACW
4. *Eleocharis cellulosa*	20	Yes	OBL
5. *Juncus effusus*	20	Yes	OBL
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	70	= Total Cover	
50% of total cover:	35	20% of total cover:	14

Woody Vine Stratum (Plot size: 30ft)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Dominance Test worksheet

Number of Dominant Species That Are OBL, FACW, or FAC:	9	(A)
Total Number of Dominant Species Across All Strata:	9	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100%	(A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals		(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 (1m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (If observed, list morphological adaptations below).

The northwest portion of the depression is dominated by herbaceous vegetation, however some trees, saplings, and shrubs are present toward the southeast and along the perimeter. The tree/shrub coverage is less than 25% on the southeast portion. Ferns also are common in the southeastern portion of this wetland.

SOIL

Sampling Point: T1, SP-4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (Inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 5/6		5YR 5/8		C	M	loamy clay	saturated
8-12	10YR 5/2		7.5YR 5/8		C	M	clay	saturated

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, MS = Masked Sand Grains. [2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Organic Bodies (A6) **(LRR P, T, U)**
___ 5 cm Mucky Mineral (A7) **LRR P, T, U)**
___ Muck Presence (A8) **(LRR U)**
___ 1 cm Muck (A9) **(LRR P, T)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Coast Prairie Redox (A18) **(MRLA 150A)**
___ Sandy Mucky Mineral (S1) **(LRR O, S)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7) **(LRR P, S, T, U)**
___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
___ Thin Dark Surface (S9) **(LRR S, T, U)**
___ Loamy Mucky Mineral (F1) **(LRR O)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
X Redox Depressions (F8)
___ Marl (F10) **(LRR U)**
___ Depleted Ochric (F11) **(MLRA 151)**
___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
___ Umbric Surface (F13) **(LRR P, T, U)**
___ Delta Ochric (F17) **(MLRA 151)**
___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) **(LRR O)**
___ 2 cm Muck (A10) **(LRR S)**
___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 153D)**
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if observed):
Type: ___
Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks: The criteria for hydric soil have been met.

The redox concentrations are evident throughout the column becoming more evident as the soil was allowed to dry.

Data Form-5

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: ±111-acre IESI TX Landfill Property City/County: Hardin County Sampling Date: 1-Oct-15

Applicant/Owner: IESI TX Landfill LP State: TX Sampling Point: T1, SP-5

Investigator(s): Bear Aspra, Mitch Juenke Section, Township, Range: ___

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): Flat Slope (%): 0

Subregion (LRR or MLRA): LLR T Lat: 30° 20' 10.002"N Long: 94° 21' 16.887"W Datum: NAD1983

Soil Map Unit Name: Kirbyville fine sandy loam NWI Classification: N/A

Are climatic/hydrologic conditions on the site typical for this time of the year? Yes X No ___ (If no, explain in Remarks)

Are Vegetation No , Soil No , or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation No , Soil No , or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes ___	No X	Is the Sampled Area within a Wetland?	Yes ___	No X
Hydric Soil Present?	Yes ___	No X			
Wetland Hydrology Present?	Yes ___	No X			

Remarks:
This sample point is within an upland pine woodland, however a few more deciduous trees are evident within the canopy. Shrub layer has limited coverage. Overall canopy coverage up to 90%

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15) **(LRR U)**
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)
___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___
Water Table Present' Yes ___ No X Depth (inches): ___
Saturation Present? Yes ___ No X Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No stream data available for this point. Aerial orthoimagery dated 2014 was reviewed.

Remarks:
No hydrology indicators are present at this sample point. Area is topographically flat. No drainage patterns were noted at this point. Aerial orthoimagery suggests this area is a very dense woodland and there is no evidence of possible standing water or water flow.

Data Form-5

VEGETATION (Four Strata) -- Use scientific names of plants. **Sampling Point:** T1, SP-5

Tree Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. *Pinus taeda*	75	Yes	FAC
2. *Liquidambar styraciflua*	10	No	FAC
3. *Acer rubrum*	5	No	FAC
4. *Quercus nigra*	5	No	FAC
5.			
6.			
7.			
8.			
	95	= Total Cover	
50% of total cover:	47.5	20% of total cover:	19

Sapling/Shrub Stratum (Plot size: 30ft)			
1. *Pinus taeda*	15	Yes	FAC
2. *Acer rubrum*	5	No	FAC
3. *Magnolia virginiana*	5	No	FACW
4. *Ilex vomitoria*	5	No	FAC
5.			
6.			
7.			
8.			
	30	= Total Cover	
50% of total cover:	15	20% of total cover:	6

Herb Stratum (Plot size: 30ft)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Woody Vine Stratum (Plot size: 30ft)			
1.			
2.			
3.			
4.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Dominance Test worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 (1m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks: (If observed, list morphological adaptations below).

There are a few more deciduous trees intermixed with the loblolly pine at this sample point. However almost all the species present within this area are Facultative.

SOIL **Sampling Point:** T1, SP-5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

	Matrix		Redox Features					
Depth (Inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 4/3		N/A				loam	uniform brown matrix

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, MS = Masked Sand Grains. [2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Organic Bodies (A6) **(LRR P, T, U)**
___ 5 cm Mucky Mineral (A7) **LRR P, T, U)**
___ Muck Presence (A8) **(LRR U)**
___ 1 cm Muck (A9) **(LRR P, T)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Coast Prairie Redox (A18) **(MRLA 150A)**
___ Sandy Mucky Mineral (S1) **(LRR O, S)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7) **(LRR P, S, T, U)**
___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
___ Thin Dark Surface (S9) **(LRR S, T, U)**
___ Loamy Mucky Mineral (F1) **(LRR O)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) **(LRR U)**
___ Depleted Ochric (F11) **(MLRA 151)**
___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
___ Umbric Surface (F13) **(LRR P, T, U)**
___ Delta Ochric (F17) **(MLRA 151)**
___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) **(LRR O)**
___ 2 cm Muck (A10) **(LRR S)**
___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 153D)**
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if observed):
Type: ___
Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks: The criteria for hydric soil have not been met.

The soil was dry and exhibit a fairly uniform brown matrix throughout the column. No redox features were noted within the loam dominated soils.

Data Form-6

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: ±111-acre IESI TX Landfill Property City/County: Hardin County Sampling Date: 1-Oct-15

Applicant/Owner: IESI TX Landfill LP State: TX Sampling Point: SP-6, SP-8, SP-9

Investigator(s): Bear Aspra, Mitch Juenke Section, Township, Range: ___

Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): slightly sloping Slope (%): 0

Subregion (LRR or MLRA): LLR T Lat: 30° 20' 15.199"N Long: 94° 21' 10.62"W Datum: NAD1983

Soil Map Unit Name: Kirbyville fine sandy loam NWI Classification: N/A

Are climatic/hydrologic conditions on the site typical for this time of the year? Yes X No ___ (If no, explain in Remarks)

Are Vegetation No , Soil No , or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation No , Soil No , or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes ___	No X		
Hydric Soil Present?	Yes ___	No X	**Is the Sampled Area within a Wetland?**	**Yes** ___ **No X**
Wetland Hydrology Present?	Yes ___	No X		

Remarks:
This sample point is within an upland pine woodland dominated by large loblolly pine with very little understory or herbaceous coverage. Overall canopy coverage up to 100%

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___	
Water Table Present'	Yes ___	No X	Depth (inches): ___	
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___	**Wetland Hydrology Present? Yes ___ No X**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No stream data. 2014 aerial orthoimagery reviewed.

Remarks:
No hydrology indicators present in these areas. Areas are within uplands. No drainage or waterflow within these areas.

Data Form-6

VEGETATION (Four Strata) -- Use scientific names of plants.

Sampling Point: SP-6, SP-8, SP-9

Tree Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. *Pinus taeda*	90	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	90	= Total Cover	
50% of total cover:	45	20% of total cover:	18

Sapling/Shrub Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. *Pinus taeda*	15	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	15	= Total Cover	
50% of total cover:	7.5	20% of total cover:	3

Herb Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Woody Vine Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. *N/A*			
2.			
3.			
4.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Dominance Test worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 (1m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks: (If observed, list morphological adaptations below).

Canopy coverage ranges from 75% up to 100% dominated by loblolly pine. A few saplings of loblolly pine are noted in soome areas. A layer of pine needles typically covers the surface of the ground.

SOIL

Sampling Point: SP-6, SP-8, SP-9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

	Matrix		Redox Features					
Depth (Inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 5/3		N/A				loam	uniform brown matrix

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, MS = Masked Sand Grains. [2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Organic Bodies (A6) **(LRR P, T, U)**
___ 5 cm Mucky Mineral (A7) **LRR P, T, U)**
___ Muck Presence (A8) **(LRR U)**
___ 1 cm Muck (A9) **(LRR P, T)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Coast Prairie Redox (A18) **(MRLA 150A)**
___ Sandy Mucky Mineral (S1) **(LRR O, S)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7) **(LRR P, S, T, U)**
___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
___ Thin Dark Surface (S9) **(LRR S, T, U)**
___ Loamy Mucky Mineral (F1) **(LRR O)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) **(LRR U)**
___ Depleted Ochric (F11) **(MLRA 151)**
___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
___ Umbric Surface (F13) **(LRR P, T, U)**
___ Delta Ochric (F17) **(MLRA 151)**
___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) **(LRR O)**
___ 2 cm Muck (A10) **(LRR S)**
___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 153D)**
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if observed):
Type: ___
Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks: The criteria for hydric soil have not been met.

The soils were dry and exhibit a fairly uniform brown color throughout the column. No redox features were noted within the soils.

Data Form-7

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site:	±111-acre IESI TX Landfill Property	City/County:	Hardin County	Sampling Date:	1-Oct-15
Applicant/Owner:	IESI TX Landfill LP	State:	TX	Sampling Point:	SP-7
Investigator(s):	Bear Aspra, Mitch Juenke			Section, Township, Range:	
Landform (hillslope, terrace, etc.):	Hill/Mound	Local relief (concave, convex, none):	Flat	Slope (%):	0
Subregion (LRR or MLRA): LLR T	Lat: 30°20'19.52"N	Long:	94°21'11.897"W	Datum:	NAD1983
Soil Map Unit Name:	Kirbyville fine sandy loam			NWI Classification:	N/A

Are climatic/hydrologic conditions on the site typical for this time of the year? Yes X No ___ (If no, explain in Remarks)

Are Vegetation Yes , Soil Yes , or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes ___ No X

Are Vegetation No , Soil No , or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes ___	No X	**Is the Sampled Area within a Wetland?**	
Hydric Soil Present?	Yes X	No ___		
Wetland Hydrology Present?	Yes ___	No X	**Yes** ___	**No X**

Remarks:
Sample Point within dense shrubs, grasses, and sapling pines / area is elevated, appears to be landfill spoil mound / Area is cleared of oldgrowth woodlands / limited to no canopy cover

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1)
___ Sediment Deposits (B2)
___ Drift Deposits (B3)
___ Algal Mat or Crust (B4)
___ Iron Deposits (B5)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Aquatic Fauna (B13)
___ Marl Deposits (B15) **(LRR U)**
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

___ Surface Soil Cracks (B6)
___ Sparsely Vegetated Concave Surface (B8)
___ Drainage Patterns (B10)
___ Moss Trim Lines (B16)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Geomorphic Position (D2)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)
___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present'	Yes ___	No X	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No stream data. 2014 aerial orthoimagery reviewed.

Remarks:
No hydrology indicatiors present in this area. Area is within uplands. No drainage or waterflow evident.

Data Form-7

VEGETATION (Four Strata) -- Use scientific names of plants.

Sampling Point: SP-7

Tree Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Sapling/Shrub Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. *Pinus taeda*	10	Yes	FAC
2. *Baccharis neglecta*	10	Yes	FAC
3. *Ilex vomitoria*	5	Yes	FAC
4.			
5.			
6.			
7.			
8.			
	25	= Total Cover	
50% of total cover:	12.5	20% of total cover:	5

Herb Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. *Schizachyrium scoparium*	15	Yes	FACU
2. *Solidago altissima*	15	Yes	FACU
3. *Panicum virgatum*	10	Yes	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	40	= Total Cover	
50% of total cover:	20	20% of total cover:	8

Woody Vine Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1.			
2.			
3.			
4.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Dominance Test worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 67% (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0[1]
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 (1m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (If observed, list morphological adaptations below).

Mostly herbaceous coverage however, there is some Roosevelt weed and pine saplings in the area. This area was probably part of the upland pine woodland adjacent to it, but may have been cutover to temporarily store spoil from the landfill. Dominant vegetave species are a mixutre of Facultative Upland and Facultative. There are no Facultative Wetland or Obligate species present.

SOIL

Sampling Point: SP-7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (Inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 4/3		N/A				loamy clay	dry brown matrix

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, MS = Masked Sand Grains. [2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Organic Bodies (A6) **(LRR P, T, U)**
___ 5 cm Mucky Mineral (A7) **LRR P, T, U)**
___ Muck Presence (A8) **(LRR U)**
___ 1 cm Muck (A9) **(LRR P, T)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Coast Prairie Redox (A18) **(MRLA 150A)**
___ Sandy Mucky Mineral (S1) **(LRR O, S)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7) **(LRR P, S, T, U)**
___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
___ Thin Dark Surface (S9) **(LRR S, T, U)**
___ Loamy Mucky Mineral (F1) **(LRR O)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) **(LRR U)**
___ Depleted Ochric (F11) **(MLRA 151)**
___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
___ Umbric Surface (F13) **(LRR P, T, U)**
___ Delta Ochric (F17) **(MLRA 151)**
___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) **(LRR O)**
___ 2 cm Muck (A10) **(LRR S)**
___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 153D)**
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if observed):
Type: ___
Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks: The criteria for hydric soil have not been met.

This appears to be spoil placed here possibly from the adjacent landfill. The native soils are likely below what was assessed in the soil sample.

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: ±111-acre IESI TX Landfill Property City/County: Hardin County Sampling Date: 1-Oct-15

Applicant/Owner: IESI TX Landfill LP State: TX Sampling Point: SP-10

Investigator(s): Bear Aspra, Mitch Juenke Section, Township, Range: ___

Landform (hillslope, terrace, etc.): Plain Local relief (concave, convex, none): pond Slope (%): 0

Subregion (LRR or MLRA): LLR T Lat: 30°20' 24.217"N Long: 94°21'30.927"W Datum: NAD1983

Soil Map Unit Name: Sorter-Dallardsville complex NWI Classification: N/A

Are climatic/hydrologic conditions on the site typical for this time of the year? Yes X No ___ (If no, explain in Remarks)

Are Vegetation Yes , Soil Yes , or Hydrology Yes significantly disturbed? Are "Normal Circumstances" present? Yes ___ No X

Are Vegetation No , Soil No , or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS

	Yes	No	
Hydrophytic Vegetation Present?		X	Is the Sampled Area within a Wetland? Yes X No ___
Hydric Soil Present?		X	
Wetland Hydrology Present?	X		

Remarks:
Sample Point is at an excavated sedimentation pond. / pond is inundated / Pond is rectangular in shape / Culvert in adjacent road empties into this sedimentation pond

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1)
- X Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- X Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- X Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?	X		
Water Table Present?		X	
Saturation Present? (includes capillary fringe)	X		

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Standing water present withn sedimentation pond / obvious evidence of previous excavations / appears to be utilized for landfill activities / Limited to no vegetation present at sedimentation pond

VEGETATION (Four Strata) -- Use scientific names of plants.

Sampling Point: SP-10

Tree Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. N/A			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Sapling/Shrub Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. N/A			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Herb Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. N/A			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Woody Vine Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. N/A			
2.			
3.			
4.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Dominance Test worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 0 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 (1m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (If observed, list morphological adaptations below).

Pond inundated / No Vegtation present at pond / No canopy cover over Sediment pond.

SOIL

Sampling Point: SP-10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (Inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 4/3							Brown loamy clay

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, MS = Masked Sand Grains. [2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Organic Bodies (A6) **(LRR P, T, U)**
- ___ 5 cm Mucky Mineral (A7) **LRR P, T, U)**
- ___ Muck Presence (A8) **(LRR U)**
- ___ 1 cm Muck (A9) **(LRR P, T)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Coast Prairie Redox (A18) **(MRLA 150A)**
- ___ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) **(LRR P, S, T, U)**
- ___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ___ Thin Dark Surface (S9) **(LRR S, T, U)**
- ___ Loamy Mucky Mineral (F1) **(LRR O)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Marl (F10) **(LRR U)**
- ___ Depleted Ochric (F11) **(MLRA 151)**
- ___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ___ Umbric Surface (F13) **(LRR P, T, U)**
- ___ Delta Ochric (F17) **(MLRA 151)**
- ___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR O)**
- ___ 2 cm Muck (A10) **(LRR S)**
- ___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ___ Anomalous Bright Loamy Soils (F20) **(MLRA 153D)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if observed):
Type: ______
Depth (inches): ______

Hydric Soil Present? Yes x No ___

Remarks: The criteria for hydric soil have been met.

Standing Water present within sedimetation pond.

Data Form-9

WETLAND DETERMINATION DATA FORM - Atlantic and Gulf Coastal Plain Region

Project/Site: ±111-acre IESI TX Landfill Property City/County: Hardin County Sampling Date: 1-Oct-15

Applicant/Owner: IESI TX Landfill LP State: TX Sampling Point: SP-11

Investigator(s): Bear Aspra, Mitch Juenke Section, Township, Range: ___

Landform (hillslope, terrace, etc.): Stream bank Local relief (concave, convex, none): gently sloped Slope (%): 0

Subregion (LRR or MLRA): LLR T Lat: 30°20' 27.362"N Long: 94°21' 3.008"W Datum: NAD1983

Soil Map Unit Name: Jayhawker silt loam NWI Classification: N/A

Are climatic/hydrologic conditions on the site typical for this time of the year? Yes X No ___ (If no, explain in Remarks)

Are Vegetation No , Soil No , or Hydrology No significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation No , Soil No , or Hydrology No naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS

Hydrophytic Vegetation Present?	Yes X	No ___		
Hydric Soil Present?	Yes ___	No X	**Is the Sampled Area within a Wetland?**	**Yes** ___ **No** X
Wetland Hydrology Present?	Yes X	No ___		

Remarks:
Sample Point along Langston Branch, a well-defined stream within a mixed woodland. Although the area would not be considered a wetland it would be a regulated Water of the US. Approximate width of the ordinary high water mark is 5 feet with incised banks to 1 foot.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15) **(LRR U)**
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches): 4		
Water Table Present'	Yes ___	No X	Depth (inches): ___		
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___	**Wetland Hydrology Present?**	**Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:
No stream data. 2014 aerial orthoimagery reviewed.

Remarks:
Langston Branch has a well-defined bed-and-bank condition of approximately 4 feet wide. Some water was within Langston Branch at the time of the field investigation.

Data Form-9

VEGETATION (Four Strata) -- Use scientific names of plants.

Sampling Point: SP-11

Tree Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. *Pinus taeda*	15	Yes	FAC
2. *Fraxinus pennsylvanica*	25	Yes	FACW
3. *Quercus virginiana*	15	Yes	FACU
4. *Populus deltoides*	20	Yes	FAC
5.			
6.			
7.			
8.			
	75	= Total Cover	
50% of total cover:	37.5	20% of total cover:	15

Sapling/Shrub Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1. *Ilex vomitoria*	30	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	30	= Total Cover	
50% of total cover:	15	20% of total cover:	6

Herb Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Woody Vine Stratum (Plot size: 30ft)	Absolute % Cover	Dominant Species?	Indicator Staus
1.			
2.			
3.			
4.			
	0	= Total Cover	
50% of total cover:	0	20% of total cover:	0

Dominance Test worksheet

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80% (A/B)

Prevalence Index Worksheet

Total % Cover of:		Multiply by:
OBL species	x 1 =	
FACW species	x 2 =	
FAC species	x 3 =	
FACU species	x 4 =	
UPL species	x 5 =	
Column Totals	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

X 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 (1m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks: (If observed, list morphological adaptations below).

Langston Branch is situtated within a fairly dense mixed pine-hardwood woodland.

SOIL

Sampling Point: SP-11

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (Inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
N/A								

[1]Type: C = Concentration, D = Depletion, RM = Reduced Matrix, MS = Masked Sand Grains. [2]Location: PL = Pore Lining, M = Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5)
___ Organic Bodies (A6) **(LRR P, T, U)**
___ 5 cm Mucky Mineral (A7) **LRR P, T, U)**
___ Muck Presence (A8) **(LRR U)**
___ 1 cm Muck (A9) **(LRR P, T)**
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Coast Prairie Redox (A18) **(MRLA 150A)**
___ Sandy Mucky Mineral (S1) **(LRR O, S)**
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Dark Surface (S7) **(LRR P, S, T, U)**
___ Polyvalue Below Surface (S8) **(LRR S, T, U)**
___ Thin Dark Surface (S9) **(LRR S, T, U)**
___ Loamy Mucky Mineral (F1) **(LRR O)**
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Marl (F10) **(LRR U)**
___ Depleted Ochric (F11) **(MLRA 151)**
___ Iron-Manganese Masses (F12) **(LRR O, P, T)**
___ Umbric Surface (F13) **(LRR P, T, U)**
___ Delta Ochric (F17) **(MLRA 151)**
___ Reduced Vertic (F18) **(MLRA 150A, 150B)**
___ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

___ 1 cm Muck (A9) **(LRR O)**
___ 2 cm Muck (A10) **(LRR S)**
___ Reduced Vertic (F18) **(outside MLRA 150A,B)**
___ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
___ Anomalous Bright Loamy Soils (F20) **(MLRA 153D)**
___ Red Parent Material (TF2)
___ Very Shallow Dark Surface (TF12)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic

Restrictive Layer (if observed):
Type: ___
Depth (inches): ___

Hydric Soil Present? Yes ___ No X

Remarks: The criteria for hydric soil have not been met.

Since this was a flowing stream, a soil sample was not excavated at this point.

APPENDIX C

REPRESENTATIVE PHOTOGRAPHS

Photo 1 Perimeter Road, Permitted Landfill to the Left, Upland Woodlands to the Right

Photo 2 Typical Upland Pine Woodland Near SP5

Photo 3 Clear Cut Upland Spoil Located East of the Permitted Landfill

Photo 4 Herbaceous Wetland (W2)

Photo 5 Rectangular Sedimentation Pond Wetland W1

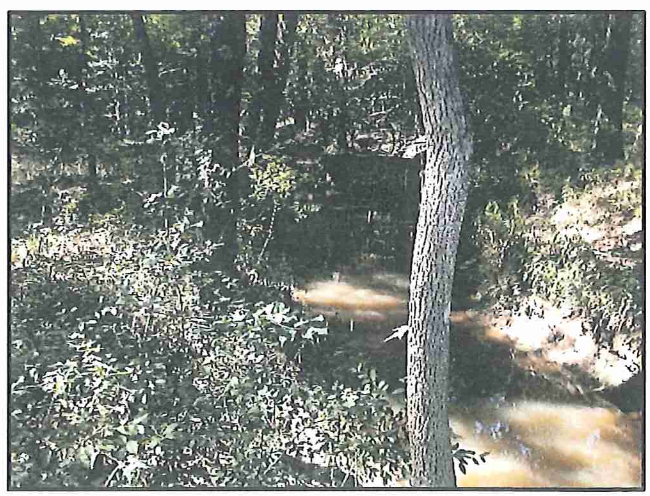


Photo 6 Langston Branch (5-Feet Wide) Located Offsite to the East

COORDINATION WITH U.S. DEPARTMENT OF THE INTERIOR, FISH AND WILDLIFE SERVICE (FWS)

CONTENTS

- December 21, 2016 WCG Response Letter to FWS.
- October 31, 2016 FWS Threatened or Endangered Species Assessment.

Weaver Consultants Group

Project No. 0771-365-11-05
December 21, 2016

Mr. Chuck Ardizzone, Field Supervisor
US Fish and Wildlife Service
17629 El Camino Real, Suite 211
Houston, Texas 77058

Re: Response to U.S. Fish and Wildlife Service (USFWS) Correspondence
Threatened or Endangered Species Assessment
Proposed IESI Hardin County Landfill Expansion
Hardin County, Texas

Dear Mr. Ardizzone:

Weaver Consultants Group, LLC (WCG) is in receipt of your response to our request for a Threatened or Endangered (T/E) Species Assessment. Your response included a copy of a February 1, 2016 USFWS letter describing the process for obtaining project-specific fish and wildlife resources from USFWS using the IPaC system. Our previously submitted (1995) T/E assessment had not utilized this system. However, in transmitting the original project assessment request to you we inadvertently had not included the results of a second T/E assessment for the project performed by Goshawk Environmental Consultants, Inc. (Goshawk), dated December 2, 2015. A copy of the 2015 T/E assessment is included as an attachment to this letter. We also have included a copy of your (guidance) letter dated February 1, 2016 as received by WCG. Finally, we have included a second copy of our October 31, 2016 request for assessment package.

As shown, the 2015 Goshawk T/E assessment utilized the IPaC system as the primary source of fish and wildlife resources related to the project property and Hardin County, concluding that:

> "Based on the reviewed literature, agency files, and observations made during the field investigation, it is highly unlikely any of the federally listed species would occur within the site or the surrounding area. Similarly, no state-listed species are known to occur on the site and none were identified during the field investigation."

Based on the additional information provided, WCG requests that USFWS provide a review letter that can be included in our permit application. Your assistance in this matter is sincerely appreciated. Please call if you have any questions or need additional information.

Sincerely,
Weaver Consultants Group, LLC

Nevzat Turan, P.E.
Senior Engineer

Attachments: T/E Species Habitat Assessment from Goshawk Environmental Consulting, Inc., dated December 3, 2015
Response Letter from USFWS, dated February 1, 2016
Original Request for T/E Determination by USFWS from WCG, dated October 31, 2016

cc: Brett O'Connor, IESI TX Landfill LP

THREATENED OR ENDANGERED SPECIES HABITAT ASSESSMENT
GOSHAWK ENVIRONMENTAL SERVICES, INC.
DECEMBER 3, 2015

3 December 2015

Joseph Vieceli
IESI TX Landfill LP
2301 Eagle Parkway, Ste. 200
Fort Worth, Texas 76177

Re: Threatened or Endangered Species Habitat Assessment
±111-Acre IESI TX Landfill LP Property
Hardin County, Texas

Dear Mr. Vieceli:

Goshawk Environmental Consulting, Inc. (Goshawk) conducted a Threatened or Endangered (T/E) species habitat assessment of the ±111-acre IESI TX Landfill LP Property in Hardin County, Texas. The assessment included a literature review and field investigation to evaluate the site for T/E species habitat and determine the likelihood of use by species.

1.0 INTRODUCTION

The site is located in the central portion of Hardin County approximately 3.4 miles southwest of Kountze, Texas (Attachment A, Figure 1). The site is comprised of the IESI Hardin County Landfill permit boundary (79.63 acres) and 31.34 acres of land adjacent to the eastern landfill permit boundary line. IESI Hardin County Landfill is a Type I municipal solid waste disposal facility currently permitted by the Texas Commission on Environmental Quality. The permitted landfill (TCEQ permit number: MSW-2214A) serves residences and businesses within Hardin County and surrounding communities. The site is located along the south frontage of Farm Road (FR) 770, approximately 0.6 mile west of its intersection with State Highway 326. The IESI Hardin County Landfill permit boundary includes a disposal area and narrow strip of undeveloped woodlands to the south. The adjacent land includes mostly undeveloped woodlands, however, IESI Hauling Operations is located along FR 770 in the northern portion.

2.0 LITERATURE REVIEW

Literature and agency file searches were conducted to identify the potential occurrence of any federally and/or state-listed T/E species or their potential habitat on the IESI TX Landfill LP Property. Map sources reviewed include the USGS 7.5 minute topographic quadrangle (Kountze South, Texas) and National Agriculture Imagery Program (NAIP) digital aerial orthoimagery (2014). Internet searches of the US Fish and Wildlife Service (USFWS) *Information, Planning and Conservation System* (IPaC) and Texas Parks and Wildlife Department (TPWD) County Lists of Protected Species and Species of Greatest Conservation Need were conducted for Hardin County. Information from the TPWD Texas Natural Diversity Database (TXNDD) was obtained and reviewed for the site.

2.1 TOPOGRAPHIC MAP

The USGS topographic Kountze South, Texas quadrangle (Attachment A, Figure 2) indicates the entire site as woodlands (green background), with the western portion more or less a flat hilltop with an elevation of 80 feet above mean sea level (AMSL). The site slopes downward toward Langston Branch which is located off site to the east. Elevation near the eastern site boundary is approximately 65 feet AMSL. No improvements are indicated within the site boundary; however, FR 770 is indicated along the northern site boundary.

2.2 Aerial Orthoimagery

The 2014 natural color aerial orthoimagery indicates the site is predominantly a solid waste landfill with undisturbed woodlands located south and east of the developed areas (Attachment A, Figure 3). Several structures/buildings and associated parking lot, with additional open area utilized for machinery/equipment parking are located between FR 770 and the disposal area. A perimeter road surrounding the disposal area is evident on the orthoimagery. An open water pond is indicated in the northwest corner of the site adjacent to the perimeter road. A larger pit, inundated with water, is evident within the south-central portion of the disposal area. Vegetation within the landfill is comprised of a tree line along the northern and western boundaries, and an area of minimal vegetation in the southwest corner. The woodlands south and east of the perimeter road appear to be stands of pine for timber. An area within the eastern woodland has been clear-cut of trees and appears to be dominated by herbaceous vegetation.

2.3 USFWS IPaC

An internet search of the USFWS IPaC was conducted to identify federally listed T/E species "that should be considered as part of an effects analysis" for the IESI TX Landfill LP Property (Attachment B). The federally listed T/E species in the IPaC Trust Resource Report for Hardin County include the least tern (*Sterna antillarum*), piping plover (*Charadrius melodus*), red knot (*Calidris canutus*), Red-cockaded Woodpecker (*Picoides borealis*), and Texas Trailing Phlox (*Phlox nivalis ssp.texensis*). Critical habitat for these species is not designated within the site or immediate area.

2.4 TPWD County List

The state listed T/E species on the TPWD County List of Protected Species and Species of Greatest Conservation Need for Hardin County accessed December 3, 2015 (Attachment C) include American peregrine falcon (*Falco peregrinus anatum*), Bachman's sparrow (*Aimophila aestivalis*), bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), piping plover, red-cockaded woodpecker, swallow-tailed kite (*Elanoides forficatus*), white-faced Ibis (*Plegadis chihi*), wood stork (*Mycteria americana*), blue sucker (*Cycleptus elongatus*), creek chubsucker (*Erimyzon oblongus*), paddlefish (*Polyodon spathula*), black bear (*Ursus americanus*), Louisiana black bear (*Ursus americanus luteolus*), Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), red wolf (*Canus rufus*), Louisiana pigtoe (*Pleurobema riddellii*), sandbank pocketbook (*Lampsilis satura*), southern hickorynut (*Obovaria jacksoniana*), Texas heelsplitter (*Potamilus amphichaenus*), Texas pigtoe (*Fusconaia askewi*), triangle pigtoe (*Fusconaia lananensis*), alligator snapping turtle (*Macrochelys temminkckii*), Louisiana pine snake (*Pituophis nuthveni*), northern scarlet snake (*Cemophora coccinea copei*), timber rattlesnake (*Crotalus horridus*), and Texas trailing phlox.

2.5 TPWD TEXAS NATURAL DIVERSITY DATABASE

Goshawk requested data from the TXNDD for the Kountze South, Texas quadrangle and surrounding areas. There are no recorded occurrences of federally listed or state listed T/E species within the site or immediate surrounding area.

3.0 FIELD INVESTIGATION

Goshawk conducted a field investigation on 1 October 2015 to assess the site for potential T/E species or their habitats. The area within the permit boundary was traversed on foot, as well as the woodland adjacent to the eastern boundary line. None of the federally listed T/E species were observed during the field investigation. The site conditions were generally consistent with those depicted on the aerial orthoimagery and described in Section 2.2.

The majority of the site is developed including an entrance road, perimeter road, gatehouse, storage areas, and disposal areas all associated with the permitted Municipal Solid Waste landfill. Heavy equipment was noted working in the disposal areas in the south-central portion of the landfill. Herbaceous vegetative cover existed over some of the disposal areas, however, no extensive vegetation was present within the immediate vicinity of the active pit. Regular activity occurs within developed portions of the site.

The woodlands to the south and east of the landfill are pine dominated woodlands. The predominant species is loblolly pine, however, sweetgum, water oak, red maple, Chinese tallow, and sweetbay occur within the canopy. Shrubs were comprised of saplings of the canopy species along with yaupon. The trees within this woodland appear to be relatively young, likely 20 years old or less.

There is an open herbaceous area within the woodlands located east of the landfill. This area appears to have been clearcut of trees and excavation for the landfill has been temporarily stored. Vegetation coverage is high and composed of mostly herbaceous species with a few shrubs and trees. Little bluestem, switchgrass, and goldenrod are the most common species present.

Adjacent properties to the west and south are similar pine woodlands as the woodland found on the site. There is a small clearing with a residential structure to the south. Additionally, a disturbed area north of FR 770 is evident. Numerous cleared right-of-ways are visible in the immediate vicinity of the site.

4.0 DISCUSSION AND FINDINGS

According to the USFWS IPaC, the least tern, piping plover, and red knot only need to be considered for wing related projects within the migratory route of these species. Although these migratory species occasionally stop over at points along their migration routes, use of the IESI TX Landfill LP Property would be unlikely due to the active disposal facility and frequent work activity. Further site development is highly unlikely to affect these species.

The red-cockaded woodpecker nests in open and mature pine forests selecting live pine trees that are infected with the red heart fungus. The red-cockaded woodpecker usually occupies territories from 60 acres to more than 600 acres depending on their population density. Red heart fungus typically affects mature pine trees (over 50 years old). The pine trees located at the site are approximately 20 years old, therefore, red heart fungus is not likely to exist at the site. It is highly unlikely that the red-cockaded woodpecker would utilize the site, therefore, would not be impacted by site development.

The Texas trailing phlox is presently known from less than twenty populations. Texas trailing phlox grows on sandy soils in open pine woodlands that are actively managed with fire. Although the site has some pine woodlands, the woodlands are not regularly maintained by fire. The shrub layer is relatively dense in some areas. Additionally, the site is underlain by predominately loamy soils. The suppression of fire and lack of sandy soils would likely preclude Texas trailing phlox from existing at the site.

State regulations prohibit the taking, possession, transportation, or sale of any state listed T/E species. Since Hardin County has the potential to support state listed T/E species care should be taken to avoid impacts. The state listed birds and mammals would have the ability to leave the site during active construction to avoid impacts. The fish (paddlefish, blue sucker, and creek chubsucker), mollusks (Texas pigtoe, triangle pigtoe, sandbank pocketbook, southern hickorynut, Louisiana pigtoe, and Texas heelsplitter), and alligator snapping turtle all require perennial water sources which do not exist at the site. However, the northern scarlet snake, Louisiana pine snake, and timber rattlesnake are ground-dwelling and relatively slow-moving, which makes them more susceptible to impacts by construction activities than are other state listed species. If these species are encountered during construction, direct impacts should be avoided.

5.0 SUMMARY

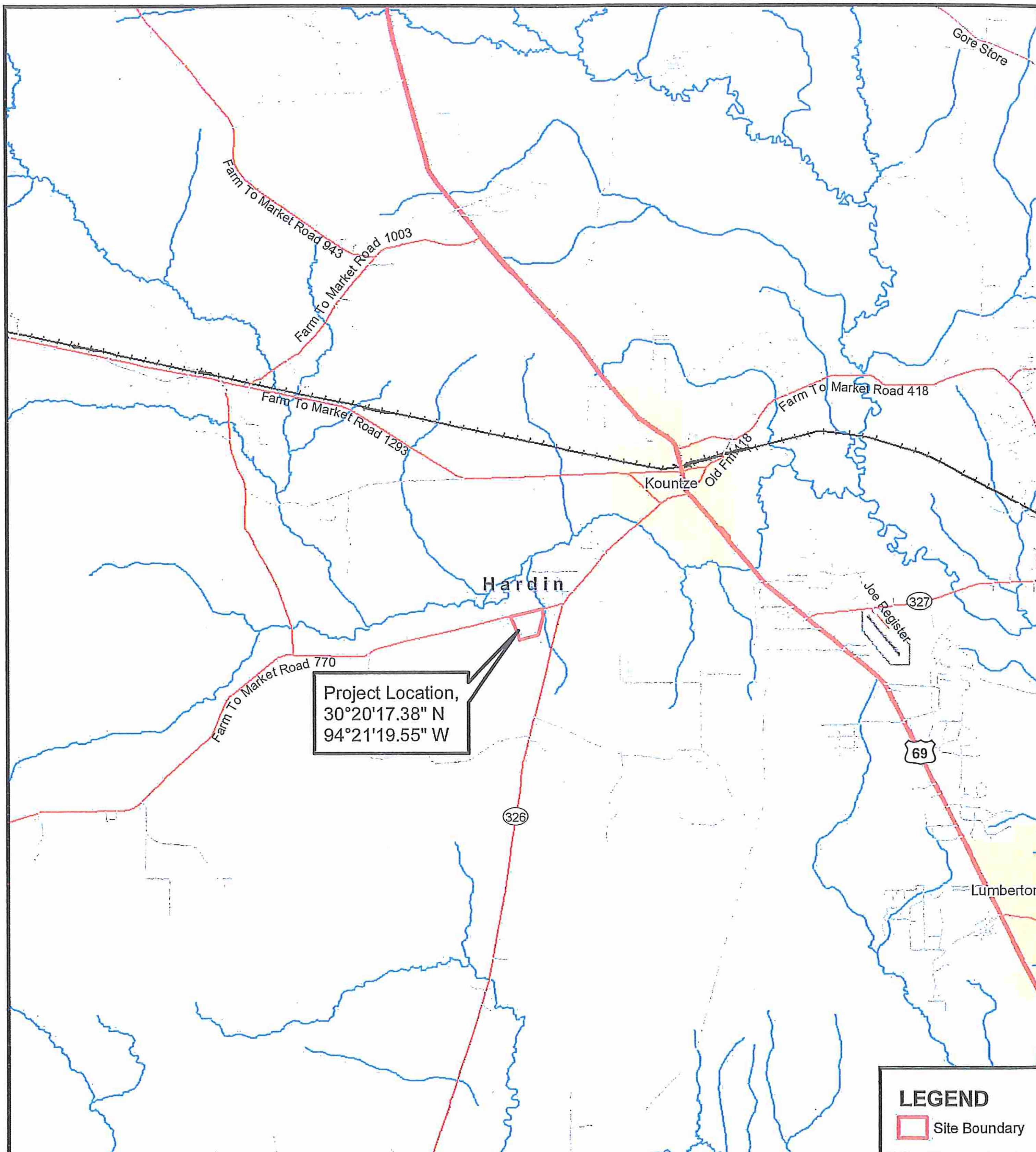
Based on the reviewed literature, agency files, and observations made during the field investigation, it is highly unlikely any of the federally listed species would occur within the site or the surrounding area. Similarly, no state-listed species are known to occur on the site and none were identified during the field investigation. If there are any questions or additional information is required, please contact our office.

Sincerely,

Zane N. Homesley
President

ATTACHMENT A

Figures



Source: ESRI, Maps & Data. 10.2
USA Base Map. 2013

0 1.5 3 Miles

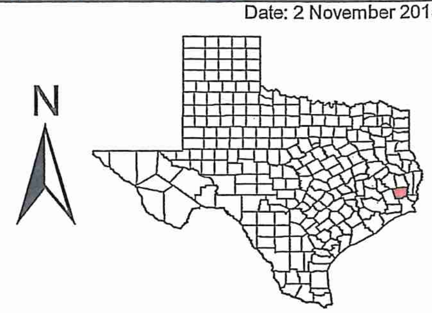
GOSHAWK ENVIRONMENTAL CONSULTING, INC.

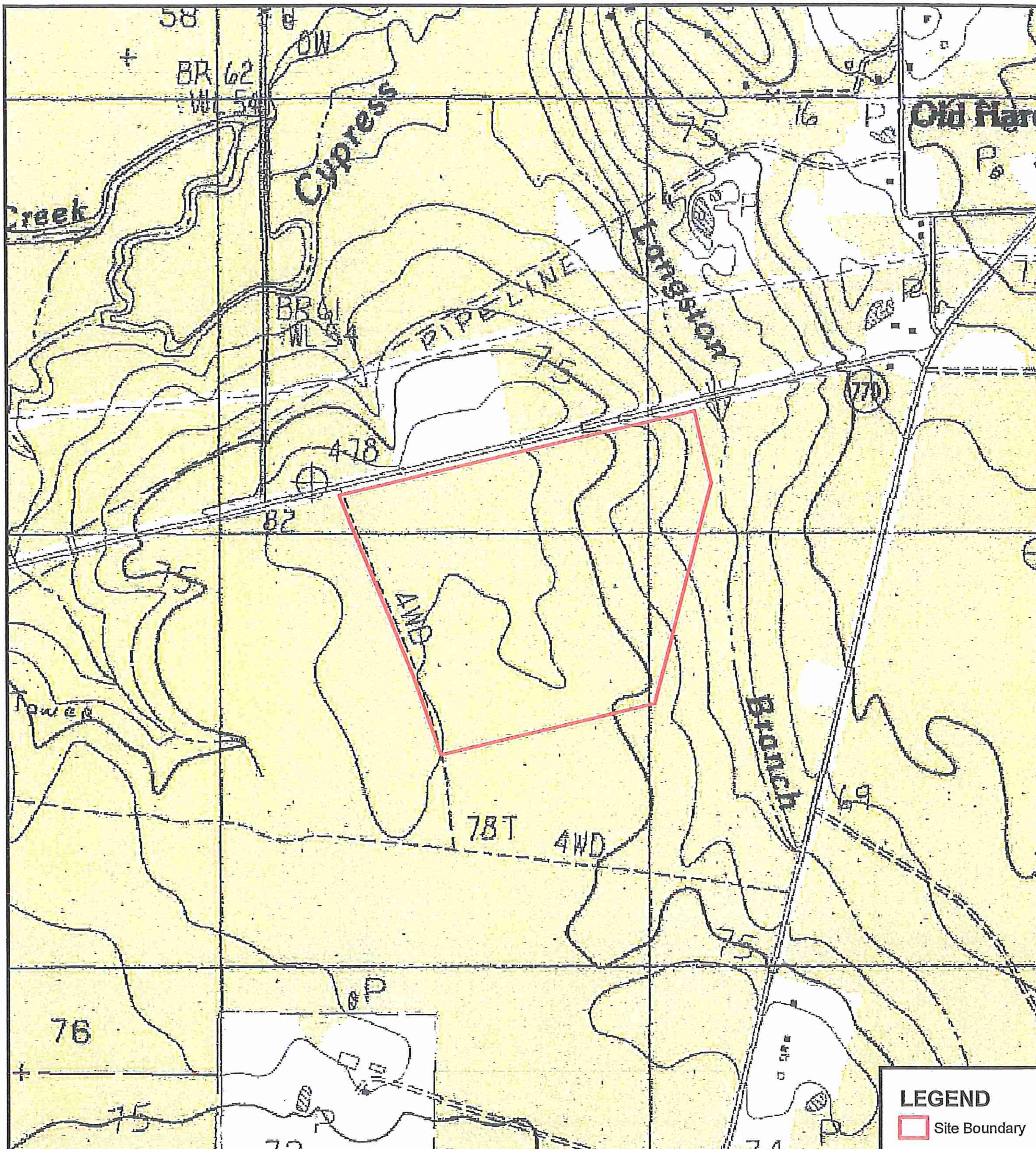
Figure 1
Vicinity Map
Hardin County, Texas

IESI TX Landfill LP Property

I/IIB-194

Date: 2 November 2015





Map Source: USGS, Kountze South, Texas Quadrangle.

Date: 2 November 2015

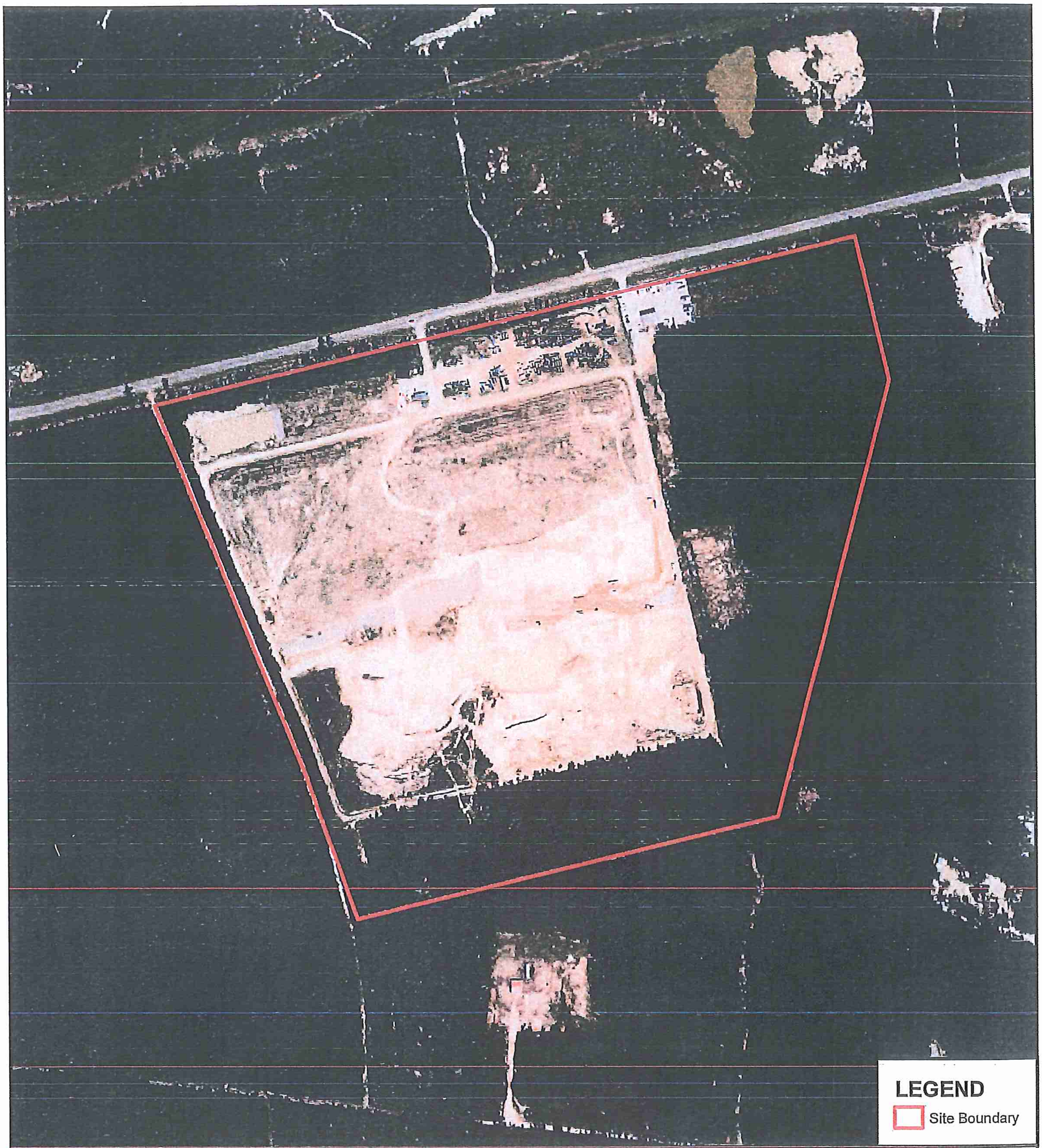
0 500 1,000 Feet

Figure 2
Topographic Map
Hardin County, Texas

IESI TX Landfill LP Property

N

GOSHAWK ENVIRONMENTAL CONSULTING, INC.



Map Source: USDA, 2014 NAIP Natural Color Imagery for Texas.

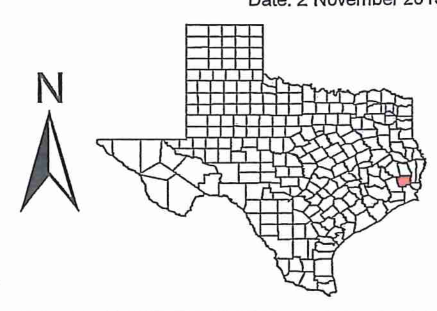
0 250 500 Feet

GOSHAWK ENVIRONMENTAL CONSULTING, INC.

Figure 3
Aerial Orthoimagery
Hardin County, Texas

IESI TX Landfill LP Property

Date: 2 November 2015



ATTACHMENT B

USFWS IPaC

IPaC Information for Planning and Conservation **U.S. Fish & Wildlife Service**

OVERVIEW DESIGN RESOURCES IMPACT ANALYSIS

REGULATORY DOCUMENTS

5 Endangered species

38 Migratory birds

Wildlife refuges

Wetlands

Endangered species

Proposed, candidate, threatened, and endangered species that are managed by the Endangered Species Program and should be considered as part of an effect analysis for this project.

Birds

Least Tern Sterna antillarum

Endangered

Conditional

Piping Plover Charadrius melodus

Threatened

Conditional

Red Knot Calidris canutus rufa

Conditional

Threatened

Red-cockaded Woodpecker Picoides borealis

Endangered

Flowering Plants

Texas Trailing Phlox Phlox nivalis ssp. texensis

Endangered

Critical habitats

Potential effects to critical habitat(s) within the project area must be analyzed along with the endangered species themselves.

THERE IS NO CRITICAL HABITAT WITHIN THIS PROJECT AREA

Migratory birds

Birds are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Any activity which results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service (1). There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

You are responsible for complying with the appropriate regulations

RELATED LINKS

Birds of Conservation Concern

Year-round bird occurrence data

Conservation measures for birds

for the protection of birds as part of this project. This involves analyzing potential impacts and implementing appropriate conservation measures for all project activities.

American Kestrel Falco sparverius paulus

Year-round

American Oystercatcher Haematopus palliatus

Year-round

Bachman's Sparrow Aimophila aestivalis

Year-round

Bald Eagle Haliaeetus leucocephalus

Year-round

Bewick's Wren Thryomanes bewickii ssp. bewickii

Season: Wintering

Black Rail Laterallus jamaicensis

Year-round

Black Skimmer Rynchops niger

Year-round

Brown-headed Nuthatch Sitta pusilla

Year-round

Burrowing Owl Athene cunicularia

Season: Wintering

Dickcissel Spiza americana

Season: Breeding

Fox Sparrow Passerella iliaca

Season: Wintering

Henslow's Sparrow Ammodramus henslowii

Season: Wintering

Hudsonian Godwit Limosa haemastica

Season: Migrating

Kentucky Warbler Oporornis formosus

Season: Breeding

Le Conte's Sparrow Ammodramus leconteii

Season: Wintering

Least Bittern Ixobrychus exilis

Season: Breeding

Lesser Yellowlegs Tringa flavipes

Season: Wintering

Little Blue Heron Egretta caerulea

Season: Breeding

Loggerhead Shrike Lanius ludovicianus

Year-round

Long-billed Curlew Numenius americanus

Season: Wintering

Louisiana Waterthrush Parkesia motacilla

Season: Breeding

Marbled Godwit Limosa fedoa

Season: Wintering

Orchard Oriole Icterus spurius

Season: Breeding

Painted Bunting Passerina ciris

Season: Breeding

Peregrine Falcon Falco peregrinus

Season: Wintering

Prairie Warbler Dendroica discolor

Season: Breeding

Prothonotary Warbler Protonotaria citrea

Season: Breeding

Red Knot Calidris canutus rufa

Season: Wintering

Red-headed Woodpecker Melanerpes erythrocephalus

Year-round

Rusty Blackbird Euphagus carolinus

Season: Wintering

Short-eared Owl Asio flammeus

Season: Wintering

Snowy Plover Charadrius alexandrinus

Season: Wintering

Swainson's Warbler Limnothlypis swainsonii

Season: Breeding

Swallow-tailed Kite Elanoides forficatus

Season: Breeding

Wilson's Plover Charadrius wilsonia

Season: Breeding

Wood Thrush Hylocichla mustelina

Season: Breeding

Worm Eating Warbler Helmitheros vermivorum

Seasons: Breeding, Migrating

Yellow Rail Coturnicops noveboracensis

Season: Wintering

Wildlife refuges

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. If your project overlaps or otherwise impacts a Refuge, please contact that Refuge to discuss the authorization process.

THERE ARE NO REFUGES WITHIN THIS PROJECT AREA

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes.

Project proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

Data limitations

Data exclusions

Data precautions

The area of this project is too large for IPaC to load all NWI wetlands in the area. The list below may be incomplete, or the acreages reported may be inaccurate. Please contact the local U.S. Fish & Wildlife office or visit the NWI map for a full list.

Freshwater Emergent Wetland

PEM1A	539.0 acres
PEM1C	214.0 acres
PEM1Ah	22.8 acres
PEM1F	19.6 acres
PEM1Fx	19.2 acres
PEM1Ad	6.84 acres
PEM1Cx	4.34 acres

PEM1Ax	1.42 acres
PEM1Ch	0.622 acre

Freshwater Forested/shrub Wetland

PFO1A	5300.0 acres
PFO1C	1000.0 acres
PSS1C	373.0 acres
PSS1A	272.0 acres
PFO1/4A	226.0 acres
PFO1/2F	162.0 acres
PFO4/1A	84.3 acres
PSS4A	81.4 acres
PFO4A	45.1 acres
PSS1F	15.6 acres
PFO1F	10.3 acres
PFO4C	9.37 acres

PSS4C	7.89 acres
PSS1Ad	6.78 acres
PSS1/2F	4.81 acres
PSS1Cd	4.55 acres
PFO2F	4.31 acres
PSS1/4C	3.72 acres
PFO1/4C	3.25 acres
PFO1Ch	2.82 acres

Freshwater Pond

PUBHx	61.9 acres
PUBFx	24.1 acres
PAB4Hx	7.14 acres
PUBHh	6.8 acres
PUBH	5.62 acres
PUBF	5.28 acres

PAB4Fx	3.9 acres
PUBFh	3.43 acres
PAB4F	3.42 acres
PUBKx	0.0919 acre

Other

PUSAx	20.7 acres
PUSAh	2.01 acres
PUSCx	1.66 acres
PUSCh	0.345 acre
PUSC	0.0983 acre

Riverine

R2UBH	4.07 acres
R2USA	1.61 acres

ATTACHMENT C

TPWD County List of Protected Species and Species of Greatest Conservation Need for Hardin County

Last Revision: 11/10/2015 5:42:00 PM

HARDIN COUNTY

BIRDS		Federal Status	State Status
American Peregrine Falcon	*Falco peregrinus anatum*	DL	T

year-round resident and local breeder in west Texas, nests in tall cliff eyries; also, migrant across state from more northern breeding areas in US and Canada, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Arctic Peregrine Falcon	*Falco peregrinus tundrius*	DL	

migrant throughout state from subspecies' far northern breeding range, winters along coast and farther south; occupies wide range of habitats during migration, including urban, concentrations along coast and barrier islands; low-altitude migrant, stopovers at leading landscape edges such as lake shores, coastlines, and barrier islands.

Bachman's Sparrow	*Aimophila aestivalis*		T

open pine woods with scattered bushes and grassy understory in Pineywoods region, brushy or overgrown grassy hillsides, overgrown fields with thickets and brambles, grassy orchards; remnant grasslands in Post Oak Savannah region; nests on ground against grass tuft or under low shrub

Bald Eagle	*Haliaeetus leucocephalus*	DL	T

found primarily near rivers and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds

Henslow's Sparrow	*Ammodramus henslowii*		

wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking

Peregrine Falcon	*Falco peregrinus*	DL	T

both subspecies migrate across the state from more northern breeding areas in US and Canada to winter along coast and farther south; subspecies (F. p. anatum) is also a resident breeder in west Texas; the two subspecies' listing statuses differ, F.p. tundrius is no longer listed in Texas; but because the subspecies are not easily distinguishable at a distance, reference is generally made only to the species level; see subspecies for habitat.

Piping Plover	*Charadrius melodus*	LT	T

wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats

Red-cockaded Woodpecker	*Picoides borealis*	LE	E

cavity nests in older pine (60+ years); forages in younger pine (30+ years); prefers longleaf, shortleaf, and loblolly

Sprague's Pipit	*Anthus spragueii*	C	

only in Texas during migration and winter, mid September to early April; short to medium distance, diurnal migrant; strongly tied to native upland prairie, can be locally common in coastal grasslands, uncommon to rare further west; sensitive to patch size and avoids edges.

HARDIN COUNTY

BIRDS		Federal Status	State Status
Swallow-tailed Kite	*Elanoides forficatus*		T

lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees

White-faced Ibis	*Plegadis chihi*		T

prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats

Wood Stork	*Mycteria americana*		T

forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960

FISHES		Federal Status	State Status
American eel	*Anguilla rostrata*		

coastal waterways below reservoirs to gulf; spawns January to February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; most aquatic habitats with access to ocean, muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries; diet varies widely, geographically, and seasonally

Blue sucker	*Cycleptus elongatus*		T

larger portions of major rivers in Texas; usually in channels and flowing pools with a moderate current; bottom type usually of exposed bedrock, perhaps in combination with hard clay, sand, and gravel; adults winter in deep pools and move upstream in spring to spawn on riffles

Creek chubsucker	*Erimyzon oblongus*		T

tributaries of the Red, Sabine, Neches, Trinity, and San Jacinto rivers; small rivers and creeks of various types; seldom in impoundments; prefers headwaters, but seldom occurs in springs; young typically in headwater rivulets or marshes; spawns in river mouths or pools, riffles, lake outlets, upstream creeks

Paddlefish	*Polyodon spathula*		T

prefers large, free-flowing rivers, but will frequent impoundments with access to spawning sites; spawns in fast, shallow water over gravel bars; larvae may drift from reservoir to reservoir

Western sand darter	*Ammocrypta clara*		

Red and Sabine River basins; clear to slightly turbid water of medium to large rivers that have moderate to swift currents, primarily over extensive areas of sandy substrate

HARDIN COUNTY

MAMMALS		Federal Status	State Status
Black bear	*Ursus americanus*	T/SA;NL	T

bottomland hardwoods and large tracts of inaccessible forested areas; due to field characteristics similar to Louisiana Black Bear (LT, T), treat all east Texas black bears as federal and state listed Threatened

Louisiana black bear	*Ursus americanus luteolus*	LT	T

possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas

Plains spotted skunk	*Spilogale putorius interrupta*		

catholic; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie

Rafinesque's big-eared bat	*Corynorhinus rafinesquii*		T

roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures

Red wolf	*Canis rufus*	LE	E

extirpated; formerly known throughout eastern half of Texas in brushy and forested areas, as well as coastal prairies

Southeastern myotis bat	*Myotis austroriparius*		

roosts in cavity trees of bottomland hardwoods, concrete culverts, and abandoned man-made structures

MOLLUSKS		Federal Status	State Status
Louisiana pigtoe	*Pleurobema riddellii*		T

streams and moderate-size rivers, usually flowing water on substrates of mud, sand, and gravel; not generally known from impoundments; Sabine, Neches, and Trinity (historic) River basins

Sandbank pocketbook	*Lampsilis satura*		T

small to large rivers with moderate flows and swift current on gravel, gravel-sand, and sand bottoms; east Texas, Sulfur south through San Jacinto River basins; Neches River

Southern hickorynut	*Obovaria jacksoniana*		T

medium sized gravel substrates with low to moderate current; Neches, Sabine, and Cypress river basins

Texas heelsplitter	*Potamilus amphichaenus*		T

quiet waters in mud or sand and also in reservoirs. Sabine, Neches, and Trinity River basins

Texas pigtoe	*Fusconaia askewi*		T

rivers with mixed mud, sand, and fine gravel in protected areas associated with fallen trees or other structures; east Texas River basins, Sabine through Trinity rivers as well as San Jacinto River

Triangle pigtoe	*Fusconaia lananensis*		T

mixed mud, sand, and fine gravel substrates; Neches River basin in the Angelina branch and possibly Village Creek

HARDIN COUNTY

REPTILES		Federal Status	State Status
Alligator snapping turtle	*Macrochelys temminckii*		T

perennial water bodies; deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October

Louisiana pine snake	*Pituophis ruthveni*	C	T

mixed deciduous-longleaf pine woodlands; breeds April-September

Northern scarlet snake	*Cemophora coccinea copei*		T

mixed hardwood scrub on sandy soils; feeds on reptile eggs; semi-fossorial; active April-September

Timber rattlesnake	*Crotalus horridus*		T

swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto

PLANTS		Federal Status	State Status
Chapman's orchid	*Platanthera chapmanii*		

in Texas, appears restricted to wetland pine savannas and savanna swales in hillside seepage bogs, two very restricted and declining habitats in the State; flowering July-August

Long-sepaled false dragon-head	*Physostegia longisepala*		

relatively open areas on poorly drained, acid loams on level terrain over Beaumont, Deweyville, and Montgomery formations; probably originally found in fire-maintained wetland pine savannas or in the transition zone between such flatwoods and adjacent coastal prairies, now found primarily in secondary habitats, such as wet borrow ditches along roadsides and moist areas in human-made clearings in pine woodlands; flowering early May-early July

Soxman's milkvetch	*Astragalus soxmaniorum*		

GLOBAL RANK: G3; Primarily in deep sandy soils of sandhills, fallow fields, and open scrub oak-pine woodlands; Perennial; Flowering March-June; Fruiting April-June

Texas screwstem	*Bartonia texana*		

in and around acid seeps in Pine-Oak forests on gentle slopes and baygall shrub thickets at spring heads; often on clumps of bryophytes at tree bases, on roots, and on logs; flowering September-November, can be identified in mid to late October when its in fruit

Texas trailing phlox	*Phlox nivalis ssp texensis*	LE	E

Texas endemic; relatively open fire-maintained pine or pine-hardwood forests on soils with a deep, sandy surface layer and clayey subsurface layers; flowering late March-early April (-May)

White firewheel	*Gaillardia aestivalis var winkleri*		

HARDIN COUNTY

PLANTS	Federal Status	State Status

Texas endemic; open pine-oak woodlands and farkleberry sandhills in deep, loose, well-drained whitish sands; flowering late spring (May-June) and sporadically through early fall

USFWS CORRESPONDENCE
FEBRUARY 1, 2016

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Texas Coastal Ecological Services Field Office
17629 El Camino Real, Suite 211
Houston, Texas 77058
281/286-8282 / (FAX) 281/488-5882

In Reply Refer To:
FWS/R2/TCESFO

February 1, 2016

Thank you for your request for threatened and endangered species, fish and wildlife, environmental, and/or aquatic resources information, comments, and/or recommendations within the United States Fish and Wildlife Service (Service) Texas Coastal Ecological Service's area (Houston Office) of responsibility.

In order to obtain information regarding fish and wildlife resources concerning a specific project or project area, we recommend that you first utilize the Service developed Information, Planning, and Conservation (IPaC) System. The IPaC system is designed for easy, public access to information about the natural resources for which the Service has trust or regulatory responsibility. Examples include threatened and endangered species, migratory birds, National Refuge lands, and National Wetlands Inventory wetlands. One of the primary goals of the IPaC system is to provide this information in a manner that assists people in planning their activities within the context of natural resource conservation. The IPaC system also assists people through the various regulatory consultation, permitting and approval processes administered by the Fish and Wildlife Service, helping achieve more effective and efficient results for both the project proponents and natural resources.

The IPaC system can be found at the following website address: http://ecos.fws.gov/ipac/ . Please note, by requesting an Official Species List you will receive an official consultation response letter and tracking number. If you still have questions concerning your project as it relates to fish and wildlife resources after visiting the IPaC system, please feel free to contact our office at the letterhead address above. We will be happy to assist you.

Sincerely,

Charles Ardizzone
Field Supervisor

Weaver Consultants Group

October 31, 2016
Project No. 0771-365-11-05

RECEIVED
NOV 01 2016
CLEAR LAKE ES
HOUSTON, TEXAS

Mr. Chuck Ardizzone, Field Supervisor
US Fish and Wildlife Service
17629 El Camino Real, Suite 211
Houston, Texas 77058

Re: Threatened or Endangered Species Assessment
Proposed IESI Hardin County Landfill Expansion
Hardin County, Texas

Dear Mr. Ardizzone:

The purpose of this letter is to demonstrate coordination with the US Fish and Wildlife Service, consistent with Title 30 Texas Administrative Code (TAC) §330.61(n)(2). This regulation requires that a permit applicant for an expansion of a municipal solid waste facility coordinate with the TPWD regarding locations and any specific data relating to threatened or endangered species.

Weaver Consultants Group, LLC is preparing a permit amendment application, under contract with IESI TX Landfill LP, to increase the capacity of the IESI Hardin County Landfill located southwest of the City of Kountze in central Hardin County. The landfill expansion will be limited to deepening a portion of the permitted landfill footprint, and vertically expanding the landfill footprint above currently permitted final grades. The amendment application will be submitted to the Texas Commission on Environmental Quality for review and approval before the landfill is expanded.

To assist you in your determination regarding threatened or endangered species or their critical habitat within or near the referenced project, please find attached (1) a project summary and site location maps, (2) previous agency correspondence, and (3) a site specific Endangered Species Survey completed as an element of the 1995 solid waste permit application.

The landfill was permitted in 1995 and has operated for over 20 years Most of the land within the landfill permit boundary has been disturbed by earth moving activities (e.g., landfill operations, cultivated fields and previous timber harvesting). Prior to being permitted as a landfill the property was used for timber cultivation, with most of the stumps and remnants from the timber harvesting having now been removed from the property. The attached project summary and site location maps provide description of the site location, currently permitted conditions, and the proposed expansion of the landfill.

ORIGINAL T/E ASSESSMENT REQUEST
WEAVER CONSULTANTS GROUP, LLC
OCTOBER 31, 2016

Weaver Consultants Group

October 31, 2016
Project No. 0771-365-11-05

Mr. Chuck Ardizzone, Field Supervisor
US Fish and Wildlife Service
17629 El Camino Real, Suite 211
Houston, Texas 77058

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Proposed IESI Hardin County Landfill Expansion
Hardin County, Texas

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Attached previous agency correspondence include a letter from the United States Department of the Interior – US Fish and Wildlife Service dated October 2, 1992, and a National Parks Service correspondence dated October 14, 1992. The US Fish and Wildlife Service correspondence states that based on review of US Fish and Wildlife Service files and the provided project maps "indicates that no federally listed threatened or endangered species are likely to occur at the project site." The second correspondence, which specifically addressed impacts to the Big Thicket National Preserve, concluded that the proposed landfill would cause no adverse impacts provided construction complied with current and future State and Federal regulations.

The third attached correspondence, from TPWD, concluded that a site-specific threatened or endangered species survey would be required for TPWD to make an assessment of the project. This survey (titled Endangered Species Survey for Proposed Hardin County Landfill, Southwestern Laboratories, Inc., May 7, 1993) was submitted as an attachment to the original solid waste permit for the landfill. The survey included both background and field studies of the property prior to landfill development, and concluded that there is "little likelihood that operation of the landfill at this site will have adverse biological consequences to any local population" of the sensitive species identified in the survey (pg. 2, 1993).

To verify compliance with §330.61(n)(2), we will need to include a review letter from US Fish and Wildlife Service within the permit application. Your assistance with this matter is sincerely appreciated. Please call if you have any questions or need additional information.

Sincerely,
Weaver Consultants Group, LLC

Nevzat Turan, P.E.
Senior Engineer

Attachments: Project Summary and Site Location Maps
October 1992 US Department of Interior Fish and Wildlife Service and National Parks Service Correspondence
February 1993 Texas Parks and Wildlife Department Correspondence
Endangered Species Survey, Southwestern Laboratories, Inc., May 7, 1993

cc: Brett O'Connor, IESI TX Landfill LP

PROJECT SUMMARY
AND
SITE LOCATION MAPS

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

10/31/2016

Project Summary
IESI Hardin County Landfill Expansion
Hardin County, Texas

Introduction

The IESI Hardin County Landfill is in the process of developing a major permit amendment application that will provide long-term disposal capacity for authorized solid waste that is generated in Hardin County and surrounding counties. The objective of this summary is to provide an overview of the proposed landfill expansion. The following subsections detail information regarding the owner and operator of the landfill, general site information, and a summary of the proposed landfill design.

Owner/Operator Information

The IESI Hardin County Landfill is owned and operated by IESI TX Landfill LP. IESI TX Landfill LP is a subsidiary of Waste Connections, Inc. Waste Connections is one of the leading providers of solid waste services in the nation. Waste Connections provides nonhazardous waste collection, transfer, recycling, and disposal services to residential, municipal, industrial and commercial customers across the country.

Site Information

The following drawings are attached to this summary.

- Figure 1 – Site Location Map. This drawing shows the site location on a standard TxDOT county highway map.
- Figure 2 – General Topographic Map. This drawing shows the permit boundary and permitted landfill footprint on a USGS map.
- Figure 3 – Aerial Photograph. This figure shows the permit boundary and permitted landfill footprint on an aerial photograph.
- Figure 4 – Permitted and Proposed Excavation Plan. This figure provides a comparison between the currently permitted landfill excavation plan and the proposed amended landfill excavation plan.

- Figure 5 – Permitted and Proposed Landfill Completion Plan. This figure provides a comparison between the currently permitted landfill completion plan and the proposed amended landfill completion plan.

The IESI Hardin County Landfill is an existing 79-acre Municipal Solid Waste (MSW) landfill (current TCEQ Permit No. MSW-2214A) located approximately 0.7 miles west of the intersection of FM 770 and SH 326 in central Hardin County.

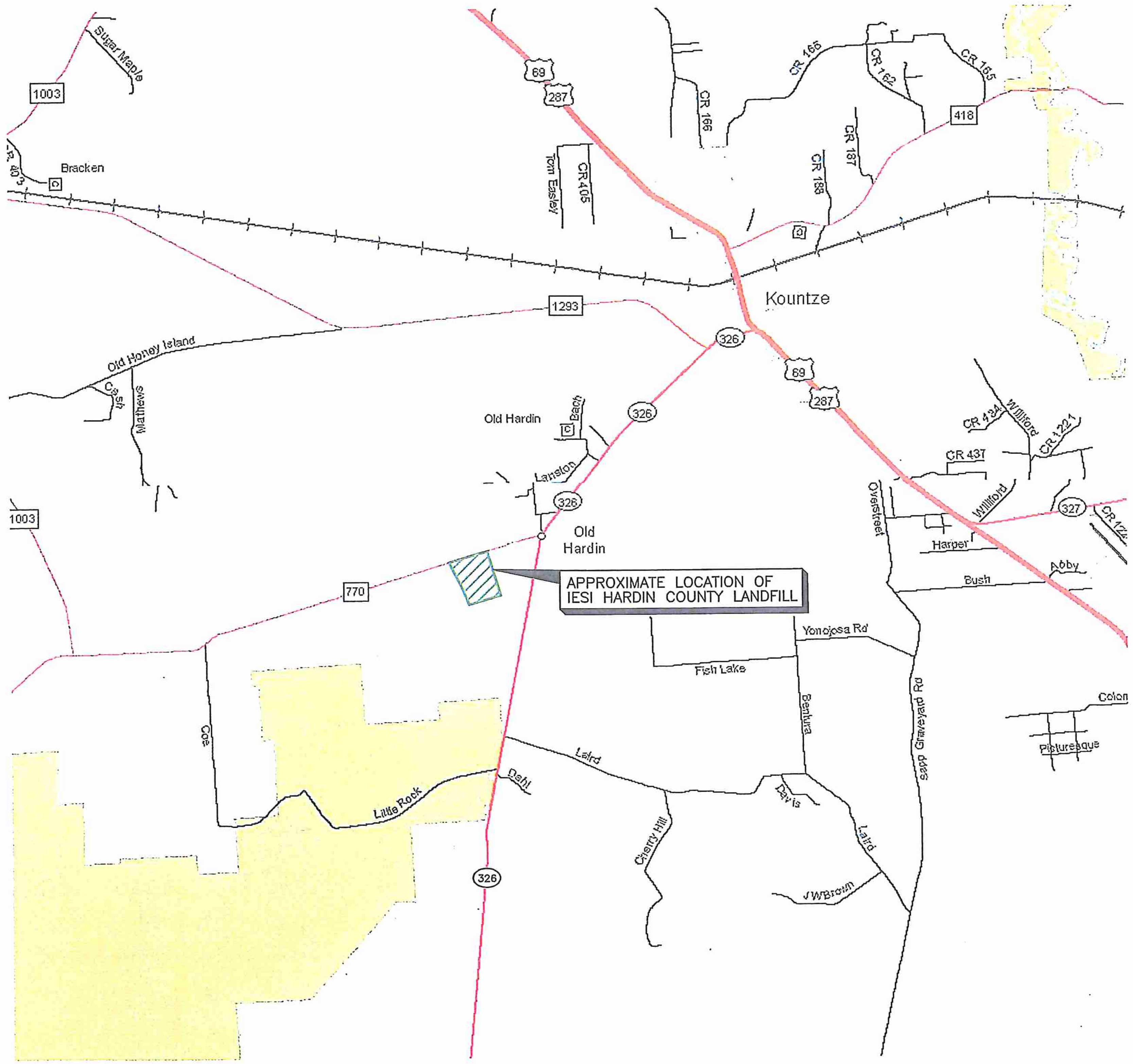
The site was originally permitted as a MSW landfill by the Texas Natural Resource Conservation Commission (TNRCC) in 1995. Approximately 32 acres of the 49.6-acre Subtitle D (i.e., composite bottom liner system) MSW disposal area has currently been developed. The facility also includes a 2.4-acre construction and demolition debris disposal unit, of which approximately 1.4 acres have been developed. The original permit number was Permit No. MSW-2214. The permit was transferred in 2002 from Hardin County to IESI TX Landfill LP.

Design Summary

The following information presents a summary of the design and operations for the proposed IESI Hardin County Landfill expansion:

- The IESI Hardin County Landfill is an existing municipal solid waste landfill facility (current TCEQ Permit No. MSW-2214A). The existing landfill currently serves residences and businesses in Hardin County and surrounding counties.
- With this expansion, the existing 79-acre permit boundary and existing 52-acre limits of waste will remain unchanged. The permitted but undeveloped waste disposal area will be deepened as shown on Figure 4, which shows both permitted top of protective cover grades (over constructed cells) and proposed excavation grades. The completion grades will be increased to optimize the disposal capacity of the permitted waste fill area. The currently permitted and proposed complete plans are shown on Figure 5.
- Accepted wastes will remain consistent with the current MSW landfill permit. The facility currently accepts municipal solid waste resulting from or incidental to municipal, community, commercial, institutional, and recreational activities; municipal solid waste resulting from construction and demolition activities; Class 2 and Class 3 nonhazardous industrial solid waste; and certain special wastes as permitted by the TCEQ. For this permit amendment cells 6 and 7 will be constructed in accordance with 30 TAC 335.590, and will accept Class 1 non-hazardous industrial waste in addition to the waste streams received by the landfill under the current permit.

- Access to the landfill will be provided via the existing site access road entrance off of FM 770. Based on travel patterns of existing landfill traffic, vehicles bound for the landfill will generally access the site using SH 326 and FM 770.
- A bottom liner system and final cover system that meet all regulatory requirements will be used for constructing the solid waste containment system. The design objective of the containment system (liner, leachate management system, and final cover) is to isolate the solid waste and remove leachate (defined as liquid that has contacted solid waste) that collects on the liner system. Leachate that is removed from the landfill is transported to an offsite, permitted treatment facility. The construction procedures of the liner system and final cover system follow strict TCEQ-approved quality control and quality assurance procedures, which are verified by an independent testing firm, and approved by a professional engineer licensed in the State of Texas. Liner construction is divided into approximately 3 to 4 acre "cells" across the permitted bottom of the landfill. Each of the containment system components must be approved by the engineer, and thoroughly reviewed and approved by the TCEQ before solid waste is placed into each constructed cell.
- To verify that the highest level of environmental protection is maintained, the following landfill monitoring systems are provided:
  - Groundwater Monitoring System. The purpose of the groundwater monitoring system is to verify the integrity of the containment system and demonstrate that area groundwater is not adversely impacted by the landfill. This is accomplished by obtaining water samples from the monitor wells, located on the perimeter of the landfill, which are screened to monitor groundwater quality. The water samples are tested at an offsite laboratory.
  - Gas Monitoring System. The purpose of the landfill gas monitoring system is to verify that landfill gas does not migrate beyond the permit boundary. Landfill gas probes are placed along the perimeter of the permit boundary.
  - These monitoring systems are sampled and tested periodically per the TCEQ-approved monitoring plans. The results are filed with the TCEQ and are public record.
- Site Operations. The site will be operated by properly trained personnel. A detailed Site Operating Plan will be included in the permit amendment application. The plan will detail the required equipment, personnel, and safety procedures required to operate the site in accordance with TCEQ regulations. The IESI Hardin County Landfill will continue to be inspected by the TCEQ on a regular basis to ensure the site is in compliance with state regulations and developed as permitted.



0 3000 6000
SCALE IN FEET

LEGEND

SITE LOCATION

NOTE:

1. MAP OBTAINED FROM TEXAS DEPARTMENT OF TRANSPORTATION DATED 2014.

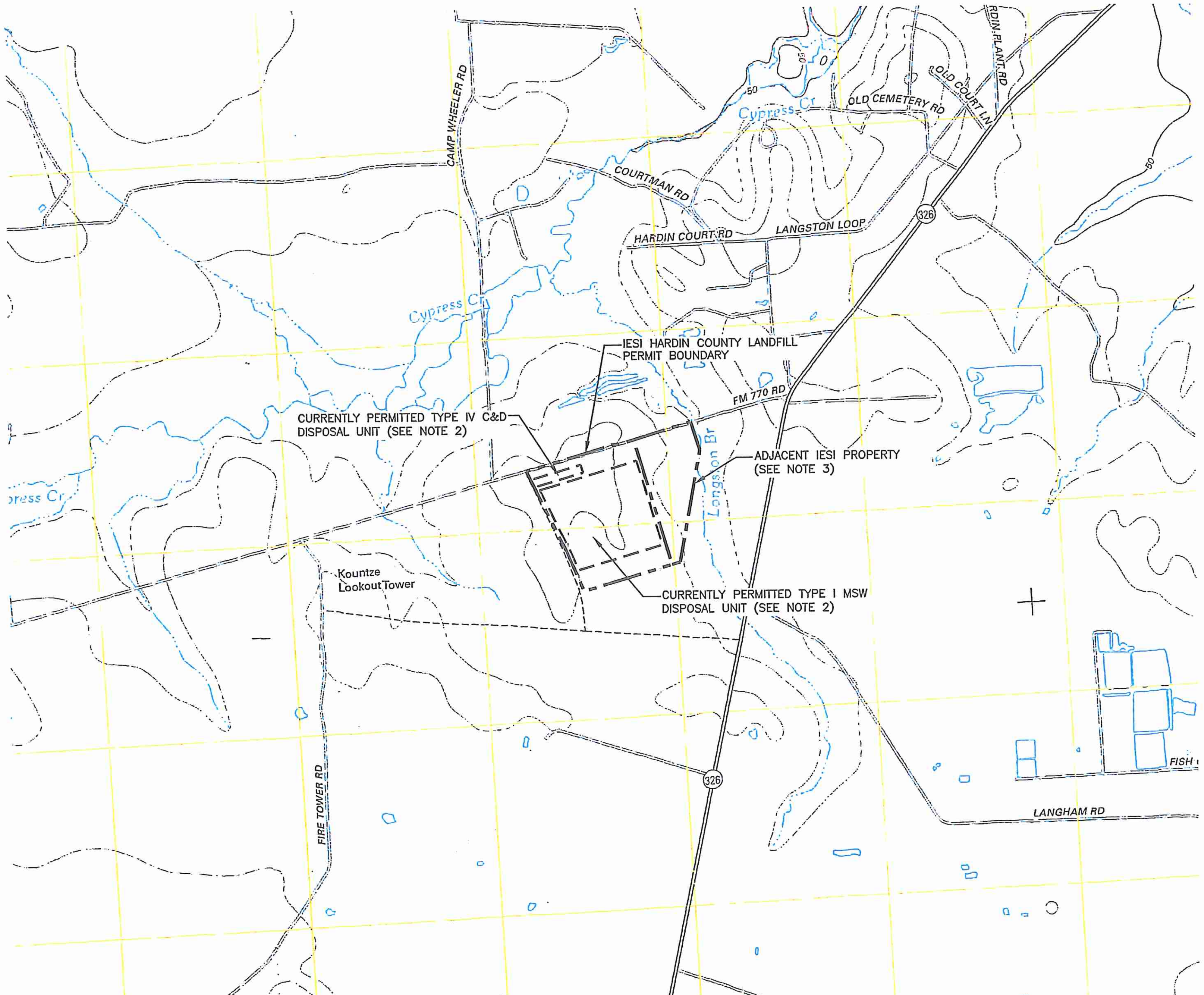
STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

10/31/2016

I/IIB-225

☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR IESI TX LANDFILL LP	MAJOR PERMIT AMENDMENT SITE LOCATION MAP
DATE: 10/2016 FILE: 0771-365-11 CAD: FIG 1-SITE LOCATION MAP.DWG DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. / DATE / DESCRIPTION	IESI HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group TBPE REGISTRATION NO. F-3727		WWW.WCGRP.COM / FIGURE 1

0:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 1-SITE LOCATION MAP.dwg, jwilson, 1:2



N

0 1000 2000
SCALE IN FEET

LEGEND

IESI PROPERTY BOUNDARY
PERMIT BOUNDARY
LIMITS OF WASTE

ROAD CLASSIFICATION

Interstate Route
US Route
Ramp
State Route
Local Road
4WD
Interstate Route
US Route
State Route

KOUNTZE SW, TX
2013

KOUNTZE SOUTH, TX
2013

NOTES:

1. ADAPTED FROM USGS 7.5 MINUTE QUADRANGLE TOPOGRAPHIC MAPS (KOUNTZE SOUTH, TX 2013 AND KOUNTZE SW, TX 2013).
2. THE FACILITY HAS TWO SEPARATE PERMITTED DISPOSAL UNITS. THE FIRST UNIT IS A TYPE I MUNICIPAL SOLID WASTE (MSW) DISPOSAL UNIT AND IT ENCOMPASSED APPROXIMATELY 49.6 ACRES. THE SECOND PERMITTED UNIT IS A 2.4 ACRE TYPE IV CONSTRUCTION AND DEMOLITION (C&D) DISPOSAL UNIT.
3. THE ADJACENT IESI PROPERTY IS APPROXIMATELY 31.3 ACRES. THIS PROPERTY WILL NOT BE JOINED TO THE DISPOSAL AREA; HOWEVER, A RESTRICTIVE COVENANT MAY BE OBTAINED FOR A PORTION OF THIS AREA FOR LANDFILL-RELATED DRAINAGE FACILITIES.

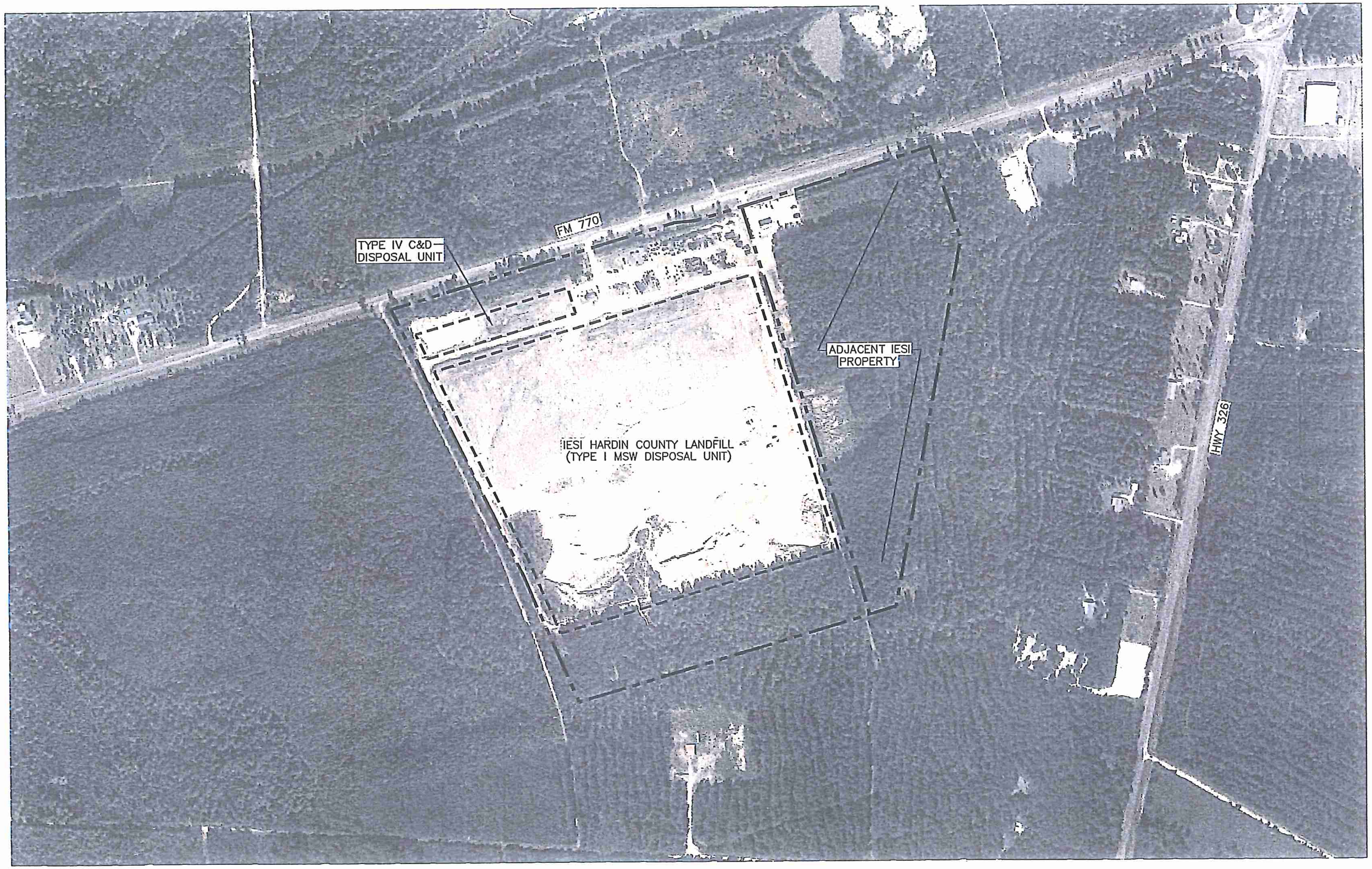
I/IIB-226

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

10/31/2016

☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR IESI TX LANDFILL LP	MAJOR PERMIT AMENDMENT GENERAL TOPOGRAPHIC MAP
DATE: 10/2016 FILE: 0771-365-11 CAD: FIG 2-GENERAL TOPO MAP.DWG DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. / DATE / DESCRIPTION	IESI HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group TBPE REGISTRATION NO. F-3727		WWW.WCGRP.COM / FIGURE 2

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 2-GENERAL TOPO MAP.dwg, jwilson, 1:2



N

0 300 600
SCALE IN FEET

LEGEND

IESI PROPERTY BOUNDARY
PERMIT BOUNDARY
LIMITS OF WASTE

NOTE:

1. AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH AND DATED 2016.

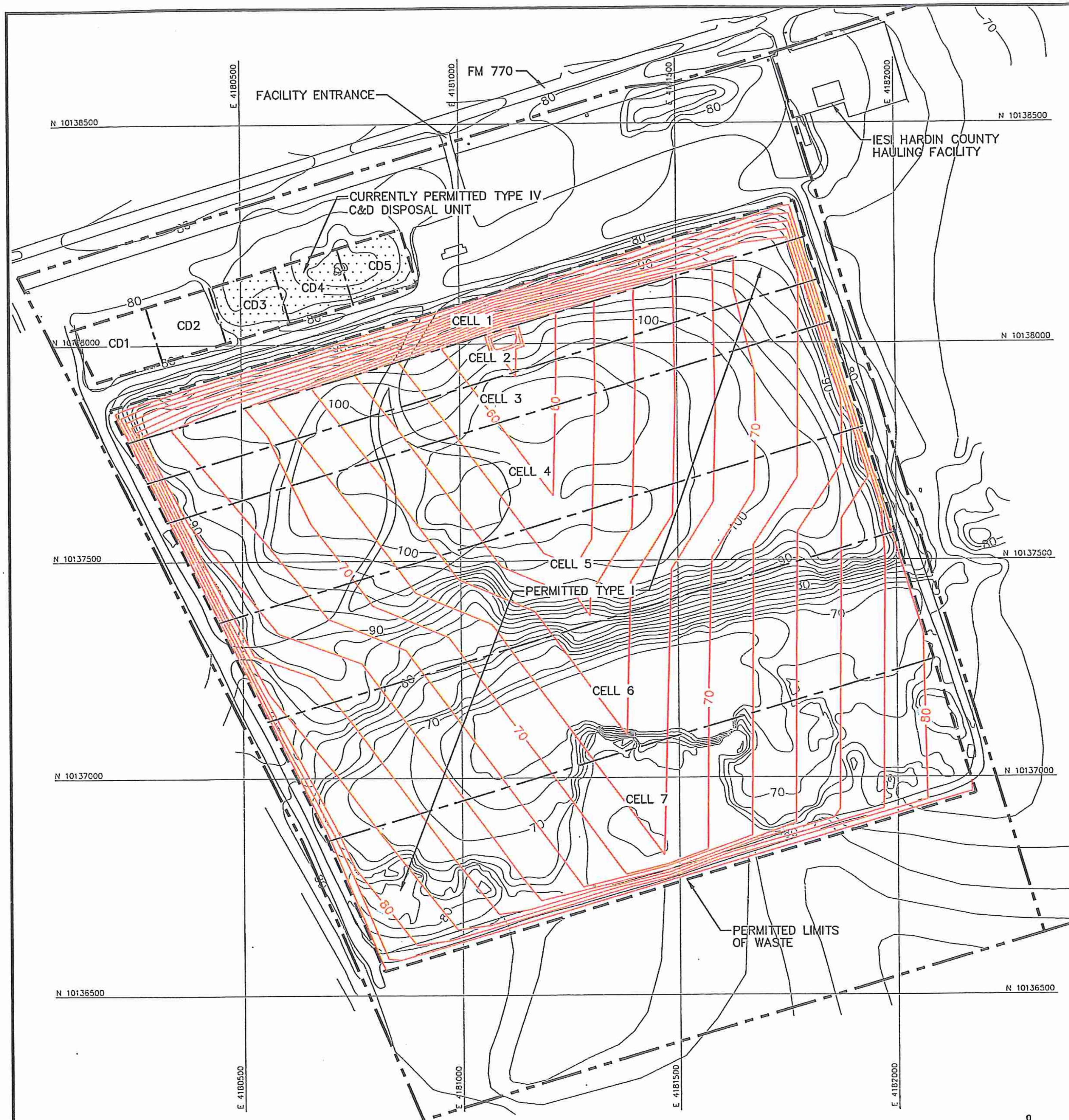
STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED PROFESSIONAL ENGINEER

10/31/2016

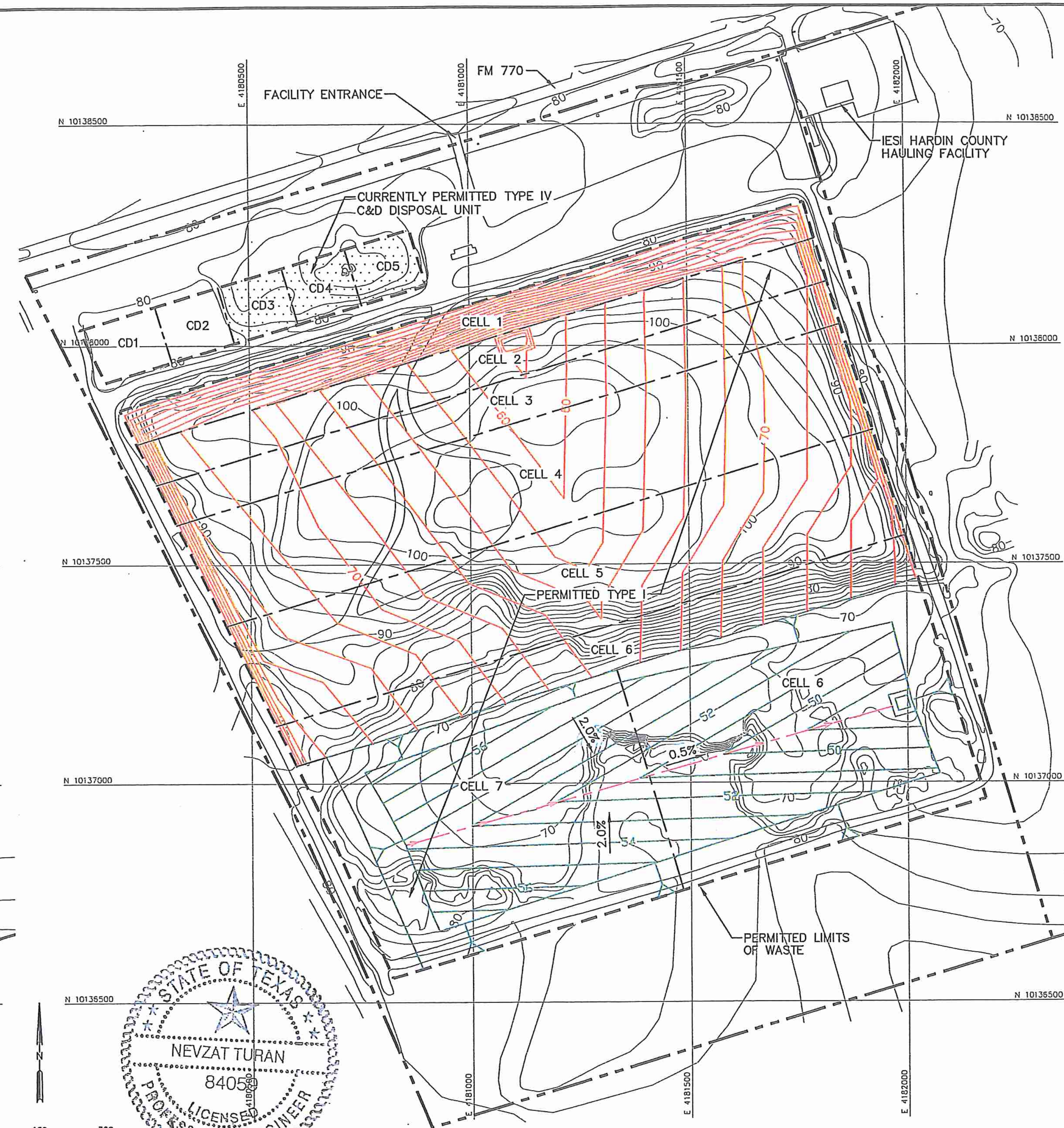
I/IIB-227

☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR IESI TX LANDFILL LP		MAJOR PERMIT AMENDMENT AERIAL PHOTOGRAPH
DATE: 10/2016 FILE: 0771-365-11 CAD: FIG 3-AERIAL PHOTOGRAPH.DWG	DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. / DATE / DESCRIPTION	IESI HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group TBPE REGISTRATION NO. F-3727			WWW.WCGRP.COM — FIGURE 3

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 3-AERIAL PHOTOGRAPH.dwg, jwilson, 1:2



CURRENTLY PERMITTED CONDITIONS PLAN



0 150 300
SCALE IN FEET

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER
10/31/2016

PROPOSED EXCAVATION PLAN

I/IIB-228

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CONTOURS FOR THE CURRENTLY PERMITTED CONDITIONS PLAN REPRESENT THE TOP OF LINER PROTECTIVE COVER CONTOURS WHICH ARE 4 TO 5 FEET ABOVE THE EXCAVATION GRADES. THE PROPOSED EXCAVATION PLAN CONTOURS WERE DEVELOPED BY WEAVER CONSULTANTS GROUP AS PART OF THE DESIGN BASIS MEMORANDUM FOR THE PROPOSED MAJOR AMENDMENT APPLICATION.
3. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.

LEGEND

	IESI EAST PROPERTY BOUNDARY
	PERMIT BOUNDARY
	PERMITTED LIMITS OF WASTE
	PROPOSED LIMITS OF WASTE
	CELL BOUNDARY
70	EXISTING CONTOUR (SEE NOTE 1)
N 10137000	STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
60	PERMITTED TOP OF PROTECTIVE COVER CONTOUR (SEE NOTE 2)
60	PROPOSED EXCAVATION CONTOUR (SEE NOTE 2)
	LEACHATE LINE

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

PREPARED FOR
IESI TX LANDFILL LP

DATE: 10/2016
FILE: 0771-365-11
CAD: FIG 4-EXCAVATION PLAN COMP.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

REVISIONS

NO.	DATE	DESCRIPTION

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

MAJOR PERMIT AMENDMENT
PERMITTED AND PROPOSED
EXCAVATION PLAN

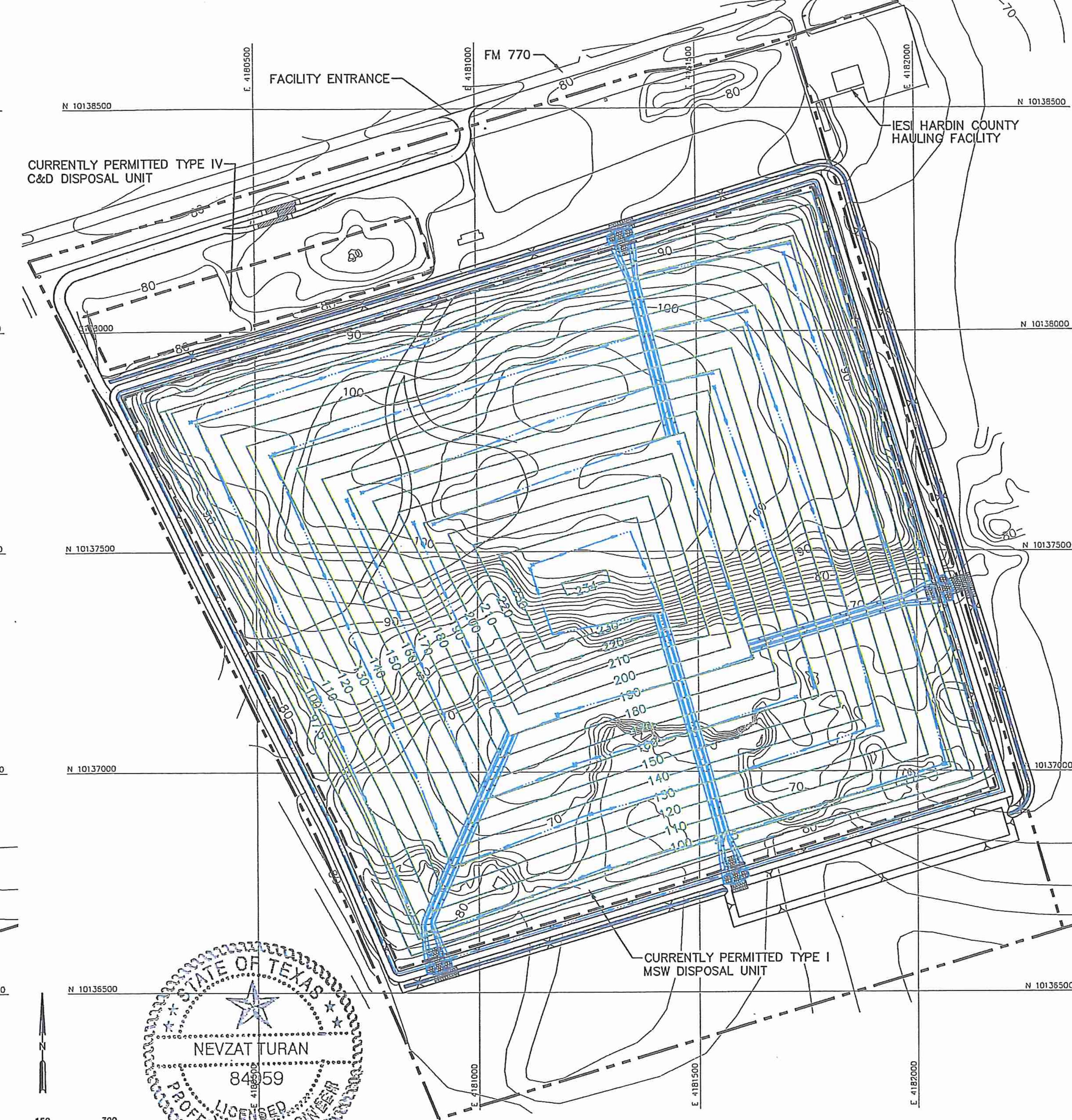
IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

WWW.WCGRP.COM

FIGURE 4

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 4-EXCAVATION PLAN COMPARISON.dwg, jwilson, 1:2

PERMITTED COMPLETION PLAN



STATE OF TEXAS
NEVZAT TURAN
84559
LICENSED PROFESSIONAL ENGINEER

10/31/2016

PROPOSED COMPLETION PLAN

0 150 300
SCALE IN FEET

N

I/IIB-229

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. PERMITTED COMPLETION PLAN FINAL COVER CONTOURS ARE OBTAINED FROM 2010 HARDIN COUNTY LANDFILL MSW PERMIT NO. 2214A. THE PROPOSED PERMITTED COMPLETION PLAN FINAL COVER CONTOURS WERE DEVELOPED BY WEAVER CONSULTANTS GROUP AS PART OF THE DESIGN BASIS MEMORANDUM FOR THE PROPOSED MAJOR AMENDMENT APPLICATION.
3. THE PROPOSED COMPLETION PLAN DRAINAGE STRUCTURES ARE SHOWN FOR INFORMATIONAL PURPOSES. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.

LEGEND

	IESI PROPERTY BOUNDARY
	PERMIT BOUNDARY
	CURRENTLY PERMITTED LIMITS OF WASTE
70	EXISTING CONTOUR (SEE NOTE 1)
N 10137000	STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
220	FINAL COVER CONTOUR (SEE NOTE 2)
	PROPOSED DRAINAGE SWALE
	PROPOSED DRAINAGE CHUTE

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 10/2016
FILE: 0771-365-11
CAD: FIG 4-COMPLETION PLAN COMP.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
IESI TX LANDFILL LP

REVISIONS

NO.	DATE	DESCRIPTION

MAJOR PERMIT AMENDMENT
PERMITTED AND PROPOSED COMPLETION PLAN

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

WWW.WCGRP.COM

FIGURE 5

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 5-COMPLETION PLAN COMPARISON.dwg, jwilson, 1:2

OCTOBER 1992
DEPARTMENT OF INTERIOR CORRESPONDENCE

PROTECTION OF ENDANGERED SPECIES

The United States Department of the Interior Fish and Wildlife Service and the Texas Parks and Wildlife Department were contacted to determine what endangered species might habitat the area. Both sources indicated that this site posed no threat of taking, harassing, or harming endangered species or their critical habitats for those known to exist in the general area. To insure that the proposed landfill would not take, harass, or harm any endangered species, a consultant was retained through Southwestern Laboratories to assess the site. Through their investigations, it was found that no endangered species would be negatively affected by development of this site as proposed. Copies of correspondence with government agencies and the consultant's report are included on the following pages of this report.

KSA ENGINEERS, INC.

HN-002

NATIONS BANK BLDG.
415 S. FIRST ST., SUITE 270
P.O. BOX 1605
LUFKIN, TEXAS 75902-1605
(409) 637-6061
FAX (409) 632-9256

September 21, 1992

Ms. Edith Erfling
United States Fish and Wildlife Service
17629 El Camino Real Suite 211
Houston, Texas 77058

RE: Proposed Hardin County Landfill Site and possible impact on local plants and wildlife.

Dear Ms. Erfling,

As per our conversation today, I am writing to inform you of the proposed location for the new Hardin County Landfill and inquire of any adverse impact this location might present to any endangered species of plants or animals in Hardin County.

KSA Engineers has been retained by Hardin County to aid them in the application for a state landfill permit from the Texas Water Commission. The design of the landfill itself will follow current and expected state and federal regulations. Following these regulations will provide for the protection of the environment surrounding the site through use of a composite liner, a quality control plan, and a thorough operations plan.

The proposed 79 acre site for this landfill is located on the south side of FM 770 about one-half mile west of FM 326.. More generally, the site is located approximately 3 miles southwest of Kountze, 1 mile north of the Big Thicket Lance Rosier Preserve, and directly across FM 770 from Hardin County's existing landfill. Enclosed with this letter are maps which illustrate the location of the proposed landfill site.

This site, until recently, has been used for the commercial production of pine trees. The last stand of trees which was grown at this site has been clear-cut and efforts are currently underway to begin the removal of the remaining stumps. Surrounding the site is a mixture of forested and cultivated lands. Over a mile to the south of the site are other timberlands in various stages of production.

It is important to us that this site be a benefit to the community. We are interested in a landfill which will provide Hardin County with a place to dispose of its solid waste without negatively affecting the surrounding environment. If you will, please review this letter and the enclosed site location maps, considering potential concerns with respect to the local plants and wildlife, especially those listed as endangered. Having reviewed this information, we then request that you write us with any comments that you may have about the project and its potential impact on the endangered species in the area.

If you have any questions that are not addressed in this letter, please feel free to call me, or our Lufkin Branch Manager, Billy Sims at (409) 637-6061. We look forward to hearing from you.

Sincerely,

KSA Engineers, Inc.

Lonnie Sikes /kat

Lonnie Sikes,
Design Engineer

Enclosures

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
Division of Ecological Services
17629 El Camino Real, Suite 211
Houston, Texas 77058

October 14, 1992

Lonnie Sikes
KSA Engineers, Inc.
Nations Bank Bldg.
P.O. Box 1605
Lufkin, Texas 75902-1605

Dear Mr. Sikes:

This responds to your September 21, 1992 letter requesting information on federally listed species or those proposed to be listed as threatened or endangered which may be in your project area. The proposed project involves a new landfill to be located on the south side of FM 770 about one-half mile west of FM 326 in Hardin County, Texas.

A review of U.S. Fish and Wildlife Service files and your project maps indicates that no federally listed threatened or endangered species are likely to occur at the project site.

If we can be of further assistance, please contact Edith Erfling at (713) 286-8282.

Sincerely,

Kenneth D. Frazier

Kenneth D. Frazier
Acting Chief, Regulatory Activities

KSA ENGINEERS, INC.

HN-002

NATIONS BANK BLDG.
415 S. FIRST ST., SUITE 270
P.O. BOX 1605
LUFKIN, TEXAS 75902-1605
(409) 637-6061
FAX (409) 632-9256

September 21, 1992

Mr. Ronald R. Switzer
Superintendent of Big Thicket Preserve
3785 Milam
Beaumont, Texas 77701

RE: Proposed Hardin County Landfill Site and possible impact on Big Thicket Preserve

Dear Mr. Switzer,

As referenced by Ranger Mike Livingston, I am writing to inform you of the proposed location for the new Hardin County Landfill and inquire of any adverse impact this location might present to the Big Thicket Preserve.

KSA Engineers has been retained by Hardin County to aid them in the application for a state landfill permit from the Texas Water Commission. The design of the landfill itself will follow current and expected state and federal regulations. Following these regulations will provide for the protection of the environment surrounding the site through use of a composite liner, a quality control plan, and a thorough operations plan.

The proposed 79 acre site for this landfill is located on the south side of FM 770 about one-half mile west of FM 326. More generally, the site is located approximately 3 miles southwest of Kountze, 1 mile north of the Big Thicket Lance Rosier Preserve, and directly across FM 770 from Hardin County's existing landfill. Enclosed with this letter are maps which illustrate the location of the proposed landfill site.

This site, until recently, has been used for the commercial production of pine trees. The last stand of trees which was grown at this site has been clear-cut and efforts are underway to begin the removal of the remaining stumps. Surrounding the site are other timberlands in various stages of production.

It is important to us that this site be a benefit to the community. We are interested in a landfill which will provide Hardin County with a place to dispose of its solid waste without negative effects to the surrounding environment, which includes the Big Thicket Preserve. If you will, please review this letter and the enclosed site location maps, considering potential concerns with respect to the Big Thicket Preserve. Having reviewed this information, we then request that you write us with any comments that you may have about the project as they relate to the Preserve.

If you have any questions that are not addressed in this letter, please feel free to call me, or our Lufkin Branch Manager, Billy Sims at 409/637-6061. We look forward to hearing from you.

Sincerely,

KSA Engineers, Inc.

Lonnie Sikes /kab

Lonnie Sikes,
Design Engineer

Enclosures

United States Department of the Interior

TAKE PRIDE IN AMERICA

NATIONAL PARK SERVICE
Big Thicket National Preserve
3785 Milam
Beaumont, Texas 77701

IN REPLY REFER TO:

N16(BITH)

October 2, 1992

Mr. Lonnie Sikes, Design Engineer
KSA Engineers, Inc.
Nations Bank Building
415 S. First St., Suite 270
P.O. Box 1605
Lufkin, TX 75902-1605

Dear Mr. Sikes:

Thank you for your letter of September 21, 1992, regarding the proposed Hardin County Landfill Site and its possible impact on the Big Thicket National Preserve (Big Thicket). After a review of your letter, accompanying maps, and information in our files pertaining to drainage patterns and other resource concerns, we have determined that your proposed landfill should not pose any problems for the Big Thicket provided the design of the landfill and its construction comply with all current and future State and Federal regulations as you have suggested.

Again, we appreciate your informing us of your proposed actions and would appreciate being kept apprised of your construction activities as construction of the Hardin County Landfill progresses. Any future correspondence on this or other resource concerns may be directed to Richard Strahan of the Resources Management Division at either the above address or telephone number (409) 839-2689.

Sincerely,

Ronald R. Switzer

Ronald R. Switzer
Superintendent

OCT 5 1992

FEBRUARY 1993
TEXAS PARKS AND WILDLIFE CORRESPONDENCE

TEXAS
PARKS AND WILDLIFE DEPARTMENT
4200 Smith School Road • Austin, Texas 78744 • 512-389-4800

ANDREW SANSOM
Executive Director

MAR 3 1993

February 19, 1993

Mr. Lonnie Sikes
KSA Engineers, Inc.
Nations Bank Bldg.
415 S. First St., suite 270
Lufkin, Texas 75902-1605

RE: Preliminary Application Report, Proposed Hardin County Landfill site

Dear Mr. Sikes:

The Environmental Quality Branch of the Texas Parks and Wildlife Department (TPWD) acknowledges receipt of the premliminary solid waste landfill permit application for the proposed Type I landfill site in Hardin County. The following is submitted in response to your request for comments on the proposed site.

You state that a review and comment letter from the TPWD is needed before the referenced site can be given formal consideration by the Texas Water Commission (TWC). After having discussed the matter with Robert Sims, Municipal Solid Waste Division, TWC-Austin, it was stated that, when required by the TWC, it is part of the scope and responsibility of the applicant to address any site or operating concerns when submitting a permit application. It is also the applicant's responsibility to conduct or contract out services including site investigations to determine any detrimental effects or impacts related to the proposed facility using the best available data or information. In the proposed application, some contacts and information related to endangered species and habitat regimes have been provided to you by the TPWD to be addressed in the permit application.

However, it is not the responsibility of the TPWD to make the assessment for the applicant. Comments based on information and data provided by the TPWD should be coordinated with actual site investigations conducted by the applicant or their designated representative.

In this instance, the TWC related to us that the preliminary application does not specify the status of biological or environmental features, or components, of the site except list the general occurrences of fauna and flora for the region described as given to you by the Department. The occurrence or absence of sensitive organisms, or the impact to sensitive biological communities, can only be documented by on-site investigations, a task to be performed by the applicant. The Department is interested in reviewing those findings as they are incorporated into the application. Consequently, to comment on those issues without specific familiarity with the actual site would be of little value at this time.

For your information, a preliminary review by the Habitat Assessment Program staff of TPWD indicates no perceived problems concerning the wetland issue raised in your letter. However, we reserve the right to make additional comments on this and other issues once a complete application packet is submitted. TPWD will be offered the opportunity to comment on the application during the procedural review established by the TWC. At that time, comments may be submitted which refer to this and other areas of concern.

If you have any questions concerning this matter, please call me in Austin at (512) 389-4580.

Sincerely,

Ismael Nava

Ismael Nava, Program Leader
Contaminant Assessment Program
Environmental Quality Branch
Resource Protection Division

cc: Robert Sims, P.E.
Municipal Solid Waste Division
Texas Water Commission

ENDANGERED SPECIES SURVEY
MAY 1993

ENDANGERED SPECIES SURVEY
FOR
PROPOSED HARDIN COUNTY LANDFILL
NEAR KOUNTZE, TEXAS

Prepared for

HARDIN COUNTY

SwL Project No. 505193-231

May 7, 1993

Prepared by
SOUTHWESTERN LABORATORIES, INC.
1225 North Loop West, Suite 1000
P.O. Box 8768
Houston, Texas 77249
713/869-7913

SWL

ENVIRONMENTAL SERVICES

1225 North Loop West
Suite 1000
P.O. Box 8768
Houston, Texas 77249
Phone: (713) 869-7913
Fax: (713) 869-7374

May 7, 1993

Honorable Tom Mayfield
County Judge
P.O. Box 760
Kountze, Texas 77625

Re: Endangered Species Survey
Proposed Hardin County Landfill
Near Kountze, Hardin County, Texas
SwL Project No. 505193-231

Dear Judge Mayfield:

Southwestern Laboratories, Inc. (SwL) has performed an Endangered Species Survey for the above referenced project according to our verbal agreement authorized by Honorable Judge Tom Mayfield of Hardin County and Lonnie Sikes of KSA Engineers, Inc. on March 18, 1993. The site was inspected on Wednesday, April 14, 1993 at 9:30 a.m. by William P. Wenstrom, Ph.D., representing SwL-Houston.

The objective of this biological survey was to address the potential of endangered species and the likelihood of their respective habitats at the property in question for purposes of developing the site as a municipal solid waste landfill.

In establishing the Endangered Species Act (ESA) of 1973, the U.S. Congress recognized that many wildlife and plant species had already been rendered extinct by human-related activities. It also recognized that many additional species were so depleted in numbers that they were in danger of becoming extinct. Congress determined that these species were of aesthetic, ecological, educational, recreational, and scientific value to the nation's public.

In response, the ESA was passed with the stated purposes of conserving these threatened or endangered species, and the ecosystems upon which these species depended. Congress further declared it policy that all Federal departments and agencies would utilize their authority to further these purposes of the ESA.

The scope of the investigation included the following tasks:

* Review of available aerial photographs, topographic maps, and readily available literature concerning the habitat requirements of specified species; and

* an on-site inspection to identify potential listed species habitats and the likelihood of their occurrence on-site.

This endangered species survey was performed in accordance with generally accepted practices of the profession undertaking similar studies at the same time and in the same geographical area, and SwL observed that degree of care and skill generally exercised by the profession under similar circumstances and conditions. No other warranty is expressed or implied.

This study and report has been prepared on behalf of and for the exclusive use of Hardin County solely for use in the biological evaluation of the site. This report and the findings contained herein shall not, in whole or in part, be disseminated or conveyed to any other party, nor used by any other party in whole or in part, without the prior written consent of Hardin County.

Background

According to information provided by the Texas Parks and Wildlife Department, a search of records contained in the Texas Natural Heritage Program Information System revealed five sensitive species possibly occurring in the general area of the proposed landfill based on the documented occurrence of the species in Hardin County, Texas. These species and their special status are as follows:

Species	Common Name	Status	
		Federal	State
Plants			
Phlox nivalis texensis	Texas trailing phlox	Endangered	Endangered
Silene subciliata	scarlet catchfly	Candidate	None
Cyperus oravioides	Mohlenbrock's umbrella sedge	Candidate	None
Animals			
Picoides borealis	Red-Cockaded woodpecker	Endangered	Endangered
Cemophora occcinea copei	Northern scarlet snake	None	Threatened

General Observations

The northern border of the proposed landfill fronts Highway 770 about three miles southwest of Kountze, Texas. The western border of the property consists of an unimproved dirt road. The eastern and southern borders of the property were marked at the time of the visit with white paint splotches on the trunks of scattered pine trees.

The proposed landfill has been recently clearcut as has the adjacent land. With the exception of a narrow buffer strip along Highway 770 and scattered trees along its southern and eastern borders, the only trees remaining on the site are apparently unmarketable specimens of small pine and hardwood. There are numerous large piles of bulldozed stumps, limbs and other slash throughout the site as well as significant surface rutting associated with the use of tracked and wheeled vehicles and equipment. Many of these ruts contained standing water as did numerous other small depressions. Unidentified tadpoles were common in the ruts and puddles of standing water.

According to the U.S. Geological Survey Kountze South, Texas, 7.5-minute quadrangle map of the area, the elevation of the site is from 75-80 feet above mean sea level. There is no appreciable topographic relief on the property which occupies an essentially flat, low-lying distributary between Cypress Creek to the north and Langston Branch to the east.

Because of the extensive surface disturbance from logging, it was difficult to determine whether the area contained any of the so-called "pimple mounds" or other circular or elongate mounds that are numerous in nearby portions of the Lance Rosier Unit. At a slightly higher elevation than surrounding terrain, mounds permit less hydric plant communities to develop than would otherwise be the case in a generally low-lying area.

Numerous white-tailed deer, opossum, and raccoon tracks, and the disarticulated skeleton of a white-tailed deer were observed on-site. Killdeer were the most common bird species on the property and several unidentified shore bird tracks were observed at the margin of several puddles where these birds forage by probing. In addition, yellow-belly sapsucker holes were noted on some of the residual pines on the property along with several common crows, many unidentified frogs, anoles, and skinks. No snakes were observed the day of the inspection.

The paucity of birds and other wildlife may, in part, be due to (1) the lack of any appreciable shrub and forested habitat on most of the site as well as (2) deteriorating weather in advance of a squall-line of serious thunderstorms that moved into the area about 1:15 p.m.

Habitat Considerations

There exists a substantial amount of information concerning the plant communities of Hardin County, most compiled in association with investigations of the Big Thicket Biological Preserve (BTBP). Perhaps the most definitive is that of Harcombe and Marks (1979) who characterized forest vegetation under contract to the Southwestern Regional Office of the National Park Service. Watson (see, for example, 1979) has also written extensively on Big Thicket plant ecology and has published numerous informal checklists (n.d.; 1980) and summaries often focusing on endemics and other rare species.

According to Harcombe and Marks (Ibid.), the area in and near the Lance Rosier Unit is topographically uniform in comparison to some of the other units of BTBP. It occupies the lowest and most recent of the Pleistocene surfaces in this area. As a result, drainage there like drainage at the proposed landfill site is generally poor. Poor drainage and flat topography allow the interdigital, intermingling of several common plant community types that normally range monotypically from lower, upland slopes to broad, swampy wetlands, including Flatland Hardwood, Lower Slope Hardwood Pine, and Wetland Pine Savanna.

Although cutover, the forest vegetation on the landfill property would have probably been classified per the topography of Harcombe and Marks (Ibid.) as wet, mixed Lower Slope Hardwood Pine or Wetland Pine Savanna prior to logging. Either of these associations are suggested by the importance of American holly (_Ilex opaca_), Yaupon (_Ilex vomitoria_), and Sweetbay (_Magnolia virginiana_) in the existing understory on and near the landfill site (Brown and Grelin, 1977). In almost no case do these forests offer the type of habitat required by the species of concern in this case.

The nesting and foraging habitat of the red-cockaded woodpecker in upland southern pine forests, for example, is relatively well understood (Hooper, et al., 1980). These birds need older, live trees in which to excavate cavities for roosting and extensive pine and pine-hardwood forests nearby in which to forage. Generally, the longer the rotation age of these forests and the higher the degree of hardwood control by selective cutting and burning, the greater is the opportunity for the species to maintain existing breeding colonies and to create new ones.

The landfill property is probably too low-lying and the pines located there appeared much too young before they were cut to be acceptable cavity trees. There was similarly no visual evidence of any cavities or cavity-starts based on careful examination with binoculars of the young residual pine trees along the border of the property. The property probably supported a relatively dense understory of shrubs and hardwoods prior to logging. This also suggests that the area lacked the more open, park-like structure favored by the red-cockaded woodpecker for roosting and feeding.

Like the xerix plant discussed below, the northern scarlet snake is an inhabitant of dry uplands with well-drained sandy or loamy soils. The northern scarlet snake is a subspecies that, in eastern Texas, is at the extreme western end of its presumed range that extends southerly along the Atlantic coast from New Jersey. Reportedly semi-fossorial, it is a burrower rarely seen during the day-light hours (Behler and King, 1979). Although sometimes discovered under rotting logs during the day, finding a specimen of the brightly-colored species (which somewhat resembles the venomous Coral snake (Micrurus fulvius tenere) even in suitable forested habitat is an arduous task in east Texas. It is probably an impossible task on the proposed landfill site which is lacking the well-drained soils preferred by the species.

Texas trailing phlox (Phlox nivalis texensis), scarlet catchfly (Silene subciliata), and Mohlenbrock's umbrella sedge (Cyperus grayioides) are xerophytes that require sunny locations on well-drained, deep, sterile sandy soils of the type usually found on river gravel deposits, sand ridges, and old stream levees. According to Ajilvsgi (1979), the so-called arid "Oak-farkleberry sandyland" offers optimum habitat for the trailing phlox and scarlet catchfly in the area. Such communities are essentially very open upland pine-oak savannas where the dominant trees are Longleaf pine (Pinus palustris) and Blue jack oak (Quercus incana), with Farkleberry (Vaccinium arboreum) commonly the only understory shrub.

In the past, fire probably prevented brush from encroaching into the sandyland savanna. The Texas trailing phlox, for example, is highly responsive to fire and would proliferate quickly after periodic burning. These types of plants also disappear quickly when shaded by hardwood understories or dense forb layers and accumulation of leaf litter and other plant debris that changes the prevailing temperature of the humus from hot to cool. Fire suppression in more-or-less "natural" stands and planting pines in sandy uplands are probably the factors most responsible for the loss of xeric vegetation in and around BTBP.

In this case, however, there is little likelihood that any of these xerophytes ever occurred on the proposed landfill site. The area is much too low and wet to offer suitable soil conditions for the growth of these species. Similarly, the site was formerly vegetated with a stand of sufficient basal area to have killed shade-intolerant plants.

Conclusions

None of the species of interest were observed by SwL, represented by Dr. Wenstrom, during the site inspection. Based on the site inspection and the habitat requirements of these species, SwL concludes that none occur on-site at this time nor is there any real possibility that any of these species occurred at this location in the recent past. Accordingly, there is equally little likelihood that operation of the landfill at this site will have adverse biological consequences to any local population of these sensitive species in Hardin County, Texas.

All of the data accumulated for the investigation (photographs, field notes, etc.) will be kept in your project file. If you have any questions or need any additional information, please do not hesitate to call. The report and information in your file is considered confidential and will not be released without your authorization.

We appreciate the opportunity to work with you on this project and hope you will contact SwL for future projects.

Sincerely,

SOUTHWESTERN LABORATORIES, INC.

Rhonda G. Chance

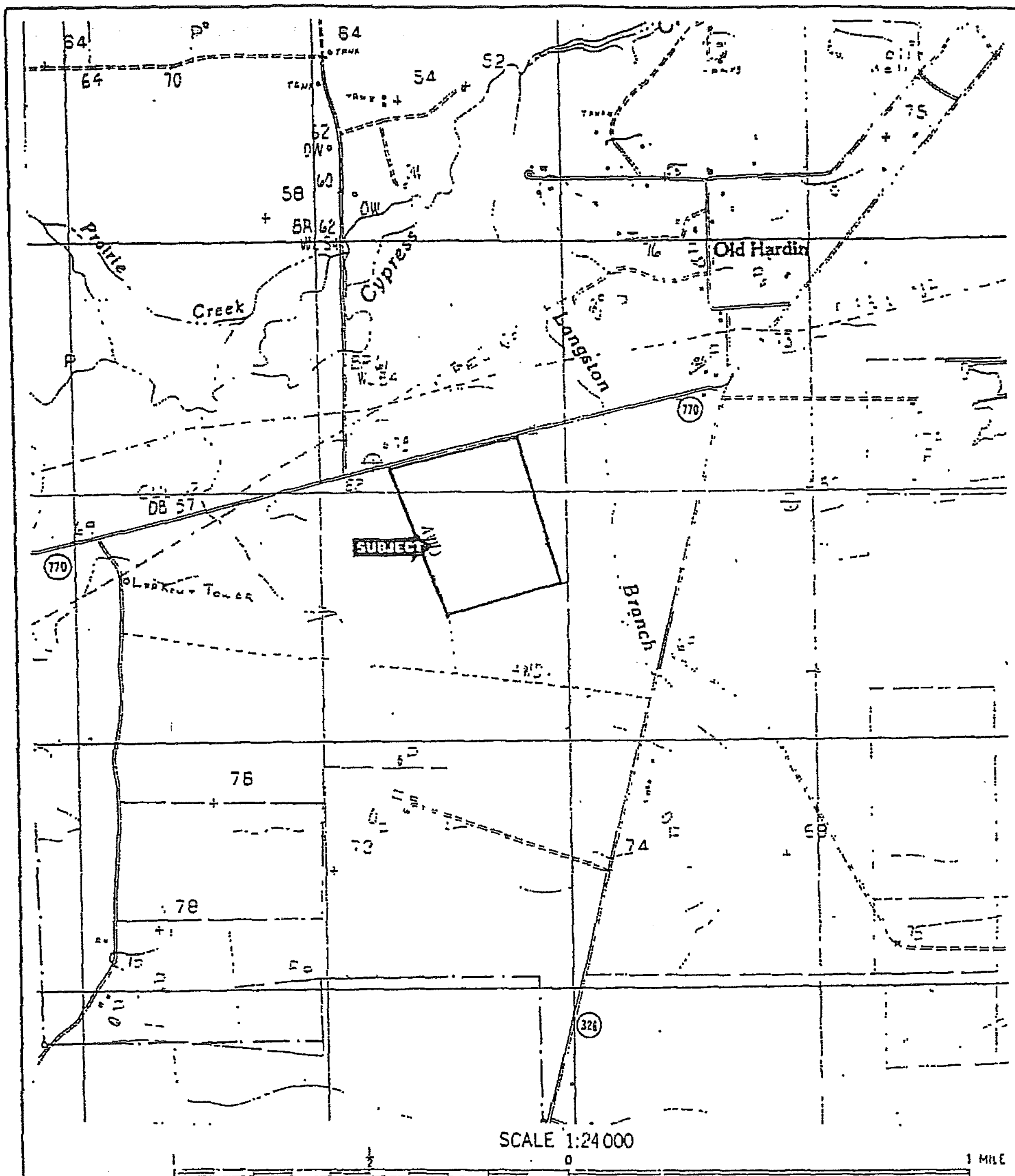
Rhonda G. Chance
Wetland Specialist

Steve Wolford

Steve Wolford, R.E.M.
Project Manager

RC/SW:ng

APPENDIX A



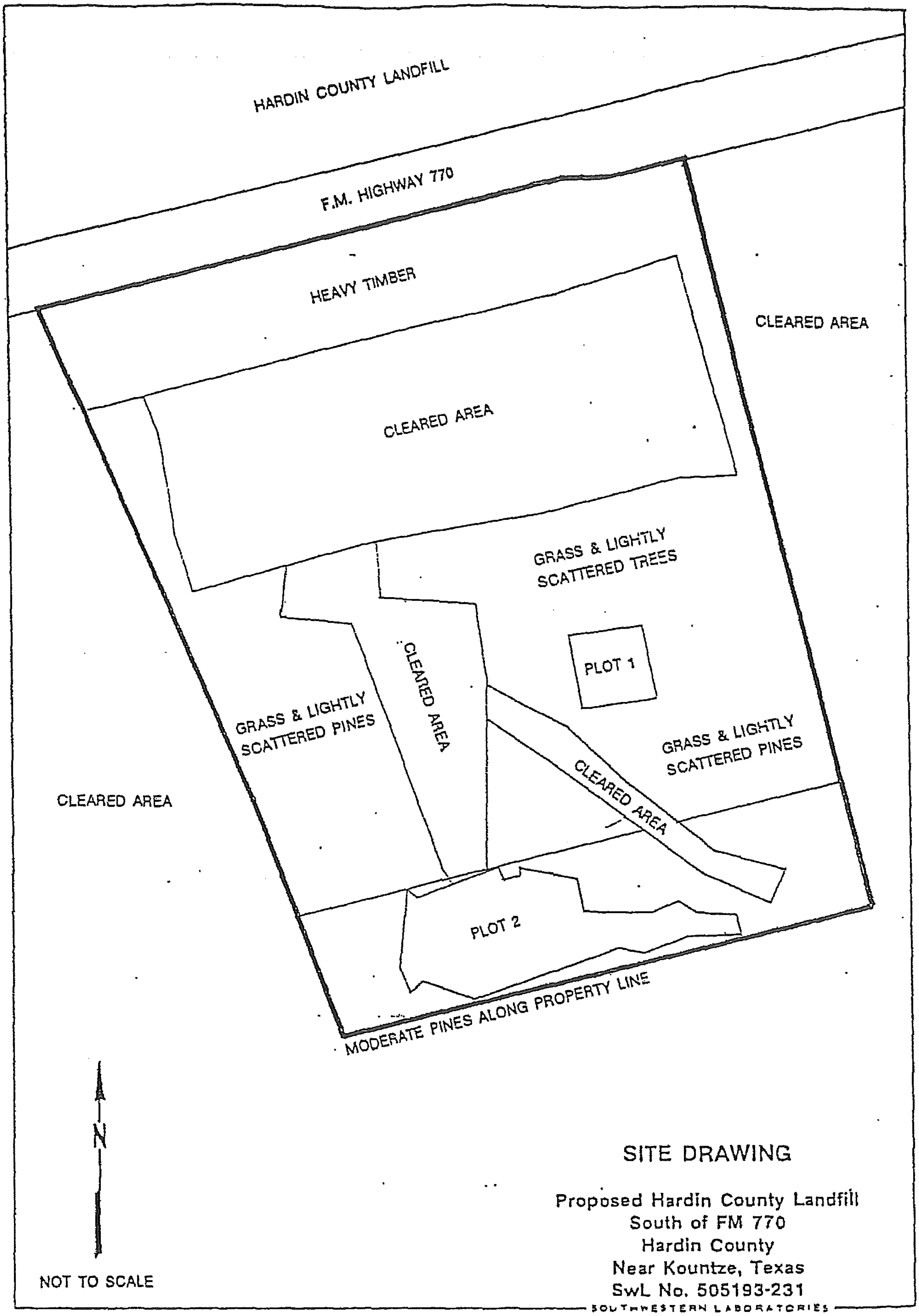
For clarification see Part I & II, Page 10.

KOUNTZE SOUTH QUADRANGLE
TEXAS–HARDIN CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

TOPOGRAPHIC MAP
Proposed Hardin County Landfill
South of FM 770
Hardin County
Near Kountze, Texas
SwL No. 505193-231

SOUTHWESTERN LABORATORIES

AUGUST 31, 1994



AUGUST 31, 1994

PART I & II -128

B

-APPENDIX B

SWL

Source: TNRIS
File No. 03-086
May 5, 1988

Scale: 1" = 1350'

N

1988

Proposed Hardin County Landfill
South of FM 770
Hardin County
Near Kountze, Texas
SwL No. 505193-231

SOUTHWESTERN LABORATORIES

AUGUST 31, 1994

REFERENCES

R E F E R E N C E S

SWL

SOURCE REFERENCES

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Federal Emergency Management Agency, 1990, Flood Insurance Rate Map.

Granata, G., Guevara, E., Dreitler, C.W., and McKalips, D.; Hydrogeology of Gulf Coast Aquifers, Houston-Galveston Area, Texas. Prepared by the Bureau of Economic Geology, The University of Texas at Austin, Geological Circular 77-4, 1977.

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Harcombe, P.A. and P.L. Marks, 1979. Forest vegetation of the Big Thicket National Preserve, Report to Office of Natural Sciences, Southwestern Region, National Park Service, Santa Fe, New Mexico under Contract No. PX7029-8-0437.

U.S. Department of Agriculture Soil Conservation Service, 1991, General Soil Map of Hardin County.

Watson, G. N.D. Rare plants of the Big Thicket. Photocopied checklist of rare or uncommon plants.

__________. 1979. Big Thicket plant ecology and introduction. Big Thicket Museum Publication Series No. 5, Saratoga.

__________. 1980. Vegetation of the Lance Roiser Unit of the Big Thicket National Preserve. Photocopied summary of vegetation with species checklist.

PROJECT TEAM MEMBERS

ENVIRONMENTAL CONSULTING

Wolford, Steve D. Project Manager	B.S. Biology M.P.H. Env. Health Sciences M.B.A. Finance EPA Accredited Asbestos Inspector State of Texas Licensed Asbestos Inspector, License #60-0083 40 Hour Hazardous Waste Operations OSHA Course Registered Environmental Professional #4013
Chance, Rhonda G. Wetland Specialist	B.S. Horticulture Science Wetland Training Institute Wetlands Assessor 40 Hour Hazardous Waste Operations OSHA Course EPA Accredited Asbestos Inspector State of Texas Licensed Asbestos Inspector, License #60-0081
Wenstrom, William P. Terrestrial Biologist	Ph.D. Wildlife Ecology University of Minnesota Traineeship, Public Health Biology Workshops, short courses, seminars in management and computer applications in natural resource management

ARCHAEOLOGY SUMMARY

On August 18, 1993, the site was subjected to an archaeological survey by Emanco of Houston, Texas. Emanco's representatives systematically walked the site, excavated four shovel tests, and generally surveyed the topography. Research of historical records were conducted as well and a report compiled. The general conclusion is that the site poses no threat to significant cultural resources. A copy of Emanco's Cultural Resources Survey follows these comments.

RECEIVED

MAY 17 1993

SOUTHWESTERN LABORATORIES, INC.

THE STATE OF TEXAS

CURTIS TUNNELL
EXECUTIVE DIRECTOR

TEXAS HISTORICAL COMMISSION

P.O. BOX 12276 AUSTIN, TEXAS 78711 (512)463-6100

DEPARTMENT OF ANTIQUITIES PROTECTION

May 10, 1993

Ms. Rhonda D. Chance
Technical Specialist of Wetlands and Endangered Species Services
Southwestern Laboratories, Inc.
P.O. Box 8768
Houston, TX 77249

Re: 80 acre tract for landfill, Hardin County
(COE-FWD, F2, F13)

Dear Ms. Chance:

Thank you for providing the opportunity to review the project referenced above. After examining our files, we note that the location of the project area has potential for containing archeological sites, some of which may be eligible for inclusion in the National Register of Historic Places. Although no sites are recorded within the boundaries of your tract, to the best of our knowledge, this area has never been examined by a professional archeologist.

An archeological survey undertaken by a qualified professional should be conducted within those portions of the project area that will be subjected to ground disturbing activities. The survey should include shovel tests sufficient to identify subsurface cultural materials. Collection of materials from any sites found during the survey is required, and all material should be curated according to 36CFR79. A report of investigations should be produced in conformance with the Secretary of the Interior's Guidelines for Archaeology and Historic Preservation.

We will continue review of this project upon receipt of the requested documentation. If you have any questions, please contact Bill Martin of our staff at 512/463-5867.

Sincerely,

James E. Bruseth, Ph.D.
Deputy State Historic Preservation Officer

Sincerely,

Timothy K. Perttula, Ph.D.
Assistant Director for Antiquities Review

JEB/TKP/wam

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS
TCEQ PERMIT NO. MSW-2214B

APPENDIX I/IIC

LOCATION RESTRICTION DEMONSTRATIONS

Prepared for

BFI Waste Systems of North America, LLC

March 2017
Revised August 2017

Revised December 2017

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

12-5-2017

Prepared by

Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Boulevard, Suite 206
Fort Worth, Texas 76109
817-735-9770

WCG Project No. 0120-758-11-02

This document is intended for permitting purposes only.

CONTENTS

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

12-5-2017

CONTENTS (Continued)

Drawings

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

12-5-2017

1 INTRODUCTION

The purpose of this report is to provide demonstrations of the location restrictions for the Hardin County Landfill (landfill). Title 30 TAC §330, Subchapter M identifies eleven location restrictions for the protection of human health and the environment. The eleven location restrictions include easements and buffer zones, airports, floodplains, groundwater, endangered or threatened species, wetlands, fault areas, seismic impact zones, unstable areas, coastal areas, and Type I landfill permit issuance prohibited.

The Subtitle D regulations also require that the owner of a site must demonstrate either that the location restrictions do not apply or that the landfill, while located in a restricted area, is designed and operated in such a way that it protects human health and the environment. In addition, the demonstrations, Certifications of Compliance, and supporting data and analysis will be retained in the Site Operating Record.

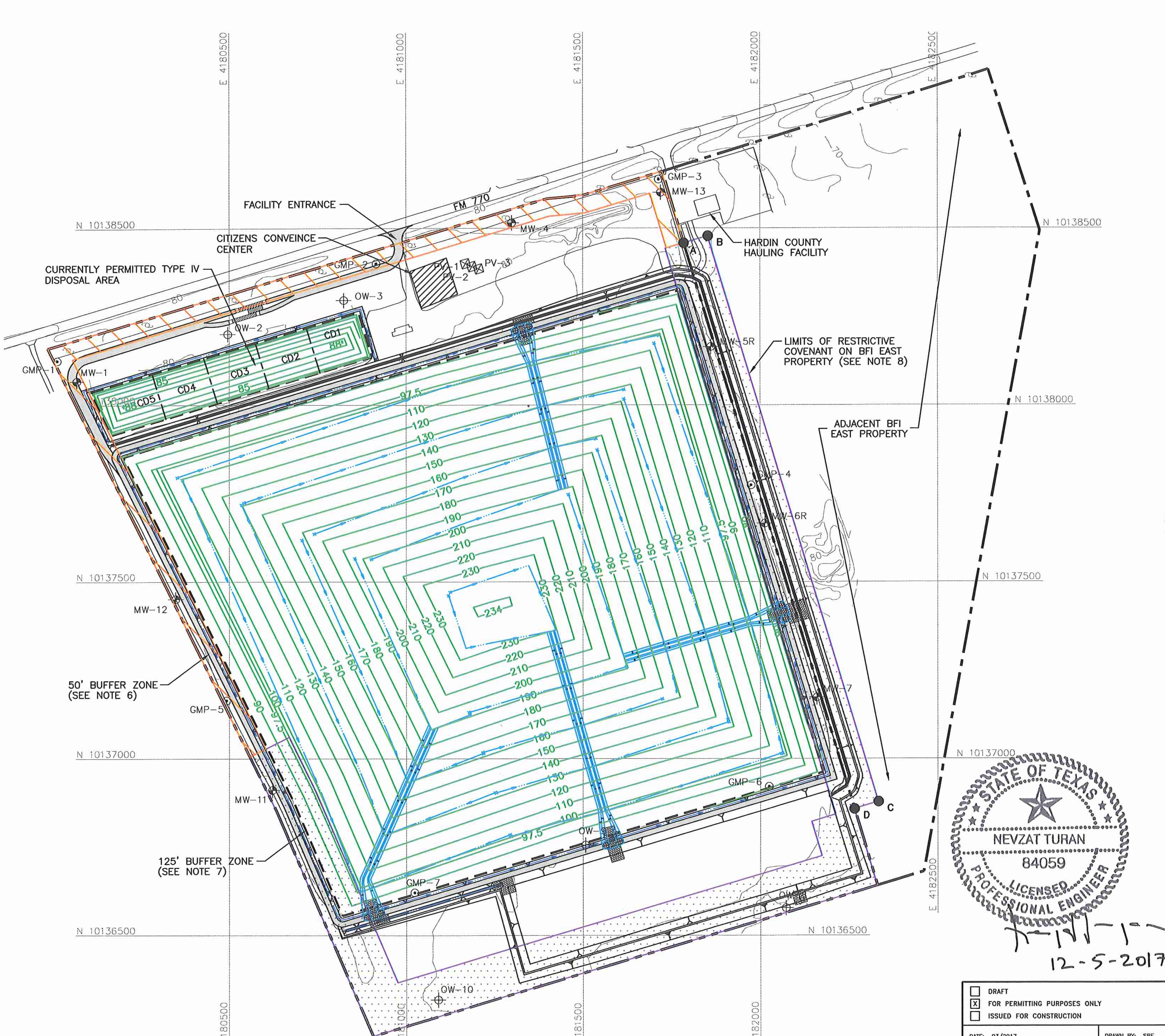
2 EASEMENTS AND BUFFER ZONES

The easements and buffer zones location restrictions within 30 TAC §330.543 require that no solid waste disposal shall occur within 25 feet of the center line of any utility line or pipeline easement but no closer than the easement, unless otherwise authorized by the Executive Director. Also, all pipeline and utility easements shall be clearly marked with posts that extend at least six feet above ground level, spaced at intervals no greater than 300 feet. In addition, for vertical or lateral expansions, the owner or operator shall establish and maintain a 125-foot buffer zone for any newly permitted airspace.

The proposed buffer zones for the site are shown on Drawing I/IIC-1 and are discussed below.

- **Existing Permitted Limits of Waste.** As shown on Drawing I/IIC-1, a buffer zone of at least 50 feet is maintained between the permit boundary and the permitted limits of waste defined in TCEQ Permit No. 2214A.
- **Vertical Expansion Area.** As shown on Drawing I/IIC-1, a buffer zone is maintained between the permit boundary and the proposed new waste disposal airspace (labeled as "newly permitted airspace limit of waste"), consistent with 30 TAC §330.543(b)(2)(B).
- **Citizens Convenience Center.** As shown on Drawing I/IIC-1, a buffer zone of over 50 feet is maintained between the permit boundary and the Citizens Convenience Center.

Given the above, the site is in compliance with the Easements and Buffer Zone Location Restrictions.



0 150 300

SCALE IN FEET

LEGEND

- BFI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- CELL BOUNDARY
- N 10137500 — STATE PLANE COORDINATE GRID
- 70 — EXISTING CONTOUR
- 234 — PROPOSED FINAL CONTOUR (SEE NOTE 3)
- PROPOSED DRAINAGE SWALE
- PROPOSED DRAINAGE CHUTE
- MW-1 — EXISTING GROUNDWATER MONITOR WELL
- OW-2 — EXISTING GROUNDWATER OBSERVATION WELL
- GMP-1 — EXISTING GAS MONITORING PROBE (SEE NOTE 9)
- 50' BUFFER ZONE (1995 PERMIT) (SEE NOTE 7)
- 125' BUFFER ZONE (2017 AMENDMENT) (SEE NOTE 6)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CURRENTLY PERMITTED TYPE IV CELLS INCLUDES CD1 THROUGH CD5. CD1, CD2, AND CD3 ARE CURRENTLY DEVELOPED AND RECEIVED TYPE IV WASTE.
3. THE PROPOSED COMPLETION PLAN DRAINAGE STRUCTURES ARE SHOWN FOR INFORMATIONAL PURPOSES. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.
4. REFER TO APPENDIX IIIF-SURFACE WATER DRAINAGE PLAN FOR DRAINAGE DESIGN INFORMATION.
5. MAXIMUM FINAL COVER ELEVATION IS 234 FT-MSL. MAXIMUM TOP OF WASTE ELEVATION IS 230.5 FT-MSL.
6. FILL AND LINER GRADES WITHIN THE 125-FT BUFFER ALONG THE WESTERN EDGE OF CELL 8 HAVE NOT BEEN INCREASED FROM 1995 PERMIT CONDITIONS FOR THIS APPLICATION.
7. AREAS SHOWN WITH 50-FT BUFFER ARE CURRENTLY PERMITTED OR CONSTRUCTED AREAS WITH NO CHANGE TO WASTE LIMITS OR GRADES PROPOSED FOR THIS APPLICATION.
8. UPON APPROVAL OF THE APPLICATION (WITHIN ONE YEAR OR PRIOR TO INSTALLATION OF THE CHANNEL, WHICH EVER COMES FIRST), RESTRICTIVE COVENANT FOR THE DRAINAGE CHANNEL INSIDE THE ADJACENT IESI EAST PROPERTY WILL BE FILED WITH HARDIN COUNTY. THE RESTRICTIVE COVENANT WILL BE BOUNDED BY POINTS A, B, C, AND D.
9. EXISTING LFG DETECTION PROBE LOCATIONS ARE SHOWN. REFER TO PART III, APPENDIX III-LANDFILL GAS MANAGEMENT PLAN FOR LFG PROBE DESIGN AND CURRENT AND FUTURE LFG DETECTION PROBE LOCATIONS.

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 03/2017
FILE: 0120-758-11
CAD: I/IIC-1-BUFFER ZONE PLAN.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	08/2017	FIRST NOD RESPONSE
2	11/2017	OWNERSHIP CHANGE

MAJOR PERMIT AMENDMENT
BUFFER ZONE PLAN

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

WWW.WCGRP.COM

DRAWING I/IIC-1

O:\0120\758\2214B EXPANSION\PARTS I-II\I-IIC\C-1-BUFFER ZONE PLAN.dwg. 11/15/2017 3:17:52 PM. rsellers. 1:2

3 AIRPORT SAFETY

The Airport Safety Location Restrictions within 30 TAC §330.545 require that airports within the vicinity of the landfill site be identified. The regulation states that landfill sites located within 10,000 feet of an airport runway end used by turbojet aircraft or within 5,000 feet of an airport runway end used by piston-type aircraft shall demonstrate that the units are designed and operated so that the landfill does not pose a bird hazard to aircrafts.

The Federal Aviation Administration (FAA) was contacted to identify publicly used airports in the vicinity of the landfill. The FAA response letter dated November 9, 2016, 2009, is included in Appendix I/IIB (this letter is attached to a October 31, 2016 WCG letter to FAA). As indicated in the letter, there are no public use airports within 10,000 feet of the site. The Hawthorne Field Airport is located just inside of six miles from the landfill permit boundary, but the FAA had no objection to the proposed major permit amendment from the standpoint of potential wildlife hazards to aircraft.

In addition, consistent with 30 TAC §330.545(b), the Hawthorne Field Airport was notified of the proposed expansion. The notification letters are included in Appendix I/IIB.

Given the above, the site is in compliance with the Airport Location Restriction.

4 FLOODPLAINS

Title 30 TAC §330.547 prohibits waste disposal operations located in the 100-year floodway, requires that new expansion areas not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste; and requires storage and processing facilities to be located outside of the 100-year floodplain absent certain demonstrations. The FEMA Flood Insurance Rate Map included as Drawing I/II-11.1 demonstrates that the permit property is outside of the 100-year floodplain and floodway.

Given the above, the site is in compliance with the Floodplains Location Restriction.

5 GROUNDWATER

The groundwater location restriction within §330.549 prohibits a Type I or Type IAE landfill on the recharge zone of the Edwards Aquifer. Given that the landfill is not located on the recharge zone of the Edwards Aquifer, the site is in compliance with the groundwater location restriction.

§330.549(b) also requires the following.

> *"Unless the executive director approves an engineered design that the applicant has demonstrated will provide equal or greater protection to human health and the environment, a new landfill cell or an areal expansion of an existing landfill cell managing Class 1 industrial solid waste may not be located in areas described in §335.584(b)(1) and (2) of this title (relating to Location Restrictions)."*

Class 1 industrial solid waste will not be received at the landfill. Based on the above, the landfill is in compliance with the Groundwater Location Restrictions.

6 ENDANGERED OR THREATENED SPECIES

The endangered or threatened species location restrictions within §330.551 requires that the facility and the operation of the facility shall not result in the destruction or adverse modification of the critical habitat of endangered or threatened species, or contribute to the taking of any endangered or threatened species.

The U.S. Fish and Wildlife Services (USFWS) and Texas Parks and Wildlife Department (TPWD) were contacted to request information regarding endangered or threatened species or their critical habitat with respect to the site. The USFWS and TPWD response letters are included in Appendix I/IIB. A response was received from the FWS, requesting that an additional assessment be performed that obtained project-specific fish and wildlife resources from FWS using the IPaC system. A site-specific threatened and endangered species habitat assessment had previously been completed by Goshawk Environmental Consultants, Inc. in December 2015, which was then resubmitted to the USFWS. This study concluded that it is highly unlikely any federally listed species would occur on the site; and that no state-listed species are known to occur on the site and none were observed.

The 79-acre site has been substantially cleared and disturbed during previously authorized landfill operations and construction activity. Therefore, it is concluded that the expansion of the landfill will not result in the destruction or adverse modification of the critical habitat of any threatened or endangered species, or cause or contribute to the taking of any threatened or endangered species.

Given the above, the site is in compliance with the Endangered or Threatened Species Location Restriction.

7 WETLANDS

The landfill property was examined for compliance with wetlands issues as described in 30 TAC §330.553, which states that new MSWLF units, lateral expansions, and material recovery operations from a landfill shall not be located in wetlands, unless the owner or operator makes appropriate demonstrations involving wetlands. A jurisdictional determination was completed in November 2015, by Goshawk Environmental Consultants, Inc. and approved by the USACE on April 18, 2016 (correspondence with the USACE is included in Appendix I/IIB).

The jurisdictional determination prepared by Goshawk, and as approved by the USACE concluded that there are no waters of the United States, including jurisdictional wetlands, present on the on the property. The proposed vertical expansion does not impact any wetlands; therefore, the proposed development meets the requirements of 30 TAC §330.553.

Given the above, the site is in compliance with the Wetland Location Restriction.

STATE OF TEXAS
AARON K. EVANS
GEOLOGY
11143
LICENSED
PROFESSIONAL GEOSCIENTIST

12-05-17

8 FAULT AREAS

The landfill and the surrounding area were examined by Aaron K. Evans, P.G., a WCG licensed professional geoscientist, for indications of the presence of Holocene time geologic faulting in accordance with §330.555 criteria. The study was conducted by reviewing available literature, published topographic and geologic maps, aerial photographs of the area, and an area reconnaissance. The following is a summary of the findings from the references as part of the determination for these fault areas:

- Geologic Atlas of Texas, Dallas Sheet, Bureau of Economic Geology (BEG), Barnes, V. E., 1992. A portion of this geologic map showing the landfill vicinity is presented as Figure IIIG-A.1 – Regional Geologic Map in Appendix IIIG of Part III. No geologic faults were identified by the Bureau of Economic Geology within 0.5 miles of the facility permit boundary.
- Quaternary Fault and Fold Database for the United States, 2006, US Geological Survey and Texas Bureau of Economic Geology. According to the USGS Quaternary Fault and Fold database, the landfill is located within the Gulf-margin normal fault zone area which extends from south Texas along the coast and into the Florida panhandle. However, the USGS database does not identify individual Quaternary faults within the zone.
- Tectonic Framework of Texas, Tectonic Map of Texas, Bureau of Economic Geology, University of Texas at Austin, Thomas E. T., 1991. The Hardin County vicinity of the Tectonic Map of Texas was reproduced on Drawing I/IIC-2. According to this map, one fault within the Wilcox Fault Zone is present approximately 1 mile north of the landfill. The fault trend of which approximately coincides with the oil and gas wells locations identified north of the site on Figure IIIG-A.11 in Appendix IIG of Part III. According to the Texas Railroad Commission reports, these oil and gas wells are drilled to depths between 8,300 and 8,600 feet within the Nona Mills Field. According to the American Association of Petroleum Geologists, oil and gas wells in the Nona Mills Field terminate in Eocene-age sands which occur in a strike-faulted anticline structural trap extending approximately 5 miles long and trending southwest to northeast (Penn, 1962). Faults of the Wilcox Fault Zone trend are of late Paleocene to Eocene in age and inactive (Ewing, 1986). This conservatively dates them at 34 million years old. In summary, the identified fault is inactive and located greater than 0.5 miles from the northern landfill permit boundary. No Holocene faults were noted by Thomas within 0.5 miles of the facility permit boundary.

STATE OF TEXAS
AARON K. EVANS
GEOLOGY
11143
LICENSED
PROFESSIONAL GEOSCIENTIST

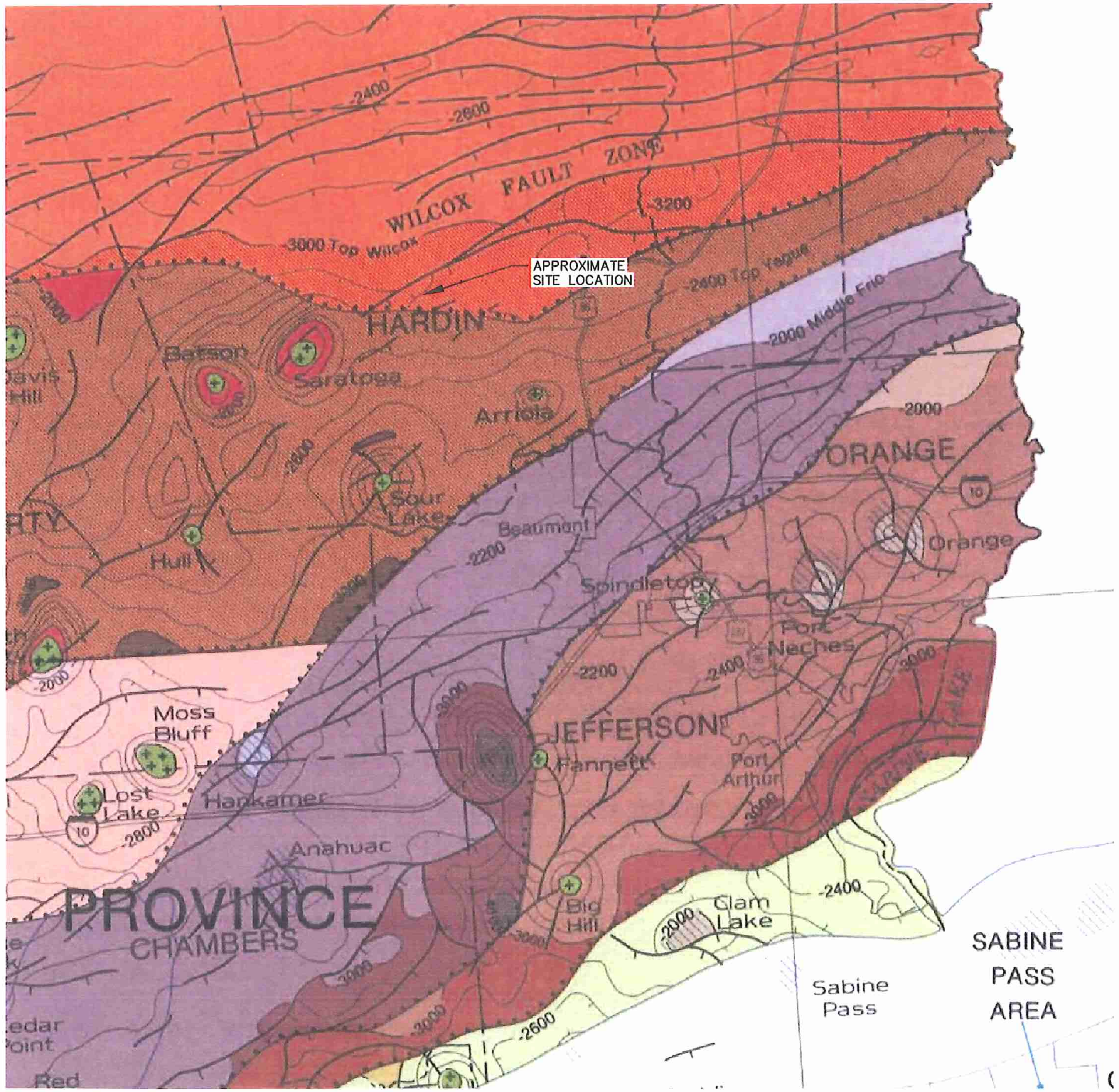
12-05-17

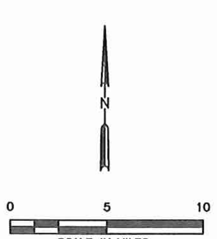
USGS 7.5 minute topographic maps including the Kountze Southwest, Texas (2013) and Kountze South, Texas (2013) maps. Figure IIIG-A.10 – Water Well Location Map in Appendix IIIE of Part III is based on portions of these USGS maps. There is no surface indication of a fault within 0.5 miles of the facility permit boundary on Figure IIIG-A.10.

- Lineaments of Texas, Bureau of Economic Geology map, The University of Texas at Austin, Woodruff, C. M., Caran, S. C., and Thompson, E. J., 1981, prepared for U.S. Department of Energy, Division of Geotechnical Energy, Contract No. DE-AS07-79-I012057 Geotechnical Resources Assessment for the State of Texas. Lineaments identified by Woodruff et al in Hill County were reviewed and are shown on Drawing I/IIC-3. No lineaments were identified by Woodruff within 0.5 miles of the facility permit boundary.
- Regional Stratigraphy and Subsurface Geology of Cenozoic Deposits, Gulf Coast Plain, South-Central United States, USGS Professional Paper 1416-G, Hosman, et al., 1996. A regional structural features map was adapted from Hosman and included as Figure IIIG-A.2 in Appendix IIIG of Part III. No geologic faults were identified by Hosman within 0.5 miles of the facility permit boundary.

The above published sources of potential fault information indicated no known active geologic faults are present within 0.5 miles of the facility. Therefore, the site complies with §330.553(b) which requires the site must be investigated for unknown faults when an active fault is known to exist within 0.5 miles of the site. In addition, Aaron K. Evans, P.G. (a WCG licensed professional geoscientist) did not observe any indications of active geologic faults within 0.5 miles of the site during the area reconnaissance.

Aaron K. Evans, P.G. (a WCG licensed professional geoscientist) completed an on-site and area reconnaissance and a review of 45 site borehole logs (drilled to a maximum depth of 98 feet below ground surface). The subsurface data were analyzed for stratigraphic offsets and fracture zones to evaluate the facility for the presence of Holocene faulting. No offsets or fracture zones are indicated in the borehole data presented in Appendix IIIG-B. No unusual scarps or topographic breaks were interpreted to be within 200 feet of the site. No evidence of faulting was found associated with on-site or adjacent roadways. No structural influence of stream courses was observed. In addition, no unusual relief or topographic features, such as sag ponds, truncated alluvial spurs, or offset tributary alignments, were observed. No evidence of Holocene faulting within 200 feet of the permit boundary was noted in the listed literature. As no evidence of Holocene faulting within 200 feet of the site was identified, the site complies with the Fault Area Location Restriction listed in §330.555(a).





NOTE:

1. MAP ADAPTED FROM TECTONIC MAP OF TEXAS, T.E. EWING et al, 1991, BUREAU OF ECONOMIC GEOLOGY, THE UNIVERSITY OF TEXAS AT AUSTIN.

EXPLANATION

TECTONIC PERIOD		EXPOSED UNITS: SEDIMENTARY		EXPOSED UNITS: IGNEOUS		SUBSURFACE CONTOURS	OTHER FEATURES
TERTIARY (and Quaternary)		Bolson fill	Ts	TRANS-PECOS PROVINCE: Late basalts; Trans-Pecos volcanic rocks (mafic to felsic, slightly to highly alkalic); Intrusive rocks (mostly felsic or alkalic)	Tb; Tv; Ti	Lower Miocene (LM_1, LM_2) (2 horizons); Top of Frio Fm. (TF); Middle Frio (*Nodosaria*, N) Fm.; Top of Vicksburg Fm. (TV); Top of Yegua Fm. (TY); Top of Wilcox Gp. (TWX)	Calderas
LARAMIDE		Deformed Cretaceous strata; Deformed Jurassic strata (including evaporites)	Ls_2; Ls_1			Top of Edwards Gp. (EDS); Top of Lower Cretaceous (TLK); Top of Glen Rose Fm.	Front of Laramide deformation
GULF COAST	POSTRIFT	Cretaceous strata (where subsurface is not contoured)	K	BALCONES PROVINCE: Ultramafic and mafic volcanic rocks; Ultramafic to felsic intrusives	Gsv; Gs	Base of Austin Chalk (BAC); Top of Edwards Gp. (EDS) or Top of Paleozoic (PZ)	Woodbine Fm pinch-out; Lower Cretaceous reef trends
GULF COAST	SYNRIFT	Red beds (Eagle Mtns) (identified in wells only)	G_1s	Basalt and diabase (in wells only)	G_1i		Louann Salt pinch-out (Sabine area)
OUACHITA and ARBUCKLE		Upper Paleozoic foreland strata (where subsurface is not contoured); Upper Paleozoic flysch; Lower Paleozoic strata ("starved basin")	P; O_2; O_1	Volcanic rocks (Hatton tuff in Ouachita Mountains; unnamed rhyolite in Sabine Island; volcaniclastics in South Texas); Metamorphic rocks (Sierra del Carmen)	Ov; Om	Top of Siluro-Devonian limestone (SD) (in New Mexico); Top of Ellenburger (ELL) or Arbuckle Gp; Precambrian (PC); Crystalline basement (Bsmt) (in Oklahoma)	Fronts of Ouachita deformation; Capitan reef and Horseshoe Atoll
SOUTHERN OKLAHOMA		Cambrian-Ordovician strata (Carbonate platform) (O-P: Ordovician-Pennsylvanian, Hueco Mtns.); Cambrian(?) strata (Meers Quartzite)	CO; Ss	Post-Cambrian igneous rock (one well only); WICHITA PROVINCE: Cambrian felsic rocks (Wichita granite, Carlton rhyolite); Cambrian mafic rocks (Raggedy Mountain gabbro group)	Sv; Sf; Sm		Ellenburger Group pinch-out marked by change in contour horizons in West and North Texas
VAN HORN		Young sedimentary strata younger than Vr (Van Horn sandstone)	Vs	Late rhyolite and granite (Franklin Mtns.)	Vr	Not differentiated (see basement inset)	
LLANO		Metasedimentary and metavolcanic rocks (Packsaddle, Carrizo Mtn.); Gneisses (Valley Spring)	Ll_2; Ll_1	Later granites (Town Mountain); Earlier granites; Ultramafic rocks (Coal Creek)	Li_2; Li_1; Lin		
SWISHER-DE BACA		? ? ? Sedimentary rocks (Hazel, Allamoore-Van Horn area; Castner, Mundy, Lanoria and Franklin Mtns.)	Ds	(Mafic igneous rocks in Allamoore Fm and Mundy Breccia—not mapped separately)			
SIERRA GRANDE				Granite (Tishomingo)	SG		
CHAVES				Gneiss, Granite (Blue River, Troy)	C		

SYMBOLS

FAULT TRACES (dashed where inferred or approximately located).

- Nature undetermined, downthrown side indicated
- El Cedral Fault — Normal fault, downthrown side indicated
- Dagout Creek — Thrust fault, teeth on upper plate
- Reverse fault, teeth on upthrown block
- Strike-slip fault
- Trend of major normal faults (offshore)
- Front of orogenic activity

FOLD AXIAL TRACES:

- Anticline, with plunge
- Syncline, with plunge
- Monocline
- Overturned anticline
- Overturned syncline
- Axial trend in highly folded rocks
- Strike trend in highly folded rocks (Van Horn)

Note: All faults and fold traces shown at the contoured horizon. Faults dashed where inferred, dotted where buried.

CONTACTS and CONTOURS:

- Contact of exposed units
- -200 — Contour, 200-m interval, tick on downdip side
- -100 — Supplemental contour, 100-m interval
- Change of contour horizon
- Limit of volcanic cover in Marfa Basin area

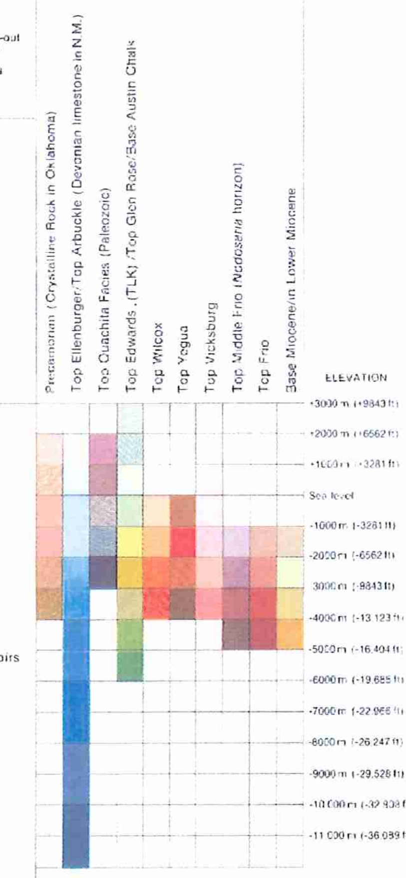
DIAPIRS and related structures:

- Gyp Hill — Salt diapir piercing the contour horizon
- Stetson — Salt diapir below the contour horizon; inferred offshore diapirs
- Conroe — Salt pillow
- Katy — Turtle structure
- Portillo — Shale diapir

OTHER:

- Volcanic center
- Ov — Well of interest, with unit penetrated
- Impact crater
- Well control (where sparse)
- COST — Continental offshore stratigraphic test

CONTOUR SHADING



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12-05-17

☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION		PREPARED FOR BFI WASTE SYSTEMS OF NORTH AMERICA, LLC	MAJOR PERMIT AMENDMENT REGIONAL TECTONIC MAP HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
DATE: 03/2017 FILE: 0120-758-11 CAD: I/IIC-6_REGIONAL TECTONIC MAP.DWG	DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. 1 — DATE 11/2017 — DESCRIPTION OWNERSHIP CHANGE	
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N

0 10 20
SCALE IN MILES

LINEAMENTS OF TEXAS

1981

THE UNIVERSITY OF TEXAS AT AUSTIN
BUREAU OF ECONOMIC GEOLOGY

BY C. M. WOODRUFF, JR., S. CHRISTOPHER CARAN, AND ERIC J. THOMPSON

Prepared for the U.S. Department of Energy, Division of Geothermal Energy, Under Contract No. DE-AS07-79-ID12057, Geothermal Resource Assessment for the State of Texas

NOTE: Lineaments presented on this map were originally perceived on 51 Landsat images (Band 5, 1:250,000 scale) of Texas and adjacent areas.

NOTE:

1. LINEAMENT MAP ADAPTED FROM LINEAMENTS OF TEXAS, C.M. WOODRUFF et al, 1981, BUREAU OF ECONOMIC GEOLOGY, THE UNIVERSITY OF TEXAS AT AUSTIN.

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☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR BFI WASTE SYSTEMS OF NORTH AMERICA, LLC	MAJOR PERMIT AMENDMENT REGIONAL LINEAMENT MAP
DATE: 03/2017 FILE: 0120-758-11 CAD: I/IIC-6_REGIONAL LINEAMENT MAP.DWG DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. 1 — DATE 11/2017 — DESCRIPTION OWNERSHIP CHANGE	HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group CA 3804 PE – 06/30/2017		WWW.WCGRP.COM — DRAWING I/IIC-3

9 SEISMIC IMPACT ZONES

The seismic impact zone location restriction defined by 30 TAC §330.557 is an area with a 10 percent or greater probability that the maximum horizontal acceleration in rock, expressed as a percentage of the earth's gravitational pull, will exceed 0.10 g in 250 years. According to the USGS earthquake hazard website (http:/earthquake.usgs.gov), the site-specific probability that the maximum horizontal seismic acceleration will exceed 0.1 g (one-tenth of the force of gravity) in a 250-year time period is 0.038 (3.8 percent). As such, the USGS-derived site-specific probability of a horizontal acceleration exceeding 0.1 g is significantly lower than the 10 percent or greater horizontal acceleration required for seismic impact zone classification. Drawing I/IIC-4 in Appendix I/IIC presents a USGS seismic impact zone map of Texas (USGS, 2014). As shown on this figure, the site is not located within a seismic impact zone. For these reasons, the Seismic Impact Zone Location Restriction does not apply to the landfill.

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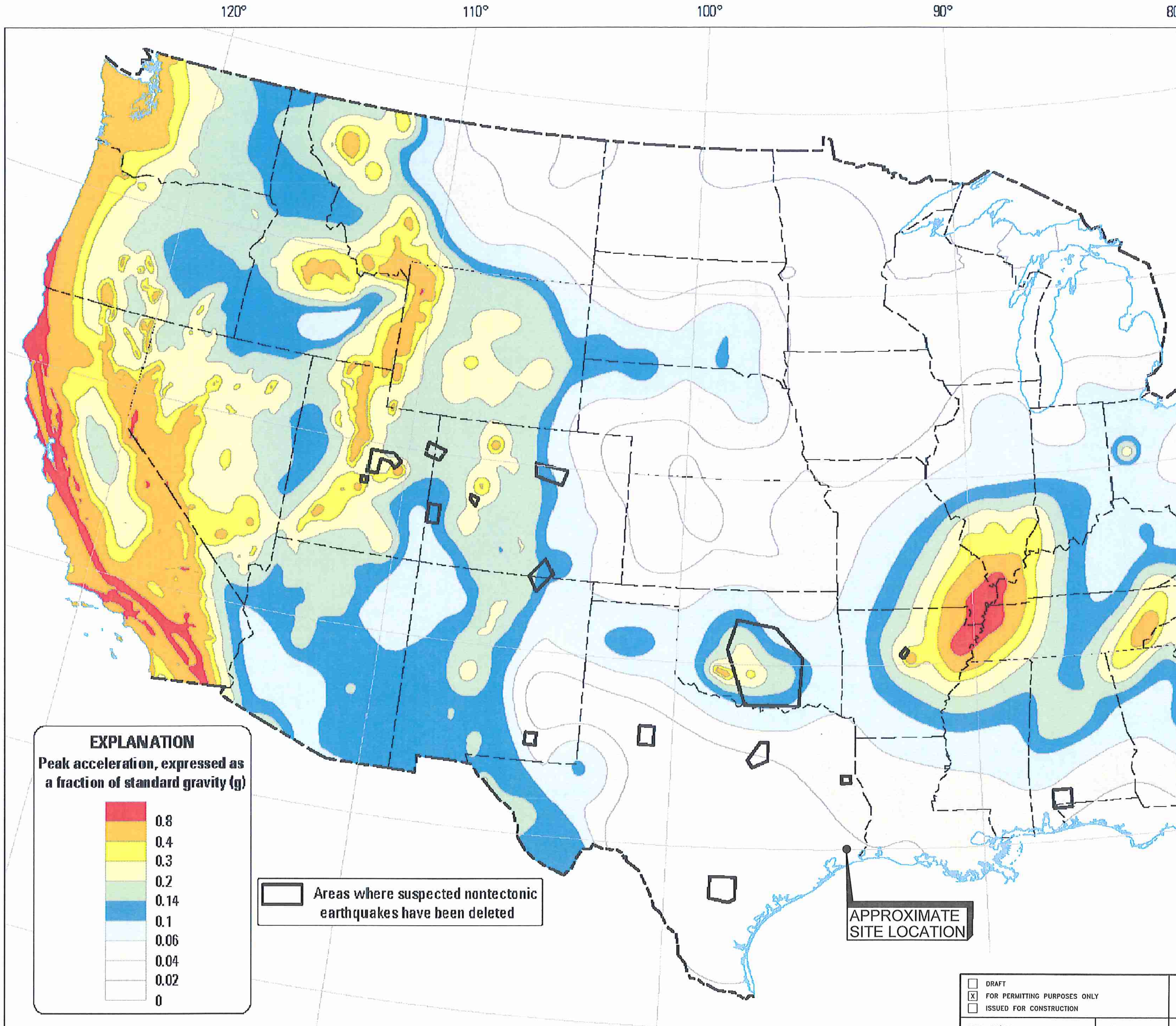

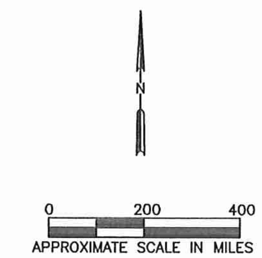

NOTES:

1. SEISMIC IMPACT ZONE MAP MODIFIED FROM 2014 USGS NATIONAL SEISMIC HAZARD MAP FOR 2% EXCEEDANCE PROBABILITY IN A 50 YEAR TIME FRAME.
2. ACCORDING TO THE USGS EARTHQUAKE HAZARD WEBSITE (http://earthquake.usgs.gov),THE PROBABILITY THAT THE PEAK GROUND ACCELERATION WILL EXCEED 0.1g IN A 250-YEAR TIME PERIOD AT THE IESI HARDIN COUNTY LANDFILL IS 3.8 PERCENT.

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☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR BFI WASTE SYSTEMS OF NORTH AMERICA, LLC	MAJOR PERMIT AMENDMENT SEISMIC IMPACT ZONE MAP HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
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(Engineer's seal pertains to non-italicized text in Section 10 of Appendix I/IIC.)

12-5-2017

(Geoscientist's seal pertains to italicized text in Section 10 of Appendix I/IIC.)

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10 UNSTABLE AREAS

10.1 Introduction

The location restriction criteria in 30 TAC §330.559 require engineering measures to be incorporated into the design of a disposal unit located in an unstable area to ensure that the integrity of the structural components of the disposal unit will not be disrupted. Unstable areas, by definition, are areas susceptible to natural or human-induced events or forces that are capable of impairing the integrity of some or all structural components (i.e., liner systems, leachate collection systems, and final cover systems) of a disposal unit. Unstable areas can include poor foundation conditions, areas susceptible to mass movement, or karst terrain.

These three potential unstable area conditions are discussed in the following three subsections.

10.2 Foundation Conditions

10.2.1 Bottom Liner Foundation Condition

As discussed in Appendices IIIE – Geotechnical Report and IIIG – Geology Report, the site is underlain by approximately 400 feet of Lissie Formation clayey sediments. At least 9 feet of low-permeability Lower Clay Stratum clay separates the landfill's excavation grades from the underlying saturated Lower Sand Stratum. The Upper Clay Stratum and portions of the Upper Sand Stratum Aquifer are designed to be removed by disposal cell excavations. A foundation settlement analysis is included in Appendix IIIE (Appendix IIIE-B) to verify that the amount of consolidation of the natural soils below the site will not adversely affect the integrity of the existing and future liner systems. As noted in Appendix IIIE, the strain on the liner system caused by differential settlement is within acceptable limits for the liner system materials. In addition, the bottom liner leachate collection system design, included in Appendix IIIC, has been developed to account for settlement. As demonstrated in Appendix IIIC, the leachate collection system will function as designed after the settlement of the foundation soils has occurred.

On-site and local geologic and geomorphologic features were evaluated as part of Appendix IIIG for naturally induced events or forces that would have the potential to affect the integrity of the landfill or the landfill's components. No potential for significant subsidence due to local groundwater withdrawal was identified in this *evaluation. According to the City of Kountze, Texas Water Department and water well search records, the area within a one-mile radius of the landfill receives drinking water obtained from private water wells. Regionally, both groundwater and surface water are used for public water supply. Regional subsidence was reviewed as part of the unstable areas evaluation. Based on local water well water level and simulation data obtained from the USGS (Kasmarek, 2013), the potentiometric surface of the regional Chicot, Evangeline, and Jasper Aquifers are heavily influenced by groundwater pumping in the nearby greater Houston area. The Southeast Texas Groundwater Conservation District (SETGCD) manages groundwater resources for Jasper, Newton, Hardin, and Tyler Counties. The Harris-Galveston Subsidence District (HGSD) regulates the withdrawal of groundwater for land subsidence prevention purposes in nearby Harris and Galveston Counties. The USGS, HGSD, and SETGCD data indicate no significant historical subsidence resulting from regional groundwater withdrawal in the immediate vicinity of Hardin County and the landfill property. In 2006 the Texas Water Development Board (TWDB) released a 51-year predictive Groundwater Availability Model (GAM) for the SETGCD. This model indicates a predicted groundwater drawdown within Hardin County of less than two feet between 1999 and 2050. For these reasons, there is no existing potential for significant landfill subsidence due to groundwater withdrawal.*

Given the above, it is concluded that no natural or human-induced event or forces will adversely affect the landfill or the landfill components.

10.2.2 Final Cover Foundation Condition

The geotechnical design in Appendix IIIE includes demonstrations that the proposed final cover system will function as designed after the final settlement of waste placed below the final cover area is complete. The demonstrations also include a strain analysis showing that the differential settlement of waste will not be detrimental to the final cover system and the maximum estimated strain will be below allowable strain values for each final cover system component.

10.3 Mass Movement

The geotechnical design in Appendix IIIE includes an analysis that the mass movement of natural soils and the landfill will not occur at the site. A detailed summary of the slope stability analyses is provided in Section 6 of Appendix IIIE. The analyses show that the excavated and constructed slopes will be stable. The analyses incorporate various interim fill conditions and the final configuration condition of the landfill. The results of the stability analyses indicate that the proposed excavation, constructed liner, interim waste fill slopes, and final configuration slopes are stable under the conditions analyzed. The results of the stability analyses demonstrate that the calculated factor of safety values are higher than the recommended minimum factor of safety. The recommended minimum factors of safety for the conditions analyzed were determined using recommendations from the USACE "Design and Construction of Levees" manual (EM 1110-2-1913) and the EPA's "Technical Guidance Manual for Design of Solid Waste Disposal Facilities." An infinite slope stability analysis was also developed for the liner and final cover systems and are discussed in more detail in Section 6.5 of Appendix IIIE. The results of both the generalized slope stability and interface slope stability analyses indicate that the landfill and its components will be geotechnically stable as designed.

Furthermore, to ensure interface stability of the landfill components, the minimum interface strength requirements have been incorporated into the Appendix IIID – Liner Quality Control Plan for future bottom and overliner construction and Appendix IIIJ-A – Final Cover System Quality Control Plan for the future final cover system.

10.4 Karst Terrain

As discussed in Section 1.1 in Appendix IIIG of Part III, the site is located in the West Gulf Coast Plain regional physiographic province. This province is underlain by Cenozoin-age fluvial deltaic sediments of the Gulf Coast Aquifer System including the Lissie Formation, Willis Formation, Golid Sand Formation, Fleming Formation, and Catahoula Formation. No surface indications of karst development were observed during on-site investigations, from area roadways, or in a site aerial photograph and area USGS topographic maps. No dissolution voids or jointing have been noted in the subsurface investigation borehole logs or in a borrow area to the east of the site that indicate any potential for karst development. In addition, the USGS karst open file report 2014-1156 indicates the landfill permit boundary contains no underlying, near surface rocks that are favorable for karst development (i.e., massively bedded limestone in the near surface). According to the Texas Speleological Survey Cave and Karst Database (2016), there are no reported caves or karst sinkholes in the landfill vicinity.

No surface indications of karst development were observed by Aaron K. Evans, P.G. (a WCG licensed professional geoscientist) during on-site investigations, from area roadways, or in a site aerial photograph. The review of area topographic maps indicates no karst topography or sinkholes exist in the site vicinity. The USGS 7.5-minute topographic maps reviewed included the Kountze South, Texas (2013) and Kountze Southwest, Texas (2013) quadrangle maps. These references are listed on Figure IIIG-A.10 in Appendix IIIG-A of Part III.

Karst terrain formation requires thickly-bedded, fractured water-soluble rocks to be present in the near surface. Potentially karstic-producing weatherable rocks include limestone, gypsum, and halite. Where the dissolution cavities become large enough, the roof of the cavity may collapse, forming a sinkhole. In a karst terrain, sinkholes may be indicated on topographic maps as circular to sub-rounded (often concentric) closed topographic contour lines that spatially may have a sponge-like texture on the *topographic map. A vanishing stream or lack of developed surface drainage on a topographic map may also indicate the presence of karst conditions. Aaron K. Evans, P.G. (a WCG licensed professional geoscientist) reviewed the referenced USGS topographic maps and determined that no characteristic karstic map features were present. No surface indications of karstic sinkholes were observed by Mr. Evans during an area reconnaissance from area roadways or in a site aerial photograph. Based on borehole evidence and regional stratigraphy, the conditions necessary for karst development (e.g., shallow unit of fractured or elevated porosity limestone) are not present beneath the landfill permit boundary.*

10.5 Summary

In summary, the bottom liner systems are founded in the Lower Sand Stratum and Lower Clay Stratum and will provide an excellent foundation layer. In addition, the final cover system is designed to ensure that the integrity of these systems will be maintained. The stability analysis shows that each landfill component will be stable and no mass movements will occur. *Finally, there is no potential for karst development to occur.* The site is and will continue to be in compliance with this location restriction.

Given the above, it is concluded that no natural or human-induced event or forces will adversely affect the landfill or the landfill components. This conclusion is based on a review of the site in its current state, *the expected groundwater usage* and development around the site, and the facility operations itself; there are no on-site local soil conditions, *geologic conditions, or geomorphologic features* as well as no human induced features or events (both surface and subsurface) that would result in significant differential settlement or other unstable conditions. Therefore, the site meets the requirements of §330.559.

11 COASTAL AREAS

The Coastal Areas Location Restriction within 30 TAC §330.561 requires that a new landfill cell or expansion of an existing cell of a landfill managing Class 1 Industrial Solid Waste not be located on a barrier island or peninsula, or within 1,000 feet of an active coastal shoreline erosion.

The landfill does not accept Class 1 Industrial Solid Waste. Therefore, the site is in compliance with the Coastal Areas Location Restriction.

12 TYPE I AND TYPE IV LANDFILL PERMIT ISSUANCE PROHIBITED

The Type I and Type IV Landfill Permit Issuance Prohibited location restriction within 30 TAC §330.563 prohibits the issuance of a permit for a Type IV landfill that is: (1) located within 100 feet of a canal that is used as a public drinking water source or for irrigation of crops used for human or animal consumption; (2) is located in a county with a population of more than 225,000 that is located adjacent to the Gulf of Mexico; and (3) the county commission within the county the landfill is located has adopted a resolution recommending denial of the application. The location restriction also prohibits the issuance of a permit for a new Type I or Type IV landfill or a permit amendment authorizing the conversion of a Type IV landfill to a Type I landfill only if the landfill is located adjacent to a county with a population of more than 3.3 million and inside the boundaries of a national forest, as designated by the United States Forest Service, on public or private land.

No canal exists within 100 feet of the Type IV C&D disposal area, and the application does not propose to convert the Type IV landfill to a Type I landfill. Finally, the landfill is not within the boundaries of a national forest.

Based on the above, the site is in compliance with the Type I and Type IV landfill Permit Issuance Prohibited Location Restriction.

APPENDIX I/IID

TRAFFIC STUDY

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS
TCEQ PERMIT NO. MSW-2214B

TRAFFIC STUDY

Prepared for

IESI TX Landfill LP

October 2016

STATE OF TEXAS
NEVZAT TURAN
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10/21/2016

Prepared by

Weaver Consultants Group, LLC
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6420 Southwest Boulevard, Suite 206
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817-735-9770

WBC Project No. 0771-365-11-07-03

CONTENTS

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10/31/2016

1 INTRODUCTION

1.1 Purpose

The purpose of this study is to show that the IESI Hardin County Landfill access roads (Farm to Market (FM) 770 and State Highway (SH) 326) will provide excellent access to the site. The study is completed consistent with the requirements listed in Title 30 Texas Administrative Code (30 TAC) §330.61(i), which requires the following information.

- Provide data on the availability and adequacy of roads that the owner or operator will use to access the site;
- Provide data on the volume of vehicular traffic on access roads within one mile of the proposed facility, both existing and expected, during the expected life of the proposed facility;
- Project the volume of traffic expected to be generated by the facility on the access roads within one mile of the proposed facility; and
- Submit documentation of coordination of all designs of proposed public roadway improvements such as turning lanes, storage lanes, etc., associated with site entrances with the agency exercising maintenance responsibility of the public roadway involved. In addition, the owner or operator shall submit documentation of coordination with the Texas Department of Transportation for traffic and location restrictions.

1.2 Summary of Proposed Landfill Expansion

The IESI Hardin County Landfill is an existing municipal solid waste landfill located in central Hardin County, approximately 0.7 miles west of the intersection of FM 770 and SH 326. The waste disposal unit is approximately 52 acres in size. The proposed expansion will not laterally increase the waste footprint. It is a vertical expansion only which includes deepening a portion of the landfill and increasing the height of the landfill within the existing permitted footprint.

A project summary and site location maps are provided in Appendix A.

2 TRAFFIC INFORMATION

2.1 Availability and Adequacy of Roads

As shown on the TxDOT Map (Figure 1 in Appendix A), the two access roads within one mile of the site are Farm to FM 770 and SH 326. The IESI Hardin County Landfill site access road enters the landfill along the north property boundary from FM 770. FM 770 is a 2-lane, asphalt-paved state highway. FM 770 intersects SH 326 approximately 0.7 miles northwest of the site entrance. SH 326 also is a 2-lane asphalt-paved state highway.

FM 770 and SH 326 will serve as the primary roadways within the vicinity of the landfill for collection vehicles delivering waste to the landfill. Other roads within one mile of the site include Camp Wheeler Road, Hardin Court Road, Miller Road, Fire Tower Road, Hargroves Lane, and Langham Road. These roads maybe periodically be used by collection vehicles to serve residences and businesses located along or near these roadways; however, they are not main access roads that collection vehicles will use to access the landfill.

The existing landfill was permitted in 1995 with an updated traffic study completed in 2010. Previous correspondence with TxDOT is included in Appendix B.

2.2 Volume of Vehicular Traffic

The volume of vehicle traffic on FM 770 and SH 326 is summarized in Table 2.1. As noted in Table 2.1, TxDOT traffic counts for 2015 were available for FM 770 and SH 326. The 2015 TxDOT traffic counts were adjusted to account for the additional traffic created by area growth over the life of the site (based on growth rates projected by the Texas Water Development Board). Growth was projected to 2047, the lifespan of the proposed landfill expansion.

Table 2.2 presents a summary of the estimated traffic patterns and vehicle counts for the access roads within 1 mile of the site. A list of the various assumptions that were used to derive the estimates is presented as notes to Table 2.2.

The traffic volume impact assessment is summarized in Table 2.2. As shown, the development of the landfill will have a minimal impact on all access roads. The level of service (LOS) for FM 770 is estimated to remain the same throughout the life of the landfill based on growth projections. In summary, the traffic associated with the landfill only utilizes a minimum amount of the capacity of the access roads (i.e., less than 0.5 percent for FM 770, and less than 0.3 percent for SH 326).

2.3 Intersection Analysis

An analysis of the landfill entrance road and FM 770 intersection is summarized on Figure 6 in Appendix A. ***As shown on Figure 6, vehicles traveling eastbound on FM 770 will arrive at the intersection at a maximum rate of one vehicle every 20 seconds in 2015 and every 17 seconds in 2047 during the peak hour flow rate. In addition, landfill vehicles accessing the site will arrive westbound at the intersection of FM 770 and the landfill entrance road every 6 minutes in 2015 and every 5 minutes in 2047 during the peak hour flow rate.*** Because of the low traffic volume associated with the intersection (landfill vehicles arrive over 5 minutes apart in both cases), the FM 770 and landfill entrance road is adequate for the associated traffic volume throughout the life of the facility.

FM 770 intersects SH 326 approximately 0.7 miles east of the landfill entrance. As shown in Table 2.2, the landfill vehicles make up a small percentage of the roadway capacity (less than 0.5 percent). Therefore, any situation that would cause the level of service provided by the intersection to decrease, such as a large amount of development in the immediate area, would not be caused from the landfill.

2.4 Queuing/Mud Control

The current configuration includes a gravel entrance road from FM 770 to the landfill perimeter road, approximately 340 feet. The long road length and gravel allows mud on vehicles to "spin off" onto the entrance road within the landfill property before the vehicle returns to FM 770. In addition, the 340-foot entrance road allows an ample queuing area for four or five landfill vehicles within the landfill to avoid disturbing vehicular traffic along FM 770, with additional queuing available on the landfill perimeter road.

Table 2.1
2-Way Traffic Volumes[1]

Location	Traffic Volumes[2] (Veh/Day)		Existing Traffic Volume 2015 (Veh/Day)						Projected Traffic Volume[3] 2047 (Veh/Day)					
			Daily			Peak Hour[4]			Daily			Peak Hour[4]		
	Daily	Peak Hour[4]	Landfill Trips[5]	Non-Landfill Trips	Total	Landfill Trips	Non-Landfill Trips	Total	Landfill Trips[5]	Non-Landfill Trips	Total	Landfill Trips	Non-Landfill Trips	Total
FM 770	1,831	183	100	1,731	1,831	10	173	183	122	2,058	2,180	12	206	218
SH 326(N)	4,478	448	70	4,408	4,478	7	441	448	86	5,245	5,331	8	525	533
SH 326(S)	1,887	189	30	1,857	1,887	3	186	189	36	2,238	2,274	4	220	224

Notes:
1 Traffic volumes listed in this table include two-way traffic volumes.
2 Traffic information was taken from a 2015 TxDOT Traffic Map.
3 The projected traffic volumes were obtained using projected growth rates for the surrounding area growth rate (non-landfill vehicles). The growth rates were obtained from the Texas Water Development Board, 2015 Regional Water Plan. The population increase for 2015-2020 is 0.88% per year, for 2021-2030 is 0.73%, for 2031-2040 is 0.49%, and for 2041-2047 is 0.35%.
4 Peak hour volumes are assumed to be ten percent of total daily traffic.
5 Landfill trips estimated from information provided by the site operator and increased as discussed in Note 3.

Table 2.2
Traffic Impact Assessment[1]

Location	Roadway Capacity[4] (Veh/Hr)	2015 Traffic Conditions				Projected 2047 Traffic Conditions[3]			
		Peak Hour Volume (Veh/Hr)	% of Roadway Capacity Used	LOS Based on Percent Time Spent Following[5]	% of Roadway Capacity Used by Landfill Vehicles	Peak Hour Volume (Veh/Hr)	% of Roadway Capacity Used	LOS Based on Percent Time Spent Following[5]	% of Roadway Capacity Used by Landfill Vehicles
FM 770	2,800	183	6.5	A	0.36	218	7.8	A	0.43
SH 326(N)	2,800	448	16.0	A	0.25	533	19.0	B	0.29
SH 326(S)	2,800	189	6.8	A	0.11	227	8.0	B	0.14

Notes:
1 Traffic volumes listed in this table include two-way traffic volumes.
2 Traffic information was taken from a 2015 TxDOT Traffic Map.
3 The projected traffic volumes were obtained using projected growth rates for the surrounding area growth rate (non-landfill vehicles). The growth rates were obtained from the Texas Water Development Board, 2015 Regional Water Plan. The population increase for 2015-2020 is 0.88% per year, for 2021-2030 is 0.73%, for 2031-2040 is 0.49%, and for 2041-2047 is 0.35%.
4 The capacities were obtained from the Highway Capacity Manual, 2000.
5 Level of service was calculated using Chapter 20 of the Highway Capacity Manual, 2000, and is based on percent time spent following for Class II highways.

3 COMPLIANCE WITH HIGHWAY BEAUTIFICATION ACT

The Texas Transportation Code (TTC) Chapter 391 outlines compliance conditions and regulations to ensure that areas adjacent to interstate and primary transportation systems in Texas comply with the Highway Beautification Act (HBA), 23 U.S.C. §131.136, and 319. In the context of the HBA, landfills are classified as junk yards, and no junkyard may be established within 1,000 feet of the right of way of a highway in the interstate or primary systems. The right of way of FM 770 is within 1,000 feet of the permit boundary of the IESI Hardin County Landfill. However, based on the definitions set forth in the HBA and the TTC, it is understood that FM 770 is not a part of the primary highway system. Therefore, the requirements set forth in the HBA are not applicable to the IESI Hardin County Landfill.

However, the design and operating requirements listed in the proposed Texas Commission on Environmental Quality (TCEQ) permit application were developed to meet the intent of the screening standards for landfills set forth in the TxDOT Right of Way Manual (Volume 7 – Beautification, Chapter 10 – Control of Junkyards). According to the TxDOT Right of Way Manual, landfills will be considered appropriately screened by:

- Fencing the landfill area;
- Confining the refuse to the smallest practical area;
- Reducing the refuse to the smallest practical volume; and
- Covering the refuse with a layer of earth at the conclusion of each day's operation or at more frequent intervals if necessary.

A summary of each of these requirements is listed in Table 3-1.

Table 3-1
IESI Hardin County Landfill Expansion
Landfill Screening Requirements

TxDOT Screening Requirements	Existing and Proposed Site Design or Permit Operating Condition
Fencing the Landfill Area	The IESI Hardin County Landfill is currently fenced along the northern permit boundary and wooded areas along the west south and east. Access into the landfill is restricted to the entrance road on the north side of the site.
Confining the Refuse to the Smallest Practical Area and Volume	Solid waste at the IESI Hardin County Landfill is disposed of at the working face of the landfill. The working face is the only portion of the disposal area containing exposed solid waste. The size of the working face is required to be confined to as small of an area as practical. Specific working face size limitations are included in the existing and proposed Site Operating Plan.
Covering the Refuse with a Layer of Earth at the Conclusion of Each Day's Operation or at More Frequent Intervals if Necessary	The Site Operating Plan mandates that at least once every 24 hours, exposed solid waste will be covered by at least six inches of earthen cover material or by TCEQ-approved alternate daily cover material. Additionally, areas that have received daily cover and become inactive for at least 180 days will receive an additional 6 inches of well-compacted cover material. This intermediate cover will be graded and seeded such that sustainable vegetation is established on these inactive areas. The erosion control plan for the IESI Hardin County Landfill outlines inspection and maintenance requirements designed to maintain the vegetation and integrity of the intermediate cover.

4 SUMMARY

In summary, the area roadway system providing access to the IESI Hardin County Landfill is excellent. The existing roadway, including the intersection of FM 770 and the access roadway to the landfill, provide good and safe access to the landfill. No roadway improvements are needed as a result of the proposed expansion.

APPENDIX A

PROJECT SUMMARY AND SITE LOCATION MAPS

PROJECT SUMMARY
AND
SITE LOCATION MAPS

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

10/31/2016

Project Summary
IESI Hardin County Landfill Expansion
Hardin County, Texas

Introduction

The IESI Hardin County Landfill is in the process of developing a major permit amendment application that will provide long-term disposal capacity for authorized solid waste that is generated in Hardin County and surrounding counties. The objective of this summary is to provide an overview of the proposed landfill expansion. The following subsections detail information regarding the owner and operator of the landfill, general site information, and a summary of the proposed landfill design.

Owner/Operator Information

The IESI Hardin County Landfill is owned and operated by IESI TX Landfill LP. IESI TX Landfill LP is a subsidiary of Waste Connections, Inc. Waste Connections is one of the leading providers of solid waste services in the nation. Waste Connections provides nonhazardous waste collection, transfer, recycling, and disposal services to residential, municipal, industrial and commercial customers across the country.

Site Information

The following drawings are attached to this summary.

- Figure 1 – Site Location Map. This drawing shows the site location on a standard TxDOT county highway map.
- Figure 2 – General Topographic Map. This drawing shows the permit boundary and permitted landfill footprint on a USGS map.
- Figure 3 – Aerial Photograph. This figure shows the permit boundary and permitted landfill footprint on an aerial photograph.
- Figure 4 – Permitted and Proposed Excavation Plan. This figure provides a comparison between the currently permitted landfill excavation plan and the proposed amended landfill excavation plan.

- Figure 5 – Permitted and Proposed Landfill Completion Plan. This figure provides a comparison between the currently permitted landfill completion plan and the proposed amended landfill completion plan.

The IESI Hardin County Landfill is an existing 79-acre Municipal Solid Waste (MSW) landfill (current TCEQ Permit No. MSW-2214A) located approximately 0.7 miles west of the intersection of FM 770 and SH 326 in central Hardin County.

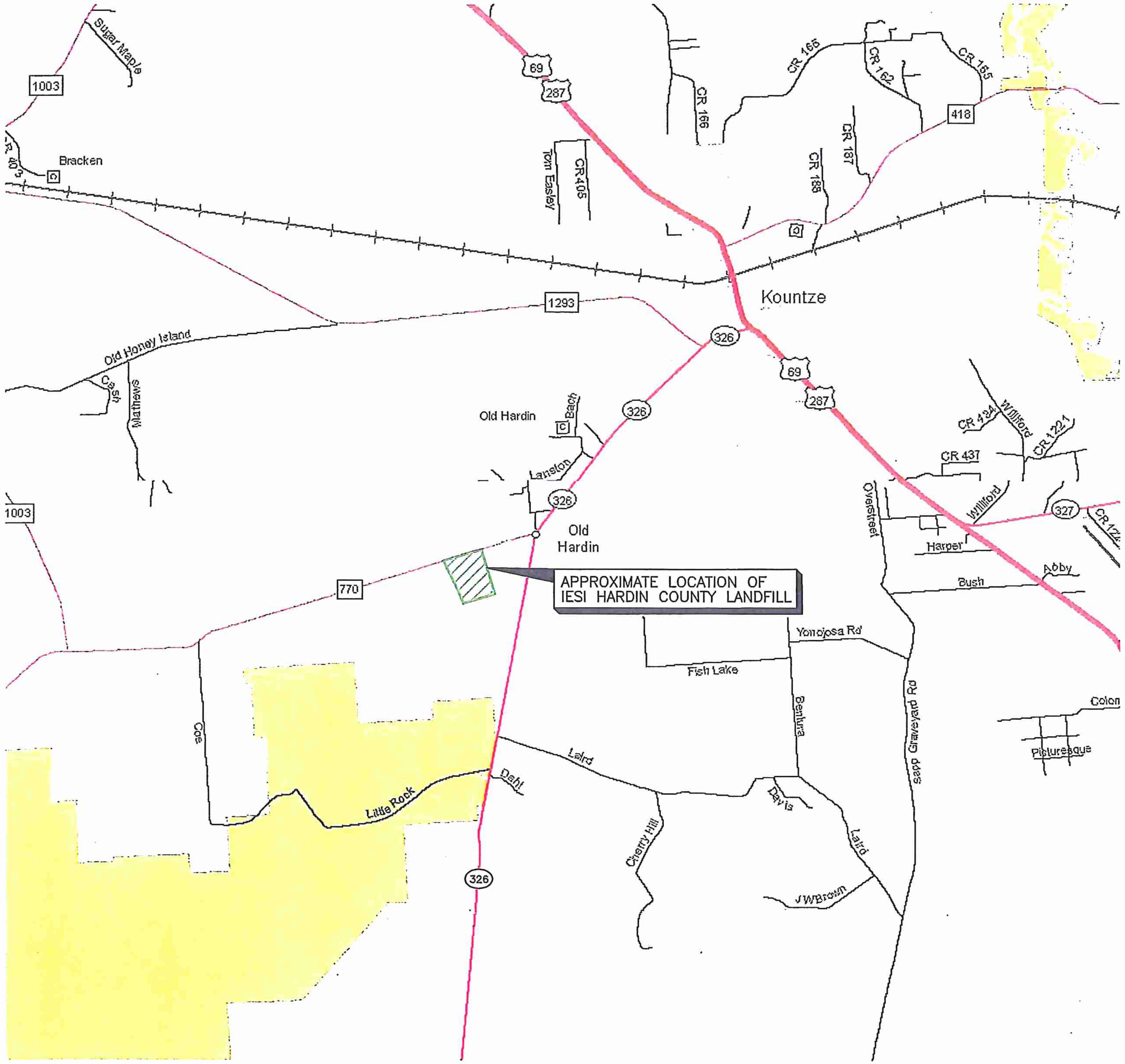
The site was originally permitted as a MSW landfill by the Texas Natural Resource Conservation Commission (TNRCC) in 1995. Approximately 32 acres of the 49.6-acre Subtitle D (i.e., composite bottom liner system) MSW disposal area has currently been developed. The facility also includes a 2.4-acre construction and demolition debris disposal unit, of which approximately 1.4 acres have been developed. The original permit number was Permit No. MSW-2214. The permit was transferred in 2002 from Hardin County to IESI TX Landfill LP.

Design Summary

The following information presents a summary of the design and operations for the proposed IESI Hardin County Landfill expansion:

- The IESI Hardin County Landfill is an existing municipal solid waste landfill facility (current TCEQ Permit No. MSW-2214A). The existing landfill currently serves residences and businesses in Hardin County and surrounding counties.
- With this expansion, the existing 79-acre permit boundary and existing 52-acre limits of waste will remain unchanged. The permitted but undeveloped waste disposal area will be deepened as shown on Figure 4, which shows both permitted top of protective cover grades (over constructed cells) and proposed excavation grades. The completion grades will be increased to optimize the disposal capacity of the permitted waste fill area. The currently permitted and proposed complete plans are shown on Figure 5.
- Accepted wastes will remain consistent with the current MSW landfill permit. The facility currently accepts municipal solid waste resulting from or incidental to municipal, community, commercial, institutional, and recreational activities; municipal solid waste resulting from construction and demolition activities; Class 2 and Class 3 nonhazardous industrial solid waste; and certain special wastes as permitted by the TCEQ. For this permit amendment cells 6 and 7 will be constructed in accordance with 30 TAC 335.590, and will accept Class 1 non-hazardous industrial waste in addition to the waste streams received by the landfill under the current permit.

- Access to the landfill will be provided via the existing site access road entrance off of FM 770. Based on travel patterns of existing landfill traffic, vehicles bound for the landfill will generally access the site using SH 326 and FM 770.
- A bottom liner system and final cover system that meet all regulatory requirements will be used for constructing the solid waste containment system. The design objective of the containment system (liner, leachate management system, and final cover) is to isolate the solid waste and remove leachate (defined as liquid that has contacted solid waste) that collects on the liner system. Leachate that is removed from the landfill is transported to an offsite, permitted treatment facility. The construction procedures of the liner system and final cover system follow strict TCEQ-approved quality control and quality assurance procedures, which are verified by an independent testing firm, and approved by a professional engineer licensed in the State of Texas. Liner construction is divided into approximately 3 to 4 acre "cells" across the permitted bottom of the landfill. Each of the containment system components must be approved by the engineer, and thoroughly reviewed and approved by the TCEQ before solid waste is placed into each constructed cell.
- To verify that the highest level of environmental protection is maintained, the following landfill monitoring systems are provided:
  - Groundwater Monitoring System. The purpose of the groundwater monitoring system is to verify the integrity of the containment system and demonstrate that area groundwater is not adversely impacted by the landfill. This is accomplished by obtaining water samples from the monitor wells, located on the perimeter of the landfill, which are screened to monitor groundwater quality. The water samples are tested at an offsite laboratory.
  - Gas Monitoring System. The purpose of the landfill gas monitoring system is to verify that landfill gas does not migrate beyond the permit boundary. Landfill gas probes are placed along the perimeter of the permit boundary.
  - These monitoring systems are sampled and tested periodically per the TCEQ-approved monitoring plans. The results are filed with the TCEQ and are public record.
- Site Operations. The site will be operated by properly trained personnel. A detailed Site Operating Plan will be included in the permit amendment application. The plan will detail the required equipment, personnel, and safety procedures required to operate the site in accordance with TCEQ regulations. The IESI Hardin County Landfill will continue to be inspected by the TCEQ on a regular basis to ensure the site is in compliance with state regulations and developed as permitted.



N

0 3000 6000

SCALE IN FEET

LEGEND

SITE LOCATION

NOTE:

1. MAP OBTAINED FROM TEXAS DEPARTMENT OF TRANSPORTATION DATED 2014.

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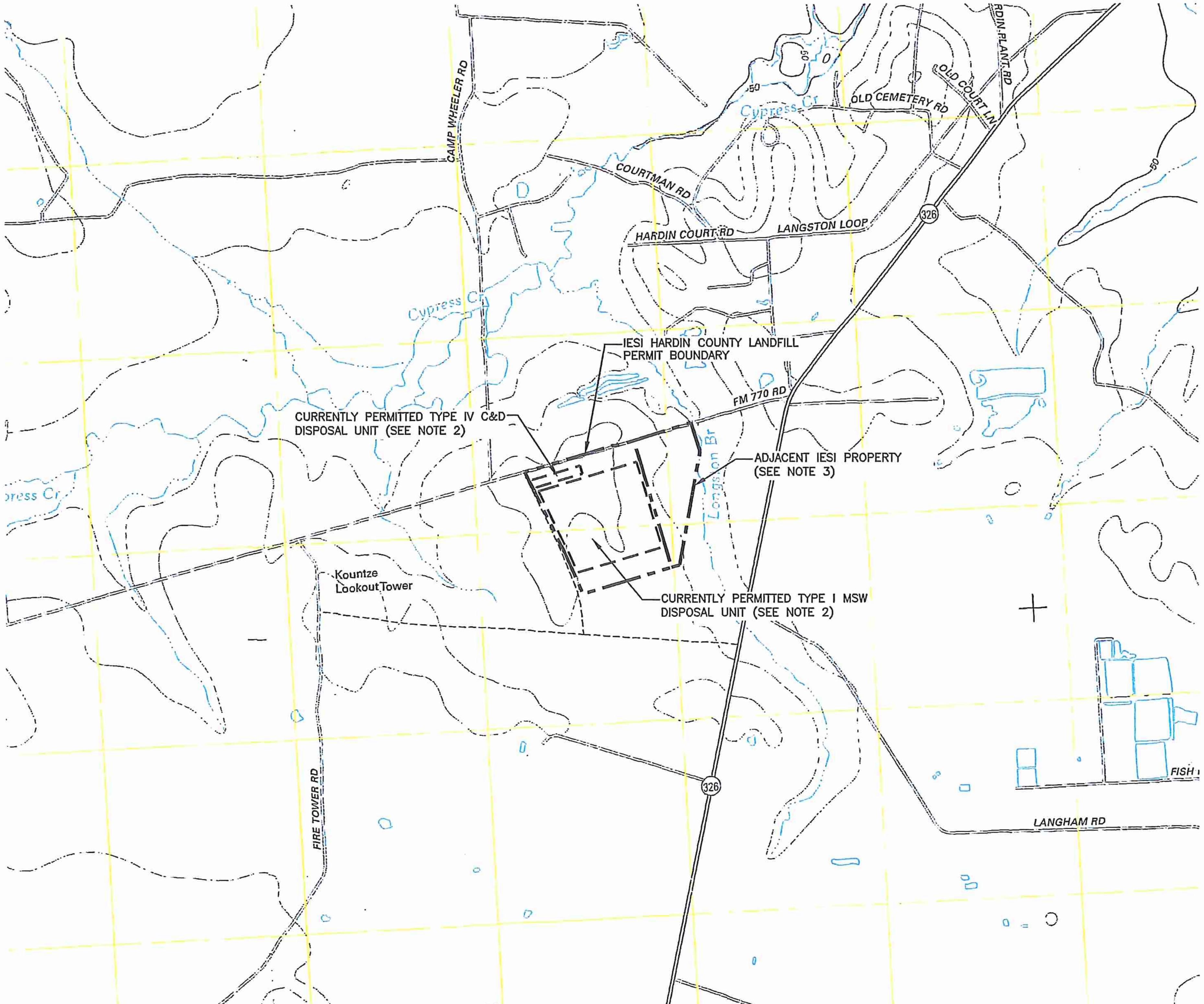
DATE: 10/2016 FILE: 0771-365-11 CAD: FIG 1-SITE LOCATION MAP.DWG DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. / DATE / DESCRIPTION	IESI HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group TBPE REGISTRATION NO. F-3727		WWW.WCGRP.COM / FIGURE 1

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 1-SITE LOCATION MAP.dwg, jwilson, 1:2



N

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SCALE IN FEET

LEGEND

IESI PROPERTY BOUNDARY
PERMIT BOUNDARY
LIMITS OF WASTE

ROAD CLASSIFICATION

Interstate Route
US Route
Ramp
State Route
Local Road
4WD
Interstate Route
US Route
State Route

KOUNTZE SW, TX
2013

KOUNTZE SOUTH, TX
2013

NOTES:

1. ADAPTED FROM USGS 7.5 MINUTE QUADRANGLE TOPOGRAPHIC MAPS (KOUNTZE SOUTH, TX 2013 AND KOUNTZE SW, TX 2013).
2. THE FACILITY HAS TWO SEPARATE PERMITTED DISPOSAL UNITS. THE FIRST UNIT IS A TYPE I MUNICIPAL SOLID WASTE (MSW) DISPOSAL UNIT AND IT ENCOMPASSED APPROXIMATELY 49.6 ACRES. THE SECOND PERMITTED UNIT IS A 2.4 ACRE TYPE IV CONSTRUCTION AND DEMOLITION (C&D) DISPOSAL UNIT.
3. THE ADJACENT IESI PROPERTY IS APPROXIMATELY 31.3 ACRES. THIS PROPERTY WILL NOT BE JOINED TO THE DISPOSAL AREA; HOWEVER, A RESTRICTIVE COVENANT MAY BE OBTAINED FOR A PORTION OF THIS AREA FOR LANDFILL-RELATED DRAINAGE FACILITIES.

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FILE: 0771-365-11
CAD: FIG 2-GENERAL TOPO MAP.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

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PREPARED FOR
IESI TX LANDFILL LP

REVISIONS

NO.	DATE	DESCRIPTION

MAJOR PERMIT AMENDMENT
GENERAL TOPOGRAPHIC MAP

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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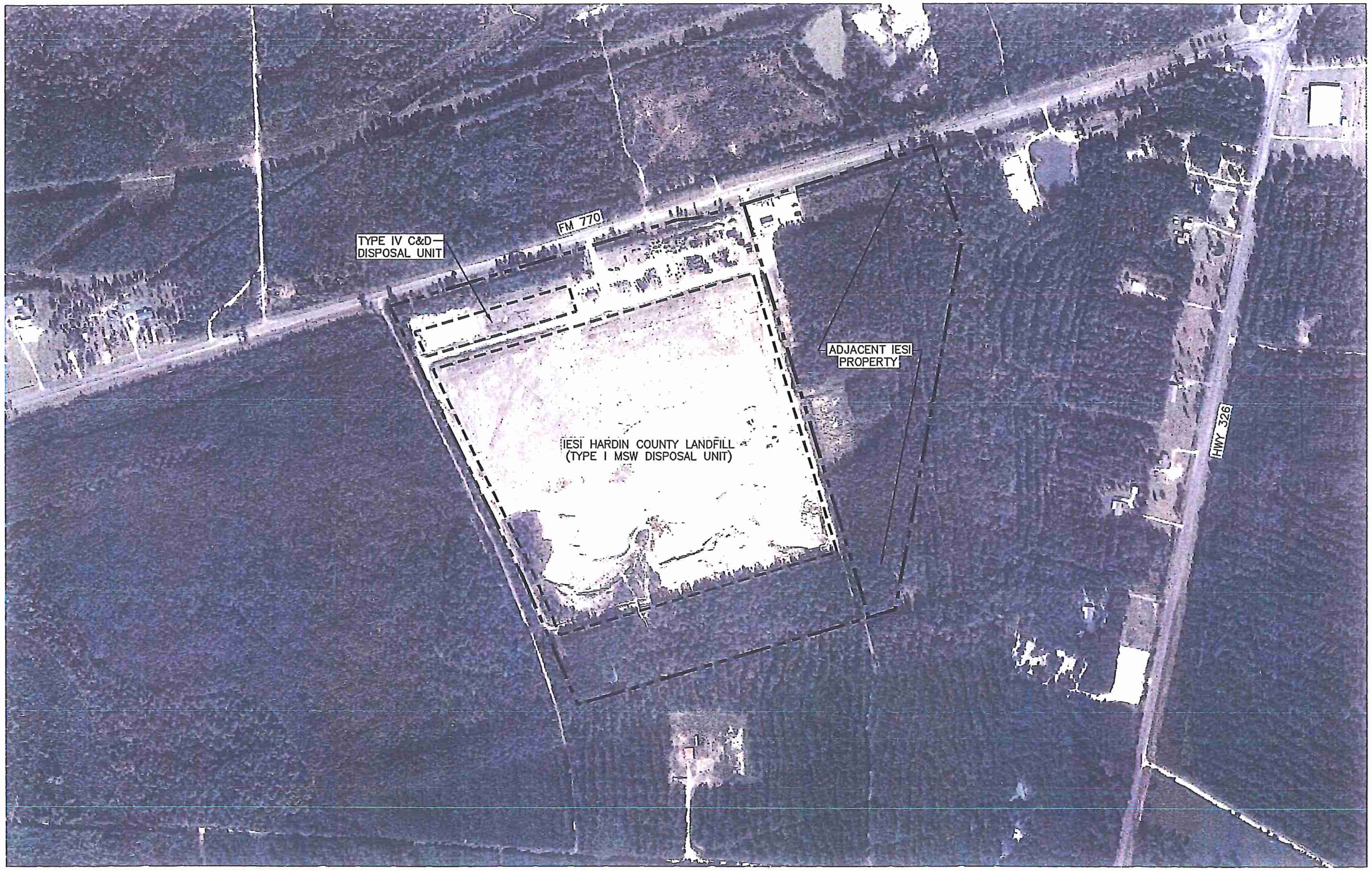
FIGURE 2

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 2-GENERAL TOPO MAP.dwg, jwilson, 1:2



N

0 300 600
SCALE IN FEET

LEGEND

- IESI PROPERTY BOUNDARY
- PERMIT BOUNDARY
- LIMITS OF WASTE

NOTE:

1. AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH AND DATED 2016.

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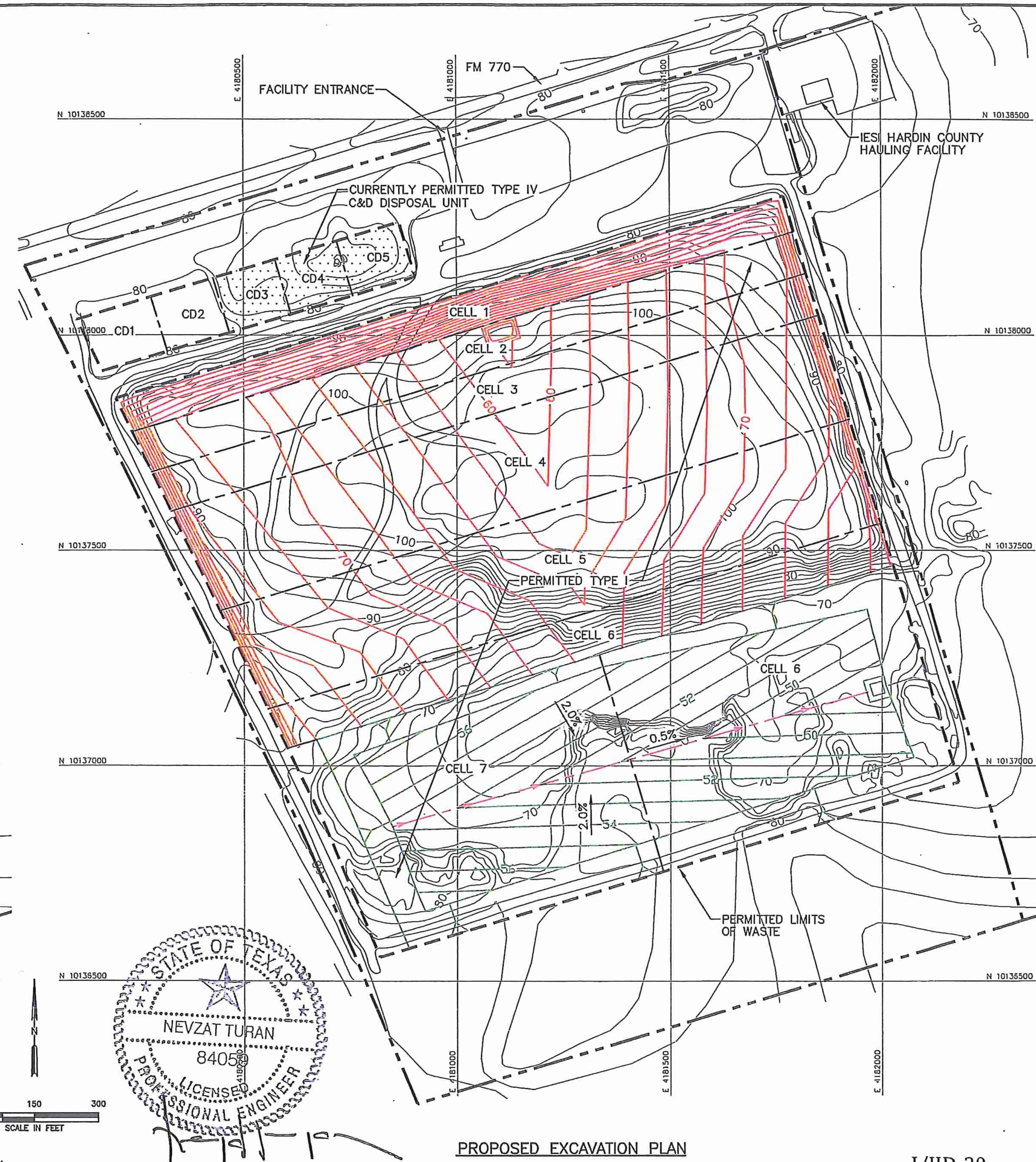
I/IID-19

☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION		PREPARED FOR IESI TX LANDFILL LP	MAJOR PERMIT AMENDMENT AERIAL PHOTOGRAPH
DATE: 10/2016 FILE: 0771-365-11 CAD: FIG 3-AERIAL PHOTOGRAPH.DWG	DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. / DATE / DESCRIPTION	IESI HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group TBPE REGISTRATION NO. F-3727			WWW.WCGRP.COM / FIGURE 3

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 3-AERIAL PHOTOGRAPH.dwg, jwilson, 1:2

CURRENTLY PERMITTED CONDITIONS PLAN



PROPOSED EXCAVATION PLAN

I/IID-20

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CONTOURS FOR THE CURRENTLY PERMITTED CONDITIONS PLAN REPRESENT THE TOP OF LINER PROTECTIVE COVER CONTOURS WHICH ARE 4 TO 5 FEET ABOVE THE EXCAVATION GRADES. THE PROPOSED EXCAVATION PLAN CONTOURS WERE DEVELOPED BY WEAVER CONSULTANTS GROUP AS PART OF THE DESIGN BASIS MEMORANDUM FOR THE PROPOSED MAJOR AMENDMENT APPLICATION.
3. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.

LEGEND

- IESI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY
- PERMITTED LIMITS OF WASTE
- PROPOSED LIMITS OF WASTE
- CELL BOUNDARY
- 70 — EXISTING CONTOUR (SEE NOTE 1)
- N 10137000 — STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
- 60 — PERMITTED TOP OF PROTECTIVE COVER CONTOUR (SEE NOTE 2)
- 80 — PROPOSED EXCAVATION CONTOUR (SEE NOTE 2)
- LEACHATE LINE

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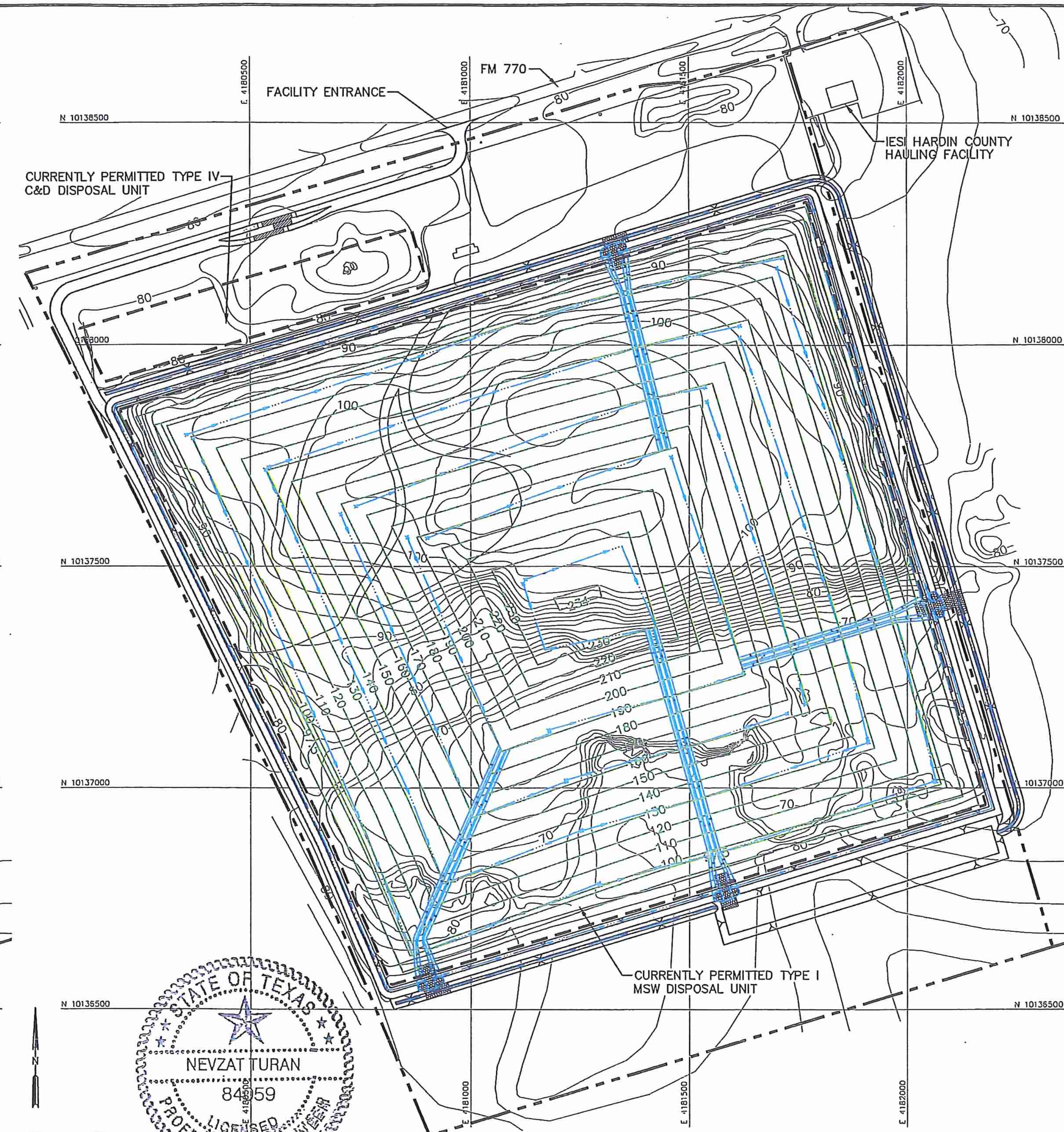
DATE: 10/2016 FILE: 0771-365-11 CAD: FIG 4-EXCAVATION PLAN COMP.DWG	DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. / DATE / DESCRIPTION	
Weaver Consultants Group TBPE REGISTRATION NO. F-3727			WWW.WCGRP.COM / FIGURE 4

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 4-EXCAVATION PLAN COMPARISON.dwg, jwilson, 1:2

PERMITTED COMPLETION PLAN



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PROPOSED COMPLETION PLAN

I/IID-21

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. PERMITTED COMPLETION PLAN FINAL COVER CONTOURS ARE OBTAINED FROM 2010 HARDIN COUNTY LANDFILL MSW PERMIT NO. 2214A. THE PROPOSED PERMITTED COMPLETION PLAN FINAL COVER CONTOURS WERE DEVELOPED BY WEAVER CONSULTANTS GROUP AS PART OF THE DESIGN BASIS MEMORANDUM FOR THE PROPOSED MAJOR AMENDMENT APPLICATION.
3. THE PROPOSED COMPLETION PLAN DRAINAGE STRUCTURES ARE SHOWN FOR INFORMATIONAL PURPOSES. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.

LEGEND

— - — -	IESI PROPERTY BOUNDARY
— - - —	PERMIT BOUNDARY
— — — —	CURRENTLY PERMITTED LIMITS OF WASTE
—70—	EXISTING CONTOUR (SEE NOTE 1)
N 10137000	STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
—220—	FINAL COVER CONTOUR (SEE NOTE 2)
	PROPOSED DRAINAGE SWALE
	PROPOSED DRAINAGE CHUTE

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FILE: 0771-365-11
CAD: FIG 4-COMPLETION PLAN COMP.DWG

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MAJOR PERMIT AMENDMENT
PERMITTED AND PROPOSED
COMPLETION PLAN

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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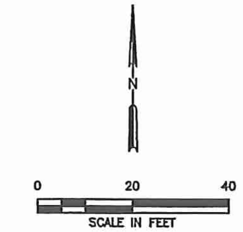
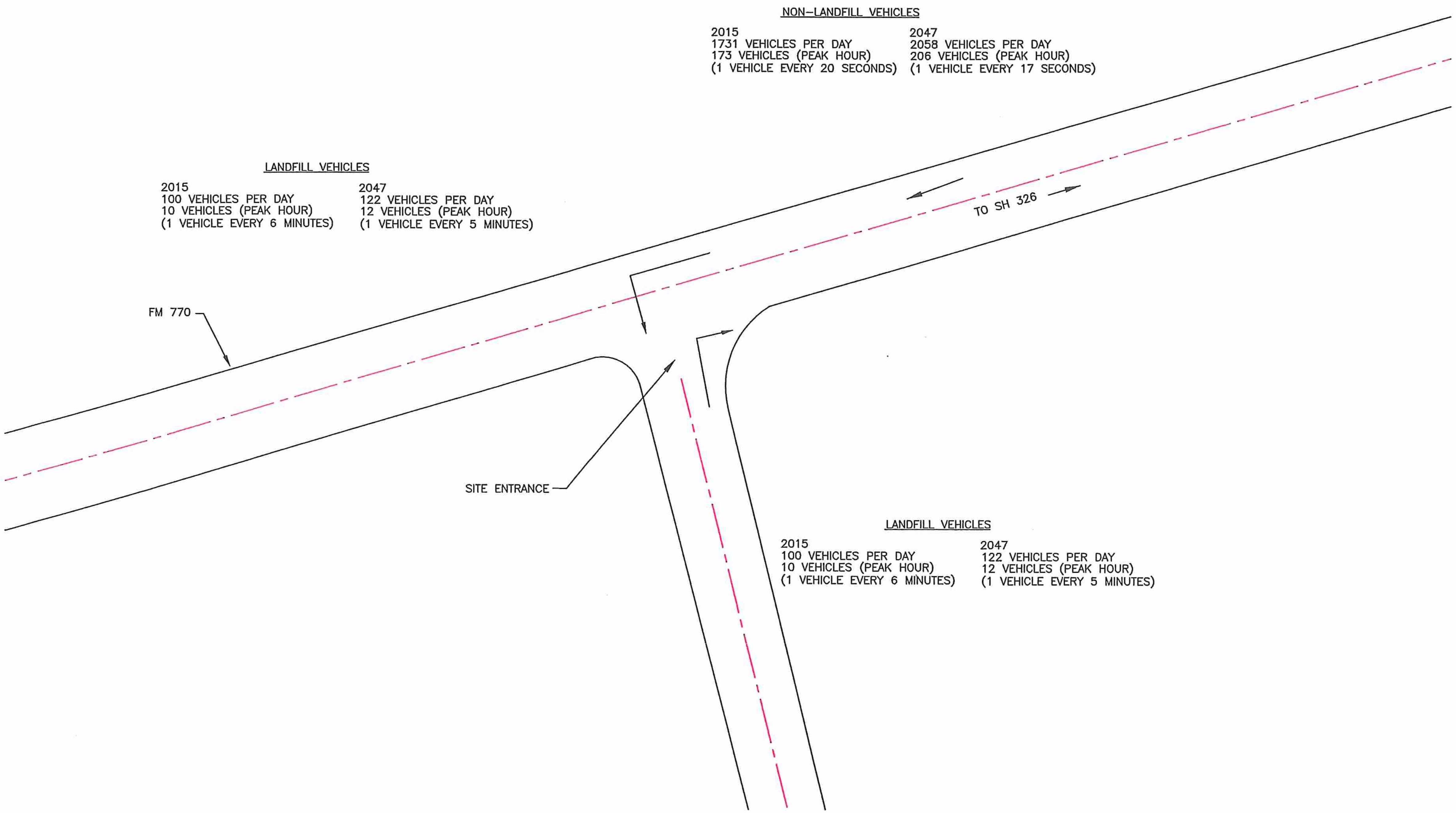
FIGURE 5

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 5-COMPLETION PLAN COMPARISON.dwg, jwilson, 1:2





CONCLUSION:
VEHICLES ENTERING AND EXITING THE SITE WILL NOT IMPEDE TRAFFIC ON FM770. AS SHOWN, THE PEAK HOUR FLOW RATES FOR NON-LANDFILL VEHICLES TRAVELING SOUTHBOUND ON FM770 IS APPROXIMATELY 1 VEHICLE PER 20 SECONDS IN 2015 AND 2047. IN ADDITION, THE PEAK HOUR FLOW RATE FOR LANDFILL VEHICLES ACCESSING THE SITE IS LESS THAN 1 VEHICLE PER 6 MINUTES IN BOTH 2015 AND 2047.

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DATE: 10/2016
FILE: 0771-365-11
CAD: FIG 6-FM770 AND HWY326 .DWG

DRAWN BY: RDM
DESIGN BY: AE
REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
IESI TX LANDFILL LP

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NO.	DATE	DESCRIPTION

MAJOR PERMIT AMENDMENT
FM 770 AND LANDFILL ENTRANCE INTERSECTION

IESI HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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FIGURE 6

O:\0771\365\EXPANSION (2016)\COORDINATION LETTERS\FIG 6-LANDFILL ENTRANCE.dwg, 10/28/2016 3:30:22 PM, rsellers, 1:2

APPENDIX B

2010 AND 1993 TxDOT COORDINATION LETTERS

BIGGS & MATHEWS ENVIRONMENTAL
Consulting Engineers • Hydrogeologists
Mansfield • Arlington • Dallas • Wichita Falls

March 29, 2010

Mr. Duane Browning
Area Engineer
Texas Department of Transportation
8450 Eastex Freeway
Beaumont, Texas 77708

Re: IESI Hardin County Landfill, TCEQ Permit No. MSW 2214A
Hardin County, Texas
Coordination Letter – Availability and Adequacy of FM 770 and SH 326

Dear Mr. Browning:

On behalf of IESI TX Landfill LP (IESI), this letter is submitted is to demonstrate coordination with the Texas Department of Transportation (TxDOT) consistent with Title 30 Texas Administrative Code (TAC) §330.61(i). This regulation requires that a municipal solid waste (MSW) facility coordinate with the Texas Department of Transportation regarding the availability and adequacy of roads that the facility uses to operate the site. As shown on the attached General Highway Map, the IESI Hardin County Landfill (TCEQ Permit No. MSW 2214A) site entrance is located on the south side of FM 770, approximately 0.7 mile west of the intersection of FM 770 and SH 326.

On behalf of IESI, we have submitted a permit modification to the Texas Commission on Environmental Quality (TCEQ) to revise the waste acceptance rate currently listed in the facility's permit. The permit currently states that approximately 20 vehicles will be entering the facility per day. Based on the proposed increase in waste acceptance, approximately 46 vehicles per day entered the facility in calendar year 2009, which included approximately 35 waste hauling vehicles and 11 support vehicles per day. In addition, the TCEQ is requesting that we coordinate with TxDOT regarding the proposed increased waste acceptance and the availability and adequacy of FM 770 and SH 326.

The permit application for the IESI Hardin County Landfill was prepared and submitted to the TCEQ in the early to mid 1990s. As part of the permit application process, correspondence was submitted on behalf of IESI to TxDOT in February 1993 requesting documentation confirming that the anticipated traffic would not have an impact on FM 770 traffic. TxDOT responded to this request in March 1993 stating that development of the site would not have much impact on the traffic of FM 770 based on the anticipated 20 vehicles per day entering the site and Annual Average Daily Traffic (AADT) value of 1,400 for FM 770.

Additional correspondence was submitted from TxDOT to IESI as part of the permit application process that included the historic AADT counts and 1992 AADT counts and depicted the traffic count locations for all AADT counts. Based on the most recent published online 2008 District Traffic Count Maps, we have compiled the 2008 AADT values for the same traffic count locations to provide a direct comparison, which is shown in Table 1 below. The traffic counts were measured on FM 770 and at locations on SH 326, north and south of

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the FM 770 intersection. As shown in Table 1, traffic has significantly increased from 1992 to 2008 within the vicinity of the facility, which demonstrates that FM 770 and SH 326 are available and adequate to handle the increased amount of trips generated by the IESI Hardin County Landfill based on the increased waste acceptance rate.

Table 1 - Annual Average Daily Traffic (AADT) Comparison

Year	FM 770	SH 326 (South)	SH 326 (North)
1992	1,400	1,300	2,900
2008	1,900	2,300	4,900
Percent Increase	35.7%	76.7%	68.9%
* Note: 1992 and 2008 AADT values based on TxDOT information.			

Table 2 below demonstrates that the total trips generated by the IESI Hardin County Landfill represent a significantly low percentage of the total AADT for FM 770 and that the continued waste acceptance does not have an impact on FM 770 traffic.

The updated site life calculations for the proposed waste acceptance rate permit modification determine that the site will consume its available landfill capacity in year 2024. As a result, we have projected the incoming vehicles per day and the AADT for FM 770 through year 2024 in Table 2 below to demonstrate that the facility trips will continue to remain a small percentage of the total AADT. The projected number of 70 incoming vehicles per day for 2024 includes approximately 55 waste hauling vehicles and 15 support vehicles and is a function of the incoming waste acceptance rate, which is anticipated to increase each year. The 2024 AADT was determined by projecting the average annual percent increase of 2.2% from the provided 1992 and published 2008 AADT values forward to 2024 for FM 770.

Table 2 - Facility Traffic and AADT Comparison (FM 770)

Year	Incoming Vehicles/Day	Total Trips Generated/Day	FM 770 (AADT)	Percent Facility Trips of AADT
1992	20	40	1,400	2.9%
2009	46	92	1,950*	4.7%
2024	70	140	2,700*	5.2%
* Note: Projected value based on 2.2% annual increase from 1992 to 2008 AADT values.				

Currently, approximately 70% and 30% of the incoming vehicles enter FM 770 from SH 326 north and south of the FM 770 intersection, respectively. Based on the trip distribution of 70% and 30% of incoming vehicles per day traveling from SH 326 north and south of the FM 770 intersection, respectively, the percent trips generated per day of AADT is calculated below in Tables 3 and 4, which demonstrate that the facility trips will remain a significantly low percentage of the total AADT for SH 326 north and south of the FM 770 intersection.

Table 3 - Facility Traffic and AADT Comparison (SH 326 North)

Year	Incoming Vehicles/Day	Total Trips Generated/Day	SH 326 North (AADT)	Percent Facility Trips of AADT
1992	14	28	2,900	0.9%
2009	32	64	5,100*	1.3%
2024	49	98	9,625*	1.0%
* Note: Projected value based on 4.3% annual increase from 1992 to 2008 ADT values.				

Table 4 - Facility Traffic and AADT Comparison (SH 326 South)

Year	Incoming Vehicles/Day	Total Trips Generated/Day	SH 326 South (AADT)	Percent Facility Trips of AADT
1992	6	12	1,300	0.9%
2009	14	28	2,410*	1.2%
2024	21	42	4,870*	0.9%
* Note: Projected value based on 4.8% annual increase from 1992 to 2008 ADT values.				

Based on the information provided in the discussion and tables above, we do not expect the proposed waste acceptance rate and corresponding facility vehicular traffic to have an impact on the availability and adequacy of FM 770 and SH 326.

In accordance with §330.61(i), we respectfully request a letter from TxDOT that confirms coordination that demonstrates the availability and adequacy of roads regarding the proposed waste acceptance rate and corresponding facility vehicular traffic to be included with our permit modification. The attached General Highway Map has been provided to assist you with your review.

We appreciate your assistance with this matter. Please call if you have any questions or need additional information.

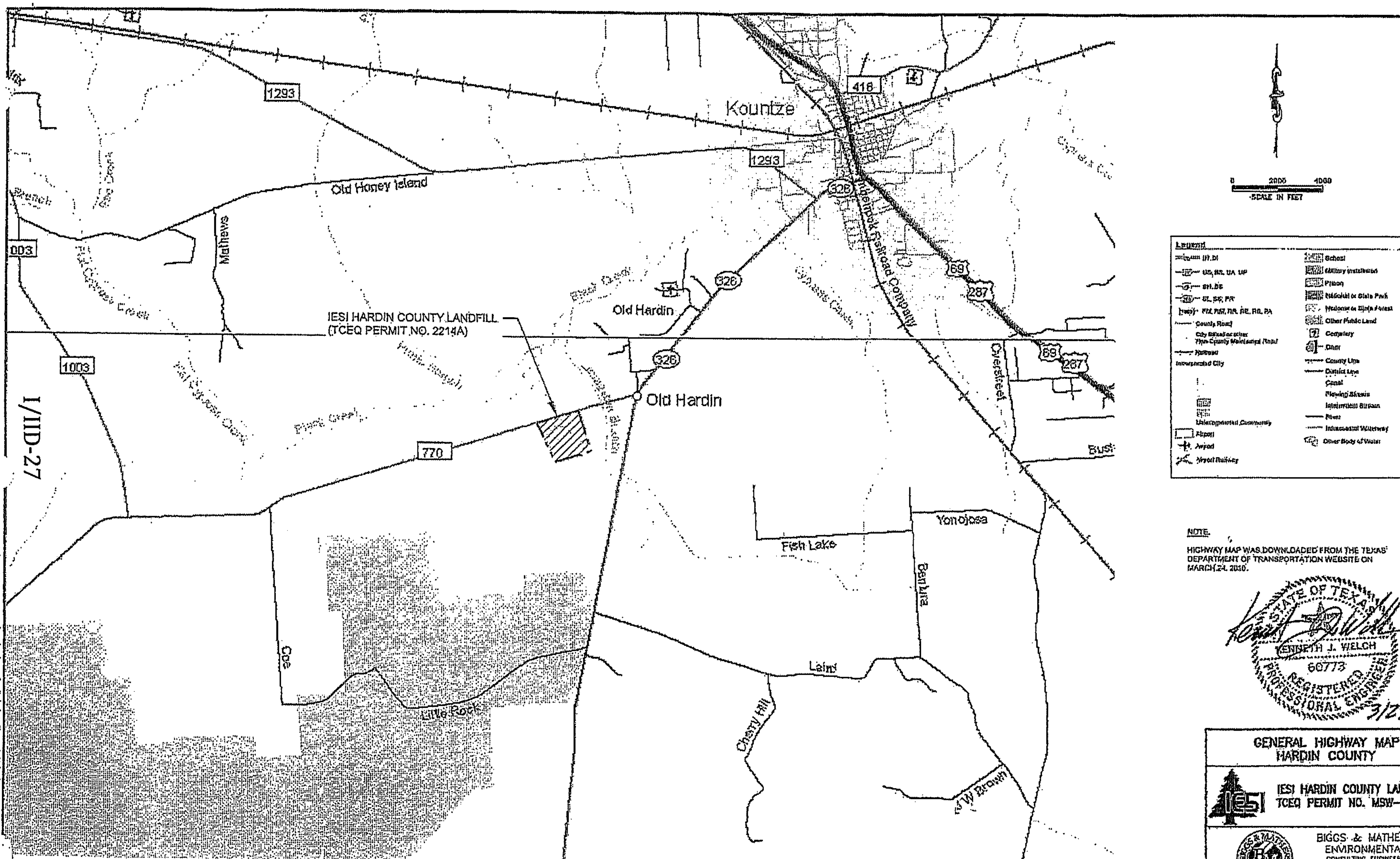
Sincerely,

BIGGS & MATHEWS ENVIRONMENTAL
TBPE No. F-256 • TBPG No. 50222

Kenneth J. Welch, P.E.
Principal Engineer

Attachments: Drawing A – General Highway Map Hardin County

cc: Mr. Joseph Viecelli, IESI (1)
Mr. Chris Brockman, IESI (1)



NOTE:
HIGHWAY MAP WAS DOWNLOADED FROM THE TEXAS DEPARTMENT OF TRANSPORTATION WEBSITE ON MARCH 24, 2010.

STATE OF TEXAS
KENNETH J. WELCH
60773
REGISTERED PROFESSIONAL ENGINEER
3/29/10

ISSUED FOR INFORMATIONAL PURPOSES ONLY

GENERAL HIGHWAY MAP
HARDIN COUNTY

IESI HARDIN COUNTY LANDFILL
TCEQ PERMIT NO. MSW-2214A

BIGGS & MATHEWS
ENVIRONMENTAL
CONSULTING ENGINEERS
MANSFIELD
DALLAS • WICHITA FALLS
817-563-1144

TBPE FIRM NO. F-256		TBPG FIRM NO. 50222	
DSN. SAB	DATE: 03/10		DRAWING
DWN SRC	SCALE: GRAPHIC		A
CHK. KJW	DWG: GenHighwayMap.dwg		

31E

HA-001

KSA ENGINEERS, INC.

NATIONS BANK BLDG.
415 S. FIRST ST., SUITE 270
P.O. BOX 1605
LUFKIN, TEXAS 75902-1605
(409) 637-6061
FAX (409) 632-9256

February 5, 1993

Edward Domingos, P.E.
Supervising Resident Engineer
1150 West Avenue N
Silsbee, Texas 77656

RE: Impact of proposed Hardin County Landfill on local traffic

Dear Mr. Domingos:

As per our telephone conversation of Thursday, February 4, 1993, I am writing to request a review of traffic impacts and necessary improvements which may result from the construction of the above referenced project. Included with this letter, please find copies of portions of our original Texas Water Commission Landfill Permit Application which pertain to this topic, drawings indicating the general location of the proposed site, and a copy of a letter from Alfred E. Smith providing us with traffic count data for the area in question.

As shown on the drawings, the site is removed from the greater portion of traffic in and around the City of Kountze, being primarily in contact with general highway traffic. The current site is located on the north side of FM 770, north and east of the center of the proposed site which will be on the south side of the road. The new location is anticipated to only change traffic patterns as far as turning direction is concerned.

The enclosed portion of the Permit Application text provides our proposed discussion of the existing and expected traffic conditions surrounding the site. This text draws from information provided in the letter from Mr. Smith as well as traffic information specific to to the current and proposed landfill sites. It is anticipated that there will be an average of 20 vehicles per day entering and exiting the proposed site. On site there will be sufficient entrance roadway to store 3 vehicles, with additional space, if necessary, on around the perimeter of the fill.

Following their first administrative review of this Landfill Permit Application, the Texas Water Commission listed among their comments a need for review of the project by the Texas Department of Transportation for any "necessary traffic improvements". We believe, in considering the historic traffic data and proposed facilities, that no improvements to the highway system will be necessary to adjust for traffic surrounding the proposed site. As such, we are requesting a review by the Texas Department of Transportation of the proposed project as it relates to the local traffic patterns, with written approval of our conclusions or suggestions as to what other actions need to be taken to insure the safety and efficiency of the State Highway system.

February 5, 1993
Edward Domingoes
Page 2

Thank you for your help in addressing this request. If we need to provide any more information than is included with this letter, please call. I or Billy Sims will be available to answer any questions at 409/637-6061.

Sincerely,

KSA ENGINEERS, INC.

Lonnie Sikes
Design Engineer

Texas Department of Transportation

P.O. BOX 3468 • BEAUMONT, TEXAS 77704-3468 • (409) 892-7311

1150 West Avenue N
Silsbee, Texas 77656

March 4, 1993

Mr. Lonnie Sikes, Design Engineer
KSA Engineers, Inc.
P.O. Box 1605
Lufkin, Texas 75902-1605

Dear Lonnie:

In response to your letter of February 5, 1993 requesting review of traffic impact on FM 770 as a result of construction of proposed Hardin County Landfill, we offer the following statement:

> It is almost impossible to ascertain prior to the actual opening what impact this new landfill site will have upon the operations of FM 770. However, based upon the 1991 ADT of 1,400 for FM 770 and the reported 20 average daily vehicular use of this site, it does not appear that this site will have much impact upon FM 770 traffic. The only way to know is to observe the operations after the site has been opened and traffic patterns have been established.

Sincerely,

Ed Dominguez P.E.

Edward C.Dominguez, P.E.
Area Resident Engineer

ECD/csk
xc: File

MAR 10 1993

APPENDIX I/IIE

TPDES PERMIT

Search Results

Water Quality General Permits and Registration Search

Summary of Authorization TXR05DR54

Permit/Registration Number:	TXR05DR54
Authorization Status:	ACTIVE
Date Coverage Began:	09/13/2017
Date Coverage Ended:	

Authorization Details

Site Name on Permit/Registration:	HARDIN COUNTY LANDFILL
Authorization Type:	INDUSTRIAL
Primary SIC Code:	4953
Activity Code :	LF
Secondary Sic Code :	4212
Sector :	L
Sector :	P
Outfall Number :	001 OUTFALL LATITUDE - 30.340658 OUTFALL LONGITUDE - (-94.358686) RECEIVING WATER BODY - CYPRESS CREEK SEGMENT NUMBER - 0608 DISCHARGE TO MARINE OR FRESH - FRESH
Outfall Number :	002 OUTFALL LATITUDE - 30.335381 OUTFALL LONGITUDE - (-94.355925) RECEIVING WATER BODY - CYPRESS CREEK SEGMENT NUMBER - 0608 DISCHARGE TO MARINE OR FRESH - FRESH
Outfall Number :	003 OUTFALL LATITUDE - 30.341 OUTFALL LONGITUDE - (-94.351294) RECEIVING WATER BODY - CYPRESS CREEK SEGMENT NUMBER - 0608 DISCHARGE TO MARINE OR FRESH - FRESH
Outfall Number :	004 OUTFALL LATITUDE - 30.341786 OUTFALL LONGITUDE - (-94.353583) RECEIVING WATER BODY - CYPRESS CREEK SEGMENT NUMBER - 0608 DISCHARGE TO MARINE OR FRESH - FRESH
Outfall Number :	005 OUTFALL LATITUDE - 30.341611 OUTFALL LONGITUDE - (-94.354408) RECEIVING WATER BODY - CYPRESS CREEK SEGMENT NUMBER - 0608 DISCHARGE TO MARINE OR FRESH - FRESH
Outfall Number :	006 OUTFALL LATITUDE - 30.341131 OUTFALL LONGITUDE - (-94.356736) RECEIVING WATER BODY - CYPRESS CREEK SEGMENT NUMBER - 0608 DISCHARGE TO MARINE OR FRESH - FRESH
Outfall Number :	007 OUTFALL LATITUDE - 30.341108 OUTFALL LONGITUDE - (-94.356853) RECEIVING WATER BODY - CYPRESS CREEK SEGMENT NUMBER - 0608

Permittee or Registrant Information

Operator: CN603851882 - BFI Waste Systems of North
Address: 5757 OATES RD STE A HOUSTON TX 77078
Annual Fee Billing Address: RUBY TEAGUE
5757 OATES RD STE A HOUSTON TX 77078

Permitted Site Information

RN: RN103759643
RE Name: HARDIN COUNTY LANDFILL
Site Location: 2525 FM 770 RD KOUNTZE TX 77625 9219
County: HARDIN
TCEQ Region: REGION 10 - BEAUMONT
Latitude: 30.202976
Longitude: -94.21155

Regulated Entity Site Information

RE Name: IESI HARDIN COUNTY LANDFILL
Site Location: 2525 FM 770 RD KOUNTZE TX 77625 9219
County: HARDIN
TCEQ Region: REGION 10 - BEAUMONT
Latitude: 30.343
Longitude: -94.3597

Application History for this Authorization

Application Type	Status	Received Date	Final Action Date
NOTICE OF INTENT	APPROVED	09/13/2017	09/13/2017

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS
TCEQ PERMIT NO. MSW-2214B

MAJOR PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN
SITE DEVELOPMENT PLAN NARRATIVE

Prepared for

BFI Waste Systems of North America, LLC

March 2017

Revised August 2017

Revised December 2017

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

12-5-2017

Prepared by:
Weaver Consultants Group, LLC
TBPE Registration No. F-3727
6420 Southwest Blvd., Suite 206
Fort Worth, TX 76109
817-735-9770

WCG Project No. 0120-758-11-02

This document is intended for permitting purposes only.

CONTENTS

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

12-5-2017

CONTENTS (Continued)

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

12-5-2017

FIGURES

LIST OF ACRONYMS

ASTM – American Society for Testing and Materials

BER – Ballast Evaluation Report

BMPs – best management practices

CFR – Code of Federal Regulations

CLOMR – Conditional Letter of Map Revision

CMP – corrugated metal pipe

CN – curve number

COC – chain-of-custody

CQA – construction quality assurance

CU – consolidated-undrained

EDE – elevation of the deepest excavation

EPA – United States Environmental Protection Agency

ETJ – extra territorial jurisdiction

FAA – Federal Aviation Administration

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

FML – flexible membrane liner

FMLER – flexible membrane liner evaluation report

ft-msl – feet above mean sea level

FTB – film tear bond

LIST OF ACRONYMS (Continued)

FWS – U.S. Fish and Wildlife Service

GLER – geomembrane liner evaluation report

GWPS – Ground Water Protection Standard

GWSAP – groundwater sampling and analysis plan

HOTCOG – Heart of Texas Council of Governments

LCS – leachate collection system

LEL – lower explosive limit

LFG – landfill gas

LLDPE – linear low density polyethylene

LQCP – Liner Quality Control Plan

MCLs – maximum contaminant levels

msl – mean sea level

MSW – municipal solid waste

NAAQS – National Ambient Air Quality Standards

NFIP – National Flood Insurance Program

NOI – Notice of Intent

NSF – National Sanitation Foundation

NSPS – New Source Performance Standards

NWP – Nationwide Permit

NWS – National Weather Service

O&M – operations and maintenance

LIST OF ACRONYMS (Continued)

PCBs – polychlorinated biphenyls

PI – Point of Intersection

PVI – Point of Vertical Intersection

POR – Professional of Record

POTW – publicly owned treatment works

QA/QC – quality-assurance/quality-control

RCRA – Resource Conservation Recovery Act

SBP – soil boring plan

SCS – Soil Conservation Service

SDP – site development plan

SLER – soils and liner evaluation report

SOP – site operating plan

SSC – statistically significant change

TAC – Texas Administrative Code

TCEQ – Texas Commission on Environmental Quality

TDH – Texas Department of Health

TPDES – Texas Pollutant Discharge Elimination System

TPWD – Texas Parks and Wildlife Department

TWC – Texas Water Commission

TWDB – Texas Water Development Board

TxDOT – Texas Department of Transportation

LIST OF ACRONYMS (Continued)

UEL – upper explosive limit

USACE – United States Army Corps of Engineers

USCS – Unified Soil Classification System

USGS – United States Geological Survey

USLE – universal soil loss equation

UTM – Universal Transverse Mercator System

WCG – Weaver Consultants Group, LLC

1 INTRODUCTION

> *This Site Development Plan Narrative addresses §330.63.*

This Site Development Plan (SDP) for the Hardin County Landfill has been prepared consistent with the MSW regulations within Title 30 Texas Administrative Code (TAC) Chapter 330, including §330.63. This SDP provides the design details needed to provide for the safeguarding of the health, welfare, and physical property of the people and the environment through consideration of geology, soil conditions, drainage, land use, zoning, and adequacy of access roads and highways.

The Hardin County Landfill is an existing 79-acre municipal solid waste landfill facility (TCEQ Permit No. MSW-2214A) located in Hardin County. BFI Waste Systems of North America, LLC (BFI) is the owner/operator of the site. BFI is a subsidiary of Republic Service, Inc. (RCI). RCI is one of the leading providers of solid waste services in the nation. RCI provides nonhazardous waste collection, transfer, recycling, and disposal services to residential, municipal, and commercial customers across the country. The landfill is located approximately 3 miles southwest of the City of Kountze, Texas, on the south side of Farm to Market Road 770 (2525 FM 770), approximately ½ mile west of the intersection of FM 770 and State Highway 326.

The purpose of this Major Permit Amendment is to expand the Type I MSW volumetric waste disposal capacity of the existing landfill by deepening and vertically increasing the existing waste disposal footprint. The currently permitted 79.0-acre permit boundary, including the 49.6-acre Type I waste disposal footprint and 2.4-acre Type IV waste disposal footprint, will remain unchanged for this permit amendment. The Type IV maximum final cover elevation will remain unchanged at 88 ft-msl (maximum top of waste is 85.5 ft-msl). This landfill expansion will provide for the long-term disposal needs of Hardin County and surrounding communities. Approximately 1.4 acres of the 2.4-acre Type IV C&D landfill have been developed. Approximately 32 acres of the 49.6-acre Type I landfill have been constructed. Approximately 16.7 acres of the remaining 17.6 acres (Cells 7 and 8) at the Type I landfill will be deepened to a depth not exceeding the previously established Elevation of Deepest Excavation (EDE) of 45.23 feet msl, and the entire Type I MSW landfill will be vertically expanded from the permit MSW-2214A final grades. The landfill will not be deepened or vertically increased within 125' of any properties not owned by BFI (buffer zone). The maximum permitted final cover elevation will be increased from 115 ft-msl to 234 ft-msl. The maximum top of waste will be increased to 230.5 ft-msl. The resulting capacity will increase from the previously permitted 2.11 million cubic yards to 5.74 million cubic yards for this permit amendment, for a net gain in Type I disposal capacity of 3.63 million cubic yards.

2 GENERAL FACILITY DESIGN

2.1 Facility Access

2.1.1 Access From Highway

The site access road enters the landfill along the northern property boundary from Farm to Market Road (FM) 770. FM 770 intersects State Highway 326 approximately ½ miles east of the landfill entrance. Access is controlled by a gate at the permit boundary. The gate is locked when the site is not in operation.

2.1.2 Access Control

Vehicle access to the landfill will be controlled at the site entrance by signs that direct all landfill traffic to the scalehouse during site operating hours. Personnel on duty at the entrance regulate access to the landfill. Outside operating hours, the gate to the site will be locked to prevent unauthorized vehicle access. A minimum 4-foot-high, 3-strand barbed wire fence will be located along the permit boundary limits to prevent unauthorized access to the site.

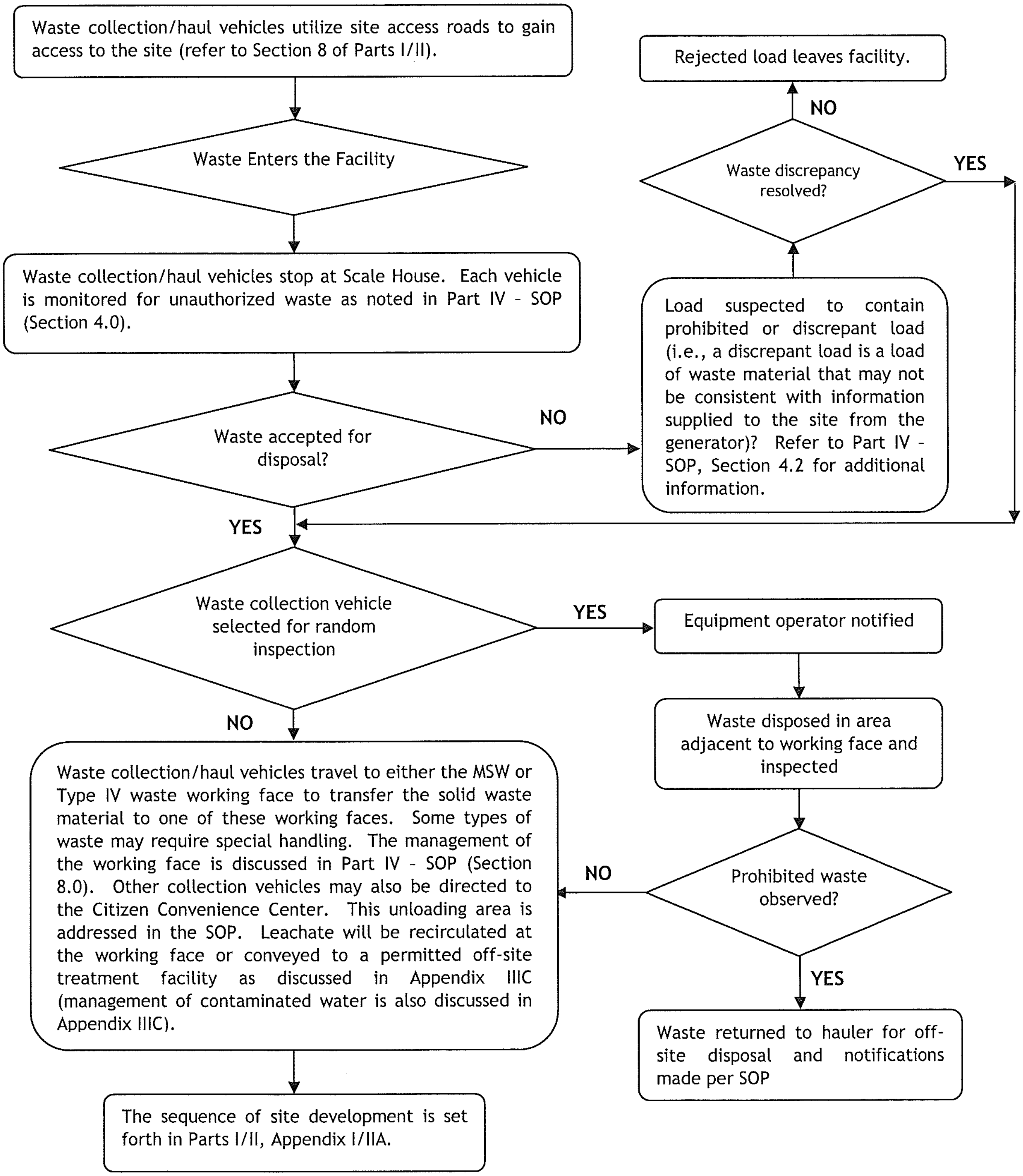
The Hardin County Landfill will restrict entry to the landfill to designated site operations personnel, solid waste haulers authorized to use the facility, TCEQ personnel, and properly identified persons whose entry is authorized by the Landfill Manager or his designee. The landfill reserves the right to deny access to the landfill to persons not demonstrating a legitimate purpose for visiting. Visitors are allowed on the active area of the landfill only when accompanied by the Landfill Manager or his designee (refer to Part IV – SOP, Section 8 for additional information).

2.2 Waste Movement

2.2.1 Waste Movement Flow Diagram

Figure III-1 (shown on the following page) provides a waste movement flow diagram for the Hardin County Landfill. The flow diagram provides a summary of the disposal sequence for waste that is accepted at the facility. Detailed waste acceptance procedures are detailed in Part IV – SOP.

Figure III-1
Waste Movement Flow Diagram



2.2.2 Waste Disposal Schematic View

Figure III-2 provides a schematic view of the Hardin County Landfill. Additional detailed drawings of the various phases of site sequencing and development are provided in Parts I/II, Appendix I/IIA; Part III, Appendix IIIA; and throughout the SDP. Drawings of the Citizen Convenience Center located near the entrance facilities are included in Parts I/II, Appendix I/IIA.

2.2.3 Ventilation and Odor Control

Landfill disposal operation will occur in open areas within the permitted waste disposal footprint; therefore, adequate ventilation will be provided. The Citizen Convenience Center will also be located in a well ventilated area (open air), as noted in Parts I/II. The containers located at the Citizen Convenience Center will be unloaded at the working face on a routine basis to minimize odors. The operator will prevent nuisance odors from leaving the boundary of the facility.

The site will comply with all the applicable air quality rules and regulations. The site will be required to operate in accordance with the New Source Performance Standards (NSPS) for MSW landfills.

Steps will be taken to limit the impact of the facility's operation on air quality. Among the measures set forth in Part IV – SOP to be employed are the following:

- Accidental fires will be controlled.
- Open burning of waste will not be permitted.
- Incoming waste will be promptly compacted into the working face area.
- Ponded water at the site will be controlled.

Odors shall be controlled at the site and will be reduced if they occur in accordance with this Odor Management Plan. A detailed Odor Control Plan is included in Part IV – SOP. Sources of landfill odor can vary considerably and may include the wastes being delivered to the landfill, the open working face, surface emissions from the covered portion of the landfill, or the leachate collection system. Many of the wastes received at a landfill are a source of odor upon receipt, such as sludge and dead animals. Other wastes have the potential for becoming a source of odor by their biodegradable characteristics, generating gases as they advance through the decomposition process. Leachate may also be a source of odor if not properly handled or disposed of in a timely manner. Among the measures listed in Part IV – SOP that may be employed to reduce potential odors are the following.

- Minimize the size of the working face area.
- Increase the thickness of soil daily cover and/or ADC applied to the working face.

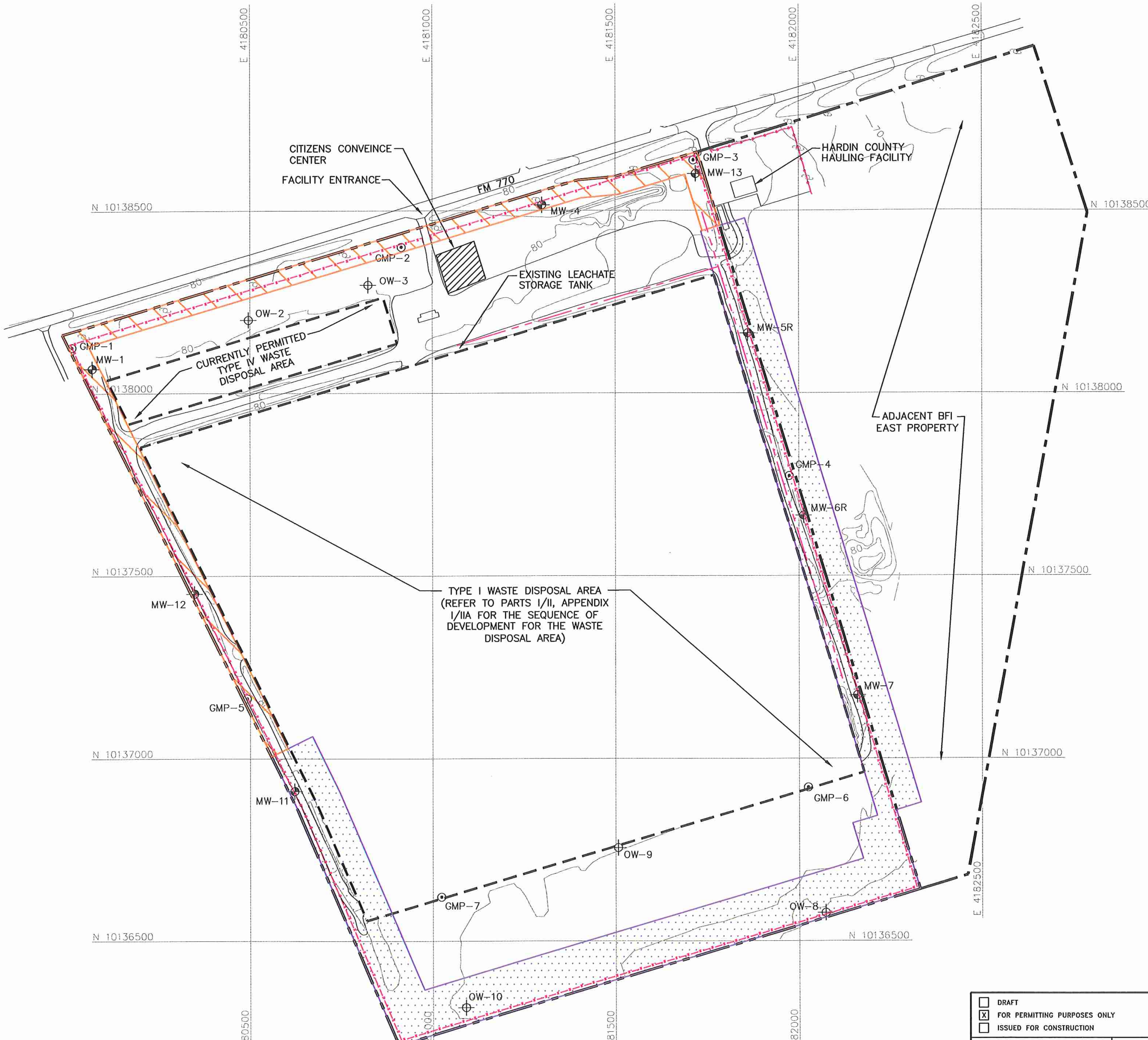
- Prevent ponded water.
- Assess the effectiveness of the LFG extraction system, if applicable, and make all necessary repairs to the system or expand the system, as needed, to control odors.
- Identify any waste stream that requires special attention to control odor. If the Scale Operator notes a load with significant odors, they will notify the working face personnel. The load will be promptly covered with soil or solid waste when it arrives at the working face.
- Inspect the leachate collection and storage system to confirm that it is functioning as designed (e.g., inspect piping and storage tank system to verify no leaks have occurred).

2.2.4 Generalized Construction Details

Generalized construction details for the landfill are included in Parts I/II, Appendix I/IIA and in this SDP (e.g., Appendix IIIA). Operation requirements for the Citizen Convenience Center and landfill are included in Part IV – SOP.

2.3 Protection of Endangered Species

Information regarding the protection of endangered species in accordance with 30 TAC §330.61(n) and §330.63(b)(5) is provided in Section 8.15 – Endangered Species Protection as included in Part IV. No endangered or threatened species have been documented at the site nor has a critical habitat for such species been identified at the site. Neither the facility nor its operation will result in the destruction or adverse modification of the critical habitat of endangered or threatened species. If endangered or threatened species are encountered during site operations, Texas Parks and Wildlife and U.S. Fish and Wildlife will be notified. A site specific Threatened and Endangered Species Habitat Assessment is included in Parts I/II, Appendix I/IIB (refer to the TPWD and FWS tabs).



N

0 150 300
SCALE IN FEET

LEGEND

- BFI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- 70 EXISTING CONTOUR
- N 10137500 STATE PLANE COORDINATE GRID
- EXISTING FENCE
- MW-1 EXISTING GROUNDWATER MONITOR WELL
- OW-2 EXISTING GROUNDWATER OBSERVATION WELL
- GMP-1 EXISTING GAS MONITORING PROBE
- PROPOSED LEACHATE FORCEMAIN
- 50' BUFFER ZONE (1995 PERMIT) (SEE NOTE 2)
- 125' BUFFER ZONE (2017 AMENDMENT) (SEE NOTE 3)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. AREAS SHOWN WITH 50-FT BUFFER ARE CURRENTLY PERMITTED OR CONSTRUCTED AREAS WITH NO CHANGE TO WASTE LIMITS OR GRADES PROPOSED FOR THIS APPLICATION.
3. FILL AND LINER GRADES WITHIN THE 125-FT BUFFER ALONG THE WESTERN EDGE OF CELL 8 HAVE NOT BEEN INCREASED FROM 1995 PERMIT CONDITIONS FOR THIS APPLICATION.

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED PROFESSIONAL ENGINEER

12-5-2017

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 08/2017
FILE: 0120-758-11
CAD: III-2 SCHEMATIC SITE PLAN.DWG

DRAWN BY: SRF
DESIGN BY: NT
REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	08/2017	FIRST NOD RESPONSE
2	11/2017	OWNERSHIP CHANGE

MAJOR PERMIT AMENDMENT
SCHEMATIC SITE PLAN

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

WWW.WCGRP.COM

FIGURE III-2

0:\0120\758\2214B EXPANSION\III-2_SCHEMATIC SITE PLAN.dwg, 11/15/2017 7:31:48 AM, rsellers, 1:2

3 FACILITY SURFACE WATER DRAINAGE REPORT

3.1 General

This facility has been designed to comply with the requirements of §330.303 and §330.63(c). Part III, Appendix IIIF contains the Surface Water Drainage Plan. None of the permit property is located within a floodplain.

In accordance with 30 TAC §330.15(h), the facility has been designed to prevent discharge of pollutants into waters of the State or waters of the United States, as follows:

- No discharge of solid waste or pollutants into or adjacent to waters of the State, including wetlands, that is in violation of the requirements of the Texas Water Code, §26.121 will occur. During the active life of the facility all stormwater coming into contact with solid waste will be retained as contaminated water and treated or disposed of as outlined in Part III, Appendix IIIC – Leachate and Contaminated Water Management Plan.
- No discharge of pollutants into or adjacent to waters of the United States, including wetlands, that violates any requirement of the Clean Water Act, including, but not limited to, the TPDES requirements, pursuant to §402 as amended, and demonstrated in Part III, Appendix IIIF - Surface Water Drainage Plan, will occur. A copy of the TPDES permit is included in Parts I/II, Appendix I/IIE. Surface water monitoring will be conducted consistent with the TPDES requirements.
- No discharge of nonpoint source pollutants to waters of the United States, including wetlands, that violates any requirement of an area-wide or statewide water quality management plan that has been approved under the Federal Clean Water Act, §208 or §319, as amended will occur. The site will comply with §208 of the Federal Clean Water Act, provided it meets the requirements outlined by the TCEQ rules and guidelines.
- No discharge of dredged or fill materials to waters of the United States, including wetlands, that is in violation of the requirements under the Federal Clean Water Act, §404, as amended, as demonstrated in Parts I/II, Appendix I/IIB (USACE coordination letter) will occur. As noted in in Parts I/II, Appendix I/IIB, no Section 404 Jurisdictional Areas are located within the permit property.

3.2 Site Drainage Patterns

For the proposed expansion, the final cover system will include erosion control structures to effectively minimize erosion of final cover soils. The proposed drainage system also includes a perimeter channel system and detention ponds that will convey stormwater collected from the landfill area to the western portion of the site. The perimeter channels have been designed to carry the 25-year storm event to the detention ponds. The detention ponds have been designed to release the collected stormwater at a rate that is consistent with the existing permitted drainage conditions.

The site is designed to prevent discharge of pollutants into waters of the state or waters of the United States, as defined by the Texas Water Code and the Federal Clean Water Act, respectively. The Hardin County Landfill is subject to TCEQ's storm water permit requirements. A copy of the TPDES permit is included in Appendix I/IIE. Surface water monitoring will be conducted consistent with TPDES requirements. Given the above, the applicant understands and is in full compliance with TPDES under the Clean Water Act, Section 402 as amended.

Existing permitted drainage conditions and postdevelopment drainage are shown in Part III, Appendix IIIF. A discussion of the impact of landfill development on the existing permitted drainage patterns is presented in Appendix IIIF.

3.3 Perimeter Drainage System

The stormwater controls for the landfill have been designed consistent with the TCEQ regulations for Type I MSW landfills. The runon/runoff stormwater controls have been designed for a 25-year storm event. These include drainage controls for the final cover, perimeter drainage channels, culverts, and detention ponds. Details for the perimeter drainage system and associated calculations are included in Part III, Appendix IIIF-A – Surface Water Drainage Plan.

The drainage system is detailed on drawings in Part III, Appendix IIIF. Drainage from the landfill itself is directed through a system of swales, chutes, and perimeter channels to the stormwater detention ponds. The detention ponds and pond outlet structures are detailed in Part III, Appendix IIIF – Surface Water Drainage Plan.

3.4 Below Grade Stormwater Controls

Control of stormwater runon and runoff within excavation areas will be achieved using temporary diversion berms, channels, and containment areas as needed. The temporary stormwater control structures are used to divert uncontaminated stormwater runoff into temporary storage areas. The stormwater will be used for liner construction, control of dust, and establishing vegetation. If discharge of uncontaminated stormwater is required, it will be discharged consistent with TPDES requirements.

Contaminated stormwater consists of stormwater that has come into contact with waste. Control of the contaminated stormwater will be provided through temporary diversion berms, channels, and containment areas. Temporary runon and runoff controls are detailed in Appendix IIIC – Leachate and Contaminated Water Management Plan. Leachate may be recirculated on areas where a composite liner and LCS are in place. Contaminated stormwater will be diverted and contained on approved areas only. Contaminated stormwater and leachate will be managed in accordance with the guidelines set forth in Appendix IIIC – Leachate and Contaminated Water Management Plan.

3.5 Aerial Fill Stormwater Controls

Additional stormwater controls will be necessary as the site is brought above grade. Temporary diversion berms, channels, and containment areas will continue to be used for control of uncontaminated and contaminated stormwater runon and runoff. Runon and runoff temporary diversion berm sizing is provided in Part III, Appendix IIIC – Leachate and Contaminated Water Management Plan, Appendix IIIC-C – Containment Berm and Diversion Berm Calculations. Separation of the contaminated stormwater and uncontaminated stormwater runoff will be provided. Diversion berms, channels, and containment areas will be implemented for the aerial fill portions of the landfill.

The final cover will incorporate drainage swales and letdown structures or chutes for conveyance of stormwater off of the final cover. These swales and chutes have been designed to protect the final cover from erosion. As areas of the final cover are completed, vegetation will be established to provide additional erosion protection. Details of the final cover design are provided in Part III, Appendix IIIA-A – Liner and Final Cover System Details. Drainage details are provided in Part III, Appendix IIIF – Surface Water Drainage Plan.

Surface water runon and runoff will be managed consistent with the TCEQ regulations. Specifically, areas that have received waste but will be inactive for longer than 180 days will be provided with intermediate cover. As such, runoff from these areas will be considered uncontaminated consistent with 30 TAC §330.207. Also, by implementing the site design and proper operating practices, contaminated water will be kept to a minimum. Routine daily cover, in combination with the other operating practices, will minimize the generation of contaminated water. Contaminated water will be managed consistent with the practices outlined in Part III, Appendix IIIC – Leachate and Contaminated Water Management Plan.

The Hardin County Landfill will use various interim and permanent erosion and sedimentation controls throughout the life of the site. The interim controls will be used around active areas and external embankment sideslopes and top dome surfaces. These controls will include temporary letdown structures, soil berms, and vegetation of intermediate cover areas to minimize the erosion potential from these areas. These interim controls will be used during all phases of landfill development to provide effective erosion stability for the external sideslopes and top dome surfaces. Refer to Part III, Appendix IIIF – Erosion Control Plan for All Phases of Landfill Operation for more information.

3.6 Erosion and Sedimentation Control

Erosion and sedimentation control is provided on site during construction activities and is incorporated into the design of the perimeter drainage system and final cover system. During construction of the various phases, perimeter berms, perimeter drainage channels, and detention ponds, erosion and sedimentation control will be provided through the use of temporary diversion berms, drainage channels, silt fences, and hay bales. Erosion potential from external sideslopes and top dome surfaces will be minimized during all phases of landfill development. These measures will provide for control of erosion and sediment prior to stormwater flows leaving the site during active life and after the closure of the site. An erosion and sedimentation control plan is presented in Part III, Appendix IIIF – Surface Water Drainage Plan. Appendix IIIF includes erosion control measures that are applicable to active site conditions prior to installation of final cover.

Permanent erosion control features have been included in the site design. These features include design of perimeter channels for non-erodible velocities. In areas where erosion has been anticipated, erosion protection of the channels in the form of gabions, rock riprap, or turf reinforcement matting is provided. Permanent erosion protection measures are also shown in Appendix IIIF – Surface Water Drainage Plan. In addition to grass cover, permanent erosion features included in the final cover design are drainage swales and chutes shown on Part III, Drawing IIIA-A.2 – Landfill Completion Plan.

3.7 Floodplain Information

None of the permit property is located within a floodplain.

3.8 Wetlands Information

The Hardin County Landfill property was examined for compliance with wetlands issues as described in 30 TAC §330.553, which states that new MSWLF units, lateral expansions, and material recovery operations from a landfill shall not be located in wetlands, unless the owner or operator makes appropriate demonstrations involving wetlands. A jurisdictional determination was completed on November 12, 2015 by Goshawk Environmental Consultants, Inc. and approved by the USACE on April 18, 2016 (correspondence with the USACE is included in Appendix I/IIB). As stated within the report, no portion of the permit property is within jurisdictional areas.

4 LANDFILL UNIT DESIGN

Consistent with 30 TAC §330.63(d)(4), this Site Development Plan was prepared to address the requirements for the landfill unit at the Hardin County Landfill. The following subsections discuss provisions for all-weather operations and access, the proposed landfill method, minimum and maximum design elevations, solid waste acceptance rates, site life, cross-sections and design details, and a liner quality control plan. In addition to these items as required by §330.63(d)(4), additional information regarding the geotechnical analyses, the liner design, and leachate management are also discussed.

4.1 All-Weather Operation

The landfill perimeter roads, haul road, and interior access roads will be constructed of crushed stone, gravel, or other suitable material and will provide access from the entrance road to the fill area. From the entrance facilities, the landfill haul road is a crushed stone road. The paved access road and crushed stone haul road will serve as mud control for waste hauling vehicles prior to exiting the site and returning to the site access roads. The crushed stone haul road and perimeter road will be maintained for all-weather access by site personnel. Additional mud control measures will be taken if these mud control measures do not effectively minimize tracking of mud onto public roads.

On-site stockpiles of crushed stone, concrete rubble, masonry demolition debris, or other similar material will be provided as needed for use in maintaining passable access roads. Grading equipment or other appropriate equipment will be used, as necessary, to control or remove mud accumulations on the perimeter access road around the landfill, the landfill haul road, the paved entrance facility area, and the site access road.

The landfill haul road and perimeter roads will be passable under inclement weather conditions to allow access to the working face area. To enhance operating efficiency during wet weather, a disposal area close to the all-weather roads may be reserved for wet-weather operations.

4.2 Landfill Methods

The proposed landfill development method for the site is a combination of area-excavation fill followed by aerial fill to the proposed landfill completion height.

The landfill drawings depicting existing site conditions, excavation, final fill height, sector fill layout, sector sections, sequence of development plans, site contour maps, and landfill completion plan are included in Parts I/II, Appendix I/IIA - Facility Layout Maps.

The excavation side slopes will be no steeper than 3 horizontal to 1 vertical (3H:1V), the aerial fill side slopes will be approximately 4H:1V, and the aerial fill top slope will be approximately 5 percent. Sectors will be closed according to the closure plan provided in Part III, Appendix IIIJ –Closure Plan.

4.3 Liner and Final Cover System Design

4.3.1 Liner System for the Undeveloped Portion of the Solid Waste Disposal Area

The liner systems for the Hardin County Landfill are designed to meet the requirements outlined in 30 TAC §330.331(a)(2), §330.331(e), and §330.333. The liner system is described below, with layers listed from top to bottom.

Standard Subtitle D Composite Liner System (Type I MSW Only Area)	Type IV C&D Area
24-inch-thick Soil Protective Cover	12-inch-thick Soil Protective Cover
Drainage Geocomposite Leachate Collection System Layer	2-foot-thick Compacted Clay Liner (CCL)
Geomembrane Liner (60-mil FML)	
2-foot-thick Compacted Clay Liner (CCL)	

A summary of the liner system design and the liner system details are included in Part III, Appendix IIIA - Landfill Unit Design Information. Information regarding liner materials and construction quality assurance are included in Part III, Appendix IIID – Liner Quality Control Plan. The elevation of the deepest excavation is 45.23 ft-msl, occurring in Sector 7.

4.3.2 Leachate Collection System

A LCS has been designed to remove leachate from the Subtitle-D areas of the landfill. The LCS layout is shown on drawings included in Appendix IIIA-A. Design of the proposed LCS and a demonstration of the adequacy of the existing LCS is discussed in Part III, Appendix IIIC - Leachate and Contaminated Water Management Plan. LCS details are provided in Part III, Appendix IIIA – Landfill Unit Design Information. Information regarding materials and construction quality assurance are included in Part III, Appendix IIID – Liner Quality Control Plan.

4.3.3 Final Cover System

The final cover system will consist of a Subtitle D composite cover for the Subtitle D lined areas, and a Type IV final cover for the Type IV lined area. The final cover system will provide a low maintenance cover, protect against erosion, minimize rainfall percolation through the cover system, and consequently minimize leachate generation within the landfills. As depicted on Drawing IIIA-A.2 – Landfill Completion Plan, a maximum of 4 percent top slopes and 4H:1V sideslopes are provided to minimize erosion and facilitate drainage of the landfill. The maximum final cover elevation for the Type I unit will be 234 ft-msl, and the maximum top of waste elevation will be 230.5 ft-msl. The maximum final cover elevation for the Type IV unit will be 88 ft-msl, and the maximum top of waste elevation will be 85.5 ft-msl. A composite final cover system will be constructed over the Subtitle D waste disposal area, and a Type IV cover constructed over the Type IV C&D disposal area. Components of the multi-layer final cover system for each option include (from top to bottom):

Composite Final Cover System (Subtitle D MSW Area)

An erosion layer consisting of a minimum 24-inch-thick layer of earthen material capable of sustaining plant growth. The vegetation layer will consist of native or introduced grasses capable of providing 95 percent coverage over the cover system.

- A double-sided drainage geocomposite will be used as the drainage layer for sideslopes, and a single-sided drainage geocomposite will be used for topslopes. Note that due to the limited size of the topslopes, a double-sided drainage layer may be substituted.
- A 40-mil, smooth (topslope) and textured (sideslope), linear low-density polyethylene (LLDPE), geomembrane liner or other equivalent geomembrane liner material may be used. Note that due to the limited size of the topslope, textured membrane may be substituted.
- An 18-inch-thick compacted clay infiltration layer with a coefficient of permeability of less than or equal to $1x10^{-5}$ cm/s. Refer to Appendix IIIJ for additional information.

Type IV C&D Area

- An erosion layer consisting of a 12-inch-thick earthen material capable of sustaining vegetative growth. The vegetation will consist of native and introduced grasses capable of providing 95 percent coverage over the cover system.
- An 18-inch-thick compacted clay infiltration layer with a coefficient of permeability of less than or equal to $1x10^{-5}$ cm/s.

Type IV final cover is only applicable to the 2.5-acre Type IV C&D area. The location of the final cover system areas and details are shown on Drawing A.2. Details of the final cover system are presented on Drawings A.6 and A.7 in Appendix IIIA-A. Material specifications along with construction and testing procedures for the final cover system are provided in Appendix IIIJ-A – Final Cover System Quality Control Plan (FCSQCP).

A demonstration that the specified final cover design will provide effective long-term erosional stability is included in Part III, Appendix IIIF – Surface Water Drainage Plan (Appendix IIIF-D). The final cover system will be constructed as outlined in Part III, Appendix IIIJ – Closure Plan. Refer to Appendix IIIJ and Appendix IIIJ-B for the specifications for these layers.

Landfill gas generated in the landfill will be collected by extraction wells, as discussed in Appendix IIII – Landfill Gas Management Plan. The landfill gas system will reduce gas pressure buildup under the final cover and control odor and gas emissions from the site.

4.3.4 Groundwater Monitoring System

The purpose of the groundwater monitoring system is to verify the integrity of the containment systems discussed in the previous sections and to confirm that area groundwater is not adversely impacted by the landfill. This is accomplished by obtaining groundwater samples from the monitoring wells on the perimeter of the landfill. Refer to Appendices IIIG and IIIH for additional groundwater monitoring system information.

4.4 Estimated Rate of Solid Waste Deposition

Currently, the Hardin County Landfill accepts approximately 55,579 tons per year of municipal solid waste and special waste (Type I), and approximately 1,800 tons of C&D (Type IV), based on the 2016 TCEQ annual report (under TCEQ Permit No. MSW-2214A).

The population equivalent, as defined in 30 TAC §330.3, is "the hypothetical population that would generate an amount of solid waste equivalent to that actually being managed based on a generation rate of five pounds per capita per day and applied to situations involving solid waste not necessarily generated by individuals." Based on this definition, the population equivalent for the average waste stream over the active life of the site (37 years – refer to Appendix IIIB) was calculated as follows:

$$\frac{(989{,}560^{1}\text{ tons/year}) \times (2{,}000\text{ pounds/ton})}{(5\text{ pounds/person/day}) \times (365\text{ days/year})} = 1{,}084{,}449\text{ persons}$$

[1] Average yearly waste inflow (based on a 286-day operating year) was calculated using the average daily waste inflow rate over the life of the site (2,754 tons/day x 286 days/year = 989,560 tons/year). Refer to Appendix IIIB for more information.

The major classifications of solid waste to be accepted by this facility for disposal include residential, commercial MSW, and industrial (does not include Class I non-hazardous industrial waste). Such waste consists of household wastes, yard waste, commercial waste, construction-demolition waste, and various non-hazardous industrial and special wastes as authorized by the TCEQ such as regulated and non-regulated asbestos, wastewater treatment plant sludge, dead animals, and other special wastes. Consistent with 30 TAC §330.15, the site will not accept liquid wastes (liquid wastes will not be disposed of at the landfill), regulated hazardous wastes, prohibited PCBs, infectious medical wastes, or other wastes prohibited by TCEQ regulations. Waste classifications are provided in Parts I/II, Section 2.1.2.

4.5 Typical Unit Cross-Sections

Typical unit cross-sections are included in Appendix IIIA-B. The cross-sections are developed consistent with the requirements of §330.63(d)(4)(E) and (F).

5 COMPLIANCE WITH §330.63(E) THROUGH §330.63(J)

The following table provides references to each SDP appendix that was developed to meet the specified rule.

Rule	SDP Appendix
§330.63(e)	Appendix IIIG – Geology Report and Appendix IIIE – Geotechnical Report
§330.63(f)	Appendix IIIH – Groundwater and Sampling Analysis
§330.63(g)	Appendix IIII – Landfill Gas Management Plan
§330.63(h)	Appendix IIIJ – Closure Plan
§330.63(i)	Appendix IIIK – Postclosure Care Plan
§330.63(j)	Appendix IIIL – Closure and Postclosure Care Cost Estimates

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS
TCEQ PERMIT NO. MSW-2214B

MAJOR PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN
APPENDIX IIIA
LANDFILL UNIT DESIGN INFORMATION

Prepared for

BFI Waste Systems of North America, LLC

March 2017
Revised August 2017

Revised December 2017

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER

12-5-2017

Prepared by

Weaver Consultants Group, LLC
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Fort Worth, Texas 76109
817-735-9770

WBC Project No. 0120-758-11-02

This document is intended for permitting purposes only.

CONTENTS

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12-5-2017

LANDFILL UNIT DESIGN INFORMATION

1.0 Introduction

This appendix addresses §330.331, §330.333, and §330.457.

The purpose of this appendix is to present the details of the liner and final cover system details consistent with Title 30 of the Texas Administrative Code (TAC) §330.331, §330.333, and §330.457. The following subsections have been developed to provide detailed information for the proposed liner systems, exiting liner systems, and final cover systems.

2.0 Proposed Liner Systems for the Subtitle D Area

The proposed composite liner systems are designed to meet the requirements of Title 30 TAC §330.331(a)(1), §330.331(a)(2), and §330.331(e). The composite liner systems that will be constructed within the undeveloped landfill sectors are described below.

Table IIIA-1
Liner System Components

Standard Subtitle D Composite Liner System (Type I MSW Only Area)	Type IV C&D Area Liner System
24-inch-thick Soil Protective Cover	12-inch-thick Soil Protective Cover
Drainage Geocomposite Leachate Collection System Layer	3-foot-thick Compacted Clay Liner (CCL)
Geomembrane Liner (60-mil FML)	
2-foot-thick Compacted Clay Liner (CCL)	

Drawing A.1 (Appendix IIIA-A) details the top of protective cover grades (Cells 1-6) and excavation grades (Cells 7-8) for the Hardin County Landfill. This drawing also references the location of the various liner system details. The liner system details are presented on Drawings A.3, A.4, and A.5. Material specifications, construction, and testing requirements for the liner system are provided in Appendix IIID – Liner Quality Control Plan (LQCP).

As shown on Typical Section A (Drawing B.2 in Appendix IIIA-B), the existing permitted waste disposal area will be expanded vertically and in depth with this major permit amendment application. The existing lateral limits of waste will not be changed for this amendment.

The excavation floor will be founded in the Upper Clay Stratum or Lower Clay Stratum, with portions of the landfill excavations penetrating the Upper Sand Stratum. The excavation sideslopes will primarily be founded in the Upper Clay Stratum or Upper Sand Stratum. The uppermost aquifer at the site occurs in the Upper Sand Stratum as discussed in Appendix IIIG – Geology Report. As discussed in Appendix IIID – LQCP and presented on Figures IIIA-A.6 and A.7, a temporary hydrostatic pressure relief system will be installed in the undeveloped portions of the site when excavations penetrate the Upper Sand Stratum to prevent the build-up of hydrostatic forces on the liner system. The groundwater dewatering system shown on Drawing III.A-A.7 will be installed on the landfill cell sideslopes that encounter the Upper Sand Stratum. Dewatering will not be required on sideslopes that do not encounter the Upper Sand Stratum.

The proposed liner system, as shown on Drawings A.4 through A.6 in Appendix IIIA-A, is designed with a leachate collection system. The design of the leachate collection system components including the drainage geocomposite leachate collection layer, leachate collection piping, chimney drains, sumps, and pumps are provided in Appendix IIIC. Material specifications, construction, and testing requirements for the leachate collection system are provided in Appendix IIID - LQCP.

A geotechnical report including a stability demonstration for the liner system is provided in Appendix IIIE – Geotechnical Report. A summary of the liner design information that is included in the Geotechnical Report is provided below.

- **Excavation Stability.** The stability of the proposed excavation slopes was evaluated at the most critical sections (i.e., where the 3H:1V sideslope is the longest). The excavation slopes were analyzed using undrained and drained strength parameters. Additionally, these sections were analyzed using undrained and drained strength parameters after clay liner and protective cover are constructed. All factors of safety generated were greater than the minimum recommended factor of safety of 1.3 for short-term conditions.
- **Liner System Stability.** The interfaces of the components of the liner system were evaluated using infinite slope stability analysis. The minimum factor of safety is greater than the acceptable factor of safety of 1.3 for short-term conditions.
- **Liner System Settlement and Strain Analysis.** The liner system was evaluated for settlement and strain due to loading of liner soil, waste, and cover soils. The maximum settlement was calculated to be 3.03 feet and the

maximum strain calculated is 0.0077 percent, which is within the acceptable range of each liner system component.

3.0 Existing Liner Systems

As of February 2017, the site has approximately 33.4 acres of existing liner. Approximately 32 acres consist of composite Subtitle D liner system and 1.4 acres are Type IV C&D liner. The existing composite liner system for the developed Subtitle D sectors is described below. The liner system for the Type IV C&D area is described in Table IIIA-1.

Table IIIA-2
Existing Liner System Components

Standard Subtitle D Composite Liner System
24-inch-thick Soil Protective Cover
Drainage Geocomposite Leachate Collection System Layer
60-mil HDPE Geomembrane Liner
2-foot-thick or 3-foot-thick CCL in MSW Areas[1]

[1]The use of 3-foot-thick CCL was discontinued when the landfill began using underdrains for groundwater control.

The impact of differential settlement on the performance of the leachate collection system is analyzed in Appendix IIIE-B and summarized in the following table.

Table IIIA-3
Leachate Collection System Settlement Analysis

Area	Design Slope between Cell Ridgeline and Leachate Collection Pipe	Design Slope of Leachate Collection Pipe	Post-Settlement Slope between Cell Ridgeline and Leachate Collection Pipe	Post-Settlement Slope of Leachate Collection Pipe
Cells 1-6[1] (existing)	1.85%	1.36%	1.12%	2.08%
Cells 7-8 (new)	2.0%	0.5%	1.74%	0.45%

[1] Based on top of protective cover grades shown on Drawing IIIA-A.2.

As shown, the slope between the leachate collection pipe from the upstream portion of the cells to the sump is reduced an insignificant amount due to the additional settlement caused by the vertical expansion. A demonstration that the existing leachate collection system will continue to function in a manner that meets all regulatory requirements is included in Appendix IIIC.

4.0 Final Cover System

The final cover system will consist of a Subtitle D composite cover for the Subtitle D lined areas, and a Type IV final cover for the Type IV lined area. The final cover system will provide a low maintenance cover, protect against erosion, minimize rainfall percolation through the cover system, and consequently minimize leachate generation within the landfills. As depicted on Drawing IIIA-A.2 – Landfill Completion Plan, a maximum of 5 percent top slopes and 4H:1V sideslopes are provided to minimize erosion and facilitate drainage of the landfill. A composite final cover system will be constructed over the Subtitle D waste disposal area, and a Type IV cover constructed over the Type IV C&D disposal area. Components of the multi-layer final cover system for each option include (from top to bottom):

Composite Final Cover System (Subtitle D MSW Area)

- An erosion layer consisting of a minimum 24-inch-thick layer of earthen material capable of sustaining plant growth. The vegetation layer will consist of native or introduced grasses capable of providing 95 percent coverage over the cover system.
- A double-sided drainage geocomposite will be used as the drainage layer for sideslopes, and a single-sided drainage geocomposite will be used for topslopes. Note that due to the limited size of the topslopes, a double-sided drainage layer may be substituted.
- A 40-mil, smooth (topslope) and textured (sideslope), linear low-density polyethylene (LLDPE), geomembrane liner or other equivalent geomembrane liner material may be used. Note that due to the limited size of the topslope, textured membrane may be substituted.
- An 18-inch-thick compacted clay infiltration layer with a coefficient of permeability of less than or equal to $1x10^{-5}$ cm/s. Refer to Appendix IIIJ for additional information.

Type IV C&D Area

- An erosion layer consisting of a 12-inch-thick earthen material capable of sustaining vegetative growth. The vegetation will consist of native and introduced grasses capable of providing 95 percent coverage over the cover system.
- An 18-inch-thick compacted clay infiltration layer with a coefficient of permeability of less than or equal to $1x10^{-5}$ cm/s.

Type IV final cover is only applicable to the 2.5-acre Type IV C&D area. The location of the final cover system areas and details are shown on Drawing A.2. Details of the final cover system are presented on Drawings A.6 and A.7 in Appendix IIIA-A. Material specifications along with construction and testing procedures for the final cover system are provided in Appendix IIIJ-A – Final Cover System Quality Control Plan (FCSQCP).

The drainage system is detailed in Appendix IIIF – Surface Water Drainage Plan. Drainage from the landfill itself is directed through a system of swales, chutes, and perimeter channels to the stormwater detention pond. The detention pond and pond outlet structures are detailed in Appendix IIIF – Surface Water Drainage Plan.

Permanent final cover erosion control structures include swales and chutes that will be constructed upon completion of the final cover. The design of the final cover system erosion control structures is provided in Appendix IIIF-B. As part of the final cover construction, an erosion layer capable of sustaining native vegetation will be constructed. Areas that receive final cover will be seeded upon completion of final cover placement. A soil loss and sheet flow velocity demonstration for the erosion layer is included in Appendix IIIF-D. The erosion layer will include a vegetation layer that provides for 90 percent ground coverage to keep soil loss below the required design values. If there are areas that do not maintain at least 90 percent coverage they will be re-seeded until at least 90 percent coverage is maintained.

The stormwater controls for the landfill have been designed consistent with the TCEQ regulations for Type I MSW landfills. The runon/runoff stormwater controls have been designed for a 25-year storm event. These include drainage controls for the final cover, perimeter drainage channels, culverts, and detention pond. Details for the perimeter drainage system and associated calculations are included in Appendix IIIF-A – Surface Water Drainage Plan.

A geotechnical report including a stability demonstration for the final cover system is provided in Appendix IIIE – Geotechnical Report and is summarized below.

- **Final Cover Stability.** The stability of the proposed final cover slopes was evaluated at the most critical sections (i.e., where the 4H:1V slopes were the longest). The final cover slopes were analyzed using drained and undrained strength parameters (effective and total stress, respectively). The minimum factors of safety generated were all greater than the minimum recommended factor of safety of 1.3 (total stress analysis) and 1.5 (effective stress analysis).
- **Final Cover System Stability.** The interfaces of the components of the final cover system were evaluated using infinite slope stability analysis. This is greater than the acceptable factor of safety of 1.5 for long-term stability.
- **Final Cover System and MSW Settlement and Strain Analysis.** The final cover system was also evaluated for settlement and strain due to consolidation of the waste material within the landfill. The maximum strain calculated is acceptable.

APPENDIX IIIA-A

LINER AND FINAL COVER SYSTEM DETAILS

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LINER AND FINAL COVER SYSTEM DETAILS

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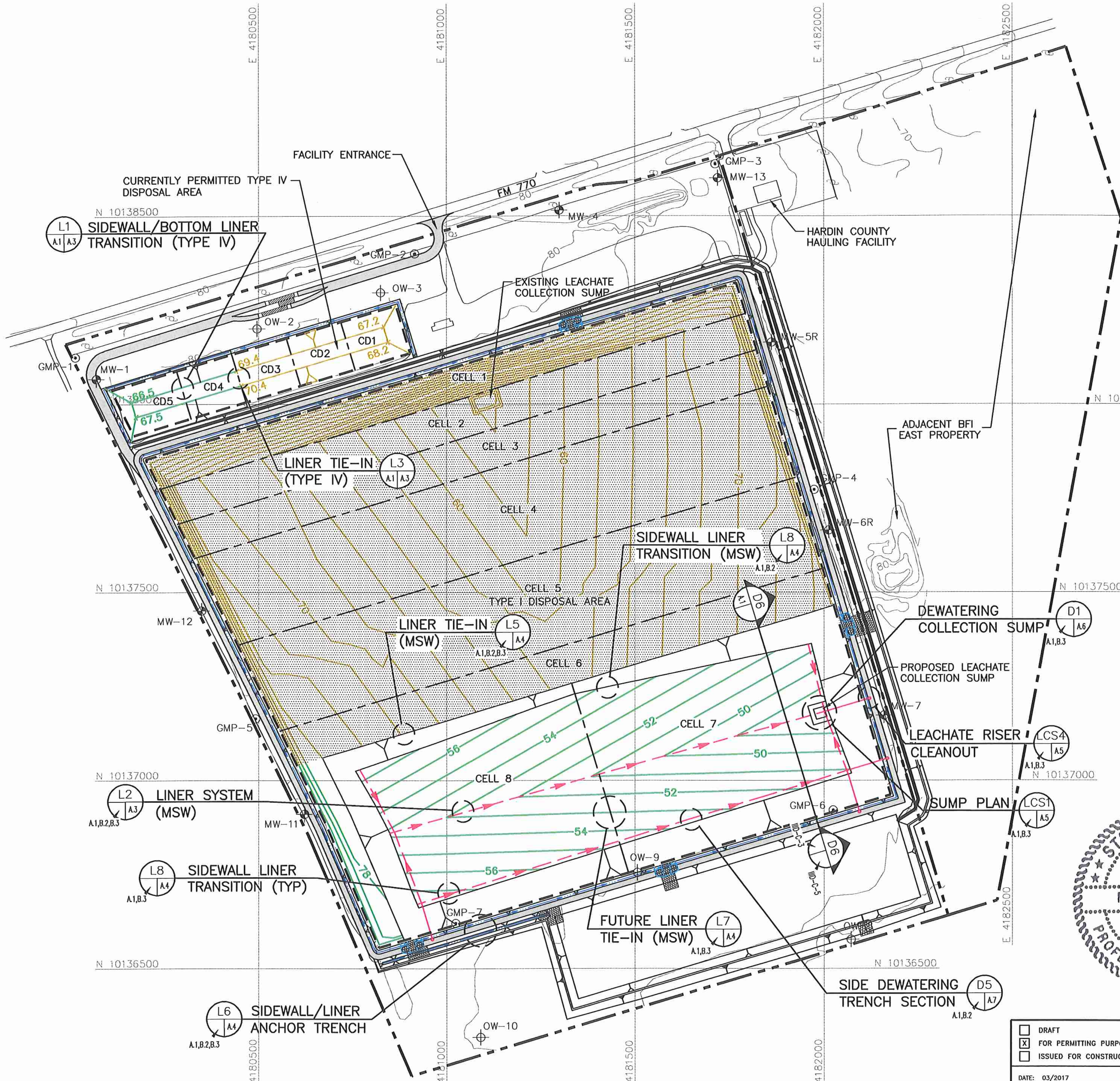

0 150 300
SCALE IN FEET

LEGEND

- BFI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- 70 — EXISTING CONTOUR (SEE NOTE 1)
- N 10137000 — STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
- CELL BOUNDARY
- 50 — PROPOSED EXCAVATION CONTOUR
- 70 — CONSTRUCTED TOP OF PROTECTIVE COVER CONTOUR
- PROPOSED LEACHATE LINE
- PROPOSED LEACHATE RISER
- EXISTING SUBTITLE D COMPOSITE LINER AREA
- MW-1 — EXISTING GROUNDWATER MONITOR WELL
- OW-2 — EXISTING GROUNDWATER OBSERVATION WELL
- GMP-1 — EXISTING GAS MONITORING PROBE (SEE NOTE 7)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CURRENTLY PERMITTED TYPE IV CELLS INCLUDES CD1 THROUGH CD5. CD1, CD2, AND CD3 ARE CURRENTLY DEVELOPED AND RECEIVED TYPE IV WASTE.
3. SEE APPENDIX IIIC FOR LEACHATE FORCEMAIN AND STORAGE TANK INFORMATION.
4. ELEVATION OF DEEPEST EXCAVATION AT LCS SUMPS IS 45.2 FT-MSL. THE MINIMUM ELEVATION OF WASTE PLACEMENT IS 50.2 FT-MSL.
5. SECTORS 1 THROUGH 8 LCS PIPES SLOPE WITH A MINIMUM 2.0% TO SUMPS AND LCS LATERAL DRAINAGE SLOPE IS A MINIMUM 2.0% ALONG THE FLOW PATH.
6. SEQUENCE OF SITE DEVELOPMENT IS PROVIDED IN PARTS I/II OF THIS APPLICATION.
7. EXISTING LFG DETECTION PROBE LOCATIONS ARE SHOWN. REFER TO PART III, APPENDIX IIII-LANDFILL GAS MANAGEMENT PLAN FOR LFG PROBE DESIGN AND CURRENT AND FUTURE LFG DETECTION PROBE LOCATIONS.

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12-5-2017

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
☐ ISSUED FOR CONSTRUCTION

DATE: 03/2017
FILE: 0120-758-11
CAD: A.1-EXCAVATION PLAN.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

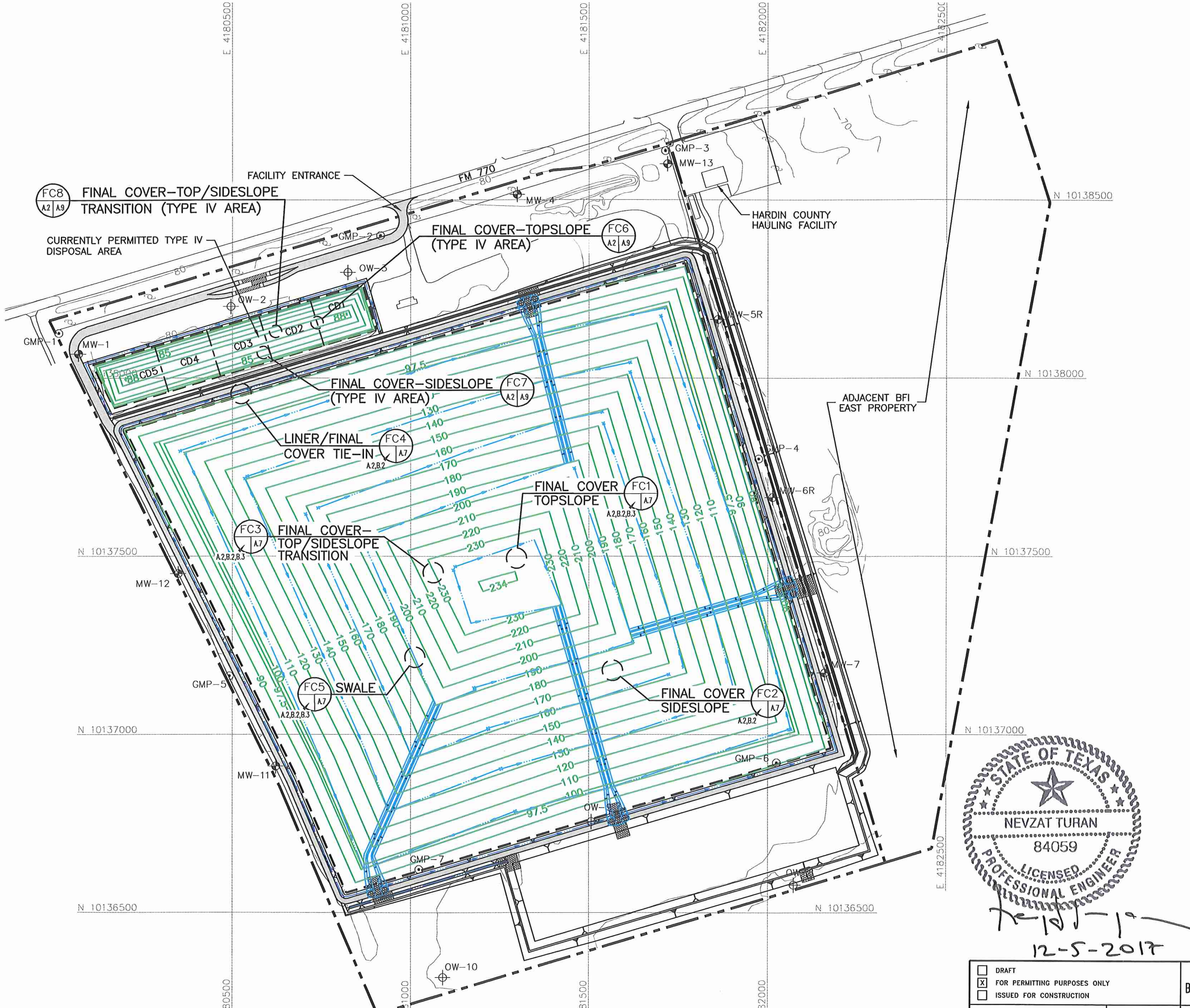
NO.	DATE	DESCRIPTION
1	08/2017	FIRST NOD RESPONSE
2	11/2017	OWNERSHIP CHANGE

MAJOR PERMIT AMENDMENT EXCAVATION PLAN

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

WWW.WCGRP.COM

DRAWING IIIA-A.1



LEGEND

- BFI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- CELL BOUNDARY
- N 10137500 — STATE PLANE COORDINATE GRID
- 70 — EXISTING CONTOUR
- 234 — PROPOSED FINAL CONTOUR (SEE NOTE 3)
- PROPOSED DRAINAGE SWALE
- PROPOSED DRAINAGE CHUTE
- MW–1 — EXISTING GROUNDWATER MONITOR WELL
- OW–2 — EXISTING GROUNDWATER OBSERVATION WELL
- GMP–1 — EXISTING GAS MONITORING PROBE (SEE NOTE 7)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05–17–2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CURRENTLY PERMITTED TYPE IV CELLS INCLUDES CD1 THROUGH CD5. CD1, CD2, AND CD3 ARE CURRENTLY DEVELOPED AND RECEIVED TYPE IV WASTE.
3. THE PROPOSED COMPLETION PLAN DRAINAGE STRUCTURES ARE SHOWN FOR INFORMATIONAL PURPOSES. FINALIZED DRAINAGE PLANS WILL BE SUBMITTED TO TEXAS COMMISSION OF ENVIRONMENTAL QUALITY. (TCEQ) AS PART OF THE PROPOSED MAJOR PERMIT AMENDMENT AND THE SITE DRAINAGE WILL EVENTUALLY BE DEVELOPED PER THE FINAL DRAINAGE PLAN APPROVED BY TCEQ.
4. REFER TO APPENDIX IIIF–SURFACE WATER DRAINAGE PLAN FOR DRAINAGE DESIGN INFORMATION.
5. MAXIMUM FINAL COVER ELEVATION FOR THE TYPE I AREA IS 234 FT–MSL. MAXIMUM TOP OF WASTE ELEVATION FOR THE TYPE I AREA IS 230.5 FT–MSL. MAXIMUM FINAL COVER ELEVATION FOR THE TYPE IV AREA IS 88 FT–MSL. MAXIMUM TOP OF WASTE ELEVATION FOR THE TYPE IV AREA IS 85.5 FT–MSL
6. UPON APPROVAL OF THE APPLICATION (WITHIN ONE YEAR OR PRIOR TO INSTALLATION OF THE CHANNEL, WHICH EVER COMES FIRST), RESTRICTIVE COVENANT FOR THE DRAINAGE CHANNEL INSIDE THE ADJACENT BFI EAST PROPERTY WILL BE FILED WITH HARDIN COUNTY.
7. EXISTING LFG DETECTION PROBE LOCATIONS ARE SHOWN. REFER TO PART III, APPENDIX IIII–LANDFILL GAS MANAGEMENT PLAN FOR LFG PROBE DESIGN AND CURRENT AND FUTURE LFG DETECTION PROBE LOCATIONS.

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
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12-5-2017

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DATE: 03/2017
FILE: 0120–758–11
CAD: A.2–LANDFILL COMPLETION PLAN.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F–3727

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	08/2017	FIRST NOD RESPONSE
2	11/2017	OWNERSHIP CHANGE

MAJOR PERMIT AMENDMENT LANDFILL COMPLETION PLAN

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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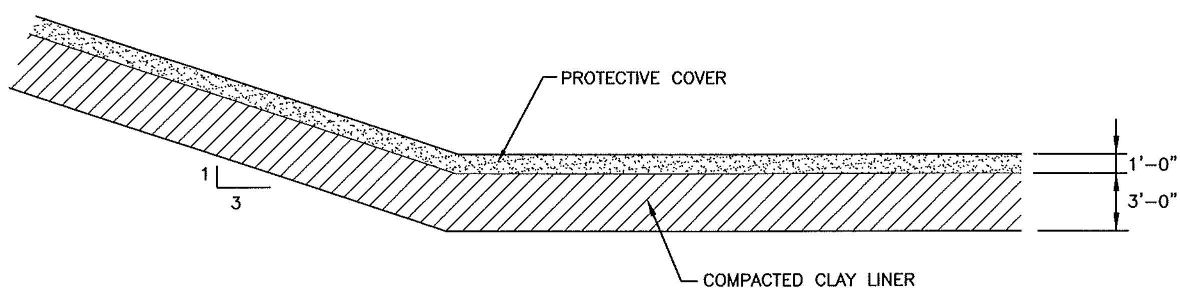
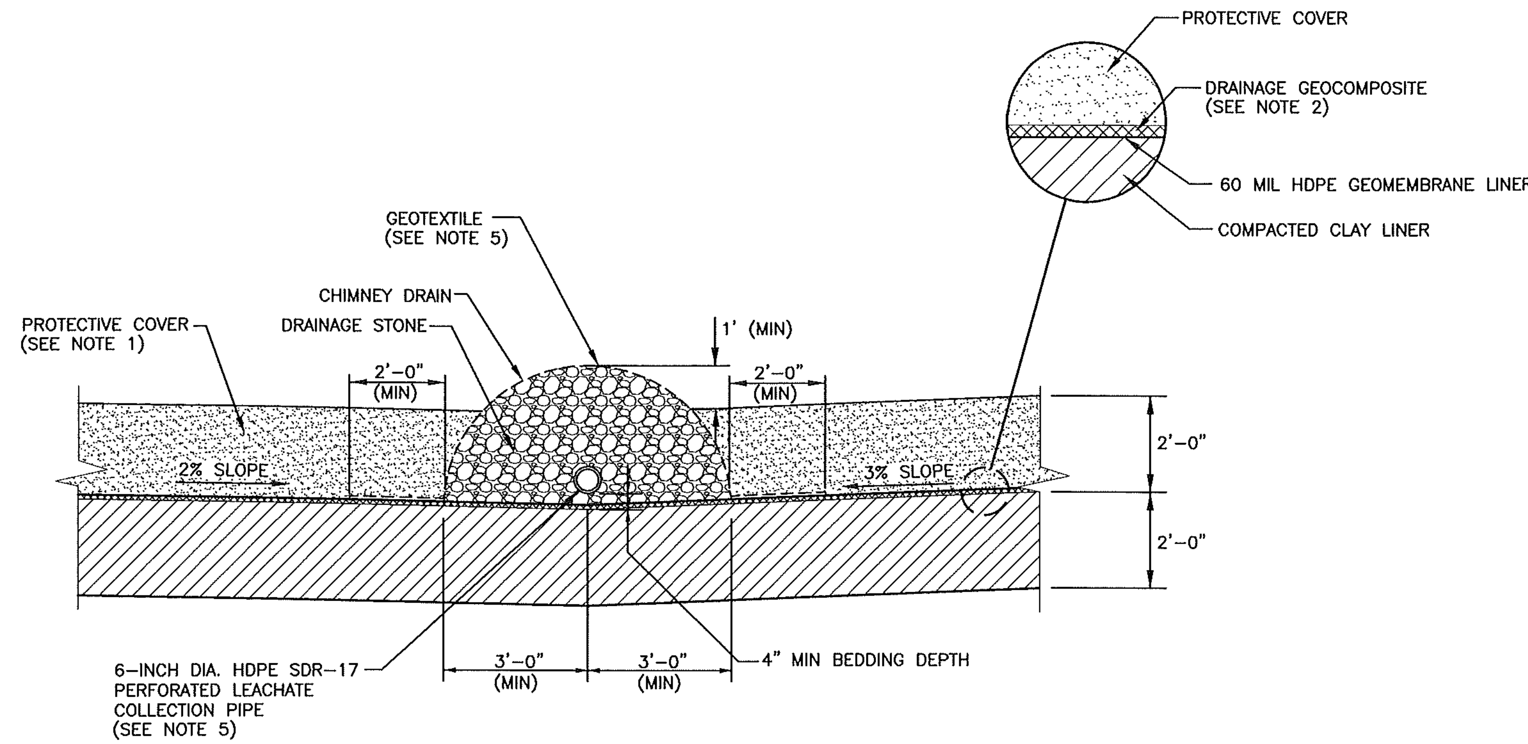
DRAWING IIIA–A.2

O:\0120\758\2214B EXPANSION\IIIA\A\A.2-LANDFILL COMPLETION PLAN.dwg, 11/14/2017 2:47:12 PM, rsellers, 1:2



SIDEWALL/BOTTOM LINER TRANSITION (TYPE IV) L1 A.1 A.3

0 5 10 SCALE IN FEET



LINER SYSTEM (MSW) L2 A.3 A.1,B.2,B.3

0 2 4 SCALE IN FEET

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NEVZAT TURAN
84059
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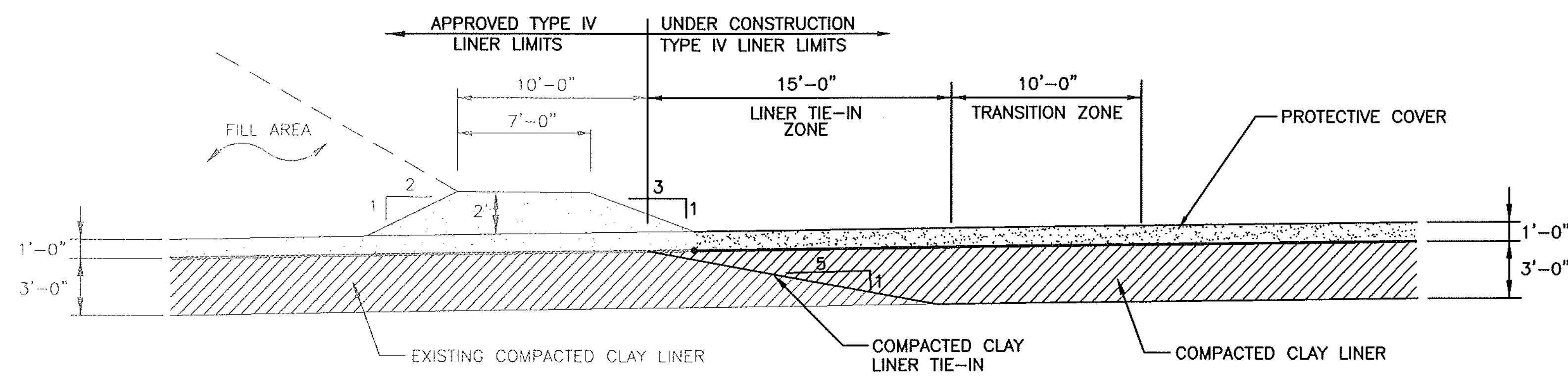
PROFESSIONAL ENGINEER
12-5-2017



LINER TIE-IN (TYPE IV) L3 A.1 A.3

0 5 10 SCALE IN FEET

NOTES:

1. PROTECTIVE COVER WILL BE PLACED ACCORDING TO THE LQCP.
2. DRAINAGE GEOCOMPOSITE FOR UNDEVELOPED AREAS CONSISTS OF A 250-MIL GEONET WITH 6 OZ/SY GEOTEXTILE HEAT BONDED ON THE TOP SIDE FOR THE BOTTOM LINER AND HEAT BONDED GEOTEXTILE (6 OZ/SY) ON BOTH SIDES FOR GEOCOMPOSITE ON 3H:1V SIDESLOPES.
3. DEPENDING ON THE SLOPE, SMOOTH OR TEXTURED HDPE GEOMEMBRANE WILL BE USED.
4. REFER TO THE LQCP IN APPENDIX IIID FOR DEWATERING SYSTEM DESIGN INFORMATION.
5. REFER TO APPENDIX IIIC FOR DESIGN INFORMATION FOR THE LEACHATE COLLECTION SYSTEM COMPONENTS INCLUDING GEOTEXTILE, GEOCOMPOSITE, AND LEACHATE COLLECTION PIPES.

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DATE: 02/2017 DRAWN BY: SRF
FILE: 0120-758-11 DESIGN BY: AE
CAD: A.3-LINER SYSTEM DETAILS.DWG REVIEWED BY: NT

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TBPE REGISTRATION NO. F-3727

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2017	OWNERSHIP CHANGE

MAJOR PERMIT AMENDMENT
LINER SYSTEM DETAILS

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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DRAWING IIIA-A.3

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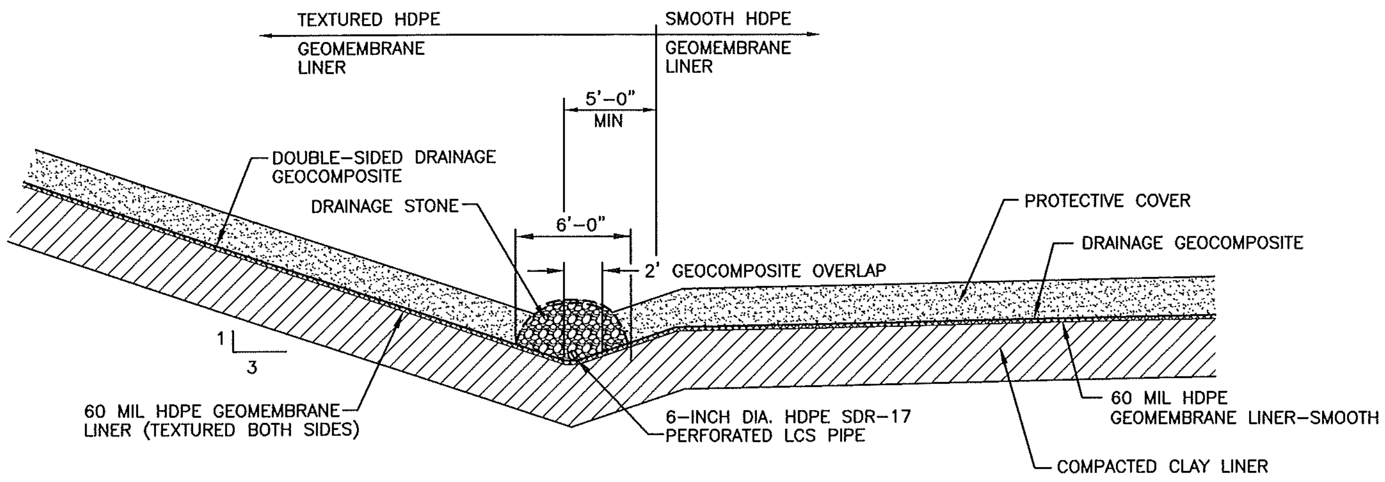
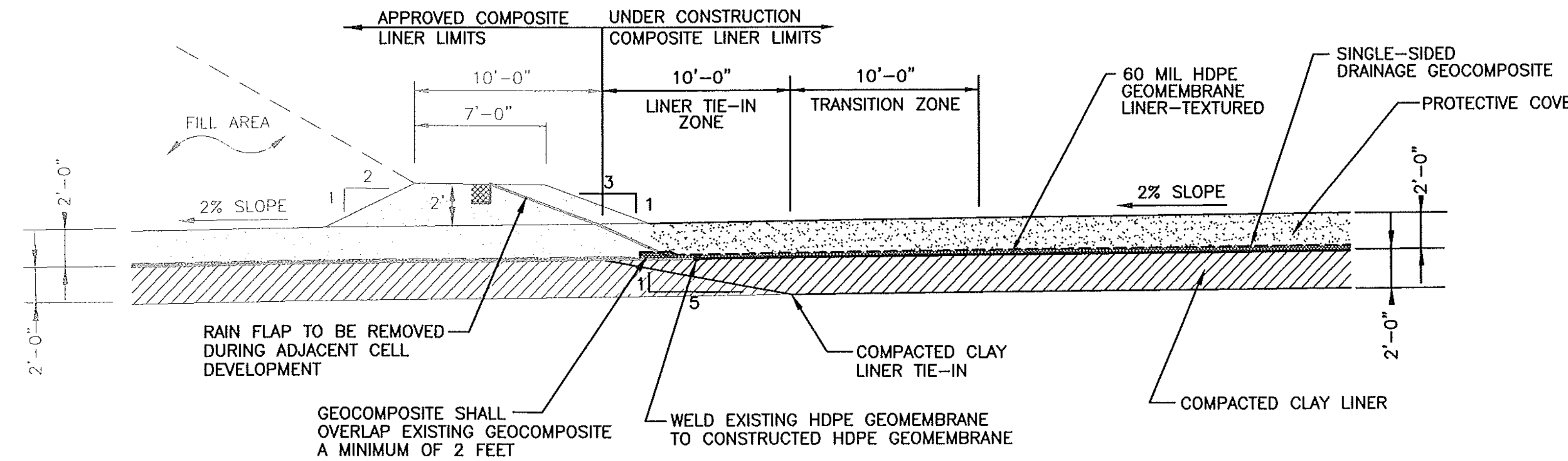
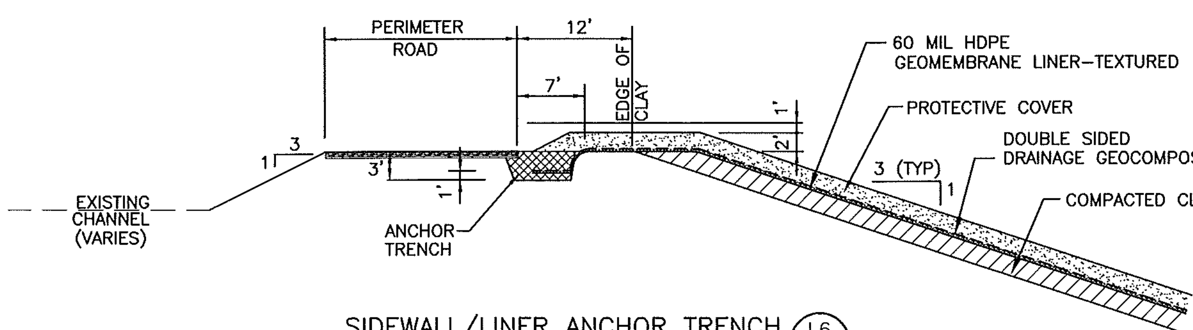


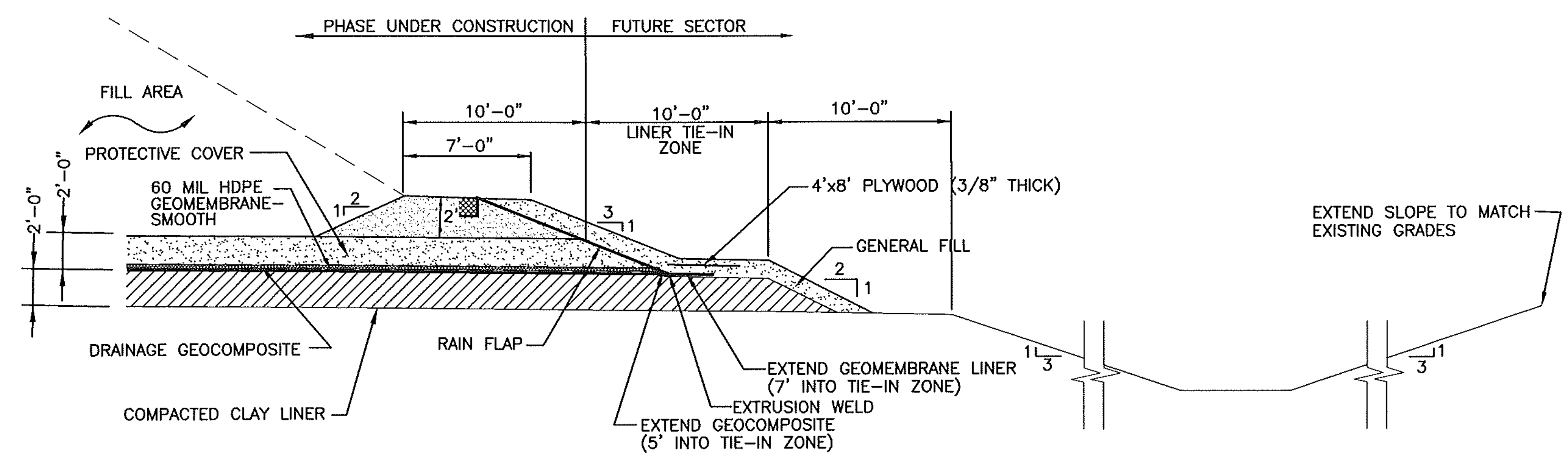
SIDEWALL LINER TRANSITION (TYP) L4 / A4
(MSW)
A.1,B.3
0 5 10
SCALE IN FEET



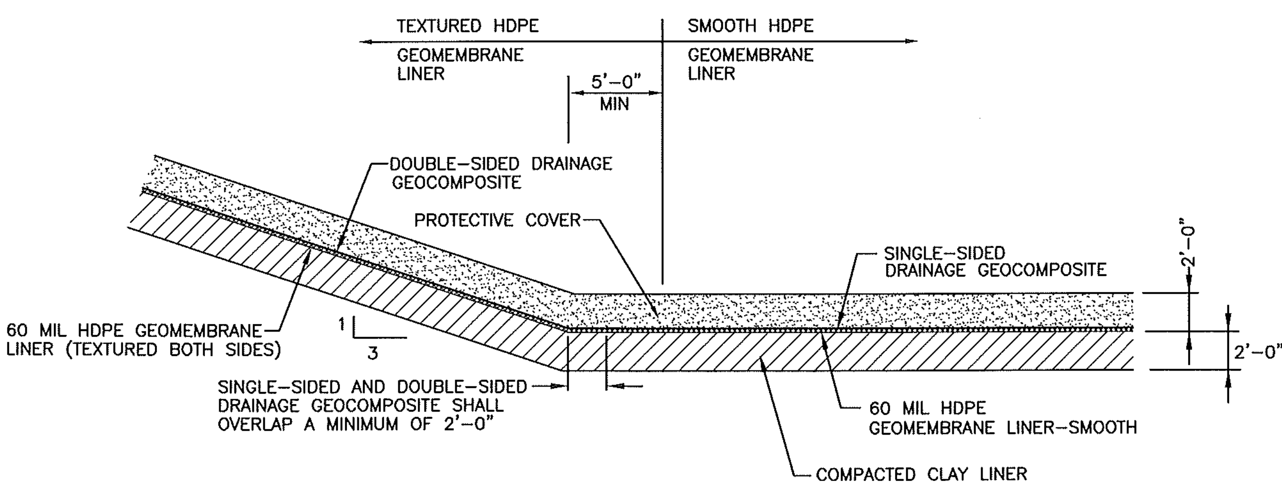
LINER TIE-IN L5 / A4
(MSW)
A.1,B.2,B.3
0 5 10
SCALE IN FEET



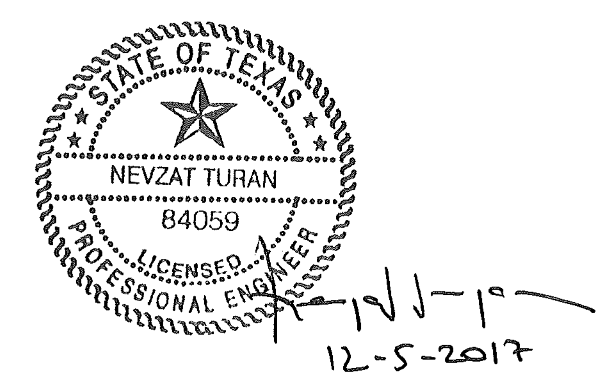
SIDEWALL/LINER ANCHOR TRENCH L6 / A4
(MSW)
A.1,B.2,B.3
0 10 20
SCALE IN FEET



FUTURE LINER TIE-IN L7 / A4
(MSW)
A.1,B.3
0 5 10
SCALE IN FEET



SIDEWALL LINER TRANSITION L8 / A4
(MSW)
A.1,B.2
0 5 10
SCALE IN FEET



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DATE: 03/2017 FILE: 0120-758-11 CAD: A.4-LINER SYSTEM DETAILS.DWG	DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT		HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
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NO.	DATE	DESCRIPTION
1	11/2017	OWNERSHIP CHANGE

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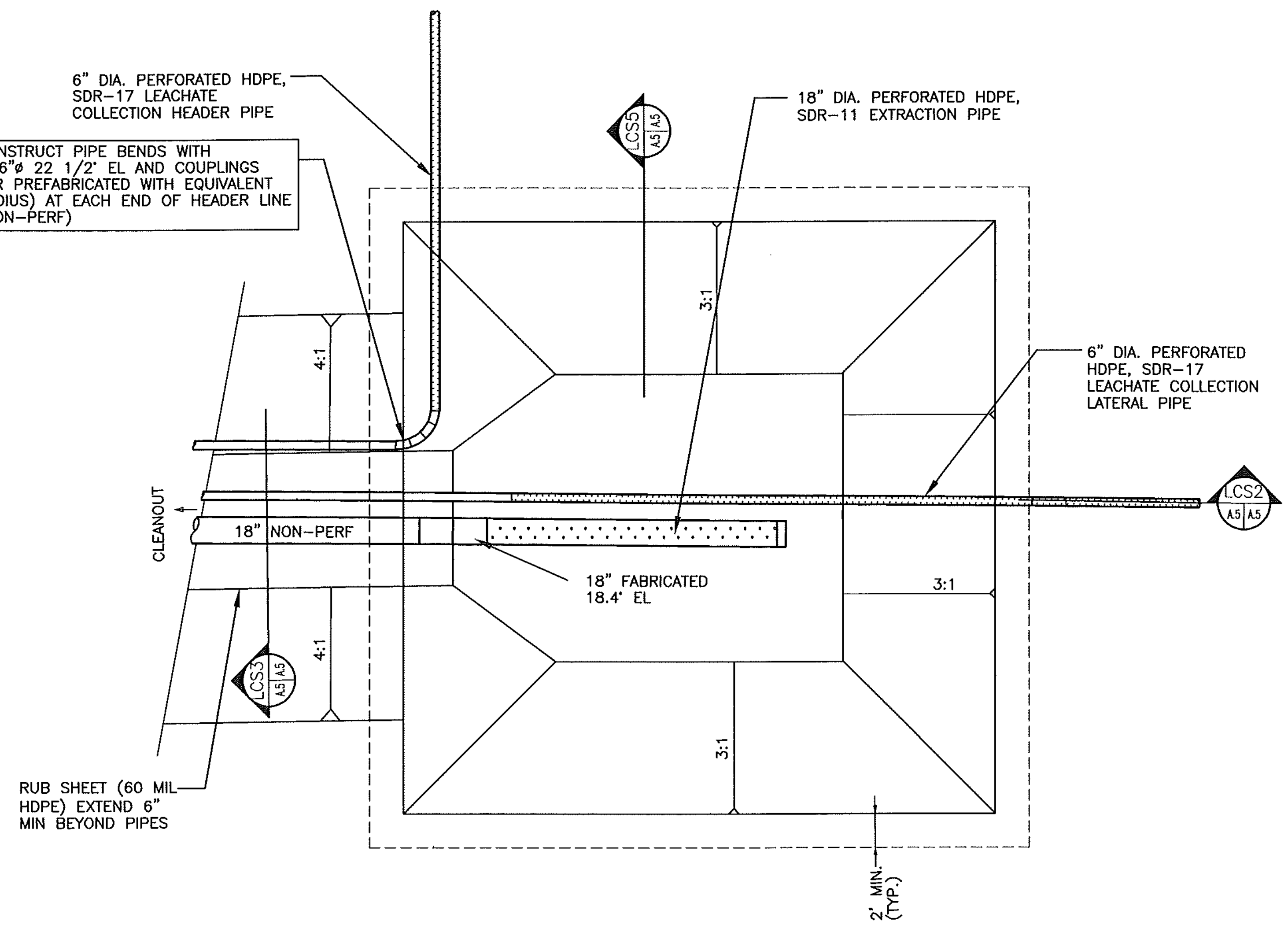
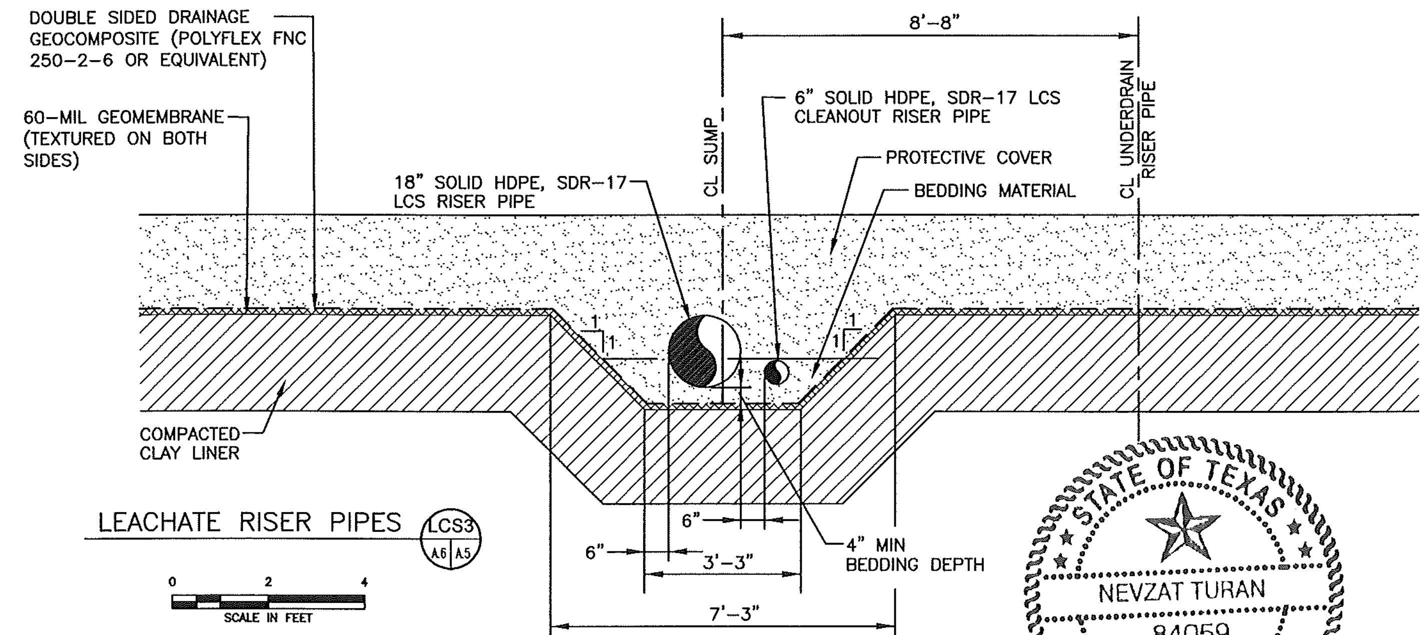


SUMP PLAN LCS1 A.5

A.1,B.3

0 5 10 SCALE IN FEET



LEACHATE RISER PIPES LCS3 A6 A5

0 2 4 SCALE IN FEET

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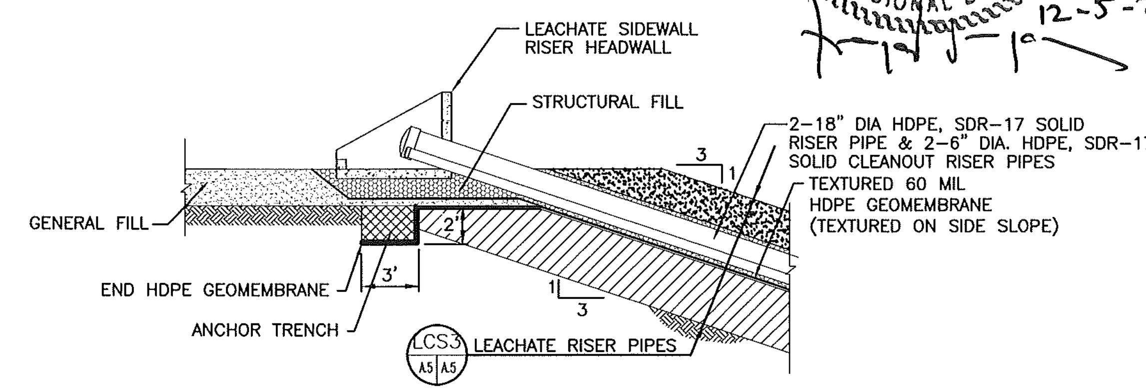
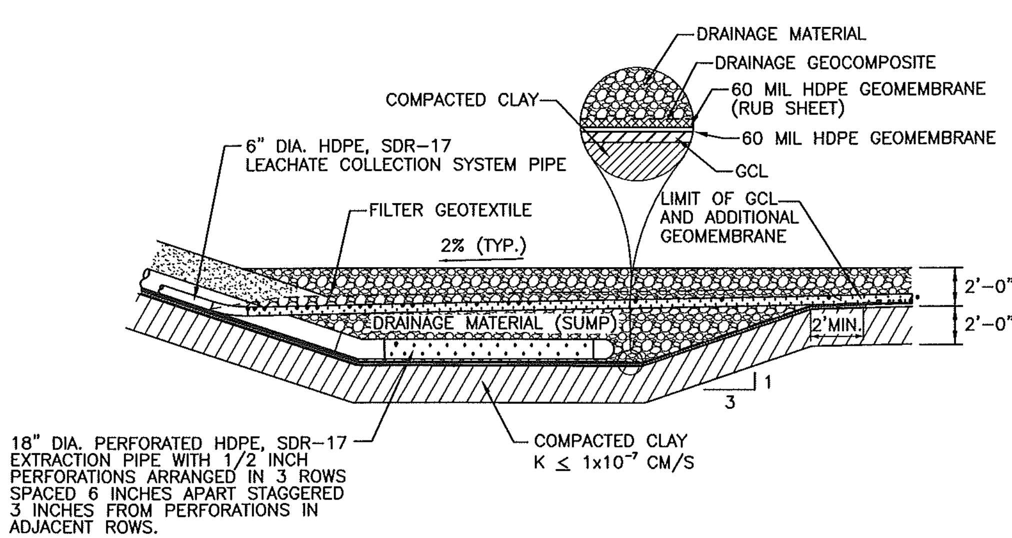
12-5-2017



LEACHATE RISER CLEANOUT LCS4 A5

A.1,B.3

0 5 10 SCALE IN FEET

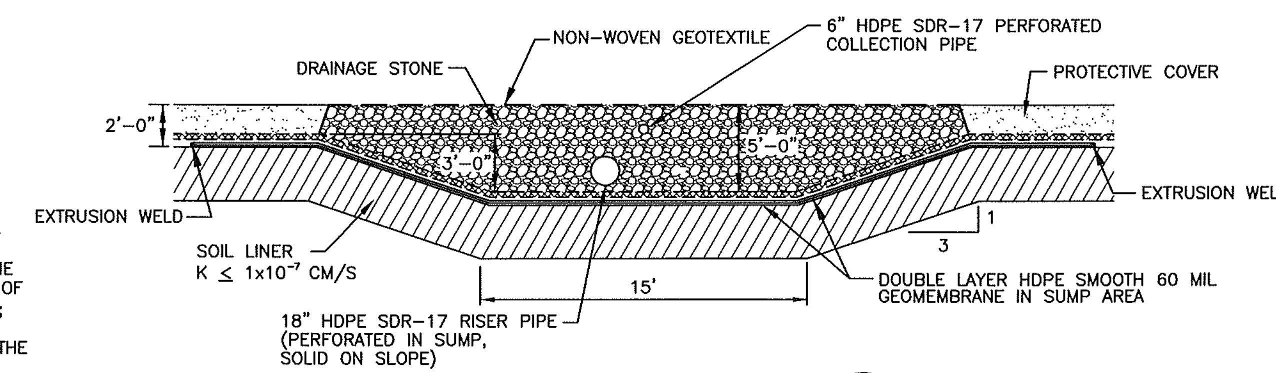


LEACHATE COLLECTION SUMP-SECTION LCS2 A5 A5

0 5 10 SCALE IN FEET

NOTES:

1. HDPE PIPE WILL BE SDR-17 UNLESS NOTED OTHERWISE. HDPE PIPE PERFORATIONS WILL BE 1/2 INCH DIAMETER. THREE ROWS OF PERFORATIONS WILL BE INSTALLED: ONE ROW OF PERFORATIONS WILL BE LOCATED AT THE TOP OF THE PIPE (0 DEGREE LOCATION); ONE AT 120 DEGREES; AND ONE AT THE 240 DEGREE LOCATION. NO PERFORATIONS SHOULD BE PLACED IN THE INVERT OF THE PIPE. THE PERFORATIONS SHOULD BE PLACED EVERY 6 INCHES IN A ROW WITH THE TOP ROW STAGGERED 3 INCHES FROM THE PERFORATIONS IN THE ADJACENT ROWS.
2. MATERIAL SPECIFICATIONS FOR ALL LEACHATE COLLECTION SYSTEM MATERIALS ARE PROVIDED IN APPENDIX IIIC-LEACHATE AND CONTAMINATED WATER PLAN. DRAINAGE MATERIAL SHALL HAVE A MINIMUM HYDRAULIC CONDUCTIVITY 1.0 CM/SEC.
3. REFER TO DRAWINGS IIIA-A.6 AND A.7 FOR SIDESLOPE GROUNDWATER UNDERDRAIN AND SUMP DESIGN DETAILS.

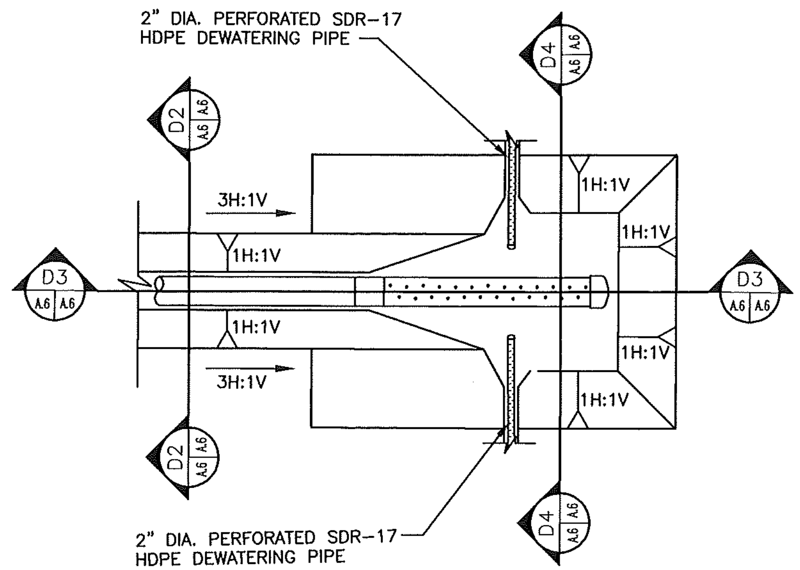


TYPICAL LEACHATE SUMP SECTION LCS5 A5 A5

0 5 10 SCALE IN FEET

☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION		PREPARED FOR BFI WASTE SYSTEMS OF NORTH AMERICA, LLC		MAJOR PERMIT AMENDMENT LEACHATE COLLECTION SYSTEM DETAILS (MSW AREA ONLY)
DATE: 03/2017 FILE: 0120-758-11 CAD: A.5-LEACHATE SYSTEM DETAILS.DWG	DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS		HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
		NO. / DATE	DESCRIPTION	
		1 / 11/2017	OWNERSHIP CHANGE	
Weaver Consultants Group TBPE REGISTRATION NO. F-3727				WWW.WCGRP.COM / DRAWING IIIA-A.5

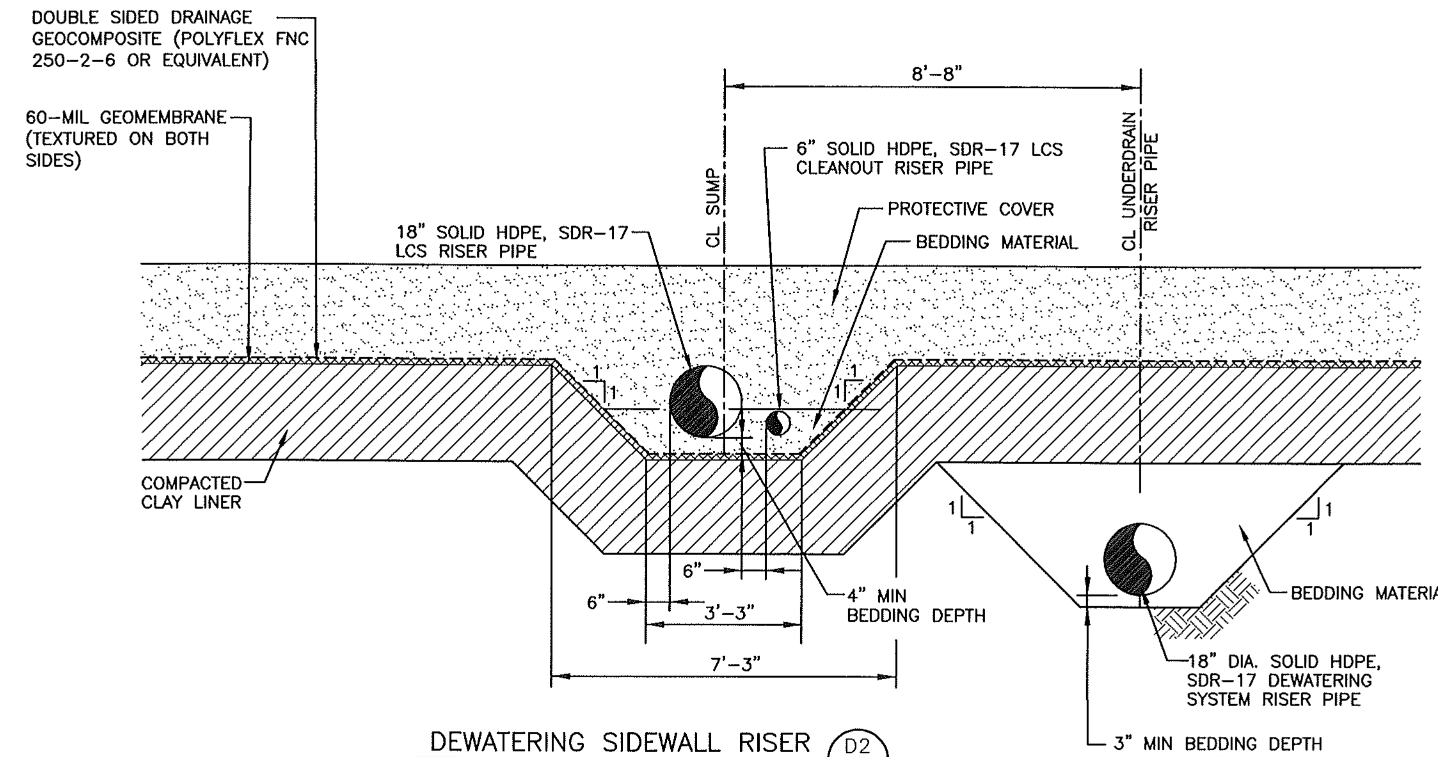
O:\0120\758\2214B EXPANSION\IIIA\A\A.5-LEACHATE DETAILS.dwg, 11/14/2017 2:48:47 PM, rsellers, 1:2



DEWATERING COLLECTION SUMP D1 A.6

A.1,B.3

0 5 10
SCALE IN FEET



DEWATERING SIDEWALL RISER D2 A.6 A.6

0 2 4
SCALE IN FEET

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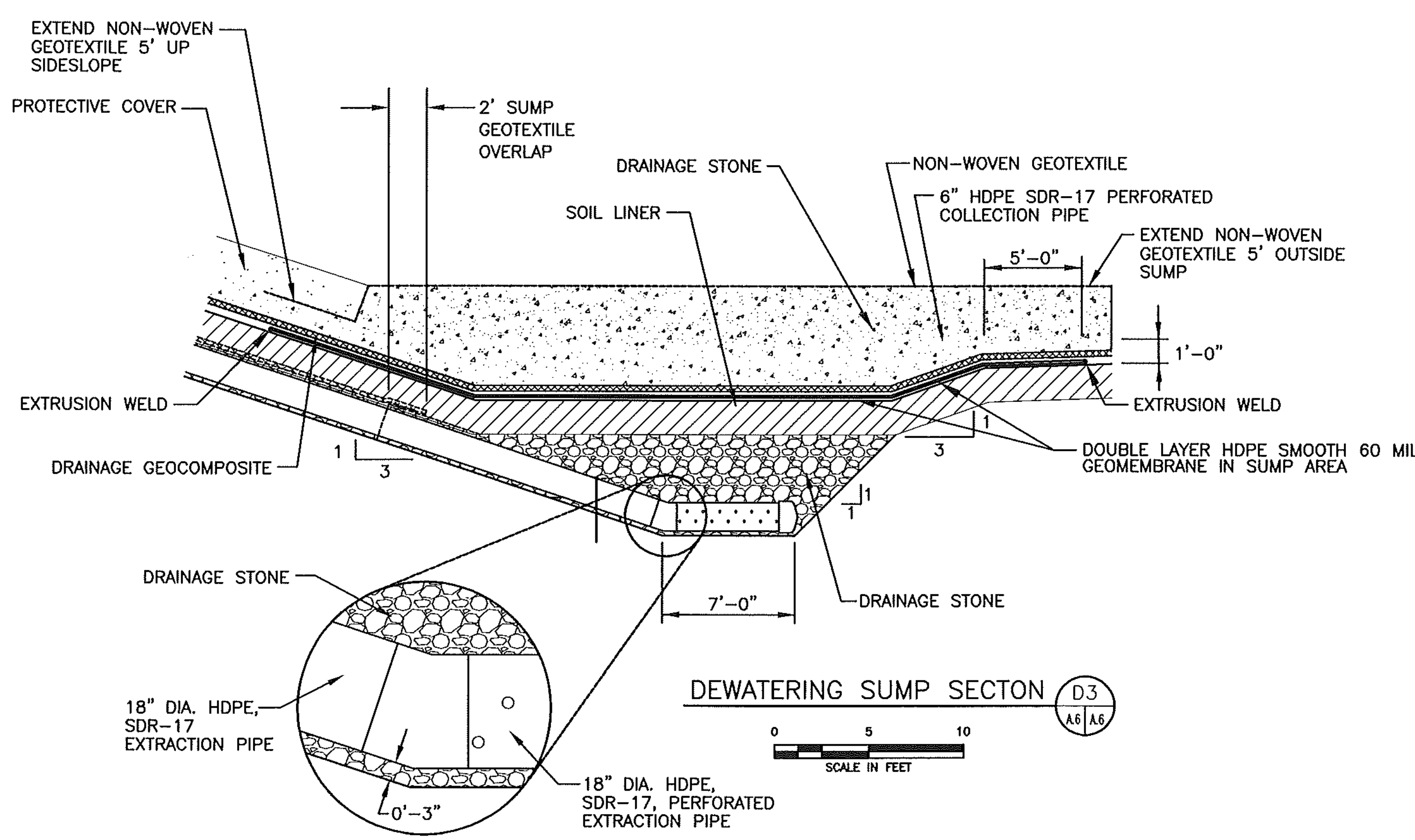
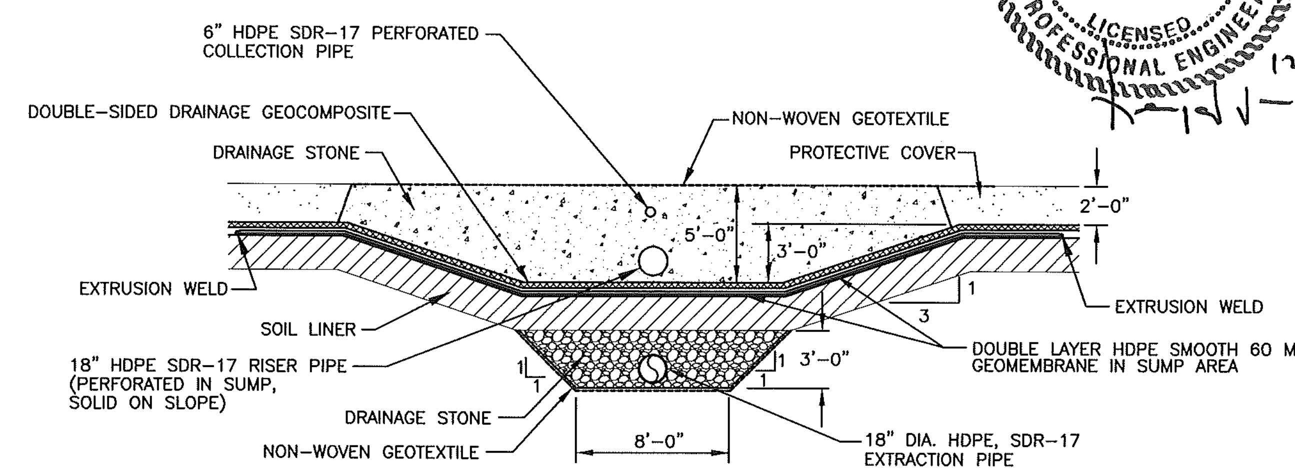


DEWATERING SUMP SECTON D3 A.6 A.6

0 5 10
SCALE IN FEET

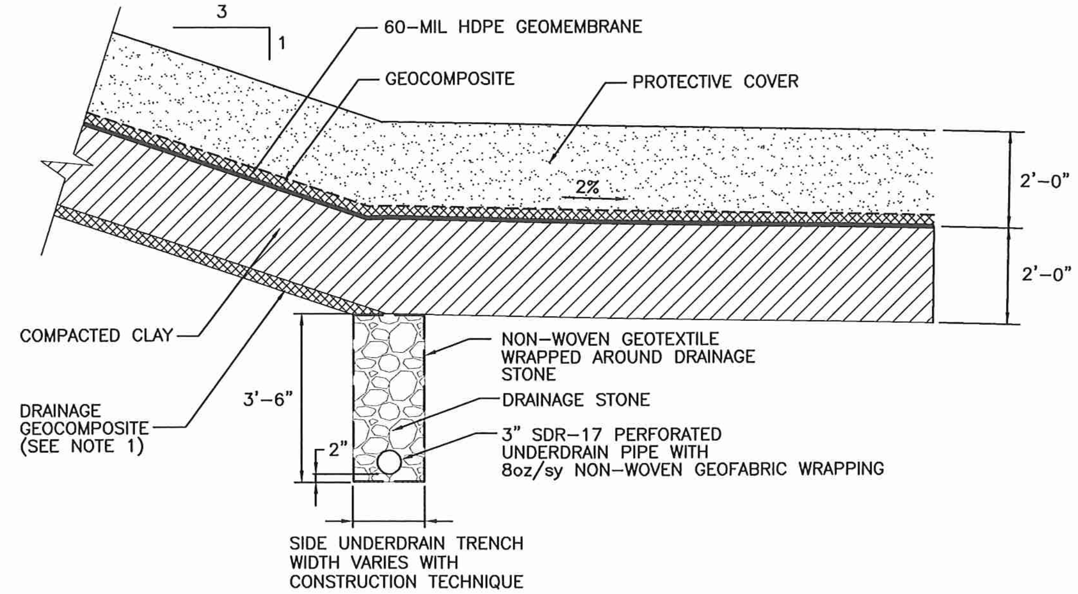


DEWATERING SUMP SECTION D4 A.6 A.6

0 5 10
SCALE IN FEET

☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR BFI WASTE SYSTEMS OF NORTH AMERICA, LLC		MAJOR PERMIT AMENDMENT SIDESLOPE DEWATERING SYSTEM DETAILS
DATE: 03/2017 FILE: 0120-758-11 CAD: A.6-DEWATERING SYSTEM DETAILS.DWG	DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS NO. 1 — DATE 11/2017 — DESCRIPTION OWNERSHIP CHANGE	HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group TBPE REGISTRATION NO. F-3727			WWW.WCGRP.COM — DRAWING IIIA-A.6

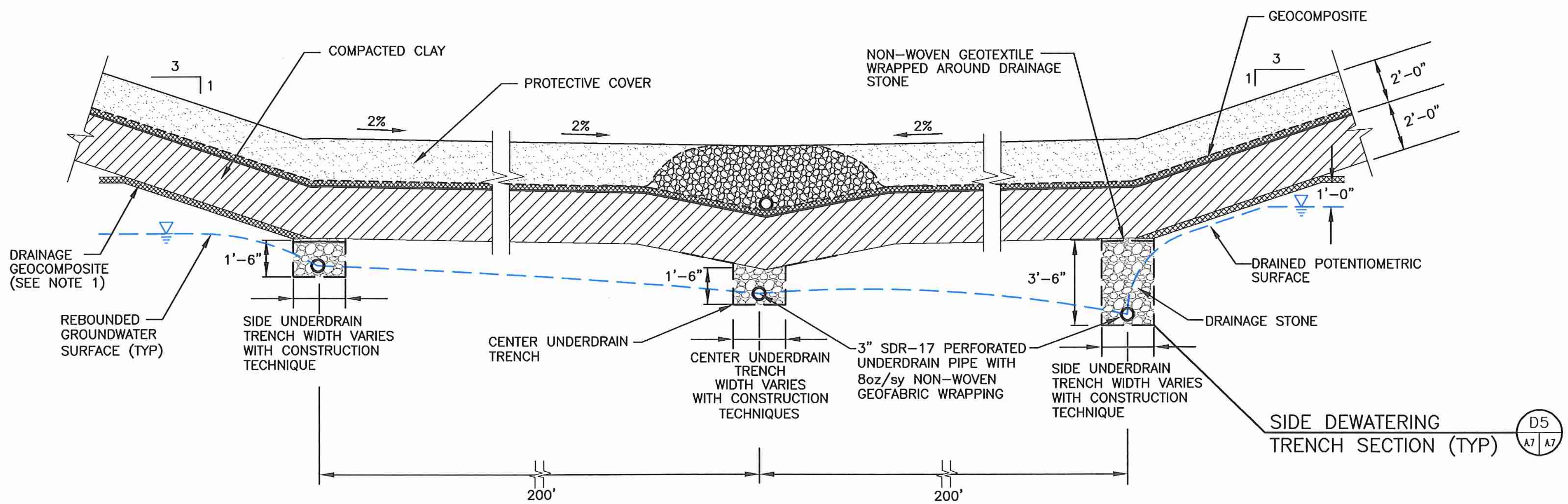
O:\0120\758\2214B EXPANSION\IIIA\A\A.6-SIDESLOPE DEWATERING-DTLS.dwg. 11/14/2017 2:49:14 PM. rsellers. 1:2



SIDE DEWATERING TRENCH SECTION (TYP) D5 A7

A1,B2,A7

0 2 4
SCALE IN FEET



TYPICAL DEWATERING SECTION D6 A1 A7

0 3 6
SCALE IN FEET

NOTE:

1. DEWATERING GEOCOMPOSITE WILL BE A MINIMUM 200-MIL THICK GEONET WITH 6oz/sy (MIN) GEOTEXTILES HEATBONDED TO BOTH SIDES. REFER TO APPENDIX IIID-C FOR DEWATERING SYSTEM DESIGN.

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12-5-2017

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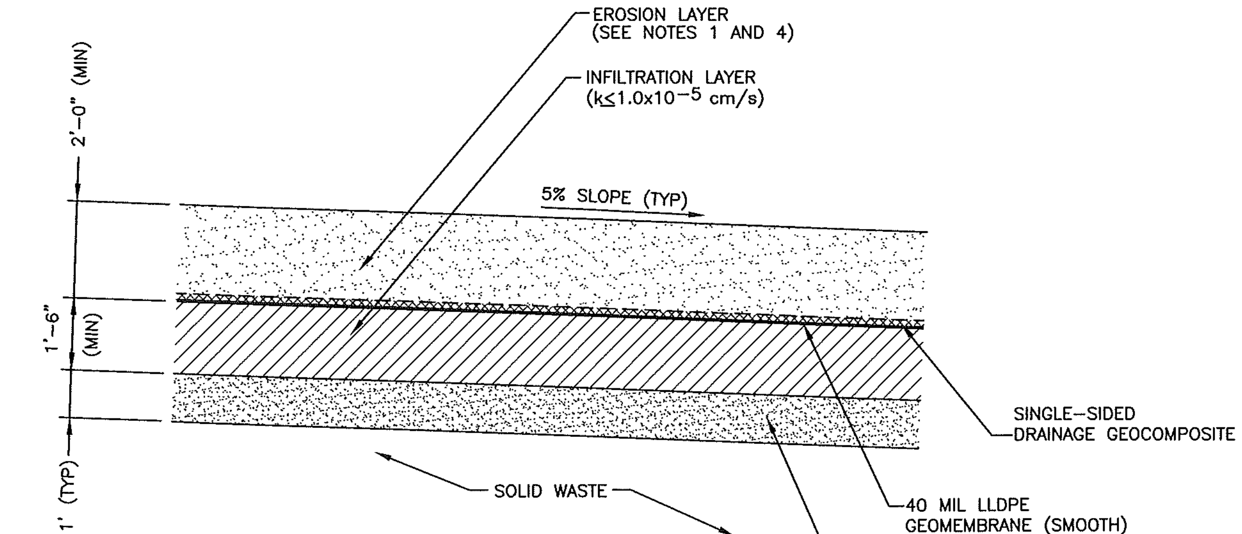
DATE: 03/2017 FILE: 0120-758-11 CAD: A.7-DEWATERING SYSTEM DETAILS.DWG	DRAWN BY: SRF DESIGN BY: AE REVIEWED BY: NT	REVISIONS	HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group TBPE REGISTRATION NO. F-3727			WWW.WCGRP.COM — DRAWING IIIA-A.7

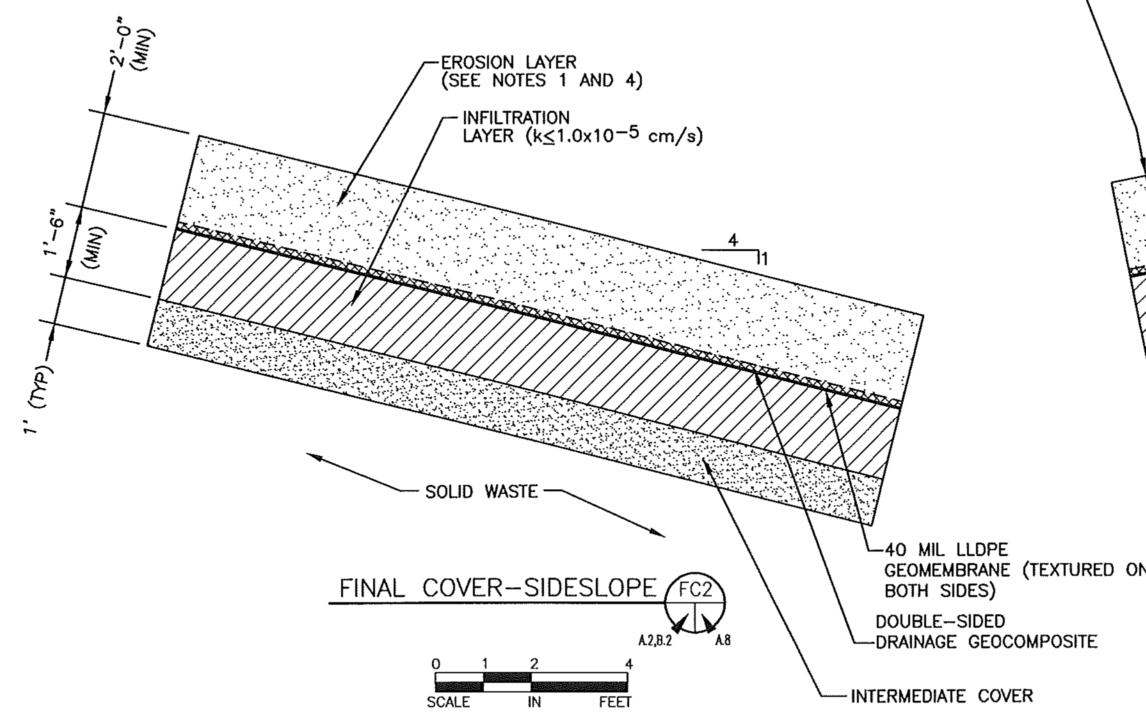
NO.	DATE	DESCRIPTION
1	08/2017	FIRST NOD RESPONSE
2	11/2017	OWNERSHIP CHANGE

O:\0120\758\2214B EXPANSION\IIIA\A\A.7-SIDESLOPE DEWATERING-DTLS.dwg, 11/14/2017 2:49:40 PM, rsellers, 1:2



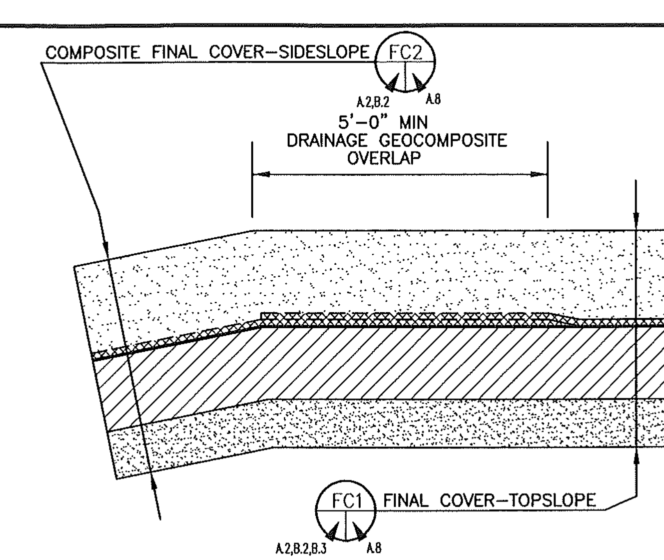
FINAL COVER-TOPSLOPE FC1 A.2,B.2,B.3 A.8

SCALE 0 1 2 4 IN FEET



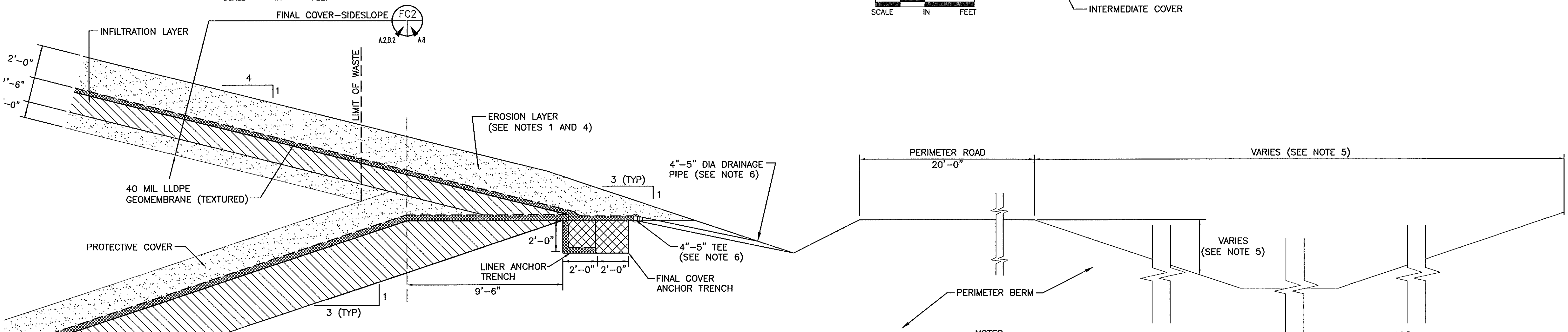
FINAL COVER-SIDESLOPE FC2 A.2,B.2 A.8

SCALE 0 1 2 4 IN FEET



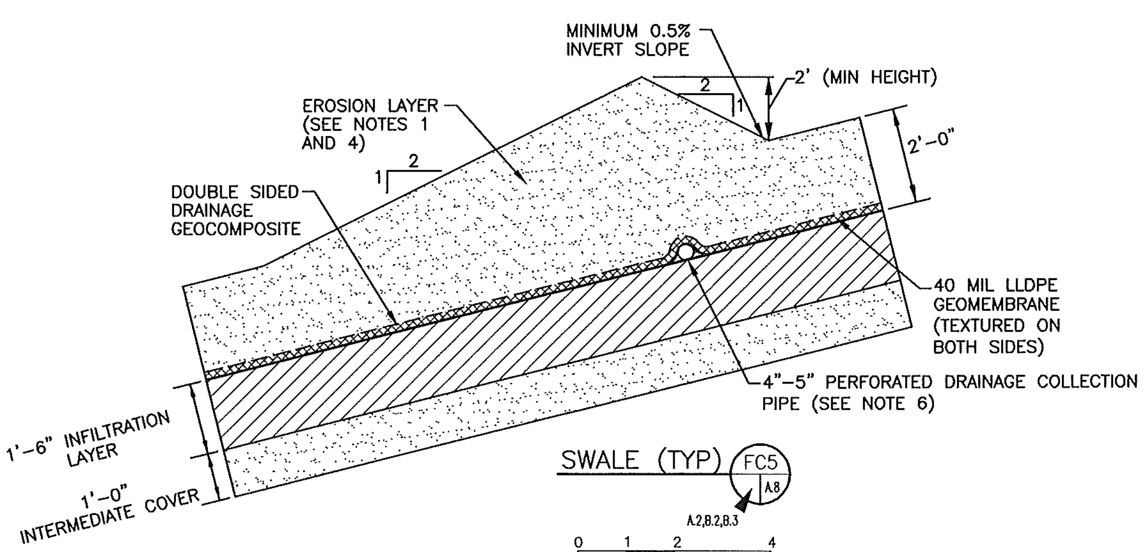
FINAL COVER-TOP/SIDESLOPE TRANSITION FC3 A.2,B.2,B.3 A.8

SCALE 0 1 2 4 IN FEET



LINER/FINAL COVER TIE-IN FC4 A.8 A.2,B.2

SCALE 0 1.5 3 6 IN FEET



SWALE (TYP) FC5 A.8 A.2,B.2,B.3

SCALE 0 1 2 4 IN FEET

NOTES:

1. TOP 6" OF EROSION LAYER WILL BE CAPABLE OF SUSTAINING SELECTED VEGETATION.
2. DRAINAGE LAYER CONSISTS OF A 250-MIL GEOCOMPOSITE-HDPE GEONET OVERLAIN BY AN 6 OZ/SY GEOTEXTILE LAYER.
3. FINAL COVER COMPONENTS WILL BE CONSTRUCTED ACCORDING TO FCSQCP (APPENDIX IIIJ-A).
4. EROSION LAYER MAY CONSIST OF BOTH ONSITE AND OFF-SITE SOILS. BORROW SOURCE TO BE SELECTED BY OWNER PRIOR TO CONSTRUCTION.
5. REFER TO APPENDIX IIIF FOR THE PERIMETER CHANNEL DESIGN.
6. THE NEED FOR PERFORATED SIDESLOPE GEOCOMPOSITE DRAINAGE PIPES, INCLUDING SIZING AND SPACING, WILL BE DETERMINED DURING CONSTRUCTION DESIGN OF THE FINAL COVER SYSTEM. PIPE SIZING AND SPACING WILL BE DETERMINED BASED ON FINAL CONTOURS, AND LABORATORY TESTING OF EROSION LAYER SOILS.

STATE OF TEXAS
NEVZAT TURAN
84059
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FILE: 0120-758-11	DESIGN BY: AE
CAD: A.8-FINAL COVER DETAILS.DWG	REVIEWED BY: NT

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2017	OWNERSHIP CHANGE

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

MAJOR PERMIT AMENDMENT
FINAL COVER DETAILS (MSW)

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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DRAWING IIIA-A.8

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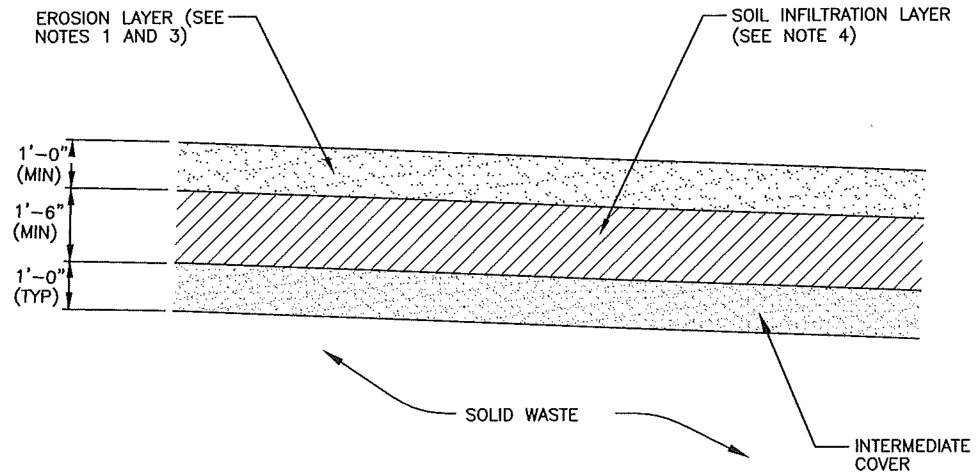
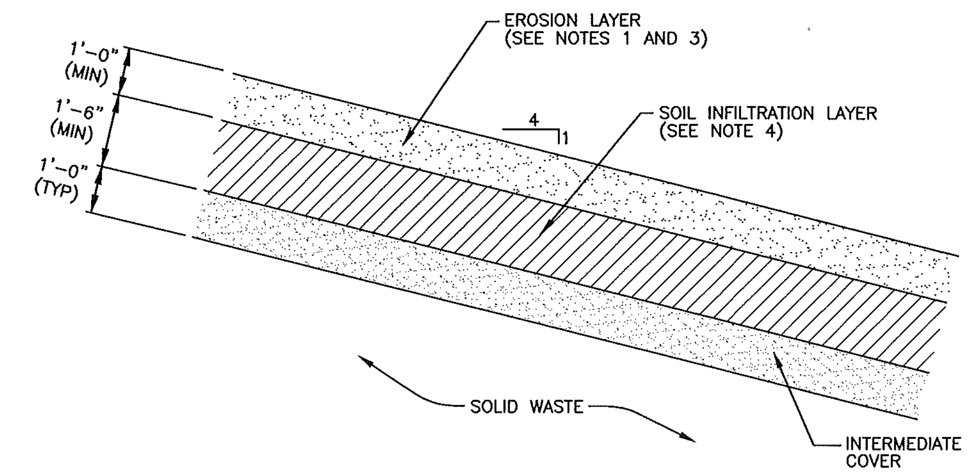


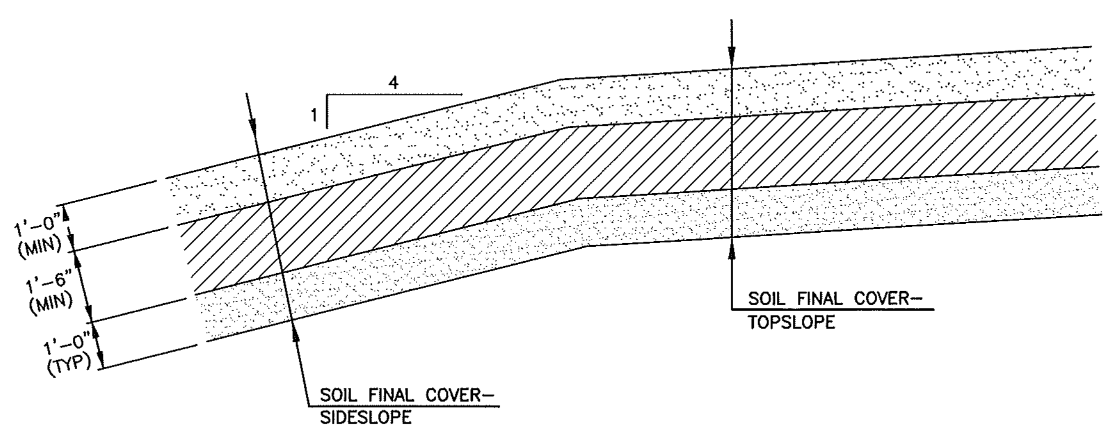
FINAL COVER–TOPSLOPE
(TYPE IV AREA)
FC6 A2 A9

0 2 4
SCALE IN FEET



FINAL COVER–SIDESLOPE
(TYPE IV AREA)
FC7 A2 A9

0 2 4
SCALE IN FEET



FINAL COVER–
TOP/SIDESLOPE TRANSITION
(TYPE IV AREA)
FC8 A2 A9

0 2 4
SCALE IN FEET

STATE OF TEXAS
NEVZAT TURAN
84059
LICENSED
PROFESSIONAL ENGINEER
12-5-2017

NOTES:

1. TOP 6" OF EROSION LAYER WILL BE CAPABLE OF SUSTAINING SELECTED VEGETATION.
2. FINAL COVER COMPONENTS WILL BE CONSTRUCTED ACCORDING TO FCSQCP (APPENDIX IIIJ–A).
3. EROSION LAYER MAY CONSIST OF BOTH ONSITE AND OFF–SITE SOILS.
4. FOR PRE–SUBTITLE D FINAL COVER, THE SOIL INFILTRATION LAYER SHALL CONSIST OF 18" OF COMPACTED CLAY WITH A COEFFICIENT OF PERMEABILITY LESS THAN OR EQUAL TO THE PERMEABILITY OF THE UNDERLYING LINER SYSTEM. IF NO INFORMATION IS AVAILABLE FOR THE BOTTOM LINER THAN INFILTRATION LAYER WILL HAVE A HYDRAULIC CONDUCTIVITY OF 1×10^{-5} cm/sec OR LESS.

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FILE: 0120–758–11 DESIGN BY: AE
CAD: A.9–FINAL COVER DETAILS.DWG REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F–3727

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2017	OWNERSHIP CHANGE

MAJOR PERMIT AMENDMENT
FINAL COVER DETAILS (TYPE IV)

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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DRAWING IIIA–A.9

APPENDIX IIIA-B

LANDFILL UNIT CROSS SECTIONS

STATE OF TEXAS
NEVZAT TURAN
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12-5-2017

CONTENTS

LANDFILL UNIT CROSS SECTIONS

STATE OF TEXAS
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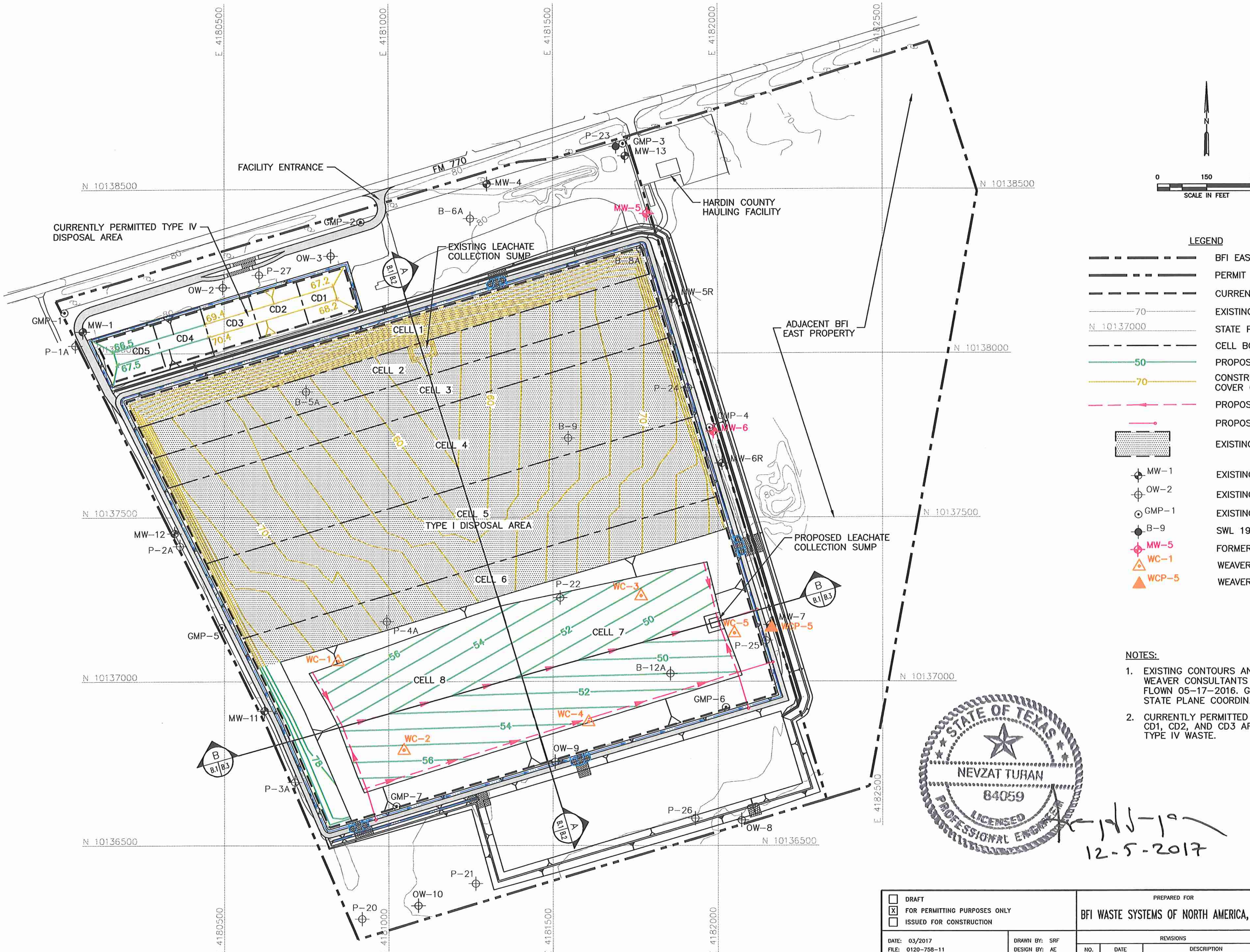
12-5-2017



LEGEND

- BFI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- 70 EXISTING CONTOUR (SEE NOTE 1)
- N 10137000 STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
- CELL BOUNDARY
- 50 PROPOSED EXCAVATION CONTOUR
- 70 CONSTRUCTED TOP OF PROTECTIVE COVER CONTOUR
- PROPOSED LEACHATE LINE
- PROPOSED LEACHATE RISER
- EXISTING SUBTITLE D COMPOSITE LINER AREA
- MW-1 EXISTING GROUNDWATER MONITOR WELL
- OW-2 EXISTING GROUNDWATER OBSERVATION WELL
- GMP-1 EXISTING GAS MONITORING PROBE
- B-9 SWL 1990/1991 BORING LOCATION
- MW-5 FORMER GROUNDWATER MONITOR WELL
- WC-1 WEAVER CONSULTANTS GROUP 2017 EXPANSION BORING
- WCP-5 WEAVER CONSULTANTS GROUP 2017 EXPANSION PIEZOMETER

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CURRENTLY PERMITTED TYPE IV CELLS INCLUDES CD1 THROUGH CD5. CD1, CD2, AND CD3 ARE CURRENTLY DEVELOPED AND RECEIVED TYPE IV WASTE.

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REVIEWED BY: NT

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MAJOR PERMIT AMENDMENT
SECTION LOCATION PLAN

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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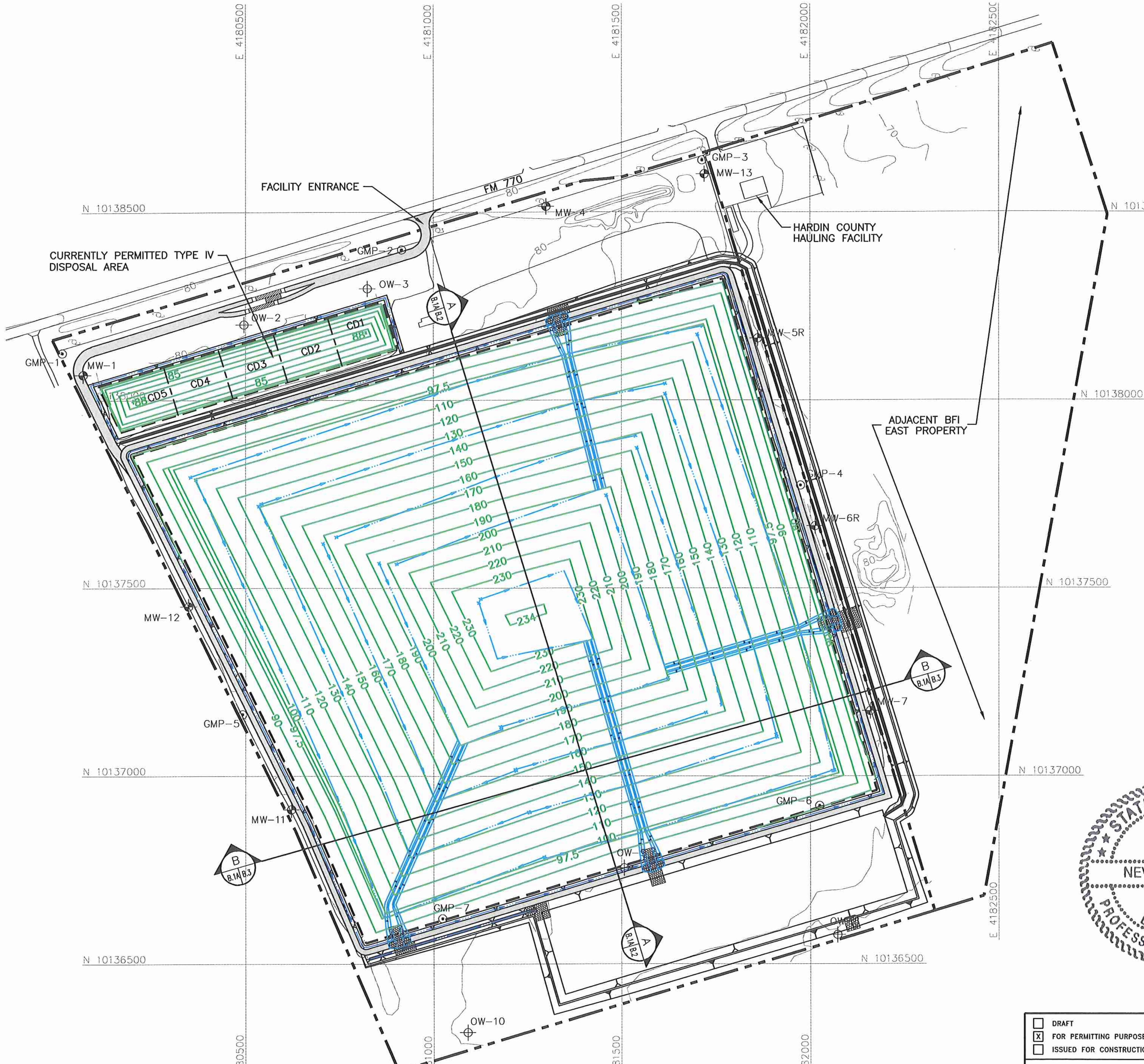
FIGURE IIIA-B.1



N

0 150 300
SCALE IN FEET

LEGEND

- BFI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- CELL BOUNDARY
- N 10137500 — STATE PLANE COORDINATE GRID
- 70 — EXISTING CONTOUR
- 234 — PROPOSED FINAL CONTOUR
- PROPOSED DRAINAGE SWALE
- PROPOSED DRAINAGE CHUTE
- MW-1 — EXISTING GROUNDWATER MONITOR WELL
- OW-2 — EXISTING GROUNDWATER OBSERVATION WELL
- GMP-1 — EXISTING GAS MONITORING PROBE (SEE NOTE 6)

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CURRENTLY PERMITTED TYPE IV CELLS INCLUDES CD1 THROUGH CD5. CD1, CD2, AND CD3 ARE CURRENTLY DEVELOPED AND RECEIVED TYPE IV WASTE.
3. REFER TO APPENDIX IIIF-SURFACE WATER DRAINAGE PLAN FOR DRAINAGE DESIGN INFORMATION.
4. MAXIMUM FINAL COVER ELEVATION FOR THE TYPE I AREA IS 234 FT-MSL. MAXIMUM TOP OF WASTE ELEVATION FOR THE TYPE I AREA IS 230.5 FT-MSL. MAXIMUM FINAL COVER ELEVATION FOR THE TYPE IV AREA IS 88 FT-MSL. MAXIMUM TOP OF WASTE ELEVATION FOR THE TYPE IV AREA IS 85.5 FT-MSL
5. UPON APPROVAL OF THE APPLICATION (WITHIN ONE YEAR OR PRIOR TO INSTALLATION OF THE CHANNEL, WHICH EVER COMES FIRST), RESTRICTIVE COVENANT FOR THE DRAINAGE CHANNEL INSIDE THE ADJACENT BFI EAST PROPERTY WILL BE FILED WITH HARDIN COUNTY.
6. EXISTING LFG DETECTION PROBE LOCATIONS ARE SHOWN. REFER TO PART III, APPENDIX IIII-LANDFILL GAS MANAGEMENT PLAN FOR LFG PROBE DESIGN AND CURRENT AND FUTURE LFG DETECTION PROBE LOCATIONS.

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MAJOR PERMIT AMENDMENT SECTION LOCATION PLAN WITH FINAL CONTOURS

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HARDIN COUNTY, TEXAS

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DRAWING IIIA-B.1A

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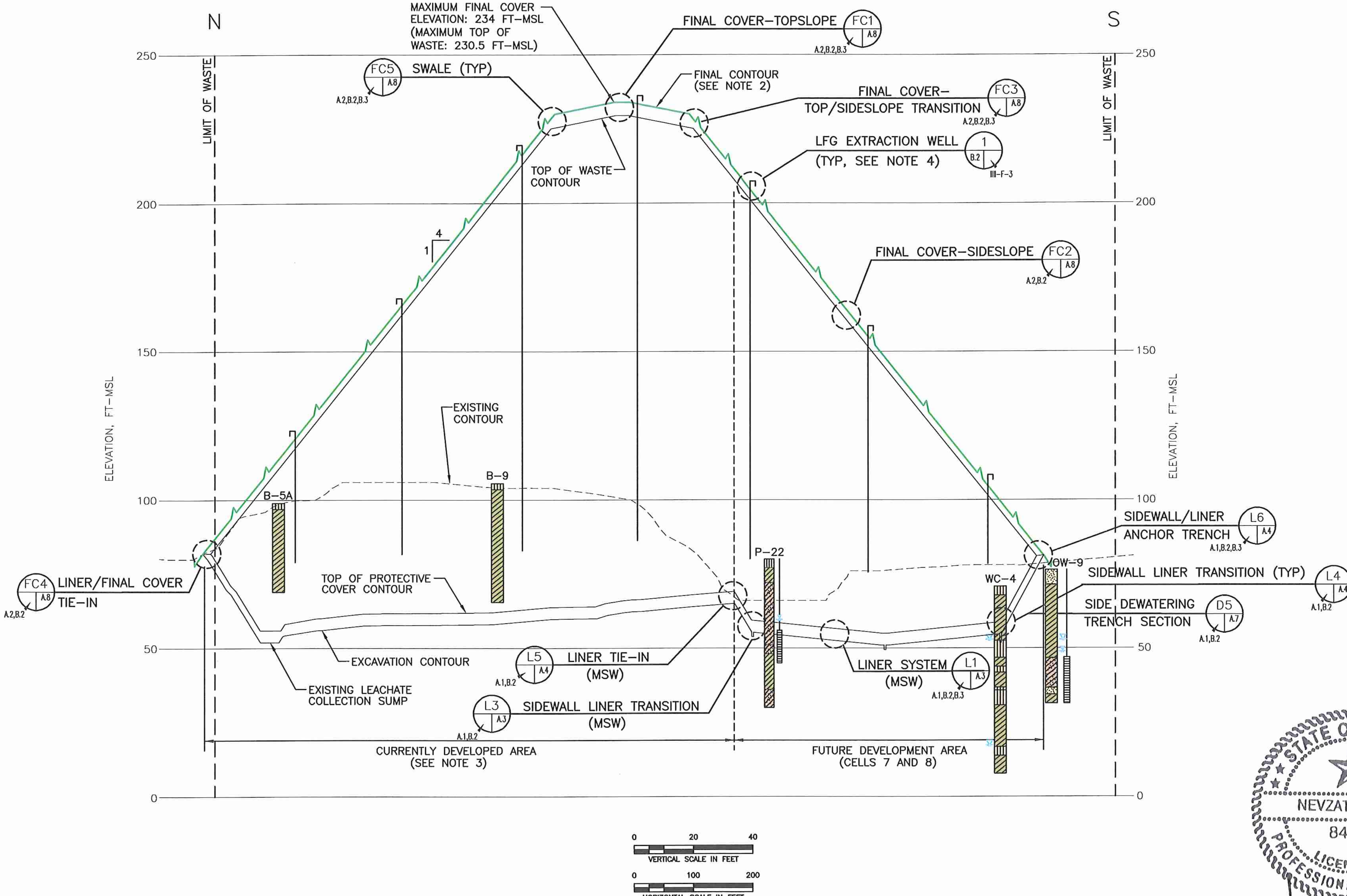

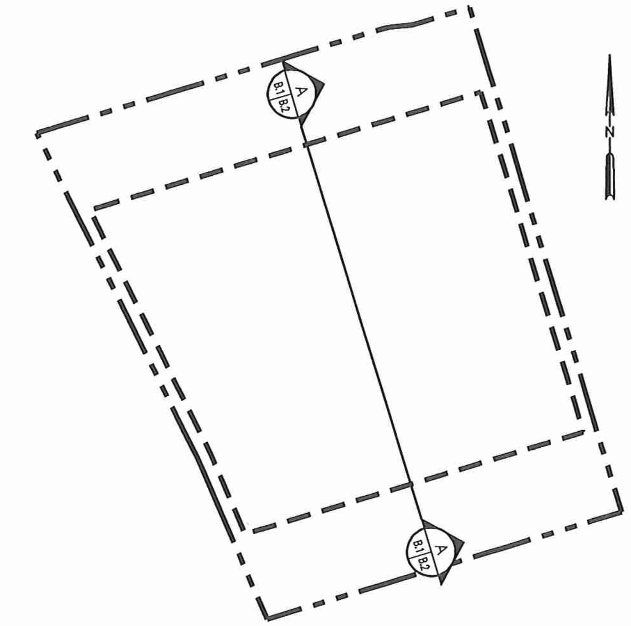

SECTION LOCATION MAP
NTS

LEGEND

- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- FINAL CONTOUR
- EXCAVATION CONTOUR
- EXISTING CONTOUR (SEE NOTE 1)
- SILT, CLAYEY SILT, OR SANDY SILT
- CLAY OR SILTY CLAY
- SAND, SILTY SAND, OR CLAYEY SAND
- SANDY CLAY
- EARTHEN FILL
- MONITOR WELL OR PIEZOMETER WITH RISER (TOP) AND SCREENED INTERVAL (BOTTOM)
- STATIC GROUNDWATER ELEVATION (FT-MSL) FROM GROUNDWATER GAUGING DATA
- GROUNWATER ELEVATION AT TIME OF DRILLING (FT-MSL)

STATE OF TEXAS
NEVZAT TURAN
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PROFESSIONAL ENGINEER
12-5-2017

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. LANDFILL FINAL COVER IS DESIGNED WITH ADD ON BERMS AS SHOWN IN DETAILS IN APPENDIX IIIF – DRAINAGE DESIGN.
3. REFER TO THE LINER SYSTEM DETAILS IN THE SLERs AND GLERs FOR CELLS 1 THROUGH 6. BOTTOM LINER IS SHOWN FOR ILLUSTRATION PURPOSES.
4. TYPICAL LOCATIONS OF LFG EXTRACTION WELLS CAN BE FOUND IN APPENDIX III-F.
5. SEE APPENDIX IIIG FOR BORING DATA. BORINGS PROJECTED INTO THE LINE OF SECTION. SEE DRAWING IIIA-B.1 FOR LOCATION.

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MAJOR PERMIT AMENDMENT
SECTION A

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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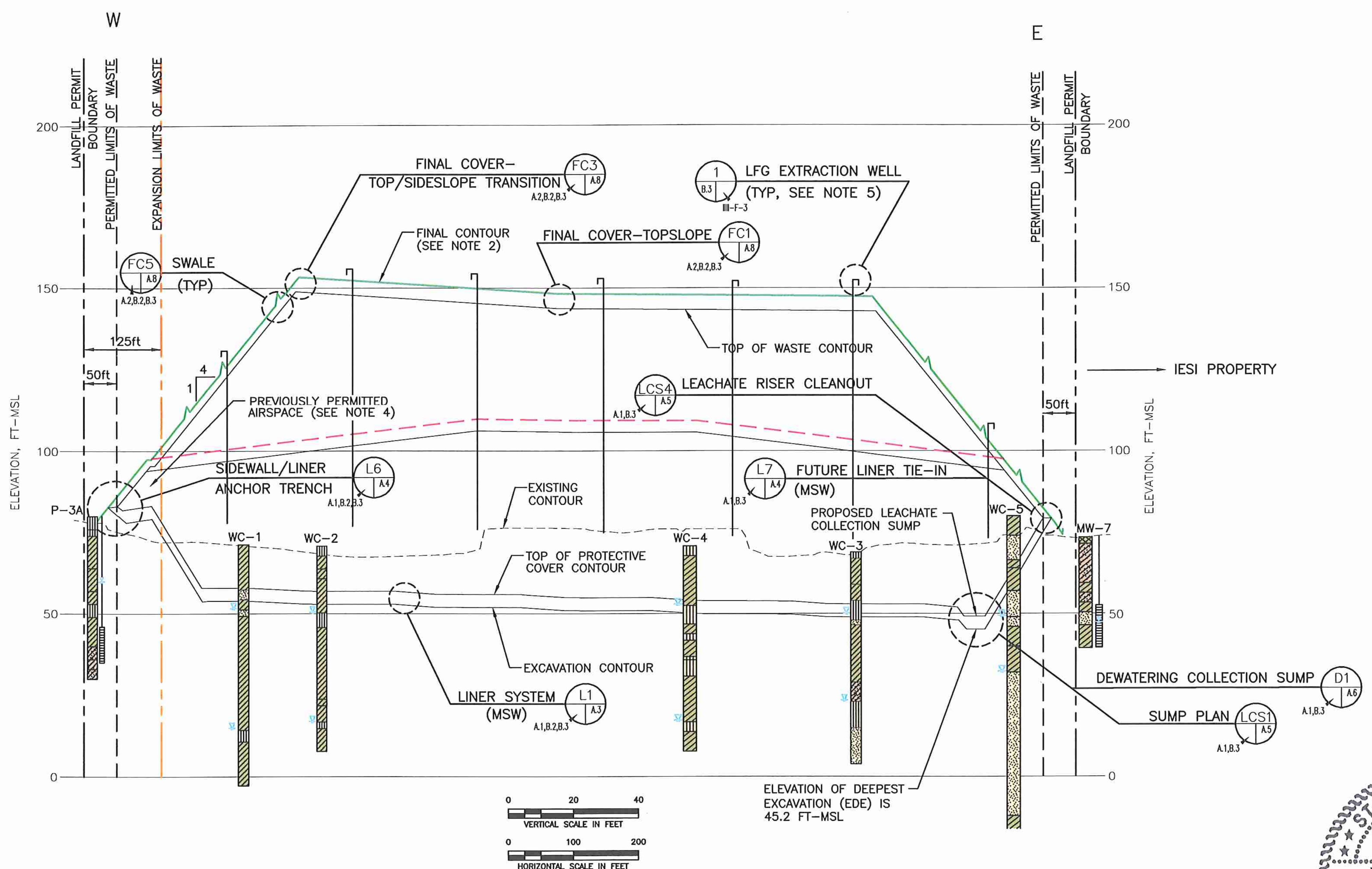
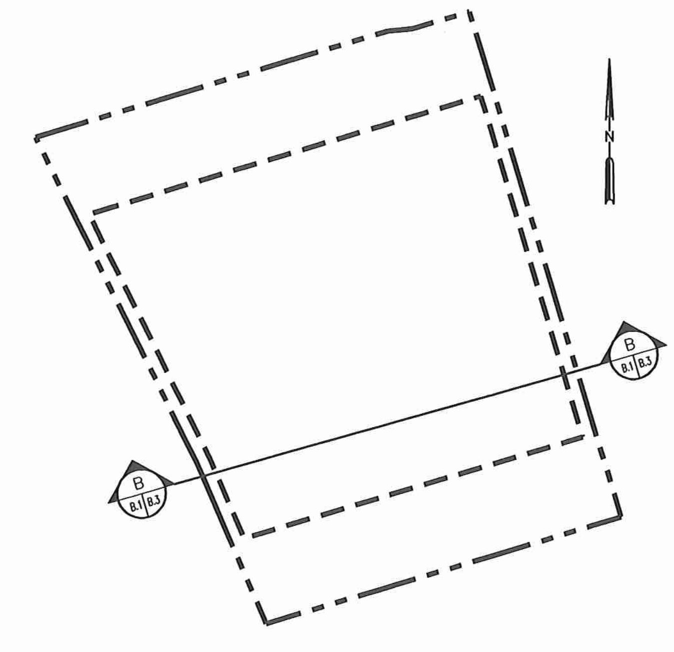
FIGURE IIIA-B.2

O:\0120\758\2214B EXPANSION\IIIA\B\FIG 2-SECTION A.dwg, 11/15/2017 7:27:22 AM, rsellers, 1:2





SECTION LOCATION MAP
NTS

LEGEND

(dash-dot line)	PERMIT BOUNDARY
(dashed line)	CURRENTLY PERMITTED LIMITS OF WASTE
(green line)	FINAL CONTOUR
(pink dashed line)	PERMITTED FINAL CONTOUR
(solid line)	EXCAVATION CONTOUR
(fine dashed line)	EXISTING CONTOUR (SEE NOTE 1)
	SILT, CLAYEY SILT, OR SANDY SILT
	CLAY OR SILTY CLAY
	SAND, SILTY SAND, OR CLAYEY SAND
	SANDY CLAY
	EARTHEN FILL
	MONITOR WELL OR PIEZOMETER WITH RISER (TOP) AND SCREENED INTERVAL (BOTTOM)
	STATIC GROUNDWATER ELEVATION (FT–MSL) FROM GROUNDWATER GAUGING DATA
	GROUNWATER ELEVATION AT TIME OF DRILLING (FT–MSL)

12-5-2017

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05–17–2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. LANDFILL FINAL COVER IS DESIGNED WITH ADD ON BERMS AS SHOWN IN DETAILS IN APPENDIX IIIF – DRAINAGE DESIGN.
3. REFER TO THE LINER SYSTEM DETAILS IN THE SLERs AND GLERs FOR CELLS 1 THROUGH 6. BOTTOM LINER IS SHOWN FOR ILLUSTRATION PURPOSES.
4. PREVIOUSLY PERMITTED WASTE VOLUME IN THE APPROXIMATELY 0.6 ACRE AREA EXISTING WITHIN THE 125 FT BUFFER WILL NOT BE INCREASED FOR THE EXPANSION.
5. TYPICAL LOCATIONS OF LFG EXTRACTION WELLS CAN BE FOUND IN APPENDIX IIII–F.
6. SEE APPENDIX IIIG FOR BORING DATA. BORINGS PROJECTED INTO THE LINE OF SECTION. SEE DRAWING IIIA–B.1 FOR LOCATION.

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MAJOR PERMIT AMENDMENT
SECTION B

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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FIGURE IIIA–B.3

O:\0120\758\2214B EXPANSION\IIIA\B\FIG 3–SECTION B.dwg, 11/15/2017 7:26:53 AM, rsellers, 1:2

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS
TCEQ PERMIT NO. MSW 2214B
PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN
APPENDIX IIIB
SITE LIFE CALCULATIONS

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12-5-2017

Prepared for

BFI Waste Systems of North America, LLC

March 2017

Revised December 2017

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WCG Project No. 0120-758-11-02

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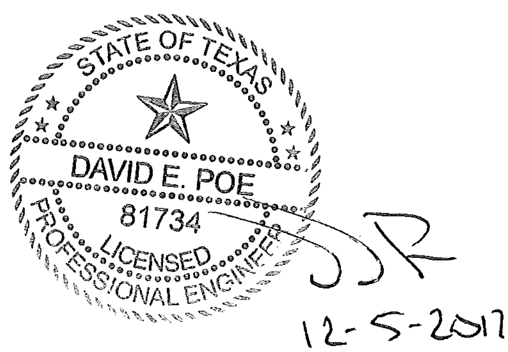
CONTENTS



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1 SITE LIFE

1.1 Solid Waste Generation

Currently, the Hardin County Landfill accepts approximately 55,579 tons per year of municipal solid waste and special waste (Type I), and approximately 1,800 tons of C&D (Type IV), based on the 2016 TCEQ annual report (under TCEQ Permit No. MSW-2214A).

To develop the site life estimate for this application the yearly waste acceptance rate reported to TCEQ for the 2016 annual report (55,579 tons/year) was used as the starting point. The waste inflow rate was then assumed to increase consistent with the projected growth rate for the facility's general service area. Site life calculations were prepared based on Type I MSW disposal.

Using this methodology, the expected maximum annual waste acceptance rate is 66,151 tons per year (year 2045). Operating criteria for a range of waste acceptance rates are included in Part IV – SOP. The above projections are based on current market conditions and may vary as market conditions change. These waste acceptance rates are not a limiting parameter of this permit. The actual yearly waste acceptance rate is a rolling quantity based on the sum of the previous four quarters of waste acceptance (refer to Part IV – SOP for additional information).

The above projections are based on current market conditions and may vary as market conditions change. Over the life of the facility, the expected average yearly weight of incoming waste is projected to be approximately 61,561 tons/year (refer to page IIIB-5).

Daily estimates are also calculated in this appendix (refer to pages IIIB-4 and IIIB-5). These daily incoming waste estimates were only developed for reference purposes (i.e., it is common in the industry to refer to the incoming waste stream in terms of a daily volume – no specific calculation or demonstration in the application is based on the daily estimate). The estimates utilize a 365-day operating schedule. As noted on page IIIB-5, the projected average daily volume of incoming waste based on a 365-day operating schedule is 169 tons.

1.2 Population Equivalent

Using the average waste inflow rate of 61,561 tons/year (169 tons/day based on a 365-day operating schedule) discussed in Section 1.1 and assuming 5 pounds of waste is generated per capita per day, the population equivalent is:

$$\frac{(61{,}561 \text{ tons/year}) \times (2{,}000 \text{ pounds/ton})}{(5 \text{ pounds/person/day}) \times (365 \text{ days/year})} = 67{,}600 \text{ persons}$$

1.3 Landfill Capacity

The estimate of maximum inventory of waste (defined as waste and daily cover) ever on site over the active life of the facility is approximately 5,744,747 million cubic yards. The total volume available for solid waste and daily cover after May 17, 2016 (date of topographic information for site life calculation) is estimated to be 4,376,747 cubic yards using the average end area method. This airspace estimate includes the remaining available volume in the existing permitted area, as well as the volume resulting from the major permit amendment.

1.4 Site Life Calculations

The site life calculations are presented on pages IIIB-3 through IIIB-5. In summary, the site life is projected to be approximately 29.7 years, which would result in the site's closure during the year 2046.

Required: Determine approximate site life (years) for the site.
For this estimate, it is assumed the site operates 365 days per year per the approved operating hours.

Solution: Determine available landfill tonnage and initial annual waste inflow rate:

Remaining airspace (includes existing permitted site and expansion)=	4,376,747 cy	(as of May 17, 2016)
Percent daily cover =	15 %	(accounts for the use of ADC)
In-place density of waste/cover soils[1] =	1,200 lb/cy	

Estimate the total remaining airspace (tons). To convert the volumetric capacity of the site to a weight based capacity, the average in-place density of the waste/daily cover must first be established. For this calculation, the relevant density is the estimated average density of the waste/cover soils after the waste/cover soils have been subjected to overburden pressure of the completely developed landfill (as opposed to the annual density that is calculated based on the capacity consumed in any given year). The estimated in-place density of solid waste/daily cover soils is then further translated into an estimate of the density of the soild waste portion of the landfill capacity, using the following calculation.

-Estimate density of waste only

$(\gamma_{soil})(15\% \text{ of } 4{,}376{,}747 \text{ cy}) + (\gamma_{waste})(85\% \text{ of } 4{,}376{,}747 \text{ cy}) = (\gamma_{soil/waste})(4{,}376{,}747 \text{ cy})$

$(2{,}430 \text{ lb/cy})(656{,}512 \text{ cy}) + (\gamma_{waste})(3{,}720{,}235 \text{ cy}) = (1{,}200 \text{ lb/cy})(4{,}376{,}747 \text{ cy})$

$\gamma_{waste} =$ 983 lb/cy

Remaining available capacity in tons = (85% of 4,376,747 cy)*(983 lb/cy*1/2000 tons/lb)

Remaining available capacity = 1,828,386 tons

Total remaining capacity (includes existing permitted site and expansion)=	1,828,386	tons

The above capacity for the remaining tons is used to estimate the site life, as shown in the following calculation.

Initial waste stream estimate =	152 tons/day
Days of operation per year =	365 days
(365 days of operation are based on 7 days of operation per week)	
Initial waste inflow rate =	**55,579 tons/year**

Assumed growth rates (based on population growth rates):

Growth rate (years 2010-2020)=	9.12%	or annualized growth rate of:	0.88%
Growth rate (years 2021-2030)=	7.58%	or annualized growth rate of:	0.73%
Growth rate (years 2031-2040)=	5.01%	or annualized growth rate of:	0.49%
Growth rate (years 2041-2050)=	3.52%	or annualized growth rate of:	0.35%
Growth rate (years 2051-2060)=	2.66%	or annualized growth rate of:	0.26%
Growth rate (years 2061-2070)=	1.94%	or annualized growth rate of:	0.19%

The growth rate estimates were obtained from the Texas Water Development Board, 2016 Regional Water Plan. The initial waste stream volume was obtained from TCEQ annual report.

The following table calculates the waste stream growth (assuming the growth rates described above) and the projected cumulative airspace consumed.

	Year	Waste Inflow (tons/year)	Tonnage Consumed (tons)	
May 5	2016	55,579	36,545	240 days
	2017	56,068	92,613	
	2018	56,561	149,175	
	2019	57,059	206,234	
	2020	57,561	263,795	
	2021	57,982	321,777	
	2022	58,405	380,182	
	2023	58,831	439,013	
	2024	59,261	498,273	
	2025	59,693	557,967	
	2026	60,129	618,096	
	2027	60,568	678,664	
	2028	61,010	739,674	
	2029	61,455	801,129	
	2030	61,904	863,033	
	2031	62,207	925,241	
	2032	62,512	987,753	
	2033	62,819	1,050,572	
	2034	63,126	1,113,698	
	2035	63,436	1,177,134	
	2036	63,747	1,240,880	
	2037	64,059	1,304,939	
	2038	64,373	1,369,312	
	2039	64,688	1,434,000	
	2040	65,005	1,499,005	
	2041	65,233	1,564,238	
	2042	65,461	1,629,699	
	2043	65,690	1,695,389	
	2044	65,920	1,761,309	
	2045	66,151	1,827,460	
	2046	926	1,828,386	5 days

Available tonnage is consumed during year	2046	
Site life is projected to be approximately	29.7	years

Summary of waste tonnage information:

Initial inflow =	152 tons/day (based on 7 days per week per permit)

$$\text{Maximum inflow} = \frac{\text{Tonnage accepted during final full year of operation (66,151 tons)}^{1}}{\text{365 days of operation per year}}$$

[1]66,151 tons represents the calculated total tonnage for the full year of 2045, the last full year waste inflow occurs.

Projected maximum waste inflow rate:

Maximum inflow =	181 tons/day

$$\text{Average inflow} = \frac{\text{Maximum waste accepted}}{\text{Site Life}}$$

Projected average waste inflow rate:

$$\frac{1{,}828{,}386 \text{ tons}}{29.7 \text{ years} \quad * \quad 365 \text{ days/year}}$$

Average inflow =	169 tons/day

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS
TCEQ PERMIT NO. MSW-2214B

MAJOR PERMIT AMENDMENT APPLICATION

PART III – SITE DEVELOPMENT PLAN
APPENDIX IIIC
LEACHATE AND CONTAMINATED WATER MANAGEMENT PLAN

Prepared for

BFI Waste Systems of North America, LLC

March 2017
Revised August 2017

Revised December 2017

STATE OF TEXAS
MARILYN D. MORRISON
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LICENSED
PROFESSIONAL ENGINEER

12-5-17

Prepared by

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WCG Project No. 0120-758-11-02

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STATE OF TEXAS
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12-5-17

CONTENTS

CONTENTS (Continued)

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TABLES

1 PURPOSE AND SCOPE

This appendix addresses §§330.177, 330.207 and 330.333.

This Leachate and Contaminated Water Management Plan for the Hardin County Landfill was prepared consistent with 30 Texas Administrative Code (TAC) §§330.177, 330.207, and 330.333. This plan provides the details of the collection, storage, treatment and disposal of contaminated water, and leachate generated during the active and postclosure periods of the landfill. The design details for the liner and final cover systems are included in Part III, Appendix IIIA-A – Liner and Final Cover System Details. The excavation plan and final contour plan are also included in Part III, Appendix IIIA-A. Additionally, Figure 3-1 includes the excavation plan showing the leachate collection system layout.

2 LEACHATE AND CONTAMINATED WATER GENERATION

2.1 Generation Process

Leachate is generated when water percolates through the layers of solid waste as moisture is released from high moisture content waste. The capacity of solid waste to absorb moisture is known as field capacity. When the field capacity is exceeded, leachate is generated. However, leachate may also flow within the landfill through preferential pathways; therefore, some downward flow of leachate will occur before the field capacity of waste is reached. The quantity of leachate produced will depend upon the climate, site topography, type of cover, construction and landfilling procedures, and waste characteristics.

Contaminated water is defined in 30 TAC §330.3(36) as "leachate, gas condensate, or water that has come into contact with waste." Contaminated water is therefore generated when stormwater runoff has come into contact with solid waste at the working face of the landfill or any other area at the site where water contacts solid waste, leachate, or gas condensate.

2.2 Leachate Generation and Contaminated Stormwater Modeling

The Hydrologic Evaluation of Landfill Performance (HELP) model, Version 3.07, was used to estimate the amount of leachate that will be generated at the Hardin County Landfill. The HELP model is a quasi-two-dimensional hydrologic model of water movement across, into, through, and out of landfills. The model uses climate, soil, and landfill design data to perform a solution technique that accounts for the effects of surface storage, runoff, infiltration, percolation, soil-moisture storage, recirculation, evapotranspiration, and lateral drainage.

Leachate generation was evaluated for both active and closed landfill conditions. An explanation of the assumed conditions, methodologies, models and printouts of the results are included as Appendix IIIC-A. The leachate generation estimates produced by HELP are compared to actual generation rates in Section 6. As discussed in Section 6, the leachate generation rates produced by HELP and used for the leachate collection system design are much higher than the actual leachate generation rates experienced to date at the site.

The Rational Method is a method of calculating peak runoff from defined watersheds, and was used to estimate the volume of contaminated water that must be contained around the working face. The design calculations and the size of the diversion and containment berms required around the working face for a 25-year, 24-hour storm event are provided in Appendix IIIC-C.

2.3 Stormwater Management

The Hardin County Landfill will manage surface water throughout the active life of the landfill to minimize the amount of stormwater that will come in contact with waste or leachate. Contaminated water will be managed consistent with 30 TAC §330.207. Surface water will be controlled through the use of diversion berms, stormwater diversion ditches, and sumps. To promote runoff and prevent ponding, the operational cover will be graded and maintained.

Stormwater that comes into contact with waste will be considered contaminated water and handled consistent with 30 TAC §330.207. Contaminated water will be contained by the containment berm at the working face as shown in Appendix IIIC-C. At no time will contaminated water be allowed to discharge into waters of the United States. Storage of contaminated water and its disposal are discussed in Section 4 and Section 5 of this appendix, respectively.

The final cover has been designed to minimize infiltration and promote runoff. Surface water will be managed throughout the active life of the landfill to minimize infiltration into the filled areas and to minimize contact with solid waste. Also, daily and intermediate cover will be graded and maintained to promote runoff and prevent ponding as described in Part IV – Site Operating Plan (SOP).

Procedures for verifying the adequacy of daily cover placement to cover all waste material is discussed in Part IV – SOP, Section 8.19.2. Runoff generated from fill areas covered with a minimum 6 inches of earthen daily cover having no exposed waste or 12 inches of intermediate cover will be considered as uncontaminated and allowed to drain to the perimeter drainage system. In the event that the 6 inches of daily cover does not prevent stormwater from contacting solid waste or leachate, this stormwater will be collected and managed as contaminated water and disposed of in an authorized manner. Surface water runoff will be diverted around the working face as shown in Appendix IIIC-C.

3 LEACHATE COLLECTION SYSTEM

3.1 System Layout and Design Criteria

3.1.1 Introduction

The leachate collection system (LCS) will consist of: (1) a collection layer placed over the liner system, (2) the leachate collection piping, and (3) the leachate collection sumps and pumps. LCS details are provided in Part III, Appendix IIIA-A – Liner and Final Cover System Details. In addition to analyzing the proposed leachate collection system, the existing leachate collection system has been analyzed to show that the proposed change in site configuration will not adversely impact the existing leachate collection system.

3.1.2 Design Criteria

The leachate management system is designed and operated to collect and remove leachate from each cell, maintain leachate levels below 12 inches (or 30 cm) above the liner systems, channel leachate to designated collection sumps, and effectively manage leachate through storage and disposal. The system is designed to eliminate potential migration of landfill leachate into the environment and to meet the requirements of 30 TAC §330.333, namely:

- constructed of materials that are chemically resistant to the leachate expected to be generated;
- of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying wastes, waste cover materials, and by equipment used at the facility; and
- designed to function through the scheduled closure and post-closure period of the facility.

The LCS is designed to maintain the maximum leachate depth on the liner to less than 12 inches, in accordance with 30 TAC §330.331(a)(2) by the monitoring of head levels and timely recovery of leachate. This is accomplished by setting the control level for the automatic sump pumps at a level less than 12 inches above the lip of the sump. The drainage geocomposite leachate collection layer is designed to convey the estimated peak leachate flow rate without the leachate level within the geocomposite exceeding the thickness of the geocomposite. The operation of the leachate sump and the conveyance capacity of the geocomposite leachate collection layer work in tandem to maintain compliance with the design standard listed in 30

TAC §330.331(a)(2). The leachate collection system piping network is designed to convey collected leachate to the leachate collection sumps. The LCS piping is designed for post-settlement slopes and to meet each of the three criteria listed within the bullets on the previous page.

The geotextiles used for the geocomposite drainage layer utilize 100 percent continuous-filament polyester or polypropylene. Extensive testing, including EPA 9090 for chemical resistance, has demonstrated that polyester and polypropylene are resistant to a wide range of chemical classes encountered in soil and to typical leachate. The LCS piping and the geonet portion of the geocomposite are constructed of polyethylene. Polyethylene is an industry standard material and is resistant to a wide range of chemical constituents, including those typically found in leachate.

3.1.3 Leachate Collection System Layout

The leachate collection system layout is shown on Figure 3-1. Cells 1 through 6 have been constructed to date. The leachate collection layer in Cells 1 and 2 consists of a sand layer to collect and transfer the leachate to the leachate collection pipes and sump. The leachate collection layer for Cells 3 through 6 includes both single-sided and double-sided geocomposites to collect and transfer leachate to the leachate collection pipes and sumps. The currently constructed leachate collection system has been evaluated considering the leachate collection layer and leachate collection header pipe grades under the proposed landfill expansion conditions. Leachate collection layer slopes and slope lengths have been estimated for the proposed closed landfill conditions. Table 3-1 provides a design summary for the developed cells constructed with a geocomposite. As shown in each case, the maximum depth of leachate that occurs in the liner system is less than 12 inches and the flow depth is less than the thickness of the drainage geocomposite.

For the undeveloped cells (Cells 7 and 8), the leachate collection layer will be placed directly over the liner system. The undeveloped cells have been designed for the estimated overburden pressure that will be created by the proposed expansion. Material specifications are included in the following subsections for these cells. Table 3-1 shows that the maximum leachate depth for these cells is also less than 12 inches and the flow depth is less than the thickness of the drainage geocomposite.

Table 3-1 presents a summary of the initial and post-settlement slope for each cell and also the maximum depth of leachate over the liner based on the HELP generated peak flow and the actual leachate generation information.

Table 3-1
Leachate Collection System Design Summary
Maximum Depth of Leachate on Liner

Cells	Location	Initial Slope	Post-Settlement Slope	Slope Used for Design	Maximum Depth of Leachate on Liner Using Peak Flow Rate Generated by HELP[1]	Maximum Depth of Leachate on Liner Using Actual Leachate Generation Information[1]	Flow Depth Less than Thickness of Drainage Geocomposite
Cells 1 through 6 (Developed cells)	Slope between cell ridgeline and leachate collection pipe	2.0%	2.0%	2.0%	0.133 inches	0.0006 inches	Yes
	Slope of leachate collection header pipe[2]	1.36%	1.12%	1.1%	Peak flow less than the capacity of the collection pipe[2]	Peak flow less than the capacity of the collection pipe[2]	
	Slope of leachate collection lateral pipe[2]	1.85%	2.08%	1.85%			
Cells 7 and 8 (Undeveloped cells)	Slope between cell ridgeline and leachate collection pipe (minimum)	1.79%	1.56%	1.5%	0.196 inches	0.0006 inches	Yes
	Slope of leachate collection pipe (minimum)	0.5%	0.45%	0.4%	Peak flow less than the capacity of the collection pipe[3]	Peak flow less than the capacity of the collection pipe[3]	

[1] Maximum depth of leachate on liner was determined using the design slope. Refer to Appendices IIIC-A and IIIC-E for additional information.
[2] The leachate collection header pipe in Cells 1 through 6 is an 8-inch-diameter PVC Schedule 80 pipe. The leachate collection lateral pipe in Cells 1 through 6 is an 6-inch-diameter PVC Schedule 80 pipe.
[3] The leachate collection pipe for Cells 7 and 8 is a 6-inch-diameter HDPE pipe.

3.1 Leachate Collection Layer

The leachate collection layer for the undeveloped cells will be placed directly over the liner system to collect and transfer leachate to the leachate collection system pipes and sumps. The leachate collection layer placed over the floor grades for the undeveloped portion of the site will consist of a 250-mil-thick HDPE geonet with a 6 oz/sy non-woven geotextile heat bonded to the top side of the HDPE geonet. The geocomposite was selected to maintain less than 12 inches of head above the bottom liner. The leachate collection layer placed over the sideslopes will consist of an HDPE geonet with a geotextile heat bonded to both sides. Calculations indicating the required properties of the geocomposite drainage layer (after accounting for losses due to clogging and compression from overburden stresses) are presented in Appendix IIIC-A. The drainage geocomposite for the undeveloped cells will comply with the specifications listed in Table 3-2.

An analysis of the developed cells is also included in Appendix IIIC-A. The existing cells include Cells 1 through 6. Cells 1 and 2 were constructed with a sand leachate collection layer. The remainder of the developed cells were constructed with a minimum 220-mil-thick geonet heat bonded to an overlying 8 oz/sy non-woven geotextile (single-sided on the floor grades).

The chimney drain will be installed above the LCS pipes and the top of the chimney drain gravel will match the top of protective cover grades as shown on details in Appendix IIIA-A – Liner and Final Cover System Details. The chimney drain will be constructed with drainage material having a hydraulic conductivity of 1.0 cm/s or greater and will be covered by a geotextile to restrict migration of the protective cover soil into the LCS. The chimney drains will allow leachate to flow into the LCS without a buildup of head above the protective cover layer. Calculations showing the adequacy of the chimney drain design are provided in Appendix IIIC-B.

3.2 Leachate Collection Piping

The liner and overlying leachate collection layer will slope to drain toward the LCS trenches, which will contain a perforated leachate collection pipe surrounded by drainage stone and separated from the adjacent protective cover and waste layers by a geotextile fabric. The leachate collection pipe will direct the leachate to the landfill sumps. The proposed leachate collection pipes will be 6-inch-diameter SDR 17 HDPE smooth wall pipes in Cells 7 and 8. The developed Cells 1 through 6 include an 8-inch-diameter PVC Schedule 80 header pipe with 6-inch-diamater PVC Schedule 80 lateral pipes spaced 100 feet apart.

Table 3-2
Geotextile and Drainage Geocomposite Required Testing and Properties for Undeveloped Area[1]

Responsible Party	Material	Test	Standard	Required Property[4]
Manufacturer	Geotextile	Unit Weight Apparent Opening Size Grab Strength Tear Strength Puncture Strength Permeability	ASTM D 5261 ASTM D 4751 ASTM D 4632 ASTM D 4533 ASTM D 4833 ASTM D 4491	6 oz/sy 80 sieve 157 lb 56 lb 56 lb 0.2 cm/s
Manufacturer	HDPE Geonet	Specific Gravity Thickness Carbon Black Tensile Strength	ASTM D 1505 ASTM D 5199 ASTM D 1603 ASTM D 5035	0.939 g/cm^3 0.25 inch 2% 45 lb/in (Peak)
Third Party Laboratory	Drainage Geocomposite	Transmissivity Strength	ASTM D 4716 ASTM D 5321	See Note 2 See Note 3
Manufacturer		Peel Adhesion	ASTM D 7005	1.0 lb/in

1 The minimum testing frequency will be one test sample per 100,000 square feet.

2 As noted in Appendix IIIC, Appendices IIIC-A and IIIC-B, the transmissivity of the floor liner single-sided geocomposite will be measured at a gradient of 0.015 under normal pressures of 1,000, 5,000, and 12,144 psf (or higher), boundary conditions consisting of soil/geocomposite/geomembrane with minimum seating time of 100 hours will be run for the first 100,000 square feet of liner construction. For each additional 100,000 square feet liner single-sided geocomposite placement area, one additional transmissivity test will be run under the minimum normal stress (i.e., 12,144 psf) with all the other assumptions the same as the first three tests. The minimum transmissivity will be 9.27×10^{-4} m^2/s. The transmissivity of the sidewall liner double-sided geocomposite shall be measured at a minimum gradient of 0.33 under a minimum normal pressure of 9,948 psf or higher. Boundary conditions consist of soil/geocomposite/geomembrane with a minimum seating time of 100 hours. The minimum transmissivity will be 1.61×10^{-4} m^2/s. For each additional 100,000 square feet liner double-sided geocomposite placement area, one additional transmissivity test will be run under the minimum normal stress (i.e., 9,948 psf) with all the other assumptions the same as the first three tests.

3 The adhesion and interface friction angle of the geocomposite components will be determined to verify they meet the values used in the slope stability analysis of Appendix IIIE.

4 Minimum required property values for the geotextile and drainage geocomposite transmissivity are based on calculations provided in Appendix IIIC-A. The geonet properties are based on values specified in GRI standard GM-13. In addition, each material will be tested prior to construction to verify that it meets the minimum required properties.

The geotextile fabric and pipe perforations are designed to prevent clogging of the fabric or pipe. The leachate collection system is designed with cleanout risers at the end of each of the collection pipes to allow cleaning. Proposed leachate collection pipe design calculations are provided in Appendix IIIC-B. These calculations demonstrate the adequacy of the pipes to convey leachate to the sumps, the structural stability of the pipes, and the satisfaction of the perforation requirements. Details of the LCS layer and pipe trench are shown in Part III, Appendix IIIA-A – Liner and Final Cover System Details.

3.3 Leachate Sumps and Pumps

The leachate collection sumps and pumps have been sized to comply with the regulatory design standard listed in 30 TAC §330.331(a)(2). The leachate collection sumps and pumps have been designed to maintain less than 30 cm (12 inches) depth of leachate over the liner. The leachate sump operating plan is included in Table 3-3.

The leachate sump that will service Cells 7 and 8 will be sized based on the amount of leachate generation. The minimum sump size will be 3 feet deep (2 feet, 4 inches below the pipe invert) with minimum dimensions of approximately 33 by 33 feet at the landfill floor and 15 by 15 feet at the sump base and will store a minimum of 1,809 cubic feet of leachate. Sumps will be backfilled with drainage stone meeting the gradation in accordance with ASTM D 448, size number 467 (nominal aggregate size is 2 inches to 3/16 inches). The sump will be emptied by a submersible pump located in an 18-inch nominal diameter sidewall riser pipe which extends into the bottom of the sump and is perforated in the sump. The pump will be operated either manually or automatically by pressure transducers. Control levels for an automatic pump will be set to maintain sump liquid levels between the lip of the sump and pump intake. The objective of the pump operation is to ensure that a free-flowing condition is maintained in the LCS. If the pump malfunctions, the pump will be removed, repaired, and replaced, or a new pump will be used (see Table 3-3 for additional information).

The leachate depth monitoring procedure and leachate removal will be the same for all disposal areas. The depth of leachate in the sump will be monitored by the pressure transducer which will be calibrated to provide direct read-out of the leachate level in the sump (e.g., typically the leachate level is shown on a continuous digital display at the sump as the pressure transducers provide a constant determination of the leachate levels in the sump). These automatic control levels will be inspected on a monthly basis. As noted in Part IV – SOP, Section 8.24, the leachate levels for each sump will be recorded in the Site Operating Record once per month. If the pressure transducers are not functioning, the pumps will be operated manually (once per month) until the automatic system is repaired. Details of the leachate sump are provided in Appendix IIIA-A – Liner and Final Cover System Details.

Table 3-3
Leachate Sump Operating Plan

Leachate Level Description	Condition	Action Required
Leachate level between lip of sump and pump intake at the bottom of the sump.	System is functioning as designed. The leachate sump controls will be set to turn on once the leachate level reaches the lip of the sump. The drainage geocomposite leachate collection layer installed on the floor of the landfill is designed to convey the estimated peak leachate flow rate without the leachate level within the geocomposite exceeding the thickness of the geocomposite. The operation of the leachate sump and the conveyance capacity of the geocomposite leachate collection layer work in tandem to maintain compliance with the design standard listed in §330.331(a)(2).	The depth of leachate in the sump is monitored by a pressure transducer which is calibrated to provide direct read-out of the leachate level in the sump (e.g., typically the leachate level is shown on a continuous digital display near the sump riser, as the pressure transducers provide a constant determination of the leachate levels in the sump). These automatic control levels will be inspected every month. As noted in Part IV – SOP, Section 8.24, the leachate levels for each sump will be recorded in the Site Operating Record once per month. Leachate flow to the sump, sump pump capacity, and range of pump operating times are listed in Appendix IIIC, Table 4-1. The sump design is discussed in Appendix IIIC, Section 3.4 and detailed sump design calculations are provided in Appendix IIIC-B.
Leachate level between the lip of the sump and 30 cm (or 12 inches) above the lip of the sump.	The pump is not able to maintain the leachate levels at or below the lip of the sump. However, the 12-inch design standard listed in §330.331(a)(2) has not been exceeded.	For these two conditions, the sump operation will be monitored daily to determine if this leachate level is the result of a short-term situation (e.g., significant storm event during initial waste filling operations of a sector, temporary loss of power at the site, etc.) or if there is a maintenance issue with the pump or pump controls. For both conditions, the leachate levels in the sump will be recorded daily (as discussed in Part IV – SOP, Section 8.24). If the leachate sump pumps are not able to maintain the leachate level below the lip of the sump at reasonable cycle times, then a pump with more capacity will be used to maintain the leachate level below the lip of the sump. As listed on Table 4-1, the typical sump operating time is approximately 1 hour a day. If the pump has to operate close to 24 hours per day for a significant period of time, then it is approaching the pump capacity limits and a larger pump will need to be installed. As noted in the EPA Technical Manual *Solid Waste Disposal Facility Criteria,* EPA530-R-93-017, "The 30-cm head allowance is a design standard and the [EPA] recognizes that this design standard may be exceeded for relatively short periods of time during the active life of the unit." To address this requirement, adequately sized sump pumps will be set to initiate pumping when leachate levels reach the lip of the sump. After the sump pump has been evaluated and found to be operating inadequately, the issue will be noted in the Site Operating Record and the pump will be repaired or replaced within 5 business days.
Leachate level over 12 inches above the lip of the sump.	System not functioning as designed and the design standard listed in §330.331(a)(2) has been exceeded.	

If the specified leachate sump pumps are not able to empty the sump and maintain less than 12 inches of head on the liner at reasonable cycle times, then a pump with more capacity will be used (refer to Section 4.1 for more information).

The specified pump will have the capacity to pump leachate at a rate of 15 gpm or 21,600 gpd. The maximum estimated flow to be pumped from the largest sector is 6,742 gpd. As noted in Section 6, the leachate generation rate predicted by the HELP model is much greater than the expected leachate generation rate that is based on site specific information.

3.4 Drainage Stone (Coarse Aggregate)

Granular drainage material around the leachate collection pipes and in the LCS sumps will consist of typical (e.g., unit weight of 90 to 110 pcf) or lightweight (e.g., unit weight less than 70 pcf) materials that comply with the following criteria. The aggregate will have a loss of mass due to calcium carbonate of less than 15 percent (in accordance with JLT-S-105-89 or ASTM D3042 method modified to use a solution of hydrochloric acid having a pH of 5). The drainage stone will meet the following gradation in accordance with ASTM D448, size number 467.

Sieve Size Square Opening	Percent Passing
2 inches	100
1½ inches	95 - 100
¾ inch	35 - 70
3/8 inch	10 - 30
No. 4 (3/16 inch)	0 - 5

Drainage materials not complying with the above gradations may also be approved by the Professional of Record (POR) if demonstrated to have a hydraulic conductivity of at least 1.0 cm/s and meet the gradation requirements of the filter and leachate collection pipe (in no case will the maximum rock size be greater than 2 inches). At a minimum, the drainage stone will meet the following gradation criteria:

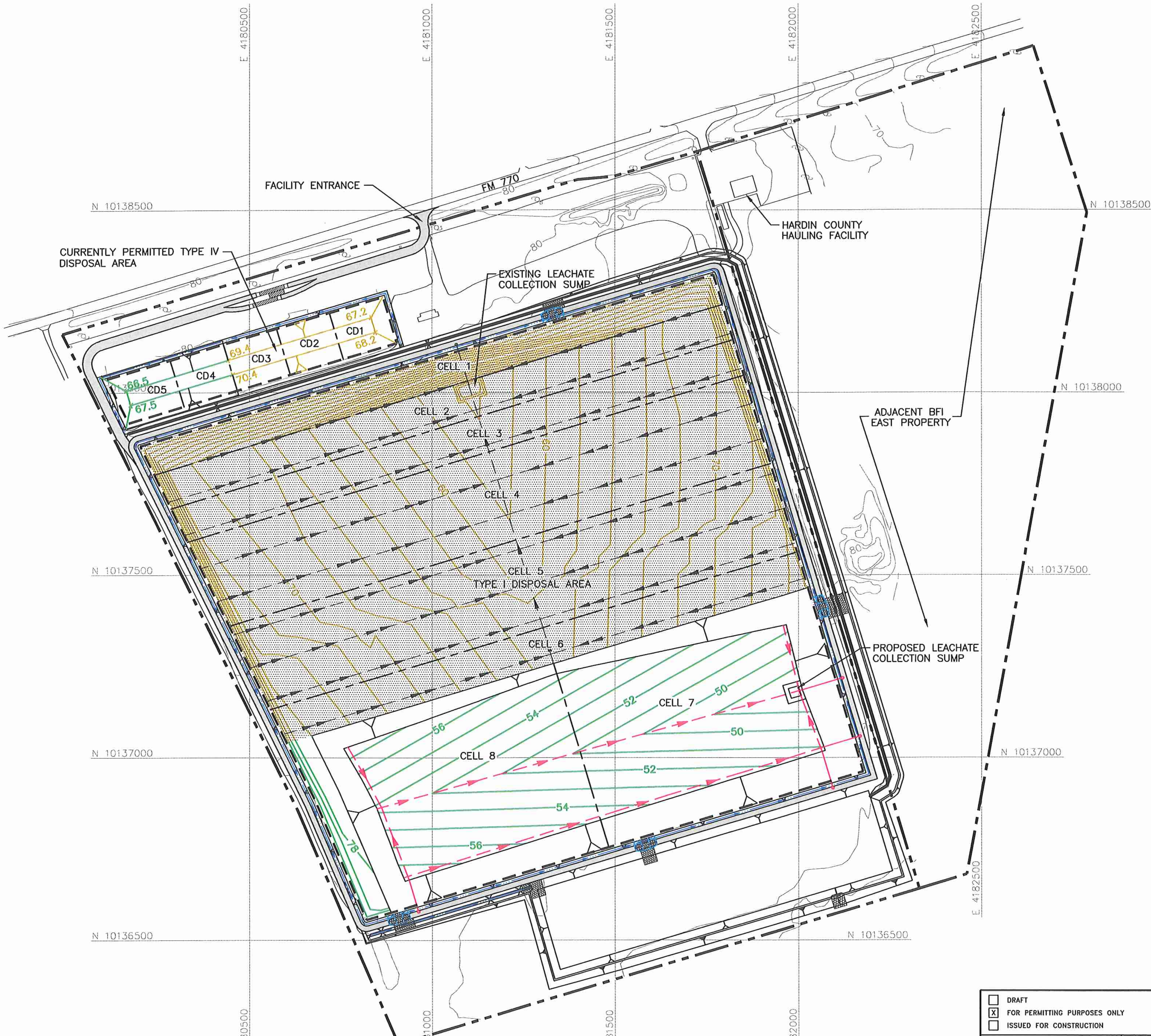
For circular holes in the leachate collection pipe:

$$\frac{\text{85 Percent Size of Filter Material}}{\text{Hole Diameter}} > 1.7$$

For slots in the leachate collection pipe:

$$\frac{\text{85 Percent Size of Filter Material}}{\text{Slot Width}} > 2.0$$

The drainage stone will be covered by a geotextile to maintain separation of drainage stone from the overlying layers. The geotextile will be resistant to commonly encountered chemicals, hydrocarbons and mildew, and will be rot resistant. Geotextile design calculations are presented in Appendix IIIC-B.



0 150 300
SCALE IN FEET

LEGEND

BFI EAST PROPERTY BOUNDARY
PERMIT BOUNDARY
CURRENTLY PERMITTED LIMITS OF WASTE
70 EXISTING CONTOUR (SEE NOTE 1)
N 10137000 STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
CELL BOUNDARY
50 PROPOSED EXCAVATION CONTOUR
70 CONSTRUCTED TOP OF PROTECTIVE COVER CONTOUR
EXISTING LEACHATE COLLECTION LINE
EXISTING LEACHATE RISER
PROPOSED LEACHATE COLLECTION LINE
PROPOSED LEACHATE RISER
PROPOSED LATERAL LEACHATE COLLECTION LINE
EXISTING SUBTITLE D COMPOSITE LINER AREA

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CURRENTLY PERMITTED TYPE IV CELLS INCLUDES CD1 THROUGH CD5. CD1, CD2, AND CD3 ARE CURRENTLY DEVELOPED AND RECEIVED TYPE IV WASTE.

STATE OF TEXAS
MARILYN D. MORRISON
102273
LICENSED
PROFESSIONAL ENGINEER
12-5-17

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- [ ] ISSUED FOR CONSTRUCTION

DATE: 03/2017
FILE: 0120-758-11
CAD: FIG 3-1-LCS PLAN.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2017	OWNERSHIP CHANGE

MAJOR PERMIT AMENDMENT LEACHATE COLLECTION SYSTEM PLAN

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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FIGURE 3-1

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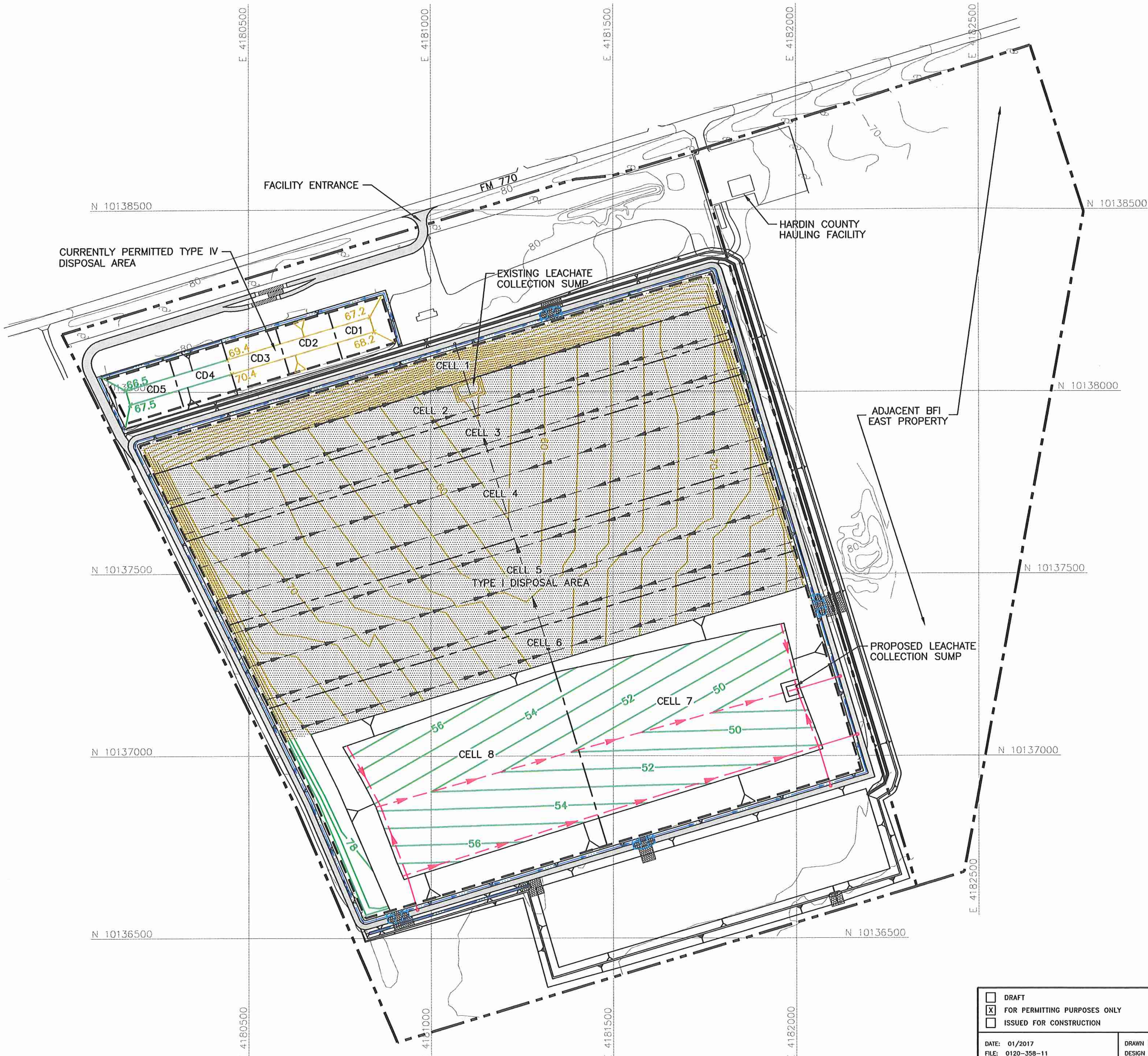

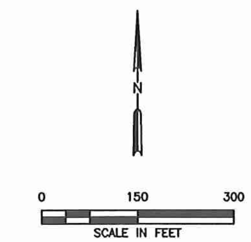

LEGEND

- BFI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- 70 EXISTING CONTOUR (SEE NOTE 1)
- N 10137000 STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
- CELL BOUNDARY
- 50 PROPOSED EXCAVATION CONTOUR
- 70 CONSTRUCTED TOP OF PROTECTIVE COVER CONTOUR
- EXISTING LEACHATE COLLECTION LINE
- EXISTING LEACHATE RISER
- PROPOSED LEACHATE COLLECTION LINE
- PROPOSED LEACHATE RISER
- PROPOSED LATERAL LEACHATE COLLECTION LINE
- EXISTING SUBTITLE D COMPOSITE LINER AREA

NOTES:

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DATE: 01/2017
FILE: 0120-358-11
CAD: FIG 3.2-POST SETTLEMENT SLOPES.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2017	OWNERSHIP CHANGE

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

MAJOR PERMIT AMENDMENT POST-SETTLEMENT SLOPES

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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FIGURE 3-2

O:\0120\758\2214B EXPANSION\IIIC\FIG 3.2-POST SETTLEMENT SLOPES.dwg. 11/15/2017 7:42:44 AM. rsellers. 1:2

4 LEACHATE AND CONTAMINATED WATER STORAGE

4.1 Leachate Storage

Temporary leachate storage will be provided in the leachate collection sumps. The leachate collection sumps have been sized based on the amount of leachate generated. Additional storage will be provided in the onsite above ground storage tank as discussed in Section 4.3. Table 4-1 summarizes the estimated leachate flow into the sump and the daily pump operating time. The estimated leachate generation rate is based on the average leachate generation produced by the HELP model analysis. As shown in Section 6, the average annual leachate generation rate produced by the HELP model analysis is greater than actual leachate generation values documented at the site. Therefore, the use of the average annual leachate generation rate produced by HELP to design the leachate collection sumps provides for a conservative analysis. Table 4-1 also includes the expected leachate generation and pump operating time which are based on site specific leachate generation values. Sump volume calculations are provided in Appendix IIIC-B. Details of the leachate sumps are provided in Appendix IIIA-A – Liner and Final Cover System Details.

Leachate levels in the sumps will be measured and recorded to evaluate leachate production and fluctuations. A form to record leachate measurements will be kept in the Site Operating Record and will be used to evaluate the effectiveness of leachate monitoring and control facilities. The sumps will be emptied by submersible pumps located within the sump section of the sidewall riser pipes to meet the design objective required by the leachate sump operating plan presented on Table 3-3. Disposal of leachate is discussed in Section 5. The design and operation of the onsite storage tank and the forcemain are discussed in Section 4.3. The location of the leachate storage tank is shown on Figure 4-1. The storage tank calculations are presented in Appendix IIIC-D.

Table 4-1
Sump Flow and Pump Operating Times

Condition	Sump Storage Summary									
	Sump for Cells 1 through 6[1]					Sump for Cells 7 and 8[1]				
	Flow (gpd)		Pump Operating Time (hours/day)		Pump Capacity (gpm)	Flow (gpd)		Pump Operating Time (hours/day)		Pump Capacity (gpm)
	Average[2]	Expected[3]	Average[2]	Expected[3]		Average[2]	Expected[3]	Average[2]	Expected[3]	
Active	6,745	855	7.5	1.0	15	7,641	466	8.5	0.5	15
Closed	164	855	0.2	1.0	15	1,493	466	1.7	0.5	15

1 Refer to Appendix IIIC-B, Sheet IIIC-B-64 – Sump Drainage Areas for cell layout and sump drainage areas.
2 Refer to Appendix IIIC-B, pages IIIC-B-58 through IIIC-B-64 for sumps volume calculations.
3 The expected flow values are based on site specific leachate generation listed in Table 6-1. The average value listed in Table 6-1 was used (i.e., 9,725 gal/ac/yr).

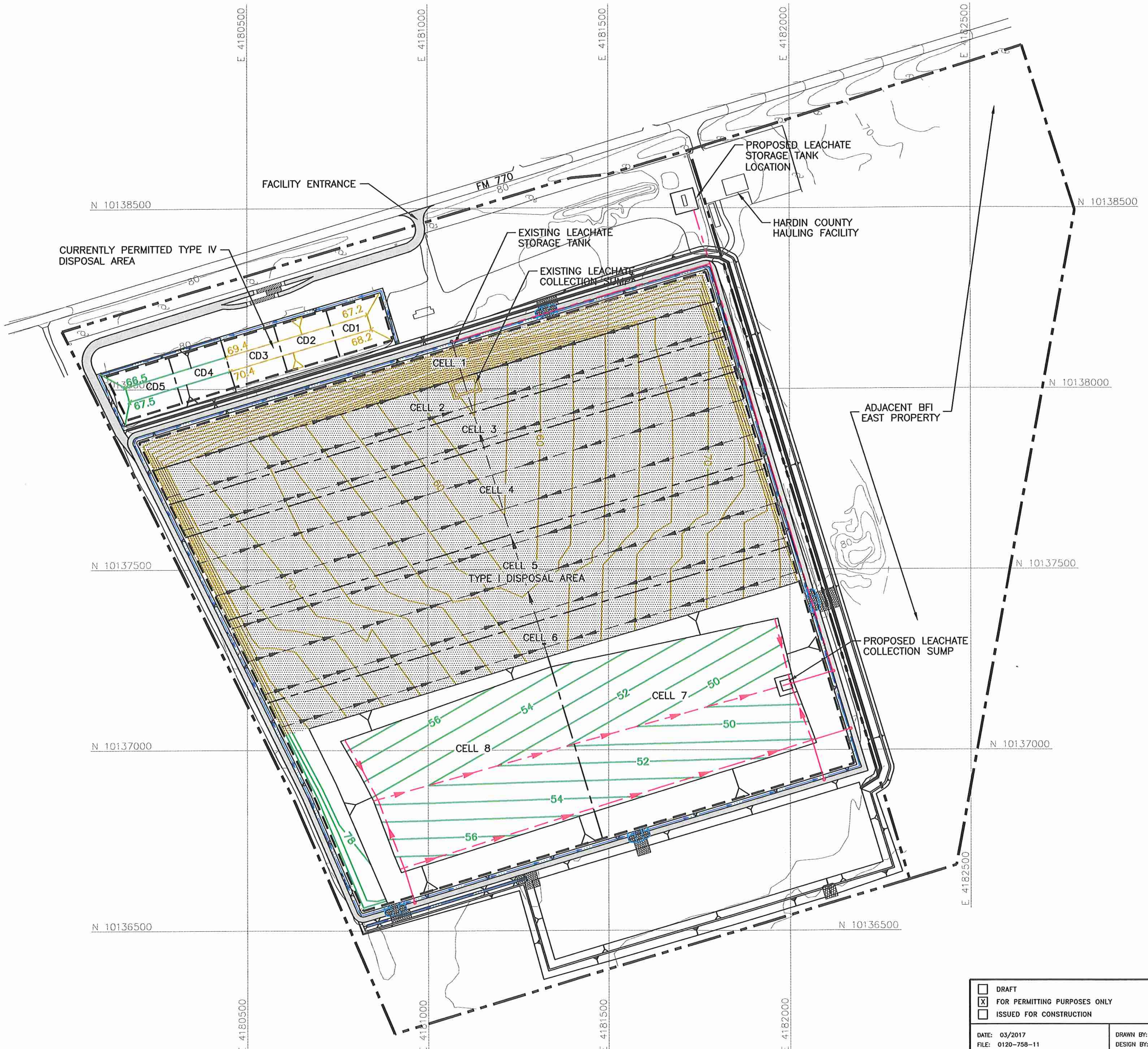
4.2 Contaminated Water Storage

Contaminated water will be contained at the working face as shown in Appendix IIIC-C. A vacuum truck or similar vehicle will remove contaminated water from this area and disposed of as discussed in Section 5.3. Contaminated water will be removed from behind the contaminated water containment berm as discussed in Part IV – SOP, Section 8.23.

4.3 Onsite Storage Tank

The existing 21,000-gallon temporary leachate storage tank is located to the north of the existing sump in Cell 1 (see Figure 4-1). The 21,000-gallon leachate storage tank provides enough storage capacity for the leachate currently generated at the site. The storage tank will be emptied, as required, to maintain capacity for the leachate currently generated at the site. However, the leachate level in the tank will be managed to provide a minimum of 3 days of emergency backup storage capacity.

At some point in the future, the site will replace the temporary 21,000 gallon leachate storage tank with a permanent leachate storage tank with a minimum capacity of 21,000 gallons. A forcemain is proposed at the site that will connect the leachate collection sumps to the proposed permanent leachate storage tank. The location of the forcemain is shown on Figure 4-1. The storage tank will be emptied consistent with the leachate storage system operation plan detailed in Section 5. The location of the proposed permanent leachate storage tank is shown on Figure 4-1. The existing and proposed tanks will be equipped with a liquid-level sensor and high-level alarm to prevent overfill.



N

0 150 300
SCALE IN FEET

LEGEND

	BFI EAST PROPERTY BOUNDARY
	PERMIT BOUNDARY
	CURRENTLY PERMITTED LIMITS OF WASTE
70	EXISTING CONTOUR (SEE NOTE 1)
N 10137000	STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
	CELL BOUNDARY
50	PROPOSED EXCAVATION CONTOUR
70	CONSTRUCTED TOP OF PROTECTIVE COVER CONTOUR
	EXISTING LEACHATE COLLECTION LINE
	EXISTING LEACHATE RISER
	PROPOSED LEACHATE COLLECTION LINE
	PROPOSED LEACHATE RISER
	PROPOSED LATERAL LEACHATE COLLECTION LINE
	PROPOSED LEACHATE FORCEMAIN
	EXISTING SUBTITLE D COMPOSITE LINER AREA

NOTES:

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DATE: 03/2017
FILE: 0120–758–11
CAD: FIG 4.1–STORAGE TANK PLAN.DWG

DRAWN BY: SRF
DESIGN BY: AE
REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F–3727

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2017	OWNERSHIP CHANGE

MAJOR PERMIT AMENDMENT
STORAGE TANK PLAN

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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FIGURE 4–1

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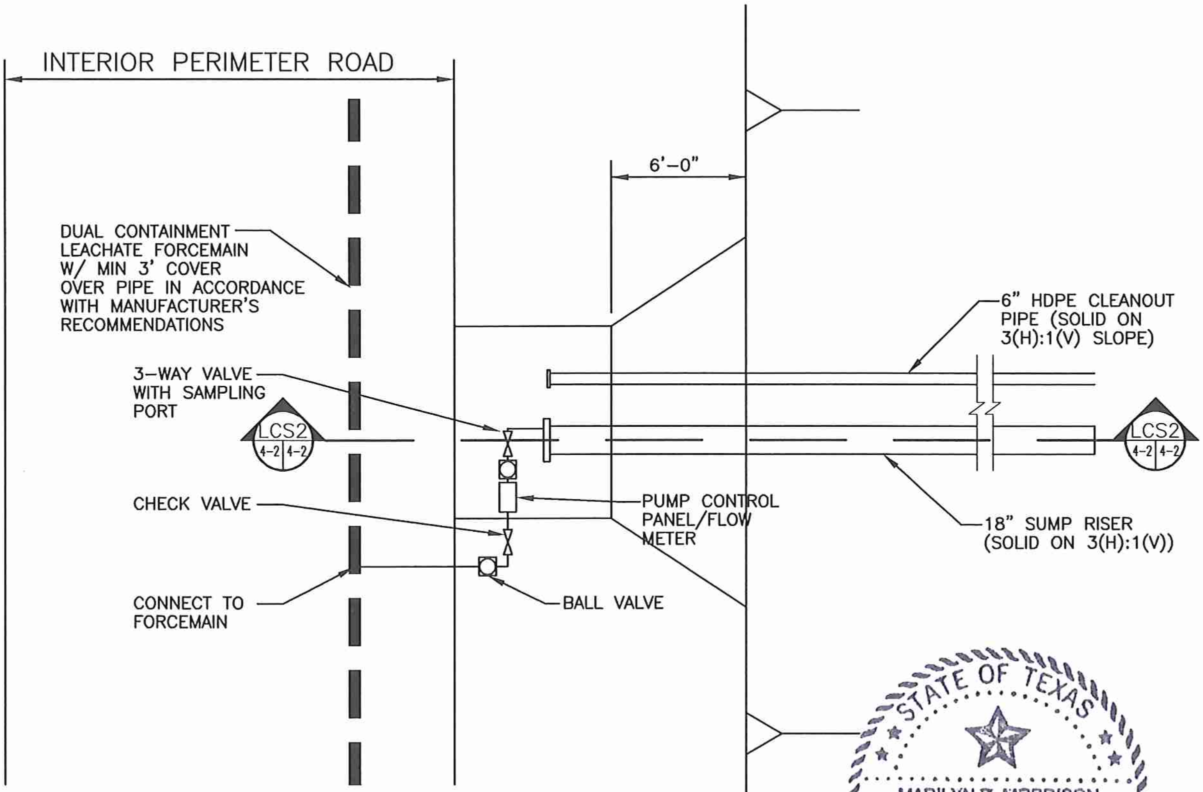

FORCEMAIN CONNECTION LCS1 3-1 4-2
N.T.S.

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MARILYN D. MORRISON
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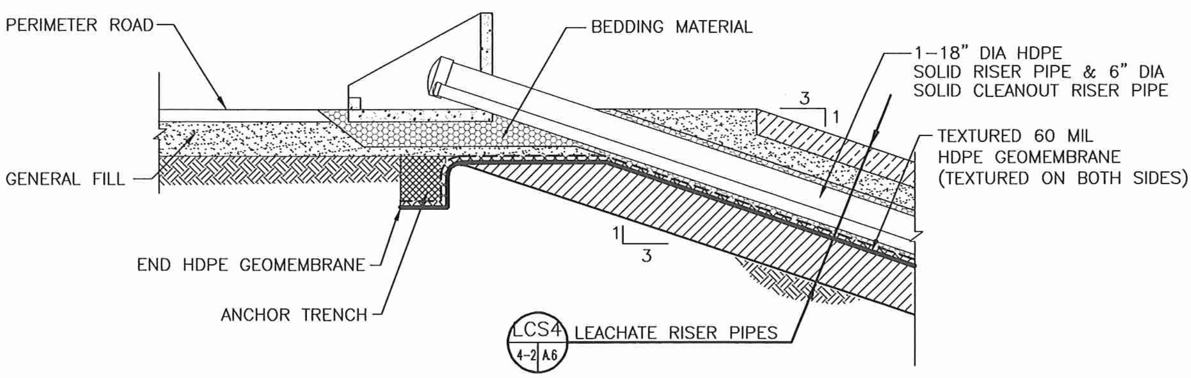
LICENSED PROFESSIONAL ENGINEER
12-5-17



LEACHATE RISER/CLEANOUT LCS2 4-2 4-2

0 4 8
SCALE IN FEET

NOTE:

1. REFER TO APPENDIX IIIA–A–LINER AND FINAL COVER SYSTEM DETAILS FOR LINER INFORMATION.

REVISIONS	
1	07/2017
2	11/2017

MAJOR PERMIT AMENDMENT
LEACHATE FORCEMAIN DETAILS

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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REGISTRATION NO. F–3727

DRAWN BY: JDW	DATE: 03/2017	FILE: 0120–758–11
REVIEWED BY: MDM	CAD: FIG 4–2.DWG	FIGURE 4–2

O:\0120\758\2214B EXPANSION\IIIC\FIG 4-2 FORCEMAIN DETAILS.dwg, 11/15/2017 7:45:37 AM, rsellers, 1:1

5 LEACHATE AND CONTAMINATED WATER DISPOSAL

5.1 Leachate Storage System Operation and Disposal

Leachate that is generated at the site will be conveyed to the leachate collection sumps. Leachate levels in the sumps are measured and recorded to evaluate leachate production and fluctuations. A form to record leachate measurements is kept in the Site Operating Record and is used to evaluate the effectiveness of the leachate monitoring and control facilities. The depth of leachate in the sump will be monitored by the pressure transducer which will be calibrated to provide direct read-out of the leachate level in the sump (e.g., typically the leachate level is shown on a continuous digital display at the sump, as the pressure transducers provide a constant determination of the leachate levels in the sump). As noted in Part IV – SOP, Section 8.24, the leachate levels for each sump will be recorded in the Site Operating Record once per month.

Leachate will be pumped from the leachate sumps to the temporary storage tanks. Once the permanent storage tank is in place leachate will be pumped from the sumps via a forcemain (which will consist of a 2-inch minimum diameter pipe contained in a 4-inch minimum diameter carrier pipe) to the leachate storage tank. The forcemain location is shown on Figure 4-1. The forcemain calculations are included in Appendix IIIC-D.

The storage tank area management plan is presented in Appendix IIIC-D. As noted in Appendix IIIC-D, the leachate levels in the storage tank will be maintained so that a minimum of 3 days of emergency backup leachate storage capacity will be provided. The collected leachate will be either recirculated (refer to Section 5.2) or transferred from the leachate storage tanks into a tanker truck for transportation directly to a properly permitted privately-owned off-site facility or a POTW for treatment. For leachate that is transported off-site, sampling and analysis will be limited to the disposal facility's requirements. The results of leachate monitoring required by the off-site, permitted disposal facility will be kept in the Site Operating Record.

Leachate levels in the storage tank will be measured once per day, to verify that the system is operating in conformance with this plan. The quantity of leachate pumped from the system is also recorded on a monthly basis. This information is maintained in the Site Operating Record. The tank will be equipped with a liquid-level sensor and a high-level alarm to prevent overfill. When the alarm is triggered, site personnel will then take appropriate actions to reduce the leachate level in the tank.

5.2 Leachate Recirculation Plan

The site does not currently recirculate. If the site choose to recirculate in the future, the procedures outlined in this section will be followed. The main purpose of recirculating leachate is to enhance the ability to manage and control leachate. Additionally, in an effort to promote an increase in waste compaction, leachate recirculation will provide the opportunity to create a uniform moisture content throughout the waste at the working face. The additional moisture will help stabilize the waste mass, thus providing for an increased compaction of the waste. The leachate will be better managed because the recirculation of leachate through the waste mass allows for treatment of the leachate to occur through physical, biological, and chemical interactions with the organic and some inorganic portions of the waste. This increases the rate of waste decomposition and stabilization, as well as increasing the rate of landfill gas recovery. Recirculation of leachate also facilitates dust control at the working face.

If the site chooses to recirculate in the future, recirculation of leachate will only occur over areas underlain by a Subtitle D liner system (i.e., Cells 1 through 8) consistent with 30 TAC §330.177. Leachate will be recirculated by surface spraying at the working face. Leachate will be distributed from a water truck or other comparable equipment using a spray bar or hose to distribute leachate back to the working face (i.e., within the active waste fill area that is contained by the containment berm).

The following performance standards will govern the application rate of leachate recirculation.

- The rate of leachate recirculation will not exceed the moisture holding capacity of the landfill. For example, the application rate will be applied so that no seeps or ponding is observed in the vicinity of the recirculation area. In addition, leachate recirculation over a specific cell will cease if the leachate flow rate to a sump approaches the capacity of the pump within the sump. For the purposes of this plan, if the leachate pump is constantly having to pump leachate more than 22 hours in a day, then the capacity of the sump has been reached. The quantity of leachate pumped from each sump will be monitored on a monthly basis. If the pump begins to operate near capacity (21,600 gpd), then the pump operating time will be monitored on a daily basis to determine if leachate recirculation needs to be reduced over the phase that flows to the sump which contains the pump that is operating near capacity. If this occurs, recirculation activities will be suspended or moved to another cell.
- Leachate recirculation will not occur immediately before, during, or immediately after rainfall events, or during freezing temperatures that could affect the holding-capacity of the waste.

- Leachate recirculation will not occur during high wind events.
- Refer to Part IV – SOP, Section 8.11 for additional information regarding the plan to be followed if odors due to leachate recirculation become an issue.

Sampling and analysis is not proposed for the recirculated leachate. Contaminated stormwater will not be recirculated into the waste.

The leachate generated from the landfill will be recirculated to the landfill working face, and excess quantities of leachate will be directed to the leachate storage facilities.

5.3 Contaminated Water Disposal

Contaminated water that collects behind the containment berm will be pumped into tanker trucks and transported to a properly permitted privately-owned treatment facility or a POTW for treatment. Contaminated water will be removed as soon as practicable from the area behind the contaminated water containment berm (refer to Section 8.23 of the SOP for additional information and record keeping requirements). Contaminated water may also be transported to the leachate storage tank. When contaminated water is stored in the leachate storage tank, no leachate recirculation will occur. Also, a record will be placed in the Site Operating Record noting that contaminated water is being stored in the leachate storage tank.

5.4 Landfill Gas Condensate

Consistent with 30 TAC §330.177 and §330.207(e), landfill gas condensate will be pumped to the leachate storage tank and disposed of as discussed in Section 5.1.

6 LEACHATE GENERATION SUMMARY

6.1 Purpose

The purpose of this section is to summarize the leachate generation rates developed in Appendix IIIC-A and compare them to leachate generation rates developed from actual leachate generation information obtained at the Hardin County Landfill and other published sources.

The following sections discuss (1) leachate information that has been obtained from the site, (2) a comparison between actual leachate generation rates and the leachate generation rates provided by the HELP model, and (3) an evaluation of the leachate depth on the liner system.

6.2 Existing Site Leachate Collection Information

Table 6-1 summarizes the leachate generation information that has been obtained for the existing site in 2014, 2015, and 2016. Supporting information for this data is included in Appendix IIIC-E. This information was used to calculate the "leachate generated per acre" value in Table 6-1. As shown in Table 6-1, the average leachate generation at the site is 9,725 gal/acre/year and the maximum leachate generation has been 12,189 gal/acre/year.

Table 6-1
Existing Site Leachate Generation Summary

Year	Annual Rainfall[1] (in)	Total Leachate Generated Per Year (gallons)	Total Subtitle D Lined Area (acres)	Average Waste Column Thickness (feet)	Leachate Generated Per Acre (gallons/ac/year)
2014	44.18	282,240	28.6	25	9,869
2015	65.49	228,480	32.1	30	7,118
2016	43.74	391,260	32.1	35	12,189
Average	51.14	300,660	30.9	30	9,725

[1] Refer to Appendix IIIC-E for more information.

6.3 Leachate Generation Comparison

The existing site leachate generation rates and the estimated leachate generation rates provided by HELP are presented on Figure 6-1. As shown, the leachate generation rates estimated by the HELP model are higher than the actual leachate generation rates. This demonstration shows that the HELP model analysis is based on conservative assumptions and the estimated leachate generation rate modeled in the application is greater than the expected actual leachate generation rate.

Figure 6-2 presents a comparison between the leachate generation volume over the life of the site and the postclosure period. The following three estimates are shown.

- HELP Analysis – Peak Value. This estimate was obtained from the HELP analysis included in Appendix IIIC-A. The estimate is based on using the peak average leachate generation information for undeveloped cells and developed cells.
- HELP Analysis – Average Value. Similar to the above, this estimate was obtained from the HELP analysis included in Appendix IIIC-A. The estimate is based on using the average leachate generation information for the undeveloped cells and developed cells.
- Estimate of Actual Leachate Generation Values. The leachate generation rate was estimated using information obtained from site personnel for the Hardin County Landfill for 2014-2016 time frame. For the postclosure period, the leachate generated was estimated based on the EPA study "Assessment and Recommendations for Improving the Performance of Waste Containment Systems" by Rudolph Bonaparte, David E. Daniel, and Robert M. Koener in December 2002. This study indicates that the leachate generation within a closed landfill decreases by a factor of four in one year after closure and by one order of magnitude in two to four years after closure. This study also indicated the flow was almost negligible after nine years of closure. Based on the above EPA study, for the first 10 years of the postclosure period the flow was assumed to be 10 percent of the closed case; for the second and third 10-year postclosure periods, the flow was assumed to be 2 percent of the closed case leachate flow.

As shown on Figure 6-2, the leachate generation rate over the life of the site that was determined from actual leachate generation information is less than both the average and the peak values estimated by the HELP model.

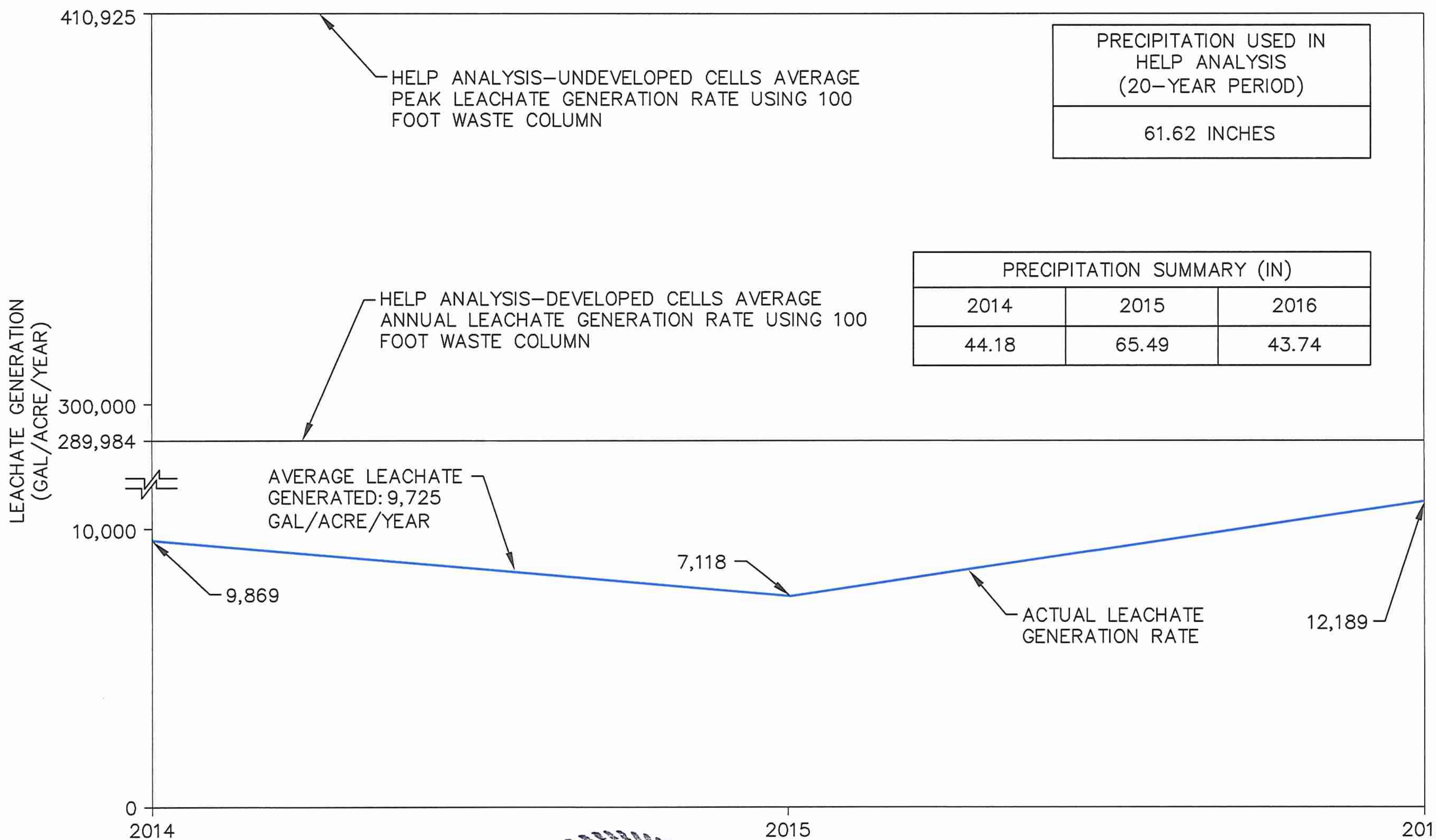
6.4 Comparison of Leachate Thickness on Liner System

Figures 6-3 and 6-4 show that when flow rates based on actual leachate generation rates are used the depth of leachate on the liner system is much less than the design depth. Figures 6-3 and 6-4 show that when actual flows are used, the depth of leachate on the liner system is much less than the design flows. Figures 6-3 and 6-4 provide leachate depth information for each cell that includes a geocomposite. The leachate depths for each cell are also compared to the compressed thickness of the geocomposite.

As shown in Figures 6-3 and 6-4, in each case the peak head on the liner using the flow rates produced by HELP is contained within the thickness of the geocomposite. When the actual flow rates are used the depth of the leachate within the drainage geocomposite utilizes only a fraction of the capacity of the drainage geocomposite. The supporting information for Figures 6-3 and 6-4 is included in Appendix IIIC-E.

6.5 Summary

As noted in Appendices IIIC-A and IIIC-B, the design of the leachate collection system components is based on the peak flow rate provided by the HELP model. As shown in this appendix, this approach results in a conservative design given that the expected actual leachate generation rates are much less than the design values.



PRECIPITATION USED IN HELP ANALYSIS (20–YEAR PERIOD)
61.62 INCHES

PRECIPITATION SUMMARY (IN)		
2014	2015	2016
44.18	65.49	43.74

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LEACHATE GENERATION RATE COMPARISON

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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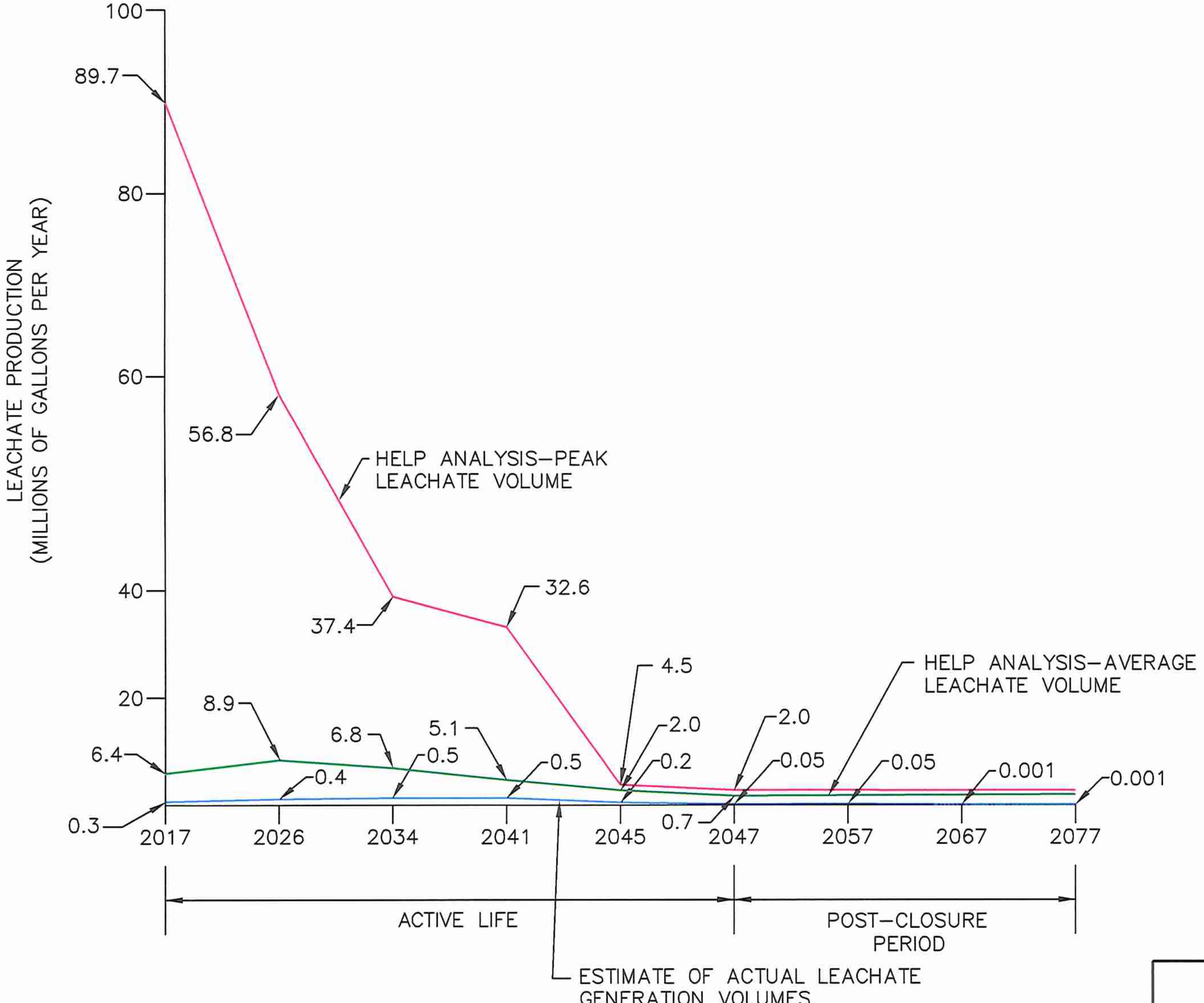
DRAWN BY: JDW	DATE: 03/2017	FILE: 0120-758-11
REVIEWED BY: MDM	CAD: FIG 6-1.DWG	FIGURE 6-1

O:\0120\758\2214B EXPANSION\IIIC\FIGURE 6-1.dwg, 11/15/2017 7:46:05 AM, rsellers, 1:1



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NOTE:

1. REFER TO APPENDIX IIIC–E FOR SUPPORTING INFORMATION.

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LEACHATE GENERATION VOLUME ESTIMATION

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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DRAWN BY: JDW	DATE: 03/2017	FILE: 0120–758–11
REVIEWED BY: MDM	CAD: FIG 6–2.DWG	FIGURE 6–2

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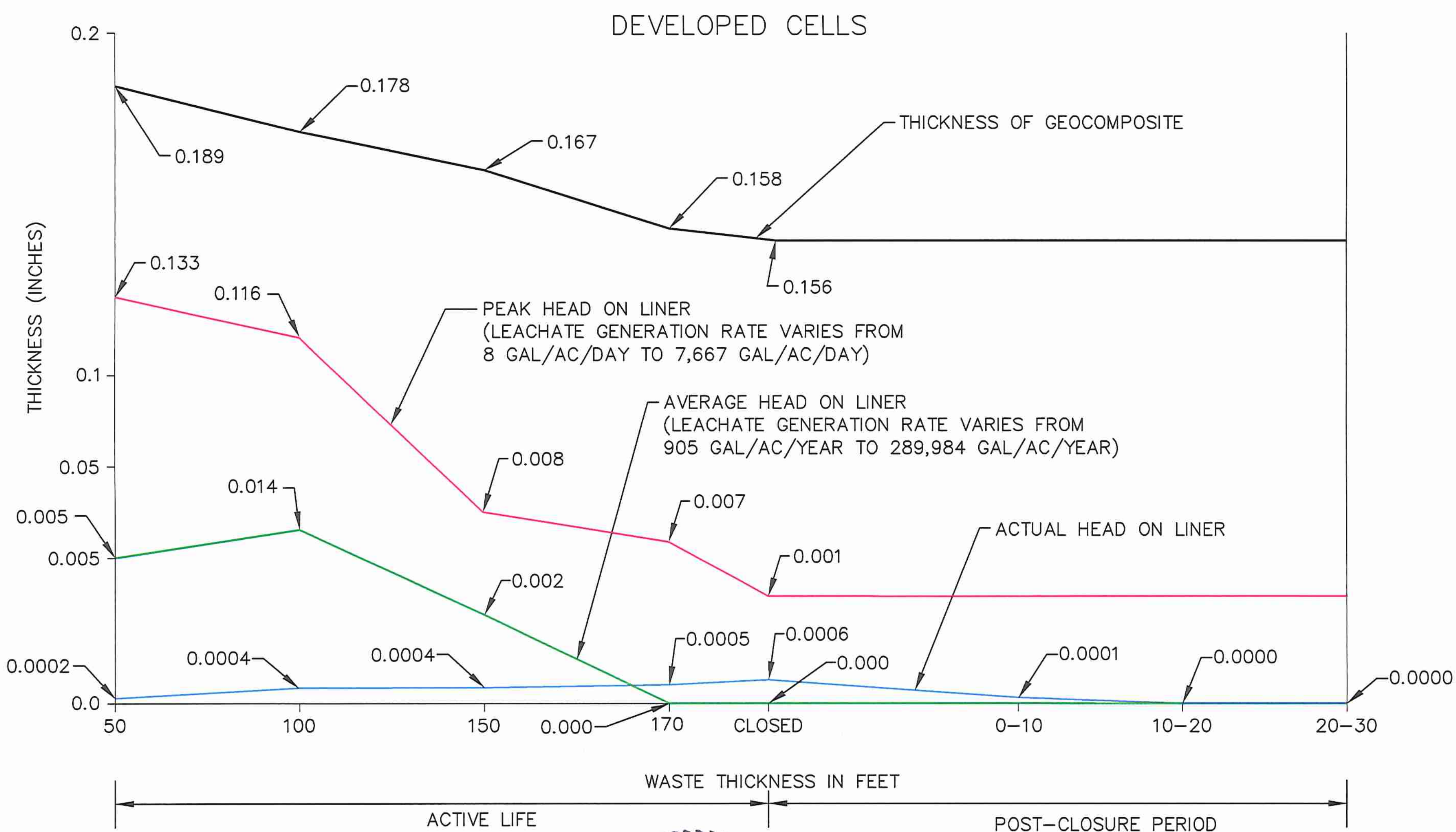

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ESTIMATION OF LEACHATE THICKNESS ON LINER SYSTEM

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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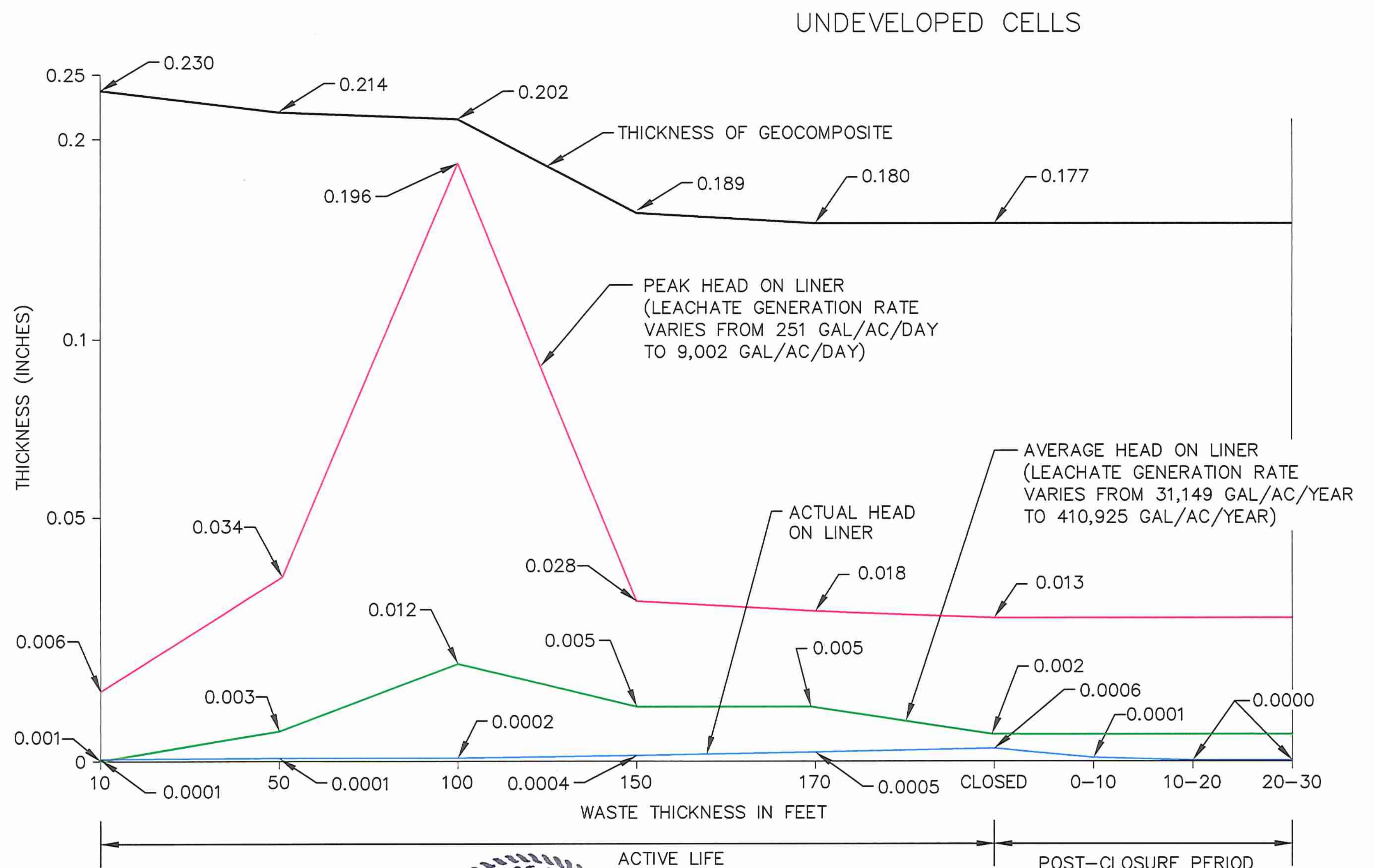
2	11/2017

DRAWN BY: JDW	DATE: 03/2017	FILE: 0120-758-11
REVIEWED BY: MDM	CAD: FIG 6-3.DWG	FIGURE 6-3

O:\0120\758\2214B EXPANSION\IIIC\FIGURE 6-3.dwg, 11/15/2017 7:46:56 AM, rsellers, 1:1



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12-5-17

ESTIMATION OF LEACHATE THICKNESS ON LINER SYSTEM

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

Weaver Consultants Group

REVISIONS	
1	07/2017
2	11/2017

DRAWN BY: JDW	DATE: 03/2017	FILE: 0120-758-11
REVIEWED BY: MDM	CAD: FIG 6-4.DWG	FIGURE 6-4

APPENDIX IIIC-A

LEACHATE GENERATION MODEL

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Includes pages IIIC-A-1 through IIIC-A-112

LEACHATE GENERATION MODEL

HELP Model

The Hydrologic Evaluation of Landfill Performance (HELP) Model, Version 3.07 was used to estimate quantity of leachate that will be generated during the active life and postclosure period of the Hardin County Landfill. The HELP Model is a quasi-two-dimensional hydrologic model of water movement across, into, through, and out of the landfill. The model uses climate, soil, and landfill design data to perform a solution technique that accounts for the effects of surface storage, runoff, infiltration, percolation, soil moisture storage, evapotranspiration, and lateral drainage.

Model Setup

The site was modeled as a 1-acre unit area for the following stages of landfill development in undeveloped cells:

- Working face with 10 feet of waste
- 50 feet of waste with intermediate cover
- 100 feet of waste with intermediate cover
- 150 feet of waste with intermediate cover
- 170 feet of waste with intermediate cover
- 170 feet of waste with final cover

The site was modeled as a 1-acre unit area for the following stages of landfill development in developed cells:

- 50 feet of waste with intermediate cover
- 100 feet of waste with intermediate cover
- 150 feet of waste with intermediate cover
- 170 feet of waste with intermediate cover
- 170 feet of waste with final cover

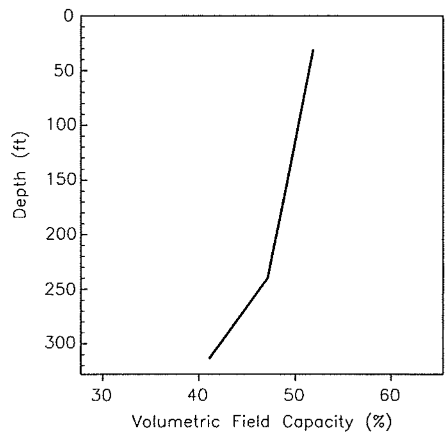
The active stage was modeled for one year with initial moisture contents initialized at 25 percent. The interim stages with intermediate cover were modeled for various lengths of time selected based on the projected duration each condition is likely to occur. The closed landfill condition was modeled for 30 years. The evaporative zone depth was selected to be 10 inches for the active and interim cases and 18 inches for the closed case. The leaf area index was selected to be 0 for the active case, 2 for the interim cases and 4.5 for the closed case based on the selected ground area. The Soil Conservation Service (SCS) runoff curve numbers were calculated by HELP based on soil data and expected ground cover, surface slope, and slope length. The active case models a curve number of 80.3 and percent runoff area of zero, which is representative given that this condition assumes complete infiltration (minus evapotranspiration). The interim cases utilize the default curve number assigned by the HELP model which is 87.1 and corresponds to "fair" ground cover. The percent runoff area used varies between 70 to 90. This is representative of the intermediate cover, which will be 12 inches of compacted soil with 60 percent or more vegetation coverage. The final case models a curve number of 81.6 and percent runoff area of 100, which corresponds to "good" ground cover. This is representative of the final cover, which will have a minimum 90 percent vegetation coverage.

Moisture Content and Field Capacity

For a conservative analysis, the initial moisture content was set at field capacity for all profile layers except the compacted clay barrier layer and the waste layer. HELP automatically sets the initial moisture content for a compacted clay barrier layer at porosity (i.e., fully saturated). The initial moisture content for the waste layer was selected to be 25 percent for the 10-foot-thick and 50-foot-thick waste column cases. A moisture content of 25 percent is typical for recently placed waste. For the remaining cases, the initial moisture content for the waste layer was selected to be 31 percent to account for the fact that the waste will be in place for a longer period of time and the moisture content could increase.

Default values for the field capacity of each profile layer, other than the waste layer, were used. The field capacity values for the waste layer were obtained from "Retention of Free Liquids in Landfills Undergoing Vertical Expansion" (Zornberg, Jorge G., et al., 1999) and varies based on average waste column thickness. The relationship used is shown in the graph below.

VOLUMETRIC FIELD CAPACITY AS A
FUNCTION OF
WASTE DEPTH



Climate Data Input

Precipitation data was synthetically generated by the HELP model program using normal mean monthly precipitation data from the NOAA for the Kountze Weather Station. The average annual precipitation over the modeled 30-year period was 60.35 inches. Temperature and solar radiation data were synthetically generated by the HELP model using program defaults for Houston, Texas.

Landfill Profile

The landfill profiles for various stages of the landfill development are presented in the attached HELP Model summary sheets. The profile presented below includes a composite liner with a standard Subtitle D final cover system.

Liner Systems

The Subtitle D composite liner for developed and undeveloped cells consists of a 60-mil high-density polyethylene (HDPE) geomembrane placed over a 24-inch-thick compacted clay liner with a hydraulic conductivity of $1x10^{-7}$ cm/s. The geomembrane liner was modeled for good installation quality, with no defects or pinholes to produce the largest leachate flow rate (which is a conservative assumption because it will produce a conservative leachate head value). Default characteristics from the HELP model were selected for the HDPE geomembrane hydraulic conductivity. Default soil characteristics from the HELP model also were selected for the 24-inch-thick compacted clay liner.

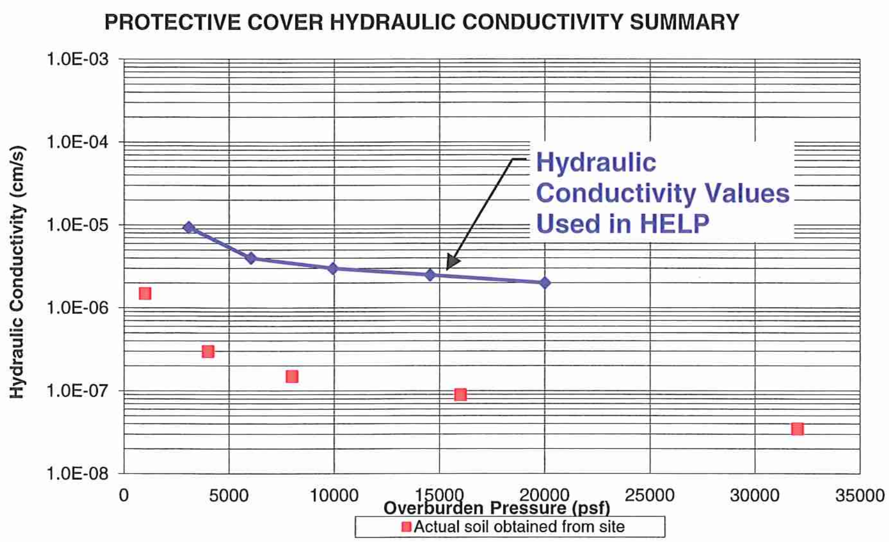
Leachate Collection System

The developed cells include a drainage geocomposite collection layer consisting of a minimum 220-mil geonet heat bonded to an overlying 8 oz/sy non-woven geotextile (single-sided on floor grades). For the undeveloped cells the geocomposite is a 250-mil geonet heat bonded to an overlying 6 oz/sy non-woven geotextile for undeveloped cells (single-sided on floor grades). The calculations for determining the hydraulic conductivity of the geocomposite are shown on pages IIIC-A-6 through IIIC-A-11.

Protective Cover

The protective cover consists of a 24-inch-thick layer of soil placed over the leachate collection system. The hydraulic conductivity of the protective cover was modeled as 1.2×10^{-4} cm/s. The hydraulic conductivity of 1.2×10^{-4} cm/s was used to provide a conservative analysis. The hydraulic conductivity of the protective cover layer is expected to decrease as the overburden pressure increases.

For the developed cells, a range of hydraulic conductivity values was used based on the following graph.



The graph showing the relationship between the hydraulic conductivity and overburden pressure for the soil protective cover was developed based on laboratory tests performed on a composite soil sample similar to what will be utilized for the liner construction events.

The samples were first consolidated at 1,000 psf, 4,000 psf, 8,000 psf, 16,000 psf, and 32,000 psf normal stresses. Falling-head hydraulic conductivity tests were run on the consolidated soil samples. The figure above shows the change of protective cover hydraulic conductivity under varying overburden pressures. As shown on the figure, even under low overburden pressure, the hydraulic conductivity of the proposed cover is well below the hydraulic conductivity values used for the HELP model demonstrations. As the waste column thickness increases, the additional overburden pressure decreases the hydraulic conductivity of the protective cover.

The reduced hydraulic conductivity of the protective cover results in reduced flux of leachate into the leachate collection system, thus the hydraulic head on the liner is expected to be lower than what is estimated in the HELP Model using the hydraulic conductivities shown on the graph for the soil protective cover. As noted in Appendix IIIC-B, the chimney drains installed over the leachate collection pipes provide a passage for the leachate that may be retained above soil protective cover. As designed, the chimney drains convey the entire leachate flow to the leachate collection pipe in the event that the protective cover does not transmit leachate.

Waste Layers

Waste layers of 10, 50, 100, 150, and 170 feet were used to represent the various stages of landfill development. A default wilting point was selected from HELP to represent municipal solid waste. The waste column was split into two layers. The top 125-foot layer was modeled with a hydraulic conductivity of $1x10^{-3}$ cm/s. A lower hydraulic conductivity of $1x10^{-4}$ cm/s was used for the bottom layer because the additional overburden pressure will cause additional consolidation to this layer that will likely lower the hydraulic conductivity. The moisture content, field capacity, and porosity values were selected as discussed previously.

Intermediate Cover

The intermediate cover consists of a 12-inch-thick layer of soil placed over the waste. Default soil characteristics were selected from HELP to represent the available onsite soils.

Final Cover

The final cover over the consists of a 24-inch erosion layer with the top 6 inches capable of sustaining growth of vegetation, a geocomposite drainage layer (to be conservative this layer is not considered in HELP modeling), a 40-mil LLDPE geomembrane liner, and an 18-inch infiltration layer. The geomembrane liner was modeled for good installation quality, 4 construction defects per acre, and a pinhole density of 1 hole per acre. The infiltration layer consists of compacted soil with a hydraulic conductivity of $1x10^{-5}$ cm/s.

HELP Model Output

The HELP summary table and output files for the various stages of the landfill development are presented starting on page IIIC-A-14.

Required:

Determine the minimum requirements of the 250 mil geocomposite leachate collection layer for the undeveloped cells. Analyze the capacity of the 220-mil geocomposite leachate collection layer for the developed cells.

Method:

1. Determine the 220 mil and 250 mil geocomposite leachate collection layer thickness under the expected loading conditions.
2. Determine factors of safety for strength and environmental conditions based on the expected duration of each stage of landfill development.
3. Identify the minimum required transmissivity for the 220-mil and 250-mil-thick single-sided geocomposite collection layer.
4. Compute the design transmissivity of the 220 mil and 250 mil geocomposite leachate collection layer for each stage of landfill development using the calculated thicknesses and the reduction factors.
5. Specify the geocomposite properties for the leachate collection layer for the undeveloped cells.

References:

1. Koerner, R.M., Designing With Geosynthetics, Third Edition, 1994.
2. Gray, Donald H., Koerner, Robert M., Qian, Xuede, Geotechnical Aspects of Landfill Design and Construction, 2002.
3. Geosynthetic Institute, GRI Standard GC-8, 2001.
4. GSE Drainage Design Manual, June 2004.
5. Acar, Yalcin B.& Daniel, David E., *Geoenvironment 2000 Characterization, Containment, Remediation, and Performance in Environmental Geotechnics,* Volume 2, American Society of Civil Engineers, 1995.

Solution:

1. Geocomposite Leachate Collection Layer Thickness:

Note: It is conservatively assumed that the existing constructed cells at the site installed a 220-mil-thick geocomposite.

Assume the geocomposite leachate collection layer will undergo compression due to the weight of soil (in the form of daily cover, intermediate cover, protective cover, or final cover) and waste.

Unloaded Geocomposite Thickness (220 mil)=	0.22	in
Unloaded Geocomposite Thickness (250 mil)=	0.25	in
Unit Weight of Soil =	116	pcf
Unit Weight of Waste and Soil[1] =	67	pcf

[1] The unit weight of waste/soil is selected at the midpoint of the maximum waste column thickness (170 ft) using the Unit Weight Profile for MSW graph provided in Ref 5.

Table 1.1 - Geocomposite Thickness (220 mil - Developed Cells)

Fill Condition	d_W[1] (ft)	d_S[2] (ft)	P[3] (psf)	t[4] (in)	t[4] (m)
Interim - 50'	50	3	3,698	0.189	0.005
Interim - 100'	100	3	7,048	0.178	0.005
Interim - 150'	150	3	10,398	0.167	0.004
Interim - 170'	170	3	11,738	0.158	0.004
Closed	170	6.5	12,144	0.156	0.004

Table 1.2 - Geocomposite Thickness (250 mil - Undeveloped Cells)

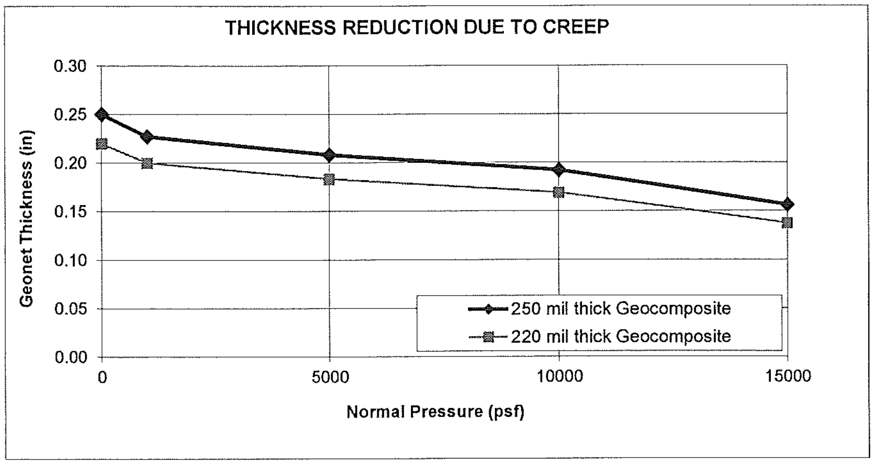
Fill Condition	d_W[1] (ft)	d_S[2] (ft)	P[3] (psf)	t[4] (in)	t[4] (m)
Active - 10'	10	2	902	0.230	0.006
Interim - 50'	50	3	3,698	0.214	0.005
Interim - 100'	100	3	7,048	0.202	0.005
Interim - 150'	150	3	10,398	0.189	0.005
Interim - 170'	170	3	11,738	0.180	0.005
Closed	170	6.5	12,144	0.177	0.004

[1] d_W is the depth of waste and daily cover soil above the geocomposite leachate collection layer.

[2] d_S is the depth of soil (protective cover, intermediate cover, or final cover) above the geocomposite leachate collection layer.

[3] P is the pressure on the geocomposite leachate collection layer due to the weight of the waste and soil.

[4] t is the thickness of the geocomposite leachate collection layer after being subjected to compression based on the chart on the next page adapted from Reference 4.



2. Reduction Factors and Factor of Safety for Strength and Environmental Conditions

Table 2 - Reduction Factors and Factor of Safety

Reduction Factors[1]		Fill Condition: Active (10'/50' Waste)	Interim (100' Waste)	Interim (150' Waste)	Interim (170' Waste)	Closed Final Cover
RF_{IN}	Delayed Intrusion	1.1	1.1	1.1	1.1	1.1
RF_{CC}	Chemical Clogging	1.0	1.5	1.6	1.8	2.0
RF_{BC}	Biological Clogging	1.0	1.1	1.1	1.2	1.3
Total Reduction Factor[2]		1.10	1.82	1.94	2.38	2.86

Overall Factor of Safety to Account For Uncertainties	2.0	2.0	2.0	2.0	2.0
Overall Reduction Factor (ORF)[3]	2.20	3.63	3.87	4.75	5.72

[1] Values are obtained from References 1, 2, and 3.

[2] The Total Reduction Factors are a product of all the reduction factors for each fill condition.

[3] The Overall Reduction Factors are a product of the Total Reduction Factor and Overall Factor of Safety to Account For Uncertainties for each fill condition.

3. Manufacturer's Transmissivity Data

The required minimum transmissivity for the 250-mil-thick single-sided geocomposite with 6 oz/sy is shown on Sheet IIIC-A-10. The transmissivity of the 220-mil-thick single-sided geocomposite with 8 oz/sy geotextile is shown on Sheet IIIC-A-11 (used in the developed cells).

4. Compute the Design Transmissivity (T) of the Geocomposite Leachate Collection Layer:

Table 3.1 - Estimate the Transmissivity (220 mil and 8 oz/sy for the Developed Cells)

Fill Condition	d_W[1] (ft)	P[2] (psf)	t[3] (in)	T[4] (m^2/s)	ORF[5]	T_{DES}[6] (m^2/s)	k[7] (cm/s)
Interim - 50'	50	3,698	0.189	1.17E-03	2.20	5.32E-04	11.08
Interim - 100'	100	7,048	0.178	9.36E-04	3.63	2.58E-04	5.70
Interim - 150'	150	10,398	0.167	8.27E-04	3.87	2.14E-04	5.04
Interim - 170'	170	11,738	0.158	7.53E-04	4.75	1.58E-04	3.95
Closed	170	12,144	0.156	7.32E-04	5.72	1.28E-04	3.23

Table 3.2 - Estimate the Transmissivity (250 mil and 6 oz/sy for the Undeveloped Cells)

Fill Condition	d_W[1] (ft)	P[2] (psf)	t[3] (in)	T[4] (m^2/s)	ORF[5]	T_{DES}[6] (m^2/s)	k[7] (cm/s)
Active - 10'	10	902	0.230	3.85E-03	2.20	1.75E-03	29.96
Interim - 50'	50	3,698	0.214	2.63E-03	2.20	1.20E-03	21.99
Interim - 100'	100	7,048	0.202	1.67E-03	3.63	4.60E-04	8.97
Interim - 150'	150	10,398	0.189	1.08E-03	3.87	2.79E-04	5.81
Interim - 170'	170	11,738	0.180	9.61E-04	4.75	2.02E-04	4.42
Closed	170	12,144	0.177	9.27E-04	5.72	1.62E-04	3.60

[1] d_W is the depth of waste above the geocomposite leachate collection layer.

[2] P is the pressure on the geocomposite leachate collection layer due to the weight of the waste and soil from Tables 1.1 and 1.2 for 220 mil and 250 mil drainage geocomposites.

[3] t is the calculated geocomposite leachate collection layer thickness from Tables 1.1 and 1.2 for 220 mil and 250 mil drainage geocomposites.

[4] T is obtained from the specified transmissivity values for a representative geocomposite leachate collection layer (6 oz/sy polypropylene geotextile with 250-mil-thick geonet and 8 oz/sy polypropylene geotextile with 220 mil) as shown on Sheets IIIC-A-10 and IIIC-A-11.

[5] ORF is the Overall Reduction Factor obtained from Table 2.

[6] T_{DES} is the design transmissivity value calculated using the following equation:

$$T_{DES} = T / ORF$$

[7] k is hydraulic conductivity and calculated using the following equation:

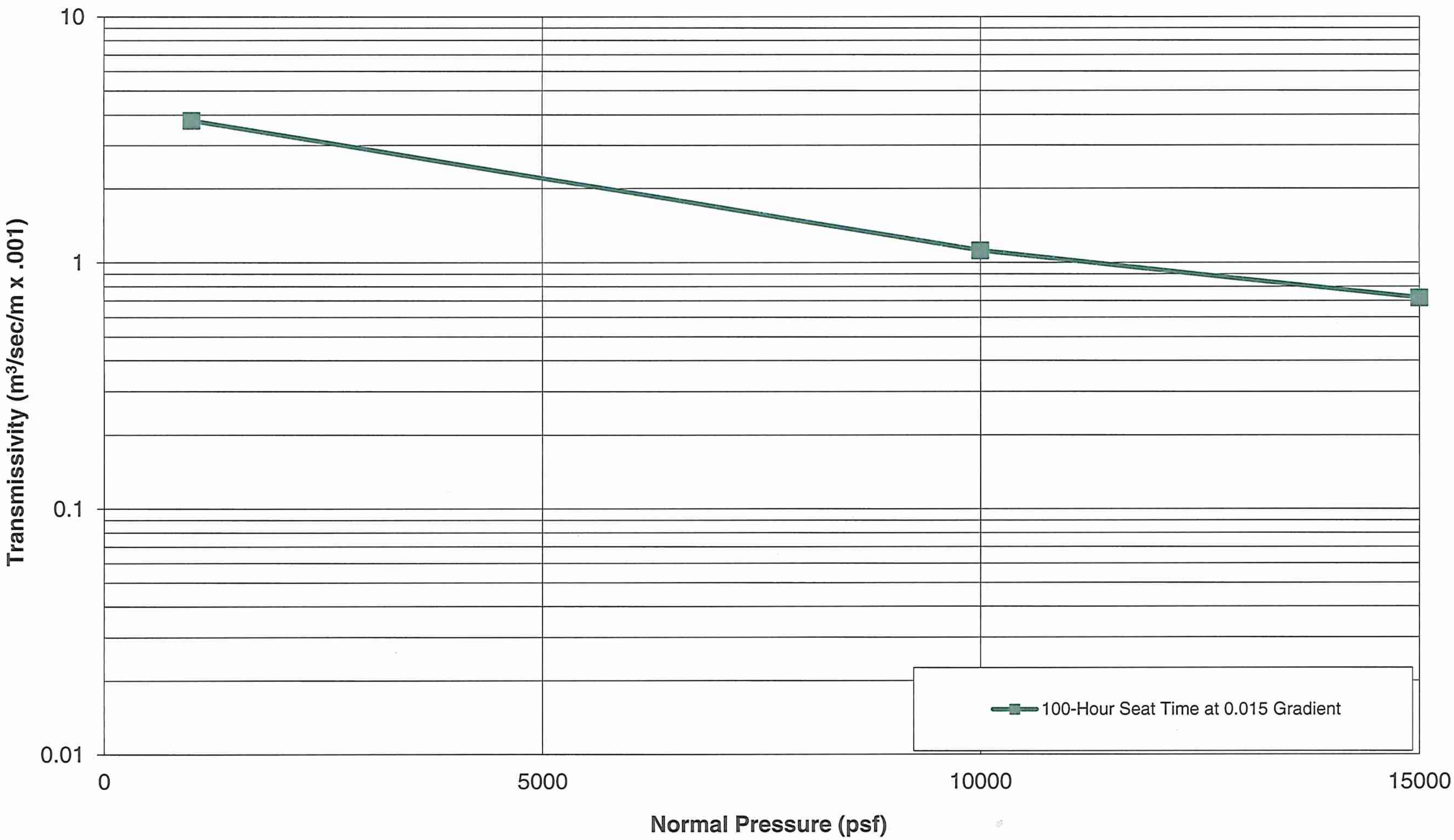
$$k = T_{DES}/t$$

5. Specify drainage geocomposite properties for undeveloped areas.

As shown on the HELP model summary sheets, a geocomposite with characteristics similar to the graphs shown on IIIC-A-10 will provide a drainage layer that will maintain less than twelve inches of head on the liner system.

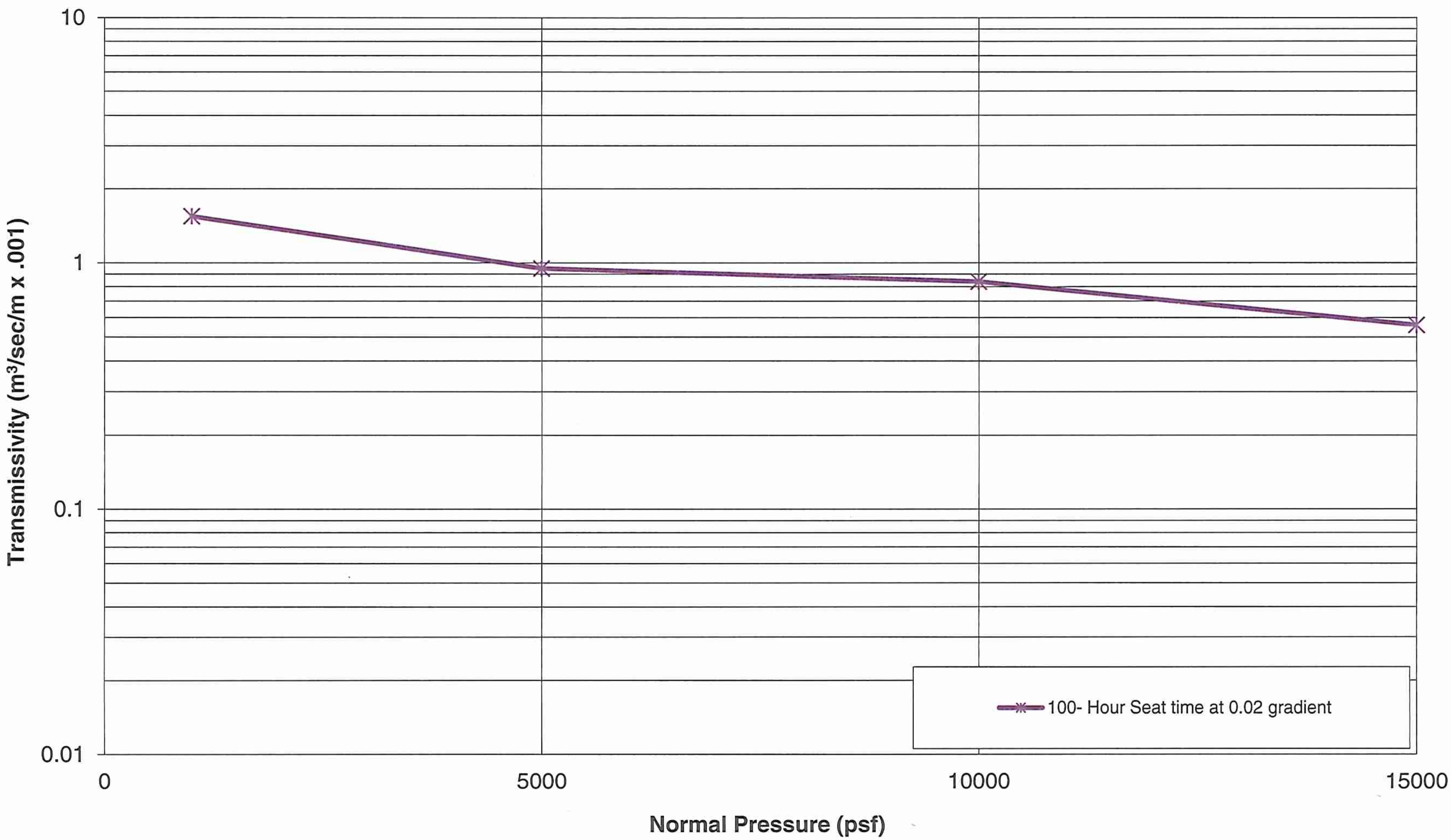
The drainage geocomposite required transmissivity values will be measured at a gradient of 0.015 under normal pressures of 1,000, 5,000 and 12,144 (or higher) psf, boundary conditions consisting of soil/geocomposite/geomembrane with minimum seating time of 100 hours and will be run for the first 100,000 square feet of liner construction. For each additional 100,000 square feet of single-sided geocomposite placement area, one additional transmissivity test will be run under the maximum normal stress (i.e., 12,144 psf or higher) with all the same assumptions as the first three tests. The minimum transmissivity will be 9.27 x10^{-4} m^2/s.

TRANSMISSIVITY OF SINGLE-SIDED GEOCOMPOSITE
6 oz/sy Polypropylene Geotextile with 250 mil Drainage Net
(Soil/Geocomposite/Geomembrane)



P:\Solid waste\Republic\Hardin County\Expansion\Part III\Appendix IIIC\IIIC-A\ Transmissivity curve.xls

TRANSMISSIVITY OF SINGLE-SIDED GEOCOMPOSITE
8 oz/sy Polypropylene Geotextile with 220 mil Drainage Net
(Soil/Geocomposite/Geomembrane)



HARDIN COUNTY LANDFILL
0120-758-11-02
HELP VERSION 3.07 SUMMARY SHEET
UNDEVELOPED CELLS

		ACTIVE (10 FT WASTE)	INTERIM (50 FT WASTE)	INTERIM (100 FT WASTE)	INTERIM (150 FT WASTE)	INTERIM (170 FT WASTE)	CLOSED (170 FT WASTE)
GENERAL INFORMATION	Case No.	1	2	3	4	5	6
	No. of Years	1	10	20	10	5	30
	Ground Cover	BARE	FAIR	FAIR	FAIR	FAIR	GOOD
	SCS Runoff Curve No.	80.3	87.1	87.1	87.1	87.6	81.6
	Model Area (acre)	1	1	1	1	1	1
	Runoff Area (%)	0	70	80	80	90	100
	Maximum Leaf Area Index	0.0	2.0	2.0	2.0	2.0	4.5
	Evaporative Zone Depth (inch)	10	10	10	10	10	18
TOPSOIL LAYER (Texture = 10)	Thickness (in)						24
	Porosity (vol/vol)						0.3980
	Field Capacity (vol/vol)						0.2440
	Wilting Point (vol/vol)						0.1360
	Init. Moisture Content (vol/vol)						0.2440
	Hyd. Conductivity (cm/s)						1.2E-04
FLEXIBLE MEMBRANE LINER (Texture = 36)	Thickness (in)						0.04
	Hyd. Conductivity (cm/s)						4.0E-13
	Pinhole Density (holes/acre)						1
	Install. Defects (holes/acre)						4
	Placement Quality						GOOD
INFILTRATION LAYER (Texture = 0)	Thickness (in)						18
	Porosity (vol/vol)						0.4270
	Field Capacity (vol/vol)						0.4180
	Wilting Point (vol/vol)						0.3670
	Init. Moisture Content (vol/vol)						0.4270
	Hyd. Conductivity (cm/s)						1.0E-05
INTERMEDIATE COVER (Texture = 11)	Thickness (in)		12	12	12	12	12
	Porosity (vol/vol)		0.4640	0.4640	0.4640	0.4640	0.4640
	Field Capacity (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100
	Wilting Point (vol/vol)		0.1870	0.1870	0.1870	0.1870	0.1870
	Init. Moisture Content (vol/vol)		0.3100	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)		6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05
WASTE TOP[3] (Texture = 0)	Thickness (in)	120	600	1200	1500	1500	1500
	Porosity (vol/vol)	0.6376	0.6376	0.6247	0.6148	0.6148	0.6148
	Field Capacity (vol/vol)	0.5185	0.5185	0.5144	0.5114	0.5114	0.5114
	Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)	0.2500	0.2500	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
WASTE BOTTOM[3] (Texture = 0)	Thickness (in)				300	540	540
	Porosity (vol/vol)				0.5539	0.5461	0.5461
	Field Capacity (vol/vol)				0.4945	0.4923	0.4923
	Wilting Point (vol/vol)				0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)				0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)				1.0E-04	1.0E-04	1.0E-04
PROTECTIVE COVER (Texture = 10)	Thickness (in)	24	24	24	24	24	24
	Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980	0.3980	0.3980
	Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360	0.1360	0.1360
	Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440	0.2440
	Hyd. Conductivity (cm/s)	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04	1.2E-04
LEACHATE COLLECTION LAYER (Texture = 0)	Thickness (in)	0.230	0.214	0.202	0.189	0.180	0.177
	Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500	0.8500	0.8500
	Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
	Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050	0.0050	0.0050
	Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
	Hyd. Conductivity (cm/s)	29.96	21.99	8.97	5.81	4.42	3.60
	Slope[1] (%)	1.5	1.5	1.5	1.5	1.5	1.5
	Slope Length (ft)	230	230	230	230	230	230
FLEXIBLE MEMBRANE LINER (Texture = 35)	Thickness (in)	0.06	0.06	0.06	0.06	0.06	0.06
	Hyd. Conductivity (cm/s)	2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13
	Pinhole Density (holes/acre)	0	0	0	0	0	0
	Install. Defects (holes/acre)	0	0	0	0	0	0
	Placement Quality	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD
COMPACTED CLAY LINER (Texture = 16)	Thickness (in)	24	24	24	24	24	24
	Porosity (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270
	Field Capacity (vol/vol)	0.4180	0.4180	0.4180	0.4180	0.4180	0.4180
	Wilting Point (vol/vol)	0.3670	0.3670	0.3670	0.3670	0.3670	0.3670
	Init. Moisture Content (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270	0.4270
	Hyd. Conductivity (cm/s)	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07
PRECIPITATION	Average Annual (in)	61.89	61.80	61.62	61.80	61.71	60.35
RUNOFF	Average Annual (in)	0.00	8.16	8.31	9.18	10.26	20.06
EVAPOTRANSPIRATION	Average Annual (in)	33.86	30.27	30.02	29.91	29.20	37.84
LATERAL DRAINAGE COLLECTED	Average Annual (cf/year)	7,959.5	34,436.5	54,929.1	15,509.7	10,248.1	4,163.7
	Peak Daily (cf/day)	109.2	508.6	1203.3	109.7	53.0	33.6
HEAD ON LINER	Average Annual (in)	0.001	0.003	0.012	0.005	0.005	0.002
	Peak Daily (in)	0.006	0.034	0.196	0.028	0.018	0.013

[1] The slope of the leachate collection layer is conservatively selected considering the settlement analysis for the undeveloped area as presented in Appendix IIIE.

[2] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

Prep By: MDM
Date: 12/5/2017

Chkd By: NT
Date: 12/5/2017

HARDIN COUNTY LANDFILL
0120-758-11-02
HELP VERSION 3.07 SUMMARY SHEET
DEVELOPED CELLS

		INTERIM (50 FT WASTE)	INTERIM (100 FT WASTE)	INTERIM (150 FT WASTE)	INTERIM (170 FT WASTE)	CLOSED (170 FT WASTE)
GENERAL	Case No.	1	2	3	4	5
INFORMATION	No. of Years	10	20	10	5	30
	Ground Cover	FAIR	FAIR	FAIR	FAIR	GOOD
	SCS Runoff Curve No.	87.1	87.1	87.1	87.6	81.6
	Model Area (acre)	1	1	1	1	1
	Runoff Area (%)	70	80	80	90	100
	Maximum Leaf Area Index	2.0	2.0	2.0	2.0	4.5
	Evaporative Zone Depth (inch)	10	10	10	10	18
TOPSOIL	Thickness (in)					24
LAYER	Porosity (vol/vol)					0.3980
(Texture = 10)	Field Capacity (vol/vol)					0.2440
	Wilting Point (vol/vol)					0.1360
	Init. Moisture Content (vol/vol)					0.2440
	Hyd. Conductivity (cm/s)					1.2E-04
FLEXIBLE	Thickness (in)					0.04
MEMBRANE	Hyd. Conductivity (cm/s)					4.0E-13
LINER	Pinhole Density (holes/acre)					1
(Texture = 36)	Install. Defects (holes/acre)					4
	Placement Quality					GOOD
INFILTRATION	Thickness (in)					18
LAYER	Porosity (vol/vol)					0.4270
(Texture = 0)	Field Capacity (vol/vol)					0.4180
	Wilting Point (vol/vol)					0.3670
	Init. Moisture Content (vol/vol)					0.4270
	Hyd. Conductivity (cm/s)					1.0E-05
INTERMEDIATE	Thickness (in)	12	12	12	12	12
COVER	Porosity (vol/vol)	0.4640	0.4640	0.4640	0.4640	0.4640
(Texture = 11)	Field Capacity (vol/vol)	0.3100	0.3100	0.3100	0.3100	0.3100
	Wilting Point (vol/vol)	0.1870	0.1870	0.1870	0.1870	0.1870
	Init. Moisture Content (vol/vol)	0.3100	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)	6.4E-05	6.4E-05	6.4E-05	6.4E-05	6.4E-05
WASTE TOP[2]	Thickness (in)	600	1200	1500	1500	1500
(Texture = 0)	Porosity (vol/vol)	0.6376	0.6247	0.6148	0.6148	0.6148
	Field Capacity (vol/vol)	0.5185	0.5144	0.5114	0.5114	0.5114
	Wilting Point (vol/vol)	0.0770	0.0770	0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)	0.2500	0.3100	0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)	1.0E-03	1.0E-03	1.0E-03	1.0E-03	1.0E-03
WASTE BOTTOM[2]	Thickness (in)			300	540	540
(Texture = 0)	Porosity (vol/vol)			0.5539	0.5461	0.5461
	Field Capacity (vol/vol)			0.4945	0.4923	0.4923
	Wilting Point (vol/vol)			0.0770	0.0770	0.0770
	Init. Moisture Content (vol/vol)			0.3100	0.3100	0.3100
	Hyd. Conductivity (cm/s)			1.0E-04	1.0E-04	1.0E-04
PROTECTIVE	Thickness (in)	24	24	24	24	24
COVER	Porosity (vol/vol)	0.3980	0.3980	0.3980	0.3980	0.3980
(Texture = 0)	Field Capacity (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440
	Wilting Point (vol/vol)	0.1360	0.1360	0.1360	0.1360	0.1360
	Init. Moisture Content (vol/vol)	0.2440	0.2440	0.2440	0.2440	0.2440
	Hyd. Conductivity (cm/s)	8.3E-06	3.7E-06	3.0E-06	2.8E-06	2.8E-06
LEACHATE	Thickness (in)	0.189	0.178	0.167	0.158	0.156
COLLECTION	Porosity (vol/vol)	0.8500	0.8500	0.8500	0.8500	0.8500
LAYER	Field Capacity (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100
(Texture = 0)	Wilting Point (vol/vol)	0.0050	0.0050	0.0050	0.0050	0.0050
	Init. Moisture Content (vol/vol)	0.0100	0.0100	0.0100	0.0100	0.0100
	Hyd. Conductivity (cm/s)	11.08	5.70	5.04	3.95	3.23
	Slope[1] (%)	2.0	2.0	2.0	2.0	2.0
	Slope Length (ft)	300	300	300	300	300
FLEXIBLE	Thickness (in)	0.06	0.06	0.06	0.06	0.06
MEMBRANE	Hyd. Conductivity (cm/s)	2.0E-13	2.0E-13	2.0E-13	2.0E-13	2.0E-13
LINER	Pinhole Density (holes/acre)	0	0	0	0	0
(Texture = 35)	Install. Defects (holes/acre)	0	0	0	0	0
	Placement Quality	GOOD	GOOD	GOOD	GOOD	GOOD
COMPACTED	Thickness (in)	24	24	24	24	24
CLAY LINER	Porosity (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270
(Texture = 16)	Field Capacity (vol/vol)	0.4180	0.4180	0.4180	0.4180	0.4180
	Wilting Point (vol/vol)	0.3670	0.3670	0.3670	0.3670	0.3670
	Init. Moisture Content (vol/vol)	0.4270	0.4270	0.4270	0.4270	0.4270
	Hyd. Conductivity (cm/s)	1.0E-07	1.0E-07	1.0E-07	1.0E-07	1.0E-07
PRECIPITATION	Average Annual (in)	61.80	61.62	61.80	61.71	60.35
RUNOFF	Average Annual (in)	8.00	8.31	9.18	10.26	22.06
EVAPOTRANSPIRATION	Average Annual (in)	30.07	30.02	29.91	29.20	37.84
LATERAL	Average Annual (cf/year)	26,689.6	38,762.7	362.7	121.0	249.2
DRAINAGE COLLECTED	Peak Daily (cf/day)	1024.8	456.9	3.1	1.2	1.1
HEAD ON LINER	Average Annual (in)	0.005	0.014	0.002	0.000	0.000
	Peak Daily (in)	0.133	0.116	0.008	0.007	0.001

[1] The slope of the leachate collection layer is conservatively selected considering the settlement analysis for the developed area as presented in Appendix IIIE.

[2] The field capacity and porosity values for the waste layer were obtained from: Zornberg, Jorge G. et. al, *Retention of Free Liquids in Landfills Undergoing Vertical Expansion.* Journal of Geotechnical and Geoenvironmental Engineering, July 1999, pp. 583-594.

HELP MODEL OUTPUT FOR UNDEVELOPED CELLS

HELP MODEL FOR UNDEVELOPED CELLS
(10 FT WASTE)

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     C:\HELP 307\HCLF\AC\DATA4.D4
TEMPERATURE DATA FILE:       C:\HELP 307\HCLF\AC\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\HELP 307\HCLF\AC\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP 307\HCLF\AC\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP 307\HCLF\AC\DATA10.D10
OUTPUT DATA FILE:            C:\HELP 307\HCLF\AC\AC.OUT


TIME:  14:30     DATE:   2/ 9/2017


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

     TITLE:  IESI HARDIN COUNTY LF - ACTIVE, 10 FT WASTE (250 MIL)

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


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


                                   LAYER  1
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
           THICKNESS                    =     120.00   INCHES
           POROSITY                     =       0.6376 VOL/VOL
           FIELD CAPACITY               =       0.5185 VOL/VOL
           WILTING POINT                =       0.0770 VOL/VOL
           INITIAL SOIL WATER CONTENT   =       0.2500 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                   LAYER  2
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  10
```

THICKNESS	=	24.00 INCHES
POROSITY	=	0.3980 VOL/VOL
FIELD CAPACITY	=	0.2440 VOL/VOL
WILTING POINT	=	0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03 CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.23 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	29.9599991000 CM/SEC
SLOPE	=	1.50 PERCENT
DRAINAGE LENGTH	=	280.0 FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 5

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #18 WITH BARE GROUND CONDITIONS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	80.30	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.500	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	6.376	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.770	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	46.106	INCHES
TOTAL INITIAL WATER	=	46.106	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM HOUSTON TEXAS

STATION LATITUDE	=	29.39 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	31
END OF GROWING SEASON (JULIAN DATE)	=	362
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	7.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.93	4.45	4.29	3.51	4.63	6.82
4.76	4.66	4.59	6.55	6.17	6.34

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
51.40	54.50	61.00	68.70	74.90	80.60
83.10	82.60	78.40	69.70	60.10	54.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS AND STATION LATITUDE = 29.39 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 20 THROUGH 20

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	4.52	5.03	4.51	2.50	8.40	5.03
	3.89	1.88	0.93	7.28	9.53	8.39
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	2.547	1.311	3.632	2.004	5.443	5.406
	3.090	0.458	1.471	3.530	2.818	2.146
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 3						
TOTALS	0.0000	0.0000	0.0183	0.0465	0.0722	0.1681
	0.2089	0.2274	0.2103	0.2527	0.3624	0.6259
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 5						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0000	0.0000	0.0001	0.0002	0.0003	0.0006
	0.0007	0.0008	0.0008	0.0009	0.0013	0.0022
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 20 THROUGH 20

	INCHES		CU. FEET	PERCENT
PRECIPITATION	61.89	(0.000)	224660.7	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	33.856	(0.0000)	122898.33	54.704
LATERAL DRAINAGE COLLECTED FROM LAYER 3	2.19270	(0.00000)	7959.507	3.54290
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00000	(0.00000)	0.007	0.00000
AVERAGE HEAD ON TOP OF LAYER 4	0.001	(0.000)		
CHANGE IN WATER STORAGE	25.841	(0.0000)	93802.81	41.753

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PEAK DAILY VALUES FOR YEARS 20 THROUGH 20

	(INCHES)	(CU. FT.)
PRECIPITATION	3.49	12668.700
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 3	0.03008	109.18493
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 4	0.003	
MAXIMUM HEAD ON TOP OF LAYER 4	0.006	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	38.7 FEET	
SNOW WATER	0.31	1126.4432
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.4124
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.0770

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

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

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FINAL WATER STORAGE AT END OF YEAR 20

LAYER	(INCHES)	(VOL/VOL)
1	55.0089	0.4584
2	6.6859	0.2786
3	0.0045	0.0195
4	0.0000	0.0000
5	10.2480	0.4270
SNOW WATER	0.000	

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HELP MODEL FOR UNDEVELOPED CELLS
(50 FT WASTE)

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**               HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                 **
**                DEVELOPED BY ENVIRONMENTAL LABORATORY                     **
**                  USAE WATERWAYS EXPERIMENT STATION                       **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY             **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     C:\HELP 307\HCLF\I50\DATA4.D4
TEMPERATURE DATA FILE:       C:\HELP 307\HCLF\I50\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\HELP 307\HCLF\I50\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP 307\HCLF\I50\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP 307\HCLF\I50\DATA10.D10
OUTPUT DATA FILE:            C:\HELP 307\HCLF\I50\I50.OUT


TIME:  14:30     DATE:   2/ 9/2017


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     TITLE:  IESI HARDIN COUNTY LF - INTERIM, 50 FT WASTE (250 MIL)

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


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  11
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4640 VOL/VOL
           FIELD CAPACITY             =      0.3100 VOL/VOL
           WILTING POINT              =      0.1870 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.3100 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.639999998000E-04 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                  LAYER  2
                                  --------
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          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                     =     600.00    INCHES
POROSITY                      =       0.6376 VOL/VOL
FIELD CAPACITY                =       0.5185 VOL/VOL
WILTING POINT                 =       0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT    =       0.2500 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.100000005000E-02 CM/SEC


                        LAYER  3
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                     =      24.00    INCHES
POROSITY                      =       0.3980 VOL/VOL
FIELD CAPACITY                =       0.2440 VOL/VOL
WILTING POINT                 =       0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT    =       0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.119999997000E-03 CM/SEC


                        LAYER  4
                        --------

            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                     =       0.21    INCHES
POROSITY                      =       0.8500 VOL/VOL
FIELD CAPACITY                =       0.0100 VOL/VOL
WILTING POINT                 =       0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT    =       0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =   21.9899998000       CM/SEC
SLOPE                         =       1.50    PERCENT
DRAINAGE LENGTH               =     230.0     FEET


                        LAYER  5
                        --------

            TYPE 4 - FLEXIBLE MEMBRANE LINER
              MATERIAL TEXTURE NUMBER  35
THICKNESS                     =       0.06    INCHES
POROSITY                      =       0.0000 VOL/VOL
FIELD CAPACITY                =       0.0000 VOL/VOL
WILTING POINT                 =       0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT    =       0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY           =       0.00    HOLES/ACRE
FML INSTALLATION DEFECTS      =       0.00    HOLES/ACRE
FML PLACEMENT QUALITY         =  3 - GOOD


                        LAYER  6
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              TYPE 3 - BARRIER SOIL LINER
              MATERIAL TEXTURE NUMBER  16
THICKNESS                      =     24.00    INCHES
POROSITY                       =      0.4270 VOL/VOL
FIELD CAPACITY                 =      0.4180 VOL/VOL
WILTING POINT                  =      0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT     =      0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.      =  0.100000001000E-06 CM/SEC
```

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

NOTE:  SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT
         SOIL DATA BASE USING SOIL TEXTURE #11 WITH A
         FAIR STAND OF GRASS, A SURFACE SLOPE OF  2.%
         AND A SLOPE LENGTH OF  200. FEET.

SCS RUNOFF CURVE NUMBER             =      87.10
FRACTION OF AREA ALLOWING RUNOFF    =      70.0    PERCENT
AREA PROJECTED ON HORIZONTAL PLANE  =       1.000  ACRES
EVAPORATIVE ZONE DEPTH              =      10.0    INCHES
INITIAL WATER IN EVAPORATIVE ZONE   =       3.100  INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE  =       4.640  INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE  =       1.870  INCHES
INITIAL SNOW WATER                  =       0.000  INCHES
INITIAL WATER IN LAYER MATERIALS    =     169.826  INCHES
TOTAL INITIAL WATER                 =     169.826  INCHES
TOTAL SUBSURFACE INFLOW             =       0.00   INCHES/YEAR
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              EVAPOTRANSPIRATION AND WEATHER DATA
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NOTE:  EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
         HOUSTON                TEXAS

    STATION LATITUDE                          =  29.39 DEGREES
    MAXIMUM LEAF AREA INDEX                   =   2.00
    START OF GROWING SEASON (JULIAN DATE)     =    31
    END OF GROWING SEASON (JULIAN DATE)       =   362
    EVAPORATIVE ZONE DEPTH                    =  10.0  INCHES
    AVERAGE ANNUAL WIND SPEED                 =   7.80 MPH
    AVERAGE 1ST QUARTER RELATIVE HUMIDITY     =  74.00 %
    AVERAGE 2ND QUARTER RELATIVE HUMIDITY     =  76.00 %
    AVERAGE 3RD QUARTER RELATIVE HUMIDITY     =  77.00 %
    AVERAGE 4TH QUARTER RELATIVE HUMIDITY     =  77.00 %
```

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NOTE:  PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
         COEFFICIENTS FOR    HOUSTON              TEXAS

         NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

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

4.93	4.45	4.29	3.51	4.63	6.82
4.76	4.66	4.59	6.55	6.17	6.34

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
51.40	54.50	61.00	68.70	74.90	80.60
83.10	82.60	78.40	69.70	60.10	54.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS
AND STATION LATITUDE = 29.39 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2 THROUGH 11

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.28	3.84	4.38	2.85	3.59	8.53
	5.55	4.28	5.42	3.61	9.02	5.46
STD. DEVIATIONS	3.49	1.69	3.25	1.07	1.89	7.99
	2.88	2.83	1.57	2.87	4.89	2.56
RUNOFF						
TOTALS	0.572	0.240	0.364	0.107	0.425	2.215
	0.410	0.448	0.373	0.472	1.968	0.562
STD. DEVIATIONS	0.688	0.285	0.486	0.147	0.562	2.712
	0.469	0.638	0.330	0.514	1.641	0.435
EVAPOTRANSPIRATION						
TOTALS	1.790	2.189	2.902	2.956	2.416	3.255
	3.630	3.079	3.592	1.923	1.518	1.015
STD. DEVIATIONS	0.140	0.239	0.644	1.068	1.041	1.916
	1.282	1.298	1.134	0.870	0.176	0.159
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	0.7567	0.7540	0.8193	0.7464	0.7652	0.7785
	0.8443	0.7600	0.7736	0.7977	0.8241	0.8668

STD. DEVIATIONS	0.6390	0.6237	0.6920	0.6074	0.6054	0.6295
	0.7377	0.5894	0.5978	0.5987	0.5951	0.6253

PERCOLATION/LEAKAGE THROUGH LAYER 6

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

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0030	0.0033	0.0033	0.0031	0.0030	0.0032
	0.0034	0.0030	0.0032	0.0032	0.0034	0.0034
STD. DEVIATIONS	0.0025	0.0027	0.0027	0.0025	0.0024	0.0026
	0.0029	0.0023	0.0025	0.0024	0.0024	0.0025

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2 THROUGH 11

	INCHES	CU. FEET	PERCENT
PRECIPITATION	61.80 (6.254)	224344.9	100.00
RUNOFF	8.157 (2.7186)	29608.84	13.198
EVAPOTRANSPIRATION	30.265 (2.2286)	109860.95	48.970
LATERAL DRAINAGE COLLECTED FROM LAYER 4	9.48664 (7.39278)	34436.516	15.34981
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.007	0.00000
AVERAGE HEAD ON TOP OF LAYER 5	0.003 (0.002)		
CHANGE IN WATER STORAGE	13.895 (10.0075)	50438.55	22.483

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PEAK DAILY VALUES FOR YEARS 2 THROUGH 11

	(INCHES)	(CU. FT.)
PRECIPITATION	7.40	26862.000
RUNOFF	4.131	14994.5732
DRAINAGE COLLECTED FROM LAYER 4	0.14010	508.56409
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 5	0.017	
MAXIMUM HEAD ON TOP OF LAYER 5	0.034	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	1.0 FEET	
SNOW WATER	2.33	8459.0430
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4605	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870	

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

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

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FINAL WATER STORAGE AT END OF YEAR 11

LAYER	(INCHES)	(VOL/VOL)
1	3.7569	0.3131
2	287.9026	0.4798
3	6.8597	0.2858
4	0.0081	0.0381
5	0.0000	0.0000
6	10.2480	0.4270
SNOW WATER	0.000	

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HELP MODEL FOR UNDEVELOPED CELLS
(100 FT WASTE)

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**               HELP MODEL VERSION 3.07   (1 NOVEMBER 1997)                **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP 307\HCLF\I100\DATA4.D4
TEMPERATURE DATA FILE:        C:\HELP 307\HCLF\I100\DATA7.D7
SOLAR RADIATION DATA FILE:    C:\HELP 307\HCLF\I100\DATA13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP 307\HCLF\I100\DATA11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP 307\HCLF\I100\DATA10.D10
OUTPUT DATA FILE:             C:\HELP 307\HCLF\I100\I100.OUT


TIME:  14:23     DATE:   2/ 9/2017


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     TITLE:  HARDIN COUNTY LF - INTERIM, 100 FT WASTE (250 MIL)

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


                                  LAYER  1
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
           THICKNESS                 =      12.00   INCHES
           POROSITY                  =       0.4640 VOL/VOL
           FIELD CAPACITY            =       0.3100 VOL/VOL
           WILTING POINT             =       0.1870 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.3100 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  = 0.639999998000E-04 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                  LAYER  2
                                  --------
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	1200.00	INCHES
POROSITY	=	0.6247	VOL/VOL
FIELD CAPACITY	=	0.5144	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10

THICKNESS	=	24.00	INCHES
POROSITY	=	0.3980	VOL/VOL
FIELD CAPACITY	=	0.2440	VOL/VOL
WILTING POINT	=	0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2440	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03	CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.20	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	8.97000027000	CM/SEC
SLOPE	=	1.50	PERCENT
DRAINAGE LENGTH	=	230.0	FEET

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	87.10	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	391.826	INCHES
TOTAL INITIAL WATER	=	391.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM HOUSTON TEXAS

STATION LATITUDE	=	29.39	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	31	
END OF GROWING SEASON (JULIAN DATE)	=	362	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	76.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

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

4.93	4.45	4.29	3.51	4.63	6.82
4.76	4.66	4.59	6.55	6.17	6.34

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
51.40	54.50	61.00	68.70	74.90	80.60
83.10	82.60	78.40	69.70	60.10	54.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS AND STATION LATITUDE = 29.39 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 18 THROUGH 37

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	6.03	4.62	3.88	3.77	3.83	4.93
	4.90	4.38	4.38	7.25	7.24	6.41
STD. DEVIATIONS	3.27	3.07	2.07	2.41	2.45	3.58
	2.41	1.96	2.11	4.46	3.09	2.35
RUNOFF						
TOTALS	0.836	0.478	0.338	0.407	0.443	0.772
	0.500	0.240	0.326	1.648	1.405	0.913
STD. DEVIATIONS	1.137	0.711	0.731	0.666	0.553	1.002
	0.745	0.235	0.334	1.802	1.082	0.970
EVAPOTRANSPIRATION						
TOTALS	1.793	2.043	2.839	2.697	2.682	2.846
	3.831	3.361	3.131	2.237	1.434	1.122
STD. DEVIATIONS	0.113	0.447	0.724	1.031	1.019	1.389
	1.618	1.061	1.232	0.635	0.264	0.158
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	1.2824	1.1495	1.5139	1.1970	1.2180	1.1993
	1.2615	1.2250	1.1850	1.2696	1.2661	1.3646

STD. DEVIATIONS	0.7019	0.6095	0.8466	0.6215	0.6721	0.6031
	0.6508	0.6150	0.5935	0.6499	0.6350	0.6968

PERCOLATION/LEAKAGE THROUGH LAYER 6

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

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0125	0.0123	0.0147	0.0120	0.0118	0.0121
	0.0123	0.0119	0.0119	0.0124	0.0127	0.0133
STD. DEVIATIONS	0.0068	0.0065	0.0082	0.0062	0.0065	0.0061
	0.0063	0.0060	0.0060	0.0063	0.0064	0.0068

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 18 THROUGH 37

	INCHES		CU. FEET	PERCENT
PRECIPITATION	61.62	(8.865)	223677.0	100.00
RUNOFF	8.308	(2.5595)	30156.88	13.482
EVAPOTRANSPIRATION	30.017	(2.9763)	108960.11	48.713
LATERAL DRAINAGE COLLECTED FROM LAYER 4	15.13199	(7.43334)	54929.113	24.55734
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.009	0.00000
AVERAGE HEAD ON TOP OF LAYER 5	0.012	(0.006)		
CHANGE IN WATER STORAGE	8.163	(10.0628)	29630.87	13.247

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PEAK DAILY VALUES FOR YEARS 18 THROUGH 37

	(INCHES)	(CU. FT.)
PRECIPITATION	6.30	22869.000
RUNOFF	3.384	12284.6641
DRAINAGE COLLECTED FROM LAYER 4	0.33148	1203.26843
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 5	0.100	
MAXIMUM HEAD ON TOP OF LAYER 5	0.196	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	4.7 FEET	
SNOW WATER	1.90	6898.1431
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870	

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

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

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FINAL WATER STORAGE AT END OF YEAR 37

LAYER	(INCHES)	(VOL/VOL)
1	3.8512	0.3209
2	533.6903	0.4447
3	7.2447	0.3019
4	0.0471	0.2332
5	0.0000	0.0000
6	10.2480	0.4270
SNOW WATER	0.000	

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HELP MODEL FOR UNDEVELOPED CELLS
(150 FT WASTE)

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP 307\HCLF\I150\DATA4.D4
TEMPERATURE DATA FILE:        C:\HELP 307\HCLF\I150\DATA7.D7
SOLAR RADIATION DATA FILE:    C:\HELP 307\HCLF\I150\DATA13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP 307\HCLF\I150\DATA11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP 307\HCLF\I150\DATA10.D10
OUTPUT DATA FILE:             C:\HELP 307\HCLF\I150\I150.OUT


TIME:  14:27     DATE:   2/ 9/2017


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     TITLE:  IESI HARDIN COUNTY LF - INTERIM, 150 FT WASTE (250 MIL)

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


                                 LAYER  1
                                 --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
           THICKNESS                    =      12.00   INCHES
           POROSITY                     =       0.4640 VOL/VOL
           FIELD CAPACITY               =       0.3100 VOL/VOL
           WILTING POINT                =       0.1870 VOL/VOL
           INITIAL SOIL WATER CONTENT   =       0.3100 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.639999998000E-04 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                 LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	1500.00 INCHES
POROSITY	=	0.6148 VOL/VOL
FIELD CAPACITY	=	0.5114 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	300.00 INCHES
POROSITY	=	0.5539 VOL/VOL
FIELD CAPACITY	=	0.4945 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-04 CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10

THICKNESS	=	24.00 INCHES
POROSITY	=	0.3980 VOL/VOL
FIELD CAPACITY	=	0.2440 VOL/VOL
WILTING POINT	=	0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03 CM/SEC

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.19 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	5.80999994000 CM/SEC
SLOPE	=	1.50 PERCENT
DRAINAGE LENGTH	=	230.0 FEET

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35

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

LAYER 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	87.10	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	577.826	INCHES
TOTAL INITIAL WATER	=	577.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM HOUSTON TEXAS

STATION LATITUDE	=	29.39 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	31
END OF GROWING SEASON (JULIAN DATE)	=	362

EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	7.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.93	4.45	4.29	3.51	4.63	6.82
4.76	4.66	4.59	6.55	6.17	6.34

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
51.40	54.50	61.00	68.70	74.90	80.60
83.10	82.60	78.40	69.70	60.10	54.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS AND STATION LATITUDE = 29.39 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2 THROUGH 11

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.28	3.84	4.38	2.85	3.59	8.53
	5.55	4.28	5.42	3.61	9.02	5.46
STD. DEVIATIONS	3.49	1.69	3.25	1.07	1.89	7.99
	2.88	2.83	1.57	2.87	4.89	2.56
RUNOFF						
TOTALS	0.584	0.270	0.429	0.110	0.479	2.542
	0.468	0.523	0.390	0.566	2.231	0.587
STD. DEVIATIONS	0.701	0.324	0.580	0.144	0.631	3.015

	0.547	0.776	0.344	0.638	1.890	0.472

EVAPOTRANSPIRATION

TOTALS	1.805	2.172	2.884	2.910	2.393	3.152
	3.573	3.041	3.550	1.870	1.525	1.032
STD. DEVIATIONS	0.139	0.263	0.635	1.057	1.079	1.884
	1.258	1.243	1.149	0.871	0.184	0.162

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.3355	0.3205	0.3563	0.3484	0.3588	0.3530
	0.3640	0.3648	0.3509	0.3683	0.3641	0.3882
STD. DEVIATIONS	0.1606	0.1315	0.1424	0.1420	0.1442	0.1379
	0.1483	0.1481	0.1380	0.1472	0.1522	0.1576

PERCOLATION/LEAKAGE THROUGH LAYER 7

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

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0050	0.0053	0.0054	0.0054	0.0054	0.0055
	0.0055	0.0055	0.0054	0.0055	0.0057	0.0058
STD. DEVIATIONS	0.0024	0.0022	0.0021	0.0022	0.0022	0.0021
	0.0022	0.0022	0.0021	0.0022	0.0024	0.0024

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2 THROUGH 11

	INCHES		CU. FEET	PERCENT
PRECIPITATION	61.80	(6.254)	224344.9	100.00
RUNOFF	9.179	(3.1201)	33318.23	14.851
EVAPOTRANSPIRATION	29.906	(2.2013)	108557.95	48.389
LATERAL DRAINAGE COLLECTED FROM LAYER 5	4.27265	(1.74306)	15509.736	6.91335
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00000	(0.00000)	0.009	0.00000
AVERAGE HEAD ON TOP OF LAYER 6	0.005	(0.002)		
CHANGE IN WATER STORAGE	18.446	(5.3080)	66958.95	29.846

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PEAK DAILY VALUES FOR YEARS 2 THROUGH 11

	(INCHES)	(CU. FT.)
PRECIPITATION	7.40	26862.000
RUNOFF	4.480	16261.5049
DRAINAGE COLLECTED FROM LAYER 5	0.03021	109.67138
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 6	0.014	
MAXIMUM HEAD ON TOP OF LAYER 6	0.028	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	1.5 FEET	
SNOW WATER	2.33	8459.0430
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 11

LAYER	(INCHES)	(VOL/VOL)
1	3.7399	0.3117
2	627.0212	0.4180
3	114.7340	0.3824
4	6.5297	0.2721
5	0.0129	0.0683
6	0.0000	0.0000
7	10.2480	0.4270
SNOW WATER	0.000	

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HELP MODEL FOR UNDEVELOPED CELLS
(170 FT WASTE)

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**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     C:\HELP 307\HCLF\I170\DATA4.D4
TEMPERATURE DATA FILE:       C:\HELP 307\HCLF\I170\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\HELP 307\HCLF\I170\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP 307\HCLF\I170\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP 307\HCLF\I170\DATA10.D10
OUTPUT DATA FILE:            C:\HELP 307\HCLF\I170\I170.OUT


TIME:  14:28     DATE:   2/ 9/2017


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     TITLE:  IESI HARDIN COUNTY LF - INTERIM, 170 FT WASTE (250 MIL)

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


                                  LAYER  1
                                  --------

                       TYPE 1 - VERTICAL PERCOLATION LAYER
                           MATERIAL TEXTURE NUMBER  11
           THICKNESS                  =     12.00    INCHES
           POROSITY                   =      0.4640 VOL/VOL
           FIELD CAPACITY             =      0.3100 VOL/VOL
           WILTING POINT              =      0.1870 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.3100 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.639999998000E-04 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                  LAYER  2
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          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =   1500.00    INCHES
POROSITY                     =      0.6148 VOL/VOL
FIELD CAPACITY               =      0.5114 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                        LAYER  3
                        --------

          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =    540.00    INCHES
POROSITY                     =      0.5461 VOL/VOL
FIELD CAPACITY               =      0.4923 VOL/VOL
WILTING POINT                =      0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-04 CM/SEC


                        LAYER  4
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          TYPE 1 - VERTICAL PERCOLATION LAYER
              MATERIAL TEXTURE NUMBER  10
THICKNESS                    =     24.00    INCHES
POROSITY                     =      0.3980 VOL/VOL
FIELD CAPACITY               =      0.2440 VOL/VOL
WILTING POINT                =      0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.119999997000E-03 CM/SEC


                        LAYER  5
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            TYPE 2 - LATERAL DRAINAGE LAYER
              MATERIAL TEXTURE NUMBER   0
THICKNESS                    =      0.18    INCHES
POROSITY                     =      0.8500 VOL/VOL
FIELD CAPACITY               =      0.0100 VOL/VOL
WILTING POINT                =      0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT   =      0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   4.42000008000      CM/SEC
SLOPE                        =      1.50    PERCENT
DRAINAGE LENGTH              =    230.0     FEET


                        LAYER  6
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            TYPE 4 - FLEXIBLE MEMBRANE LINER
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MATERIAL TEXTURE NUMBER 35

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

LAYER 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 120. FEET.

SCS RUNOFF CURVE NUMBER	=	87.60	
FRACTION OF AREA ALLOWING RUNOFF	=	90.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	652.226	INCHES
TOTAL INITIAL WATER	=	652.226	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
HOUSTON TEXAS

STATION LATITUDE	=	29.39 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	31
END OF GROWING SEASON (JULIAN DATE)	=	362

EVAPORATIVE ZONE DEPTH = 10.0 INCHES
AVERAGE ANNUAL WIND SPEED = 7.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 74.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 76.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 77.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 77.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.93	4.45	4.29	3.51	4.63	6.82
4.76	4.66	4.59	6.55	6.17	6.34

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
51.40	54.50	61.00	68.70	74.90	80.60
83.10	82.60	78.40	69.70	60.10	54.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS AND STATION LATITUDE = 29.39 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 28 THROUGH 32

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	7.79	2.70	3.05	3.51	3.19	4.80
	5.59	4.15	3.61	8.72	8.50	6.10
STD. DEVIATIONS	3.48	1.03	1.09	2.62	1.86	4.39
	3.17	1.96	1.46	6.02	3.24	2.13
RUNOFF						
TOTALS	1.484	0.214	0.133	0.498	0.490	0.824
	0.858	0.390	0.236	2.273	1.893	0.968
STD. DEVIATIONS	1.821	0.393	0.169	0.720	0.665	1.021

	1.165	0.345	0.295	2.572	1.396	1.065

EVAPOTRANSPIRATION

TOTALS	1.783	2.253	2.761	2.547	2.316	2.582
	3.511	3.585	2.673	2.389	1.655	1.148
STD. DEVIATIONS	0.175	0.250	0.918	1.184	0.638	1.849
	2.117	0.745	0.509	0.409	0.101	0.131

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.2064	0.2140	0.2435	0.2345	0.2419	0.2364
	0.2428	0.2409	0.2295	0.2423	0.2399	0.2511
STD. DEVIATIONS	0.0762	0.0399	0.0370	0.0353	0.0369	0.0338
	0.0321	0.0300	0.0384	0.0417	0.0362	0.0373

PERCOLATION/LEAKAGE THROUGH LAYER 7

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

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0041	0.0046	0.0048	0.0048	0.0048	0.0048
	0.0048	0.0048	0.0047	0.0048	0.0049	0.0050
STD. DEVIATIONS	0.0015	0.0008	0.0007	0.0007	0.0007	0.0007
	0.0006	0.0006	0.0008	0.0008	0.0007	0.0007

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 28 THROUGH 32

	INCHES		CU. FEET	PERCENT
PRECIPITATION	61.71	(6.635)	223992.8	100.00
RUNOFF	10.261	(3.6375)	37248.73	16.629
EVAPOTRANSPIRATION	29.204	(3.5474)	106012.18	47.328
LATERAL DRAINAGE COLLECTED FROM LAYER 5	2.82316	(0.44756)	10248.088	4.57519
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00000	(0.00000)	0.009	0.00000
AVERAGE HEAD ON TOP OF LAYER 6	0.005	(0.001)		
CHANGE IN WATER STORAGE	19.417	(2.3656)	70483.86	31.467

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PEAK DAILY VALUES FOR YEARS 28 THROUGH 32

	(INCHES)	(CU. FT.)
PRECIPITATION	4.90	17787.000
RUNOFF	2.722	9881.7607
DRAINAGE COLLECTED FROM LAYER 5	0.01460	53.01102
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 6	0.009	
MAXIMUM HEAD ON TOP OF LAYER 6	0.018	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.76	2759.9431
MAXIMUM VEG. SOIL WATER (VOL/VOL)		0.4423
MINIMUM VEG. SOIL WATER (VOL/VOL)		0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 32

LAYER	(INCHES)	(VOL/VOL)
1	3.7778	0.3148
2	550.4328	0.3670
3	178.5622	0.3307
4	6.2832	0.2618
5	0.0068	0.0380
6	0.0000	0.0000
7	10.2480	0.4270
SNOW WATER	0.000	

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HELP MODEL FOR UNDEVELOPED CELLS (CLOSED)

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07   (1 NOVEMBER 1997)               **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     C:\HELP 307\HCLF\CL\DATA4.D4
TEMPERATURE DATA FILE:       C:\HELP 307\HCLF\CL\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\HELP 307\HCLF\CL\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP 307\HCLF\CL\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP 307\HCLF\CL\DATA10.D10
OUTPUT DATA FILE:            C:\HELP 307\HCLF\CL\CL.OUT


TIME:  14:29     DATE:   2/ 9/2017


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     TITLE:  IESI HARDIN COUNTY LF - CLOSED, 170 FT WASTE (250 MIL)

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


                                  LAYER  1
                                  --------

                       TYPE 1 - VERTICAL PERCOLATION LAYER
                           MATERIAL TEXTURE NUMBER  10
           THICKNESS                  =     24.00    INCHES
           POROSITY                   =      0.3980 VOL/VOL
           FIELD CAPACITY             =      0.2440 VOL/VOL
           WILTING POINT              =      0.1360 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.2440 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.119999997000E-03 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  5.00
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                  LAYER  2
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TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.04 INCHES
POROSITY	=	0.0000 VOL/VOL
FIELD CAPACITY	=	0.0000 VOL/VOL
WILTING POINT	=	0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY	=	1.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	4.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	3 - GOOD

LAYER 3

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05 CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 11

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4640 VOL/VOL
FIELD CAPACITY	=	0.3100 VOL/VOL
WILTING POINT	=	0.1870 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.639999998000E-04 CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	1500.00 INCHES
POROSITY	=	0.6148 VOL/VOL
FIELD CAPACITY	=	0.5114 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	540.00 INCHES
POROSITY	=	0.5461 VOL/VOL
FIELD CAPACITY	=	0.4923 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-04 CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10

THICKNESS	=	24.00 INCHES
POROSITY	=	0.3980 VOL/VOL
FIELD CAPACITY	=	0.2440 VOL/VOL
WILTING POINT	=	0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03 CM/SEC

LAYER 8

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.18 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	3.59999990000 CM/SEC
SLOPE	=	1.50 PERCENT
DRAINAGE LENGTH	=	230.0 FEET

LAYER 9

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 10

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 120. FEET.

SCS RUNOFF CURVE NUMBER	=	81.60	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	18.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	4.392	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	7.164	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.448	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	665.768	INCHES
TOTAL INITIAL WATER	=	665.768	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
HOUSTON TEXAS

STATION LATITUDE	=	29.39 DEGREES
MAXIMUM LEAF AREA INDEX	=	4.50
START OF GROWING SEASON (JULIAN DATE)	=	31
END OF GROWING SEASON (JULIAN DATE)	=	362
EVAPORATIVE ZONE DEPTH	=	18.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	7.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

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

-------	-------	-------	-------	-------	-------
4.93	4.45	4.29	3.51	4.63	6.82
4.76	4.66	4.59	6.55	6.17	6.34

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
51.40	54.50	61.00	68.70	74.90	80.60
83.10	82.60	78.40	69.70	60.10	54.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS AND STATION LATITUDE = 29.39 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2 THROUGH 31

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.53	4.62	4.00	3.29	3.84	5.97
	5.15	4.49	4.57	5.76	7.49	5.64
STD. DEVIATIONS	3.00	2.67	2.56	1.93	2.19	5.68
	2.68	2.73	1.89	4.17	3.91	2.80
RUNOFF						
TOTALS	4.117	2.851	1.270	0.358	0.431	1.603
	0.391	0.261	0.159	1.752	4.412	4.451
STD. DEVIATIONS	2.780	2.448	1.969	0.682	0.825	3.404
	0.707	0.583	0.286	2.869	3.914	2.827
EVAPOTRANSPIRATION						
TOTALS	1.335	2.050	3.647	4.886	3.853	4.130
	4.868	4.056	3.981	2.761	1.385	0.883
STD. DEVIATIONS	0.139	0.188	0.583	0.738	1.436	2.079
	2.078	1.665	1.244	0.869	0.229	0.125
PERCOLATION/LEAKAGE THROUGH LAYER 3						
TOTALS	0.0465	0.0402	0.0385	0.0264	0.0175	0.0174
	0.0172	0.0158	0.0180	0.0247	0.0372	0.0468

STD. DEVIATIONS	0.0025	0.0021	0.0038	0.0070	0.0066	0.0066
	0.0059	0.0046	0.0071	0.0091	0.0077	0.0014

LATERAL DRAINAGE COLLECTED FROM LAYER 8

TOTALS	0.1051	0.0955	0.1027	0.0952	0.0931	0.0895
	0.0913	0.0904	0.0877	0.0955	0.0974	0.1036
STD. DEVIATIONS	0.0567	0.0550	0.0646	0.0677	0.0726	0.0719
	0.0736	0.0752	0.0695	0.0664	0.0595	0.0568

PERCOLATION/LEAKAGE THROUGH LAYER 10

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

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 2

AVERAGES	22.9646	21.7669	18.9725	13.2866	8.3669	8.6139
	8.2168	7.4789	8.8955	11.9632	18.9310	23.0987
STD. DEVIATIONS	1.2574	1.1509	1.8953	3.6625	3.3595	3.4400
	2.9780	2.3492	3.6994	4.5791	4.0211	0.6915

DAILY AVERAGE HEAD ON TOP OF LAYER 9

AVERAGES	0.0025	0.0025	0.0025	0.0024	0.0023	0.0022
	0.0022	0.0022	0.0022	0.0023	0.0024	0.0025
STD. DEVIATIONS	0.0014	0.0015	0.0016	0.0017	0.0018	0.0018
	0.0018	0.0018	0.0017	0.0016	0.0015	0.0014

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2 THROUGH 31

	INCHES		CU. FEET	PERCENT
PRECIPITATION	60.35	(8.946)	219082.6	100.00
RUNOFF	22.055	(7.5493)	80059.04	36.543
EVAPOTRANSPIRATION	37.837	(3.8377)	137347.75	62.692
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.34621	(0.02416)	1256.749	0.57364
AVERAGE HEAD ON TOP OF LAYER 2	14.380	(1.030)		
LATERAL DRAINAGE COLLECTED FROM LAYER 8	1.14703	(0.77980)	4163.707	1.90052
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00000
AVERAGE HEAD ON TOP OF LAYER 9	0.002	(0.002)		
CHANGE IN WATER STORAGE	-0.685	(0.8351)	-2487.90	-1.136

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PEAK DAILY VALUES FOR YEARS 2 THROUGH 31

	(INCHES)	(CU. FT.)
PRECIPITATION	7.40	26862.000
RUNOFF	6.803	24693.8379
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.001567	5.68974
AVERAGE HEAD ON TOP OF LAYER 2	24.000	
DRAINAGE COLLECTED FROM LAYER 8	0.00927	33.63955
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 9	0.007	
MAXIMUM HEAD ON TOP OF LAYER 9	0.013	
LOCATION OF MAXIMUM HEAD IN LAYER 8 (DISTANCE FROM DRAIN)	7.2 FEET	
SNOW WATER	2.33	8459.0430

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3980
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1360

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

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

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FINAL WATER STORAGE AT END OF YEAR 31

LAYER	(INCHES)	(VOL/VOL)
1	9.3193	0.3883
2	0.0000	0.0000
3	7.6860	0.4270
4	3.7200	0.3100
5	458.8798	0.3059
6	149.4948	0.2768
7	5.8560	0.2440
8	0.0027	0.0153
9	0.0000	0.0000
10	10.2480	0.4270
SNOW WATER	0.000	

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HELP MODEL OUTPUT FOR DEVELOPED CELLS

HELP MODEL FOR DEVELOPED CELLS
(50 FT WASTE)

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)               **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY                  **
**                     USAE WATERWAYS EXPERIMENT STATION                    **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     C:\HELP 307\HCLF\I50\DATA4.D4
TEMPERATURE DATA FILE:       C:\HELP 307\HCLF\I50\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\HELP 307\HCLF\I50\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP 307\HCLF\I50\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP 307\HCLF\I50\DATA10.D10
OUTPUT DATA FILE:            C:\HELP 307\HCLF\I50\I50.OUT


TIME:  14:35     DATE:  11/22/2016


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     TITLE:  HARDIN COUNTY LF - INTERIM, 50 FT WASTE (EXIST. CELL)

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


                                   LAYER  1
                                   --------

                       TYPE 1 - VERTICAL PERCOLATION LAYER
                           MATERIAL TEXTURE NUMBER  11
           THICKNESS                    =     12.00   INCHES
           POROSITY                     =      0.4640 VOL/VOL
           FIELD CAPACITY               =      0.3100 VOL/VOL
           WILTING POINT                =      0.1870 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0.3100 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.639999998000E-04 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


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

```
             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   0
THICKNESS                    =     600.00   INCHES
POROSITY                     =       0.6376 VOL/VOL
FIELD CAPACITY               =       0.5185 VOL/VOL
WILTING POINT                =       0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.2500 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                        LAYER  3
                        --------

             TYPE 1 - VERTICAL PERCOLATION LAYER
                 MATERIAL TEXTURE NUMBER   0
THICKNESS                    =      24.00   INCHES
POROSITY                     =       0.3980 VOL/VOL
FIELD CAPACITY               =       0.2440 VOL/VOL
WILTING POINT                =       0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.830000045000E-05 CM/SEC


                        LAYER  4
                        --------

               TYPE 2 - LATERAL DRAINAGE LAYER
                 MATERIAL TEXTURE NUMBER   0
THICKNESS                    =       0.19   INCHES
POROSITY                     =       0.8500 VOL/VOL
FIELD CAPACITY               =       0.0100 VOL/VOL
WILTING POINT                =       0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   11.0799999000      CM/SEC
SLOPE                        =       2.00   PERCENT
DRAINAGE LENGTH              =     300.0    FEET


                        LAYER  5
                        --------

               TYPE 4 - FLEXIBLE MEMBRANE LINER
                 MATERIAL TEXTURE NUMBER  35
THICKNESS                    =       0.06   INCHES
POROSITY                     =       0.0000 VOL/VOL
FIELD CAPACITY               =       0.0000 VOL/VOL
WILTING POINT                =       0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY          =       0.00   HOLES/ACRE
FML INSTALLATION DEFECTS     =       0.00   HOLES/ACRE
FML PLACEMENT QUALITY        =  3 - GOOD


                        LAYER  6
```

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	87.10	
FRACTION OF AREA ALLOWING RUNOFF	=	70.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	169.826	INCHES
TOTAL INITIAL WATER	=	169.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
HOUSTON TEXAS

STATION LATITUDE	=	29.39 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	31
END OF GROWING SEASON (JULIAN DATE)	=	362
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	7.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

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

4.93	4.45	4.29	3.51	4.63	6.82
4.76	4.66	4.59	6.55	6.17	6.34

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
51.40	54.50	61.00	68.70	74.90	80.60
83.10	82.60	78.40	69.70	60.10	54.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS
AND STATION LATITUDE = 29.39 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2 THROUGH 11

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.28	3.84	4.38	2.85	3.59	8.53
	5.55	4.28	5.42	3.61	9.02	5.46
STD. DEVIATIONS	3.49	1.69	3.25	1.07	1.89	7.99
	2.88	2.83	1.57	2.87	4.89	2.56
RUNOFF						
TOTALS	0.541	0.240	0.364	0.101	0.410	2.245
	0.396	0.444	0.359	0.485	1.888	0.523
STD. DEVIATIONS	0.645	0.284	0.481	0.136	0.529	2.662
	0.457	0.655	0.318	0.536	1.605	0.419
EVAPOTRANSPIRATION						
TOTALS	1.796	2.196	2.880	2.923	2.390	3.210
	3.590	3.048	3.586	1.905	1.524	1.024
STD. DEVIATIONS	0.142	0.240	0.650	1.053	1.063	1.890
	1.244	1.276	1.150	0.869	0.160	0.158
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	0.7504	0.4925	0.3303	0.3026	0.2398	0.8511
	0.7089	0.2573	0.1601	0.2574	1.1123	1.8897

STD. DEVIATIONS	1.3339	1.1385	0.5132	0.6169	0.3557	1.5864
	1.8233	0.3741	0.2375	0.4179	1.9094	2.4125

PERCOLATION/LEAKAGE THROUGH LAYER 6

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

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0058	0.0042	0.0025	0.0024	0.0018	0.0068
	0.0055	0.0020	0.0013	0.0020	0.0089	0.0146
STD. DEVIATIONS	0.0103	0.0097	0.0040	0.0049	0.0027	0.0126
	0.0141	0.0029	0.0019	0.0032	0.0152	0.0186

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2 THROUGH 11

	INCHES	CU. FEET	PERCENT
PRECIPITATION	61.80 (6.254)	224344.9	100.00
RUNOFF	7.997 (2.7087)	29029.77	12.940
EVAPOTRANSPIRATION	30.071 (2.1874)	109159.27	48.657
LATERAL DRAINAGE COLLECTED FROM LAYER 4	7.35251 (9.89314)	26689.615	11.89669
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.007	0.00000
AVERAGE HEAD ON TOP OF LAYER 5	0.005 (0.006)		
CHANGE IN WATER STORAGE	16.382 (12.4026)	59466.21	26.507

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PEAK DAILY VALUES FOR YEARS 2 THROUGH 11

	(INCHES)	(CU. FT.)
PRECIPITATION	7.40	26862.000
RUNOFF	4.055	14720.2637
DRAINAGE COLLECTED FROM LAYER 4	0.28233	1024.84399
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 5	0.067	
MAXIMUM HEAD ON TOP OF LAYER 5	0.133	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	3.1 FEET	
SNOW WATER	2.33	8459.0430
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4519	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870	

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

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

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FINAL WATER STORAGE AT END OF YEAR 11

LAYER	(INCHES)	(VOL/VOL)
1	3.7193	0.3099
2	311.1000	0.5185
3	8.5539	0.3564
4	0.0234	0.1238
5	0.0000	0.0000
6	10.2480	0.4270
SNOW WATER	0.000	

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HELP MODEL FOR DEVELOPED CELLS
(100 FT WASTE)

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******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
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PRECIPITATION DATA FILE:      C:\HELP 307\HCLF\I100\DATA4.D4
TEMPERATURE DATA FILE:        C:\HELP 307\HCLF\I100\DATA7.D7
SOLAR RADIATION DATA FILE:    C:\HELP 307\HCLF\I100\DATA13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP 307\HCLF\I100\DATA11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP 307\HCLF\I100\DATA10.D10
OUTPUT DATA FILE:             C:\HELP 307\HCLF\I100\I100.OUT


TIME:  14:42     DATE:  11/22/2016


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     TITLE:  HARDIN COUNTY LF - INTERIM, 100 FT WASTE (EXIST. CELLS)

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


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


                                   LAYER  1
                                   --------

                      TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER  11
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4640 VOL/VOL
           FIELD CAPACITY             =      0.3100 VOL/VOL
           WILTING POINT              =      0.1870 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.3100 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  =  0.639999998000E-04 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


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

```
            TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   0
THICKNESS                     =    1200.00    INCHES
POROSITY                      =       0.6247 VOL/VOL
FIELD CAPACITY                =       0.5144 VOL/VOL
WILTING POINT                 =       0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT    =       0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.100000005000E-02 CM/SEC


                         LAYER  3
                         --------

            TYPE 1 - VERTICAL PERCOLATION LAYER
                MATERIAL TEXTURE NUMBER   0
THICKNESS                     =      24.00    INCHES
POROSITY                      =       0.3980 VOL/VOL
FIELD CAPACITY                =       0.2440 VOL/VOL
WILTING POINT                 =       0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT    =       0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.369999998000E-05 CM/SEC


                         LAYER  4
                         --------

              TYPE 2 - LATERAL DRAINAGE LAYER
                MATERIAL TEXTURE NUMBER   0
THICKNESS                     =       0.18    INCHES
POROSITY                      =       0.8500 VOL/VOL
FIELD CAPACITY                =       0.0100 VOL/VOL
WILTING POINT                 =       0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT    =       0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =   5.69999981000       CM/SEC
SLOPE                         =       2.00    PERCENT
DRAINAGE LENGTH               =     300.0     FEET


                         LAYER  5
                         --------

              TYPE 4 - FLEXIBLE MEMBRANE LINER
                MATERIAL TEXTURE NUMBER  35
THICKNESS                     =       0.06    INCHES
POROSITY                      =       0.0000 VOL/VOL
FIELD CAPACITY                =       0.0000 VOL/VOL
WILTING POINT                 =       0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT    =       0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.     =  0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY           =       0.00    HOLES/ACRE
FML INSTALLATION DEFECTS      =       0.00    HOLES/ACRE
FML PLACEMENT QUALITY         =  3 - GOOD


                         LAYER  6
```

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	87.10	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	391.826	INCHES
TOTAL INITIAL WATER	=	391.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
HOUSTON TEXAS

STATION LATITUDE	=	29.39	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	31	
END OF GROWING SEASON (JULIAN DATE)	=	362	
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	76.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

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

4.93	4.45	4.29	3.51	4.63	6.82
4.76	4.66	4.59	6.55	6.17	6.34

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
51.40	54.50	61.00	68.70	74.90	80.60
83.10	82.60	78.40	69.70	60.10	54.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS
AND STATION LATITUDE = 29.39 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 18 THROUGH 37

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	6.03	4.62	3.88	3.77	3.83	4.93
	4.90	4.38	4.38	7.25	7.24	6.41
STD. DEVIATIONS	3.27	3.07	2.07	2.41	2.45	3.58
	2.41	1.96	2.11	4.46	3.09	2.35
RUNOFF						
TOTALS	0.836	0.478	0.338	0.407	0.443	0.772
	0.500	0.240	0.326	1.648	1.405	0.913
STD. DEVIATIONS	1.137	0.711	0.731	0.666	0.553	1.002
	0.745	0.235	0.334	1.802	1.082	0.970
EVAPOTRANSPIRATION						
TOTALS	1.793	2.043	2.839	2.697	2.682	2.846
	3.831	3.361	3.131	2.237	1.434	1.122
STD. DEVIATIONS	0.113	0.447	0.724	1.031	1.019	1.389
	1.618	1.061	1.232	0.635	0.264	0.158
LATERAL DRAINAGE COLLECTED FROM LAYER 4						
TOTALS	1.6987	1.3806	1.1568	0.7942	0.4303	0.4505
	0.5314	0.3769	0.2986	0.5965	1.1757	1.7882

STD. DEVIATIONS	1.9249	1.5994	1.6014	1.1574	0.5937	0.5913
	0.7710	0.5505	0.3936	0.6757	1.4893	1.8504

PERCOLATION/LEAKAGE THROUGH LAYER 6

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

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0254	0.0227	0.0173	0.0123	0.0064	0.0070
	0.0080	0.0056	0.0046	0.0089	0.0182	0.0268
STD. DEVIATIONS	0.0288	0.0262	0.0240	0.0179	0.0089	0.0092
	0.0115	0.0082	0.0061	0.0101	0.0231	0.0277

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 18 THROUGH 37

	INCHES	CU. FEET	PERCENT
PRECIPITATION	61.62 (8.865)	223677.0	100.00
RUNOFF	8.308 (2.5595)	30156.88	13.482
EVAPOTRANSPIRATION	30.017 (2.9763)	108960.11	48.713
LATERAL DRAINAGE COLLECTED FROM LAYER 4	10.67843 (11.11237)	38762.707	17.32977
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000 (0.00000)	0.009	0.00000
AVERAGE HEAD ON TOP OF LAYER 5	0.014 (0.014)		
CHANGE IN WATER STORAGE	12.616 (13.0252)	45797.30	20.475

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              PEAK DAILY VALUES FOR YEARS    18 THROUGH    37
-------------------------------------------------------------------------
                                                (INCHES)      (CU. FT.)
                                               ----------    -------------
   PRECIPITATION                                 6.30        22869.000

   RUNOFF                                        3.384       12284.6641

   DRAINAGE COLLECTED FROM LAYER  4              0.12586       456.85812

   PERCOLATION/LEAKAGE THROUGH LAYER  6          0.000000        0.00002

   AVERAGE HEAD ON TOP OF LAYER  5               0.058

   MAXIMUM HEAD ON TOP OF LAYER  5               0.116

   LOCATION OF MAXIMUM HEAD IN LAYER  4
         (DISTANCE FROM DRAIN)                   2.3 FEET

   SNOW WATER                                    1.90         6898.1431


   MAXIMUM VEG. SOIL WATER (VOL/VOL)                     0.4640

   MINIMUM VEG. SOIL WATER (VOL/VOL)                     0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 37

LAYER	(INCHES)	(VOL/VOL)
1	3.8512	0.3209
2	620.4789	0.5171
3	9.5234	0.3968
4	0.0509	0.2858
5	0.0000	0.0000
6	10.2480	0.4270
SNOW WATER	0.000	

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****

HELP MODEL FOR DEVELOPED CELLS
(150 FT WASTE)

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


PRECIPITATION DATA FILE:     C:\HELP 307\HCLF\I150\DATA4.D4
TEMPERATURE DATA FILE:       C:\HELP 307\HCLF\I150\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\HELP 307\HCLF\I150\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP 307\HCLF\I150\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP 307\HCLF\I150\DATA10.D10
OUTPUT DATA FILE:            C:\HELP 307\HCLF\I150\I150.OUT


TIME:  15: 9     DATE:  11/22/2016


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

     TITLE:  HARDIN COUNTY LF - INTERIM, 150 FT WASTE (EXIST. CELLS)

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


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


                                     LAYER  1
                                     --------

                         TYPE 1 - VERTICAL PERCOLATION LAYER
                             MATERIAL TEXTURE NUMBER  11
           THICKNESS                  =     12.00   INCHES
           POROSITY                   =      0.4640 VOL/VOL
           FIELD CAPACITY             =      0.3100 VOL/VOL
           WILTING POINT              =      0.1870 VOL/VOL
           INITIAL SOIL WATER CONTENT =      0.3100 VOL/VOL
           EFFECTIVE SAT. HYD. COND.  = 0.639999998000E-04 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


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

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	1500.00 INCHES
POROSITY	=	0.6148 VOL/VOL
FIELD CAPACITY	=	0.5114 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	300.00 INCHES
POROSITY	=	0.5539 VOL/VOL
FIELD CAPACITY	=	0.4945 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-04 CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00 INCHES
POROSITY	=	0.3980 VOL/VOL
FIELD CAPACITY	=	0.2440 VOL/VOL
WILTING POINT	=	0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000011000E-05 CM/SEC

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.17 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	5.03999996000 CM/SEC
SLOPE	=	2.00 PERCENT
DRAINAGE LENGTH	=	300.0 FEET

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER

MATERIAL TEXTURE NUMBER 35

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

LAYER 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	87.10	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	577.826	INCHES
TOTAL INITIAL WATER	=	577.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM HOUSTON TEXAS

STATION LATITUDE	=	29.39 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	31
END OF GROWING SEASON (JULIAN DATE)	=	362

EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	7.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.93	4.45	4.29	3.51	4.63	6.82
4.76	4.66	4.59	6.55	6.17	6.34

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
51.40	54.50	61.00	68.70	74.90	80.60
83.10	82.60	78.40	69.70	60.10	54.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS AND STATION LATITUDE = 29.39 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2 THROUGH 11

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.28	3.84	4.38	2.85	3.59	8.53
	5.55	4.28	5.42	3.61	9.02	5.46
STD. DEVIATIONS	3.49	1.69	3.25	1.07	1.89	7.99
	2.88	2.83	1.57	2.87	4.89	2.56
RUNOFF						
TOTALS	0.584	0.270	0.429	0.110	0.479	2.542
	0.468	0.523	0.390	0.566	2.231	0.587
STD. DEVIATIONS	0.701	0.324	0.580	0.144	0.631	3.015

	0.547	0.776	0.344	0.638	1.890	0.472

EVAPOTRANSPIRATION

TOTALS	1.805	2.172	2.884	2.910	2.393	3.152
	3.573	3.041	3.550	1.870	1.525	1.032
STD. DEVIATIONS	0.139	0.263	0.635	1.057	1.079	1.884
	1.258	1.243	1.149	0.871	0.184	0.162

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.0076	0.0066	0.0080	0.0085	0.0080	0.0073
	0.0095	0.0094	0.0093	0.0096	0.0075	0.0086
STD. DEVIATIONS	0.0073	0.0062	0.0062	0.0066	0.0063	0.0054
	0.0075	0.0074	0.0070	0.0072	0.0054	0.0067

PERCOLATION/LEAKAGE THROUGH LAYER 7

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

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001
STD. DEVIATIONS	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2 THROUGH 11

	INCHES	CU. FEET	PERCENT
PRECIPITATION	61.80 (6.254)	224344.9	100.00
RUNOFF	9.179 (3.1201)	33318.23	14.851
EVAPOTRANSPIRATION	29.906 (2.2013)	108557.95	48.389
LATERAL DRAINAGE COLLECTED FROM LAYER 5	0.09991 (0.07746)	362.669	0.16166
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00000 (0.00000)	0.009	0.00000
AVERAGE HEAD ON TOP	0.000 (0.000)		

OF LAYER 6

CHANGE IN WATER STORAGE	22.619	(4.4114)	82106.04	36.598

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PEAK DAILY VALUES FOR YEARS 2 THROUGH 11

	(INCHES)	(CU. FT.)
PRECIPITATION	7.40	26862.000
RUNOFF	4.480	16261.5049
DRAINAGE COLLECTED FROM LAYER 5	0.00085	3.08179
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 6	0.000	
MAXIMUM HEAD ON TOP OF LAYER 6	0.008	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	2.33	8459.0430
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870	

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

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

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FINAL WATER STORAGE AT END OF YEAR 11

LAYER	(INCHES)	(VOL/VOL)
1	3.7399	0.3117
2	662.7178	0.4418
3	120.6316	0.4021
4	6.6738	0.2781
5	0.0019	0.0114
6	0.0000	0.0000
7	10.2480	0.4270
SNOW WATER	0.000	

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HELP MODEL FOR DEVELOPED CELLS
(170 FT WASTE)

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**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     C:\HELP 307\HCLF\I170\DATA4.D4
TEMPERATURE DATA FILE:       C:\HELP 307\HCLF\I170\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\HELP 307\HCLF\I170\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP 307\HCLF\I170\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\HELP 307\HCLF\I170\DATA10.D10
OUTPUT DATA FILE:            C:\HELP 307\HCLF\I170\I170.OUT


TIME:  15:13     DATE:  11/22/2016


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     TITLE:  HARDIN COUNTY LF - INTERIM, 170 FT WASTE (EXIST. CELLS)

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


                                  LAYER  1
                                  --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  11
           THICKNESS                   =     12.00    INCHES
           POROSITY                    =      0.4640 VOL/VOL
           FIELD CAPACITY              =      0.3100 VOL/VOL
           WILTING POINT               =      0.1870 VOL/VOL
           INITIAL SOIL WATER CONTENT  =      0.3100 VOL/VOL
           EFFECTIVE SAT. HYD. COND.   =  0.639999998000E-04 CM/SEC
       NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                  LAYER  2
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           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
THICKNESS                    =    1500.00    INCHES
POROSITY                     =        0.6148 VOL/VOL
FIELD CAPACITY               =        0.5114 VOL/VOL
WILTING POINT                =        0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =        0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                         LAYER  3
                         --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
THICKNESS                    =     540.00    INCHES
POROSITY                     =        0.5461 VOL/VOL
FIELD CAPACITY               =        0.4923 VOL/VOL
WILTING POINT                =        0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =        0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-04 CM/SEC


                         LAYER  4
                         --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
THICKNESS                    =      24.00    INCHES
POROSITY                     =        0.3980 VOL/VOL
FIELD CAPACITY               =        0.2440 VOL/VOL
WILTING POINT                =        0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT   =        0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =  0.279999995000E-05 CM/SEC


                         LAYER  5
                         --------

             TYPE 2 - LATERAL DRAINAGE LAYER
               MATERIAL TEXTURE NUMBER   0
THICKNESS                    =       0.16    INCHES
POROSITY                     =        0.8500 VOL/VOL
FIELD CAPACITY               =        0.0100 VOL/VOL
WILTING POINT                =        0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT   =        0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   3.95000005000      CM/SEC
SLOPE                        =       2.00    PERCENT
DRAINAGE LENGTH              =     300.0     FEET


                         LAYER  6
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             TYPE 4 - FLEXIBLE MEMBRANE LINER
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MATERIAL TEXTURE NUMBER 35

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

LAYER 7

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 120. FEET.

SCS RUNOFF CURVE NUMBER	=	87.60	
FRACTION OF AREA ALLOWING RUNOFF	=	90.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	652.226	INCHES
TOTAL INITIAL WATER	=	652.226	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM HOUSTON TEXAS

STATION LATITUDE	=	29.39 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	31
END OF GROWING SEASON (JULIAN DATE)	=	362

EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	7.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.93	4.45	4.29	3.51	4.63	6.82
4.76	4.66	4.59	6.55	6.17	6.34

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
51.40	54.50	61.00	68.70	74.90	80.60
83.10	82.60	78.40	69.70	60.10	54.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS AND STATION LATITUDE = 29.39 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 28 THROUGH 32

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	7.79	2.70	3.05	3.51	3.19	4.80
	5.59	4.15	3.61	8.72	8.50	6.10
STD. DEVIATIONS	3.48	1.03	1.09	2.62	1.86	4.39
	3.17	1.96	1.46	6.02	3.24	2.13
RUNOFF						
TOTALS	1.484	0.214	0.133	0.498	0.490	0.824
	0.858	0.390	0.236	2.273	1.893	0.968
STD. DEVIATIONS	1.821	0.393	0.169	0.720	0.665	1.021

	1.165	0.345	0.295	2.572	1.396	1.065

EVAPOTRANSPIRATION

TOTALS	1.783	2.253	2.761	2.547	2.316	2.582
	3.511	3.585	2.673	2.389	1.655	1.148
STD. DEVIATIONS	0.175	0.250	0.918	1.184	0.638	1.849
	2.117	0.745	0.509	0.409	0.101	0.131

LATERAL DRAINAGE COLLECTED FROM LAYER 5

TOTALS	0.0019	0.0024	0.0027	0.0030	0.0028	0.0023
	0.0027	0.0033	0.0026	0.0034	0.0029	0.0032
STD. DEVIATIONS	0.0011	0.0021	0.0026	0.0027	0.0028	0.0020
	0.0023	0.0029	0.0021	0.0023	0.0020	0.0019

PERCOLATION/LEAKAGE THROUGH LAYER 7

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

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6

AVERAGES	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
STD. DEVIATIONS	0.0000	0.0000	0.0001	0.0001	0.0001	0.0000
	0.0000	0.0001	0.0000	0.0001	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 28 THROUGH 32

	INCHES		CU. FEET	PERCENT
PRECIPITATION	61.71	(6.635)	223992.8	100.00
RUNOFF	10.261	(3.6375)	37248.73	16.629
EVAPOTRANSPIRATION	29.204	(3.5474)	106012.18	47.328
LATERAL DRAINAGE COLLECTED FROM LAYER 5	0.03334	(0.02562)	121.031	0.05403
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.00000	(0.00000)	0.008	0.00000
AVERAGE HEAD ON TOP	0.000	(0.000)		

OF LAYER 6

CHANGE IN WATER STORAGE	22.207	(2.0257)	80610.86	35.988

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PEAK DAILY VALUES FOR YEARS 28 THROUGH 32

	(INCHES)	(CU. FT.)
PRECIPITATION	4.90	17787.000
RUNOFF	2.722	9881.7607
DRAINAGE COLLECTED FROM LAYER 5	0.00032	1.17215
PERCOLATION/LEAKAGE THROUGH LAYER 7	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 6	0.000	
MAXIMUM HEAD ON TOP OF LAYER 6	0.007	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.76	2759.9431
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4423	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870	

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

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

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FINAL WATER STORAGE AT END OF YEAR 32

LAYER	(INCHES)	(VOL/VOL)
1	3.7778	0.3148
2	561.0660	0.3740
3	181.8459	0.3368
4	6.3203	0.2633
5	0.0017	0.0105
6	0.0000	0.0000
7	10.2480	0.4270
SNOW WATER	0.000	

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HELP MODEL FOR DEVELOPED CELLS
(CLOSED)

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**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07   (1 NOVEMBER 1997)               **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:     C:\HELP 307\HCLF\CL\DATA4.D4
TEMPERATURE DATA FILE:       C:\HELP 307\HCLF\CL\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\HELP 307\HCLF\CL\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP 307\HCLF\CL\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP 307\HCLF\CL\DATA10.D10
OUTPUT DATA FILE:            C:\HELP 307\HCLF\CL\CL.OUT


TIME:  16:24     DATE:  11/22/2016


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     TITLE:  HARDIN COUNTY LF - CLOSED, 170 FT WASTE (EXIST. CELLS)

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


                                   LAYER  1
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  10
           THICKNESS                    =     24.00   INCHES
           POROSITY                     =      0.3980 VOL/VOL
           FIELD CAPACITY               =      0.2440 VOL/VOL
           WILTING POINT                =      0.1360 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0.2440 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.119999997000E-03 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  5.00
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


                                   LAYER  2
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             TYPE 4 - FLEXIBLE MEMBRANE LINER
               MATERIAL TEXTURE NUMBER  36
THICKNESS                    =       0.04    INCHES
POROSITY                     =       0.0000 VOL/VOL
FIELD CAPACITY               =       0.0000 VOL/VOL
WILTING POINT                =       0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY          =       1.00    HOLES/ACRE
FML INSTALLATION DEFECTS     =       4.00    HOLES/ACRE
FML PLACEMENT QUALITY        =   3 - GOOD


                        LAYER  3
                        --------

               TYPE 3 - BARRIER SOIL LINER
               MATERIAL TEXTURE NUMBER   0
THICKNESS                    =      18.00    INCHES
POROSITY                     =       0.4270 VOL/VOL
FIELD CAPACITY               =       0.4180 VOL/VOL
WILTING POINT                =       0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   0.999999975000E-05 CM/SEC


                        LAYER  4
                        --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER  11
THICKNESS                    =      12.00    INCHES
POROSITY                     =       0.4640 VOL/VOL
FIELD CAPACITY               =       0.3100 VOL/VOL
WILTING POINT                =       0.1870 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   0.639999998000E-04 CM/SEC


                        LAYER  5
                        --------

           TYPE 1 - VERTICAL PERCOLATION LAYER
               MATERIAL TEXTURE NUMBER   0
THICKNESS                    =    1500.00    INCHES
POROSITY                     =       0.6148 VOL/VOL
FIELD CAPACITY               =       0.5114 VOL/VOL
WILTING POINT                =       0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT   =       0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.    =   0.100000005000E-02 CM/SEC


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

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	540.00	INCHES
POROSITY	=	0.5461	VOL/VOL
FIELD CAPACITY	=	0.4923	VOL/VOL
WILTING POINT	=	0.0770	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-04	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	24.00	INCHES
POROSITY	=	0.3980	VOL/VOL
FIELD CAPACITY	=	0.2440	VOL/VOL
WILTING POINT	=	0.1360	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2440	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.279999995000E-05	CM/SEC

LAYER 8

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.16	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	3.23000002000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	300.0	FEET

LAYER 9

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 10

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4270	VOL/VOL
FIELD CAPACITY	=	0.4180	VOL/VOL
WILTING POINT	=	0.3670	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #10 WITH A GOOD STAND OF GRASS, A SURFACE SLOPE OF 4.% AND A SLOPE LENGTH OF 120. FEET.

SCS RUNOFF CURVE NUMBER	=	81.60	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	18.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	4.392	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	7.164	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.448	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	665.768	INCHES
TOTAL INITIAL WATER	=	665.768	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM HOUSTON TEXAS

STATION LATITUDE	=	29.39	DEGREES
MAXIMUM LEAF AREA INDEX	=	4.50	
START OF GROWING SEASON (JULIAN DATE)	=	31	
END OF GROWING SEASON (JULIAN DATE)	=	362	
EVAPORATIVE ZONE DEPTH	=	18.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	7.80	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	76.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

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

4.93	4.45	4.29	3.51	4.63	6.82
4.76	4.66	4.59	6.55	6.17	6.34

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
51.40	54.50	61.00	68.70	74.90	80.60
83.10	82.60	78.40	69.70	60.10	54.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR HOUSTON TEXAS
AND STATION LATITUDE = 29.39 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 2 THROUGH 31

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.53	4.62	4.00	3.29	3.84	5.97
	5.15	4.49	4.57	5.76	7.49	5.64
STD. DEVIATIONS	3.00	2.67	2.56	1.93	2.19	5.68
	2.68	2.73	1.89	4.17	3.91	2.80
RUNOFF						
TOTALS	4.117	2.851	1.270	0.358	0.431	1.603
	0.391	0.261	0.159	1.752	4.412	4.451
STD. DEVIATIONS	2.780	2.448	1.969	0.682	0.825	3.404
	0.707	0.583	0.286	2.869	3.914	2.827
EVAPOTRANSPIRATION						
TOTALS	1.335	2.050	3.647	4.886	3.853	4.130
	4.868	4.056	3.981	2.761	1.385	0.883
STD. DEVIATIONS	0.139	0.188	0.583	0.738	1.436	2.079
	2.078	1.665	1.244	0.869	0.229	0.125
PERCOLATION/LEAKAGE THROUGH LAYER 3						
TOTALS	0.0465	0.0402	0.0385	0.0264	0.0175	0.0174
	0.0172	0.0158	0.0180	0.0247	0.0372	0.0468

STD. DEVIATIONS	0.0025	0.0021	0.0038	0.0070	0.0066	0.0066
	0.0059	0.0046	0.0071	0.0091	0.0077	0.0014

LATERAL DRAINAGE COLLECTED FROM LAYER 8

TOTALS	0.0057	0.0052	0.0057	0.0057	0.0059	0.0056
	0.0058	0.0059	0.0057	0.0059	0.0057	0.0059
STD. DEVIATIONS	0.0016	0.0015	0.0017	0.0016	0.0017	0.0016
	0.0016	0.0014	0.0015	0.0015	0.0014	0.0014

PERCOLATION/LEAKAGE THROUGH LAYER 10

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

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 2

AVERAGES	22.9646	21.7669	18.9725	13.2866	8.3669	8.6139
	8.2168	7.4789	8.8955	11.9632	18.9310	23.0987
STD. DEVIATIONS	1.2574	1.1509	1.8953	3.6625	3.3595	3.4400
	2.9780	2.3492	3.6994	4.5791	4.0211	0.6915

DAILY AVERAGE HEAD ON TOP OF LAYER 9

AVERAGES	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 2 THROUGH 31

	INCHES	CU. FEET	PERCENT
PRECIPITATION	60.35 (8.946)	219082.6	100.00
RUNOFF	22.055 (7.5493)	80059.04	36.543
EVAPOTRANSPIRATION	37.837 (3.8377)	137347.75	62.692
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.34621 (0.02416)	1256.749	0.57364
AVERAGE HEAD ON TOP OF LAYER 2	14.380 (1.030)		

LATERAL DRAINAGE COLLECTED FROM LAYER 8	0.06866 (	0.01826)	249.247	0.11377
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000 (	0.00000)	0.009	0.00000
AVERAGE HEAD ON TOP OF LAYER 9	0.000 (	0.000)		
CHANGE IN WATER STORAGE	0.393 (	0.6443)	1426.57	0.651

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PEAK DAILY VALUES FOR YEARS 2 THROUGH 31

	(INCHES)	(CU. FT.)
PRECIPITATION	7.40	26862.000
RUNOFF	6.803	24693.8379
PERCOLATION/LEAKAGE THROUGH LAYER 3	0.001567	5.68974
AVERAGE HEAD ON TOP OF LAYER 2	24.000	
DRAINAGE COLLECTED FROM LAYER 8	0.00031	1.12376
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 9	0.000	
MAXIMUM HEAD ON TOP OF LAYER 9	0.001	
LOCATION OF MAXIMUM HEAD IN LAYER 8 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	2.33	8459.0430
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3980	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1360	

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

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

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FINAL WATER STORAGE AT END OF YEAR 31

LAYER	(INCHES)	(VOL/VOL)
1	9.3193	0.3883
2	0.0000	0.0000
3	7.6860	0.4270
4	3.7200	0.3100
5	475.3864	0.3169
6	165.0353	0.3056
7	6.1606	0.2567
8	0.0018	0.0113
9	0.0000	0.0000
10	10.2480	0.4270
SNOW WATER	0.000	

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APPENDIX IIIC-B

LEACHATE COLLECTION SYSTEM DESIGN CALCULATIONS

STATE OF TEXAS
MARILYN D. MORRISON
102273
LICENSED
PROFESSIONAL ENGINEER

12-5-17

Includes pages IIIC-B-1 through IIIC-B-102

CONTENTS

STATE OF TEXAS
MARILYN D. MORRISON
102273
LICENSED
PROFESSIONAL ENGINEER
12-5-17

LEACHATE COLLECTION PIPE CAPACITY CALCULATIONS

HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE COLLECTION PIPE
CAPACITY CALCULATIONS

REQUIRED: Size the leachate collection system pipe in Cells 7 and 8. Analyze the leachate collection pipe in Cells 1 through 6.

METHOD:

A. Use leachate production rates determined from the HELP model analysis (see Appendix IIIC-A) to size the leachate collection pipes. The developed cells include an 8-inch PVC Sch 80 header pipe with 6-inch PVC Sch 80 lateral pipes spaced 100 feet apart. The future cells will include 6-inch HDPE SDR 17 leachate collection pipes.

B. Determine required hole size (perforations) based on characteristics of the surrounding drainage media.

REFERENCES:

1. Bass, J., *Avoiding Failure of Leachate Collection and Cap Drainage Systems*, Pollution Technology Review No. 138, Noyles Data Corporation, 1986.

2. Texas Natural Resource Conservation Commission, *Leachate Collection System Handbook*, 30 TAC 330.201, 1993.

3. Driscopipe, *Leachate Pipe Systems*, Phillips Drisco Inc., 1992.

SOLUTION:

Determine the peak daily flow rate estimate:

The following tables summarize the fill conditions that are likely to be present and have the greatest contribution of leachate into the LCS. The peak flow rate (lateral drainage in the LCS layer) is shown for each condition.

Developed Cells

From the HELP model (Appendix IIIC-A; Developed Cells):

CONDITION	PEAK cfd/ac	PEAK gpd/ac
Interim 50' Waste	1,024.8	7,666
Interim, 100' Waste	456.9	3,418
Interim, 150' Waste	3.1	23
Interim, 170' Waste	1.2	9

Undeveloped Cells

From the HELP model (Appendix IIIC-A; Undeveloped Cells):

CONDITION	PEAK cfd/ac	PEAK gpd/ac
Active, 10' Waste	109.2	817
Interim 50' Waste	508.6	3,804
Interim, 100' Waste	1,203.3	9,001
Interim, 150' Waste	109.7	821
Interim, 170' Waste	53.0	396

The area draining to the leachate collection header pipe located in the developed cells is 32.1 acres. The largest area draining to a lateral leachate collection pipe located in the developed cells is 3.7 acres. The largest area draining to the leachate collection header pipe located in the undeveloped cells is 17.5 acres.

8-inch Header Pipe in Cells 1 through 6

The maximum leachate production expected in the leachate collection header pipe in the developed cells is predicted to occur assuming the following scenario:

1. Interim condition, 50' waste over 7.3 ac
2. Interim condition, 100' waste over 9.8 ac
3. Interim condition, 150' waste over 9.1 ac
4. Interim condition, 170' waste over 5.9 ac

CONDITION	AREA ac	PEAK gpd/ac	PEAK gpd	PEAK cfs
Interim 50' Waste	7.3	7,666	55,958	0.0866
Interim, 100' Waste	9.8	3,418	33,493	0.0518
Interim, 150' Waste	9.1	23	211	0.0003
Interim, 170' Waste	5.9	9	53	0.0001
Total=	32.1		89,715	0.1388

HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE COLLECTION PIPE
CAPACITY CALCULATIONS

6-inch Lateral Pipe in Cells 1 through 6

The maximum leachate production expected in the leachate collection lateral pipe in the developed cells is predicted to occur assuming the following scenario:

1. Interim condition, 50' waste over	0.8	ac
2. Interim condition, 100' waste over	1.3	ac
3. Interim condition, 150' waste over	1.0	ac
4. Interim condition, 170' waste over	0.6	ac

CONDITION	AREA ac	PEAK gpd/ac	PEAK gpd	PEAK cfs
Interim 50' Waste	0.8	7,666	6,132	0.0095
Interim, 100' Waste	1.3	3,418	4,443	0.0069
Interim, 150' Waste	1.0	23	23	0.0000
Interim, 170' Waste	0.6	9	5	0.0000
Total=	3.7		10,604	0.0164

6-inch Header Pipe in Cells 7 and 8

The maximum leachate production expected in the leachate collection header pipe in the undeveloped cells is predicted to occur assuming the following scenario:

1. Active condition, 10' waste over	3.0	ac
2. Interim condition, 50' waste over	3.8	ac
3. Interim condition, 100' waste over	4.5	ac
4. Interim condition, 150' waste over	3.5	ac
5. Interim condition, 170' waste over	2.7	ac

CONDITION	AREA ac	PEAK gpd/ac	PEAK gpd	PEAK cfs
Active, 10' Waste	3.0	817	2,450	0.0038
Interim 50' Waste	3.8	3,804	14,456	0.0224
Interim, 100' Waste	4.5	9,001	40,503	0.0627
Interim, 150' Waste	3.5	821	2,872	0.0044
Interim, 170' Waste	2.7	396	1,070	0.0017
Total=	17.5		61,352	0.0949

SUMMARY OF LEACHATE PRODUCTION:

8-inch Header Pipe in Cells 1 through 6

Leachate Production = 0.1388 cfs

6-inch Lateral Pipe in Cells 1 through 6

Leachate Production = 0.0164 cfs

6-inch Header Pipe in Cells 7 and 8

Leachate Production = 0.0949 cfs

HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE COLLECTION PIPE
CAPACITY CALCULATIONS

Determination of flow capacity (Q_{full}) for the 8-inch PVC Sch 80 perforated pipe:

$$Q_{full} = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

Where: A = Cross-sectional area of pipe, with d representing the inside diameter in feet
R = Hydraulic radius of pipe in feet under full flow conditions

	ID =	7.625	in
	=	0.635	ft
$A = \frac{\Pi \times d^2}{4}$	A =	0.317	sq ft
$R = \frac{d}{4}$	R =	0.159	ft
S = Design slope of pipe	S =	0.011	ft / ft
n = Manning's number	n =	0.013	

Q_{full} =	1.115	cfs

Determination of flow capacity (Q_{full}) for 6-inch PVC Sch 80 perforated pipe:

	ID =	5.761	in
	=	0.480	ft
	A =	0.181	sq ft
	R =	0.120	ft
S = Design slope of pipe	S =	0.0185	ft / ft
n = Manning's number	n =	0.013	

Q_{full} =	0.685	cfs

HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE COLLECTION PIPE
CAPACITY CALCULATIONS

Determination of flow capacity (Q_{full}) for proposed 6-inch SDR 17 perforated pipe:

	Standard Dimension Ratio (SDR) =	17	
	ID =	5.845	in
	=	0.487	ft
	A =	0.186	sq ft
	R =	0.122	ft
S = Design slope of pipe	S =	0.004	ft / ft
n = Manning's number	n =	0.015	

Q_{full} = 0.287 cfs

Compare Peak Q_{max} and Q_{full} for the 8" PVC Sch 80 pipe:

Q_{full} = 1.115 cfs >> Q_{max} = 0.1388 cfs

Compare Peak Q_{max} and Q_{full} for the 6" PVC Sch 80 pipe:

Q_{full} = 0.685 cfs >> Q_{max} = 0.0164 cfs

Compare Peak Q_{max} and Q_{full} for the 6" SDR 17 pipe:

Q_{full} = 0.287 cfs >> Q_{max} = 0.0949 cfs

Conclusion:
A PVC Sch 80 pipe with a nominal diameter of 8 inches exceeds flow capacity requirements for the header pipe in Cells 1 through 6. A PVC Sch 80 pipe with a nominal diameter of 6 inches exceeds flow capacity requirements for the the lateral pipe in Cells 1 through 6. An HDPE SDR 17 pipe with a nominal diameter of 6 inches exceeds flow capacity requirements for the collection pipe in Cells 7 and 8.

B. Perforation configuration for a 6-inch SDR 17 perforated pipe for Cells 7 and 8:

Pipe perforations must allow free passage of leachate and also prevent migration of drainage media into collection pipes. Therefore, size of perforations depends on media particle size. Two perforation alternatives are evaluated below:

For leachate collection pipes with slotted perforations:

$$\frac{D_{85} \text{ of Filter}}{\text{Slot Width}} > 2.0$$

Where: D_{85} = Particle size for which 85% of all particles are smaller than

Assume: Drainage media is an ASTM D number 467 aggregate

	D_{85} =	25	mm
	=	0.984	in
Standard slot width:	d =	0.125	in

Check values to find that:

$$\frac{D_{85} \text{ of Filter}}{\text{Slot Width}} = 7.9 > 2.0 \quad \text{(acceptable)}$$

For leachate collection pipes with circular holes:

$$\frac{D_{85} \text{ of Filter}}{\text{Hole Diameter}} > 1.7$$

Where: D_{85} = Particle size for which 85% of all particles are smaller than

Assume: Drainage media is an ASTM D number 467 aggregate

	D_{85} =	25	mm
	=	0.984	in
Standard hole diameter	d =	0.5	in

Check values to find that:

$$\frac{D_{85} \text{ of Filter}}{\text{Hole Diameter}} = 2.0 > 1.7 \quad \text{(acceptable)}$$

In Addition:

A minimum open area of 1 square inch per foot of drainage pipe is recommended by the U.S. Soil Conservation Service and the U.S. Bureau of Reclamation. Therefore, number of 0.5 in diameter holes per foot will be 6 and total slot area provided by the manufacturer will provide documentation that minimum of 1 square inch of total slot area is provided per linear foot of pipe.

LEACHATE COLLECTION PIPE
STRUCTURAL STABILITY

HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE COLLECTION PIPE STRUCTURAL STABILITY
6" DIA HDPE PIPE

REQUIRED: Analyze structural stability of the 6 inch diameter leachate collection system pipe.

METHOD:

A. Determine the critical load and calculate stress under the following two conditions:

1. Construction loading
2. Overburden loading

B. Use the critical loading pressure to analyze pipe stability under the following three possible failure conditions:

1. Wall crushing
2. Wall buckling
3. Ring deflection

NOTE:

1. The leachate trench details shown on pages IIIC-B-51 and IIIC-B-52 are for illustration purposes only to show parameters used in the following calculations. Leachate collection system details can be found in Appendix IIIA-A.
2. The leachate collection pipe to be used in Cells 7 and 8 will be a SDR 17 HDPE pipe.

REFERENCES:

1. Bass, J., *Avoiding Failure of Leachate Collection and Cap Drainage Systems*, Pollution Technology Review No. 138, Noyles Data Corporation, 1986.

2. Texas Natural Resource Conservation Commission, *Leachate Collection System Handbook*, 30 TAC 330.201, 1993.

3. Phillips 66 Driscopipe, *System Design*, 1991.

4. Landfill Design Series, *Leachate Gas Management Systems Design, Volume 5, Leachate Management and Storage*, Appendix A, 1993.

5. Caterpillar Tractor Company, *Caterpillar Performance Handbook,* Edition 27, October 1996.

6. Quian, Xuede, R.M. Koerner, D. H. Gray, "Geotechnical Aspects of Landfill Design and Construction." Prentice-Hall, Inc., New Jersey, 2002.

SOLUTION:

A. Determine the critical load and stress:

A.1. Maximum construction loading:

Assume: CAT 637E Series II scraper with an even load distribution

Loaded weight =	190,500	lb
Tire pressure =	80	psi
Number of tires =	4	

For a circular tire imprint:

$$F = \frac{\text{Loaded Weight}}{\text{Number of Tires}}$$

Where: F = Force exerted by one tire (lb)

F =	47,625	lb

Determine area of contact for circular tire imprint:

$$r = (F/pp)^{1/2}$$

Where:
r = Radius of contact (in)
F = Force exerted by one tire (lb)
p = Tire pressure (psi)

r =	13.8	in

Use Boussinesq's solution to find the stress at a point below a uniformly loaded circular area:

$$y = p\,(1 - ((r/z)^2+1)^{-3/2})$$

Where:
y = Change in vertical stress (psi)
p = Tire pressure (psi)
r = Radius of contact (in)
z = Protective cover thickness (in)

z = 24 in

y =	27.8	psi

Assume only one wheel load on pipe and add 50% for impact loading:

P_L = 1.5y

Where: P_L = Maximum live load (psi)

P_L =	41.7	psi

P_D = (zw)/1728

Where: P_D = Maximum dead load (psi)
z = Protective cover thickness (in)
w = Unit weight of protective cover (pcf)

z = 24 in
w = 116 pcf

P_D =	1.61	psi

P_T = P_L + P_D

Where: P_T = Maximum construction load (psi)

P_T =	43.3	psi

A.2. Overburden loading (postclosure load):

For maximum fill load on pipe:

2.0	ft protective cover @	116	pcf =	232	psf
4.5	ft final & intrm cover @	116	pcf =	522	psf
170.0	ft solid waste/soil @	67	pcf =	11,390	psf
			S =	12,144	psf

P_T =	84.3	psi

Determine critical loading condition:

Construction loading:	P_T =	43.3	psi
Overburden loading:	P_T =	84.3	psi

Overburden loading is most critical to the structural stability of the pipe and will be used to determine the design pipe stress.

Determine design stress:

1. Adjust critical stress to account for loss of strength in the pipe due to perforations:

$$P_{DES1} = 12P_T / (12 - l_p)$$

Where:
- l_p = Cumulative length of perforations per foot of pipe
- P_T = Critical pipe stress (psi)
- P_{DES1} = Pipe stress adjusted for loss of strength (psi)

6	holes / foot
0.5	in / hole

l_p =	3.0	in/ft

From determination of critical loading:

P_T =	84.3	psi

P_{DES1} =	112.4	psi

Adjust pipe stress determined above to account for effects of soil arching:

2. The design pipe stress is estimated by accounting for the soil structure interaction between the buried leachate collection pipe and its backfill to obtain a realistic loading condition on the pipe.

2a. For the burial conditions shown on Figure 1 (page IIIC-B-51), the pipe may be classified as a positive projecting conduit.

2b. Because the pipe is flexible and will deflect in the vertical plane as shown on Figure 2 (page IIIC-B-52), the pipe will experience a reduction in loading due to soil arching. Soil arching is present when the soil column over the pipe settles and creates shear stresses in the surrounding soil. Those shear stresses will support the soil column, thereby reducing the load experienced by the pipe (see Figure 3, page IIIC-B-52).

2c. The load on the pipe will be estimated using Marston's Formula:

$$W_c = \gamma C_c B_c^{\,2} \qquad (1)$$

$$C_c = \frac{e^{\pm 2k\mu(H_e/B_c)} - 1}{\pm 2k\mu} + \left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) e^{\pm 2k\mu(H_e/B_c)} \qquad (2)$$

Where:
- W_c = Load per unit length of conduit (lb/ft)
- γ = Unit weight of soil above conduit (pcf)
- B_c = Outer diameter of conduit (ft)
- H = Height of fill above conduit (ft)
- H_e = Height of plane of equal settlement above critical plane (ft)
- k = Lateral pressure ratio (earth pressure coefficient)
- μ = tan ϕ
- ϕ = Angle of internal friction of pipe-zone backfill (PZB) (degrees)

$$H_e = \pm r_{sd}\, p\left(\frac{H}{B_c}\right) \qquad (3)$$

Where:
- r_{sd} = Settlement ratio
- p = Ratio of the conduit projection above the compacted soil liner to its diameter

$$r_{sd} = \frac{(S_m + S_g) - (S_f + dc)}{S_m} \qquad (4)$$

Where:
- S_m = Compression deformation of soil column adjacent to conduit
- S_g = Settlement of natural ground adjacent to conduit
- S_f = Settlement of conduit into foundation material
- dc = Vertical deflection of the conduit

It is assumed that for a leachate collection pipe S_g and S_f are equivalent. The equation settlement ratio, therefore, reduces to the following:

$$r_{sd} = \frac{S_m - dc}{S_m} \qquad (5)$$

Since the trench aggregate (PZB) is much stiffer than the pipe, dc is larger than S_m implying that r_{sd} will be negative. Because r_{sd} is negative, the pipe is categorized as an incomplete ditch as specified by Marston. Note that in the above equations, where a + and a - sign are used together, the upper sign corresponds to a positive r_{sd} and a the lower sign to a negative r_{sd}.

2d. Load analysis solution by trial and error

Step 1: Assume a value for the settlement ratio, r_{sd}.

r_{sd} = -0.64

Step 2: Calculate S_m based on the estimated vertical stress at the level of the pipe and the deformation modulus E of the PZB.

$S_m = P_{DES1} D / E_s$

Where:
P_{DES1} = Pipe stress adjusted for loss of strength (psi)
D = Pipe diameter (in)
E_s = PZB soil modulus (psi)

P_{DES1} =	112.4	psi
D =	6.625	in
E_s =	3,000	psi

S_m =	0.248	in

Step 3: Calculate dc using Equation (5):

$dc = S_m (1 - r_{sd})$

dc =	0.407	in

Step 4: Use the Iowa Formula (provided below) to calculate load per unit length (W_c).

$$W_c = \frac{dc}{(DL)k}\left(\frac{EI}{r^3} + 0.061E'\right)$$

Where:
DL = Deflection lag factor
k = Bedding factor
E = Young's modulus for pipe material (psi)
I = Moment of inertia for pipe wall = $t^3/12$ (in^4/in)
r = Pipe radius (in)
E' = Modulus of soil reaction (psi)

DL =	2.5	(Ref 6)
k =	0.1	(Ref 6)
E =	32,800	psi (refer to chart 25 on page IIIC-B-54, based on P_{DES1} above)
t =	0.390	in (SDR 17 pipe)
I =	0.005	in^4/in
r =	3.3	in
E' =	3,000	psi

W_c =	305	lb/in

Step 5: Calculate C_c using Equation 1:

$$C_c = \frac{W_c}{\gamma B_c^{\ 2}}$$

Composite unit weight for waste and soil:

6.5	ft soil @	116	pcf =	754	psf
170	ft waste @	67	pcf =	11,390	psf
			Total =	12,144	psf

γ =	68.80	pcf (weighted average based on above table)
B_c =	6.625	in

C_c =	174.6	(unitless)

Step 6: Solve for H_e/B_c using Equation 2 in an iterative manner:

H =	170	ft
H/B_c =	307.9	

Assume: H_e/B_c = 2.19

$k\mu$ =	0.13	(Ref 4)
$e^{-2k\mu(He/Bc)}-1$ =	-0.43	
$-2k\mu$ =	-0.26	
$(H/B_c - H_e/B_c)$ =	305.7	
$e^{-2k\mu(He/Bc)}$ =	0.57	

Left-hand-side of equation (LHS) =	175
Right-hand-side of equation (RHS) =	175

Step 7: Substitute H_e/B_c into equation given below to determine if proper value for r_{sd} was used.

$$\left[\frac{1}{2k\mu} \pm \left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) \pm \frac{r_{sd}\,p}{3}\right] \frac{e^{\pm 2k\mu(H_e/B_c)} - 1}{\pm 2k\mu} \pm \frac{1}{2}\left(\frac{H_e}{B_c}\right)^2$$
$$\pm \frac{r_{sd}\,p}{3}\left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) e^{\pm 2k\mu(H_e/B_c)} - \frac{1}{2k\mu}\left(\frac{H_e}{B_c}\right) \mp \left(\frac{H}{B_c}\right)\left(\frac{H_e}{B_c}\right) = \pm r_{sd}\,p\left(\frac{H}{B_c}\right)$$

Because r_{sd} is negative for the incomplete ditch condition, the lower signs in the above equation are used.

p =	1
kμ =	0.13
H/B_c =	307.9
H_e/B_c =	2.19
r_{sd} =	-0.64
LHS =	197
RHS =	197

If LHS is not approximately equal to RHS, adjust value for r_{sd} in Step 1 and repeat solution procedure.

2e. Once the solutions to the above equations are determined, the design pipe stress may be calculated and the deflection of the pipe determined.

$P_{DES2} = W_c / D$

Where: P_{DES2} = Load on pipe adjusted to account for effects of soil arching (psi)

W_c =	305	lb/in
D =	6.6	in

P_{DES2} =	46	psi

A summary table for the structural stability analysis is provided on page IIIC-B-19 for the 6-inch-diameter leachate collection pipe. A pipe will be selected from this table for use in the collection system based on the calculated factors of safety for each possible failure condition. An example calculation is provided below that outlines the procedures used to determine the factors of safety for all pipe SDR sizes shown in the summary table.

B. Use the critical loading pressure to analyze pipe stability:

Example pipe structural stability calculations:

SDR	= Standard dimension ratio	=	17	
S_Y	= compressive yield strength	=	1,500	psi
RD_{all}	= allowable ring deflection	=	4.2	%

1. Wall crushing (Ref 3)

$S_A = P_{DES2}\,(SDR - 1) / 2$ $\qquad$ $FS = S_Y / S_A$

Where:
- S_A = Actual compressive stress (psi)
- SDR = Standard dimension ratio
- P_{DES2} = Load pipe adjusted to account for effects of soil arching (psi)
- S_Y = Compressive yield strength (psi)
- FS = Factor of safety against wall crushing

P_{DES2} = 46 psi

S_A =	368.5	psi
FS =	4.1	

Compare calculated and suggested factor of safety:	4.1	> 1.0

2. Wall buckling (Ref 3)

$P_{cb} = 0.8\,(E'\,(2.32E / SDR^3))^{1/2}$ $\qquad$ $FS = P_{cb} / P_{DES2}$

Where:
- P_{cb} = Critical buckling pressure at top of pipe (psi)
- E' = Soil modulus (psi)
- E = Stress/time dependent tensile modulus for design loading conditions (psi)
- P_{DES2} = Load pipe adjusted to account for effects of soil arching (psi)
- FS = Factor of safety against wall buckling

E' =	3,000	psi (Refer to page IIIC-B-53)
E =	22,500	psi for 50 years based on S_A above (see chart page IIIC-B-54)
P_{DES2} =	46	psi

P_{cb} =	142.8	psi
FS =	3.1	

Compare calculated and suggested factor of safety:	3.1	> 1.0

3. Ring deflection (Ref 3)

$E_S = P_{DES2} / E'$

Where:
E_S = Soil strain (%)
P_{DES2} = Load pipe adjusted to account for effects of soil arching (psi)
E' = Soil modulus (psi)

P_{DES2} =	46	psi
E' =	3,000	psi

E_S =	1.5	%

Ring deflection for buried HDPE pipe is conservatively the same (no more than) the vertical compression of the soil envelope around the pipe. Therefore, assumed actual ring deflection (RD_{act}) is equal to soil strain.

RD_{act} = 1.5 %

Allowable ring deflection, RD_{all} = 4.2 %

$RD_{act} < RD_{all}$, design is acceptable

Note: An additional factor of safety is inherent to the design of the leachate collection system due to the presence of a gravel envelope surrounding the leachate collection pipe. The gravel layer will transmit leachate in the event that the leachate collection pipe becomes plugged or crushed.

Prep By: MDM
Date: 12/5/2017

Chkd By: NT
Date: 12/5/2017

HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE COLLECTION PIPE STRUCTURAL STABILITY
6" DIA HDPE PIPE

Adjusted load to account for soil arching = 46 psi

	Wall Crushing			Wall Buckling				Ring Deflection			
SDR	S_Y	S_A	FS_{WC}	E[2]	E'	P_{cb}	FS_{WB}	RD_{all}	E'	RD_{act}	FS_{RD}
32.5	1,500	725.5	2.1	14,500	3,000	43.4	0.9	8.1	3,000	1.5	5.3
26.0	1,500	575.8	2.6	17,500	3,000	66.6	1.4	6.5	3,000	1.5	4.2
21.0	1,500	460.6	3.3	20,000	3,000	98.1	2.1	5.2	3,000	1.5	3.4
19.0	1,500	414.6	3.6	21,100	3,000	117.1	2.5	4.7	3,000	1.5	3.1
17.0 [1]	1,500	368.5	4.1	22,500	3,000	142.8	3.1	4.2	3,000	1.5	2.7
15.5	1,500	334.0	4.5	23,500	3,000	167.7	3.6	3.9	3,000	1.5	2.5
13.5	1,500	288.1	5.2	25,000	3,000	212.5	4.6	3.4	3,000	1.5	2.2
11.0	1,500	230.3	6.5	27,000	3,000	300.6	6.5	2.7	3,000	1.5	1.8

denotes standard size

[1] Select 6-inch-diameter HDPE SDR 17.0 pipe for use in the leachate collection system based on the calculated factors of safety.

[2] Values for the modulus of elasticity were selected from the attached chart (page IIIC-B-54), Reference 3, using the calculated stress in the pipe wall (S_A under the wall crushing heading in the above table) for a 50 year duration (maximum loading is the overburden load on the pipe).

HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE COLLECTION PIPE STRUCTURAL STABILITY
18"-DIA HDPE PIPE

REQUIRED: Analyze structural stability of the 18 inch diameter leachate collection system pipe.

METHOD:

A. Determine the critical load and calculate stress under the following two conditions:

1. Construction loading
2. Overburden loading

B. Use the critical loading pressure to analyze pipe stability under the following three possible failure conditions:

1. Wall crushing
2. Wall buckling
3. Ring deflection

NOTE: The leachate trench details shown on pages IIIC-B-51 and IIIC-B-52 are for illustration purposes only to show parameters used in the following calculations. Leachate collection system details can be found in Appendix IIIA-A.

REFERENCES:

1. Bass, J., *Avoiding Failure of Leachate Collection and Cap Drainage Systems*, Pollution Technology Review No. 138, Noyles Data Corporation, 1986.

2. Texas Natural Resource Conservation Commission, *Leachate Collection System Handbook*, 30 TAC 330.201, 1993.

3. Phillips 66 Driscopipe, *System Design*, 1991.

4. Landfill Design Series, *Leachate Gas Management Systems Design, Volume 5, Leachate Management and Storage*, Appendix A, 1993.

5. Caterpillar Tractor Company, *Caterpillar Performance Handbook,* Edition 27, October 1996.

6. Quian, Xuede, R.M. Koerner, D. H. Gray, "Geotechnical Aspects of Landfill Design and Construction." Prentice-Hall, Inc., New Jersey, 2002.

SOLUTION:

A. Determine the critical load and stress:

A.1. Maximum construction loading

Assume: CAT 637E Series II scraper with an even load distribution

Loaded weight =	190,500	lb
Tire pressure =	80	psi
Number of tires =	4	

For a circular tire imprint:

$$F = \frac{\text{Loaded Weight}}{\text{Number of Tires}}$$

Where: F = Force exerted by one tire (lb)

F =	47,625	lb

Determine area of contact for circular tire imprint:

$$r = (F/pp)^{1/2}$$

Where:
r = Radius of contact (in)
F = Force exerted by one tire (lb)
p = Tire pressure (psi)

r =	13.8	in

Use Boussinesq's solution to find the stress at a point below a uniformly loaded circular area:

$$y = p\,(1 - ((r/z)^2+1)^{-3/2})$$

Where:
y = Change in vertical stress (psi)
p = Tire pressure (psi)
r = Radius of contact (in)
z = Protective cover thickness (in)

z = 24 in

y =	27.8	psi

Assume only one wheel load on pipe and add 50% for impact loading:

P_L = 1.5y

Where: P_L = Maximum live load (psi)

P_L =	41.7	psi

P_D = (zw)/1728

Where: P_D = Maximum dead load (psi)
z = Protective cover thickness (in)
w = Unit weight of protective cover (pcf)

z = 24 in
w = 116 pcf

P_D =	1.61	psi

P_T = $P_L + P_D$

Where: P_T = Maximum construction load (psi)

P_T =	43.3	psi

A.2. Overburden loading (postclosure load):

For maximum fill load on pipe:

2.0	ft gravel & cover @	116	pcf =	232	psf
4.5	ft final & intrm cover @	116	pcf =	522	psf
170.0	ft solid waste/soil @	67	pcf =	11,390	psf
			S =	12,144	psf

P_T =	84.3	psi

Determine critical loading condition:

Construction loading:	P_T =	43.3	psi
Overburden loading:	P_T =	84.3	psi

Overburden loading is most critical to the structural stability of the pipe and will be used to determine the design pipe stress.

Determine Design Stress:

1. Adjust critical stress to account for loss of strength in the pipe due to perforations:

$P_{DES1} = 12P_T / (12 - l_p)$

Where:

	l_p	= Cumulative length of perforations per foot of pipe
	P_T	= Critical pipe stress (psi)
	P_{DES1}	= Pipe stress adjusted for loss of strength (psi)
	6	holes / foot
	0.5	in / hole
l_p =	3.0	in/ft

From determination of critical loading:

P_T =	84.3	psi
P_{DES1} =	112.4	psi

Adjust pipe stress determined above to account for effects of soil arching:

2. The design pipe stress is estimated by accounting for the soil structure interaction between the buried leachate collection pipe and its backfill to obtain a realistic loading condition on the pipe.

2a. For the burial conditions shown on Figure 1 (page IIIC-B-51), the pipe may be classified as a positive projecting conduit.

2b. Because the pipe is flexible and will deflect in the vertical plane as shown on Figure 2 (page IIIC-B-52), the pipe will experience a reduction in loading due to soil arching. Soil arching is present when the soil column over the pipe settles and creates shear stresses in the surrounding soil. Those shear stresses will support the soil column, thereby reducing the load experienced by the pipe (see Figure 3, page IIIC-B-52).

2c. The load on the pipe will be estimated using Marston's Formula:

$$W_c = \gamma C_c B_c^{\ 2} \tag{1}$$

$$C_c = \frac{e^{\pm 2k\mu(H_e/B_c)} - 1}{\pm 2k\mu} + \left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) e^{\pm 2k\mu(H_e/B_c)} \tag{2}$$

Where:
- W_c = Load per unit length of conduit (lb/ft)
- γ = Unit weight of soil above conduit (pcf)
- B_c = Outer diameter of conduit (ft)
- H = Height of fill above conduit (ft)
- H_e = Height of plane of equal settlement above critical plane (ft)
- k = Lateral pressure ratio (earth pressure coefficient)
- μ = tan ϕ
- ϕ = Angle of internal friction of pipe-zone backfill (PZB) (degrees)

$$H_e = \pm r_{sd}\, p\left(\frac{H}{B_c}\right) \tag{3}$$

Where:
- r_{sd} = Settlement ratio
- p = Ratio of the conduit projection above the compacted soil liner to its diameter

$$r_{sd} = \frac{\left(S_m + S_g\right) - \left(S_f + dc\right)}{S_m} \tag{4}$$

Where:
- S_m = Compression deformation of soil column adjacent to conduit
- S_g = Settlement of natural ground adjacent to conduit
- S_f = Settlement of conduit into foundation material
- dc = Vertical deflection of the conduit

It is assumed that for a leachate collection pipe S_g and S_f are equivalent. The equation settlement ratio, therefore, reduces to the following:

$$r_{sd} = \frac{S_m - dc}{S_m} \tag{5}$$

Since the trench aggregate (PZB) is much stiffer than the pipe, dc is larger than S_m implying that r_{sd} will be negative. Because r_{sd} is negative, the pipe is categorized as an incomplete ditch as specified by Marston. Note that in the above equations, where a + and a - sign are used together, the upper sign corresponds to a positive r_{sd} and a the lower sign to a negative r_{sd}.

2d. Load analysis solution by trial and error

Step 1: Assume a value for the settlement ratio, r_{sd}.

r_{sd} = -0.68

Step 2: Calculate S_m based on the estimated vertical stress at the level of the pipe and the deformation modulus E of the PZB.

$S_m = P_{DES1}\,D / E_s$

Where:
P_{DES1} = Pipe stress adjusted for loss of strength (psi)
D = Pipe diameter (in)
E_s = PZB soil modulus (psi)

P_{DES1} =	112.4	psi
D =	18	in
E_s =	3,000	psi

S_m =	0.675	in

Step 3: Calculate dc using Equation (5):

$dc = S_m\,(1 - r_{sd})$

dc =	1.133	in

Step 4: Use the Iowa Formula (provided below) to calculate load per unit length (W_c).

$$W_c = \frac{dc}{(DL)k}\left(\frac{EI}{r^3} + 0.061E'\right)$$

Where:
DL = Deflection lag factor
k = Bedding factor
E = Young's modulus for pipe material (psi)
I = Moment of inertia for pipe wall = $t^3/12$ (in^4/in)
r = Pipe radius (in)
E' = Modulus of soil reaction (psi)

DL =	2.5	(Ref 6)
k =	0.1	(Ref 6)
E =	32,800	psi (refer to chart 25 on page IIIC-B-54, based on P_{DES1} above)
t =	1.059	in (SDR 17 pipe)
I =	0.099	in^4/in
r =	9.0	in
E' =	3,000	psi

$\boxed{W_c = 850 \text{ lb/in}}$

Step 5: Calculate C_c using Equation 1:

$$C_c = \frac{W_c}{\gamma B_c^{\,2}}$$

Composite unit weight for waste and soil:

6.5	ft waste @	116	pcf =	754	psf
170.0	ft soil @	67	pcf =	11,390	psf
			Total =	12,144	psf

γ =	68.8	pcf (weighted average based on above table)
B_c =	18	in

$\boxed{C_c = 65.9 \text{ (unitless)}}$

Step 6: Solve for H_e/B_c using Equation 2 in an iterative manner:

H =	177	ft
H/B_c =	117.7	

Assume: H_e/B_c = 2.28

$k\mu$ =	0.13	(Ref 4)
$e^{-2k\mu(He/Bc)}-1$ =	-0.45	
$-2k\mu$ =	-0.26	
$(H/B_c - H_e/B_c)$ =	115.4	
$e^{-2k\mu(He/Bc)}$ =	0.55	

Left-hand-side of equation (LHS) = 66
Right-hand-side of equation (RHS) = 66

Step 7: Substitute H_e/B_c into equation given below to determine if proper value for r_{sd} was used.

$$\left[\frac{1}{2k\mu} \pm \left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) \pm \frac{r_{sd}p}{3}\right] \frac{e^{\pm 2k\mu(H_e/B_c)} - 1}{\pm 2k\mu} \pm \frac{1}{2}\left(\frac{H_e}{B_c}\right)^2$$
$$\pm \frac{r_{sd}p}{3}\left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) e^{\pm 2k\mu(H_e/B_c)} - \frac{1}{2k\mu}\left(\frac{H_e}{B_c}\right) \mp \left(\frac{H}{B_c}\right)\left(\frac{H_e}{B_c}\right) = \pm r_{sd}\, p\left(\frac{H}{B_c}\right)$$

Because r_{sd} is negative for the incomplete ditch condition, the lower signs in the above equation are used.

p =	1
$k\mu$ =	0.13
H/B_c =	117.7
H_e/B_c =	2.28
r_{sd} =	-0.68
LHS =	80
RHS =	80

If LHS is not approximately equal to RHS, adjust value for r_{sd} in Step 1 and repeat solution procedure.

2e. Once the solutions to the above equations are determined, the design pipe stress may be calculated and the deflection of the pipe determined.

P_{DES2} $= W_c / D$

Where: P_{DES2} = Load on pipe adjusted to account for effects of soil arching (psi)

W_c =	850	lb/in
D =	18.0	in

P_{DES2} =	47	psi

A summary table for the structural stability analysis is provided on page IIIC-B-30 for the 18-inch-diameter leachate collection pipe. A pipe will be selected from this table for use in the collection system based on the calculated factors of safety for each possible failure condition. An example calculation is provided below that outlines the procedures used to determine the factors of safety for all pipe SDR sizes shown in the summary table.

B. Use the critical loading pressure to analyze pipe stability:

Example pipe structural stability calculations:

SDR	= Standard dimension ratio	=	17	
S_Y	= compressive yield strength	=	1,500	psi
RD_{all}	= allowable ring deflection	=	4.2	%

1. Wall crushing (Ref 3)

$S_A = P_{DES2}\,(SDR - 1)\,/\,2$ FS $= S_Y / S_A$

Where:
- S_A = Actual compressive stress (psi)
- SDR = Standard dimension ratio
- P_{DES2} = Load pipe adjusted to account for effects of soil arching (psi)
- S_Y = Compressive yield strength (psi)
- FS = Factor of safety against wall crushing

P_{DES2} = 47 psi

S_A =	377.7	psi
FS =	4.0	

Compare calculated and suggested factor of safety:	4.0	> 1.0

2. Wall buckling (Ref 3)

$P_{cb} = 0.8\,(E'\,(2.32E / SDR^3))^{1/2}$ FS $= P_{cb} / P_{DES2}$

Where:
- P_{cb} = Critical buckling pressure at top of pipe (psi)
- E' = Soil modulus (psi)
- E = Stress/time dependent tensile modulus for design loading conditions (psi)
- P_{DES2} = Load pipe adjusted to account for effects of soil arching (psi)
- FS = Factor of safety against wall buckling

E' =	3,000	psi (Refer to page IIIC-B-53)
E =	22,000	psi for 50 years based on S_A above (see chart page IIIC-B-54)
P_{DES2} =	47	psi

P_{cb} =	141.2	psi
FS =	3.0	

Compare calculated and suggested factor of safety:	3.0	> 1.0

3. Ring deflection (Ref 3)

$E_S = P_{DES2} / E'$

Where:
E_S = Soil strain (%)
P_{DES2} = Load pipe adjusted to account for effects of soil arching (psi)
E' = Soil modulus (psi)

P_{DES2} = 47 psi
E' = 3,000 psi

$\boxed{E_S = 1.6\ \%}$

Ring deflection for buried HDPE pipe is conservatively the same (no more than) the vertical compression of the soil envelope around the pipe. Therefore, assumed actual ring deflection (RD_{act}) is equal to soil strain.

RD_{act} = 1.6 %

Allowable ring deflection, RD_{all} = 4.2 %

$\boxed{RD_{act} < RD_{all}\text{, design is acceptable}}$

Note: An additional factor of safety is inherent to the design of the leachate collection system due to the presence of a gravel envelope surrounding the leachate collection pipe. The gravel layer will transmit leachate in the event that the leachate collection pipe becomes plugged or crushed.

HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE COLLECTION PIPE STRUCTURAL STABILITY
18"-DIA PIPE

Adjusted load to account for soil arching = 47 psi

	Wall Crushing			Wall Buckling				Ring Deflection			
SDR	S_Y	S_A	FS_{WC}	E[2]	E'	P_{cb}	FS_{WB}	RD_{all}	E'	RD_{act}	FS_{RD}
32.5	1,500	743.6	2.0	15,000	3,000	44.1	0.9	8.1	3,000	1.6	5.1
26.0	1,500	590.2	2.5	18,000	3,000	67.5	1.4	6.5	3,000	1.6	4.1
21.0	1,500	472.1	3.2	20,000	3,000	98.1	2.1	5.2	3,000	1.6	3.3
19.0	1,500	424.9	3.5	21,500	3,000	118.2	2.5	4.7	3,000	1.6	3.0
17.0 [1]	1,500	377.7	4.0	23,000	3,000	144.4	3.1	4.2	3,000	1.6	2.7
15.5	1,500	342.3	4.4	23,500	3,000	167.7	3.6	3.9	3,000	1.6	2.5
13.5	1,500	295.3	5.1	25,000	3,000	212.5	4.5	3.4	3,000	1.6	2.2
11.0	1,500	236.1	6.4	27,000	3,000	300.6	6.4	2.7	3,000	1.6	1.7

denotes standard size

[1] Select 18-inch-diameter HDPE SDR 17.0 pipe for use in the leachate collection system based on the calculated factors of safety.

[2] Values for the modulus of elasticity were selected from the attached chart (page IIIC-B-54), Reference 3, using the calculated stress in the pipe wall (S_A under the wall crushing heading in the above table) for a 50 year duration (maximum loading is the overburden load on the pipe).

REQUIRED: Analyze structural stability of the 6 inch diameter leachate collection system pipe.

METHOD:

A. Determine the critical load and calculate stress under the following two conditions:

1. Construction loading
2. Overburden loading

B. Use the critical loading pressure to analyze pipe stability under the following three possible failure conditions:

1. Wall crushing
2. Wall buckling
3. Ring deflection

NOTE:

1. The leachate trench details shown on pages IIIC-B-51 and IIIC-B-52 are for illustration purposes only to show parameters used in the following calculations. Leachate collection system details can be found in Appendix IIIA-A.
2. The leachate collection header pipe used in the developed cells is a 6" PVC Schedule 80 pipe.

REFERENCES:

1. Bass, J., *Avoiding Failure of Leachate Collection and Cap Drainage Systems,* Pollution Technology Review No. 138, Noyles Data Corporation, 1986.

2. Texas Natural Resource Conservation Commission, *Leachate Collection System Handbook,* 30 TAC 330.201, 1993.

3. Phillips 66 Driscopipe, *System Design,* 1991.

4. Landfill Design Series, *Leachate Gas Management Systems Design, Volume 5, Leachate Management and Storage*, Appendix A, 1993.

5. Caterpillar Tractor Company, *Caterpillar Performance Handbook,* Edition 27, October 1996.

6. Quian, Xuede, R.M. Koerner, D. H. Gray, "Geotechnical Aspects of Landfill Design and Construction." Prentice-Hall, Inc., New Jersey, 2002.

7. Part 636 Structural Engineering National Engineering Handbook, Chapter 52 - Structural Design of Flexible Conduits, United States Department of Agriculture.

SOLUTION:

A. Determine the critical load and stress:

A.1. Maximum construction loading:

Assume: CAT 637E Series II scraper with an even load distribution

Loaded weight =	190,500	lb
Tire pressure =	80	psi
Number of tires =	4	

For a circular tire imprint:

$$F = \frac{\text{Loaded Weight}}{\text{Number of Tires}}$$

Where: F = Force exerted by one tire (lb)

F =	47,625	lb

Determine area of contact for circular tire imprint:

$$r = (F/pp)^{1/2}$$

Where:
r = Radius of contact (in)
F = Force exerted by one tire (lb)
p = Tire pressure (psi)

r =	13.8	in

Use Boussinesq's solution to find the stress at a point below a uniformly loaded circular area:

$$y = p\,(1 - ((r/z)^2+1)^{-3/2})$$

Where:
y = Change in vertical stress (psi)
p = Tire pressure (psi)
r = Radius of contact (in)
z = Protective cover thickness (in)

z = 24 in

y =	27.8	psi

Assume only one wheel load on pipe and add 50% for impact loading:

P_L = 1.5y

Where: P_L = Maximum live load (psi)

P_L =	41.7	psi

P_D = (zw)/1728

Where: P_D = Maximum dead load (psi)
z = Protective cover thickness (in)
w = Unit weight of protective cover (pcf)

z = 24 in
w = 116 pcf

P_D =	1.61	psi

P_T = P_L + P_D

Where: P_T = Maximum construction load (psi)

P_T =	43.3	psi

A.2. Overburden loading (postclosure load):

For maximum fill load on pipe:

2.0	ft protective cover @	116	pcf =	232	psf
4.5	ft final & intrm cover @	116	pcf =	522	psf
170.0	ft solid waste/soil @	67	pcf =	11,390	psf
			S =	12,144	psf

P_T =	84.3	psi

Determine critical loading condition:

Construction loading:	P_T =	43.3	psi
Overburden loading:	P_T =	84.3	psi

Overburden loading is most critical to the structural stability of the pipe and will be used to determine the design pipe stress.

Determine design stress:

1. Adjust critical stress to account for loss of strength in the pipe due to perforations:

$P_{DES1} = 12P_T / (12 - l_p)$

Where:

l_p = Cumulative length of perforations per foot of pipe
P_T = Critical pipe stress (psi)
P_{DES1} = Pipe stress adjusted for loss of strength (psi)

6 holes / foot
0.5 in / hole

l_p =	3.0	in/ft

From determination of critical loading:

P_T = 84.3 psi

P_{DES1} =	112.4	psi

Adjust pipe stress determined above to account for effects of soil arching:

2. The design pipe stress is estimated by accounting for the soil structure interaction between the buried leachate collection pipe and its backfill to obtain a realistic loading condition on the pipe.

2a. For the burial conditions shown on Figure 1 (page IIIC-B-51), the pipe may be classified as a positive projecting conduit.

2b. Because the pipe is flexible and will deflect in the vertical plane as shown on Figure 2 (page IIIC-B-52), the pipe will experience a reduction in loading due to soil arching. Soil arching is present when the soil column over the pipe settles and creates shear stresses in the surrounding soil. Those shear stresses will support the soil column, thereby reducing the load experienced by the pipe (see Figure 3, page IIIC-B-52).

2c. The load on the pipe will be estimated using Marston's Formula:

$$W_c = \gamma C_c B_c^2 \qquad (1)$$

$$C_c = \frac{e^{\pm 2k\mu(H_e/B_c)} - 1}{\pm 2k\mu} + \left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) e^{\pm 2k\mu(H_e/B_c)} \qquad (2)$$

Where:
- W_c = Load per unit length of conduit (lb/ft)
- γ = Unit weight of soil above conduit (pcf)
- B_c = Outer diameter of conduit (ft)
- H = Height of fill above conduit (ft)
- H_e = Height of plane of equal settlement above critical plane (ft)
- k = Lateral pressure ratio (earth pressure coefficient)
- μ = tan ϕ
- ϕ = Angle of internal friction of pipe-zone backfill (PZB) (degrees)

$$H_e = \pm r_{sd}\, p \left(\frac{H}{B_c}\right) \qquad (3)$$

Where:
- r_{sd} = Settlement ratio
- p = Ratio of the conduit projection above the compacted soil liner to its diameter

$$r_{sd} = \frac{(S_m + S_g) - (S_f + dc)}{S_m} \qquad (4)$$

Where:
- S_m = Compression deformation of soil column adjacent to conduit
- S_g = Settlement of natural ground adjacent to conduit
- S_f = Settlement of conduit into foundation material
- dc = Vertical deflection of the conduit

It is assumed that for a leachate collection pipe S_g and S_f are equivalent. The equation settlement ratio, therefore, reduces to the following:

$$r_{sd} = \frac{S_m - dc}{S_m} \qquad (5)$$

Since the trench aggregate (PZB) is much stiffer than the pipe, dc is larger than S_m implying that r_{sd} will be negative. Because r_{sd} is negative, the pipe is categorized as an incomplete ditch as specified by Marston. Note that in the above equations, where a + and a - sign are used together, the upper sign corresponds to a positive r_{sd} and a the lower sign to a negative r_{sd}.

2d. Load analysis solution by trial and error

Step 1: Assume a value for the settlement ratio, r_{sd}.

r_{sd} = -0.55

Step 2: Calculate S_m based on the estimated vertical stress at the level of the pipe and the deformation modulus E of the PZB.

$S_m = P_{DES1} D / E_s$

Where:
P_{DES1} = Pipe stress adjusted for loss of strength (psi)
D = Pipe diameter (in)
E_s = PZB soil modulus (psi)

P_{DES1} =	112.4	psi
D =	6.625	in
E_s =	3,000	psi

S_m =	0.248	in

Step 3: Calculate dc using Equation (5):

$dc = S_m (1 - r_{sd})$

dc =	0.384	in

Step 4: Use the Iowa Formula (provided below) to calculate load per unit length (W_c).

$$W_c = \frac{dc}{(DL)k}\left(\frac{EI}{r^3} + 0.061E'\right)$$

Where:
DL = Deflection lag factor
k = Bedding factor
E = Young's modulus for pipe material (psi)
I = Moment of inertia for pipe wall = $t^3/12$ (in^4/in)
r = Pipe radius (in)
E' = Modulus of soil reaction (psi)

DL =	2.5	(Ref 6)
k =	0.1	(Ref 6)
E =	140,000	psi (long-term, see page IIIC-B-55 from Ref 7)
t =	0.432	in (PVC Sch 80 pipe)
I =	0.007	in^4/in
r =	3.3	in
E' =	3,000	psi

W_c =	321	lb/in

Step 5: Calculate C_c using Equation 1:

$$C_c = \frac{W_c}{\gamma B_c^{\ 2}}$$

Composite unit weight for waste and soil:

6.5	ft soil @	116	pcf =	754	psf
170.0	ft waste @	67	pcf =	11,390	psf
			Total =	12,144	psf

γ =	68.8	pcf (weighted average based on above table)
B_c =	6.625	in

C_c =	183.4	(unitless)

Step 6: Solve for H_e/B_c using Equation 2 in an iterative manner:

	H =	170	ft
	H/B_c =	307.9	
Assume:	H_e/B_c =	2.00	
	$k\mu$ =	0.13	(Ref 4)
	$e^{-2k\mu(He/Bc)}-1$ =	-0.41	
	$-2k\mu$ =	-0.26	
	$(H/B_c - H_e/B_c)$ =	305.9	
	$e^{-2k\mu(He/Bc)}$ =	0.59	

Left-hand-side of equation (LHS) =	183
Right-hand-side of equation (RHS) =	183

Step 7: Substitute H_e/B_c into equation given below to determine if proper value for r_{sd} was used.

$$\left[\frac{1}{2k\mu} \pm \left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) \pm \frac{r_{sd}\,p}{3}\right]\frac{e^{\pm 2k\mu(H_e/B_c)} - 1}{\pm 2k\mu} \pm \frac{1}{2}\left(\frac{H_e}{B_c}\right)^2$$
$$\pm \frac{r_{sd}\,p}{3}\left(\frac{H}{B_c} - \frac{H_e}{B_c}\right)e^{\pm 2k\mu(H_e/B_c)} - \frac{1}{2k\mu}\left(\frac{H_e}{B_c}\right) \mp \left(\frac{H}{B_c}\right)\left(\frac{H_e}{B_c}\right) = \pm r_{sd}\,p\left(\frac{H}{B_c}\right)$$

Because r_{sd} is negative for the incomplete ditch condition, the lower signs in the above equation are used.

p =	1
$k\mu$ =	0.13
H/B_c =	307.9
H_e/B_c =	2.00
r_{sd} =	-0.55
LHS =	168
RHS =	168

If LHS is not approximately equal to RHS, adjust value for r_{sd} in Step 1 and repeat solution procedure.

2e. Once the solutions to the above equations are determined, the design pipe stress may be calculated and the deflection of the pipe determined.

P_{DES2} $= W_c / D$

Where: P_{DES2} = Load on pipe adjusted to account for effects of soil arching (psi)

W_c =	321	lb/in
D =	6.6	in

P_{DES2} =	48	psi

B. Use the critical loading pressure to analyze pipe stability:

Example pipe structural stability calculations:

SDR	= Standard dimension ratio	=	15	
S_Y	= Compressive yield strength	=	2,000	psi (see page IIIC-B-57 from Ref 7)
D_{all}	= Allowable deflection	=	5.0	%

1. Wall crushing (Ref 3)

$S_A = P_{DES2}\,(SDR - 1) / 2$ FS $= S_Y / S_A$

Where:
- S_A = Actual compressive stress (psi)
- SDR = Standard dimension ratio
- P_{DES2} = Load pipe adjusted to account for effects of soil arching (psi)
- S_Y = Compressive yield strength (psi)
- FS = Factor of safety against wall crushing

P_{DES2} = 48 psi

S_A =	362.9	psi
FS =	5.5	

Compare calculated and suggested factor of safety:	5.5	> 1.0

2. Wall buckling (Ref 3)

$P_{cb} = 0.8\,(E'\,(2.32E / SDR^3))^{1/2}$ FS $= P_{cb} / P_{DES2}$

Where:
- P_{cb} = Critical buckling pressure at top of pipe (psi)
- E' = Soil modulus (psi)
- E = Stress/time dependent tensile modulus for design loading conditions (psi)
- P_{DES2} = Load pipe adjusted to account for effects of soil arching (psi)
- FS = Factor of safety against wall buckling

E' =	3,000	psi (Refer to page IIIC-B-53)
E =	140,000	psi (long-term, see page IIIC-B-55 from Ref. 7)
P_{DES2} =	48	psi

P_{cb} =	429.9	psi
FS =	8.9	

Compare calculated and suggested factor of safety:	8.9	> 1.0

3. Deflection (Ref 7)

D_{act} $= DL * k * P_{DES2} (100) / [2E / (3 (SDR - 1)^3 + 0.061 E']$

Where:
- D_{act} = Calculated deflection (%)
- DL = Deflection lag factor
- k = Bedding factor
- P_{DES2} = Load pipe adjusted to account for effects of soil arching (psi)
- E = Young's modulus for pipe material (psi)
- E' = Soil modulus (psi)

DL =	2.5	(Ref 6)
k =	0.1	(Ref 6)
P_{DES2} =	48	psi
E =	400,000	psi (short term, see page IIIC-B-56 from Ref 7)
E' =	3,000	psi

D_{act}	4.3	%

Allowable deflection, D_{all} = 5.0 %

$D_{act} < D_{all}$, design is acceptable

Note: An additional factor of safety is inherent to the design of the leachate collection system due to the presence of a gravel envelope surrounding the leachate collection pipe. The gravel layer will transmit leachate in the event that the leachate collection pipe becomes plugged or crushed.

REQUIRED: Analyze structural stability of the 8 inch diameter leachate collection system pipe.

METHOD:

A. Determine the critical load and calculate stress under the following two conditions:

1. Construction loading
2. Overburden loading

B. Use the critical loading pressure to analyze pipe stability under the following three possible failure conditions:

1. Wall crushing
2. Wall buckling
3. Ring deflection

NOTE:

1. The leachate trench details shown on pages IIIC-B-51 and IIIC-B-52 are for illustration purposes only to show parameters used in the following calculations. Leachate collection system details can be found in Appendix IIIA-A.
2. The leachate collection lateral pipe used in the developed cells is a 8" PVC Schedule 80 pipe.

REFERENCES:

1. Bass, J., *Avoiding Failure of Leachate Collection and Cap Drainage Systems*, Pollution Technology Review No. 138, Noyles Data Corporation, 1986.

2. Texas Natural Resource Conservation Commission, *Leachate Collection System Handbook*, 30 TAC 330.201, 1993.

3. Phillips 66 Driscopipe, *System Design*, 1991.

4. Landfill Design Series, *Leachate Gas Management Systems Design, Volume 5, Leachate Management and Storage*, Appendix A, 1993.

5. Caterpillar Tractor Company, *Caterpillar Performance Handbook,* Edition 27, October 1996.

6. Quian, Xuede, R.M. Koerner, D. H. Gray, "Geotechnical Aspects of Landfill Design and Construction." Prentice-Hall, Inc., New Jersey, 2002.

7. Part 636 Structural Engineering National Engineering Handbook, Chapter 52 - Structural Design of Flexible Conduits, United States Department of Agriculture.

SOLUTION:

A. Determine the critical load and stress:

A.1. Maximum construction loading:

Assume: CAT 637E Series II scraper with an even load distribution

Loaded weight =	190,500	lb
Tire pressure =	80	psi
Number of tires =	4	

For a circular tire imprint:

$$F = \frac{\text{Loaded Weight}}{\text{Number of Tires}}$$

Where: F = Force exerted by one tire (lb)

F =	47,625	lb

Determine area of contact for circular tire imprint:

$$r = (F/pp)^{1/2}$$

Where:
r = Radius of contact (in)
F = Force exerted by one tire (lb)
p = Tire pressure (psi)

r =	13.8	in

Use Boussinesq's solution to find the stress at a point below a uniformly loaded circular area:

$$y = p\,(1 - ((r/z)^2+1)^{-3/2})$$

Where:
y = Change in vertical stress (psi)
p = Tire pressure (psi)
r = Radius of contact (in)
z = Protective cover thickness (in)

z = 24 in

y =	27.8	psi

Assume only one wheel load on pipe and add 50% for impact loading:

P_L = 1.5y

Where: P_L = Maximum live load (psi)

P_L =	41.7	psi

P_D = (zw)/1728

Where: P_D = Maximum dead load (psi)
z = Protective cover thickness (in)
w = Unit weight of protective cover (pcf)

z = 24 in
w = 116 pcf

P_D =	1.61	psi

P_T = $P_L + P_D$

Where: P_T = Maximum construction load (psi)

P_T =	43.3	psi

A.2. Overburden loading (postclosure load):

For maximum fill load on pipe:

2.0	ft protective cover @	116	pcf =	232	psf
4.5	ft final & intrm cover @	116	pcf =	522	psf
170.0	ft solid waste/soil @	67	pcf =	11,390	psf
			S =	12,144	psf

P_T =	84.3	psi

Determine critical loading condition:

Construction loading:	P_T =	43.3	psi
Overburden loading:	P_T =	84.3	psi

Overburden loading is most critical to the structural stability of the pipe and will be used to determine the design pipe stress.

Determine design stress:

1. Adjust critical stress to account for loss of strength in the pipe due to perforations:

P_{DES1} $= 12P_T / (12 - l_p)$

Where:

	l_p	= Cumulative length of perforations per foot of pipe
	P_T	= Critical pipe stress (psi)
	P_{DES1}	= Pipe stress adjusted for loss of strength (psi)
	6	holes / foot
	0.5	in / hole
l_p =	3.0	in/ft

From determination of critical loading:

P_T =	84.3	psi
P_{DES1} =	112.4	psi

Adjust pipe stress determined above to account for effects of soil arching:

2. The design pipe stress is estimated by accounting for the soil structure interaction between the buried leachate collection pipe and its backfill to obtain a realistic loading condition on the pipe.

2a. For the burial conditions shown on Figure 1 (page IIIC-B-51), the pipe may be classified as a positive projecting conduit.

2b. Because the pipe is flexible and will deflect in the vertical plane as shown on Figure 2 (page IIIC-B-52), the pipe will experience a reduction in loading due to soil arching. Soil arching is present when the soil column over the pipe settles and creates shear stresses in the surrounding soil. Those shear stresses will support the soil column, thereby reducing the load experienced by the pipe (see Figure 3, page IIIC-B-52).

2c. The load on the pipe will be estimated using Marston's Formula:

$$W_c = \gamma C_c B_c^{\ 2} \qquad (1)$$

$$C_c = \frac{e^{\pm 2k\mu(H_e/B_c)} - 1}{\pm 2k\mu} + \left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) e^{\pm 2k\mu(H_e/B_c)} \qquad (2)$$

Where:

- W_c = Load per unit length of conduit (lb/ft)
- γ = Unit weight of soil above conduit (pcf)
- B_c = Outer diameter of conduit (ft)
- H = Height of fill above conduit (ft)
- H_e = Height of plane of equal settlement above critical plane (ft)
- k = Lateral pressure ratio (earth pressure coefficient)
- μ = tan ϕ
- ϕ = Angle of internal friction of pipe-zone backfill (PZB) (degrees)

$$H_e = \pm r_{sd}\, p\left(\frac{H}{B_c}\right) \qquad (3)$$

Where:

- r_{sd} = Settlement ratio
- p = Ratio of the conduit projection above the compacted soil liner to its diameter

$$r_{sd} = \frac{\left(S_m + S_g\right) - \left(S_f + dc\right)}{S_m} \qquad (4)$$

Where:

- S_m = Compression deformation of soil column adjacent to conduit
- S_g = Settlement of natural ground adjacent to conduit
- S_f = Settlement of conduit into foundation material
- dc = Vertical deflection of the conduit

It is assumed that for a leachate collection pipe S_g and S_f are equivalent. The equation settlement ratio, therefore, reduces to the following:

$$r_{sd} = \frac{S_m - dc}{S_m} \qquad (5)$$

Since the trench aggregate (PZB) is much stiffer than the pipe, dc is larger than S_m implying that r_{sd} will be negative. Because r_{sd} is negative, the pipe is categorized as an incomplete ditch as specified by Marston. Note that in the above equations, where a + and a - sign are used together, the upper sign corresponds to a positive r_{sd} and a the lower sign to a negative r_{sd}.

2d. Load analysis solution by trial and error

Step 1: Assume a value for the settlement ratio, r_{sd}.

r_{sd} = -0.58

Step 2: Calculate S_m based on the estimated vertical stress at the level of the pipe and the deformation modulus E of the PZB.

$$S_m = P_{DES1} D / E_s$$

Where:

P_{DES1}	= Pipe stress adjusted for loss of strength (psi)
D	= Pipe diameter (in)
E_s	= PZB soil modulus (psi)

P_{DES1} =	112.4	psi
D =	8.625	in
E_s =	3,000	psi

S_m =	0.323	in

Step 3: Calculate dc using Equation (5):

$$dc = S_m (1 - r_{sd})$$

dc =	0.511	in

Step 4: Use the Iowa Formula (provided below) to calculate load per unit length (W_c).

$$W_c = \frac{dc}{(DL)k}\left(\frac{EI}{r^3} + 0.061E'\right)$$

Where:

DL	= Deflection lag factor
k	= Bedding factor
E	= Young's modulus for pipe material (psi)
I	= Moment of inertia for pipe wall = $t^3/12$ (in^4/in)
r	= Pipe radius (in)
E'	= Modulus of soil reaction (psi)

DL =	2.5	(Ref 6)
k =	0.1	(Ref 6)
E =	140,000	psi (long-term, see page IIIC-B-55 from Ref 7)
t =	0.5	in (PVC Sch 80 pipe)
I =	0.010	in^4/in
r =	4.3	in
E' =	3,000	psi

W_c =	411	lb/in

Step 5: Calculate C_c using Equation 1:

$$C_c = \frac{W_c}{\gamma B_c^{\ 2}}$$

Composite unit weight for waste and soil:

6.5	ft soil @	116	pcf =	754	psf
170.0	ft waste @	67	pcf =	11,390	psf
			Total =	12,144	psf

γ =	68.8	pcf (weighted average based on above table)
B_c =	8.625	in

C_c =	138.8	(unitless)

Step 6: Solve for H_e/B_c using Equation 2 in an iterative manner:

	H =	170	ft
	H/B_c =	236.5	
Assume:	H_e/B_c =	2.07	
	$k\mu$ =	0.13	(Ref 4)
	$e^{-2k\mu(He/Bc)}-1$ =	-0.42	
	$-2k\mu$ =	-0.26	
	$(H/B_c - H_e/B_c)$ =	234.5	
	$e^{-2k\mu(He/Bc)}$ =	0.58	

Left-hand-side of equation (LHS) = 139
Right-hand-side of equation (RHS) = 139

Step 7: Substitute H_e/B_c into equation given below to determine if proper value for r_{sd} was used.

$$\left[\frac{1}{2k\mu} \pm \left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) \pm \frac{r_{sd}\, p}{3}\right] \frac{e^{\pm 2k\mu(H_e/B_c)} - 1}{\pm 2k\mu} \pm \frac{1}{2}\left(\frac{H_e}{B_c}\right)^2$$

$$\pm \frac{r_{sd}\, p}{3}\left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) e^{\pm 2k\mu(H_e/B_c)} - \frac{1}{2k\mu}\left(\frac{H_e}{B_c}\right) \mp \left(\frac{H}{B_c}\right)\left(\frac{H_e}{B_c}\right) = \pm r_{sd}\, p\left(\frac{H}{B_c}\right)$$

Because r_{sd} is negative for the incomplete ditch condition, the lower signs in the above equation are used.

p =	1
kμ =	0.13
H/B_c =	236.5
H_e/B_c =	2.07
r_{sd} =	-0.58
LHS =	137
RHS =	137

If LHS is not approximately equal to RHS, adjust value for r_{sd} in Step 1 and repeat solution procedure.

2e. Once the solutions to the above equations are determined, the design pipe stress may be calculated and the deflection of the pipe determined.

P_{DES2} $= W_c / D$

Where: P_{DES2} = Load on pipe adjusted to account for effects of soil arching (psi)

W_c =	411	lb/in
D =	8.6	in

P_{DES2} =	48	psi

B. Use the critical loading pressure to analyze pipe stability:

Example pipe structural stability calculations:

SDR	= Standard dimension ratio	=	17	
S_Y	= Compressive yield strength	=	2,000	psi (see page IIIC-B-57 from Ref 7)
D_{all}	= Allowable deflection	=	5.0	%

1. Wall crushing (Ref 3)

$S_A = P_{DES2}\,(SDR - 1) / 2$ FS $= S_Y / S_A$

Where:
- S_A = Actual compressive stress (psi)
- SDR = Standard dimension ratio
- P_{DES2} = Load pipe adjusted to account for effects of soil arching (psi)
- S_Y = Compressive yield strength (psi)
- FS = Factor of safety against wall crushing

P_{DES2} = 48 psi

S_A =	405.1	psi
FS =	4.9	

Compare calculated and suggested factor of safety:	4.9	> 1.0

2. Wall buckling (Ref 3)

$P_{cb} = 0.8\,(E'\,(2.32E / SDR^3))^{1/2}$ FS $= P_{cb} / P_{DES2}$

Where:
- P_{cb} = Critical buckling pressure at top of pipe (psi)
- E' = Soil modulus (psi)
- E = Stress/time dependent tensile modulus for design loading conditions (psi)
- P_{DES2} = Load pipe adjusted to account for effects of soil arching (psi)
- FS = Factor of safety against wall buckling

E' =	3,000	psi (Refer to page IIIC-B-53)
E =	140,000	psi (long-term, see page IIIC-B-55 from Ref. 7)
P_{DES2} =	48	psi

P_{cb} =	356.3	psi
FS =	7.5	

Compare calculated and suggested factor of safety:	7.5	> 1.0

3. Deflection (Ref 7)

$$D_{act} = DL * k * P_{DES2} (100) / [2E / (3 (SDR - 1)^3 + 0.061 E']$$

Where:

D_{act}	= Calculated deflection (%)
DL	= Deflection lag factor
k	= Bedding factor
P_{DES2}	= Load pipe adjusted to account for effects of soil arching (psi)
E	= Young's modulus for pipe material (psi)
E'	= Soil modulus (psi)

DL =	2.5	(Ref 6)
k =	0.1	(Ref 6)
P_{DES2} =	48	psi
E =	400,000	psi (short term, see page IIIC-B-56 from Ref 7)
E' =	3,000	psi

D_{act}	4.8	%

Allowable deflection, D_{all} = 5.0 %

$D_{act} < D_{all}$, design is acceptable

Note: An additional factor of safety is inherent to the design of the leachate collection system due to the presence of a gravel envelope surrounding the leachate collection pipe. The gravel layer will transmit leachate in the event that the leachate collection pipe becomes plugged or crushed.

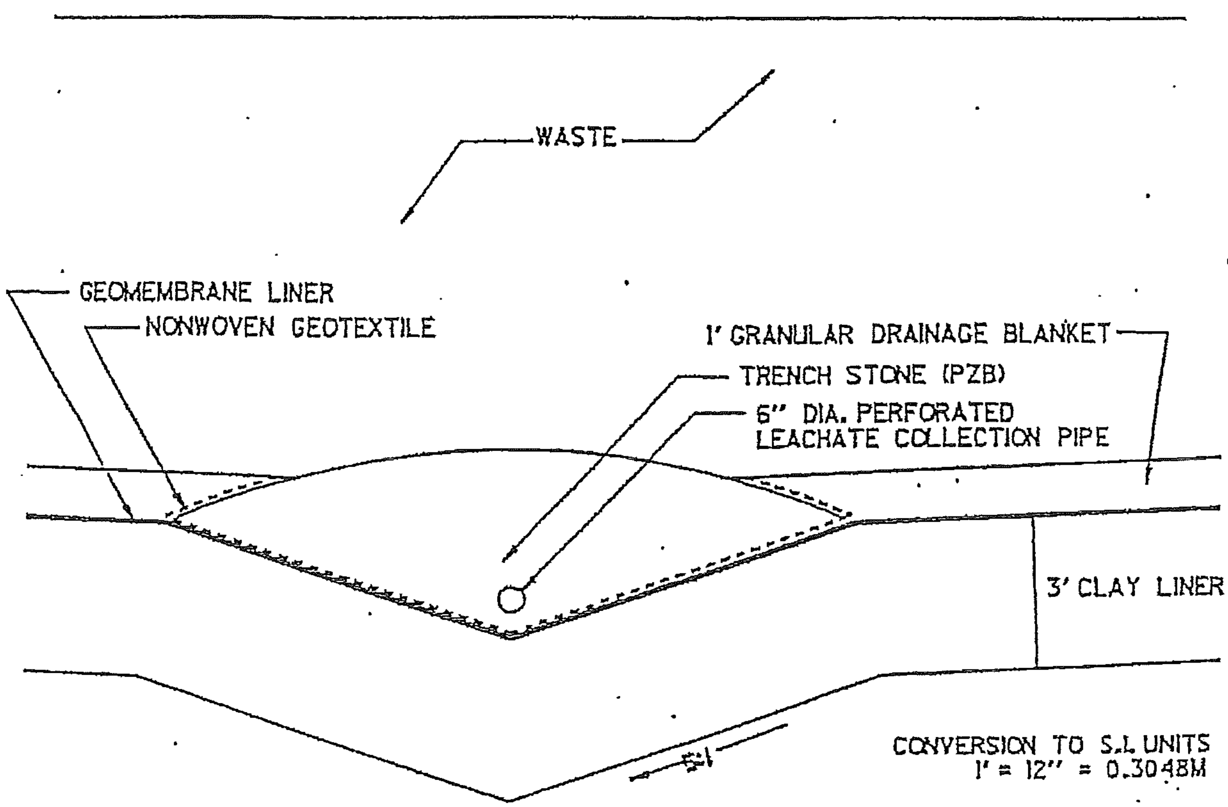

FIGURE 1: TYPICAL V-SHAPED TRENCH FOR LANDFILLS WITH COMPOSITE LINERS

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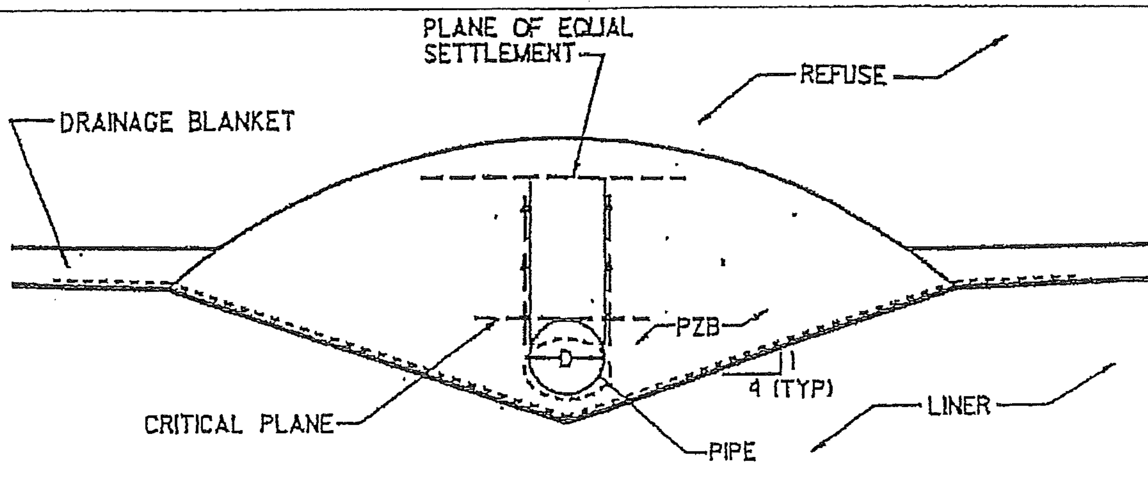

FIGURE 2: SETTLEMENT OF LEACHATE PIPE INDUCING SHEAR STRESSES IN PZB

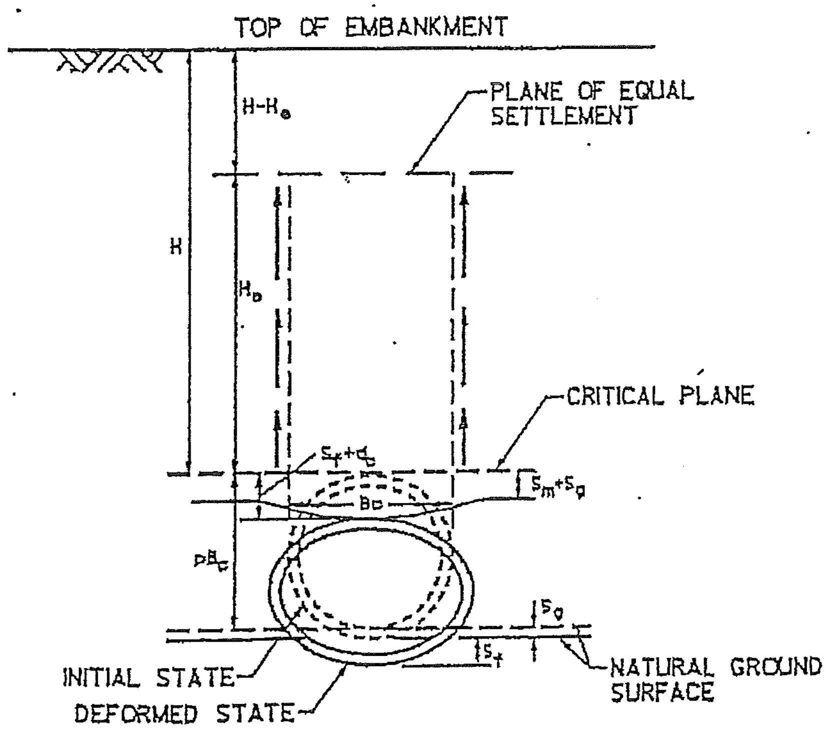

FIGURE 3: CASE OF AN INCOMPLETE DITCH CONDITION FOR A POSITIVE PROJECTING CONDUIT

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Simplified Burial Design: A conservative estimate of the ability of Driscopipe pipelines to perform in a buried environment is found in Chart 24. It is based on a minimum 2:1 safety factor and 50 year design service life. A detailed burial design starts on page 37. The detailed design should be used for critical or marginal applications or whenever a more precise solution is desired.

Detailed Burial Design:
Design by Wall Crushing: Wall crushing would theoretically occur when the stress in a pipe wall, due to the external vertical pressure, exceeded the long-term compressive strength of the pipe material. To ensure that the Driscopipe wall is strong enough to endure the external pressure the following check should be made:

$$S_A = \frac{(SDR - 1)}{2} P_T$$

Values of E'

Based on Soil Type (ASTM D2321) and Degree of Compaction

Soil Type of Initial Backfill Embedment Material	Description	E' (psi) for Degree of Compaction (Proctor Density, %) Loose	Slight (70-85%)	Moderate (85-95%)	High (95%)
I	Manufactured angular, granular materials (crushed stone or rock, broken coral, cinders, etc.)	1,000	3,000	3,000	3,000
II	Coarse grained soils with little or no fines	N.R.	1,000	2,000	3,000
III	Coarse grained soils with fines	N.R.	N.R.	1,000	2,000
IV	Fine-grained soils	N.R.	N.R.	N.R.	N.R.
V	Organic soils (peat, muck, clay, etc.)	N.R.	N.R.	N.R.	N.R.

N.R. = Not Recommended for use by ASTM D2321 for pipe wall support

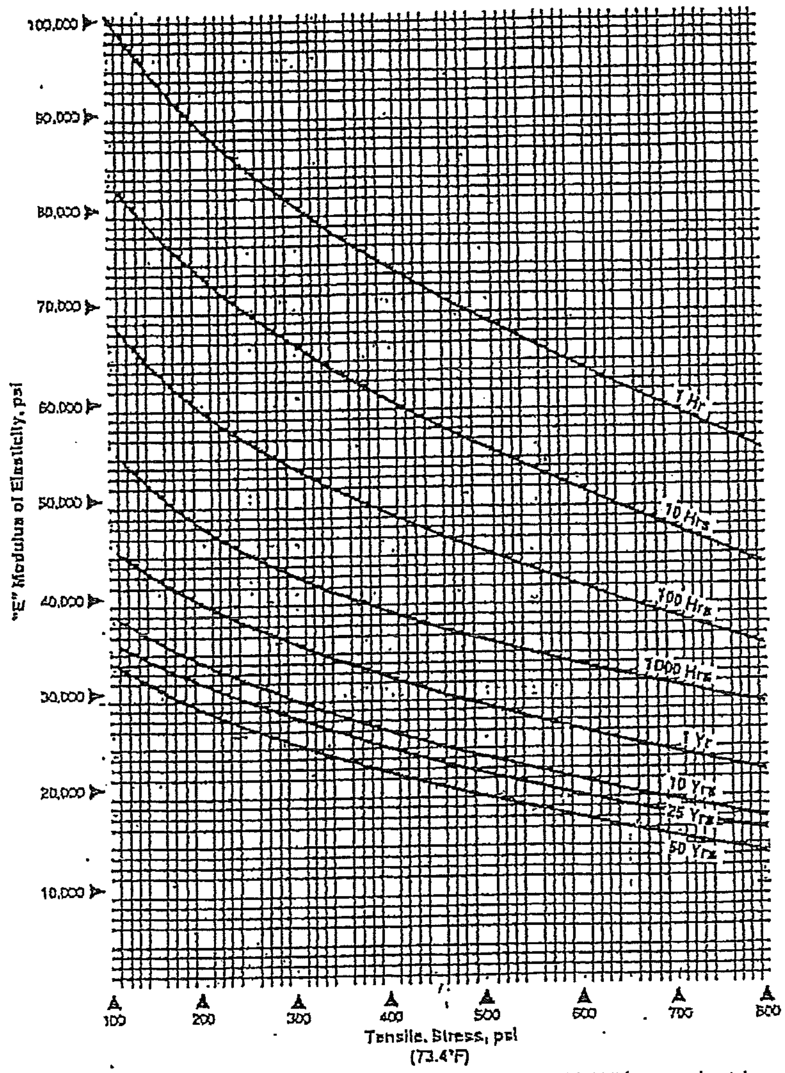
Chart 24

SDR	Maximum Burial Depth, ft. in dry soil of 100 lbs/cu. ft. Soil Modulus, psi* 1000	2000	3000	Maximum External Pressure psi Soil Modulus, psi* 1000	2000	3000	Maximum Deflection, % after installation Soil Modulus, psi* 1000	2000	3000
32.5	25	32	37	17	22	26	1.7	0.9	0.6
26	33	45	52	23	31	36	2.3	1.2	0.8
21	46	61	71	32	42	49	3.2	1.6	1.1
19	52	69	81	36	48	56	3.6	1.8	1.2
17	61	121	181	42	84	126	4.2	2.1	1.4
15.5	56	112	168	39	78	117	3.9	2.0	1.3
13.5	49	98	147	34	68	102	3.4	1.7	1.1
11	39	78	117	27	54	81	2.7	1.4	0.9
9.3	33	68	101	23	47	70	2.3	1.2	0.8
8.3	30	61	89	21	42	62	2.1	1.1	0.7
7.3	26	52	79	18	36	55	1.8	0.9	0.6

*assumes no external loads

Chart 25

Time Dependent Modulus of Elasticity for Polyethylene Pipe vs. Stress Intensity (73.4°F)



NOTE: The short term modulus of elasticity of Driscopipe per ASTM D 638 is approximately 100,000 psi. Due to the cold flow (creep) characteristic of the pipe material, this modulus is dependent upon the stress intensity and the time duration of the applied stress.

3. Phillips 66 Driscopipe, "System Design", 1991.

E_{long} = long term modulus of elasticity, lb/in^2
(see table below)
The long term modulus of elasticity is recommended if the pipe is subject to the pressure in the normal operations. If the pipe is subject to the pressure for short time periods and infrequently, the use of the short-term modulus of elasticity is acceptable.

E' = modulus of soil reaction, lb/in^2 (table 52–2)

I_{pw} = pipe wall moment of inertia

$$= \frac{t^3}{12}, \text{in}^4/\text{in} \quad \text{(for solid wall pipe)}$$

where:
t = pipe wall thickness, in

D_o = outside pipe diameter, in

Material	Modulus of elasticity* (lb/in^2)
PVC	140,000 (long term)
ABS	65,000 (long term)
Polyethylene	22,000 (long term)

* Long-term modulus of elasticity varies with the cell class of each plastic. Specific values may be obtained from the manufacturer.

Pipes that are out-of-round or deflected increase in bending moment and have less allowable buckling pressure. The allowable buckling pressure should be reduced by the following factor:

$$C = \left[\frac{\left(1 - \frac{\%\Delta X}{D}\frac{1}{100}\right)}{\left(1 + \frac{\%\Delta X}{D}\frac{1}{100}\right)^2}\right]^3 \tag{52–34}$$

where:
C = reduction factor for buckling pressure

$\frac{\%\Delta X}{D}$ = percent deflection

Table 52–2 Average values of the modulus of soil reaction for the Modified Iowa Equation

Soil type – pipe bedding material (Unified Soil Classification – ASTM D2487)	E' for degree of compaction of bedding, lb/in^2 1/			
	Dumped	Slight, < 85% proctor, < 40% relative density	Moderate, 85-95% proctor, 40-70% relative density	High, > 95% proctor, > 70% relative density
Fine-grained soil (LL>50) 2/ Soil with medium to high plasticity CH, MH, CH-MH	No data available, use E' = 0 or consult with a geotechnical engineer			
Fine-grained soil (LL<50) soil with medium to no plasticity CL, ML, ML-CL, with less than 25% coarse-grained particles	50	200	400	1,000
Fine-grained soil (LL<50) soil with medium to no plasticity CL, ML, ML-CL, with more than 25% coarse-grained particles. Coarse-grained soil with fines GM, GC, SM, SC contains more than 12% fines	100	400	1,000	2,000
Coarse-grained soil with little or no fines GW, GP, SW, SP contains less than 12% fines	200	1,000	2,000	3,000
Crushed rock	1,000	3,000	3,000	3,000

1/ Source ASCE Journal of Geotechnical Engineering Division, January 1977
2/ LL = liquid limit

Corrugated-plastic pipe as:

$$\frac{\%\Delta X}{D} = \frac{\left(D_L P_s + P_w + P_v\right)\left(\frac{1}{144}\right)K(100)}{\left[0.149PS + 0.061E'\right]} \qquad (52\text{–}31)$$

Profile-wall pipe:

$$\frac{\%\Delta X}{D} = \frac{\left(D_L P_s + P_w + P_v\right)\left(\frac{1}{144}\right)K(100)}{\left[\left(\frac{1.24(RSC)}{D_i}\right) + 0.061E'\right]} \qquad (52\text{–}32)$$

where:

$\frac{\%\Delta X}{D}$ = percent deflection
D_L = deflection lag factor (1.0 to 1.5)
K = bedding constant (0.1)
P_s = pressure on pipe from soil (lb/ft^2)
P_w = pressure on pipe from wheel load (lb/ft^2)
P_v = internal vacuum pressure (lb/ft^2)
E = modulus of elasticity of pipe material (as shown below)
SDR = D_o dimension ratio
  SDR = D_o/t
  D_o = pipe outside diameter, in
  t = minimum wall thickness, in
SIDR = D_i dimension ratio
  SIDR = D_i/t
  D_i = pipe inside diameter, in
  t = minimum wall thickness, in
PS = pipe stiffness
RSC = ring stiffness constant
D_i = inside pipe diameter, in
E' = modulus of soil reaction, lb/in^2 (see table 52–2)

Material	Modulus of elasticity* (lb/in^2)
PVC	400,000 (short term)
ABS	300,000 (short term)
Polyethylene	110,000 (short term)

* Short-term modulus of elasticity varies with the cell class of each plastic. Specific values may be obtained from the manufacturer.

The modulus of soil reaction, E', is an interactive modulus representing support of the soil in reaction to the lateral pipe deflection under load. Amster Howard of the Bureau of Reclamation (Howard, 1977) developed recommended E' values based on the soil prism load described above. The recommended values are provided in table 52–2.

The allowable deflections for plastic pipe typically are limited to 5 percent for a spillway/outlet conduit in embankment dam practice and 7.5 percent in water or liquid conveyance practice and drains in embankment dam practice.

(3) Wall buckling

Plastic pipe embedded in soil may buckle because of excessive loads and deformations. The total permanent pressure must be less than the allowable buckling pressure. The permanent load should consist of the soil pressure, groundwater pressure, and any internal long-term vacuum pressures. The allowable buckling pressure may be determined from:

$$q_a = \frac{1}{FS}\left(32R_w B' E' \frac{E_{long} I_{pw}}{D_o^{\,3}}\right)^{1/2} \qquad (52\text{–}33)$$

(Moser, 2001)

where:

q_a = allowable buckling pressure, lb/in^2
FS = design factor of safety
  = 2.5 for $(h/(D_o/12)) > 2$
  = 3.0 for $(h/(D_o/12)) < 2$
  where:
  h = height of ground surface above top of pipe, ft
  D_o = outside diameter of the pipe, in
R_w = water buoyancy factor
  = $1-0.33(h_w/h)$, $0<h_w<h$
  where:
  h = height of ground surface above top of pipe, ft
  h_w = height of water above top of pipe, ft
B' = empirical coefficient of elastic support

$$= \frac{4\left(h^2 + \left(\frac{D_o}{12}\right)h\right)}{1.5\left(2h + \left(\frac{D_o}{12}\right)\right)^2}$$

Appendix 52C

Material Properties, Pressure Ratings, and Pipe Dimensions for Plastic Pipe

(Note: The source of the information in this appendix is subject to periodic updating. The source documents should be referenced for any updated information.)

Table 52C–1 Hydrostatic design basis, allowable long-term compressive stress, short-term hoop strength, and designation of plastic pipe

Plastic pipe material	Hydrostatic design basis (lb/in²)	Allowable long-term compressive stress (lb/in²)	Short-term hoop strength (lb/in²)	Designation
PVC Type I, Grade 1 (12454-B)	4,000	2,000	6,400	PVC1120
PVC Type I, Grade 2 (12454-C)	4,000	2,000	6,400	PVC1220
PVC Type II, Grade 1 (14333-D)	4,000	2,000	6,400	PVC2120
PVC Type II, Grade 1 (14333-D)	3,200	1,600	5,000	PVC2116
PVC Type II, Grade 1 (14333-D)	2,500	1,250	5,000	PVC2112
PVC Type II, Grade 1 (14333-D)	2,000	1,000	5,000	PVC2110
ABS Type 1, Grade 2	1,600	800	3,300	ABS1208
ABS Type 1, Grade 2	2,000	1,000	5,240	ABS1210
ABS Type 2, Grade 1	2,700	1,350	6,600	ABS2112
ABS Type 1, Grade 3	3,200	1,600	6,000	ABS1316
PE Grade P 14	800	400	1,250	PE1404
PE Grade P 23	1,000	500	2,000	PE2305
PE Grade P 23	1,260	630	2,520	PE2306
PE Grade P 24	1,260	630	2,520	PE2406
PE Grade P 33	1,260	630	2,520	PE3306
PE Grade P 34	1,260	630	2,520	PE3406
PE Grade P 34	1,600	800	3,200	PE3408

Source: ASTM D 1527, D 1785, D 2104, D 2239, D 2241, D 2282, and D 3035.

LEACHATE SUMP DESIGN

REQUIRED: Size the leachate collection sump in Cell 7. Demonstrate the existing sump in Cell 1 can manage the leachate from the proposed landfill configuration.

METHOD:

A. Use leachate production rates from HELP model and the sump drainage areas from Sheet IIIC-B-64. Sump details are provided in Appendix IIIA-A.
B. Determine geometry of sump and its corresponding storage capacity.
C. Assume pump size and determine the average pump cycle time.

REFERENCES:

1. Texas Natural Resource Conservation Commission, *Leachate Collection System Handbook*, 30 TAC 330.201, 1993.

2. Bass, J., *Avoiding Failure of Leachate Collection and Cap Drainage Systems*, Pollution Technology Review No. 138, Noyles Data Corporation, 1986.

3. Phillips 66 Driscopipe, *System Design*, 1991.

4. Heisler, Sanford I., P.E., Wiley Engineer's Desk Reference, John Wiley & Sons, Inc., New York, 1998.

SOLUTION:

A. Average flow rate into sump

A.1 Determine the per acre flow rate for specific leachate collection sumps.

Leachate sump drainage areas are shown on Sheet IIIC-B-64 Sump Drainage Areas.

The following tables summarize the fill conditions that are likely to be present contributing to the LCS and sump.

Sump in Cell 1
From the HELP model (Appendix IIIC-A; Developed Cells)

CONDITION	Average cfy/ac	Average gpd/ac
Interim, 50' Waste	26,690	547
Interim, 100' Waste	38,763	794
Interim, 150' Waste	363	7
Interim, 170' Waste	121	2
Closed, 170' Waste	249	5

The area draining to the existing leachate collection sump is 32.1 acres. The leachate generation rates from the HELP runs for the developed cells.

Sump in Cell 7
From the HELP model (Appendix IIIC-A; Undeveloped Cells)

CONDITION	Average cfy/ac	Average gpd/ac
Active, 10' Waste	7,960	163
Interim, 50' Waste	34,437	706
Interim, 100' Waste	54,929	1,126
Interim, 150' Waste	15,510	318
Interim, 170' Waste	10,248	210
Closed, 170' Waste	4,164	85

The area draining to the proposed leachate collection sump is 17.5 acres. The leachate generation rates are from the HELP runs for the undeveloped cells.

1. Sump in Cell 1

32.1 acres

Condition	Rate	Active		Inactive		Closed	
	(gpd/ac)	area (ac)	rate (gpd)	area (ac)	rate(gpd)	area (ac)	rate(gpd)
Interim, 50' Waste	547	4.01	2,195	0.00	0.00	0.00	0.00
Interim, 100' Waste	794	5.62	4,462	0.00	0.00	0.00	0.00
Interim, 150' Waste	7	6.42	48	0.00	0.00	0.00	0.00
Interim, 170' Waste	2	9.63	24	32.10	80	0.00	0.00
Closed, 170' Waste	5	3.21	16	0.00	0	32.10	164
Total		28.89	6,745	32.10	80	32.10	164

2. Sump in Cell 7

17.5 acres

Condition	Rate	Active		Inactive		Closed	
	(gpd/ac)	area (ac)	rate (gpd)	area (ac)	rate(gpd)	area (ac)	rate(gpd)
Active, 10' Waste	163	1.75	285	0.00	0.00	0.00	0.00
Interim, 50' Waste	706	2.19	1,544	0.00	0.00	0.00	0.00
Interim, 100' Waste	1,126	3.06	3,447	0.00	0.00	0.00	0.00
Interim, 150' Waste	318	3.50	1,112	0.00	0.00	0.00	0.00
Interim, 170' Waste	210	5.25	1,103	17.50	3,675	0.00	0.00
Closed, 170' Waste	85	1.75	149	0.00	0	17.50	1,493
Total		17.50	7,641	17.50	3,675	17.50	1,493

B. Required storage capacity of sump

Assumed porosity of drainage stone: $P = 0.4$

$V_{Daily\ Inflow} = V_C / P$

1. Active

	V_C (gpd)	V_C (cf/day)	$V_{Daily\ Inflow}$ (cf/day)
Sump in Cell 1	6,745	902	2,254
Sump in Cell 7	7,641	1,022	2,554

2. Inactive with Intermediate Cover

	V_C (gpd)	V_C (cf/day)	$V_{Daily\ Inflow}$ (cf/day)
Sump in Cell 1	80	11	27
Sump in Cell 7	3,675	491	1,228

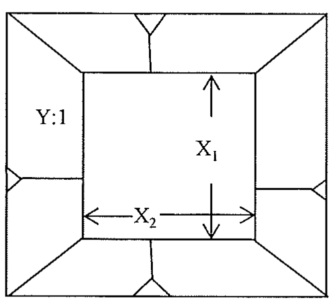
3. Closed

	V_C (gpd)	V_C (cf/day)	$V_{Daily\ Inflow}$ (cf/day)
Sump in Cell 1	164	22	55
Sump in Cell 7	1,493	200	499

Total sump volume:

$$V_{TOT} = 1/3\left(A_1 + A_2 + \sqrt{(A_1 \cdot A_2)}\right)h$$ (Ref. 4, page 17)

Where:
A_1 = Area of bottom of sump
A_2 = Area of top of sump
h = Depth of sump



Y = Slope of sump side walls

$A_1 = X_1 * X_2$
$A_2 = (X_1 + 2(h*Y))*(X_2 + 2(h*Y))$

	X_1 (ft)	X_2 (ft)	Y (ft)	h (ft)	A_1 (ft^2)	A_2 (ft^2)	V_{TOT} (ft^3)
Sump in Cell 1	28	56	3	4	1,568	4,160	11,043
Sump in Cell 7	15	15	3	3	225	1,089	1,809

Compute the number of days storage provided for the following:

$$\text{STORAGE (Detention Time)} = \frac{V_{TOT}}{V_{\text{Daily Inflow}}}$$

1. Active

	$V_{\text{Daily Inflow}}$ (cu ft/day)	V_{TOT} (cu ft)	Storage (days)
Sump in Cell 1	2,254	11,043	4.9
Sump in Cell 7	2,554	1,809	0.7

2. Inactive with Intermediate Cover

	$V_{\text{Daily Inflow}}$ (cu ft/day)	V_{TOT} (cu ft)	Storage (days)
Sump in Cell 1	27	11,043	415.1
Sump in Cell 7	1,228	1,809	1.5

3. Closed

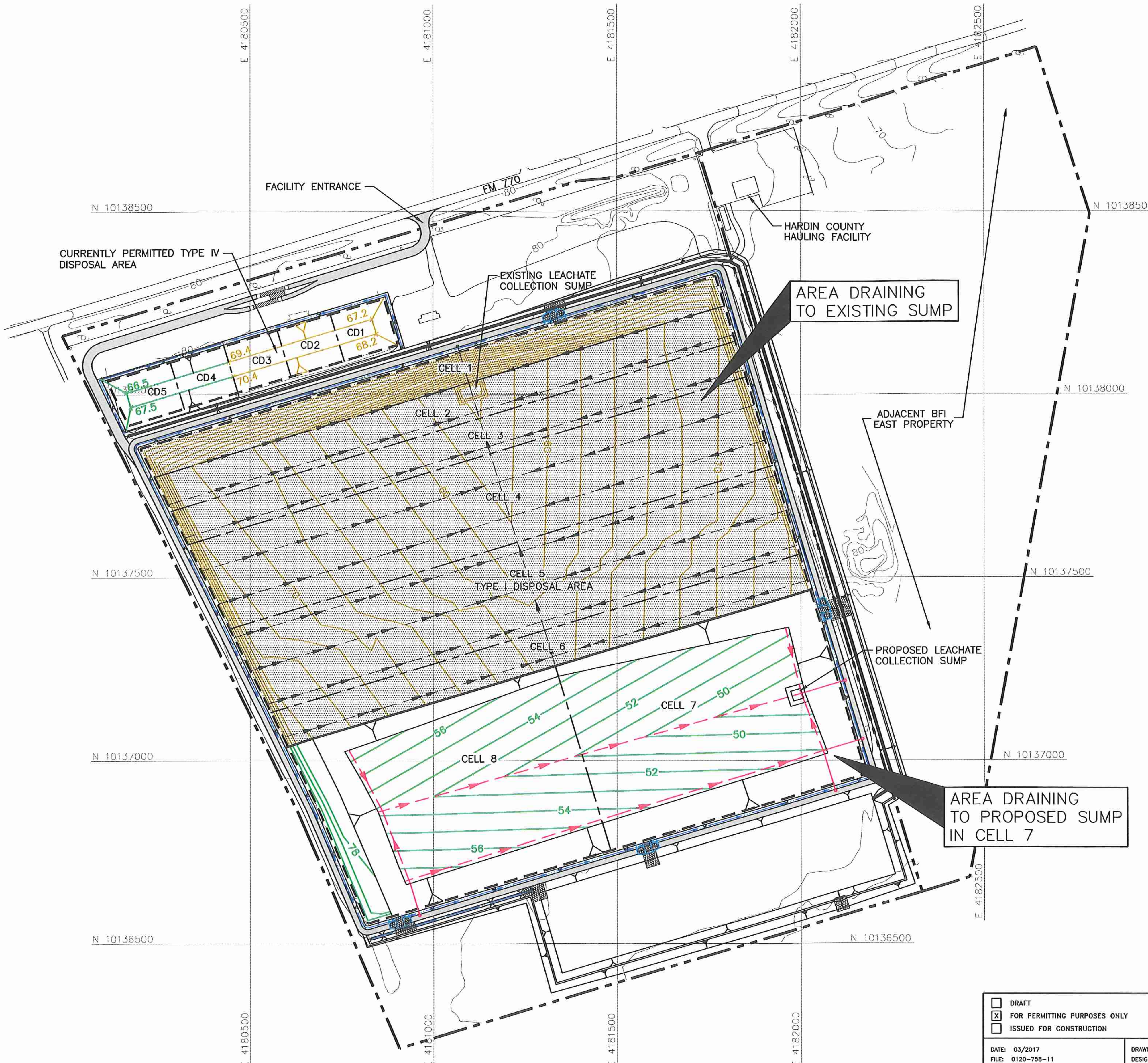
	$V_{\text{Daily Inflow}}$ (cu ft/day)	V_{TOT} (cu ft)	Storage (days)
Sump in Cell 1	55	11,043	201.5
Sump in Cell 7	499	1,809	3.6

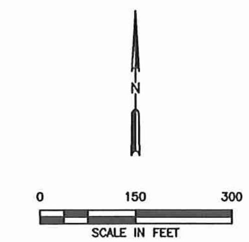
C. Estimated rate of leachate removal (for Active)

Submersible pump capacity = 15 gpm

	Production (gpd)	Average Pump Time (min/day)	(hr/day)
Sump in Cell 1	6,745	449.7	7.5
Sump in Cell 7	7,641	509.4	8.5

Average pump time is less than 24 hours per day; therefore the design is acceptable. A pump with less capacity may also be used if it can be determined that the actual leachate generation is less than the design flow. Prior authorization from TCEQ will be required with a permit modification.





LEGEND

- BFI EAST PROPERTY BOUNDARY
- PERMIT BOUNDARY
- CURRENTLY PERMITTED LIMITS OF WASTE
- 70 EXISTING CONTOUR (SEE NOTE 1)
- N 10137000 STATE PLANE COORDINATE SYSTEM (SEE NOTE 1)
- CELL BOUNDARY
- 50 PROPOSED EXCAVATION CONTOUR
- 70 CONSTRUCTED TOP OF PROTECTIVE COVER CONTOUR
- EXISTING LEACHATE COLLECTION LINE
- EXISTING LEACHATE RISER
- PROPOSED LEACHATE COLLECTION LINE
- PROPOSED LEACHATE RISER
- PROPOSED LATERAL LEACHATE COLLECTION LINE
- EXISTING SUBTITLE D COMPOSITE LINER AREA
- DRAINAGE AREA BOUNDARY

NOTES:

1. EXISTING CONTOURS AND ELEVATIONS DEVELOPED BY WEAVER CONSULTANTS GROUP FROM AERIAL PHOTOGRAPHY FLOWN 05-17-2016. GRID SYSTEM IS TIED TO THE TEXAS STATE PLANE COORDINATE SYSTEM NAD 83, CENTRAL ZONE.
2. CURRENTLY PERMITTED TYPE IV CELLS INCLUDES CD1 THROUGH CD5. CD1, CD2, AND CD3 ARE CURRENTLY DEVELOPED AND RECEIVED TYPE IV WASTE.

STATE OF TEXAS
MARILYN D. MORRISON
102273
LICENSED
PROFESSIONAL ENGINEER
12.5.17

☐ DRAFT
☒ FOR PERMITTING PURPOSES ONLY
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DATE: 03/2017 DRAWN BY: SRF
FILE: 0120-758-11 DESIGN BY: AE
CAD: IIIC-B-64-SUMP DRAINAGE AREAS.DWG REVIEWED BY: NT

Weaver Consultants Group
TBPE REGISTRATION NO. F-3727

PREPARED FOR
BFI WASTE SYSTEMS OF NORTH AMERICA, LLC

REVISIONS

NO.	DATE	DESCRIPTION
1	11/2017	OWNERSHIP CHANGE

MAJOR PERMIT AMENDMENT
SUMP DRAINAGE AREAS

HARDIN COUNTY LANDFILL
HARDIN COUNTY, TEXAS

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SHEET IIIC-B-64

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GEOTEXTILE DESIGN

REQUIRED: Determine geotextile properties for the following:

A. Geotextile "A" around the chimney drain granular drainage material.
B. Geotextile "B" used as top component of drainage geocomposite.

METHOD: Design geotextiles and determine material property requirements.

REFERENCES:

1. MIRAFI, *Geotextile Filter Design, Application, and Product Selection Guide*, 1991, http://www.tcmirafi.com/pdf/brochures/ef_guidelines.pdf.
2. Koerner, R.M., *Designing With Geosynthetics*, Fifth Edition, 2005.
3. AASHTO Designation: M288-06.
4. GRI White Paper #4, *Reduction Factors (RFs) Used in Geosynthetic Design,* Feb. 3, 2005, revised March 1, 2007.

SOLUTION:

A. Geotextile "A" Around the Chimney Drain Granular Drainage Material.

The design calculations assume the waste located above the chimney drain will have a hydraulic conductivity of $1.0\text{x}10^{-3}$ cm/s and the protective cover soil will consist of soils with a hydraulic conductivity less than $1.2\text{x}10^{-4}$ cm/s and percent fines (passing #200 sieve) greater than 20 percent.

If the protective cover material contains less than 20 percent fines, these geotextile calculations will be revised and included in the GLER for a specific cell to demonstrate the adequacy of the material used.

Retention:

Based on Chart 1 - "Soil Retention Criteria," given on page IIIC-B-71, the apparent opening size (O_{95}) may be determined.

$O_{95} <$ 0.21 mm

Permeability:

The required permeability is determined by comparing the permeability of the overlying waste material ($1.0\text{x}10^{-3}$ cm/s) and the protective cover ($1.2\text{x}10^{-4}$ cm/s) with the permeability of the geotextile after the appropriate reduction factors are applied to the laboratory permeability of the geotextile.

Minimum Laboratory Permeability Specified (k_{ult}) = 0.2 cm/s

To determine the allowable permeability (k_{allow}) of the geotextile, the following reduction factors are used:

Table 1 - Reduction Factors[1]

RF_{SCB} = Reduction factor for soil clogging and blinding	2.0
RF_{CR} = Reduction factor for creep reduction of void space	2.0
RF_{IN} = Reduction factor for adjacent materials intruding into void spaces	1.2
RF_{CC} = Reduction factor for chemical clogging	1.5
RF_{BC} = Reduction factor for biological clogging	2.0
Overall Reduction Factor (ORF) =	14.4

[1] Reduction factors obtained from Ref. 4.

$k_{allow} = k_{ult} / ORF = (0.2 \text{ cm/s}) / 14.4$

$\boxed{k_{allow} = 1.4\text{E-}02 \text{ cm/s}}$

$k_{allow} >> k_{waste}$ ($1.0\text{x}10^{-3}$ cm/s) or $k_{protective\ cover}$ ($1.2\text{x}10^{-4}$ cm/s).

The predicted permeability of the geotextile is greater than the surrounding materials (i.e., waste and protective cover). The chimney drain geotextile will not impede the flow of leachate into the LCS pipe. Therefore, no head will develop on the chimney drain geotextile.

Specification: Chimney drain geotextile permeability shall be equal to or greater than 0.2 cm/s as determined by ASTM D 4491.

Survivability:

Based on Table 2, "Survivability Strength Requirements," provided on page IIIC-B-72, geotextile properties should be selected considering high contact stresses (i.e., heavy confining stresses).

Durability:

Chemical compatibility with leachate will be considered during the selection process for the specific geotextile.

Summary of required properties for geotextile "A" (around the chimney drain granular drainage material):

Apparent opening size	<	0.21	mm
Grab tensile strength	>	157	lbs
Elongation	>=	50	%
Puncture strength	>	56	lbs
Trapezoid tear	>	56	lbs
Permeability	>=	0.2	cm/s

B. Geotextile "B" Used as Top Component of Drainage Geocomposite.

The design calculations assume the protective cover soil will consist of soils with a hydraulic conductivity less than 1.2×10^{-4} cm/s and percent fines (passing #200 sieve) greater than 20 percent.

If the protective cover material contains less than 20 percent fines, these geotextile calculations will be revised and included in the GLER for a specific cell to demonstrate adequacy of material used.

Retention:

Based on Chart 1 - "Soil Retention Criteria," given on page IIIC-B-71, the apparent opening size (O_{95}) may be determined.

$O_{95} <$ 0.21 mm

Permeability:

The required permeability is determined by comparing the permeability of the protective cover (1.2×10^{-4} cm/s) with the permeability of the geotextile after the appropriate reduction factors are applied to the laboratory permeability of the geotextile.

Minimum Laboratory Permeability Specified (k_{ult}) = 0.2 cm/s

To determine the allowable permeability (k_{allow}) of the geotextile, the following reduction factors are used:

Table 2 - Reduction Factors[1]

RF_{SCB} = Reduction factor for soil clogging and blinding	2.0
RF_{CR} = Reduction factor for creep reduction of void space	2.0
RF_{IN} = Reduction factor for adjacent materials intruding into void spaces	1.2
RF_{CC} = Reduction factor for chemical clogging	1.5
RF_{BC} = Reduction factor for biological clogging	2.0
Overall Reduction Factor (ORF) =	14.4

[1] Reduction factors obtained from Ref. 4.

$k_{allow} = k_{ult} / ORF = (0.2\ \text{cm/s}) / 14.4$

$\boxed{k_{allow} = 1.4\text{E-}02\ \text{cm/s}}$

$k_{allow} \gg k_{protective\ cover}$ (1.2×10^{-4} cm/s).

Specification: Geotextile component of geocomposite permeability shall be equal to or greater than 0.2 cm/s as determined by ASTM D 4491.

Survivability:

Based on Table 2, "Survivability Strength Requirements," provided on page IIIC-B-72, geotextile properties should be selected considering high contact stresses (i.e., heavy confining stress).

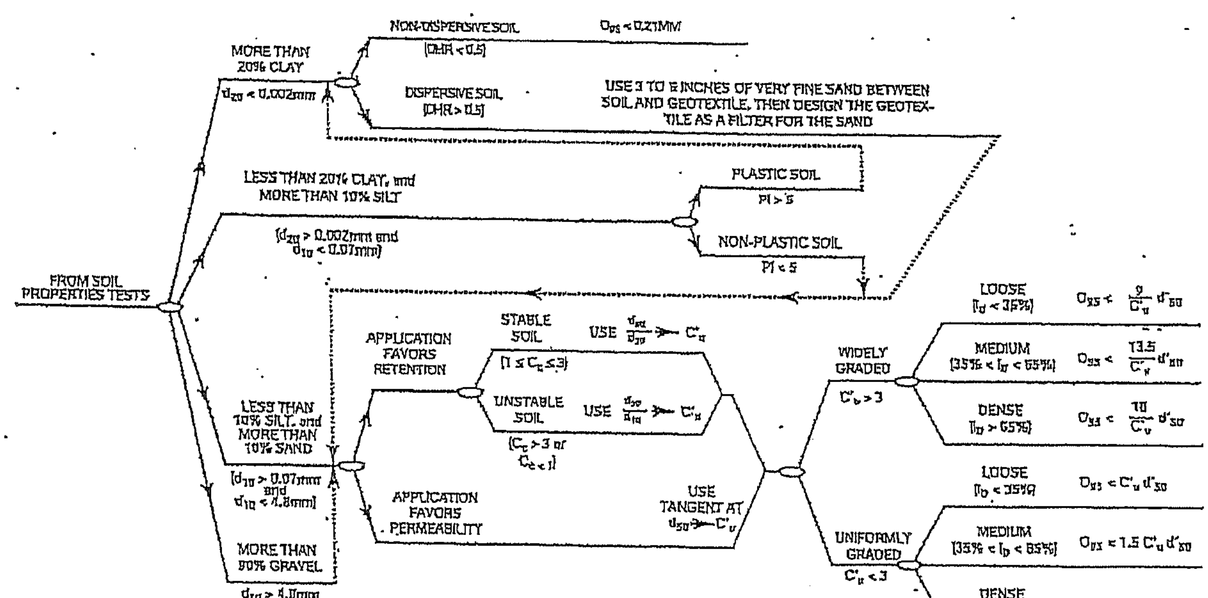
Durability:

Chemical compatibility with leachate will be considered during the selection process for the specific geotextile.

Summary of required properties for geotextile "B" (top component of drainage geocomposite):

Apparent opening size	<	0.21	mm
Grab tensile strength	>	157	lbs
Elongation	>=	50	%
Puncture strength	>	56	lbs
Trapezoid tear	>	56	lbs
Permeability	>=	0.2	cm/s

Chart 1. Soil Retention Criteria of Steady-State Flow Conditions



NOTES:

d_x = particle diameter of which size x percent is smaller

$C'_u = \sqrt{\frac{d'_{100}}{d'_0}}$ where: d'_{100} and d'_0 are the extremities of a straight line drawn through the particle-size distribution, as directed above and d'_{50} is the midpoint of this line

$C_c = \frac{(d_{30})^2}{d_{60} \times d_{10}}$

I_D = relative density of the soil
PI = plasticity index of the soil
DHR = double-hydrometer ratio of the soil
O_{95} = geotextile opening size

Table 2. Survivability Strength Requirements (after AASHTO, 1996)

Application	Condition	GRAB STRENGTH (LBS)	ELONGATION (%)	SEWN SEAM STRENGTH (LBS)	PUNCTURE STRENGTH (LBS)	BURST STRENGTH (LBS)	TRAPEZOID TEAR (LBS)
SUBSURFACE DRAINAGE	HIGH CONTACT STRESSES	247	< 50% *	222	90	392	56
	(ANGULAR DRAINAGE MEDIA) (HEAVY COMPACTION) or (HEAVY CONFINING STRESSES)	✳157	≥ 50%	142	✳56	189	✳56
	LOW CONTACT STRESSES	180	< 50% *	162	67	305	56
	(ROUNDED DRAINAGE MEDIA) (LIGHT COMPACTION) or (LIGHT CONFINING STRESSES)	112	≥ 50%	101	40	138	40
ARMORED EROSION CONTROL	HIGH CONTACT STRESSES	247	< 50% *	222	90	392	56
	(DIRECT STONE PLACEMENT) (DROP HEIGHT > 3 FT)	202	≥ 50%	182	79	247	79
	LOW CONTACT STRESSES	247	< 50% *	222	90	292	56
	(SAND OR GEOTEXTILE CUSHION) and (DROP HEIGHT < 3 FT)	157	≥ 50%	142	56	189	56

* Only woven monofilament geotextiles are acceptable as < 50% elongation filtration geotextiles. No woven slit film geotextiles are permitted.

CHIMNEY DRAIN CAPACITY CALCULATIONS

HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE COLLECTION SYSTEM
CHIMNEY DRAIN CAPACITY CALCULATIONS

Required: Evaluate the adequacy of the chimney drain design along the leachate collection pipe for the maximum leachate impingement rate.

Method:
1. Determine the maximum leachate inflow rate into the chimney drain located above the leachate collection pipes.
2. Determine the minimum drainage capacity of the chimney drain.
3. Compare the allowable flow rate to the required flow rate.

References:
1. GSE Nonwoven Geotextile (6 oz/sy)
2. GRI White Paper #4, *Reduction Factors (RFs) Used in Geosynthetic Design,* Feb. 3, 2005, revised March 1, 2007.

Solution:

1. Determine the maximum leachate inflow rate into the chimney drain.

A comparison of the undeveloped and developed area HELP runs was used to determine the worst case scenario (i.e., which scenario generates the maximum leachate inflow rate). HELP model results are included in Appendix IIIC-A.

Area	Peak Daily Generation Rate, q		Maximum Drainage Length, L[1]	Inflow Rate, Q_{req}
	(cf/ac/day)	(cfs/sf)	(ft)	(cfs)
Undeveloped	1203.3	3.20E-07	460	1.47E-04
Developed	1024.8	2.72E-07	600	1.63E-04

[1] The maximum drainage length as shown takes in to account both sides draining to the chimney drain.

Maximum leachate inflow rate to the chimney drain per unit length (1 ft) is calculated using the following equation:

$$Q_{req} = L * 1 * q$$

where:

Q_{req} = Maximum leachate inflow rate into chimney drain, cfs
L = Maximum length draining to chimney drain from both sides
q = Peak daily leachate generation rate from HELP model listed above, cfs/sf

Maximum Leachate Generation Rate from above table:

$$\boxed{Q_{req} = 1.63\text{E-04 cfs}}$$

2. Determine the minimum drainage capacity of the chimney drain.

Minimum drainage capacity of the chimney drain per unit length (1 ft):

$$Q_{ult} = k * i * w * 1$$

where:

Q_{ult} = Ultimate flow rate
k = Minimum permeability of the geotextile wrap
i = Hydraulic gradient = 1 under free drainage
w = Width of the chimney drain keyed into the waste layer, measured at the top of protective layer, min. 4 ft, as shown in Appendix IIIA-A, Drawing A.3.

k =	0.2	cm/s	=	6.56E-03	fps	(Ref. 1)
i =	1					
w =	4	ft				

Q_{ult} =	2.62E-02	cfs

To determine the allowable drainage capacity of the geotextile, the following reduction factors are used:

Table 1 - Reduction Factors[1]

RF_{SCB} =	Reduction factor for soil clogging and blinding	2.0
RF_{CR} =	Reduction factor for creep reduction of void space	2.0
RF_{IN} =	Reduction factor for adjacent materials intruding into void spaces	1.2
RF_{CC} =	Reduction factor for chemical clogging	1.5
RF_{BC} =	Reduction factor for biological clogging	2.0
	Overall Reduction Factor (ORF) =	14.4

[1] Reduction factors obtained from Ref. 2.

$$Q_{allow} = Q_{ult} / ORF$$

where:

Q_{allow} = Allowable flow rate
Q_{ult} = Ultimate flow rate
ORF = Overall reduction factor from Table 1

Q_{allow} =	1.82E-03	cfs

3. Compare the allowable flow rate to the required flow rate.

Q_{allow} =	1.82E-03	cfs	>>	Q_{req} =	1.63E-04	cfs

The predicted flow does not exceed the capacity of the chimney drain geocomposite. The permeability of the gravel will be greater than that of the geotextile. Therefore, the proposed chimney drain design is adequate to convey the generated leachate to the leachate collection pipe.

DOUBLE-SIDED DRAINAGE GEOCOMPOSITE EVALUATION FOR 3H:1V SIDESLOPES

DOUBLE-SIDED DRAINAGE GEOCOMPOSITE EVALUATION FOR 3H:1V SIDESLOPES

Required: Determine the minimum requirements of the 220-mil and 250-mil-thick double-sided geocomposite used for the 3H:1V sideslopes of leachate collection system.

Method:

1.a. Use the maximum peak flow from the HELP Model analysis in Appendix IIIC-A as the flow into the double-sided drainage geocomposite located on the 3H:1V sideslopes.
1.b. Determine the minimum required transmissivity of the 220-mil and 250-mil-thick double-sided geocomposite leachate collection layer.

2. Determine the transmissivity of the double-sided drainage geocomposite.
2.a. Determine the overburden pressure acting on the double-sided drainage geocomposite.
2.b. Determine the transmissivity reduction factors of safety for strength and environmental conditions based on the critical loading condition.
2.c. Determine the reduced transmissivity of double-sided geocomposite.

3. Compare reduced laboratory transmissivity of double-sided drainage geocomposite with the required transmissivity for double-sided geocomposite.

4. Determine the head on liner.

5. Conclusion.

References:

1. Koerner, R.M., *Designing With Geosynthetics*, Third Edition, 1994.
2. *HELP* Model results in Appendix IIIC-A of the Site Development Plan.
3. Gray, Donald H.,Koerner, Robert M., Qian, Xuede, Geotechnical Aspects of Landfill Design and Construction, 2002.
4. Geosynthetic Institute, GRI Standard GC8, 2001.
5. Giroud, J.P. et al., Hydraulic Design of Geosynthetic and Granular Liquid Collection Layers, *Geosynthetics International*, Vol 7, 2000.
6. GSE Drainage Design Manual, May 2004.
7. Acar, Yalcin B.& Daniel, David E., *Geoenvironment 2000 Characterization, Containment, Remediation, and Performance in Environmental Geotechnics,* Volume 2, American Society of Civil Engineers, 1995.

Solution:

1.a. Determine the flow into the double-sided drainage geocomposite:

Note: The highest leachate generation rate between the HELP runs for the developed and undeveloped cells were used to be conservative.

Developed Cells (220-mil) - Exterior Sideslope

Flow into double-sided geocomposite, q = 1,024.8 cf/ac/day, generated by HELP Model

Flow into unit area of geocomposite, q_h = q / (43,560 * 24 * 60 * 60)
q_h = 2.72E-07 cfs/sf

Longest 3H:1V sideslope, L_S= 85 ft

Unit flow, q_L= q_h * L_S
q_L= 2.31E-05 cf/ft-s (or sf/s)

Note: The value q_L is used to develop the minimum required transmissivity of the double-sided geocomposite.

Undeveloped Cells (250-mil) - Exterior Sideslope

Flow into double-sided geocomposite, q = 1203.3 cf/ac/day, generated by HELP Model

Flow into unit area of geocomposite, q_h = q / (43,560 * 24 * 60 * 60)
q_h = 3.20E-07 cfs/sf

Longest 3H:1V sideslope, L_S= 86 ft

Unit flow, q_L= q_h * L_S
q_L= 2.75E-05 cf/ft-s (or sf/s)

Note: The value q_L is used to develop the minimum required transmissivity of the double-sided geocomposite.

Undeveloped Cells (250-mil) - Interior Sideslope

Flow into double-sided geocomposite, q = 1203.3 cf/ac/day, generated by HELP Model

Flow into unit area of geocomposite, q_h = q / (43,560 * 24 * 60 * 60)
q_h = 3.20E-07 cfs/sf

Longest 3H:1V sideslope, L_S= 81 ft

Unit flow, q_L= q_h * L_S
q_L= 2.59E-05 cf/ft-s (or sf/s)

Note: The value q_L is used to develop the minimum required transmissivity of the double-sided geocomposite.

1.b. Determine the required transmissivity (T_r) of the double-sided geocomposite:

Developed Cells (220-mil) - Exterior Sideslope

$T_r = q_L / (\sin \beta)$

$\beta =$ 18.4 ° (3H:1V placement slope for double-sided geocomposite)
$\sin \beta =$ 0.32

$T_r =$ 7.33E-05 sf/s
$T_r =$ 6.81E-06 m^2/s

Undeveloped Cells (250-mil) - Exterior Sideslope

$T_r = q_L / (\sin \beta)$

$\beta =$ 18.4 ° (3H:1V placement slope for double-sided geocomposite)
$\sin \beta =$ 0.32

$T_r =$ 8.71E-05 sf/s
$T_r =$ 8.09E-06 m^2/s

Undeveloped Cells (250-mil) - Interior Sideslope

$T_r = q_L / (\sin \beta)$

$\beta =$ 18.4 ° (3H:1V placement slope for double-sided geocomposite)
$\sin \beta =$ 0.32

$T_r =$ 8.20E-05 sf/s
$T_r =$ 7.62E-06 m^2/s

2. Determine the transmissivity of the double-sided drainage geocomposite:

The transmissivity of geocomposite is first determined by laboratory testing. This transmissivity is reduced as detailed in step 2.b to determine the design transmissivity (T_D) value. T_D value is then compared to T_r value.

2.a. Overburden pressure acting on the double-sided drainage geocomposite:

Assume the geocomposite leachate collection layer will undergo linear compression due to the weight of soil (in the form of daily cover, intermediate cover, protective cover, or final cover) and waste.

Unloaded Geocomposite Thickness (220 mil)=	0.22	in
Unloaded Geocomposite Thickness (250 mil)=	0.25	in
Unit Weight of Soil =	116	pcf

Table 1.1 - Developed Cells Geocomposite Thickness (220-mil)

Fill Condition	d_W[1] (ft)	γ_W[2] (ft)	d_S[3] (ft)	P[4] (psf)	t[5] (in)
Interim - 50'	50	49	3.0	2,798	0.193

Table 1.2 - Undeveloped Cells Geocomposite Thickness (250-mil)

Fill Condition	d_W[1] (ft)	γ_W[2] (ft)	d_S[3] (ft)	P[4] (psf)	t[5] (in)
Interim - 45'	45	48	3.0	2,508	0.220
Interim - 150'	150	64	3.0	9,948	0.192

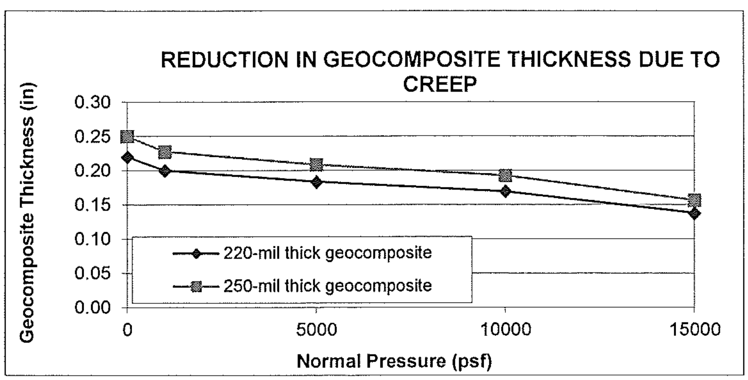
[1] d_W is the depth of waste and daily cover soil above the 3H:1V slope of the geocomposite leachate collection layer.

[2] The unit weight of waste/soil (γ_w) is selected at the midpoint of the waste column using the Unit Weight Profile for MSW graph provided in Ref. 7.

[3] d_S is the depth of soil above the geocomposite leachate collection layer.

[4] P is the pressure on the geocomposite leachate collection layer due to the weight of the waste and soil.

[5] t is the thickness of the geocomposite leachate collection layer after being subjected to linear compression based on the chart below adapted from Ref. 6.



2.b. Reduction factors and factor of safety for strength and environmental conditions:

Table 2 - Reduction Factors and Factor of Safety

Reduction Factors[1]		Fill Condition
		Interim
RF_{IN}	Delayed Intrusion	1.1
RF_{CC}	Chemical Clogging	1.9
RF_{BC}	Biological Clogging	1.2
	Total Reduction Factor[2]	2.51

Overall Factor of Safety to Account for Uncertainties	2.0
Overall Reduction Factor (ORF)[3]	5.02

[1] Values are interpreted from References 1, 3, and 4.

[2] The Total Reduction Factor is a product of all the reduction factors for the fill condition.

[3] The Overall Reduction Factor is a product of the Total Reduction Factor and Overall Factor of Safety to Account for Uncertainties for the fill condition.

2.c. Determine the reduced transmissivity of double-sided geocomposite:

Developed Cells (220-mil) - Exterior Sideslope

Laboratory transmissivity value for 220-mil-thick double-sided geocomposite, T_{Lb} based on the graph on page IIIC-B-88.

T_{Lb}= 1.10E-04 m^2/s

T_{LbR}= T_{Lb}/ORF Reduced manufacturer transmissivity (ORF is the overall reduction factor defined in Table 2.)

T_{LbR}= 2.19E-05 m^2/s

Undeveloped Cells (250-mil) - Exterior Sideslope

Laboratory transmissivity value for 250-mil-thick double-sided geocomposite, T_{Lb} based on the graph on page IIIC-B-89.

T_{Lb}= 4.13E-04 m^2/s

T_{LbR}= T_{Lb}/ORF Reduced manufacturer transmissivity (ORF is the overall reduction factor defined in Table 2.)

T_{LbR}= 8.23E-05 m^2/s

Undeveloped Cells (250-mil) - Interior Sideslope

Laboratory transmissivity value for 250-mil-thick double-sided geocomposite, T_{Lb} based on the graph on page IIIC-B-89.

T_{Lb}= 1.61E-04 m^2/s

T_{LbR}= T_{Lb}/ORF Reduced manufacturer transmissivity (ORF is the overall reduction factor defined in Table 2.)

T_{LbR}= 3.21E-05 m^2/s

3. Required (T_r) versus reduced laboratory (T_{LbR}) transmissivity comparison:

Developed Cells (220-mil) - Exterior Sideslope

T_r =	6.81E-06 m^2/s	This value was determined in Step 1.b.
T_{LbR}=	2.19E-05 m^2/s	This value was determined in Step 2.c.

Ratio of T_{LbR} to T_r should be higher than 1 in order the specified geocomposite be acceptable.

T_{LbR} / T_r= 3.22

Undeveloped Cells (250-mil) - Exterior Sideslope

T_r =	8.09E-06 m^2/s	This value was determined in Step 1.b.
T_{LbR}=	8.23E-05 m^2/s	This value was determined in Step 2.c.

Ratio of T_{LbR} to T_r should be higher than 1 in order the specified geocomposite be acceptable.

T_{LbR} / T_r= 10.17

Undeveloped Cells (250-mil) - Interior Sideslope

T_r =	7.62E-06 m^2/s	This value was determined in Step 1.b.
T_{LbR}=	3.21E-05 m^2/s	This value was determined in Step 2.c.

Ratio of T_{LbR} to T_r should be higher than 1 in order the specified geocomposite be acceptable.

T_{LbR} / T_r= 4.21

4. Determine the head on the liner:

The head on liner is determined using the following formula:

$$T_{\max} = \frac{\sqrt{(\tan^2\beta + \frac{4q_h}{k_1})} - \tan\beta}{2\cos\beta} * L$$ (Ref. 5)

where,
T_{max}= maximum head on liner, ft
β= slope, deg
q_h= inflow rate, in/s
k_1= hydraulic conductivity of geocomposite, in/s
L= slope length, ft

β=	18.4 °
tanβ=	0.33
$\tan^2\beta$=	0.11
cosβ=	0.95

k_1 is hydraulic conductivity and is calculated using the following equation:
k_1 = T_{LbR} / t

Developed Cells (220-mil) - Exterior Sideslope

k_1 =	0.004	m/s
=	0.18	in/s
q_h=	2.72E-07	fps
=	3.27E-06	in/s
L=	85	ft
T_{max}=	0.0050	ft
=	0.060	in

T_{max} is less than the compressed thickness of the geocomposite listed in Table 1.1.

Undeveloped Cells (250-mil) - Exterior Sideslope

k_1 =	0.015	m/s
=	0.58	in/s
q_h=	3.20E-07	fps
=	3.84E-06	in/s
L=	86	ft
T_{max}=	0.0018	ft
=	0.022	in

T_{max} is less than the compressed thickness of the geocomposite listed in Table 1.2.

Undeveloped Cells (250-mil) - Interior Sideslope

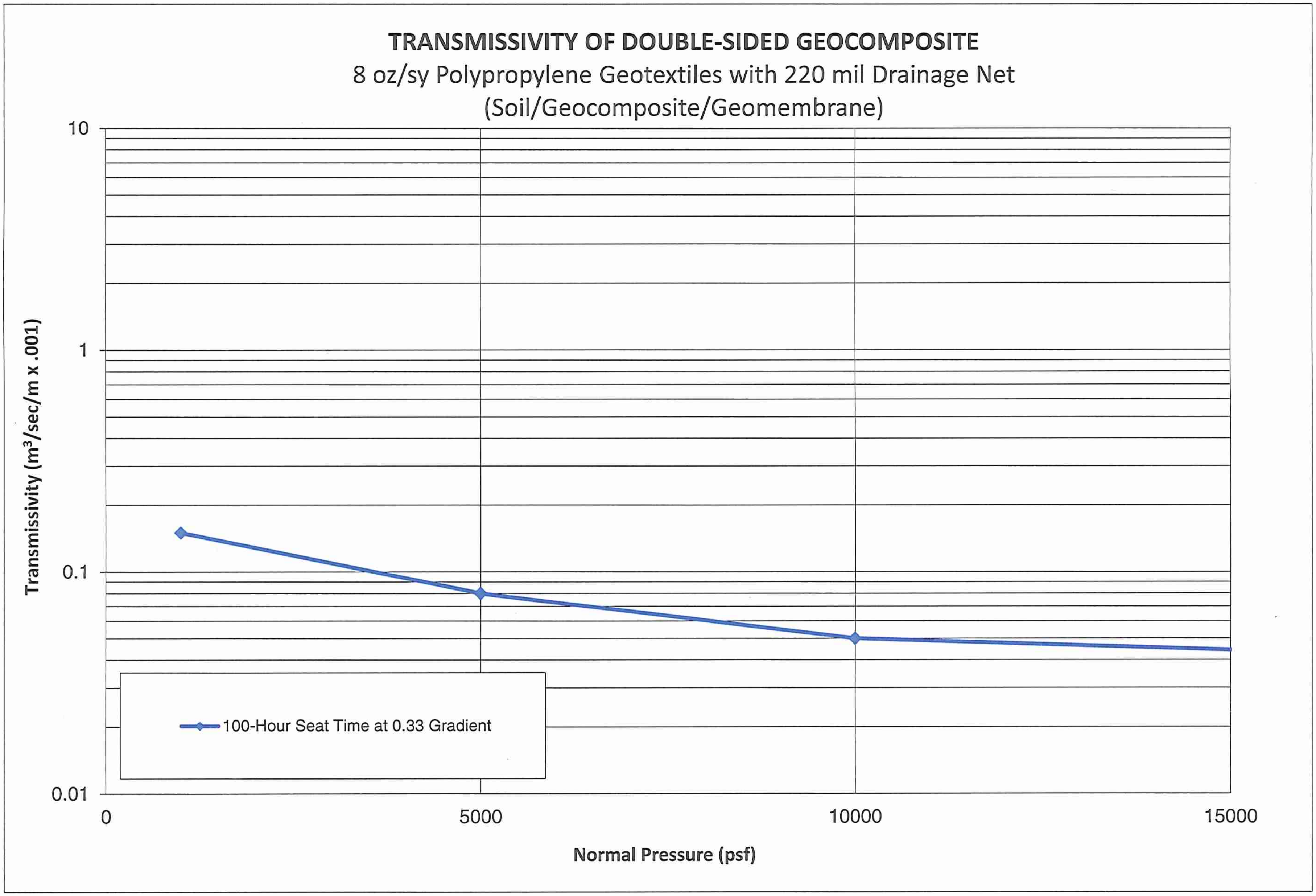
k_1 =	0.007	m/s
=	0.26	in/s
q_h=	3.20E-07	fps
=	3.84E-06	in/s
L=	81	ft
T_{max}=	0.0038	ft
=	0.046	in

T_{max} is less than the compressed thickness of the geocomposite listed in Table 1.2.

5. Conclusion:

The transmissivity of the specified doubled-sided drainage geocomposite is higher than the transmissivity that is required based on the lines and grades established for the leachate collection system. Therefore, the specified double-sided drainage geocomposite is acceptable for the design.

For the undeveloped areas using a 250-mil thick geocomposite, the transmissivity of the double-sided geocomposite shall be measured at a minimum gradient of 0.33 under a maximum normal pressure of 9,948 psf or higher, boundary conditions consisting of soil/geocomposite/geomembrane with a minimum seat time of 100 hours. The minimum transmissivity shall be $1.61 \times 10^{-4}\ m^2/s$.


TRANSMISSIVITY OF DOUBLE-SIDED GEOCOMPOSITE
8 oz/sy Polypropylene Geotextiles with 220 mil Drainage Net
(Soil/Geocomposite/Geomembrane)
Transmissivity (m³/sec/m x .001)
10
1
0.1
0.01
0
5000
10000
15000
Normal Pressure (psf)
100-Hour Seat Time at 0.33 Gradient

GROUNDWATER INFLOW CALCULATIONS

HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE COLLECTION SYSTEM
GROUNDWATER INFLOW RATE CALCULATION

REQUIRED: Determine the maximum groundwater inflow rate into the leachate collection system, consistent with §330.337(d).

METHOD:

1. Determine the permeability of the materials surrounding the liner system, the potentiometric conditions of the groundwater, and the geomembrane hole size and spacing.

2. Calculate the maximum groundwater inflow rate into the leachate collection system.

REFERENCES:

1. Rowe, R. Kerry et al. *Barrier Systems for Waste Disposal Facilities,* 2nd Edition, Spon Press, 2004.

SOLUTION:

1. **Determine the permeability of the materials surrounding the liner system, the potentiometric conditions of the groundwater, and the geomembrane hole size and spacing.**

The maximum groundwater unit flow rate can be defined with the following equation:

$q_o=ki$, where:

q_o= Unit groundwater flow rate below the liner system
k= Hydraulic conductivity of the soil below the liner system
i= Hydraulic gradient of the soil below the liner system

The bottom of the landfill is excavated into both the upper clay stratum, the upper sand stratum, and the lower clay stratum. To be conservative, this calculation will use properties of the upper sand stratum. As listed in Appendix IIIG, the average hydraulic conductivity of the upper sand stratum is 1.10×10^{-4} cm/s. The maximum hydraulic gradient listed in Appendix IIIG for the upper sand stratum is 0.0038 ft/ft.

Therefore, the unit groundwater flow rate below the liner system is $q_o=ki$.

k=	1.10E-04	cm/s
i=	0.0038	ft/ft
q_o=	4.18E-07	cm/s

2. **Calculate the maximum groundwater inflow rate into the leachate collection system.**

To calculate the groundwater inflow to the liner system, the following equation is used:

$$h_w = \left\{ \frac{r_0^2 q_0}{2k_{om}} + \frac{Q}{2\pi k_{om}} \left[\ln\left(\frac{Q}{\pi r_0^2 q_0}\right) - 1 \right] + \frac{1}{4g^2} \left(\frac{Q}{1.88 r_0^2}\right)^4 \right\}^{0.5}$$

where

h_w= Groundwater head on the liner
r_o= Radius of the geomembrane defect
q_o= Unit groundwater flow rate below the liner system
Q= Inflow rate through the geomembrane into the leachate collection system
k_{om}= Hydraulic conductivity of the layer upgradient (below) the geomembrane liner system
g= Acceleration due to gravity

HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE COLLECTION SYSTEM
GROUNDWATER INFLOW RATE CALCULATION

The groundwater head on the liner (h_w) is taken from the location where the potentiometric levels are the most critical. Drawing IIIG-D.5 in Appendix IIIG-D shows a highest measured groundwater map. At the most critical area the potentiometric level of the groundwater is at approximately 66 ft-msl, while the elevation of the liner is 52 ft-msl. Therefore, the overall groundwater head is estimated to be 14 ft.

To be conservative, the pinhole density is assumed to be 4 holes per acre and the geomembrane installation defects is assumed to be 4 holes per acre.

The area of 1 hole of geomembrane installation defect equals 1 cm^2 and 1 pinhole has a diameter of 1mm.

The radius of the geomembrane defect (r_o) based on the pinhole density and geomembrane installation defect equals 0.03717 ft.

In order to calculate the inflow rate through the geomembrane into the leachate collection system (Q), the following calculated values are used.

h_w=	14	ft (equal to the overall groundwater head)
r_o=	0.03717	ft
q_o=	4.18E-07	cm/s or
	1.37E-08	ft/s
g=	32.2	ft/s^2
k_{om}=	1.00E-07	cm/s or
	3.28E-09	ft/s
Q=	5.00E-07	cf/s per acre or
	0.004	in/yr

Summary: The 100' waste HELP run for the undeveloped cells (which has the highest peak daily head on liner) was rerun by adding 0.004 in/yr of groundwater inflow basec on the above calculations. The HELP run is provided on Sheets IIIC-B-95 through IIIC-B-102. Based on the results, it can be seen that there is an insignificant increase in average annual flow rate (54,929.1 cf/year to 54,943.6 cf/year and no change in the peak daily flow rate of 1,203.3 cf/day. There was also no change in the annual and peak head on liner. Therefore, it can be concluded that the design and capacity of leachate collection system is not significantly affected by groundwater inflow.

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


PRECIPITATION DATA FILE:     C:\HELP 307\HCLF\I100\DATA4.D4
TEMPERATURE DATA FILE:       C:\HELP 307\HCLF\I100\DATA7.D7
SOLAR RADIATION DATA FILE:   C:\HELP 307\HCLF\I100\DATA13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP 307\HCLF\I100\DATA11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP 307\HCLF\I100\DATA10.D10
OUTPUT DATA FILE:            C:\HELP 307\HCLF\I100\I100.OUT


TIME:  19:42     DATE:   2/14/2017


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

     TITLE:  HARDIN COUNTY LF - INTERIM, 100 FT WASTE (250 MIL)

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


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


                                    LAYER  1
                                    --------

                       TYPE 1 - VERTICAL PERCOLATION LAYER
                          MATERIAL TEXTURE NUMBER  11
           THICKNESS                    =     12.00    INCHES
           POROSITY                     =      0.4640 VOL/VOL
           FIELD CAPACITY               =      0.3100 VOL/VOL
           WILTING POINT                =      0.1870 VOL/VOL
           INITIAL SOIL WATER CONTENT   =      0.3100 VOL/VOL
           EFFECTIVE SAT. HYD. COND.    =  0.639999998000E-04 CM/SEC
         NOTE:  SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY  3.00
                  FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.


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

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	1200.00 INCHES
POROSITY	=	0.6247 VOL/VOL
FIELD CAPACITY	=	0.5144 VOL/VOL
WILTING POINT	=	0.0770 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 10

THICKNESS	=	24.00 INCHES
POROSITY	=	0.3980 VOL/VOL
FIELD CAPACITY	=	0.2440 VOL/VOL
WILTING POINT	=	0.1360 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2440 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.119999997000E-03 CM/SEC

LAYER 4

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.20 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	8.97000027000 CM/SEC
SLOPE	=	1.50 PERCENT
DRAINAGE LENGTH	=	230.0 FEET
SUBSURFACE INFLOW	=	0.00 INCHES/YR

LAYER 5

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

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

LAYER 6

TYPE 3 - BARRIER SOIL LINER
MATERIAL TEXTURE NUMBER 16

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4270 VOL/VOL
FIELD CAPACITY	=	0.4180 VOL/VOL
WILTING POINT	=	0.3670 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4270 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000001000E-06 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE #11 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 2.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	87.10	
FRACTION OF AREA ALLOWING RUNOFF	=	80.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	10.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	3.100	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.640	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.870	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	391.826	INCHES
TOTAL INITIAL WATER	=	391.826	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM HOUSTON TEXAS

STATION LATITUDE	=	29.39 DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00
START OF GROWING SEASON (JULIAN DATE)	=	31
END OF GROWING SEASON (JULIAN DATE)	=	362
EVAPORATIVE ZONE DEPTH	=	10.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	7.80 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	74.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	76.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	77.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	77.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
4.93	4.45	4.29	3.51	4.63	6.82
4.76	4.66	4.59	6.55	6.17	6.34

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
51.40	54.50	61.00	68.70	74.90	80.60
83.10	82.60	78.40	69.70	60.10	54.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR HOUSTON TEXAS AND STATION LATITUDE = 29.39 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 18 THROUGH 37

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	6.03	4.62	3.88	3.77	3.83	4.93
	4.90	4.38	4.38	7.25	7.24	6.41
STD. DEVIATIONS	3.27	3.07	2.07	2.41	2.45	3.58
	2.41	1.96	2.11	4.46	3.09	2.35
RUNOFF						
TOTALS	0.836	0.478	0.338	0.407	0.443	0.772
	0.500	0.240	0.326	1.648	1.405	0.913
STD. DEVIATIONS	1.137	0.711	0.731	0.666	0.553	1.002
	0.745	0.235	0.334	1.802	1.082	0.970
EVAPOTRANSPIRATION						
TOTALS	1.793	2.043	2.839	2.697	2.682	2.846
	3.831	3.361	3.131	2.237	1.434	1.122
STD. DEVIATIONS	0.113	0.447	0.724	1.031	1.019	1.389
	1.618	1.061	1.232	0.635	0.264	0.158
SUBSURFACE INFLOW INTO LAYER 4						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LATERAL DRAINAGE COLLECTED FROM LAYER 4

TOTALS	1.2827	1.1499	1.5142	1.1974	1.2183	1.1997
	1.2619	1.2253	1.1853	1.2699	1.2665	1.3650
STD. DEVIATIONS	0.7019	0.6095	0.8466	0.6215	0.6721	0.6031
	0.6508	0.6150	0.5935	0.6499	0.6350	0.6968

PERCOLATION/LEAKAGE THROUGH LAYER 6

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

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 5

AVERAGES	0.0125	0.0123	0.0147	0.0120	0.0119	0.0121
	0.0123	0.0119	0.0119	0.0124	0.0127	0.0133
STD. DEVIATIONS	0.0068	0.0065	0.0082	0.0062	0.0065	0.0061
	0.0063	0.0060	0.0060	0.0063	0.0064	0.0068

****

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 18 THROUGH 37

	INCHES		CU. FEET	PERCENT
PRECIPITATION	61.62	(8.865)	223677.0	100.00
RUNOFF	8.308	(2.5595)	30156.88	13.482
EVAPOTRANSPIRATION	30.017	(2.9763)	108960.11	48.713
SUBSURFACE INFLOW INTO LAYER 4	0.00000		0.000	0.00000
LATERAL DRAINAGE COLLECTED FROM LAYER 4	15.13599	(7.43334)	54943.629	24.56383
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.009	0.00000
AVERAGE HEAD ON TOP OF LAYER 5	0.012	(0.006)		
CHANGE IN WATER STORAGE	8.163	(10.0628)	29630.87	13.247

****

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PEAK DAILY VALUES FOR YEARS 18 THROUGH 37

	(INCHES)	(CU. FT.)
PRECIPITATION	6.30	22869.000
RUNOFF	3.384	12284.6641
DRAINAGE COLLECTED FROM LAYER 4	0.33149	1203.30823
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 5	0.100	
MAXIMUM HEAD ON TOP OF LAYER 5	0.196	
LOCATION OF MAXIMUM HEAD IN LAYER 4 (DISTANCE FROM DRAIN)	4.8 FEET	
SNOW WATER	1.90	6898.1431

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4640
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1870

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

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

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FINAL WATER STORAGE AT END OF YEAR 37

LAYER	(INCHES)	(VOL/VOL)
1	3.8512	0.3209
2	533.6903	0.4447
3	7.2447	0.3019
4	0.0471	0.2332
5	0.0000	0.0000
6	10.2480	0.4270
SNOW WATER	0.000	

****
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APPENDIX IIIC-C

CONTAINMENT BERM AND DIVERSION BERM CALCULATIONS

STATE OF TEXAS
MARILYN D. MORRISON
102273
LICENSED
PROFESSIONAL ENGINEER

12-5-17

Includes pages IIIC-C-1 through IIIC-C-8

HARDIN COUNTY LANDFILL
0120-758-11-02
CONTAINMENT / DIVERSION BERM

REQUIRED:

1. Determine the height of the contaminated water berm required at the working face.
2. Determine the height of the diversion berm required for run-on control of the working face.

PROCEDURE:

Containment Berm Calculations

1. Determine the 25-year, 24-hour rainfall.
2. Calculate the volume of water captured behind the containment berm for 25-year, 24-hour rainfall event.
3. Calculate the height of the containment berm required to hold the volume of water calculated in step 2.

Diversion Berm Calculations

1. Determine the 25-year frequency runoff flow rates for the diversion berm run-on drainage areas by the Rational Method.
2. Calculate the capacity of the diversion berm swales at various slopes.
3. Calculate the height of the diversion berm required for the flow rate of run-on surface water.

REFERENCES:

1. Dodson & Associates, Inc., "ProHEC-1 PLUS Program Documentation", 1995.
2. Texas Department of Transportation, Hydraulic Design Manual, April, 2002.

SOLUTION:

Containment Berm Calculations

1. Based on Reference 1, the 25-year, 24-hour rainfall volume for Hardin County is:

   $R \approx$ 10.00 in

2. Determine the volume of storage required.

   $V_R = CAR$

   Where:

C =	Runoff coefficient	=	0.5	
A =	Drainage area	=	varies	ac
R =	25-year, 24-hour rainfall depth =		10.0	in

   The storage volume required for varying drainage areas are shown on the attached table.

3. Determine the height of the containment berm for a non-sloping water storage area.

   $$H = \frac{V_R}{A_{stor}}$$

   Where: A_{stor} = Storage area (sf)

   Values for height of the containment berm (H) are listed on Sheet IIIC-C-8 for several storage areas.

4. Determine the height of the berm for a sloping water storage area.

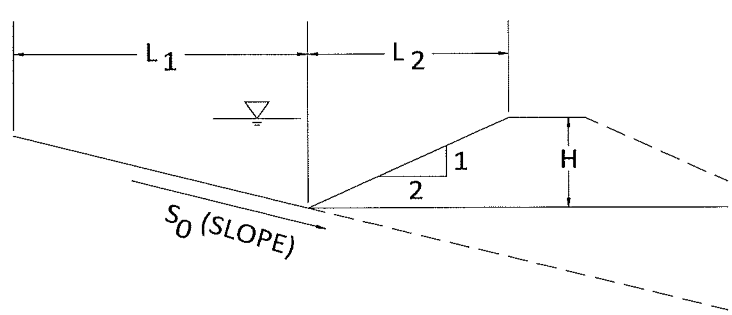
   The volume contained by the berm is equal to the cross-sectional storage area multiplied by the width of the berm. The computed volume must be greater than the volume found in step 2.

   $V_C = A_s W$

   Where: A_s = Cross-sectional storage area (sf)
   W = Width (ft)

   The minimum width of the downstream berm is 100 feet.

Figure 1. Cross Section of Berm and Storage Area



$$A_s = \frac{(L_1 + L_2)H}{2}$$

Where: $L_1 = \frac{H}{So}$ (feet)

$L_2 =$ 2H (feet)

$S_o =$ Slope of active cell (ft/ft)

Example calculations:

1. Non-sloping water storage area:

Variables:	$S_o =$	0.00	%	R =	10.0	in
	$A_{stor} =$	0.25	ac	C =	0.5	
	A =	0.50	ac	W =	100	ft
Volume:	$V_R =$	9,075	cf			
Height:	H =	0.833	ft			

2. Sloping water storage area:

Variables:	$S_o =$	1.00	%	R =	10.0	in
	$A_{stor} =$	0.25	ac	C =	0.5	
	A =	0.50	ac	W =	100	ft

Height: An iterative process is used to determine the height of the berm required to meet the storage volume requirement for a non-sloping storage area.

H = 1.4 ft

Check to ensure that the above berm height is adequate:

$L_1 =$	140.00	ft
$L_2 =$	2.80	ft
$A_s =$	99.96	sf
$V_C =$	9,996	cf

V_C is larger than V_R, berm has adequate height. See page IIIC-C-5 and Sheet IIIC-C-8 for summary.

3. Sloping water storage area:

Variables:	S_o =	2.00	%	R =	10.0	in
	A_{stor} =	0.25	ac	C =	0.5	
	A =	0.50	ac	W =	100	ft

Height: An iterative process is used to determine the height of the berm required to meet the storage volume requirement for a non-sloping storage area.

H =	1.9	ft

Check to ensure that the above berm height is adequate:

L_1 =	95.00	ft
L_2 =	3.80	ft
A_s =	93.86	sf
V_C =	9,386	cf

V_C is larger than V_R, berm has adequate height. See page IIIC-C-5 and Sheet IIIC-C-8 for summary.

Prep By: CLR
Date: 12/5/2017

HARDIN COUNTY LANDFILL
0120-758-11-02
CONTAINMENT BERM

Chkd By: MDM
Date: 12/5/2017

Drainage Area	Storage Area	Volume Required		Slope	Berm Height	Cross Sectional Area	Width	Water Surface Area	Volume Provided	L_1[1]	L_2[1]
(ac)	(ac)	(cf)		(%)	(ft)	(sf)	(ft)	(ac)	(cf)	(ft)	(ft)
0.5	0.25	9,075		0	0.833						
				1	1.4	99.96	100	0.328	9,996	140.0	2.8
				2	1.9	93.86	100	0.227	9,386	95.0	3.8
1.0	0.50	18,150		0	0.833						
				1	1.9	184.11	100	0.445	18,411	190.0	3.8
				2	2.7	189.54	100	0.322	18,954	135.0	5.4
2.0	1.00	36,300		0	0.833						
				1	2.7	371.79	100	0.632	37,179	270.0	5.4
				2	3.8	375.44	100	0.454	37,544	190.0	7.6
4.0	2.00	72,600		0	0.833						
				1	3.8	736.44	100	0.890	73,644	380.0	7.6
				2	5.3	730.34	100	0.633	73,034	265.0	10.6

[1] L_1 and L_2 are shown on the Figure 1 on page IIIC-C-2.

Diversion Berm Calculations

- As shown on Sheet IIIC-C-8, several swales were analyzed to determine the adequacy of the swale configuration.
- Hydraulic calculations are summarized on Sheet IIIC-C-8.

The swales were analyzed by the Rational Method.

From Reference 2 for Hardin County:

$Q = C\,I\,A$

C = runoff coefficie 0.5 (intermediate cover)
I = intensity, in/hr
A = drainage area, ac

$I = \dfrac{b}{(t_c + d)^e}$

b = 80
d = 7.5
e = 0.72
t_c is assumed to be 10 min. for all cases

I = 10.19 in/hr

Diversion Berm

Area(ac)	Flow Rate (cfs)
0.5	2.5
1	5.1
1.5	7.6
2	10.2
2.5	12.7
3	15.3

For 33H:1V Diversion Berm Area Slope

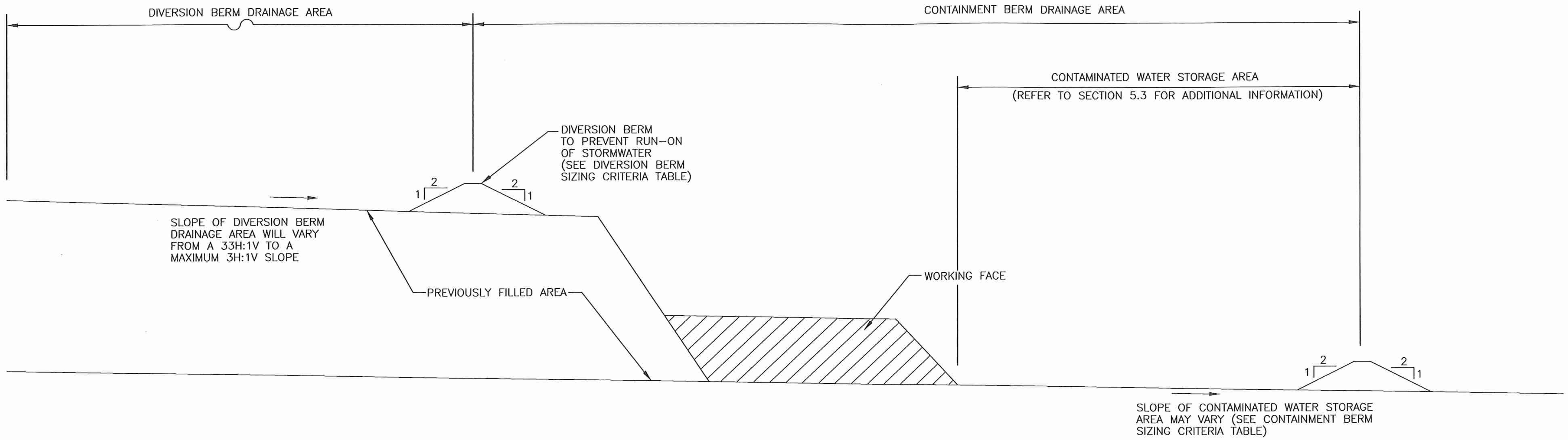
Drainage Area	Flow Rate (cfs)	Bottom Slope(ft/ft)	Manning's n	Side Slope (left)	Side Slope (right)	Bottom Width(ft)	Normal Depth(ft)	Flow Vel. (fps)	Froude Number	Velocity Head(ft)	Energy Head(ft)	Flow Area (sf)	Flow Top Width(ft)
0.5	2.5	0.01	0.03	2	33.0	0	0.31	1.45	0.643	0.03	0.35	1.73	11.00
1	5.1	0.01	0.03	2	33.0	0	0.41	1.73	0.671	0.05	0.46	2.96	14.38
1.5	7.6	0.01	0.03	2	33.0	0	0.48	1.91	0.688	0.06	0.53	3.99	16.71
2	10.2	0.01	0.03	2	33.0	0	0.53	2.05	0.700	0.07	0.60	4.98	18.66
2.5	12.7	0.01	0.03	2	33.0	0	0.58	2.16	0.709	0.07	0.65	5.87	20.27
3	15.3	0.01	0.03	2	33.0	0	0.62	2.27	0.717	0.08	0.70	6.75	21.74

Note: Calculations were performed using the HYDROCALC Hydraulics for Windows developed by Dodson and Associates (Version 2.0.1, 2012).

For 3H:1V Diversion Berm Area Slope

Drainage Area	Flow Rate (cfs)	Bottom Slope(ft/ft)	Manning's n	Side Slope (left)	Side Slope (right)	Bottom Width(ft)	Normal Depth(ft)	Flow Vel. (fps)	Froude Number	Velocity Head(ft)	Energy Head(ft)	Flow Area (sf)	Flow Top Width(ft)
0.5	2.5	0.01	0.03	2	3	0	0.66	2.26	0.692	0.08	0.74	1.10	3.32
1	5.1	0.01	0.03	2	3	0	0.87	2.70	0.720	0.11	0.98	1.89	4.35
1.5	7.6	0.01	0.03	2	3	0	1.01	2.99	0.741	0.14	1.15	2.54	5.04
2	10.2	0.01	0.03	2	3	0	1.13	3.22	0.756	0.16	1.29	3.17	5.63
2.5	12.7	0.01	0.03	2	3	0	1.22	3.39	0.764	0.18	1.40	3.75	6.12
3	15.3	0.01	0.03	2	3	0	1.31	3.55	0.772	0.20	1.51	4.31	6.57

Note: Calculations were performed using the HYDROCALC Hydraulics for Windows developed by Dodson and Associates (Version 2.0.1, 2012).



CONTAINMENT BERM SIZING CRITERIA *

CONTAINMENT BERM DRAINAGE AREA (ACRES)	CONTAMINATED WATER STORAGE AREA (ACRES)	FLOOR SLOPE OF CONTAMINATED WATER STORAGE AREA	CALCULATED MINIMUM HEIGHT OF CONTAINMENT BERM (FT)	REQUIRED MINIMUM HEIGHT OF CONTAINMENT BERM (FT)
0.5	0.25	0 % 1 % 2 %	0.833 1.4 1.9	1.0 1.5 2.0
1.0	0.50	0 % 1 % 2 %	0.833 1.9 2.7	1.0 2.0 3.0
2.0	1.00	0 % 1 % 2 %	0.833 2.7 3.8	1.0 3.0 4.0
4.0	2.00	0 % 1 % 2 %	0.833 3.8 5.3	1.0 4.0 5.5

* CONTAINMENT BERM WILL BE SIZED USING THE ABOVE TABLE AS A GUIDLINE TO CONTAIN STORMWATER FROM THE 25 YEAR, 24 HOUR STORM EVENT. SUPPORTING CALCULATIONS ARE INCLUDED ON PAGES IIIC-C-2 THROUGH IIIC-C-5. NOTE THAT THE CRITERIA SET FORTH IN THE ABOVE TABLE IS BASED ON A MINIMUM DOWNSLOPE CONTAINMENT BERM LENGTH OF 100 FEET.

DIVERSION BERM SIZING CRITERIA *

DIVERSION BERM DRAINAGE AREA (ACRES)	MINIMUM 3%			MAXIMUM 33%		
	FLOW RATE (CFS)	FLOW DEPTH (FT)	REQUIRED MINIMUM DIVERSION BERM HEIGHT (FT)	FLOW RATE (CFS)	FLOW DEPTH (FT)	REQUIRED MINIMUM DIVERSION BERM HEIGHT (FT)
0.5	2.5	0.31	1.31	2.5	0.66	1.66
1	5.1	0.41	1.41	5.1	0.87	1.87
1.5	7.6	0.48	1.48	7.6	1.01	2.01
2	10.2	0.53	1.53	10.2	1.13	2.13
2.5	12.7	0.58	1.58	12.7	1.22	2.22
3	15.3	0.62	1.62	15.3	1.31	2.31

* DIVERSION BERM WILL BE SIZED USING THE ABOVE TABLE AS A GUIDELINE TO CONTAIN STORMWATER FROM THE 25 YEAR, 24 HOUR STORM EVENT. SUPPORTING CALCULATIONS ARE INCLUDED ON PAGES IIIC-C-6 THROUGH IIIC-C-7.

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☐ DRAFT ☒ FOR PERMITTING PURPOSES ONLY ☐ ISSUED FOR CONSTRUCTION	PREPARED FOR BFI WASTE SYSTEMS OF NORTH AMERICA, LLC	MAJOR PERMIT AMENDMENT LEACHATE AND CONTAMINATED WATER PLAN HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
DATE: 03/2017 FILE: 0120-758-11 CAD: IIIC-C-8 CONTAM WTR PLAN.DWG DRAWN BY: RDM DESIGN BY: CLR REVIEWED BY: MDM	REVISIONS NO. 1 — DATE 11/2017 — DESCRIPTION OWNERSHIP CHANGE	
Weaver Consultants Group CA 3804 PE - 06/30/2017		WWW.WCGRP.COM — SHEET IIIC-C-8

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APPENDIX IIIC-D

STORAGE TANK CALCULATIONS AND FORCEMAIN CAPACITY

STATE OF TEXAS
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Includes pages IIIC-D-1 through IIIC-D-13

Required: 1. Determine the required leachate storage capacity.

Method: 1. Determine the leachate generation at the site based on actual leachate generation information.

2. Design the secondary containment area for the leachate storage tank.

Assumed: The existing temporary 21,000 gallon leachate storage tank will remain in service at the site. If at some point IESI wants to use a permanent tank, it would be located on the northeast side of the site as shown on Figure 4-1.

The actual leachate generation data has been used to estimate the amount of leachate to be stored in the storage tanks. The actual leachate generation information is included in Section 6 and in Appendix IIIC-E.

Solution:

1. Determine the leachate generation at the site based on actual leachate generation information.

The actual annual average leachate generated	=	9,725	gal/acre/year	(Refer to Section 6 of App IIIC)
	=	27	gal/acre/day	

Phases of Development	Total Area, acres	Leachate Generation, gallons per day
Currently Constructed Cells 1 through 6	32.1	855
Cells 1 through 8	49.6	1,322

Summary
The existing temporary 21,000-gallon storage tank will be managed so that three days of emergency storage capacity is maintained in the tank at all times.

2. Design the secondary containment area for the 21,000 gallon tank.

Note: This design applies to both the temporary storage tank and the permanent storage tank.

This calculation is based on a storage tank with the following dimensions. If a different tank is used, this calculation must be updated.

Minimum Tank Dimensions		
Length =	30	ft
Width =	10	ft
Height =	9	ft
Tank Volume =	20,199	gal

1) The layout footprint shown on Sheet IIIC-D-5 is planned for the secondary containment area.

2) Determine Available Secondary Containment Volume, V_{des}.

$V_{des} = 1/3\ (A1 + A2 + (A1 * A2)^{0.5})\ h$
$A1 = X1 * X2$
$A2 = (X1 + 2(h*Y))*(X2 + 2(h*Y))$

Where:

A1 = Area of bottom of containment area
A2 = Area of top of containment area
h = Berm height
X1 = Floor width
X2 = Floor length
Y = Berm sideslope

X1 =	50	ft
X2 =	40	ft
Y =	2	H:1V
h =	2	ft (without freeboard)
A1 =	2,000	sf
A2 =	2,784	sf
V_{des} =	4,762	cf

Note: The berm height provided will be 3 feet, which will allow 1.0 foot of freeboard.

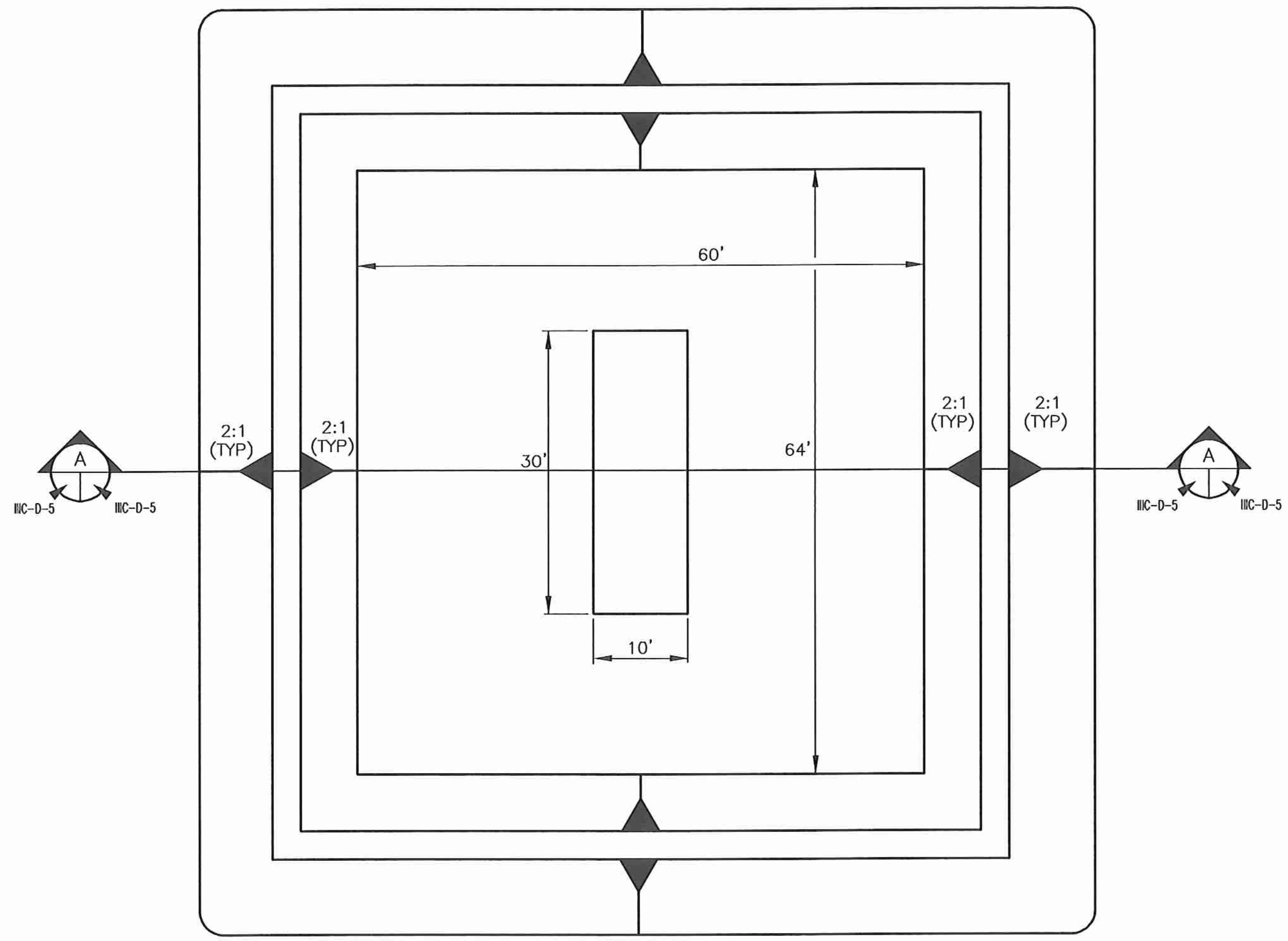
3) Calculate Required Containment Volume, V_{req}.

The containment area must be able to hold the volume of one tank and rainfall generated from the 25-year, 24-hour storm event (10.0 inches).

Volume of tank =	20,199	gal
=	2,700	cf
Number of tanks =	1	
Total tank volume =	2,700	cf
Volume of runoff (10.0 inches x A1) =	1,667	cf
V_{req} =	4,367	cf

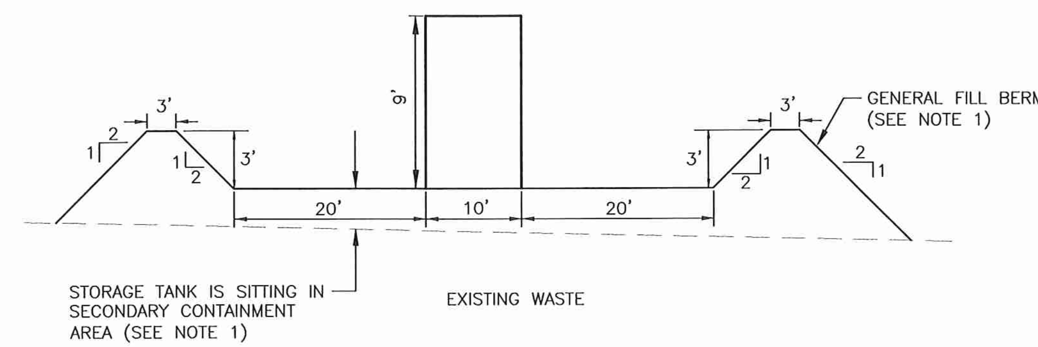
4) Verify that design is acceptable.

V_{des} = 4,762 cf > V_{req} = 4,367 cf



LEACHATE STORAGE SECONDARY CONTAINMENT PLAN

0 10 20
SCALE IN FEET



TYPICAL SECTION A
IIIC-D-5 IIIC-D-5

0 10 20
SCALE IN FEET
HORIZONTAL

0 5 10
SCALE IN FEET
VERTICAL

NOTES:

1. THE CONTAINMENT BERMS AND FLOOR OF THE STORAGE TANK AREA WILL BE CONSTRUCTED OF CH OR CL MATERIAL AS DEFINED BY THE UNITED SOIL CLASSIFICATION SYSTEM (USCS) FOR LOCATIONS OUTSIDE THE LIMITS OF WASTE. THE FLOOR OF THE STORAGE TANK AREA WILL BE A 2-FOOT THICK (MIN) BOTTOM.
2. THIS CONFIGURATION APPLIES TO BOTH THE TEMPORARY STORAGE TANK AND THE PERMANENT STORAGE TANK.

SECONDARY CONTAINMENT VOLUME CALCULATIONS

LEACHATE STORAGE AREA SECONDARY CONTAINMENT WILL PROVIDE STORAGE TO CONTAIN THE VOLUME OF THE TANK (21,000 GALLONS) AND THE 25-YEAR 24 HOUR STORM EVENT (INCHES) RAINFALL VOLUME.

VOLUME OF STORAGE TANK = 20,199 gal x $\frac{1\ ft^3}{7.481\ gal}$ = 2,700 ft^3

VOLUME OF 25-YEAR 24 hr STORM = 10.0 INCHES x STORAGE AREA = (10.0"/12") X [(50 X 40)] ft^2 = 1,667 ft^3

VOLUME REQUIRED = 2,700 + 1,667 = 4,367 ft^3 MINIMUM

VOLUME PROVIDED BY 2.0 FEET OF THE CONTAINMENT BERM = [1/3(2,000+2,784+(2,000 X 2,784)$^{0.5}$)2]= 4,762 ft^3

VOLUME PROVIDED (4,762 ft^3) > VOLUME REQUIRED (4,367 ft^3)

MINIMUM BERM HEIGHT = 3 ft (INCLUDING 1 ft OF FREEBOARD)

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DATE: 03/2017 FILE: 0120-758-11 CAD: IIIC-D-5 TANK.DWG	DRAWN BY: RDM DESIGN BY: CLR REVIEWED BY: MDM	REVISIONS NO. 1 — DATE 11/2017 — DESCRIPTION OWNERSHIP CHANGE		HARDIN COUNTY LANDFILL HARDIN COUNTY, TEXAS
Weaver Consultants Group CA 3804 PE – 06/30/2017				WWW.WCGRP.COM — SHEET IIIC-D-5

HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE FORCEMAIN CAPACITY CALCULATIONS

REQUIRED: Size the leachate forcemain collection pipe for the proposed permanent leachate storage tank.

METHOD:

A. Use leachate production rates provided in Appendix IIIC-A (based on the HELP model analysis) to determine the required capacity of the leachate collection forcemain pipe.

B. Determine the capacity of the leachate collection system forcemain pipe.

C. Calculate the maximum pressure experienced by the forcemain pipe.

D. Evaluate the flow velocity in the forcemain pipe.

E. Conclusion.

REFERENCES:

1. Driscopipe Systems Design, Phillips 66. 1992 Phillips Driscopipe, Inc. 1235-91 A 01

SOLUTION:

A. Use leachate production rates provided in Appendix IIIC-A to determine the required capacity of the leachate collection forcemain pipes.

CONDITION	AREA[1]	AVERAGE ANNUAL FLOW		TOTAL FLOW	FLOW
	ac	cfy[2]	gpd/ac	gpd	cfs
Active, 10' Waste	5.0	7959.5	163	816	0.0013
Active, 50' Waste	8.0	34436.5	706	5,646	0.0087
Interim, 100' Waste	13.0	54929.1	1,126	14,634	0.0226
Interim, 150' Waste	10.6	15509.7	318	3,369	0.0052
Interim, 170' Waste	8.0	10248.1	210	1,680	0.0026
Interim, 170' Waste	5.0	4163.7	85	427	0.0007
Total =	49.6				0.0411

[1]Total limits of waste of 49.6 acres is represented with different waste column thicknesses for demonstration purposes.
[2]The average annual flows in cubic feet per year (cfy) have been obtained from the HELP Model summary table included on page IIIC-A-12. The highest values for a given waste thickness have been used for demonstration purposes.

Total maximum leachate production =	Q =	0.0411	cubic feet per second (cfs)
	Q =	18	gallons per minute (gpm)
	Q =	26,571	gallons per day (gpd)

Required capacity of leachate forcemain pipe = 26,571 gpd

B. Determine the capacity of the leachate collection system forcemain pipe.

Capacity of the forcemain is calculated by using the following formula from Ref. 1.

$$\Delta P_{100} = \frac{452 * Q^{1.85}}{C^{1.85} * D^{4.86}} \qquad \text{Eq. 1}$$

where:

ΔP_{100} = Friction pressure loss, pounds per square inch per 100 feet of pipe
Q = Rate of flow, gallons per minute
C = Pipe coefficient, See Chart 4 on Page IIIC-D-13
D = Pipe internal diameter, inches

Rearrange Equation 1 to solve for Q.

$$Q = \left(\frac{\Delta P_{100} * C^{1.85} * D^{4.86}}{452} \right)^{(1/1.85)} \qquad \text{Eq. 2}$$

Calculate ΔP_{100}:

$$\Delta P_{100} = (P - \Delta h) / (L/100)$$

where:

P = Pipe strength, psi
Δh = Geometric head difference, psi
L = Pipe length, ft

P = 160 psi (refer to page IIIC-D-12 for SDR11 pipe)

Calculate Δh:

Elevation at the low point of forcemain =	78	ft-msl
Elevation at the high point of forcemain =	84	ft-msl
Δh =	6	ft

Convert units from feet to psi:

Note: 1 psi is equal to 2.31 feet of water column.

$$\Delta h \text{ (psi)} = \Delta h \text{ (ft)} / (2.31 \text{ ft/psi})$$

Δh = 2.60 psi

Pipe Strength Available for Friction Loss = P - Δh

Pipe Strength for Friction Loss = 157.40 psi

L= 1,350 ft

(Note: Forcemain length is assumed to be the length from the riser location of Cell 7 to the permanent leachate storage tank location (refer to Figure 4-1 in Appendix IIIC for location). This is a conservative assumption given that it is assumed that the design pipe flow travels the maximum distance for estimating the total head loss.)

ΔP_{100} = (160-2.60)/(1,350/100)

ΔP_{100} = 11.66 psi

Calculate maximum capacity of the 2-inch pipe by using Equation 2 above:

C =	155	(refer to page IIIC-D-13)
D =	1.943	inches, internal diameter of inside pipe (refer to page IIIC-D-12)

$Q = [(\Delta P_{100} C^{1.85} D^{4.86})/452]^{(1/1.85)}$

$Q = [(11.66 * 155^{1.85} * 1.943^{4.86})/452]^{(1/1.85)}$

Q =	122.9	gpm
Q =	176,966	gpd

The above calculated value reflects the maximum capacity of the pipe, which is greater than the required capacity (i.e., 179,966 gpd > 26,571 gpd).

C. Calculate the maximum pressure experienced by the forcemain pipe.

Calculate head loss in the 3-inch diameter forcemain using the following equation from Ref. 1:

$$\Delta P_{100} = \frac{452 * Q^{1.85}}{C^{1.85} * D^{4.86}}$$

Q =	18	gpm (from Step A)
C =	155	From Chart 4 on Page IIIC-D-13
D =	1.943	inches, diameter of inside pipe
ΔP_{100}=	0.35	psi

Total head loss ($\Sigma\Delta P$) = ΔP_{100} * (L/100) = 0.35 psi x (1350/100)

$\Sigma\Delta P$= 4.72 psi

To account for local head losses (elbows, etc.) multiply the calculated total head loss with a factor of safety of 1.2.

F.S.=	1.2	
$\Sigma\Delta P$ * F.S.=	5.66	psi

Calculate total head at the pump:

$$P_{tot} = \Delta h + \Sigma\Delta P$$

where:

P_{tot} = Total head at pump, psi
Δh = Geometric head (from Step B)
$\Sigma\Delta P$ = Total head loss, psi

P_{tot} = 2.60 psi + 5.66 psi

P=	8.26	psi

D. Evaluate the flow velocity in the forcemain pipe.

$V = 0.408 * (Q/D^2)$ (Ref. 1)

where:

Q = Rate of flow, gpm
D = Pipe internal diameter, inches

Q =	18	gpm (from Step A)
D =	1.943	inches

V=	1.99	fps

E. Conclusion.

The pipe capacity (122.9 gpm) is not exceeded by the expected flow of 18 gpm.

The forcemain can withstand 160 psi, and the maximum pressure calculated as 8.26 psi; therefore, the pipe strength is acceptable.

The calculated velocity of the 2-inch forcemain for 1.99 fps of flow is well within acceptable flow velocity range.

Throughout the life of the site, the flow rate in the forcemain will range from 0 to 18 gpm. Excessive sediment accumulation in the forcemain will be prevented by the system operation. For example, the pump will operate on a periodic basis. When the pump activates, flow in the forcemain will surge and the velocity will increase periodically which will transport sediment to the discharge point. This variation in Q will functionally minimize the sediment build-up potential in the pipe.

3/4" (1.050 OD)

SDR 11	160 psi	0.12 lbs./ft.	0.860 ID	.095 wall

1" (1.315 OD)

SDR 11	160 psi	0.19 lbs./ft.	1.075 ID	.120 wall

1-1/4" (1.660 OD)

SDR 11	160 psi	0.31 lbs./ft.	1.358 ID	.151 wall

1-1/2" (1.900 OD)

SDR 11	160 psi	0.41 lbs./ft.	1.554 ID	.173 wall

2" (2.375 OD)

SDR 7	267 psi	0.94 lbs/ft	1.697 ID	.339 wall
SDR 9	200 psi	0.76	1.847	.264
SDR 11 ⊙	**160 psi**	**0.64**	**1.943**	**.216**
SDR 13.5	128 psi	0.53	2.023	.176
SDR 15.5	110 psi	0.47	2.069	.153
SDR 17	100 psi	0.43	2.095	.140

3" (3.500 OD)

SDR 7	267 psi	2.05 lbs/ft.	2.500 ID	.500 wall
SDR 9	200 psi	1.66	2.722	.389
SDR 11 ⊙	**160 psi**	**1.39**	**2.864**	**.318**
SDR 13.5	128 psi	1.15	2.982	.259
SDR 15.5	110 psi	1.02	3.048	.226
SDR 17 ⊙	**100 psi**	**0.93**	**3.088**	**.206**
SDR 19	89 psi	0.84	3.132	.184
SDR 21	80 psi	0.77	3.166	.167
SDR 26	64 psi	0.62	3.230	.135
SDR 32.5	51 psi	0.50	3.284	.108

4" (4.500 OD)

SDR 7	267 psi	3.39 lbs/ft.	3.214 ID	.643 wall
SDR 9	200 psi	2.74	3.500	.500
SDR 11 ⊙	**160 psi**	**2.29**	**3.682**	**.409**
SDR 13.3	128 psi	1.90	3.834	.333
SDR 15.5 ⊙	**110 psi**	**1.68**	**3.020**	**.290**
SDR 17 ⊙	**100 psi**	**1.54**	**3.970**	**.265**
SDR 19	89 psi	1.39	4.026	.237
SDR 21	80 psi	1.26	4.072	.214
SDR 26 ⊙	**64 psi**	**1.03**	**4.154**	**.173**
SDR 32.5	51 psi	0.83	4.224	.138

5-3/8" (5.375 OD)

SDR 17	100 psi	2.20 lbs./ft.	4.743 ID	.316 wall
SDR 21	80 psi	1.80	4.863	.256
SDR 26	64 psi	1.47	4.961	.207
SDR 32.5	51 psi	1.18	5.045	.165

5" (5.563 OD)

SDR 7	267 psi	5.17 lbs/ft.	3.973 ID	.795 wall
SDR 9	200 psi	4.18	4.327	.618
SDR 11	160 psi	3.51	4.551	.506
SDR 13.5	128 psi	2.91	4.739	.412
SDR 15.5	110 psi	2.57	4.845	.359
SDR 17	100 psi	2.35	4.909	.327
SDR 19	89 psi	2.12	4.977	.293
SDR 21	80 psi	1.93	5.033	.265
SDR 26	64 psi	1.57	5.135	.214
SDR 32.5	51 psi	1.27	5.221	.171

6" (6.625 OD)

SDR 7	267 psi	7.33 lbs./ft.	4.733 ID	.946 wall
SDR 9	200 psi	5.93	5.153	.736
SDR 11 ⊙	**160 psi**	**4.97**	**5.421**	**.602**
SDR 13.5	128 psi	4.13	5.643	.491
SDR 15.5	110 psi	3.63	5.771	.427
SDR 17 ⊙	**100 psi**	**3.34**	**5.845**	**.390**
SDR 19	89 psi	3.01	5.927	.349
SDR 21 ⊙	**80 psi**	**2.73**	**5.995**	**.315**
SDR 26 ⊙	**64 psi**	**2.23**	**6.115**	**.255**
SDR 32.5 ⊙	**51 psi**	**1.80**	**6.217**	**.204**

7" (7.125 OD)

SDR 7	267 psi	8.49 lbs./ft.	5.089 ID	1.018 wall
SDR 9	200 psi	6.86	5.541	.792
SDR 11	160 psi	5.75	5.829	.648
SDR 13.5	128 psi	4.78	6.069	.528
SDR 15.5	110 psi	4.21	6.205	.460
SDR 17	100 psi	3.86	6.287	.419
SDR 19	89 psi	3.48	6.375	.375
SDR 21	80 psi	3.16	6.445	.340
SDR 26 ⊙	**64 psi**	**2.58**	**6.577**	**.274**
SDR 32.5	51 psi	2.08	6.685	.220

8" (8.625 OD)

SDR 7	267 psi	12.43 lbs./ft.	6.161 ID	1.232 wall
SDR 9	200 psi	10.05	6.709	.958
SDR 11 ⊙	**160 psi**	**8.42**	**7.057**	**.784**
SDR 13.5	128 psi	7.00	7.347	.639
SDR 15.5	110 psi	6.16	7.513	.556
SDR 17 ⊙	**100 psi**	**5.65**	**7.611**	**.507**
SDR 19	89 psi	5.10	7.717	.454
SDR 21 ⊙	**80 psi**	**4.64**	**7.803**	**.411**
SDR 26 ⊙	**64 psi**	**3.79**	**7.961**	**.332**
SDR 32.5 ⊙	**51 psi**	**3.05**	**8.095**	**.265**

⊙ denotes standard sizes

Effective: 3-1-94

Chart 4

Table of "C" Values for "Hazen and Williams Formula"

Constant	Type of Pipe
155	Driscopipe
140	New steel pipe or tubing Glass tubing Asbestos cement
130	Copper tubing Ordinary brass pipe Cast iron – new Cast iron – tar coated but new Cast iron – fully cement lined
125	Steel pipe – old
120	Wood stave pipe Concrete pipe New wrought iron pipe Four to six years old cast iron pipe
110	Ten to twelve years old cast iron pipe Vitrified pipe Spiral riveted steel, flow with lap Galvanized steel
100	Spiral riveted steel, flow against lap Thirteen to twenty years old cast iron pipe Galvanized steel – over 5 years old Cast iron – tar coated over 10 years old
90	Twenty-six to thirty-year old cast iron pipe
60	Corrugated steel pipe

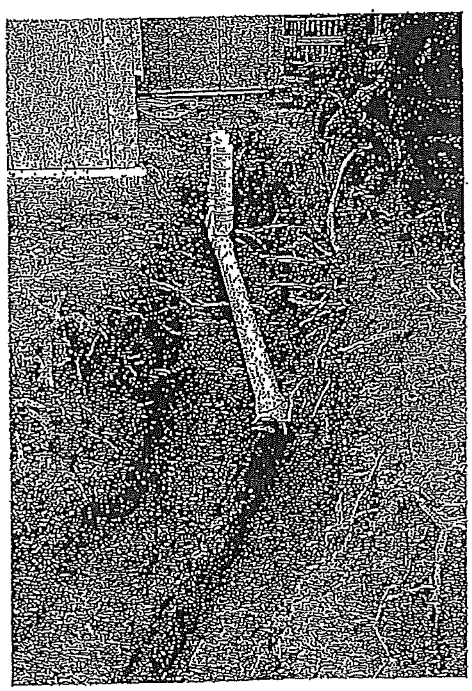
Fitting Pressure Drop: Listed below in Chart 5 are various common piping system components and the associated pressure loss through the fitting expressed as an equivalent length of straight pipe in terms of diameters. The inside diameter (in feet) multiplied by the equivalent length diameters gives the equivalent length (in feet) of pipe. This equivalent length of pipe is added to the total footage of the piping system when calculating the total system pressure drop.

These equivalent lengths should be considered an approximation suitable for most installations.

Chart 5

Fabricated Fitting	Equiv. Length
Running Tee	20 D
Branch Tee	50 D
90° Fab, Ell	30 D
60° Fab, Ell	25 D
45° Fab, Ell	18 D
45° Fab, Wye	60 D
Conventional Globe Valve (Full Open)	350 D
Conventional Angle Valve (Full Open)	180 D
Conventional Wedge Gate Valve (Full Open)	15 D
Butterfly Valve (Full Open)	40 D
Conventional Swing Check Valve	100D

(See Appendix for further data on resistance of valves and fittings to flow).



APPENDIX IIIC-E

SITE LEACHATE GENERATION INFORMATION

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Includes pages IIIC-E-1 through IIIC-E-10

CONTENTS

This appendix includes the following leachate generation information.

- Sheet IIIC-E-2. Summary table listing the leachate generation information for 2014, 2015, and 2016 for Hardin County Landfill.
- Sheets IIIC-E-4 through IIIC-E-5. Summary of leachate generation volume over the life of the site using actual leachate generation rate information.
- Sheets IIIC-E-6 through IIIC-E-8. Summary of leachate generation over the life of the site using the HELP analysis included in Appendices IIIC-A and IIIC-E.
- Sheets IIIC-E-9 through IIIC-E-10. Leachate depth on liner calculations for the actual leachate generation rates.

This information is summarized in Section 6 of the Leachate and Contaminated Water Management Plan.

HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE GENERATION SUMMARY TABLE

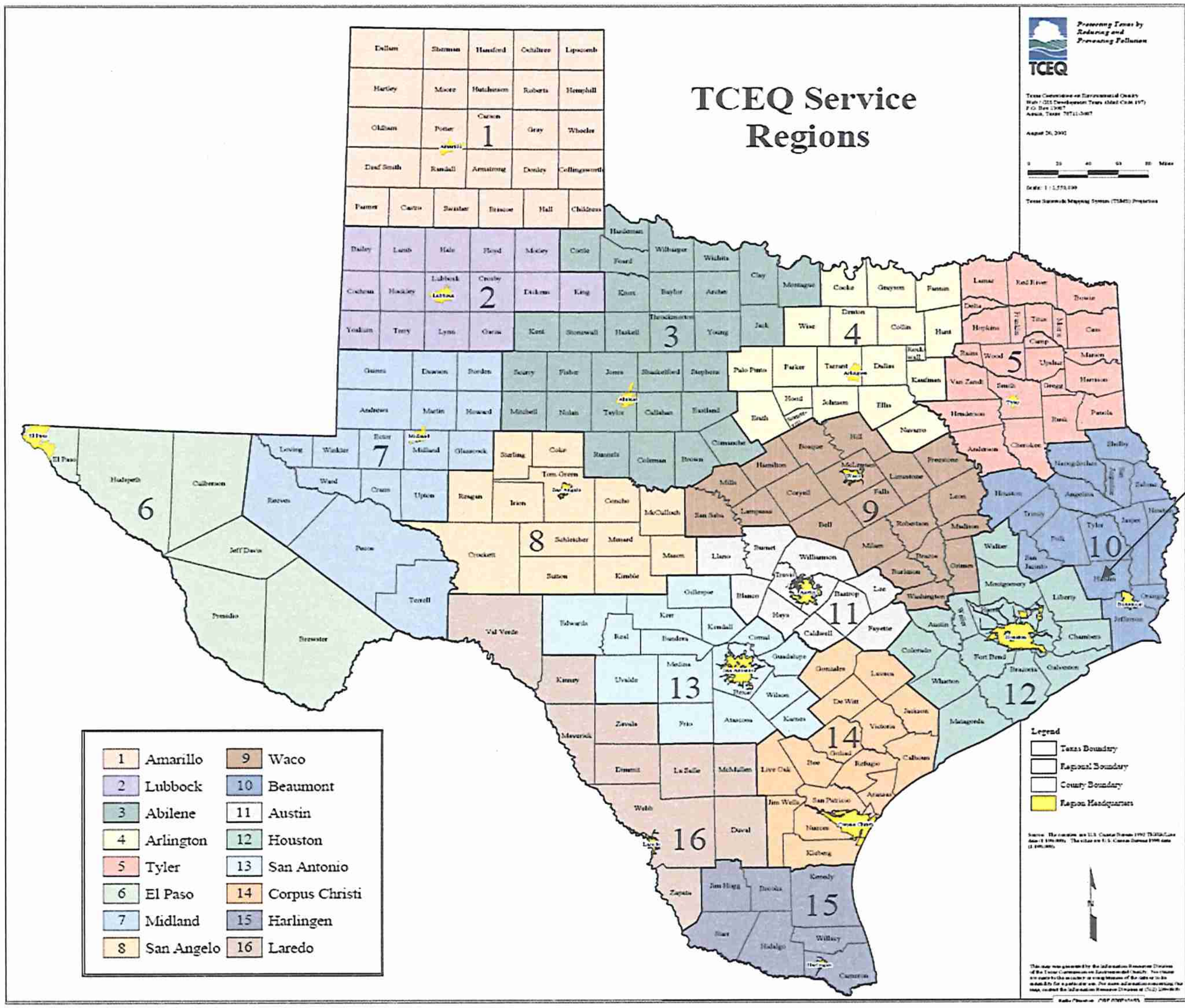
Purpose: Summarize the leachate information for the Hardin County Landfill. The leachate generation information was provided by IESI site personnel. The site location is shown on Sheet IIIC-E-3.

LEACHATE GENERATION INFORMATION

Year	Annual Rainfall[1] (in)	Total Leachate generated per year (gallons)	Lined Area (acres)	Average Waste Column Thickness (feet)	Leachate Generated[2] (gallons/ac/year)
2014	44.18	282,240	28.6	25	9,869
2015	65.49	228,480	32.1	30	7,118
2016	43.74	391,260	32.1	35	12,189
Average	51.14	300,660	30.9	30	9,725

[1]The rainfall data was obtained from the US Department of Commerce, Record of Climatological Observations, Kountze Weather Station located approximately 4.1 miles from the site. The 2016 rainfall data was totalled from January to November 2016.

[2]The 2016 leachate generation value is based on data obtained from January to September 2016. The information was used to project the leachate generation rate for a full year.



Weaver Consultants Group, LLC
Rev. 1, 12/5/2017

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HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE GENERATION VOLUMES
USING ACTUAL LEACHATE GENERATION INFORMATION

Required: Estimate the leachate volume generated over the life of the site and the postclosure period using leachate generation information from IESI Hardin County Landfill and information obtained from an EPA study.

References:

1. Bonaparte, Rudolph, Daniel, David E., and Koerner, Robert M. "Assessment and Recommendations for Improving the Performance of Waste Containment Systems," U.S. EPA, EPA/600/R-02/099, Dec. 2002.
2. Leachate generation information for the IESI Hardin County Landfill obtained from IESI site personnel.

Procedure:

1. Determine the approximate sector development sequence.
2. Estimate the leachate generation volume of each stage of development.

Solution:

1. Determine the approximate sector development sequence.

The approximate sector development sequence is shown on Table IIIC-E-1.
Leachate generation volumes will be compared for the following years.

- 2017
- 2027
- 2035
- 2042
- 2047
- 2048 through 2057 - First 10 years of postclosure period
- 2058 through 2067 - Second 10 years of postclosure period
- 2068 through 2077 - Third 10 years of postclosure period

2. Estimate the leachate generation volume of each stage of development.

This information is provided on Sheet IIIC-E-5.

HARDIN COUNTY LANDFILL
0120-758-11-02
LEACHATE GENERATION VOLUMES USING ACTUAL LEACHATE GENERATION INFORMATION

TABLE IIIC-E-1
LEACHATE GENERATION VOLUME OVER THE LIFE OF THE SITE

Year	Sectors Developed	Lined Area (acres)	Leachate Generation Rate (gallons per acre)	Total Leachate Generated (gallons)	Source of Information
2017	Cells 1 through 6	32.07	9,725	311,881	Leachate generation information from IESI Hardin County Landfill (average of 2014-2016) was used on a per acre basis to estimate the leachate generation rate.
2026	Cells 1 through 7	40.80	9,725	396,780	
2034	Cells 1 through 8	49.56	9,725	481,971	
2041	Cells 1 through 8	49.56	9,725	481,971	
2045	Cells 1 through 8	49.56	9,725	189,317	Leachate generation information from IESI Hardin County Landfill (average of 2014 to 2016) was used on a per acre basis to estimate the leachate generation rate. 19.77 acres of the landfill area will be closed in 2045. Therefore, 10 percent of the leachate generation rate was used for the closed area.
2047	Cells 1 through 8	49.56	9,725	48,197	Leachate generation information from IESI Hardin County Landfill (average of 2014 to 2016) was used on a per acre basis to estimate the leachate generation rate. 49.56 acres of the landfill area will be closed in 2047. Therefore, 10 percent of the leachate generation rate was used for the closed area.
SITE CLOSURE IN 2047					
2048 through 2057	Cells 1 through 8	49.56	973	48,197	As noted in Ref. 1, it is projected that the leachate generation rates are decreased by a factor of four within one year after closure and by one order of magnitude within 2 to 4 years and almost negligible after 9 years. Based on this reference, the leachate was assumed to be 10% of the year 2047 for the first 10 years and for the second and third 10 years, the leachate was assumed to be 2% of the leachate in year 2047.
2058 through 2067	Cells 1 through 8	49.56	195	9,639	
2068 through 2077	Cells 1 through 8	49.56	195	9,639	

Required: Estimate the leachate volume generated over the life of the site and the post-closure period using information included in Appendix IIIC-A (HELP modeling information).

Reference: HELP model analysis included in Appendix IIIC-A.

Procedure:

1. The sector development sequence established on Sheet IIIC-E-5 will be used for this analysis.
2. Estimate the leachate generation value for each stage of development. This information is provided on Table IIIC-E-2. The HELP model summary information are provided on Table IIIC-E-3.

HARDIN COUNTY LANDFILL
0120-758-11-02
TABLE IIIC-E-2
LEACHATE GENERATION VALUE DURING THE LIFE OF THE SITE

Year	Sector Development	Lined Area (acres)	Total Leachate Generated		Source of Information
			Average (gal/year)	Peak (gal/year)	
2017	Cells 1 through 5	32.07	6,403,253	89,740,936	Cells 1 through 6 assumed a 50 foot waste column thickness to determine the average and peak leachate generation rates derived from HELP.
2026	Cells 1 through 7	40.80	8,910,947	56,767,712	Cells 1 through 4 assumed a 100 foot waste column thickness; Cells 5 and 6 assumed a 50 foot waste column thickness; and Cell 7 assumed a 10 foot waste column thickness to determine the average and peak leachate generation rates derived from HELP.
2034	Cells 1 through 8	49.56	6,813,159	37,361,674	Cells 1 through 4 assumed a 150 foot waste column thickness; Cells 5 and 6 assumed a 100 foot waste column thickness; Cell 7 assumed a 50 foot waste column thickness; and Cell 8 assumed a 10 foot waste column thickness to determine the average and peak leachate generation rates derived from HELP.
2041	Cells 1 through 8	49.56	5,059,363	32,582,404	Cells 1 through 4 assumed a 170 foot waste column thickness; Cells 5 through 7 assumed a 150 foot waste column thickness; and Cell 8 assumed a 100 foot waste column thickness to determine the average and peak leachate generation rates derived from HELP.
2045	Cells 1 through 8	49.56	1,998,096	4,480,723	Cells 1 through 4 assumed a closed 170 foot waste column thickness; Cells 5 through 7 assumed a 170 foot waste column thickness; and Cell 8 assumed a 150 foot waste column thickness to determine the average and peak leachate generation rates derived from HELP.
2047	Cells 1 through 8	49.56	706,779	2,010,695	Cells 1 through 8 assumed a closed 170 foot waste column thickness to determine the average and peak leachate generation rates derived from HELP.

Table IIIC-E-3[1]
Summary of Leachate Generation Rates

Developed Cells				
	Average (cf/year/acre)	Average (gal/year/acre)	Peak (cf/day/acre)	Peak (gal/day/acre)
50 ft	26689.6	199,665	1024.8	7,667
100 ft	38762.7	289,984	456.9	3,418
150 ft	362.7	2,713	3.1	23
170 ft	121	905	1.2	9
Closed	249.2	1,864	1.1	8
Undeveloped Cells				
	Average (cf/year/acre)	Average (gal/year/acre)	Peak (cf/day/acre)	Peak (gal/day/acre)
Active	7959.5	59,545	109.2	817
50 ft	34436.5	257,619	508.6	3,805
100 ft	54929.1	410,925	1203.3	9,002
150 ft	15509.7	116,028	109.7	821
170 ft	10248.1	76,666	53	396
Closed	4163.7	31,149	33.6	251

[1]Refer to Appendix IIIC-A for detailed HELP analyses results.

Required: Determine the leachate depth on the liner system using the actual leachate generated information provided on Sheet IIIC-E-5.

References:

1. Giroud, J.P. et al., Hydraulic Design of Geosynthetic and Granular Liquid Collection Layers, *Geosynthetics International*, Vol 7, 2000.

Solution:

1. Use the following equation to determine the head on the liner:

$$T_{\max} = \frac{\sqrt{(\tan^2\beta + \frac{4q_h}{k_1})} - \tan\beta}{2\cos\beta} * L \qquad \text{(Ref. 1)}$$

where,
T_{max}= maximum head on liner, ft
β= slope, deg
q_h= inflow rate, in/s
k_1= hydraulic conductivity of geocomposite, in/s
L= slope length, ft

Developed Cells (220-mil geocomposite)

β= 1.15 °
tanβ= 0.020
$\tan^2\beta$= 0.0004
cosβ= 1.00
L= 300 ft

Condition	q_h (gal/acre/year)	q_h (in/s)	k_1 (in/s)	T_{max} (in)
Interim (50 ft waste)	9,725	1.14E-08	11.08	0.0002
Interim (100 ft waste)	9,725	1.14E-08	5.70	0.0004
Interim (150 ft waste)	9,725	1.14E-08	5.04	0.0004
Interim (170 ft waste)	9,725	1.14E-08	3.95	0.0005
Closed (170 ft waste)	9,725	1.14E-08	3.23	0.0006
Post Closure (0-10)	973	1.14E-09	3.23	0.0001
Post Closure (10-20)	195	2.27E-10	3.23	0.0000
Post Closure (20-30)	195	2.27E-10	3.23	0.0000

Undeveloped Cells (250-mil geocomposite)

β=	0.86 °
tanβ=	0.015
$\tan^2\beta$=	0.0002
cosβ=	1.00
L=	230 ft

Condition	q_h (gal/acre/year)	q_h (in/s)	k_1 (in/s)	T_{max} (in)
Active (10 ft waste)	9,725	1.14E-08	29.96	0.0001
Interim (50 ft waste)	9,725	1.14E-08	21.99	0.0001
Interim (100 ft waste)	9,725	1.14E-08	8.97	0.0002
Interim (150 ft waste)	9,725	1.14E-08	5.81	0.0004
Interim (170 ft waste)	9,725	1.14E-08	4.42	0.0005
Closed (170 ft waste)	9,725	1.14E-08	3.60	0.0006
Post Closure (0-10)	973	1.14E-09	3.60	0.0001
Post Closure (10-20)	195	2.27E-10	3.60	0.0000
Post Closure (20-30)	195	2.27E-10	3.60	0.0000